OPG Interrogatory #1

Issue Number: 3.1
Issue: Are OPG's proposed capital structure and rate of return on equity appropriate?

Interrogatory:

Reference: Exhibit M3 page 4

"Further, I evaluate OPG's risk relative to a refined sample of proxy companies, whose generation and regulatory characteristics more closely match OPG than do those of Concentric's sample. This sample is characterized by having very little non-regulated operations, little to no market risk exposure, nuclear generation, and an investment grade credit rating."

Exhibit M3, page 4:
"I therefore reduce the sample to consist of only companies with substantial nuclear (or hydroelectric) generation and to only those that have in excess of 90 percent of generation assets subject to regulation."

Exhibit M3, pages 32-34, in the section titled, "Results from Refined Proxy Group."
The Brattle Group's addition of one company (i.e., DTE Energy Company) and two operating subsidiaries (i.e., Entergy Arkansas, Inc., and Entergy Louisiana, LLC) that were not included in Concentric's proxy group.

Interrogatory:

a) Please provide the analysis that The Brattle Group performed on proxy companies to develop its "Refined Proxy Group" including:
   i. The work paper supporting Figure 6 in Exhibit M3, including the data supporting the "Composition" and "Book Value Equity Capitalization" columns;
   ii. The "screening model" or other analysis performed to develop the Refined Proxy Group; and
   iii. The universe of utilities considered, including utilities that were ultimately excluded from the analysis, along with excluded companies' "Composition" and "Book Value Equity Composition."

b)
   i. How does The Brattle Group define the percentage of each company's assets subject to regulation (e.g., dollars, MW, etc.)?
   ii. Please provide the percentage of assets subject to regulation for each company in the Concentric proxy group and in the Refined Proxy Group.

c) With regard to The Brattle Group's statement that, "I therefore reduce the sample to consist of only companies with substantial nuclear (or hydroelectric) generation and to only those that have in excess of 90 percent of generation assets subject to regulation," How does The Brattle Group define "substantial"?

Response:

The following response was provided by The Brattle Group:

a)
   i. See attachment M3-3.1-OPG-1_Attachment 1.
   ii. To get the initial sample, Dr. Villadsen relied on the methodology described in M3-3.1-SEC-1_Attachment 1, pp. 25-27.
   iii. See attachment M3-3.1-OPG-1_Attachment 2. Dr. Villadsen did not screen companies based on their book value equity composition, and therefore does not have the book value equity composition for excluded companies.

b)
   i. In figure 3 of exhibit M3, Dr. Villadsen defined the percentage of assets subject to regulation on a MW basis. In the attachment to part ii below, Dr. Villadsen presents Edison Electric Institute's classification of assets subject to regulation for the Concentric proxy group. Dr. Villadsen does not know with certainty whether EEI makes their classification on a dollar or MW basis, although she strongly suspects it is on a dollar basis given that EEI states that their categorization is based on business segmentation data presented in 10Ks, and most 10Ks present this information in dollars.
   ii. See attachment M3-3.1-OPG-1_Attachment 3.

c) The company in the refined sample with the lowest percentage of nuclear generation is DTE Energy Company with 17%, so this qualified as "substantial" nuclear generation.

Refined Comparables Complete Generation Break Down

		Coal	Nuclear	Hydroelectric	Natural Gas/Oil	Other	Purchased Power	Total
Ameren Corporation	[a]	67.1%	23.3%	3.6%	0.3%	0.2%	5.5%	100.0%
DTE Energy Company	[b]	67.0%	17.0%	0.0%	1.0%	0.0%	15.0%	100.0%
El Paso Electric Company	[c]	6.0%	47.0%	0.0%	34.0%	0.0%	13.0%	100.0%
Entergy Arkansas, Inc.	[d]	14.0%	54.0%	0.0%	18.0%	0.0%	14.0%	100.0%
Entergy Louisiana, LLC	[e]	2.0%	27.0%	0.0%	46.0%	0.0%	25.0%	100.0%
PG&E Corporation	[f]	0.0%	22.6%	5.3%	8.9%	0.4%	62.8%	100.0%
Pinnacle West Capital Corporation	[g]	31.0%	26.8%	0.0%	18.5%	1.5%	22.2%	100.0%
Tennessee Valley Authority	[h]	29.0%	33%[2]	8%[2]	16.0%	0.0%	14.0%	59.0%
BC Hydro and Power Authority	[i]	0.0%	0.0%	75.0%	0.0%	0.6%	24.4%	100.0%
Bonneville Power Administration	[j]	0.0%	9.9%	84.5%[1]	0.1%	1.0%	4.5%	15.5%
IDACORP, Inc.	[k]	28.4%	0.0%	35.9%	12.6%	0.0%	23.0%	100.0%
OPG	[l]	0.0%	57.5%	42.5%	0.0%	0.0%	0.0%	100.0%

Notes:
Other Includes solar, biomass, wind, and uncategorized renewables
1: This percentage includes both small and large and small hydroelectric generation, whereas the percentage in Exhibit M3, Figure 6 just included large hydroelectric generation.

2: In Exhibit M3, Figure 6, we mistakenly referred to the numbers as for the fiscal year ending September 30, 2016, however they were figures for the fiscal year ending September 30, 2015. These are the correct percentages for the fiscal year ending September 30, 2016. They are each 1 percent lower than the 2015 figures.

Refined Sample of Nuclear and Hydroelectric Generation Companies (FY 2015)

		Composition[2]	S&P LT Issuer Rating	Book Value Equity Capitalization
[1]		[2]	[3]	[4]
	Companies with Nuclear Generation:	**% Nuclear of Total Mwh Generation**		
	Investor Owned Utilities:			
[a]	Ameren Corporation	23%	BBB+	47.4%
[b]	DTE Energy Company	17%	BBB+	47.4%
[c]	El Paso Electric Company	47%	BBB	44.6%
[d]	Entergy Arkansas, Inc.	54%	BBB	41.7%
[e]	Entergy Louisiana, LLC	27%	BBB	48.6%
[f]	PG&E Corporation	23%	BBB	49.4%
[g]	Pinnacle West Capital Corporation	27%	A-	55.3%
[h]	**Mean of Investor Owned Utilities**	**31%**		**47.8%**
[i]	**Median of Investor Owned Utilities**	**27%**		**47.4%**
[j]	Tennessee Valley Authority	34% nuclear / 9% hydroelectric	None	22.1%
	Companies with Hydroelectric Generation:	**% Hydro of Total Mwh Generation**		
[k]	BC Hydro and Power Authority	75%	None	19.6%
[l]	Bonneville Power Administration	84%	None	15.5%
[m]	IDACORP, Inc.		BBB	54.1%
[n]	**Mean of Hydroelectric sample**	**79%**		**29.7%**
[o]	**Median of Hydroelectric sample**	**79%**		**19.6%**

Sources:
[2]: Value Line, Inc
[3],[4]: SNL Financial
Ameren Corporation 2015 10-K
DTE Energy Company 2015 10-K
El Paso Electric Company 2015 10-K
Entergy Coporation 2015 10-K
PG&E Corporation 2015 10-K
Pinnacle West Capital Corporation 2015 10-K
https://transmission.bpa.gov/business/operations/wind/baltwg.aspx
Notes:
[2]: For entries under "% Nuclear of Total Generation", the percentage reflects the proportion of total 2015 generation, i
[2]: Percentages for Ameren Corporation, El Paso Electric Company, PG&E Corporation, and Pinnacle West Capital Corpor
[2] : The percentage for DTE Energy Company could not be verified in its 10-K
[2]: Percentages for Entergy Arkanas, Inc. and Entergy Louisiania, LLC are taken from the Entergy Corporation 10-K. Value

Sources:
2[a]-2[c], 2[f],2[g],2[n]: Value Line, Inc

Fuel Mix by 2015 Generating Production

Ticker	Company		Nuclear	Coal	Natural Gas	Other (includes hydro, oil, renewables, purchased power)	Source	Notes
ALE	ALLETE	[a]	0%	51%	0%	49%	Value Line	Purchased 35% of power according to value line
LNT	Alliant Energy	[b]	0%	48%	39%	13%	Alliant 2015 10-K	
AEP	Amer. Elec. Power	[c]	-	-	-	-	2015 10-K, p. 45-48	Owns primarily coal generation, but also some natural gas, hydro, and nuclear.
AEE	Ameren Corp.	[d]	23%	67%	0%	10%	Value Line	
BKH	Black Hills Corp.	[e]	0%	33%	0%	67%	Value Line	Purchased 63% of power according to value line.
CNP	CenterPoint Energy	[f]	-	-	-	-	Value Line	Does not own generation assets
CMS	CMS Energy Corp.	[g]	0%	44%	10%	46%	Value Line	Purchased 43% of power according to value line
DTE	DTE Energy	[h]	17%	67%	1%	15%	Value Line	
ETR	Entergy Corp.	[i]	31%	7%	35%	27%	Value Line	
MGEE	MGE Energy	[j]	0%	48%	12%	40%	Value Line	Purchased 40% of power according to value line
OGE	OGE Energy	[k]	0%	34%	30%	36%	Value Line	Purchased 31% of power according to value line
OTTR	Otter Tail Corp.	[l]	0%	69%	13%	17%	OTTR 2015 10-K	
VVC	Vectren Corp.	[m]	0%	77%	23%	0%	VVC 2015 10-K pg. 6	
ED	Consol. Edison	[n]	-	15%	-	85%	ED 2015 10-K pg. 45	See intermediate tab for more detail. Purchased most of its power according to value line
D	Dominion Resources	[o]	30%	26%	23%	21%	Value Line	
PPL	PPL Corp.	[p]	0%	85%	14%	1%	Value Line / 10-K	Spun off part of power generation (PPL Energy Supply) in 2015. See page 26 of 10-K for generation ownership.
PEG	Public Serv. Enterprise	[q]	32%	21%	42%	5%	Value Line / 10-K	A subsidiary, PSEG Power LLC, has nuclear, gas, and coal plants for generation that total 16,970MW of total capacity
EIX	Edison Int'l	[r]	7%	0%	7%	86%	Value Line	Purchased 85% of power according to value line.
EE	El Paso Electric	[s]	47%	6%	34%	13%	Value Line	
IDA	IDACORP Inc.	[t]	0%	28%	13%	59%	Value Line	Purchased 23% of power according to value line. 36% hydro
NEE	NextEra Energy	[u]	22%	4%	69%	5%	Value Line	
OPG	Ontario Power Generation	[v]	39%	0%	0%	61%	DBRS	Other 61% generation includes 18% Thermal, 44% Hydroelectric
PCG	PG&E Corp.	[w]	23%	0%	9%	68%	Value Line	Purchased 63% of power according to value line.
PNW	Pinnacle West Capital	[x]	27%	31%	20%	22%	Value Line	
POR	Portland General	[y]	0%	19%	23%	58%	Value Line	Purchased 43% of power according to value line.
SCG	SCANA Corp.	[z]	19%	48%	28%	5%	Value Line	Pruchased 2%
SRE	Sempra Energy	[{]	-	-	-	-	Value Line	Purchases most of its power. Has subs. in gas pipeline & storage, power generation, & lng.
XEL	Xcel Energy Inc.	[|]	12%	43%	23%	22%	Xcel 2015 10-K	Percentages include owned and purchased power. (Owned generation = 67% / purchased = 33%)

Sources/Notes:
Value Line and 10-K reports.
[o],[y]: Percentages are based on total 2015 generation reported in Xcel Energy's 2015 10-K as a proxy for generation capacity

Concentric Proxy Group - Regulated Assets by Company

Company	EEI Regulated Assets Classification
[1]	[2]
ALLETE, Inc.	M
Ameren Corp.	R
American Electric Power Company, Inc.	R
Duke Energy Corp.	R
Edison International	R
El Paso Electric Company	R
Emera Inc.	-
Entergy Corp.	R
FirstEnergy Corporation	M
Fortis Inc.	-
Great Plains Energy Inc.	R
IDACORP, Inc.	R
NextEra Energy, Inc.	M
PG&E Corporation	R
Pinnacle West Capital Corporation	R
PNM Resources, Inc.	R
Portland General Electric Company	R
Southern Company	R
Westar Energy, Inc.	R
Xcel Energy Inc.	R

Sources and Notes:
Edison Electric Institute Rate Case Summary Q1 2016
R = Regulated (greater than 80 percent of total assets are regulated).
M = Mostly Regulated (50 to 80 percent of total assets are regulated).

Brattle Refined Sample - Regulated Assets by Company

	Company	% Regulated Assets
	[1]	[2]
	Investor Owned Utilities:	
[a]	Ameren Corp.	99.10%
[b]	DTE Energy Company	93.20%
[c]	El Paso Electric Company	99.90%
[d]	Entergy Arkansas, Inc.	91%
[e]	Entergy Louisiana, LLC	90.2%
[f]	PG&E Corporation	99.30%
[g]	Pinnacle West Capital Corporation	99%
[h]	Tennessee Valley Authority	-
	Companies with Hydroelectric generation:	
[i]	BC Hydro and Power Authority	-
[j]	Bonneville Power Administration	-
[k]	IDACORP, Inc.	> 80% per EEI

Sources and Notes:
[a]-[g]: Velocity Suite, ABB Inc. (EV); a MW basis
[k]: Edison Electric Institute Rate Case Summary Q1 2016 (Not certain whether EEI makes their classification on a $ or MW basis)

OPG Interrogatory #2

Issue Number: 3.1
Issue: Are OPG's proposed capital structure and rate of return on equity appropriate?

Interrogatory:

Reference: Exhibit M3 page 12

"Further, as shown in Exhibit BV-1 many of the proxy companies used by Concentric own substantial coal generation, which faces its own challenges and may require substantial capital investments to adhere to current and impending environmental regulation."

a) Is it The Brattle Group's opinion that coal generation requires greater levels of capital investments than nuclear generation? Please provide any analyses, studies or reports supporting such opinions.
b) For the companies in the Refined Proxy Group, please provide any analysis performed by The Brattle Group of the effects of current and impending environmental regulations on required capital investments.
c) For the companies in Concentric's proxy group that were excluded from the Refined Proxy Group, please provide any analysis performed by The Brattle Group of the effects of current and impending environmental regulations on required capital investments.
d) Please provide all analyses, studies or reports by the Brattle Group comparing the business and risks of coal generation to nuclear generation.

Response:

The following response was provided by The Brattle Group:

a) No, the relative magnitude of the capital investment required on coal vs. nuclear generation varies by unit. However, continued operation and profitability of the coal units that are operated on a merchant basis face a substantial risk from capital and operating expenditures associated with environmental regulations, as well as market pressures from low gas prices and increased penetration of renewables. The environmental regulations that continue to pose cost risks for the coal units include Regional Haze rule, Cross-State Air Pollution Rule (CSAPR), and restrictions on carbon emissions (such as the Regional Greenhouse Gas Initiative in the Northeast, the EPA's

Clean Power Plan that is currently stayed by the courts, or similar federal or regional regulations that could replace CPP). In addition, regulated owners of coal units that are at risk for retirement due to the factors outlined above may face the stranded asset risk.

b) Dr. Villadsen has not performed an analysis of effects on impending environmental regulations on Dr. Villadsen's refined proxy group or on Concentric's proxy group, but notes that (1) unregulated generation has larger risks of non-recovery and (2) for U.S. based companies, it is unclear which environmental policies will be implemented over the next few years. However, see the response to a) above.

c) See response to part a) and b) above

d) Dr. Villadsen has not performed such a study.

OPG Interrogatory #3

Issue Number: 3.1
Issue: Are OPG's proposed capital structure and rate of return on equity appropriate?

Interrogatory:

Reference: Exhibit M3 page 27

"As discussed above, OPG will have elevated operating, and construction and execution risks during the Darlington Refurbishment Program. During this period, OPG will have large capital expenditures without associated revenues, and will experience increase in its credit risks. The timing of the delayed cash flow will impact OPG's liquidity, credit metrics and likely, its leverage. In contrast, the refined sample of comparable companies is not engaged in capital expenditure programs at this scale and thus – on this dimension – have lower risk compared to OPG. However, the inclusion of DRP in the provincial LTEP, establishing the need for the refurbishment program, and enacting of regulation to assure regulatory support and recovery of prudent costs, are substantial mitigating factors for OPG's elevated construction and execution risks. I believe that, as a result of these mitigating factors, OPG's risk during the refurbishment program will be comparable to the average company in my refined sample."

Does the Brattle Group believe that these "risk mitigating factors" completely offset the "elevated operating, and construction and execution risks during the Darlington Refurbishment Program" in relation to the comparator companies? If so, please explain the basis for this conclusion.

Response:

The following response was provided by The Brattle Group:

Not necessarily. Having undertaken a credit metric analysis, an evaluation of the supply, demand, competitive, operating, and regulatory risks of OPG, Dr. Villadsen finds that the refined sample provides a good benchmark for establishing OPG's equity ratio for the upcoming regulatory period.

OPG Interrogatory #4

Issue Number: 3.1
Issue: Are OPG's proposed capital structure and rate of return on equity appropriate?

Interrogatory:

Reference: Exhibit M3 Exhibits BV-1, BV-4 and BV-5

Please provide the work papers supporting Exhibit M3, Exhibits BV-1, BV-4 and BV-5, including "expected future interest rates" in Exhibit BV-4b.

Response:

The following response was provided by The Brattle Group:

See attachment M3-3.1-OPG-4_Attachment 1.

Inputs to Forecast of OPG Credit Metrics (C$ millions)

	Net Income and EBITDA:	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
[a]	Growth in total rate base	-	4.1%	5.9%	1.9%	-0.9%	38.5%	3.3%
[b]	Total Rate Base (Ex. L Tab 3.1 Schedule 20 VECC-005 Attachment 1 Table 5)	9,800	10200	10800	11000	10900	15100	15600
[c]	Growth in nuclear rate base	-	15.1%	22.2%	6.1%	0.0%	114.3%	6.7%
[d]	Nuclear rate base (C1-1-1 page 1) (also PDF pg. 136 of IRR Issue 3)	2346.5	2700	3300	3500	3500	7500	8000
[e]	Return on Equity (C1-1-1 Tables 1-9)	2.67%	8.78%	8.78%	8.78%	8.78%	8.78%	8.78%
[f]	Equity Capitalization	0.45	0.45	0.45	0.45	0.45	0.45	0.45
[g]	Net Income ([b]*[e]*[f])	417.0	403.0	426.7	434.6	430.7	596.6	616.4
[h]	Adjustment for earnings on nuclear fixed assets/nuclear waste mgmt.	673.0	673.0	673.0	673.0	673.0	673.0	673.0
[i]	Net Income (after adjustment for nuclear waste earnings)	-256.0	-270.0	-246.3	-238.4	-242.3	-76.4	-56.6
[j]	Net income after deducting interest capitalized (2015 same as w/o adj.)	-256.0	-270.0	-246.3	-238.4	-242.3	-76.4	-56.6
[k]	Nuclear Planned Depreciation (F4-1-1 table 2)	298.0	293.6	346.9	378.7	384.0	524.9	338.1
[l]	Nuclear depreciation from Bruce A and B	419.0	419.0	419.0	419.0	419.0	419.0	419.0
[m]	Hydro and unregulated service depreciation (as per OPG financial statement 2015 pg.57)	383.0	383.0	383.0	383.0	383.0	383.0	383.0
[n]	Total OPG Depreciation (sum of [k]:[m])	1100.0	1095.6	1148.9	1180.7	1186.0	1326.9	1140.1
[o]	Interest Expense	182.0	237.0	330.7	337.7	365.5	405.6	400.7
[p]	Planned Nuclear Income Tax (F4-2-1 Table 2)	-31.8	-18.7	-18.4	-18.4	-18.4	51.2	51.7
[q]	Assumed Income Tax on Hydroelectric portion of rate base (see note)	51.2	51.2	51.2	51.2	51.2	51.2	51.2
[r]	Total Tax Liability	92.0	95.8	32.8	32.8	32.8	102.4	102.9
[s]	EBITDA (after nuclear waste adj.)	1118.0	1158.3	1266.1	1312.8	1341.9	1758.5	1587.0
[t]	EBIT (after nuclear waste adj.)	18.0	62.7	117.2	132.1	155.9	431.6	446.9

	Cash Flow from Operating Activities and FFO:	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
[u]	Cash Flow from Operations (S&P definition)	1151	1191	1299	1346	1375	1792	1620
[v]	FFO (after accounting for nuclear waste earnings) (S&P definition)	844.0	825.6	902.6	942.3	943.7	1250.5	1083.5

	Interest Expense:	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
[aa]	Interest Amount to deduct for debt that matured in prior year		17	13	53	21	20	30
[bb]	Interest Rate on New Debt Issues		3.8%	4.0%	4.6%	4.9%	4.9%	4.9%
[cc]	Interest Amount on New Debt Issues		25	104	57	48	60	25
[dd]	Interest Expense on Long Term Debt	285	293	384	388	414	454	449
[ee]	Interest on Short Term Debt (C1-1-1 Tables 1-9)	8	2.7	2.9	3.4	3.8	3.8	3.8
[ff]	Interest capitalized to PP&E	102	$50	$47	$44	$44	$43	$43
[gg]	Total Interest Expense	$191	$246	$340	$347	$374	$415	$410

	Long Term Debt:	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
[hh]	Debt Issues Maturing (2015 Financial)	500	273	1103	398	368	663	410
[ii]	Planned New Debt Issues		400	1500	850	600	550	100
[jj]	Long Term Debt (including current portion)	5472	5872	7372	8222	8822	9372	9472
[kk]	Long Term Debt (excluding current portion)	5199	4769	6974	7854	8159	8962	9322
[ll]	Current Portion of Long Term Debt	273	1103	398	368	663	410	150
[mm]	Short Term Debt Amount	225	37.1	37.1	37.1	37.1	37.1	37.1
[nn]	Operating Lease Obligations (per OPG Financial Statements)	16	16	17	17	14	14	14
[oo]	Total Debt	5713	5925	7426	8276	8873	9423	9523

	Summary							
[pp]	Total Rate Base	$9,800	$10,200	$10,800	$11,000	$10,900	$15,100	$15,600
[qq]	Return on Equity	2.67%	8.78%	8.78%	8.78%	8.78%	8.78%	8.78%
[rr]	Debt Share of Capital Structure	55%	55%	55%	55%	55%	55%	55%
[ss]	Equity Share of Capital Structure	45%	45%	45%	45%	45%	45%	45%
[tt]	EBIT	$18	$63	$117	$132	$156	$432	$447
[uu]	Funds From Operations (FFO)	$844	$826	$903	$942	$944	$1,251	$1,083
[vv]	Cash Flow from Operations (S&P)	$1,151	$1,191	$1,299	$1,346	$1,375	$1,792	$1,620
[ww]	Total Debt	$5,713	$5,925	$7,426	$8,276	$8,873	$9,423	$9,523
[xx]	Total Equity (assumed constant at 2015 level)	$10,045	$10,045	$10,045	$10,045	$10,045	$10,045	$10,045
[yy]	Cost of Debt (C1-1-1 Tables 1-9)	5.18%	5.21%	4.91%	4.63%	4.56%	4.52%	4.51%
[aaa]	Interest Capitalized to PP&E		$50	$47	$44	$44	$43	$43
[bbb]	Gross Interest Expense	$293	$296	$387	$391	$418	$458	$453
	DBRS:							
[ccc]	EBIT / Gross Interest Expense (x)	0.06	0.21	0.30	0.34	0.37	0.94	0.99
[ddd]	Predicted Credit Rating based on EBIT / Gross Interest Expense	BB/B	BB/B	BB/B	BB/B	BB/B	BB/B	BB/B
	S&P:							
[eee]	Debt / EBITDA (x)	5.11	5.12	5.87	6.30	6.61	5.36	6.00
[fff]	Predicted Financial Risk based on Debt / EBITDA	Significant	Significant	Significant	Aggressive	Aggressive	Significant	Aggressive
[ggg]	FFO / Interest (x)	4.64	3.48	2.73	2.79	2.58	3.08	2.70
[hhh]	Predicted Financial Risk based on FFO / Interest	Intermediate	Intermediate	Significant	Significant	Significant	Intermediate	Significant
[iii]	FFO / Debt (%)	14.8%	13.9%	12.2%	11.4%	10.6%	13.3%	11.4%
[jjj]	Predicted Financial Risk based on FFO / Debt	Intermediate	Intermediate	Significant	Significant	Significant	Intermediate	Significant
[kkk]	CFO / Debt (%)	20.1%	20.1%	17.5%	16.3%	15.5%	19.0%	17.0%
[lll]	Predicted Financial Risk based on CFO / Debt	Modest	Modest	Intermediate	Intermediate	Intermediate	Intermediate	Intermediate

Sources and Notes:
[b]: OPG Ex. L Tab 3.1 Schedule 20 VECC-005 Attachment 1 Table 5 (IRR Issue 3)
[d]: OPG Ex. L Tab 3.1 Schedule 20 VECC-005 Attachment 1 Table 5 (IRR Issue 3)
[h]: Adjustment of 673 is consistent with DBRS's adjustment in Ex. L Tab 3.1 Schedule 20 VECC-008 Attachment 4
[q]: Hydro tax assumed as 51.2mm, which is the same as the nuclear income tax in 2020 when the nuclear rate base is 7.5bn. The hydro rate base in earlier years is 7.5bn so we apply the 51.2mm in taxes to hydro in earlier years.
[u],[v]: S&P Definitions as per S&P Corporate Methodology: Ratios and Adjustments, 11/19/2013
[v]: To calculate FFO with net interest expense, we assume that interest income is held constant at $9mm, which was OPG's average interest income between 2011 and 2015
[jj]: We do not subtract debt issues maturing in each year on the assumption that in a worst case scenario OPG will re-issue an equal amount of debt to pay off the principal on maturing notes
[ddd]: DBRS Methodology for Rating Companies in the Regulated Electric, Natural Gas, and Water Utilities Industry (Oct. 2016)
[fff],[hhh],[jjj],[lll]: S&P Rating Services Corporates Methodology pg. 36 (11/19/2013)

Forecasted Rate of OPG's Debt

	Q1	Q2	Q3	Q4	Average
2016	3.59%	3.74%	3.81%	3.87%	3.75%
2017	3.93%	3.97%	4.00%	4.09%	4.00%
2018	4.23%	4.40%	4.68%	4.89%	4.55%
2019	4.93%	4.93%	4.93%	4.93%	4.93%
2020	4.93%	4.93%	4.93%	4.93%	4.93%
2021	4.93%	4.93%	4.93%	4.93%	4.93%

Source: Ex. C1-1-2 Page 4 of 6

Derivation of OPG's Forecasted Debt

	2015	2016	2017	2018	2019	2020	2021
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
[a] Planned New Debt Issues	$0	$400	$1,500	$850	$600	$550	$100
[b] Long Term Debt	$5,472	$5,872	$7,372	$8,222	$8,822	$9,372	$9,472
[c] Short Term Debt	$225	$37	$37	$37	$37	$37	$37
[d] Operating Lease Obligations	$16	$16	$17	$17	$14	$14	$14
[e] Total Debt	$5,713	$5,925	$7,426	$8,276	$8,873	$9,423	$9,523

Sources and Notes:
[a]: OPG Ex. C1-1-2 Page 5 of 6
[b]: 2015 value based on OPG Financial Statement; future values calculated as [a] of current year + [b] of prior year
[c]: 2015 value based on OPG Financial Statement; future years taken from OPG Ex. C1-1-3 Table 2
[d]: Forecast provided in 2015 OPG Financial Statement
[e]: [b]+[c]+[d]; we assume a worst case scenario in which debt issues maturing in each period (per Ex. C1-1-2 Page 5) are fully re-issued to pay back their principal amounts

Derivation of OPG's forecasted EBITDA, Funds from Operations, and Cash Flow from Operations ($C Millions)

	2015	2016	2017	2018	2019	2020	2021
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
[a] Rate Base	$9,800	$10,200	$10,800	$11,000	$10,900	$15,100	$15,600
[b] ROE		8.78%	8.78%	8.78%	8.78%	8.78%	8.78%
[c] Equity Capitalization	45%	45%	45%	45%	45%	45%	45%
[d] Net Income	$417	$403	$427	$435	$431	$597	$616
[e] Net Income after nwf adjustment (See note)	-$256	-$270	-$246	-$238	-$242	-$76	-$57
[f] Net Interest Expense	$182	$237	$331	$338	$365	$406	$401
[g] Total Tax Liability	$92	$96	$33	$33	$33	$102	$103
[h] Total OPG Depreciation	$1,100	$1,096	$1,149	$1,181	$1,186	$1,327	$1,140
[i] EBIDTA	$1,118	$1,158	$1,266	$1,313	$1,342	$1,759	$1,587
[j] Funds from Operations	$844	$826	$903	$942	$944	$1,251	$1,083
[k] Cash Flow from Operations	$1,151	$1,191	$1,299	$1,346	$1,375	$1,792	$1,620

Sources and Notes:
[a]: OPG Ex. L Tab 3.1 Schedule 20 VECC-005 Attachment 1 Table 5 (IRR Issue 3)
[b]: 8.78% OEB approved ROE
[c]: OPG's allowed equity capitalization as of EB-2013-0321
[d]: [a]x[b]x[c]; 2015 value taken from financial statement
[e]: [d]-673, to be consistent with DBRS in their adjustment for earnings from nuclear waste management
[f]: Calculations of The Brattle Group based on OPG forecasted Debt and expected future interest rates
[g]: Calculations of The Brattle Group with reference to OPG Ex. F4-2-1 Table 2
[h]: Calculations of The Brattle Group with reference to OPG Ex. F4-1-1 Table 2
[i]: [e]+[f]+[g]+[h]
[j]: [i]-[g]-[f]; in accordance with S&P Corporate Methodology
[k]: [e]+[f]+[g]+[h]+33; 33 is the value of OPG's 2015 deferred income tax

OPG Forecasted DBRS Credit Ratings at 0% Equity Capitalization (C$ Millions)

		2015	2016	2017	2018	2019	2020	2021
		[1]	[2]	[3]	[4]	[5]	[6]	[7]
	Revenue Requirement Metrics:							
[a]	Total Rate Base	$9,800	$10,200	$10,800	$11,000	$10,900	$15,100	$15,600
[b]	Return on Equity	2.67%	8.78%	8.78%	8.78%	8.78%	8.78%	8.78%
[c]	Debt Share of Capital Structure	55%	55%	55%	55%	55%	55%	55%
[d]	Equity Share of Capital Structure	45%	45%	45%	45%	45%	45%	45%
[e]	EBIT	$18	$63	$117	$132	$156	$432	$447
	Key Financial Metrics:							
[f]	Total Debt	$5,713	$5,925	$7,426	$8,276	$8,873	$9,423	$9,523
[g]	Total Equity (assumed constant at 2015 level)	$10,045	$10,045	$10,045	$10,045	$10,045	$10,045	$10,045
[h]	Interest Expense on Long Term Debt	$285	$293	$384	$388	$414	$454	$449
[i]	Interest Expense on Short Term Debt	$8	$3	$3	$3	$4	$4	$4
[j]	Gross Interest Expense	$293	$296	$387	$391	$418	$458	$453
	Key Financial Ratio employed by DBRS:							
[k]	EBIT / Gross Interest Expense (x)	0.06	0.21	0.30	0.34	0.37	0.94	0.99
[l]	Predicted Credit Rating based on EBIT / Gross Interest Expense	BB/B	BB/B	BB/B	BB/B	BB/B	BB/B	BB/B

Sources and Notes:
[a]: OPG Ex. L Tab 3.1 Schedule 20 VECC-005 Attachment 1 Table 5 (IRR Issue 3)
[b]: Allowed ROE set by OEB
[e]: Brattle Exhibit BV-5a
[f]: Brattle Exhibit BV-5b
[g]: Held constant at 2015 level per OPG's financial statement
[f]: Calculations of The Brattle Group based on OPG forecasted Debt and expected future interest rates
[i]: 2015 value from financial statement; forecast based on OPG Ex. C1-1-3 Table 2
[j]: [h]+[i]
[k]: [e]/[j]

OPG Forecasted S&P Credit Ratings at 0% Equity Capitalization (C$ Millions)

		2015	2016	2017	2018	2019	2020	2021
		[1]	[2]	[3]	[4]	[5]	[6]	[7]
	Revenue Requirement Metrics:							
[a]	Total Rate Base	$9,800	$10,200	$10,800	$11,000	$10,900	$15,100	$15,600
[b]	Return on Equity	2.67%	8.78%	8.78%	8.78%	8.78%	8.78%	8.78%
[c]	Debt Share of Capital Structure	55%	55%	55%	55%	55%	55%	55%
[d]	Equity Share of Capital Structure	45%	45%	45%	45%	45%	45%	45%
[e]	EBITDA	$1,118	$1,158	$1,266	$1,313	$1,342	$1,759	$1,587
	Key Financial Metrics:							
[f]	Funds From Operations (FFO)	$844	$826	$903	$942	$944	$1,251	$1,083
[g]	Cash Flow from Operations (CFO)	$1,151	$1,191	$1,299	$1,346	$1,375	$1,792	$1,620
[h]	Total Debt	$5,713	$5,925	$7,426	$8,276	$8,873	$9,423	$9,523
[i]	Total Equity (assumed constant at 2015 level)	$10,045	$10,045	$10,045	$10,045	$10,045	$10,045	$10,045
[j]	Net Interest Expense	$182	$237	$331	$338	$365	$406	$401
	Key Financial Ratios employed by S&P:							
[k]	Debt / EBITDA (x)	5.11	5.12	5.87	6.30	6.61	5.36	6.00
[l]	Predicted Financial Risk based on Debt / EBITDA	Significant	Significant	Significant	Aggressive	Aggressive	Significant	Aggressive
[m]	FFO / Interest (x)	4.64	3.48	2.73	2.79	2.58	3.08	2.70
[n]	Predicted Financial Risk based on FFO / Interest	Intermediate	Intermediate	Significant	Significant	Significant	Intermediate	Significant
[o]	FFO / Debt (%)	14.8%	13.9%	12.2%	11.4%	10.6%	13.3%	11.4%
[p]	Predicted Financial Risk based on FFO / Debt	Intermediate	Intermediate	Significant	Significant	Significant	Intermediate	Significant
[q]	CFO / Debt (%)	20.1%	20.1%	17.5%	16.3%	15.5%	19.0%	17.0%
[r]	Predicted Financial Risk based on CFO / Debt	Modest	Modest	Intermediate	Intermediate	Intermediate	Intermediate	Intermediate

Sources and Notes:
[a]: OPG Ex. L Tab 3.1 Schedule 20 VECC-005 Attachment 1 Table 5 (IRR Issue 3
[b]: Allowed ROE set by OEB
[e]: Brattle Exhibit BV-5a
[h]: Brattle Exhibit BV-5b; note that we do not follow S&P's Corporate Methodology to deduct surplus cash from our calculation of total deb
[j]: Brattle Exhibit BV-5a
[k]: [h]/[e]
[m]: [f]/[j]
[o]: [f]/[h]
[q]: [g]/[h]

Replication of OPG's Cost of Existing Debt as of FY 2015

	Principal (C$ millions)	Maturity Date	Effective Rate	Cost of Debt Weight
[1]	[2]	[3]	[4]	[5]
Long Term Debt:				
Notes Payable to OEFC				
	$270	2016	4.91%	0.24%
	$900	2017	5.35%	0.88%
	$395	2018	5.27%	0.38%
	$365	2019	5.44%	0.36%
	$660	2020	4.56%	0.55%
	$185	2021	4.28%	0.14%
	$150	2022	3.30%	0.09%
	$40	2023	3.12%	0.02%
	$300	2041	5.07%	0.28%
	$200	2042	4.36%	0.16%
UMH Energy Partnership				
	$187	2041	7.86%	0.27%
PSS Generating Station Limited Parternship				
	$245	2067	4.90%	0.22%
Lower Mattagami Energy Partnership				
	$200	2017	2.35%	0.09%
	$225	2021	4.46%	0.18%
	$200	2024	3.53%	0.13%
	$250	2041	5.26%	0.24%
	$200	2043	5.05%	0.18%
	$275	2046	4.26%	0.21%
	$225	2052	4.26%	0.18%
Cost of Long Term Debt	$5,472			4.81%

Sources and Notes:
2015 OPG Financial Statement Note 6
OPG also entered a $700 million credit facility with OEFC in June 2016 that expires Dec 2017 (Currently not included above) (But no borrowings as of Q2 2016)

OPG Interrogatory #5

Issue Number: 3.1
Issue: Are OPG's proposed capital structure and rate of return on equity appropriate?

Interrogatory:

Reference: Exhibit M3 page 4

"The regulatory risk from the methodology used to recover pension and OPEB cost is minimal."

Exhibit M3, pages 6-7:
"However, the difference between recovering accrual or cash based pension and OPEB cost is one of timing, so only if $450 million of pensions and OPEB costs were disallowed would the $450 million be lost. However the reliance on accrual or cash pension and OPEB costs for OPG's payment determination will impact the timing of the recovery and hence the timing of cash inflows. OPG's exposure is thus the time value of the funds and, if applicable, disallowance risk for amounts outside the 2014-2015 test years. Such amounts are magnitudes smaller then a $450 million."

Exhibit M3, pages 14-15:
"[T]he issue, which Concentric did not address, is primarily whether there is any risk of disallowances. These risks are mitigated by regulatory precedence for including pension and OPEB in rates, so I consider the risk low in the long-term and modest in the near term as incentive regulation is being implemented for the first time."

Exhibit M3, pages 30-31:
"Because the accrual of OPG's pension and OPEB are currently larger than its cash costs, the regulatory treatment defers recovery to future periods. Thus, the distinction between accrual and cash recovery of cost is one of timing, so while OPG's current cash flow is impacted, the total cash flow is not (absent future disallowances). Therefore the notion that the accrued difference between the accrual amount and the cash amount is "at risk" exaggerates OPG's regulatory risk. The amount would only be lost if disallowed. Thus, there is a timing difference and as the going forward treatment has yet to be determined, OPG faces some uncertainty, but Concentric's statements that the full amount is "at risk" substantially exaggerates the risk."

OPG Submission on Pension and OPEB Recovery (EB-2015-0040, September 22, 2016, page 23)

OPG's Submission highlighted that the amounts recorded in the Pension and OPEB Cash to Accrual Variance Account are at risk if the OEB determines that the effective date of a decision to adopt the cash basis for pension and OPEB is the date the account was approved; however, if the effective date is after December 31, 2016, OPG would be able to recover these amounts:

"*The first financial issue raised by OPG at the consultation was an immediate write-off to net income of approximately $190M, which is the value of the regulatory asset on OPG's balance sheet for the RPP portion of the Pension & OPEB Cash versus Accrual Differential Deferral Account (forecast as of December 31, 2016)*[1]*. The write-off would take place to the extent the OEB does not allow recovery of this balance in transitioning OPG to a contribution funding method of recovery. For example, if the OEB were to prospectively transition OPG to a contribution funding method as of January 1, 2017, the proposed effective date for new payment amounts in OPG's EB-2016-0152 rate application, and therefore allow recovery of the December 31, 2016 account balance, the write-off would be avoided."*

OPG Submission on Pension and OPEB Recovery (EB-2015-0040, September 22, 2016, page 24)

Page 24 of OPG's submission also notes that the cash and accrual basis are only equal over time if regulation starts at inception of the company. Under these circumstances, over time the same total costs are recovered with timing differences as noted by The Brattle Group; however OPG has not been regulated since inception.

Interrogatory:

a. If the OEB determined that the cash basis of cost recovery for Pension and OPEB costs is to be used for ratemaking purposes and OPG's rates are currently established on a cash basis, on what basis does The Brattle Group assume that the risk is minimal that OPG will not be allowed to recover the cash to accrual differences prior to the issuance of the OEB's determination establishing the cash basis of cost recovery of pension and OPEB costs?
b. As OPG has not been regulated since inception, is there a risk that cost recovery would in fact not simply be timing differences as discussed in the Brattle Group submission reference? Given the magnitude of this amount for OPG, is this risk not a substantial regulatory risk?

[1] The risk of the write-off was also raised at page 11 lines 16-19 in OPG's July 31, 2015 submission to the consultation
OPG, EB-2015-0040 Initial Written Submissions on the Regulatory Treatment of Pensions and Other Post-Employment Benefit Costs, 31 July 2015, [*OPG Initial Submission*].
http://www.rds.ontarioenergyboard.ca/webdrawer/webdrawer.dll/webdrawer/rec/489086/view/OPG_Sub_20150731.PDF

Response:

The following response was provided by The Brattle Group:

a) Dr. Villadsen is not sure she understands the question, but in an effort to be responsive, she responds as follows. As noted in M3, Dr. Villadsen observes that, for a fully regulated entity, the difference between recovering pension and OPEB cost on an accrual and cash basis is one of timing (absent disallowances). See M3, pages 30-31 for additional detail. Therefore, Dr. Villadsen finds that the distinction between accrual and cash recovery for a fully regulated entity is one of timing, which (as noted in M3, pages 30-31) may impact current cash flow but, absent disallowances, should not impact total cash flow.

b) Hypothetically, an entity that is not fully regulated throughout its existence could be impacted by the choice of cash vs. accrual recovery of pension and OPEB costs to the extent that existing pension or OPEB obligations were not reflected in the regulatory books at the time the entity became regulated. However, such impact on OPG should be mitigated by it having recovered pension and OPEB costs on an accrual basis until EB-2013-0321 was issued and by Decision EB-2007-0905 p. 12 accepting OPG's financial position as of year-end 2007. Dr. Villadsen also found no discussion of disallowing pension or OPEB costs in EB-2007-0905.

OPG Interrogatory #6

Issue Number: 3.1
Issue: Are OPG's proposed capital structure and rate of return on equity appropriate?

Interrogatory:

Reference: Exhibit M3 page 18

"Further, because OPG's nuclear generation is fully regulated, OPG's exposure to risks association with outages is mitigated."

EB-2007-0905 – OEB Decision with Reasons dated November 3, 2008, Section 9.2.1, pages 173-174:

"The Board will continue the current 100% variable payment structure for nuclear output...

The Board believes OPG should be fully incented to produce as accurate a forecast of nuclear production as possible and should be at risk if actual output falls short of forecast. This is the same position OPG would be in if the nuclear facilities were not regulated and were compensated through the hourly spot market or bilateral contracts."

Exhibit E2-1-1, page 3, Chart 2:

Chart 2

OPG Nuclear Production Variance and Revenue Impact

Line No.		2008	2009	2010	2011	2012	2013	2014	2015	Average	Total
		(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
1	OPG Application - TWh	51.4	49.9	-	48.9	50.0	-	48.5	46.1		
2	OEB Approved - TWh+	51.4	49.9	50.7	50.4	51.5	51.0	49.0	46.6		
3	Actual -TWh	48.2	46.8	45.8	48.6	49.0	44.7	48.1	44.5		
4	Variance (TWh) (line 3 - line 2)	-3.2	-3.1	-4.9	-1.8	-2.5	-6.3	-0.9	-2.1	-3.2	-24.7
5	Revenue Impact - $M#	-159.9	-154.9	-242.4	-87.3	-121.3	-305.7	-45.9	-114.3	-154.0	-1231.8

\+ 2010 is the average of 2008 and 2009 Board Approved; 2013 is average of 2011 and 2012 Board Approved.

\# At OEB-approved rates of $52.98/MWh for 2008-2010 less fuel cost, and $51.52/MWh for 2011-2013 less fuel cost.
For 2014, 10 months at OEB–approved rate of $51.52/MWh and 2 months at OEB approved rate of $59.29/MWh, less fuel cost (average $52.82/MWh).
For 2015, at OEB approved rate of $59.29/MWh less fuel cost

Interrogatory:

a) Given the design of OPG's payment amount set through regulation is intended to maximize OPG's exposure to outage risk to incent OPG to minimize unforeseen outages, how does regulation mitigate OPG's exposure to risks associated with outages?

b) Given the impacts of production shortfalls illustrated in Exhibit E2-1-1, Chart 2 would The Brattle Group not agree that production shortfalls have been a significant contributor to OPG's under earnings since regulation?

c) Given both Darlington and Pickering operations going forward will be substantially different (i.e., refurbishment and extending operations) than they have been in the past (i.e., pure operational focus), is it not reasonable to assume that outage planning will becoming increasingly less certain, increasing the risks associated with outages?

Response:

The following response was provided by The Brattle Group:

a) Dr. Villadsen understands that deferral and variance accounts are not available for nuclear generation production variances due to unforced outages. However, she notes that similar risk exposure is present for the comparable companies in her refined sample. Finally, Dr. Villadsen's understands that OPG has requested the ability to update its forecast of production output in an intervening year of the 2017-2021 period, i.e., during the refurbishment program.[1] Such an update should enhance OPG's ability to match the forecasted production and actual production.

b) Dr. Villadsen agrees that this is substantial portion of OPG's under-earnings to date. However, Dr. Villadsen has not investigated the reasons for the production shortfalls and is focused on OPG's risks going forward.

c) Not necessarily. Dr. Villadsen is not an engineer but finds it plausible that during the refurbishment of Darlington, construction progress and production outages could be predicted and that following refurbishment, production planning will be enhanced. As for the extension of operations at Pickering, Dr. Villadsen cannot comment on the ability of OPG to predict outages.

[1] Exh.A1-3-3 pp. 10-14.

OPG Interrogatory #7

Issue Number: 3.1
Issue: Are OPG's proposed capital structure and rate of return on equity appropriate?

Interrogatory:

Reference: Exhibit M3 Appendix

Please provide Dr. Villadsen's filed evidence in Arizona on behalf of Arizona Public Service on the cost of equity (i.e., Direct Testimony on return on equity for Arizona Public Service Company, Arizona Corporation Commission, Docket E-01345A-16-0036, June 2016).

Response:

The following response was provided by The Brattle Group:

Please see the response to M3-3.1-SEC-1_Attachment 1.

AMPCO Interrogatory #1

Issue Number: 3.1
Issue: Are OPG's proposed capital structure and rate of return on equity appropriate?

Interrogatory:

Reference: Exhibit M3. EB-2013-0321 Decision with Reasons

At Reference 2, the Board's Decision with Reasons in EB-2013-0321 (page 114) states:

> "OPG raised various other arguments with respect to the need for at least the same, or higher, equity thickness. One of these arguments was that there is a greater risk associated with the future move to incentive regulation. The Board does not accept that moving to incentive regulation significantly increases risk to the entity such that the capital structure should be reset, and has not done so for any of the other companies that it regulates. …The Board therefore is not persuaded by the comments made by OPG and its consultant that the future move to an incentive regulatory mechanism for OPG increases business risk such that a higher equity thickness should be considered."

At Reference1, The Brattle Group Inc. Report entitled "Common equity Ratio for OPG's Regulated Generation" at page 4:

> "Compared to the time around EB-2013-0321, OPG is exposed to larger variability in its income due to the move from cost of service to incentive regulation for regulated hydroelectric facilities."

a) Please rationalize the Brattle Group's opinion with regard to the OEB's prior decision on the same matter.
b) Does the contrast in the above statements cause Brattle to rethink its position in respect of Regulatory Risk? If not, why not?

Response:

The following response was provided by The Brattle Group:

a) Please see the response to M3-3.1-SEC-3.

b) No. Dr. Villadsen observes that the cited paragraph references a "future move to an incentive regulatory mechanism" whereas the current proceeding proposes such a move. For additional comments, please see the response to M3-3.1-SEC-3.

AMPCO Interrogatory #2

Issue Number: 3.1
Issue: Are OPG's proposed capital structure and rate of return on equity appropriate?

Interrogatory:

Reference: Exhibit M3. EB-2016-0152, Technical Conference Volume 1, page163

a) At the time it created its report, did the Brattle Group understand that OPG's $12.8B total cost estimate for DRP is constructed on a "P90" basis – that is, OPG has a 90% confidence interval that the total cost of DRP will come in at or less than $12.8B?

b) Does this high confidence interval, in concert with the existing support that the government has set out for DRP (financial backstop, specific LTEP inclusion, O.Reg. 53/05 support for need and for recovery of deferral account balances) cause Brattle to rethink its position in respect of Construction Risk? If not, why not?

Response:

The following response was provided by The Brattle Group:

a) Yes, Brattle learned during the technical conference that the cost estimate for DRP had a 90% confidence interval.

b) No. As noted above, Brattle learned of the high confidence level during the technical conference, November 14-16.

AMPCO Interrogatory #3

Issue Number: 3.1
Issue: Are OPG's proposed capital structure and rate of return on equity appropriate?

Interrogatory:

Reference: Exhibit M3.

As set out on page 25 of the report, OPG's rate smoothing proposal will reduce OPG's cash flow during the DRP construction period (also relevant is the fact that the deferral account will attract interest as per O. Reg. 53/05). However, as also set out on the same page, this will be offset by the proposal to increase nuclear payments by 11 percent annually to 2021.

a) Please comment on whether these two points combined result in a net increase in risk or a net decrease in risk.

Response:

The following response was provided by The Brattle Group:

a) The primary effect of the smoothing / rate proposal is to move the risk to OPG in time. Without a smoothing across years, OPG would face higher risks early on in the construction period and lower risks later on. Thus, the impact would be a reduction in risk over the next few years, offset by an increase in a future year.

AMPCO Interrogatory #4

Issue Number: 3.1
Issue: Are OPG's proposed capital structure and rate of return on equity appropriate?

Interrogatory:

Reference: Exhibit M3, Ex D2-T1-S2 Table 1 and Ex A2-T3-S1 Attachments

At page 10, The Brattle Group Inc. Report entitles "Common equity Ratio for OPG's Regulated Generation" states:

> "A delayed recovery of expended capital is normal in capital intensive industries – wherein capital intensive assets have longer lead times for development and operationalization. Therefore, in such industries, there is generally an increased strain on the utility's credit metrics during major capital development programs, leading to upward pressure on the utility's financial risk profile."

a) Between 2012 and 2015, DBRS ratings remained unchanged. In the same time period, S&P downgraded OPG, but did so for consistency with its downgrade of the Province of Ontario S&P's assessment of OPG's financial risk profile remained unchanged. Between 2012 and the end of 2015, OPG spent $2.639B in capital on DRP. Despite mention of the issue, neither DBRS nor S&P have specific action as a direct result of increased capex over the period. Please illustrate the harm to OPG's credit metrics that resulted from this level of capital expenditure.

Response:

The following response was provided by The Brattle Group:

a) Dr. Villadsen did not calculate OPG's credit metrics for years prior to 2015. Based on Dr. Villadsen's forward looking credit metric assessment, OPG's capital spending program adds significant levels of debt – about $4 billion – between 2016 and 2021. At the same time however, commensurate increases in rate base is delayed until 2020. This is expected to reduce revenue, cash flow and earnings metrics relative to the size of the rate base for the company. Particularly in years 2018 and 2019, OPG's credit metrics are expected to decline (at least by one notch per S&P's financial risk categorization) from its 2015 levels. In fact,

had it not been for the favorable regulatory environment and a “very strong” government-related entity criteria from S&P, OPG’s current financial metrics – on a stand-alone basis – would have already resulted in a lower credit rating than it currently enjoys.

AMPCO Interrogatory #5

Issue Number: 3.1
Issue: Are OPG's proposed capital structure and rate of return on equity appropriate?

Interrogatory:

Reference: Exhibit M3, Ex B1-T1-S1, page 3 of 8, chart 1

a) If OPG does not close $4.8B of the DRP to its nuclear rate base in 2020 as proposed, and instead closes it at some later date outside the 2017-2021 rate period, what impact does this have on Brattle's position with respect to equity thickness for the 2017-2021 period? Please explain.

Response:

The following response was provided by The Brattle Group:

a) If OPG were to experience significant unplanned/unexpected delays during the Darlington Refurbishment Program, its construction and execution risks could be higher, but its financial leverage may be lower over the near term. Delays in executing the planned refurbishment program could impact OPG's credit metrics is several ways. (i) Assuming that construction costs are incurred as planned, but the DRP is not completed on time would result in OPG experiencing a further decline in credit metrics. (ii) Assuming that both construction costs and completion are delayed, the increase in construction risk would be offset by lower leverage and credit metrics would improve relative to the forecasted level. Without knowing the reasons for such a delay (within or outside OPG's control, foreseen / unforeseen, etc.), Dr. Villadsen cannot opine on how she would change the equity thickness.

SEC Interrogatory #1

Issue Number: 3.1
Issue: Are OPG's proposed capital structure and rate of return on equity appropriate?

Interrogatory:

Reference: Exhibit M3

Please provide a list detailing all of the reports or studies prepared by Dr. Villadsen, alone or jointly with others, in the last ten years dealing with return on equity, equity thickness, or cost of capital. For each such report, please provide the name of the client, and whether the client was a utility or utility association, regulator or association of regulators, customer or customer association, or other. For each such report that has been filed in a public proceeding, or has otherwise been made public, please provide a copy in electronic format.

Response:

The following response was provided by The Brattle Group:

Please see the attached excel filed labelled "Response to M3-3.1-SEC-12", which contains links to most of Dr. Villadsen's prior testimony or reports on the return on equity, equity thickness, or cost of capital. This file also lists the party on whose behalf Dr. Villadsen was filing the report or testimony.

Documents that are not readily available on the internet are provided as M3-3.1-SEC-1 Attachments 1 – 11

DIRECT TESTIMONY OF BENTE VILLADSEN

On Behalf of Arizona Public Service Company

Docket No. E-01345A-16-0036

June 1, 2016

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DIRECT TESTIMONY OF BENTE VILLADSEN
ON BEHALF OF ARIZONA PUBLIC SERVICE COMPANY
(Docket No. E-01345A-16-0036)

I. INTRODUCTION AND SUMMARY

Q. PLEASE STATE YOUR NAME AND ADDRESS.

A. My name is Bente Villadsen and my business address is The Brattle Group, 44 Brattle Street, Cambridge, Massachusetts 02138, USA.

Q. WHAT IS THE PURPOSE OF YOUR DIRECT TESTIMONY IN THIS PROCEEDING?

A. I have been asked by Arizona Public Service Company (APS or Company) to determine and present APS's cost of equity and recommend the return on equity that should be included in its rates. I have also been asked to discuss how decoupling affect the cost of equity. Finally, my testimony offers an opinion on the fair value of APS's rate base and an appropriate fair value rate of return.

Q. PLEASE SUMMARIZE YOUR QUALIFICATIONS.

A. I am a principal of The Brattle Group and have more than 15 years of experience working with regulated utilities on cost of capital and related matters. My practice focuses on cost of capital, regulatory finance and accounting issues. I have testified or filed expert reports on cost of capital in Alaska, Alberta, Arizona, California, New Mexico, Oregon as well as before the Bonneville Power Administration and the Surface Transportation Board. I have provided white papers on cost of capital to the British Columbia Utilities Commission and the Canadian Transportation Agency as well as to European and Australian regulators on cost of capital. I have testified or filed testimony on regulatory accounting issues before the Federal Energy Regulatory Commission (FERC), the Michigan Public Service Commission as well as in international and U.S. arbitrations and regularly advice utilities on regulatory matters as well as risk

management. I have previously testified on cost of capital before the Arizona Corporation Commission (Commission or ACC). I hold a Ph.D. from Yale University and a BS/MS from University of Aarhus, Denmark. Appendix A contains more information on my professional qualifications as well as a list of my prior testimonies.

Q. PLEASE SUMMARIZE YOUR TESTIMONY.

A. To determine APS's cost of equity I selected a relevant sample of integrated electric utilities that are subject to regulation as well as a utility sample, whose assets are similar to those of APS. I calculated the cost of equity for the sample using standard Capital Asset Pricing Models (CAPM), Discounted Cash Flow (DCF) models and a risk premium model. Having estimated the cost of equity for the sample, I then considered specific risks of APS to derive a range of cost of equity estimates for the Company. I concluded that a range of reasonable return on equity (ROE) estimates are as indicated below:

Return on Equity

	Reasonable Range for Proxy Group
CAPM-based Methods	10.0% - 10.5%
DCF-based Methods	9.9% - 10.8%
Risk Premium Method	10.3%

I conclude that APS should be in the upper half of the range because, among other things, of its significant portfolio of nuclear generation. I also note that APS has been unable to earn its allowed ROE since 2002.

For these reasons and because APS's revised rates are expected to be in effect beginning in 2017, I believe that APS should be placed in the upper end of the range and recommend that a ROE of 10.5% is appropriate for setting rates in this case.

As I mentioned, in my testimony I also discuss the relationship between decoupling of rates and cost of capital. The majority of the utilities in my sample have a decoupling mechanism in place, consequently, the impact, if any, of decoupled rates would already be captured and reflected in the cost of equity ranges that I have provided. Further, additional research has shown that decoupling does not measurably impact the cost of capital. Therefore, I conclude that decoupling does not affect the cost of equity.

Finally, I discuss the fair value rate base for APS and the return hereon. I find that the fair value rate base claimed by APS, which is the average of original and reconstruction cost new is a reasonable if conservative estimation of fair value in the economic sense. Further, a FVROR on the incremental rate base (Fair Value Increment) of up 6.04% (calculated as the inflation adjusted ROR) would be reasonable, as would applying the weighted cost of capital of 8.13% to the entire FVRB. Thus, the Company's request of a return on the Fair Value Increment of 1%, as well as an overall FVROR of 5.84% is conservative.

II. APPROACH TO ESTIMATING THE COST OF CAPITAL

A. *Preliminary Comments*

Q. WHAT ARE THE GUIDING PRINCIPLES FOR DETERMINING A JUST AND REASONABLE RATE OF RETURN ON UTILITY INVESTMENTS?

A. Fortunately, there has been a lot of guidance provided on this topic over the years. Perhaps the seminal guidance was provided by the U.S. Supreme Court in the Hope and Bluefield cases, which found that:[1]

[1] *Bluefield Water Works & Improvement Co. v. Public Service Commission of West Virginia*, 262 U.S. 679 (1923) (Bluefield), and *Federal Power Com'n v. Hope Natural Gas Co.*, 320 U.S. 591 (1944) (Hope).

1. The return to the equity owner should be commensurate with returns on investments in other enterprises having corresponding risks;[2]
2. The return should be reasonably sufficient to assure confidence in the financial soundness of the utility; and
3. The return should be adequate, under efficient and economical management for the utility to maintain and support its credit and enable it to raise the money necessary for the proper discharge of its public duties.[3]

Q. PLEASE DESCRIBE HOW YOU CONDUCTED YOUR COST OF EQUITY ANALYSIS.

A. I selected a sample of regulated electric utilities that are comparable to APS, estimated the return that investors required to provide capital for those utilities and reviewed the return on equity authorized in other jurisdictions. I also reviewed the specific risks for APS including business, financial, and regulatory risk.

In order to provide additional support for my recommendation, I undertake several analyses. Specifically, I use the CAPM, DCF and Risk Premium analyses; all of which are widely used in the utility and ratemaking setting. The wisdom of employing multiple methodologies has been acknowledged by the Commission in prior decisions.[4]

To arrive at my final ROE recommendation, I considered (i) the ranges of my cost of equity numbers, (ii) the current economic outlook, (iii) the financial risk differences, (iv) the business risks of APS relative to that of the benchmark samples, (v) the regulatory environment in which APS operates. Based upon my analyses of those

[2] *Hope.*
[3] *Bluefield.*
[4] For example, Decision 71914, p. 34.

factors, I determined that a reasonable range of ROE was between 10.25% and 10.75% and concluded that a recommended ROE of 10.5% was appropriate.

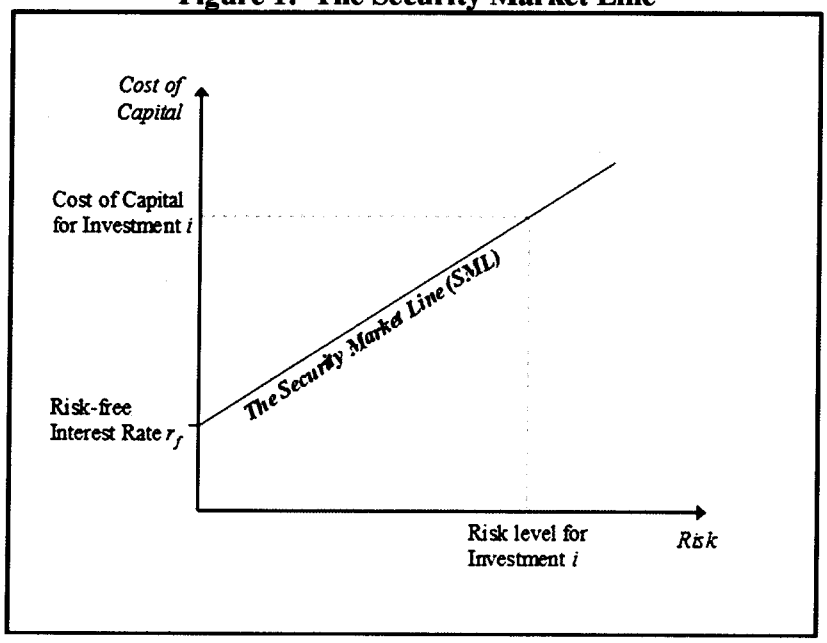
1. Cost of Capital and Risk

Q. HOW IS THE "COST OF CAPITAL" DEFINED?

A. The cost of capital is defined as the expected rate of return in capital markets on alternative investments of equivalent risk. The cost of capital is a type of opportunity cost: it represents the rate of return that investors could expect to earn elsewhere without bearing more risk. "Expected" is used in the statistical sense: the mean of the distribution of possible outcomes. The terms "expect" and "expected," as in the definition of the cost of capital itself, refer to the probability-weighted average over all possible outcomes.

The definition of the cost of capital recognizes a tradeoff between risk and return that can be represented by the "security market risk-return line" or "Security Market Line" for short. This line is depicted in Figure 1 below. The higher the risk, the higher the cost of capital required.

Figure 1: The Security Market Line



Q. WHY IS THE COST OF CAPITAL RELEVANT IN RATE REGULATION?

A. The "cost of capital" is the return that investors expect to earn on investments of comparable risk[5] and is one of the relevant factors set forth in the Hope and Bluefield cases.

Q. WHAT DOES THIS MEAN FROM AN ECONOMIC PERSPECTIVE?

A. From an economic perspective, rate levels that give investors a fair opportunity to earn the cost of capital are the lowest levels that compensate investors for the risks they bear. A utility's ability to attract capital and maintain its financial integrity requires that the combined equity return and equity ratio be such that not only is the expected return commensurate with that of other enterprises, but it also meets the expectations of credit market participants.

[5] *See also* Stewart C. Myers, "The Application of Finance Theory to Public Utility Rate Cases," *The Bell Journal of Economics & Management Science* 3:58-97 (1972).

More important for customers, however, are the broader economic consequences of providing an inadequate return to the company's investors. In the short run, deviations from the expected rate of return on the rate base from the cost of capital may seemingly create a "zero-sum game"—investors gain if customers are overcharged, and customers gain if investors are shortchanged. In the longer term, inadequate returns are likely to cost customers—and society generally—far more than may be saved in the short run. Inadequate returns lead to inadequate investment, whether for maintenance or for new plant and equipment. Without access to investor capital, the company may be forced to forgo opportunities to maintain, upgrade, and expand its systems and facilities in ways that decrease long run costs. Indeed, the cost to consumers of an undercapitalized industry can be far greater than any short-run gains from shortfalls in the cost of capital. This is especially true in capital-intensive industries (such as the electric and gas utility industry), which feature systems that take a time to decay. Such long-lived infrastructure assets cannot be repaired or replaced overnight, because of the time necessary to plan and construct the facilities. Thus, it is in customers' interest not only to make sure the expected return of the investors does not exceed the cost of capital, but also that the expected return does not fall short of the cost of capital.

2. The Impact of Risk on the Cost of Capital

Q. PLEASE SUMMARIZE HOW YOU FACTORED RISK WHEN DETERMINING THE COST OF CAPITAL.

A. I analyzed the difference in leverage among the sample utilities and the benchmark equity percentage of APS. To determine where in the estimated range APS's ROE reasonably falls, I compared the business risk of APS relative to the sample utilities and also the capital markets.

Q. WHY IS CAPITAL STRUCTURE IMPORTANT FOR THE DETERMINATION OF THE COST OF EQUITY?

A. Shareholders in a company with more debt face more equity risk and therefore the return on equity needs to be greater.[6] There are several manners in which the impact of financial risk can be taken into account in an analysis of cost of equity. One way is to determine the after-tax weighted-average cost of capital for the entities and let that figure be constant between the estimate obtained for the sample and the entity to which it is applied. This assumes that the after-tax weighted-average cost of capital is constant for a range that spans the capital structures used to estimate the cost of equity and the regulatory capital structure. A second approach was developed by Professor Hamada, who unlevered the beta estimates in the CAPM to obtain a so-called all-equity or assets beta and then re-levered the beta to determine the beta associated with the target regulatory capital structure. This requires an estimate of the systematic risk associated with debt (i.e., the debt beta), which is usually quite small. In Appendix B, I set forth additional technical details related to methods to account for financial risk when estimating the cost of capital.

Q. PLEASE IDENTIFY THE APS OR ARIZONA-SPECIFIC RISK FACTORS.

A. First, APS's generation capacity includes 27% nuclear, which is substantially higher than the average among my sample companies (about 13%).[7] The magnitude and composition of generating facilities matter because capital-intensive investments increase the fixed cost component and hence the operating leverage of a company.[8] Nuclear generation not only has very large fixed costs, but also large operating risks and

[6] Robert S. Hamada, "Portfolio Analysis, Market Equilibrium and Corporate Finance," *The Journal of Finance* 24: 13-31 (March 1969).

[7] *See* Figure 4 below for details.

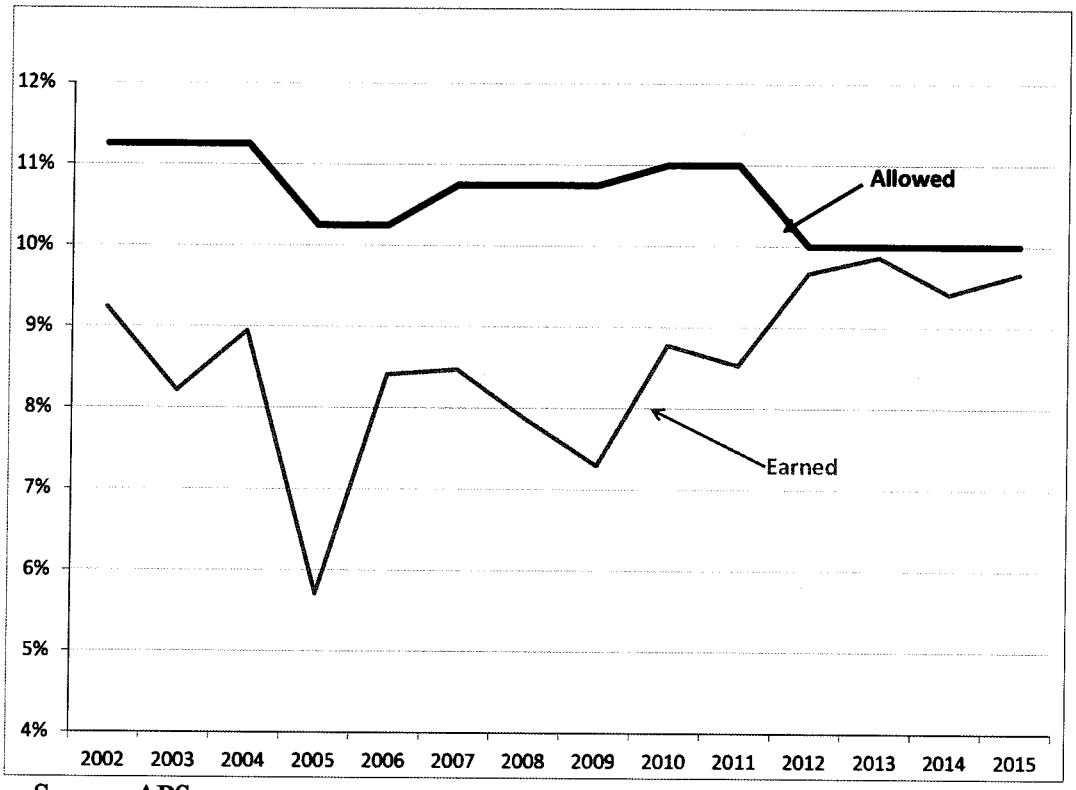
[8] For an exposition of this, *see* Richard A. Brealey, Stewart C. Myers, and Franklin Allen, "*Principles of Corporate Finance*," 11th Edition, 2014 (Brealey, Myers & Allen 2014), pp. 227-228.

APS is the operator of the largest nuclear generating facility in the country, Palo Verde units 1, 2 and 3. Second, APS has not earned its allowed ROE since 2002 and the earned ROE has been substantially below the allowed ROE during several years. This is illustrated in Figure 2 below (*see* Attachment BV-2DR). Third, the majority of the publicly traded electric utilities in the U.S. are larger than APS. The average market capitalization and annual revenue of my sample companies are twice that of Pinnacle West Capital Corporation (Pinnacle West), the parent of APS.[9] Empirical studies have shown that investors require a higher premium to invest in smaller companies than in larger ones. The single-jurisdiction, comparatively smaller size of Pinnacle West means that the Company has less diversification and hence has a more concentrated risk exposure to, for example, adverse local conditions. Finally, I note that decoupling mechanisms are available to the majority of companies in my sample as well as in the majority of U.S. states. Also, decoupling has been shown to have no detectable impact on the return on equity.[10] Therefore, should the Commission in the future implement a decoupling mechanism, it should not affect the ROE.

[9] APS represents a very large proportion of the revenue, income, assets and equity comprising the Pinnacle West Corporation according to Pinnacle West's 2014 Annual Report's income statements and balance sheets for the corporation and the utility. Figure 8 summarizes the size and other facts about the sample companies and APS.

[10] Joe Wharton & Michael J. Vilbert, "Decoupling and the Cost of Capital," *The Electricity Journal*, vol. 28, 2015, pp. 19-28.

Figure 2: APS Earned and Allowed ROE: 2002-2015



Source: APS.

I note that APS obtained an A2 rating from Moody's in June 2015 following an upgrade to A3 in January 2014,[11] while Standard & Poor's upgraded APS to A- in December 2013.[12] The improved rating, which lowers debt costs, coincides with the closing of the gap between the allowed and earned ROE. I note that the financial improvements coincide with regulatory initiatives, so that (ignoring the height of the financial crisis in 2008-09), APS's financial performance has improved after the upgrade of the regulatory environment in Arizona to Average / 3 by Regulatory Research Associates[13] and further with the approval of several rate mechanisms from 2012 onwards that aim to recover

[11] Moody's, "Moody's upgrades Pinnacle West Capital and Arizona Public Service; outlooks are stable," June 2, 2015 and https://www.moodys.com/credit-ratings/Arizona-Public-Service-Company-credit-rating-62000.

[12] Standard & Poor's.

[13] SNL, "Commissions," Reviewed March 5, 2016.

costs more quickly.[14] It is important to continue these efforts to ensure the utility and customers have access to debt capital at relatively low cost.

Q. HOW DID YOU FACTOR THE ADDITIONAL CAPITAL MARKET INFORMATION INTO YOUR ANALYSIS?

A. The return that investors require to provide equity capital depends not only on the relative risk of the investment being considered but also on the return generally available in the market for investments with comparable risk. Therefore, I felt that it was essential to consider prevailing conditions and trends in financial markets when determining inputs to the models used to estimate the cost of equity and when evaluating the reasonableness of the estimates.

III. IMPACT OF THE ECONOMY AND MARKETS ON THE COST OF EQUITY

A. *Interest Rates*

Q. WHAT ARE THE RELEVANT DEVELOPMENTS REGARDING INTEREST RATES?

A. Recent interest rates and especially government bond yields have been low. However, the spread between utility bond yields and government bond yields of the same maturity is higher than they have been historically; both when measured over the long run and more recently.

Figure 3 below shows the development in BBB rated utility and Government bond yields from 1999 to today.[15] It is evident that the yield spread (the difference between

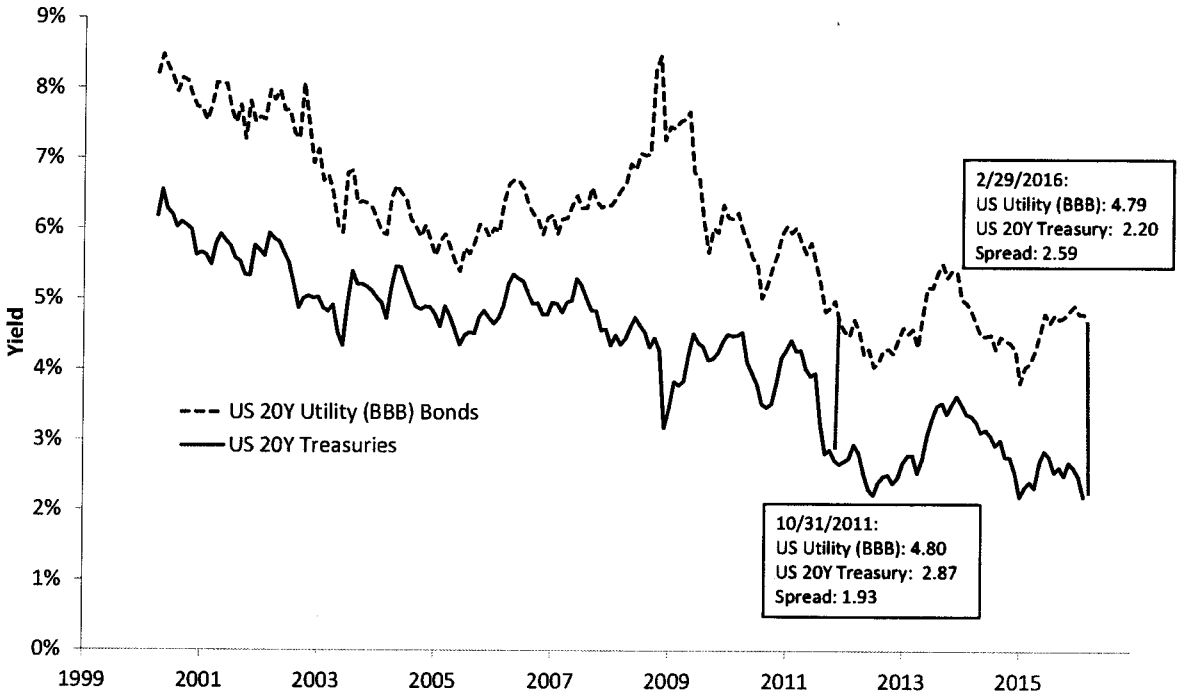
[14] *Ibid.* For example, a Lost Fixed Cost Recovery mechanism was initially approved in 2012 and effective beginning in 2015 a Four Corners Adjustment rider that will allow APS to recover costs associated with APS share in Four Corners.

[15] For clarity "BBB rated" refer to bonds in the range of BBB- through BBB+ and "A rated" reference bonds in the range of A- through A+. The majority of electric utilities are low A or high BBB rated.

the yield on BBB rated utility bonds and government bonds) has increased both relative to its historical average and relative to the Company's most recent rate case filing (Docket No. E-01345A-11-0224).

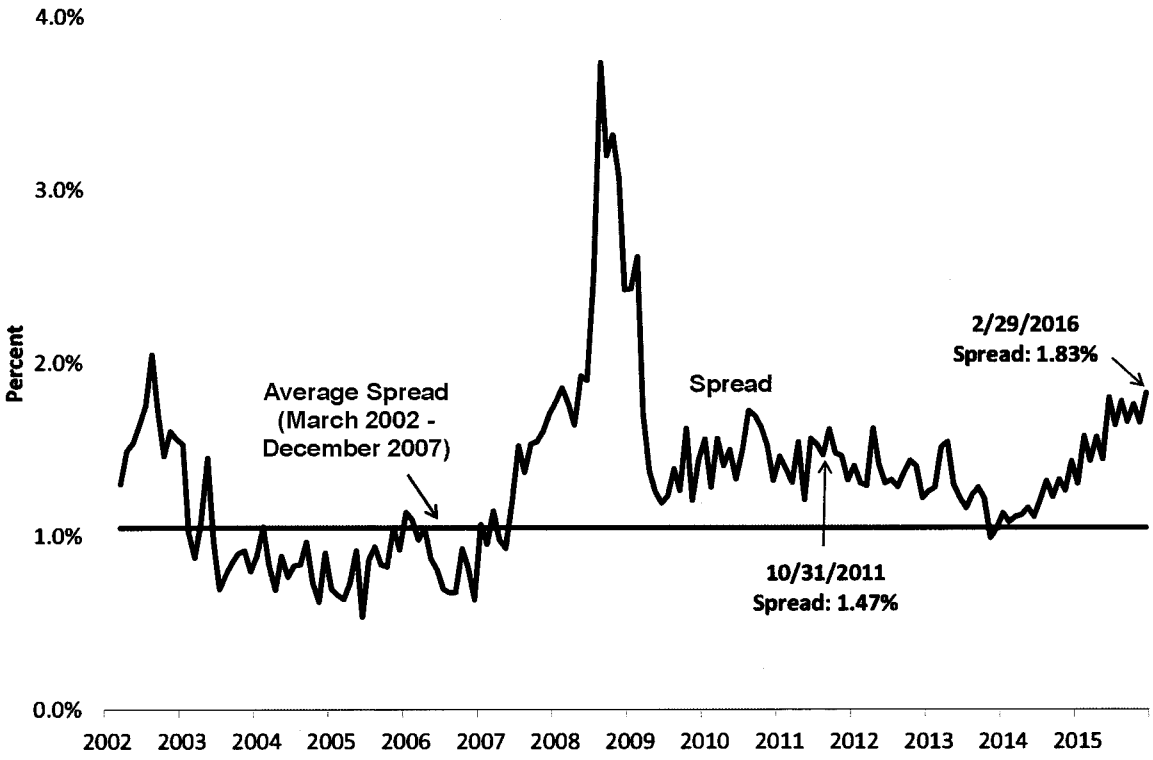
Figure 4 shows the spread between A rated utility bonds and government bond yields along with the average spread prior to the financial crisis. Again, it is evident that the spread is greater. Thus, a review of both BBB rated and A rated bonds clearly illustrates the increase in the spread between the utility bond yield and government bond yields.

Figure 3: BBB Utility and Government Bond Yields



Source: Bloomberg

Figure 4: Spread between A Rated Utility and 20-Year Government Bond Yield



Source: Bloomberg.

Q. HOW DOES THE CURRENT SPREAD BETWEEN UTILITY AND GOVERNMENT BOND YIELDS COMPARE TO THE HISTORICAL SPREAD?

A. As shown in Figure 3 and Figure 4 above, the spread between BBB rated utility bond yields or between A rated utility bond yields and government bond yields has grown. At the end of February, 2016 the BBB spread stood at 2.56%, which is approximately 136 basis points higher than prior to the 2008-09 financial crisis. At the same time the A rated utility bond yield was 1.83% for an increase of about 90 basis points over the pre-crisis level. Not only is the yield spread increased relative to its pre-crisis levels, but it is also greater relative to the level in the more recent past as illustrated in the figures above. (*see* Attachment BV-3DR)

Q. HOW ARE INTEREST RATES EXPECTED TO TREND GOING FORWARD?

A. Blue Chip Economic Indicators expects that the yield on 10-year Treasury Notes will increase by about 120 basis points by 2017 and the publication forecasts addition increases for 2018 and beyond.[16] Comparably, Consensus Forecast expect the 10-year yield to increase by 130 basis points by 2017 and by an additional 50 basis point by 2019, while the Congressional Budget Office predicts an increase of approximately 200 basis points over the coming years.[17] These expectations are consistent with the current downward pressure on Government bond yields, which has largely been caused by the Federal Reserve's quantitative easing program and general stimuli of the U.S. economy.[18]

Q. HOW DO THESE DEVELOPMENTS IMPACT THE COST OF EQUITY ANALYSIS?

A. There are several ways in which the current interest rate environment affects the cost of equity analysis. First and most directly, the CAPM utilizes as one of its inputs a measure of the risk-free rate (*see* Figure 1). I used the yield on a US government bond as a proxy for the risk-free rate. The estimated cost of equity using the CAPM increases (decreases) by 1% when the relied upon risk-free rate (e.g., the government bond rate) increases (decreases) by 1%. Therefore, to the extent that the government bond rate is driven by monetary policy rather than market factors, so is the CAPM estimate. Importantly, if the government bond rate is downward (upward) biased, then the CAPM estimate will be downward (upward) biased. When that is the case, it is necessary to normalize the relied upon government bond rate, so that the resulting CAPM estimate reflects a non-biased government bond rate.

[16] Blue Chip Economic Indicators, January 2016 and October, 2015.
[17] Consensus Forecasts, October 2015. Congressional Budget Office, "The Budget and Economic Outlook: 2015-2025," January 2015, p. 53.
[18] For a summary of the magnitude of the Federal Reserve's purchase program, see, for example, Bloomberg, "The Fed Eases Off," September 16, 2015.

Second and as a further indication of a potential bias, if the spread between the yield on utility (or corporate) bonds and government bonds (the "yield spread") widens, it indicates that the premium that investors require for holding securities other than government bonds has increased. Thus, there is evidence that the market equity risk premium has increased. A higher than normal yield spread is one indication of the higher risk premiums currently prevailing in capital markets. Investors consider a risk-return tradeoff (like the one displayed in Figure 1 above) and select investments based upon the desired level of risk. Higher yield spreads reflect the fact that the return on corporate debt is higher relative to government bond yields than is normally the case, even for regulated utilities. Because equity is more risky than debt, this means that the spread between the cost of equity and government bond yields must also be higher; i.e., the premium required to hold equity (the Market Risk Premium or MRP) rather than government bonds has increased. If this fact is not recognized, then the traditional cost of capital estimation models will underestimate the cost of capital prevailing in the capital markets.

Third, in times of economic uncertainty (such as the present) investors seek to reduce their exposure to market risk. This precipitates a so-called "flight to safety," wherein demand for low-risk government bonds rises at the expense of demand for stocks. If yields on bonds are extraordinarily low, however, any investor seeking a higher expected return must choose alternative investments such as stocks, real estate, gold or collectibles. Of course, all of these investments are riskier than government bonds, and investors demand a risk premium (perhaps an especially high one in times of economic uncertainty) for investing in them. But short of accepting meager returns, investors simply have few alternatives to returning to the stock market. Utility stocks may have experienced the "flight to safety" phenomenon to a larger degree than other stock because they traditionally have paid a substantial portion of their earnings as dividends.

Therefore, investors who have sought income from their investments and found government bonds too unattractive may have accepted a higher risk and invested in utility stock with the goal of receiving periodic dividend payments.

One possible explanation of the current elevated level of the yield spread is that current and near-term expected levels of government bond yields are artificially depressed due to monetary policy.[19] I emphasize that the U.S. government bond yields (as well as that of many other western countries) is expected to increase substantially over the next several years.[20]

Q. WHAT ARE THE IMPLICATIONS OF ELEVATED YIELD SPREADS TO THE COST OF EQUITY?

A. The increase in the yield spread indicates that (i) the current long-term government bond yields are depressed relative to their normal levels; and/or (ii) investors are demanding a premium higher than the historical premium to hold securities that are not risk free. The latter is an indication that the market equity risk premium may be elevated relative to its historical level. Regardless of the interpretation, the consequence is that if cost of equity is estimated using the current risk-free rate and a market equity risk premium based on historical data, then it will be downward biased. Hence, it is necessary to "normalize" the risk-free rate, take into account the current (rather than historical) market equity risk premium, or a combination of these two interpretations.[21]

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[19] As of year-end 2014, the Federal Reserve held approximately $1.8 trillion of mortgage-backed securities, whereas the magnitude was less than $0.5 trillion in mid-2009. Source: Bloomberg, "The Fed Eases Off," September 16, 2015.

[20] If investors' believe the yield on government bonds will soon elevate, they may demand higher yields on corporate debt relative to the prevailing government bond yields, thus widening the yield spread.

[21] I note that if a combination interpretation is used, it becomes important to make sure that the overall (total) "normalization" takes into account the elevated yield spread once and only once.

B. *Market Volatility*

Q. HOW DID YOU FACTOR THE STOCK MARKET'S VOLATILITY INTO YOUR ANALYSIS?

A. Academic research has found that investors expect a higher risk premium during more volatile periods. The higher the risk premium, the higher the required return on equity. For example, French, Schwert & Stambaugh (1987) found a positive relationship between the expected market risk premium (MRP) and volatility:

> We find evidence that the expected market risk premium (the expected return on a stock portfolio minus the Treasury bill yield) is positively related to the predictable volatility of stock returns. There is also evidence that unexpected stock returns are negatively related to the unexpected change in the volatility of stock returns. This negative relation provides indirect evidence of a positive relation between expected risk premiums and volatility.[22]

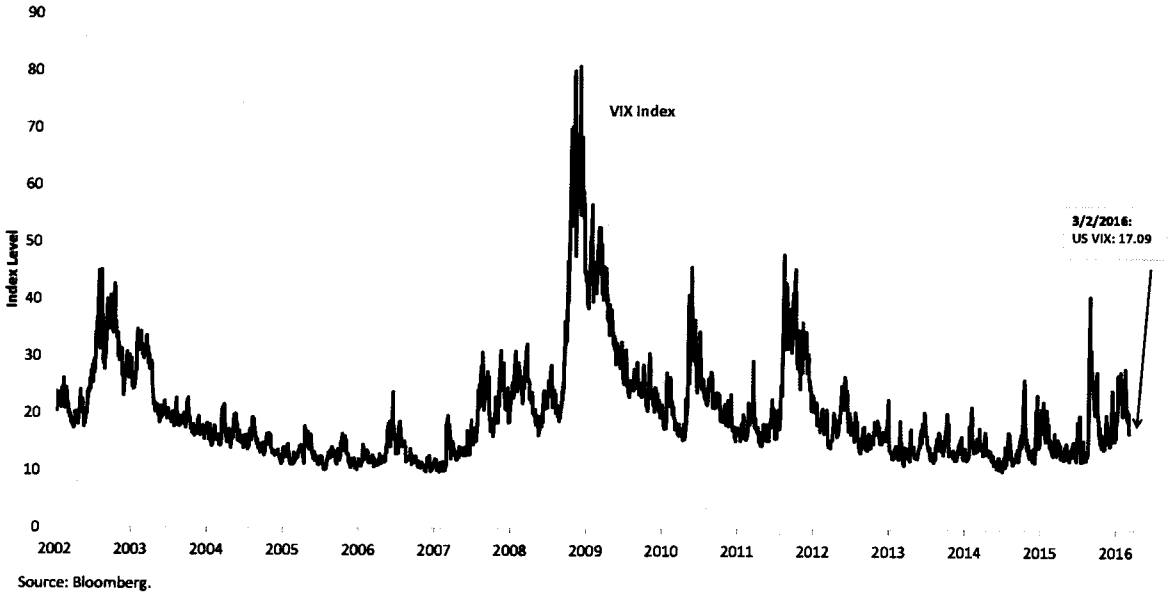
One implication of this finding is that the MRP tends to increase when market volatility is high, even when investors' level of risk aversion remains unchanged.

A measure of the market's expectations for volatility is the VIX index, which measures the 30-day implied volatility of the S&P 500 index. These indices are also referenced as the "investor fear gauge." While the long-term average for the VIX is about 20, the current level is elevated and was above 28 on February 11, 2016.[23] During the more recent period, the VIX spiked in August at about 40. Thus, the market volatility has higher in the early part of 2016 than it has been in recent periods. (*See* Attachment BV-4DR.)

[22] K. French, W. Schwert and R. Stambaugh (1987), "Expected Stock Returns and Volatility," *Journal of Financial Economics*, Vol. 19, p. 3.

[23] Yahoo Finance. It has since declined.

Figure 5: Volatility Index



Source: Bloomberg.

Q. WHAT DO YOU MEAN BY THE TERM "RISK AVERSION?"

A. Risk aversion is the recognition that investors dislike risk, which means that for any given level of risk, investors must expect to earn an appropriate return to be induced to invest. An increase in risk aversion means that investors now require a higher return for that same level of risk.

Q. DO YOU HAVE ANY EVIDENCE THAT THE RETURN PREMIUM DEMANDED BY INVESTORS FOR TAKING RISK IS HIGHER THAN IT WAS PRIOR TO THE 2008-09 FINANCIAL CRISIS?

A. Yes. Looking to forecasted MRPs, both academic research and financial data services such as Bloomberg have found an increase in the expected MRP compared to prior to the financial crisis. Not only did the expected MRP increase but it remains above the historical level. For example, Bloomberg's expected MRP exceeds the historical

average MRP and currently stands at about 8%, while the historical arithmetic average MRP from 1926 to 2014 is 7%.[24]

Q. HAS THE MRP INCREASED SINCE THE 2008-09 FINANCIAL CRISIS?

A. Yes. A recently updated analysis by Duarte and Rosa of the Federal Reserve of New York aggregates the results of many models of the required MRP in the U.S. and tracks them over time. This analysis finds a very high MRP in recent years.

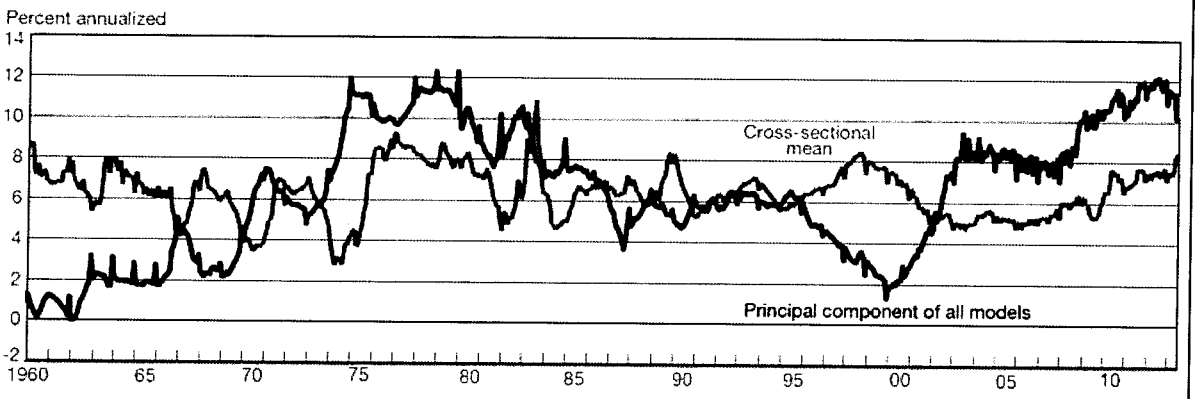
The analysis estimates the MRP that results from a range of models each year from 1960 through the present.[25] The analysis then reports the average as well as the first principal component of results.[26] The analysis then finds that the models used to determine the risk premium are converging to provide more comparable estimates and that the average annual estimate of the MRP was at an all-time high in 2013. These estimates are reasonably consistent with those obtained from Bloomberg and the consistent elevation of the MRP over the historical figure indicates that the elevated level is persistent. Figure 6 below shows Duarte and Rosa's summary results.

[24] Bloomberg and Duff & Phelps, "*2015 Valuation Handbook: Guide to Cost of Capital*," 2015, pp. 3-24.

[25] Fernando Duarte and Carlo Rosa, "The Equity Risk Premium: A Review of Models," *Federal Reserve Bank of New York*, December 2015 (Duarte & Rosa 2015).

[26] Duarte & Rosa emphasize the "first principal component" of the 20 models. This means that the authors used statistics to compute the weighted average combination of the models that captures the most variability among the 20 models over time.

Figure 6
Duarte and Rosa's Chart 3
One-Year Ahead MERP and Cross-Sectional Mean of Models



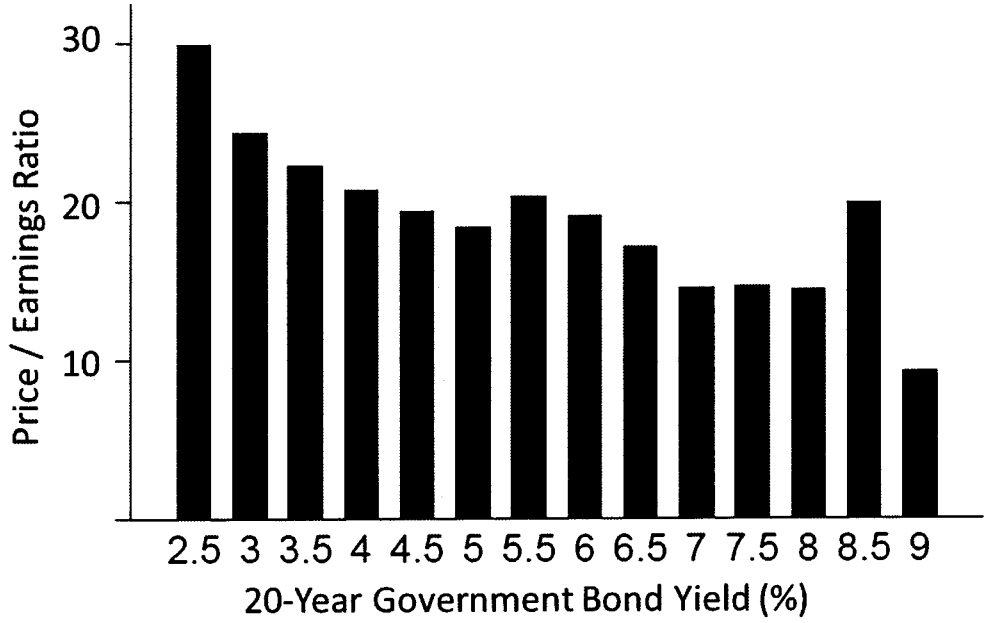
Q. ARE THERE OTHER REASONS WHY CAPITAL MARKETS MAY CONTINUE TO EXHIBIT HIGH VOLATILITY?

A. Yes, the early part of 2016 saw very large market declines across the globe and trading on the Chinese market was halted. For example, the New York Stock Index is down by about 8.5% during the first 6 weeks of 2016 with significant increases and decreases. At the same time, expected market volatility is high as illustrated in Figure 5. Further, oil prices are currently very low by historic standards – with a substantial impact on oil producing countries and regions. Finally, unrest in the Middle East (e.g., Syria and Saudi Arabia/Iran) has contributed to continued uncertainty and thereby an increase in the market equity risk premium that investors require. Lastly, it appears that the Euro zone once again may need to deal with the Greek debt situation.

Q. ARE THERE OTHER FEATURES OF FINANCIAL MARKETS THAT ARE CURRENTLY UNUSUAL?

A. Yes. The current level of many companies, including utilities, Price-to-Earnings (P/E) ratio is higher than what has been experienced historically. Empirically, the P/E ratio increases when interest rates decline. This is shown in Figure 7 below.

Figure 7: Average Price / Earnings Ratio of Comparable Electric Utilities vs. 20-Year Treasury Bond Yield



Source: Bloomberg (using quarterly data from 1990 through 2015)

Q. PLEASE EXPLAIN THE RELATIONSHIP BETWEEN THE P/E RATIO AND THE 20-YEAR GOVERNMENT BOND YIELD OF INTEREST IN YOUR ANALYSIS.

A. The dividend yield, which is calculated as Dividends divided by Price (D/P), is closely related to the P/E ratio as dividends are paid out of earnings. If the P/E ratio is very high (low), then the Earnings-to-Price ratio is low (high) and so is the dividend yield (D/P). The average electric utility pays approximately 60% of its earnings as dividends,[27] so if the P/E ratio increases from, for example, 15 to 17 (13.3%), then the Earnings / Price ratios declines by 0.79% (from 6.67% to 5.88%) and the dividend yield decline by 0.47%. Therefore, if the 20-year government bond yield is artificially depressed and expected to increase, then the dividend yield is also artificially depressed and expected

[27] Value Line Investment Survey as of December 2015 for 2016. Summarized in Attachment BV-11DR.

to increase. As a result, the results from the standard dividend discount models are likely to underestimate the cost of equity that will prevail going forward.

Q. WHAT DO YOU CONCLUDE FROM THIS INFORMATION?

A. The increase in the spread between the yield on utility and government bonds indicates that the premium investors require to hold assets that are not risk-free has increased. Likewise, the recent trends in preferred equity yields confirm that the premium on assets other than government bonds has increased. Similarly, the forecasted MRP is high relative to its recent past and the volatility index is higher than any time since 2012. All of these factors point to a relatively high degree of market volatility and that investors' required premia to hold assets that are not risk-free is elevated. Similarly, the very low risk-free rate are likely to have led to higher P/E ratios due to the flight to quality discussed above and consequently an lower than "normal" dividend yields.

C. *Impact On Roe Estimation*

Q. PLEASE SUMMARIZE HOW THE ECONOMIC DEVELOPMENTS DISCUSSED ABOVE HAVE AFFECTED THE RETURN ON EQUITY AND DEBT THAT INVESTORS REQUIRE.

A. Utilities rely on investors in capital markets to provide funding to support their capital expenditure program and efficient business operations, and investors consider the risk return tradeoff in choosing how to allocate their capital among different investment opportunities. It is therefore important to consider how investors view the current economic conditions; including the plausible development in the risk-free rate and the current MRP.

These investors have been dramatically affected by the credit crisis and ongoing market volatility, so there are reasons to believe that their risk aversion remains elevated relative to pre-crisis periods.

Likewise, the effects of the Federal Reserve's monetary policy have artificially lowered the risk-free rate. As a result, yield spreads on utility debt, including top-rated instruments, have remained elevated. The evidence presented above demonstrates that the equity risk premium is higher today than it was prior to the crisis for all risky investments. This is true even for investments of lower-than-average risk, such as the equity of regulated utilities.

Q. DOES YOUR ANALYSIS CONSIDER THE CURRENT ECONOMIC CONDITIONS?

A. Yes. In implementing the CAPM and risk premium models, I considered the downward biased risk-free rate as well as the elevated MRP. Specifically, I relied on two sets of inputs for the CAPM: I consider the elevated spread between utility and government bond yields and either (i) normalize the risk-free rate to reflect the currently downward bias of the yields and combine that with the historical MRP; or (ii) rely on Blue Chip's 2017 government bond yield forecast for the risk-free rate and combine that with a MRP that reflects the strong evidence that risk premiums are elevated relative to their long-term historical average. Similarly, I consider the impact on the dividend yield from the discussion above, which indicate that dividend yields will increase with increasing interest rates and hence be higher going forward than they are today.

IV. ANALYZING THE COST OF EQUITY

A. *Approach*

Q. PLEASE OUTLINE YOUR APPROACH FOR DETERMINING THE COST OF EQUITY FOR APS.

A. As described above in Section II.A, the standard for establishing a fair rate of return on equity requires that a regulated utility be allowed to earn a return equivalent to what an investor could expect to earn on an alternative investment of equivalent risk. Therefore,

my approach to estimating the cost of equity for APS focuses on measuring the expected returns required by investors to invest in companies that face business and financial risks comparable to those faced by APS. Because the models I rely upon most heavily require market data, my consideration of comparable companies is restricted to those that have publicly traded stock.

To this end, I have selected a sample of publicly-traded companies that primarily provide regulated electric utility services.

For this sample and a subsample, I derive estimates of the representative cost of equity according to standard financial models including two versions of the CAPM and two versions of DCF model. I further review results based on one version of the so-called risk premium model, as well as summary analysis of allowed ROEs for integrated electric utilities. The latter analysis is conducted using allowed returns on equity and associated allowed equity ratios rather than market data; the results of these analyses are used as a test on the reasonableness of my market-based results.

As the cost of equity for the CAPM and DCF based models are derived from market data that reflect the capital that investors hold in the sample companies, I consider the impact of any difference between the financial risk inherent in the cost of equity estimates and the capital structure to which it is assigned using several methods to avoid any one method biasing the results.

B. *Sample Selection*

Q. WHY DO YOU APPLY YOUR COST OF CAPITAL MODELS TO A SAMPLE OF COMPARABLE COMPANIES INSTEAD OF ESTIMATING THE COST OF CAPITAL FOR APS DIRECTLY?

A. It is a well-established point of finance theory (and practice) that the cost of capital depends on the use—not the source—of the invested capital. This means that if a diversified company has subsidiary parts engaged in distinct lines of business, the cost of capital for each part is specifically dependent on the risks inherent in its own line of business, not on the risks of the consolidated company as a whole.

APS is not publicly traded (although its parent Pinnacle West is), so it is not possible to directly estimate the cost of equity using the CAPM or DCF models. This is because these models rely on market information (such as stock prices, betas based on historical stock returns, and growth rate estimates) to estimate the expected returns required by equity investors.

Nor would it be appropriate to infer the appropriate cost of equity for APS based solely on the measured cost of equity of Pinnacle West as (1) a sample of one is simply too small; and (2) Pinnacle West have other lines of business albeit relatively small.

That is why I develop samples of publicly traded companies that are as analogous as possible to APS in terms of business risk, and apply the models to those samples as proxies for the APS. Subsequently, I discuss APS and Arizona-specific risks and place APS relative to the estimated cost of equity.

Q. HOW DO YOU IDENTIFY SAMPLE COMPANIES?

A. APS is an integrated electric utility, so I start with the universe of publicly traded utilities classified as electric utilities in Value Line. I then eliminated companies

engaged in substantial merger and acquisition (M&A) activities over the past 5-years and companies with less than 50% of its assets subject to regulation. Further, I require that the companies have an investment grade credit rating, no recent dividend cuts, more than $300 million in revenues to ensure liquidity, and generally have data available for estimation (*see* Attachment BV-6DR).

Q. WHAT ARE THE CHARACTERISTICS OF THE ELECTRIC SAMPLE?

A. The Electric sample comprises electric companies whose primary source of revenues and majority of assets are in the regulated portion of the electric industry. The final sample consists of the 27 electric utilities listed in Figure 8 below. These companies own regulated electric utility subsidiaries in many states, and some also provide electric transmission service regulated by the U.S. FERC.[28] Therefore, the Electric sample is broadly representative of the regulated electric utility industry from a business risk perspective. Further, the majority of the utilities own or lease generation albeit their generation mix may differ from that of APS.

Figure 8 reports the sample companies' annual revenues for the trailing twelve months ended September 2015 and the percentage of their assets devoted to regulated electric operations according to Edison Electric Institute's (EEI) classifications of electric utilities as being either regulated (R), having greater than 80% regulated electric assets or mostly regulated (MR), having 50-80% regulated electric assets. It also displays each company's Market Capitalization and the S&P Credit Rating in 2015, as well as its Value Line beta and the consensus long-term (3- to 5-year) earnings growth rate estimate for the company from Thomson Reuters IBES and Value Line. (*See* Attachment BV-6DR.)

[28] None of the included entities are primarily electric transmission entities.

Figure 8
Electric Sample Companies

Company	Annual Revenues (USD million)	Regulated Assets	Market Cap. 2015 Q3 (USD million)	Betas	S&P Credit Rating (2015)	Long Term Growth Est.	Nuclear Generation (%)
	[3]	[4]	[5]	[6]	[7]	[8]	[9]
ALLETE	$1,500	R	$2,393	0.80	BBB+	4.2%	0.0%
Alliant Energy	$3,254	R	$6,434	0.80	A-	5.6%	17.0%
Amer. Elec. Power	$16,034	R	$27,037	0.70	BBB	4.4%	0.0%
Ameren Corp.	$6,098	R	$9,802	0.75	BBB+	7.1%	21.0%
CenterPoint Energy	$7,386	M	$7,692	0.85	A-	1.6%	-
CMS Energy Corp.	$6,146	R	$9,338	0.75	BBB+	6.3%	0.0%
Consol. Edison	$12,554	R	$18,927	0.60	A-	3.0%	-
Dominion Resources	$11,195	M	$41,040	0.70	A-	5.8%	33.0%
DTE Energy	$9,919	R	$13,951	0.75	BBB+	5.1%	17.0%
Edison Int'l	$11,452	R	$19,740	0.70	BBB+	0.3%	6.0%
El Paso Electric	$686	R	$1,432	0.75	BBB	8.0%	47.0%
Entergy Corp.	$11,203	R	$11,376	0.70	BBB	-2.6%	33.0%
G't Plains Energy	$2,502	R	$3,964	0.85	BBB+	6.2%	13.0%
IDACORP Inc.	$991	R	$3,087	0.80	BBB	3.1%	0.0%
MGE Energy	$564	M	$1,396	0.75	AA-	6.4%	0.0%
NextEra Energy	$17,216	M	$44,783	0.75	A-	7.0%	23.0%
OGE Energy	$2,197	R	$5,399	0.95	A-	3.2%	0.0%
Otter Tail Corp.	$783	R	$972	0.85	BBB	7.4%	0.0%
PG&E Corp.	$16,908	R	$24,840	0.70	BBB	8.2%	21.0%
Pinnacle West Capital	$3,501	R	$6,850	0.75	A-	4.8%	27.0%
Portland General	$1,912	R	$3,155	0.80	BBB	4.6%	0.0%
Public Serv. Enterprise	$9,896	M	$20,317	0.75	BBB+	1.7%	28.0%
SCANA Corp.	$4,163	M	$7,565	0.75	BBB+	4.3%	19.0%
Sempra Energy	$10,171	M	$22,956	0.80	BBB+	9.9%	0.0%
Vectren Corp.	$2,435	M	$3,324	0.75	A-	6.1%	0.0%
Westar Energy	$2,438	R	$5,239	0.75	BBB+	4.7%	8.0%
Xcel Energy Inc.	$11,024	R	$17,219	0.65	A-	4.8%	12.0%
Average	$6,820		$12,601	0.76		4.9%	13.0%
APS	3,501	R	n/a	n/a	A-	n/a	27.0%

Q. HOW DOES THE ELECTRIC SAMPLE COMPARE TO APS?

A. The Electric sample consists of 27 electric utilities from which I also create a subsample of companies that report between 17% and 37% of their generation capacity is nuclear. This sample consists of Alliant, Ameren, Dominion, DTE Energy, Entergy, NextEra, PG&E, Pinnacle West (albeit I consider the results without the parent of APS), PSE&G, and SCANA. The subsample intends to capture any nuclear related risks and therefore includes companies, whose nuclear generation percentage is within +/- 10% of APS's proportion of nuclear generation (*see* Attachment BV-7DR).

I note further that the average sample company (subsample) company has twice (three times) as much revenue as does APS and the average market capitalization is twice that of Pinnacle West. Thus, APS is smaller than the average sample company.

APS currently has a slightly higher credit rating than the average sample company, but (1) the difference is on average one notch (A- versus BBB+) and therefore small, (2) APS only achieved an A- rating in 2014 and was thus BBB+ rated during part of the estimation period, and (3) credit rating measure default risk rather than the cost of equity. Therefore, the impact of a slightly higher credit rating is simply that the Company has slightly lower default risk than the average sample company, which may be reflected in lower interest rates, which benefits customers. It does not, however, affect the cost of equity.

Finally, I note that the majority of the sample companies listed in Figure 8 have operating companies that have some form of decoupling mechanism. I discuss decoupling in more detail in Section VI.

Q. ARE THERE ANY DIFFERENCES IN THE REGULATORY ENVIRONMENT IN WHICH THE COMPARABLE COMPANIES AND APS OPERATES?

A. While all jurisdictions to a degree are unique, I did note several factors that impact more specifically APS's business risk. For example, APS has experienced larger than average penetration of distributed generation for a loss in load. I also note that Arizona operates with a historic test year.[29] This contrast to other states, where 32 states allow a future or

[29] I understand that the ACC has authorized APS to implement a rider to reflect in rates the costs associated with the Company's acquisition of a share of the coal-fired Four Corners Unit 4 and 5.

hybrid test year.[30] One issue associated with the use of historic test years is that it can become difficult to earn the allowed ROE during times of construction. As shown in Figure 2, APS has not earned its allowed ROE in the most recent 13 years.

It is essential that the Commission take APS-specific risks into account when determining the appropriate risk-adjusted cost of equity that APS should be allowed.

C. *The CAPM Based Cost Of Equity Estimates*

Q. PLEASE BRIEFLY EXPLAIN THE CAPM.

A. In the CAPM the collective investment decisions of investors in capital markets will result in equilibrium prices for all risky assets such that the returns investors expect to receive on their investments are commensurate with the risk of those assets relative to the market as a whole. The CAPM posits a risk-return relationship known as the Security Market Line (*see* Figure 1 in Section II), in which the required expected return on an asset is proportional to that asset's relative risk as measured by that asset's so-called "beta."

More precisely, the CAPM states that the cost of capital for an investment, S (e.g., a particular common stock), is given by the following equation:

$$r_s = r_f + \beta_s \times MRP \qquad (1)$$

where r_S is the cost of capital for investment S;

r_f is the risk-free interest rate;

β_S is the beta risk measure for the investment S; and

MRP is the market equity risk premium.

[30] Joe Wharton, Bente Villadsen, and Heidi Bishop, "Alternative Regulation and Ratemaking: Approaches for Water Companies," prepared for the *National Association of Water Companies*, September 2013, p. 43.

The CAPM is a "risk-positioning model" that relies on the empirical fact that investors price risky securities to offer a higher expected rate of return than safe securities. It says that an investment whose returns do not vary relative to market returns should receive the risk-free interest rate (that is the return on a zero-risk security, the y-axis intercept in Figure 1). Further, it says that the risk premium of a security over the risk-free rate equals the product of the beta of that security and the Market Risk Premium: the risk premium on a value-weighted portfolio of all investments, which by definition has average risk.

1. Inputs to the CAPM

Q. WHAT INPUTS DOES YOUR IMPLEMENTATION OF THE CAPM REQUIRE?

A. As demonstrated by equation (1), estimating the cost of equity for a given company requires a measure of the risk-free rate of interest and the market equity risk premium (MRP), as well as a measurement of the stock's beta. There are many methodological choices and sources of data that inform the selection of these inputs. I discuss these issues, along with the finance theory underlying the CAPM, in Appendix B to my written evidence. I performed multiple CAPM calculations corresponding to distinct "scenarios" reflecting different values of the inputs. This allowed me to derive a range of reasonable estimates for the cost of equity capital implied by each of my samples.

Q. WHAT VALUES DID YOU USE FOR THE RISK-FREE RATE OF INTEREST?

A. I used the yield on a 20-year Government Bond as the risk-free asset for purposes of my analysis. Recognizing the fact that the cost of capital set in this proceeding will be in place over the next several years, I rely on a forecast of what Government bond yields will be one year out. Specifically, Blue Chip predicts that the yield on a 10-year

Government Bond will be 3.4% by Q4, 2017.[31] I use year-end 2017 as the benchmark as rates are expected to be in effect well beyond that date. I adjust this value upward by 53 basis points, which is my estimate of the representative maturity premium for the 20-year over the 10-year Government Bond.[32] This gives me a lower bound on the risk-free rate of 3.93%.

I also considered a scenario in which the appropriate risk-free rate of interest is 4.73%, which adds a portion of the increase in yield spread to the risk-free rate to take the downward pressure on the government bond yield into account. An alternative is to increase the MRP to reflect the widening of the yield spread.[33] The baseline Government bond yield of 3.93% reflects that Government bond yields are expected to increase substantially through 2020, where the Blue Chip forecast indicates a yield around 4.5%.[34]

Q. WHAT VALUES DID YOU USE FOR THE MARKET EQUITY RISK PREMIUM (MRP)?

A. Like the cost of capital itself, the market equity risk premium is a forward-looking concept. It is by definition the premium above the risk-free interest rate that investors can *expect* to earn by investing in a value-weighted portfolio of all risky investments in the market. The premium is not directly observable, and must be inferred or forecasted based on known market information. One commonly used method for estimating the

[31] Blue Chip Economic Indicators, Consensus Forecasts, October 2015.
[32] This maturity premium is estimated by comparing the average excess yield on 20-year versus 10-year Government Bonds over the period 1990 - 2015, using data from Bloomberg.
[33] As of February 29, 2016, the spread between A rated utility and government bond yields was elevated by 90 basis points relative to the historical norm, so the application of only 80 basis points as an upward adjustment to the risk-free interest rate is conservative.
[34] Blue Chip Economic Indicators, October 10, 2015 has a consensus forecast for the 10-year government bond yield of 4.0%, so if the maturity premium remains at 0.53% the 20-year government bond is forecasted to be about 4.5%.

MRP is to measure the historical average premium of market returns over the income returns on government bonds over some long historical period. *Duff and Phelps* performs such a calculation of the MRP. The average market risk premium from 1926 to the present (2014) is 7.0%.[35] I used this value of the MRP in one input scenario to my CAPM analyses.

However, investors may require a higher or lower risk premium, reflecting the investment alternatives and aggregate level of risk aversion at any given time. As explained in Section III, there is substantial evidence that investors' level of risk aversion remains elevated relative to the time before the global financial crisis and ensuing recession that commenced in 2008. In recognition of this evidence, together with forward-looking measurements of the expected market equity risk premium that are higher than the long-term historical average, I also performed CAPM calculations using 8% for the market equity risk premium. The 8% forecasted MRP is consistent with Bloomberg's current forecast.[36]

Q. WHAT IS THE BASIS FOR STATING THAT THE CURRENT MRP IS HIGHER THAN ITS HISTORICAL AVERAGE?

A. Academic articles that were written in the late 1990s or early 2000s often found that the U.S. MRP at the time was lower than the its historical average based on various forward-looking models, such as market-wide versions of the DCF model. A recent article by Duarte and Rosa of the Federal Reserve of New York summarizes many of these models and also estimates the MRP from the models each year from 1960 through

[35] *See Duff and Phelps 2015 Valuation Handbook*, pp. 3-19.

[36] Bloomberg currently forecast the U.S. MRP at 8.5% over a 10-year Government bond, so using a maturity premium of about 0.5%; the forecasted MRP is approximately 8% over a 20-year government bond.

the present.[37] The authors find that the models are converging to provide more consensus around the estimate and that the average annual estimate of the MRP is consistent with the academic literature and with forward-looking estimates such as Bloomberg's. Their analysis shows that the U.S. MRP was lower than its long-term historical average in the early 2000s, but is currently at an all-time high. Chart 3 from Duarte & Rosa 2015 was re-produced in Figure 6, which shows the average estimated MRP (over 30-day T-bills) for 20 models.

These findings are broadly consistent with the forward-looking MRP's calculated by Bloomberg albeit a bit higher even after downward adjustment for the maturity premium. I also note that the approximately 80 basis points elevation in the yield spread indicate a substantial elevation in the MRP.[38] However, I conservatively relied on the historical average MRP of 7% and a forward-looking MERP of 8% in my CAPM analysis.[39]

Q. WHAT BETAS DID YOU USE FOR THE COMPANIES IN YOUR SAMPLE?

A. I used Value Line betas, which are estimated using five years of weekly data, which is consistent with the regulatory practice in Arizona.

[37] Fernando Duarte and Carlo Rosa, "The Equity Risk Premium: A Consensus of Models," *Federal Reserve Bank of New York*, December 2015 (Duarte & Rosa 2015).

[38] *See* Appendix B, Section II for details.

[39] Following the evidence in standard finance textbooks, I rely on the arithmetic average for the historic market risk premium. See, for example, Brealey, Myers and Allen, "Principles of Corporate Finance," 11th Edition, 2014 pp. 162-163 and Ross, Westerfield and Jaffe, "Corporate Finance," 10th Edition, 2013 pp. 322-323.

2. The Empirical CAPM

Q. DID YOU USE ANY OTHER CAPM-BASED MODEL?

A. Yes. Empirical research has shown that the CAPM tends to overstate the actual sensitivity of the cost of capital to beta: low-beta stocks tend to have higher risk premiums than predicted by the CAPM and high-beta stocks tend to have lower risk premiums than predicted.[40] A number of variations on the original CAPM theory have been proposed to explain this finding, but the observation itself can also be used to estimate the cost of capital directly, using beta to measure relative risk by making a direct empirical adjustment to the CAPM.

The second variation on the CAPM that I employed makes use of these empirical findings. It estimated the cost of capital with the equation,

$$r_S = r_f + \alpha + \beta_S \times (MRP - \alpha) \qquad (2)$$

where α is the "alpha" adjustment of the risk-return line, a constant, and the other symbols are defined as for the CAPM (*see* equation (2) above).

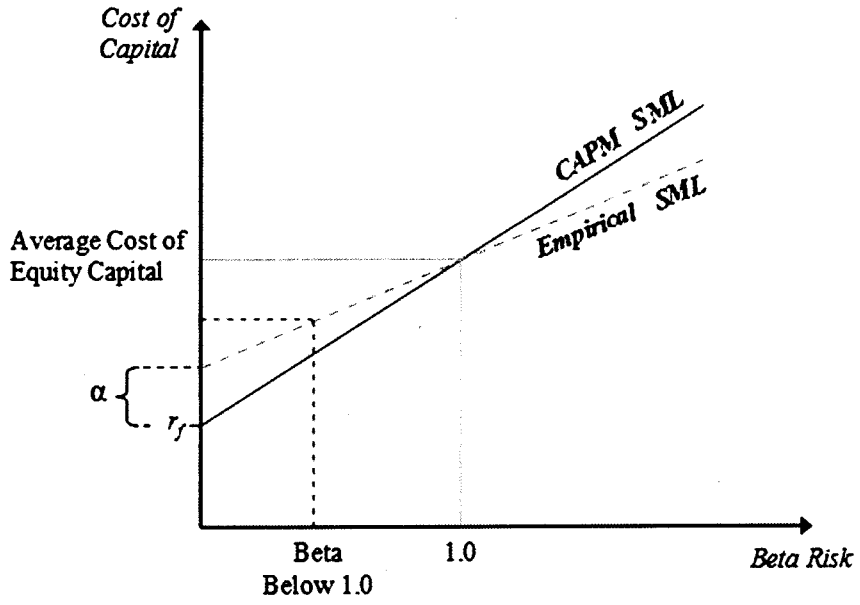
I call this model the Empirical Capital Asset Pricing Model, or "ECAPM." The alpha adjustment has the effect of increasing the intercept but reducing the slope of the Security Market Line in Figure 1, which results in a Security Market Line that more closely matches the results of empirical tests. In other words, the ECAPM produces more accurate predictions of eventual realized risk premiums than does the CAPM.

[40] *See* Figure A-4 in Appendix B for references to relevant academic articles.

Q. WHY DO YOU USE THE ECAPM?

A. Research shows that the analysis performs better empirically performs better, when paired with the ECAPM, which recognizes the consistent empirical observation that the CAPM underestimates the cost of capital for low beta stocks. In other words, the ECAPM is based on recognizing that the actual observed risk-return line is flatter and has a higher intercept than that predicted by the CAPM. The alpha parameter (α) in the ECAPM adjusts for this fact, which has been established by repeated empirical tests of the CAPM. Appendix B discusses the empirical findings that have tested the CAPM and also provides documentation for the magnitude of the adjustment, (α).

Figure 9: The Empirical Security Market Line



3. Results from the CAPM Based Models

Q. PLEASE SUMMARIZE THE PARAMETERS OF THE SCENARIOS AND VARIATIONS YOU CONSIDERED IN YOUR CAPM AND ECAPM ANALYSES.

A. The parameters for the two scenarios are displayed in Figure 10 below. The basis for using the scenarios is the empirical observation that the yield spread is higher than normal as is the forecasted MRP. The increased yield spread could reflect the increase

in the MRP or downward pressure on the yield of government bonds due to a flight to quality or other factors. Therefore, I used the unadjusted forecast risk-free rate with a higher estimate of the MRP, and the unadjusted historical average MRP with the increased estimate of the risk-free interest rate as illustrated in Figure 10. This is a conservative approach as it is plausible that both downward pressure on the risk-free rate and upward pressure on the MRP could simultaneously occur. Scenario 1 normalizes the risk-free rate and uses a historical MRP while Scenario 2 uses an unadjusted forecast of the risk-free rate and a forecasted MRP. Because I did not simultaneously normalize both the government bond rate and the MRP, my estimates are more likely to be downward than upward biased.

Figure 10: Parameters Used in CAPM-based Models

	Scenario 1	Scenario 2
Risk-Free Interest Rate	4.7%	3.9%
Market Equity Risk Premium	7.0%	8.0%

Q. PLEASE EXPLAIN THE DIFFERENCE BETWEEN THE DATA RELIED UPON TO ESTIMATE THE COST OF EQUITY AND THE REGULATORY RATE BASE TO WHICH THE COST OF EQUITY IS APPLIED.

A. Both the CAPM and the DCF models rely on market data to estimate the cost of equity for the sample companies, so the results reflect the value of the capital that investors hold during the estimation period (market values). The allowed return on equity is applied to the fair value rate base, which could be financed differently than the sample companies.

Q. WHY IS THIS DIFFERENCE IMPORTANT TO THE ESTIMATION OF THE COST OF EQUITY?

A. Taking differences in financial leverage into consideration does not change the value of the rate base, but it does consider the fact that the more debt a company has, the higher

is the financial risk associated with an equity investment.[41] To see this I constructed a simple example below, where only the financial leverage of a company varies. I assumed the return on equity is 11% at a 50% equity capital structure and determine the return on equity that would result in the same overall return if the percentage of equity in the capital structure were reduced to 45%.

Figure 11
Illustration of Impact of Financial Risk on Allowed ROE

	Company A (50% Equity)	Company B (40% Equity)
Rate Base	$1,000	$1,000
Equity	$500	$450
Debt	$500	$550
Cost of Debt (5%)	$25	$27.5
Return on Equity	$55	$42.5
Total Cost of Capital (7.5%)	**$80**	**$80**
ROE / Implied ROE	11%	11.67%

The table above illustrates how financial risk affects returns and also the allowed ROE: the overall return does not change, but the allowed ROE required to produce the same return goes up in recognition of the increased risk to equity investors caused by the higher degree of financial leverage.

The principle illustrated in Figure 11 is exemplary of the adjustments I performed to account for differences in financial risk when conducting estimates of the cost of equity applicable to APS. I considered financial risk using several commonly used methods

[41] *See* Appendix B for a description of common practice and underlying finance principles related to the impact of financial risk on the cost of equity.

including the Hamada method to avoid undue influence from any one set of assumptions.[42] The details of these methods are included in Appendix B.

Q. CAN YOU SUMMARIZE THE RESULTS FROM APPLYING THE CAPM-BASED METHODOLOGIES?

A. Yes. The results are presented in Figure 12 below.[43] Note that I included estimates from both the full Electric sample as well as from the sub-sample, whose inclusion of nuclear generation in its generation mix is comparable to that of APS.

[42] These methods include calculating the ROE implied by the overall cost of capital as illustrated in Figure 10, as well as two versions of the so-called Hamada method for levering and unlevering betas in the CAPM and ECAPM. *See* Appendix B for further discussion and detail.

[43] Tables and supporting schedules detailing my cost of capital calculations for Electric sample are contained in Attachment BV-6DR.

Figure 12: Electric Sample CAPM-Based Results

Estimated Return on Equity	Scenario 1 [1]	Scenario 2 [2]
Full Sample		
Financial Risk Adjusted Method		
CAPM	10.2%	10.1%
ECAPM (α = 1.5%)	10.5%	10.5%
Hamada Adjustment Without Taxes		
CAPM	10.2%	10.2%
ECAPM (α = 1.5%)	10.5%	10.5%
Hamada Adjustment With Taxes		
CAPM	10.1%	10.1%
ECAPM (α = 1.5%)	10.5%	10.4%
Nuclear Subsample		
Financial Risk Adjusted Method		
CAPM	10.1%	10.0%
ECAPM (α = 1.5%)	10.5%	10.4%
Hamada Adjustment Without Taxes		
CAPM	10.1%	10.1%
ECAPM (α = 1.5%)	10.4%	10.4%
Hamada Adjustment With Taxes		
CAPM	10.0%	10.0%
ECAPM (α = 1.5%)	10.4%	10.3%

Q. HOW DO YOU INTERPRET THE RESULTS OF YOUR CAPM AND ECAPM ANALYSES?

A. The results indicate an ROE range of 10.0% to 10.5% for a company with 56% equity. Because studies have found that the ECAPM empirically perform better, the ECAPM results deserve higher weight for a range of 10.3% to 10.5%. As seen in Table 12, there is little difference between the estimation results for the full sample and the subsample of entities, whose generation capacity includes 17-37% nuclear generation.

D. *The DCF Based Estimates*

1. Single- and Multi-Stage DCF Models

Q. CAN YOU DESCRIBE THE DCF APPROACH TO ESTIMATING THE COST OF EQUITY?

A. The DCF model attempts to estimate the cost of capital for a given company directly, rather than based on its risk relative to the market as the CAPM does. The DCF method simply assumes that the market price of a stock is equal to the present value of the dividends that its owners expect to receive. The method also assumes that this present value can be calculated by the standard formula for the present value of a cash flow—literally a stream of expected "cash flows" discounted at a risk-appropriate discount rate. When the cash flows are dividends, that discount rate is the cost of equity capital:

$$P_0 = \frac{D_1}{1+r} + \frac{D_2}{(1+r)^2} + \frac{D_3}{(1+r)^3} + \cdots + \frac{D_T}{(1+r)^T} \qquad (3)$$

Where P_0 is the current market price of the stock;

D_t is the dividend cash flow expected at the end of period t;

T is the last period in which a dividend cash flow is to be received; and

r is the cost of equity capital.

Importantly, this formula implies that if the current market price and the pattern of expected dividends are known, it is possible to "solve for" the discount rate, r, that makes the equation true. In this sense, a DCF analysis can be used to estimate the cost of equity capital implied by the market price of a stock and market expectations for its future dividends.

Many DCF applications make the assumption the growth rate last forever, so the formula can be rearranged to estimate the cost of capital. Specifically, the implied DCF

cost of equity can then be calculated using the well-known "DCF formula" for the cost of capital:

$$r = \frac{D_1}{P_0} + g = \frac{D_0}{P_0} \times (1 + g) + g \qquad (4)$$

where D_0 is the current dividend, which investors expect to increase at rate g by the end of the next period, and over all subsequent periods into perpetuity.

Equation (4) says that if equation (3) holds, the cost of capital equals the expected dividend yield plus the (perpetual) expected future growth rate of dividends. I refer to this as the single-stage DCF model; it is also known as the Gordon Growth model.

Q. ARE THERE DIFFERENT VERSIONS OF THE DCF MODEL?

A. Yes. There are many alternative versions, notably (i) multi-stage models, (ii) models that use cash flow rather than dividends, or versions that combine aspects of (i) and (ii).[44]

I do not present evidence on these models in this proceeding, because a model that uses dividends as the only source of cash, current GDP growth forecasts, and current dividend yields would yield unreasonable results.

[44] For example, the Surface Transportation Board uses a cash flow based model with three stages. *See*, for example, Surface Transportation Board Decision, "STB Ex Parte No. 664 (Sub-No. 1)," Decided January 23, 2009.

2. DCF Inputs and Results

Q. WHAT GROWTH RATE INFORMATION DID YOU USE?

A. I looked to a sample of investment analysts' forecasted earnings growth rates from for companies in my samples. I used investment analyst forecasts of company-specific growth rates sourced from *Value Line* and Thomson Reuters *IBES*.

Additionally, I relied on the dividend yield of the companies, which I estimate using the most recently available dividend information (currently) and the average of the last 15 days of stock prices. Because of the stock price of utilities currently is higher than they historically have been and because some companies engage in share buybacks, the dividend yield underestimates the yield on cash distributions to investors.

Q. PLEASE ADDRESS THE INPUT DATA IN THE DCF MODEL.

A. The Gordon Growth / single-stage DCF models require forecast growth rates that reflect investor expectations about the pattern of dividend growth for the companies over a sufficiently long horizon, but estimates are typically only available for 3-5 years.

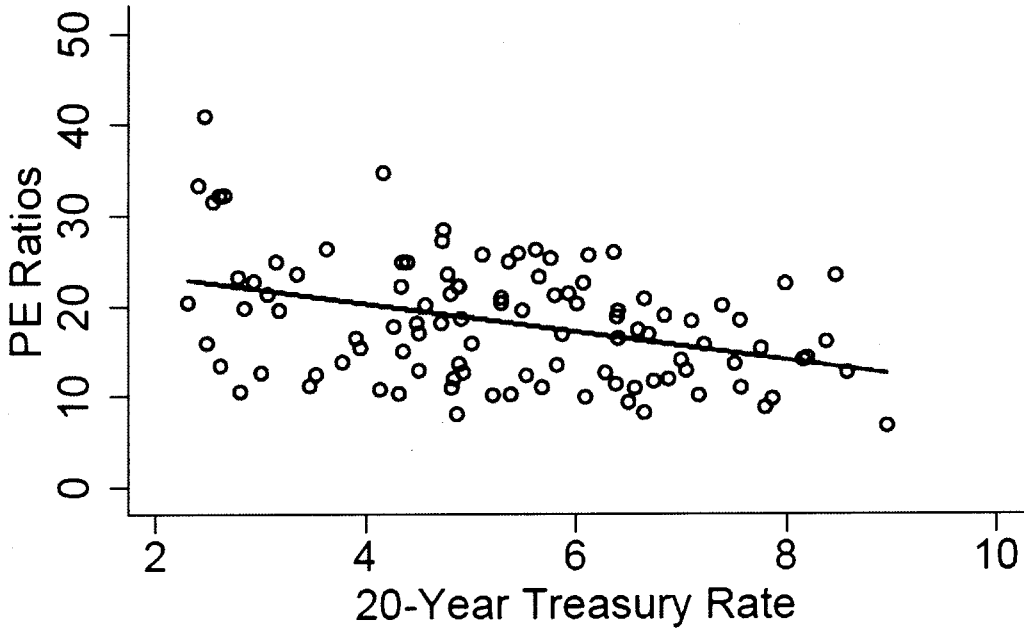
One issue with the data is that it includes solely dividend payments as cash distributions to shareholders, while some companies also use share repurchases to distribute cash to shareholders. To the extent that companies in my samples use share repurchases, the DCF model using dividend yields will under estimate the cost of equity for these companies. While there are companies in my sample that have engaged in share buybacks in the past, the magnitude is currently not large.

A second issue is that the flight to quality has resulted in higher than usual stock prices for electric utilities and hence lower than usual dividend yields. As a result, the dividend yield may be downward biased.

Q. HAVE YOU ATTEMPTED TO DETERMINE THE EFFECT OF THESE ASPECTS OF THE DATA ON YOUR ANALYSIS?

A. Yes. As discussed previously, the Price / Earnings (P/E) ratio for utilities appears to have an inverse relationship to the long-term government bond yield. I therefore regressed the P/E ratios of the companies in my sample as well as the average and median for both the sample and subsample on the 20-year government bond yield. This regression is illustrated in Figure 13 below. Specifically, I regressed the average and median P/E ratio for the sample and subsample on the 20-year government bond yield using quarterly data from 1990-2015.

Figure 13 2: Regression of Average P/E Ratio for Sample Companies on 20-Year Government Bond Yield



My statistical analysis found that the median P/E ratio increases by 0.89 and 1.04 for the full sample and nuclear subsample, when the 20-year government bond yield decline by 1%, respectively. The average impact is higher at 1.31 to 1.55,[45] but these figures cover a relatively wide range across individual companies. Using this range and a generic dividend payout ratio of 60% (the average for my sample is a little over 60%, so the

[45] *See* Attachment BV-11DR.

assumption is conservative), I find that if the P/E ratio increases by, for example, 1.3 for each 1% decline in the government bond yield, then the E/P ratio declines by 0.77 (=1/1.77) for each 1% decline in the yield and if the dividend payout ratio is 60%, the dividend yield would decline by about 46 basis points (=60% × 0.77). Thus, the dividend yield would be understated by an amount relative to what it would be during more normal government bond yields.[46] This is an example of the flight to quality discussed above. I consider the impact of this phenomena below, when discussing my DCF results.[47]

Q. WHAT ARE THE DCF BASED COST OF EQUITY ESTIMATES FOR THE SAMPLES?

A. The results are presented in Figure 14 below.[48] I show both the raw results from the DCF model and the results that would prevail if the interest impact is considered. As for the CAPM, I show the results for the full sample and for the nuclear subsample.

Figure 143: Electric Sample's DCF Results

	Interest Rate Impact not Considered	Interest Rate Impact Considered
Full Sample	9.9%	10.3% - 10.4%
Nuclear Sample	10.4%	10.8% - 10.9%

Q. HOW DO YOU INTERPRET THE RESULTS OF YOUR DCF ANALYSES?

[46] This is consistent with a recent paper by Philip U. Straehl and Roger G. Ibbotson, "The Supply of Stock Returns: Adding Back Buybacks," Morningstar, 2015, who find that "the dividend discount model (DDM), based on current dividend yields and historical per-share growth rates, significantly underestimates expected returns relative to the total payout model."

[47] I note that according to Morningstar, the most commonly used return model determine expected return as dividend yield plus earnings per share growth plus Change in P/E. Morningstar, "Meet CAPE's Older Sister CATY: Using "Total Payout Yield" to Derive Better Equity Return Forecasts" by Philip Straehl, 2016.

[48] Tables and supporting schedules detailing my cost of capital calculations are included in Attachment BV-6DR.

A. The DCF results indicate an ROE of 10.3% to 10.9% once the impact of elevated P/E ratio is considered. Because of the elevated P/E ratios and because APS's assets are more aligned with the assets of the nuclear subsample, I believe the DCF results indicate an ROE well above 10% and in line with to slightly higher than the CAPM-based results reported in Figure 12. Notably, the results from the nuclear subsample are higher than those for the full sample.

E. *Risk Premium Model Estimates*

Q. DID YOU ESTIMATE THE COST OF EQUITY THAT RESULTS FROM AN ANALYSIS OF RISK PREMIUMS IMPLIED BY ALLOWED ROES IN PAST UTILITY RATE CASES?

A. Yes. In this type of analysis, sometimes called the "risk premium model," the cost of equity capital for utilities is estimated based on the historical relationship between allowed ROEs in utility rate cases and the risk-free rate of interest at the time the ROEs were granted. These estimates add a "risk premium" implied by this relationship to the relevant (prevailing or forecast) risk-free interest rate:

$$Cost\ of\ Equity = r_f + Risk\ Premium$$

Q. WHAT ARE THE MERITS OF THIS APPROACH?

A. First, it estimates the cost of equity from regulated entities as opposed to holding companies, so that the relied upon figure is directly applicable to a rate base. Second, the allowed returns are clearly observable to market participants, who will use this data one input to making investment decisions, so that the information is at the very least a good check on whether the return is comparable to that of other investments. Third, I analyze spread between the allowed ROE at a given time and the then prevailing interest rate to ensure that I properly consider the interest rate regime at the time the ROE was awarded. This implementation ensures that I can compare allowed ROE granted at different times and under different interest rate regimes.

Q. HOW DID YOU USE RATE CASE DATA TO ESTIMATE THE RISK PREMIUMS FOR YOUR ANALYSIS?

A. Using quarterly data from Regulatory Research Associates from Q1 1990 to Q4 2015,[49] I compared (statistically) the average allowed rate of return on equity granted by U.S. state regulatory agencies in integrated electric utility rate cases to the average 20-year Treasury bond yield that prevailed in each quarter. I calculated the allowed utility "risk premium" in each quarter as the difference between allowed returns and the Treasury bond yield, since this represents the compensation for risk allowed by regulators. Then I used the statistical technique of ordinary least squares (OLS) regression to estimate the parameters of the linear equation:

$$Risk\ Premium = A_0 + A_1 \times (Treausury\ Bond\ Yield) \qquad (5)$$

I derived my estimates of A_0 and A_1 using standard statistical methods (OLS regression) and find that the regression has a high degree of explanatory power in a statistical sense (R^2=0.79) and the parameter estimates, A_0=8.886% and A_1= -0.593, are statistically significant. The negative slope coefficient reflects the empirical fact that regulators grant smaller risk premiums when risk-free interest rates (as measured by Treasury bond yields) are higher. This is consistent with past observations that the premium investors require to hold equity over government bonds increases as government bond yields decline. In the regression described above, the allowed ROE on average declined by 59 basis point when the government bond yield declined by 100 basis points. This relationship is illustrated graphically in Attachment BV-8DR, which contains my risk premium analysis.

[49] SNL Financial as of 1/7/2016.

Q. WHAT RESULT DID YOUR RISK PREMIUM ANALYSIS PROVIDE FOR THE APS'S COST OF EQUITY?

A. To estimate a cost of equity, I apply my regression equation at the normalized risk-free interest of 4.7%.[50] The calculation is shown below and gives a cost of equity estimate of 10.8% for the sample:

$$\textbf{\textit{Risk Premium}} = 8.886\% - 0.593 \times 4.7\% = \mathbf{6.32\%}$$

$$\textbf{\textit{Cost of Equity}} = 4.7\% + 6.32\% = \mathbf{10.8\%}$$

I note that the average equity percentage for integrated electric utilities recently has been about 51%, so if I take the financial risk into account, the risk premium model indicates an ROE of 10.3% for an entity with 56% equity (*see* Attachment BV-8DR).

Q. WHAT CONCLUSIONS DID YOU DRAW FROM YOUR RISK PREMIUM ANALYSIS?

A. Although risk premium models based on historical allowed returns are not underpinned by fundamental finance principles in the manner of the CAPM or DCF models, I believe they can provide useful benchmarks for evaluating appropriate rates of return. My risk premium model cost of equity estimates demonstrate that the results of my DCF and CAPM analyses are in line with the actions of utility regulators. Because the risk premium analysis as implemented takes into account the interest rate prevailing during the quarter the decision was issued, it provides a useful benchmark for the cost of equity in any interest environment.

[50] As discussed above, this represents the Blue Chip estimate for the 10-year Government Bond yield at the end of 2017, adjusted upward by 53 basis points to account for the maturity premium between 10- and 20-yr government bonds and by a further 80 basis points to account for the elevated levels of utility yield spreads.

V. RISK CHARACTERISTICS AND THE COST OF EQUITY

A. *BACKGROUND*

Q. PLEASE SUMMARIZE YOUR ROE EVIDENCE.

A. Based on my analysis, I find the range of ROE estimates displayed in Figure 15 below.[51]

Figure 15: Range of ROE Estimates

	Full Sample	Nuclear Sample
	[1]	[2]
CAPM	10.1% - 10.2%	10.0% - 10.1%
ECAPM	10.4% - 10.5%	10.3% - 10.5%
Simple DCF	9.9%	10.4%
DCF Considering Interest Rates	10.3% - 10.4%	10.8% - 10.9%
Risk Premium	10.3%	n/a

I note that in considering the impact of interest rates on the DCF estimates, I rely on the current widening of the spread between utility and government bonds of 80 basis points. An alternative would be to use the difference between the forecasted government bond yield and the current bond yield of almost 110 basis points (3.4% in Q4, 2017 versus the December 2015 yield of 2.24%). Thus, my estimates use the more conservative estimate. Based on the data above, I consider a **reasonable range for the sample** to be 10.0% to 10.8% (excluding the highest and lowest estimate) and will next address APS specific risks and its ROE relative to the sample.

B. *APS And Arizona-Specific Risks*

Q. PLEASE IDENTIFY THE APS AND ARIZONA-SPECIFIC RISKS THAT YOU ANALYZED.

A. My analysis included the following APS and Arizona-specific risk factors: (i) APS relies to a larger degree than the sample companies on nuclear generation, (ii) the magnitude and growth in distributed generation is higher than in most states (iii) APS has been

[51] I acknowledge that some companies in the subsample (e.g., Dominion, NextEra, PSE&G, and Scana) have non-trivial non-regulated activities.

unable to earn its allowed ROE in the last 13 years, and (iv) APS is smaller than the average company in my sample. All of these characteristics add to APS's risk.

Q. PLEASE DISCUSS THE IMPACT OF BEING MORE DEPENDENT ON NUCLEAR GENERATION THAN ITS PEERS.

A. Figure 16 below summarizes the generation composition in my sample and Attachment BV-7DR provides details.

Figure 16: Generation Composition

	APS	Subsample	Sample
[1]	[2]	[3]	[4]
Nuclear	27%	24%	13%
Coal	34%	33%	39%
Natural Gas	17%	21%	21%
Other (incl. purchases)	22%	21%	27%

Sources:
Value Line and SEC 2014 Form 10-Ks.

It is evident from Figure 16 that APS relies more heavily on nuclear generation than the sample and more heavily on nuclear and coal than the subsample, but the Company's generation mix is closer to that of the subsample. There are at least three reasons why nuclear generation and to a degree coal impacts the utility's risk. First, nuclear generation (and coal more than natural gas) has very large fixed costs relative to their variable costs, which means that the operating leverage is higher. As a result, the asset risk (beta) increases relative to that of an asset with less operating leverage. Simply put, the costs associated with operating a nuclear facility cannot readily be reduced simply because demand is reduced. Second, nuclear facilities tend to be very large and indeed APS operates the largest nuclear generating facility in the country, Palo Verde units 1, 2 and 3 but is a much smaller utility than the majority of those included in my sample / nuclear subsample. Because the generation facility is one large unit (as opposed to

many smaller units), the operation has less flexibility than other types of generation. Third, nuclear facilities are subject to substantial scrutiny and decommissioning costs are significant. This again adds to the risk profile and certainly the subsample results may be more representative than those of the sample.[52]

Q. HOW DOES THE MAGNITUDE AND GROWTH IN DISTRIBUTED GENERATION IMPACT APS?

A. APS has more distributed generation in its service territory than the majority of U.S. utilities; including those in my sample. Photovoltaic capacity constitute .82% of the total installed capacity in Arizona and is among the sample companies only exceeded by the magnitude installed in California and New Jersey with the latter being a deregulated state (*see* Attachment BV-9DR). Therefore, it is imperative that the utility's rates are structured so that it does not undermine its ability to earn the allowed ROE or APS will face asymmetric risk of earning below its allowed ROE.

Q. WHY IS AN ANALYSIS OF THE EARNED VS. ALLOWED ROE RELEVANT TO A DETERMINATION OF THE ROE IN THIS CASE?

A. Based on data obtained from APS, I have calculated the degree to which the company has under earned its allowed ROE since 2002. I found that APS has under earned its allowed ROE every year since 2002 and by a substantial amount as the average under earning is close to 2%. While APS's ability to earn its allowed ROE has improved in recent years, the fact that it has under earned in the most recent 13 years indicates that absent constructive rate making, the Company may be facing an asymmetric risk. There are two consequences to this observation. First, I recommend that the barriers to earning the allowed ROE be removed if possible and second, if it is not possible to remove the

[52] I acknowledge that some companies in the subsample (e.g., Dominion, NextEra, PSE&G, and Scana) have non-trivial non-regulated activities.

barriers to on average earn the allowed ROE, it may be necessary to provide APS with a cushion to ensure it earns its allowed ROE. Put differently, it would be misguided to award APS an ROE towards the lower end of what is reasonable because providing an inadequate return because a return below the cost of capital may adversely affect the utility's ability to provide stable and favorable rates because some potential efficiency investments may be delayed and the company may be forced to file more frequent rate cases. Moreover, in the long run, inadequate returns are likely to cost customers—and society generally—far more than may be saved in the short run. Inadequate returns lead to inadequate investment, whether for maintenance or for new plant and equipment. Without access to investor capital, the company may be forced to forgo opportunities to maintain, upgrade, and expand its systems and facilities in ways that decrease long run costs. Indeed, the cost to consumers of an undercapitalized industry can be far greater than any short-run gains from shortfalls in the cost of capital. This is especially true in capital-intensive industries (such as the electric utility industry), which feature systems that take a long time to decay. Such long-lived infrastructure assets cannot be repaired or replaced overnight, because of the time necessary to plan and construct the facilities. Thus, it is in customers' interest not only to make sure the return investors expect does not exceed the cost of capital, but also to make sure that the return does not fall short of the cost of capital.

Q. HOW DOES APS'S SMALLER SIZE AFFECT INVESTORS' EXPECTED RETURN?

A. Empirical studies have shown that the return investors require depend on the size of the company in which they invest and that the required return is larger the smaller the company is.[53] As APS is approximately half the size of the average sample company as

[53] Duff & Phelps, "2014 Valuation Handbook: Guide to Cost of Capital," (Duff & Phelps (2014), pp. 7-2.

measured by revenue and Pinnacle West is half (one third) of the sample's (subsample's) size as measured by market capitalization, it is evident that APS is smaller than the average sample / subsample company. Duff & Phelps looks at 25 deciles of companies by market capitalization size and report the average premium that a company requires based on the decile in which the company's capitalization falls. Based on the market capitalization of Pinnacle West, which predominantly is APS, and that of the subsample (sample), APS's size merits a size premium. Looking to Duff & Phelp (2014) risk premia by market capitalization, APS smaller size would merit a size premium of up to 75 basis points over the average sample company.[54] Because there are companies in the sample (subsample), who are of the same size as APS, I do not simply add 75 basis points to APS's ROE but instead use this information to place APS relative to the estimates displayed in Section V.

Q. WHAT CONCLUSIONS DO YOU DRAW FROM THE ANALYSIS ABOVE?

A. As APS faces larger operating leverage from nuclear generation than the sample, is of a smaller size than the sample, have a larger exposure to distributed generation, and may be subject to asymmetric risk in earning its allowed ROE, I submit that a lower bound on APS's cost of equity is the upper half of the estimated range; i.e., 10.25% – 10.75%. I recommend that APS be allowed a ROE at the midpoint of the range; 10.5% as the Company's smaller size and operating leverage increases its cost of capital over that of the sample. I further note that it is important that any obstacles to APS earning its allowed ROE be removed as credit rating agencies look to earned returns and investors ultimately are paid from earned returns.

[54] Duff & Phelps (2014), Appendix A-3.

VI. DECOUPLING AND ROE

Q. PLEASE EXPLAIN DECOUPLING.

A. Decoupling is a regulated ratemaking approach that severs the direct link and relationship between level of unit sales (kilowatt-hours) to consumers and the level of base revenues that are approved for through the collection of volumetric rates. Specific decoupling mechanisms are in place in 28 states.[55]

Q. WHY DO YOU CONSIDER THE IMPACT OF DECOUPLING ON COST OF CAPITAL?

A. Because decoupling has the effect of reducing the volatility of the utility's revenue, some have argued that it reduces the cost of capital. The basis for the assumption was that volatility is related to risk, so a reduction in revenue volatility could impact the utility's risk and hence it's cost of capital.

Q. WHAT IS THE EVIDENCE REGARDING THE RELATIONSHIP BETWEEN DECOUPLING AND COST OF CAPITAL?

A. First, the majority of the companies in my sample have some form of decoupling for some subsidiaries, so any impact on the cost of capital would already be captured in the data displayed in Section V. Second, empirical studies have shown that there is no impact of decoupling on the cost of capital among U.S. electric utilities (or gas utilities). Third, finance theory holds that only systematic (or non-diversifiable) risk affects the cost of equity, so only if decoupling affected the systematic risk would it impact the cost of equity. I discuss each of these in turn below.

[55] Joe Wharton & Michael J. Vilbert, "Decoupling and the Cost of Capital," *The Electricity Journal*, vol. 28, 2015, pp. 19-28.

Q. PLEASE SUMMARIZE THE PREVALENCE OF DECOUPLING MECHANISMS AMONG YOUR SAMPLE COMPANIES.

A. Figure 17 below shows the prevalence of decoupling mechanisms among the sample companies and subsample companies. In the table, I also indicate in parentheses restructured states where the utility operates as well as any decoupled gas operations.

From the table, it appears that of the 10 companies in the subsample, 7 have some form of decoupling in place and among the 27 sample companies only 7 have no decoupling of which some operations are in restructured states, where the operating utility owns no generation. Thus, both the sample and the subsample has a substantial amount of decoupling and much of the effect decoupling, if any, would be captured in the estimation results (*see* Attachment BV-10DR).

Figure 17: Decoupling Mechanisms Among Sample Companies

Company	Decoupling	No Decoupling	Restructured States
[1]	[2]	[3]	[4]
ALLETE		MN	
Alliant Energy		IA, (IA), WI, (WI)	
Amer. Elec. Power	AR*, IN*, KY*, LA*, OH*, OK*	MI, TN, TX, VA, WV	OH, TX
Ameren Corp.	MO*	IL, (IL), (MO)	IL
CenterPoint Energy	(AR), (LA)*, (MN), (OK)*	TX, (TX)	TX
CMS Energy Corp.		MI, (MI)	
Consol. Edison	NY, (NY)	NJ	NJ
Dominion Resources		NC, (OH), VA, (WV)	OH
DTE Energy	(MI)*	MI	
Edison Int'l	CA		
El Paso Electric		NM, TX	TX
Entergy Corp.	AR*, LA*, (LA), MS*	TX	TX
G't Plains Energy	MO*	KS	
IDACORP Inc.	ID*	OR	
MGE Energy		WI, (WI)	
NextEra Energy		FL, TX	TX
OGE Energy	AR*, OK*		
Otter Tail Corp.		MN, ND	
PG&E Corp.	CA, (CA)		
Pinnacle West Capital	AZ*		
Portland General	OR*		
Public Serv. Enterprise	(NJ)*	NJ	NJ
SCANA Corp.	(NC), (SC)*	SC	
Sempra Energy	(AL)*, CA, (CA)		
Vectren Corp.	IN*, (IN)	(OH)	OH
Westar Energy	KS*		
Xcel Energy Inc.	(CO)*, SD*	CO, MN, (MN), NM, ND, (ND), TX, WI, (WI)	TX

Sources/Notes:
Regulatory Research Associates, "Adjustment Clauses," October 2, 2015.
Highlighted companies are included in our subsample of utilities with 17% to 37% nuclear generation.
"*" indicates partial decoupling.
"( )" indicates decoupling status for associated gas operations.

Q. PLEASE DISCUSS THE EMPIRICAL EVIDENCE YOU MENTIONED REGARDING DECOUPLING.

A. Empirical studies of the effect of decoupling on the cost of capital have found none. More specifically, Wharton & Vilbert (2015) studied electric utilities that introduced decoupling or had decoupling removed during the period 2007-14 using quarterly and estimated the cost of capital for those with and without decoupling. They found no

statistical evidence that decoupling affected the cost of equity.[56] A study by Michenfelder similarly found that no effect of decoupling on the cost of equity.[57] Thus, empirical studies have not found any impact of decoupling on the cost of capital.

Q. DO YOU HAVE ANY OTHER COMMENTS ON THE RELATIONSHIP BETWEEN DECOUPLING AND THE COST OF CAPITAL?

A. Yes. Finance theory holds that only systematic (non-diversifiable) risk affects the cost of capital. Therefore, decoupling only affects the cost of capital to the extent it affects systematic risk. While decoupling mechanisms vary substantially across jurisdictions, it is plausible that an investor can diversify away from any specific volumetric effect and hence diversify the risk away. If that is the case there is no impact on the cost of capital from decoupling.

Q. BASED ON THE DISCUSSION ABOVE, WHAT DO YOU CONCLUDE?

A. Because a large number of the companies in my sample have decoupling mechanisms in place, any impact on the cost of equity is already captured in my estimates. Further, empirical research have not detected any relationship between the cost of equity and decoupling, so there is no evidence that decoupling affect the cost of equity. Therefore, decoupling should not affect the allowed ROE.

VII. FAIR VALUE RATE BASE AND FAIR VALUE ROR

Q. PLEASE EXPLAIN THE FAIR VALUE RATE BASE CONCEPT.

A. According to the Arizona Constitution,

> The corporation commission shall, to aid it in the proper discharge of its duties, ascertain the fair value of the property within the state of every

[56] Joe Wharton & Michael J. Vilbert, "Decoupling and the Cost of Capital," *The Electricity Journal*, vol. 28, 2015, pp. 19-28.

[57] Richard A. Michelfelder, "Decoupling: Impact on the Risk of Public Utility Stocks," Presentation at SURFA, April 15, 2011.

> public service corporation doing business therein; and every public service corporation doing business within the state shall furnish to the commission all evidence in its possession, and all assistance in its power, requested by the commission in aid of the determination of the value of the property within the state of such public service corporation.[58]

Thus, the state Constitution requires Commission to determine the fair value of the property APS uses in the state of Arizona in connection with setting rates.

Q. HOW HAS THE COMMISSION IMPLEMENTED THE FAIR VALUE RATE BASE CONCEPT?

A. For decades, the Commission has determined the Fair Value Rate Base (FVRB) and the Fair Value Rate of Return (FVROR). In these cases, the Commission has determined the FVRB as the average of the Original Cost Rate Base and the Reconstruction Cost New Less Depreciation Rate Base (RCND). The latter was determined as the original cost adjusted by inflation with accumulated depreciation deducted according to the estimated useful life of the assets.

Q. DO YOU HAVE ANY COMMENTS ON THIS APPROACH?

A. Yes. Standard financial economics would define Fair Market Value (FMV) as the price at which a willing buyer and seller would exchange the assets in question. Now I know that FMV is not the same as fair value, but my analysis shows that the Commission's approach is not unreasonable, albeit likely conservative at least as to the case of APS.

[58] Arizona Constitution, Article 15, Section 14. http://www.azleg.gov/FormatDocument.asp?inDoc=/const/15/14.htm

Q. PLEASE DISCUSS ANY ANALYSIS YOU HAVE DONE TO TEST THE REASONABLENESS OF CALCULATING THE FVRB USING THE COMMISSION'S TRADITIONAL 50/50 WEIGHTING OF ORIGINAL COST AND RECONSTRUCTION COST NEW LESS DEPRECIATION RATE BASES.

A. To determine whether the methodology described above is reasonable, I looked at investor valuations of integrated electric utilities. Specifically, I analyzed the implied value of electric utilities' assets using recent transactions multiples. Using transaction data for 2013-2016, I found that the average implied asset value of integrated electric utilities were approximately 1.89 times the book value of assets. Transactions are a direct measure of the value that investors assign to a utility. The specifics of my analysis is presented in Attachment BV-5DR.

Figure 18: Market Valuations Indications

	Integrated Elec Util	Utilities
Transactions		
Average	89%	109%
Median	93%	97%
Minimum	46%	46%
Maximum	120%	156%%

Transaction multiples generally are the best indicator of fair value, so I recommend that the fair value be measured using the transaction multiple. Consequently, an analysis of financial markets show the FMV of the adjusted jurisdictional original cost rate base of $6.771 is about $12.797 billion.[59] The Company's calculation of FVRB is $9.976 billion, which is within the range of my above estimates, albeit near the bottom.

Q. HOW DO YOU PROPOSE THAT THE FVROR IS ESTIMATED?

A. The FVRB is supported by the same capital elements as is APS's original cost rate base, and there is no reason to believe that the weighting would change simply because the dollar amount is higher. Therefore, I propose that the FVRB be allowed a ROR that is

[59] Calculated as 1.89×$6.771 billion.

the weighted average of my recommended ROE of 10.5% and the embedded cost of debt of 5.13%, or 8.13%.

Another way would be to determine a return for the Fair Value Increment on a standalone basis and simply weight it in with the debt and equity components of original cost rate base. I suggest that a return of up to the inflation adjusted ROR is appropriate for the Fair Value Increment – this figure is 6.04%.[60] This would produce an overall FVROR of 7.46% by weighting the 6.04% return by the percentage of FVRB represented by the Fair Value Increment (32.13%) and weighting the 8.13% by the remaining percent of FVRB represented by original cost (67.87%).[61] Therefore, APS's proposed FVROR of 5.84%, including only a 1% return on the Fair Value Increment, is conservative.

Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?

A. Yes.

[60] Using Blue Chip as of October 2015, the forecasted GDP inflation is 2.1%, so FVROR can be calculated as follows: (5.13%-2.1%)×44% + (10.5% - 2.1%%)×56% = 6.04%.

[61] Numbers are taken from Schedule A-1 of the Commission's Standard Filing Requirements accompanying the Application in this case.

BEFORE THE
ARIZONA CORPORATION COMMISSION

APPENDICES TO THE DIRECT TESTIMONY OF BENTE VILLADSEN

FOR
ARIZONA PUBLIC SERVICE COMPANY

Cost of Capital

June 1, 2016

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Appendix A: Resume of Dr. Bente Villadsen

Dr. Bente Villadsen's work concentrates in the areas of regulatory finance and accounting. Her recent work has focused on accounting issues, damages, cost of capital and regulatory finance. In the regulatory finance area, Dr. Villadsen has testified on cost of capital and accounting, analyzed credit issues in the utility industry, risk management practices as well the impact of regulatory initiatives such as energy efficiency and de-coupling on cost of capital and earnings. Among her recent accounting work, she has been involved in accounting disclosure issues and principles including impairment testing, fair value accounting, leases, accounting for hybrid securities, accounting for equity investments, cash flow estimation as well as overhead allocation. Dr. Villadsen has estimated damages in the U.S. as well as internationally for companies in the construction, telecommunications, energy, cement, and rail road industry. She has filed testimony and testified in federal and state court, in international and U.S. arbitrations and before state and federal regulatory commissions. Her testimonies and expert reports pertain to accounting issues, damages, discount rates and cost of capital for regulated entities.

Dr. Villadsen holds a Ph.D. from Yale University's School of Management with a concentration in accounting. She has a joint degree in mathematics and economics (BS and MS) from University of Aarhus in Denmark. Prior to joining The Brattle Group, she was a Professor of Accounting at the University of Iowa, University of Michigan, and at Washington University in St. Louis where she taught financial and cost accounting. She has also taught graduate classes in econometrics and quantitative methods. Dr. Villadsen also worked as a consultant for Risoe National Laboratories in Denmark.

AREAS OF EXPERTISE

- Regulatory Finance
  - Cost of Capital
  - Cost of Service (including prudence)
  - Energy Efficiency, De-coupling and the Impact on Utilities Financials
  - Relationship between regulation and credit worthiness
  - Risk Management
  - Regulatory Advisory
- Accounting and Corporate Finance
  - Application of Accounting Standards
  - Disclosure Issues
  - Credit Issues in the Utility Industry
- Damages and Valuation
  - Utility valuation
  - Lost Profit
  - Stock Price Drop

EXPERIENCE

Regulatory Finance

- On behalf of the Association of American Railroads, Dr. Villadsen appeared as an expert before the Surface Transportation Board and submitted expert reports on the determination of the cost of equity for U.S. freight railroads.
- For several electric, gas and transmission utilities in Alberta, Canada, Dr. Villadsen filed evidence on the cost of equity and appropriate capital structure for 2015-17. Her evidence was filed with the Alberta Utilities Commission.
- She has estimated the cost of equity on behalf of Portland General Electric, Anchorage Water and Wastewater, American Water, California Water, and EPCOR in state regulatory proceedings. She has also submitted testimony to Bonneville Power Authority. Much of her testimony involves not only cost of capital estimation but also the impact of credit metrics and various regulatory mechanisms such as revenue stabilization, riders and trackers.
- In Australia, she has submitted led and co-authored a report on cost of equity and debt estimation methods for the Australian Pipeline Industry Association. The equity report was filed with the Australian Energy Regulator as part of the APIA's response to the Australian Energy Regulator's development of rate of return guidelines and both reports were filed with the Economic Regulation Authority by the Dampier Bunbury Pipeline. She has also submitted a report on aspects of the WACC calculation for Aurizon Network to the Queensland Competition Authority.
- In Canada, Dr. Villadsen has co-authored reports for the British Columbia Utilities Commission and the Canadian Transportation Agency regarding cost of capital methodologies. Her work consisted partly of summarizing and evaluating the pros and cons of methods and partly of surveying Canadian and world-wide practices regarding cost of capital estimation.
- Dr. Villadsen worked with utilities to estimate the magnitude of the financial risk inherent in long-term gas contracts. In doing so, she relied on the rating agency of Standard & Poor's published methodology for determining the risk when measuring credit ratios.

- For utilities that are providers of last resort, she has provided estimates of the proper compensation for providing the state-mandated services to wholesale generators.
- In connection with the AWC Companies application to construct a backbone electric transmission project off the Mid-Atlantic Coast, Dr. Villadsen submitted testimony before the Federal Energy Regulatory Commission on the treatment the accounting and regulatory treatment of regulatory assets, pre-construction costs, construction work in progress, and capitalization issues.
- On behalf of ITC Holdings, she filed testimony with the Federal Energy Regulatory Commission regarding capital structure issues.
- Testimony on the impact of transaction specific changes to pension plans and other rate base issues on behalf of Balfour Beatty Infrastructure Partners before the Michigan Public Service Commission.
- On behalf of financial institutions, Dr. Villadsen has led several teams that provided regulatory guidance regarding state, provincial or federal regulatory issues for integrated electric utilities, transmission assets and generation facilities. The work was requested in connection with the institutions evaluation of potential investments.
- For a natural gas utility facing concerns over mark to market losses on long term gas hedges, Dr. Villadsen helped develop a program for basing a portion of hedge targets on trends in market volatility rather than on just price movements and volume goals. The approach was refined and approved in a series of workshops involving the utility, the state regulatory staff, and active intervener groups. These workshops evolved into a forum for quarterly updates on market trends and hedging positions.
- She has advised the private equity arm of three large financial institutions as well as two infrastructure companies, a sovereign fund and pension fund in connection with their acquisition of regulated transmission, distribution or integrated electric assets in the U.S. and Canada. For these clients, Dr. Villadsen evaluated the regulatory climate and the treatment of acquisition specific changes affecting the regulated entity, capital expenditures, specific cost items and the impact of regulatory initiatives such as the FERC's incentive return or specific states' approaches to the recovery of capital expenditures riders and trackers. She has also reviewed the assumptions or worked directly with the acquirer's financial model.

- On behalf of a provider of electric power to a larger industrial company, Dr. Villadsen assisted in the evaluation of the credit terms and regulatory provisions for the long-term power contract.
- For several large electric utility, Dr. Villadsen reviewed the hedging strategies for electricity and gas and modeled the risk mitigation of hedges entered into. She also studies the prevalence and merits of using swaps to hedge gas costs. This work was used in connection with prudence reviews of hedging costs in Colorado, Oregon, Utah, West Virginia, and Wyoming.
- She estimated the cost of capital for major U.S. and Canadian utilities, pipelines, and railroads. The work has been used in connection with the companies' rate hearings before the Federal Energy Regulatory Commission, the Canadian National Energy Board, the Surface Transportation Board, and state and provincial regulatory bodies. The work has been performed for pipelines, integrated electric utilities, non-integrated electric utilities, gas distribution companies, water utilities, railroads and other parties.
- For a Canadian pipeline, Dr. Villadsen co-authored an expert report regarding the cost of equity capital and the magnitude of asset retirement obligations. This work was used in arbitration between the pipeline owner and its shippers.
- In a matter pertaining to regulatory cost allocation, Dr. Villadsen assisted counsel in collecting necessary internal documents, reviewing internal accounting records and using this information to assess the reasonableness of the cost allocation.
- She has been engaged to estimate the cost of capital or appropriate discount rate to apply to segments of operations such as the power production segment for utilities.
- In connection with rate hearings for electric utilities, Dr. Villadsen has estimated the impact of power purchase agreements on the company's credit ratings and calculated appropriate compensation for utilities that sign such agreements to fulfill, for example, renewable energy requirements.
- Dr. Villadsen has been part of a team assessing the impact of conservation initiatives, energy efficiency, and decoupling of volumes and revenues on electric utilities financial performance. Specifically, she has estimated the impact of specific regulatory proposals on the affected utilities earnings and cash flow.

- On behalf of Progress Energy, she evaluated the impact of a depreciation proposal on an electric utility's financial metric and also investigated the accounting and regulatory precedent for the proposal.
- For a large integrated utility in the U.S., Dr. Villadsen has for several years participated in a large range of issues regarding the company's rate filing, including the company's cost of capital, incentive based rates, fuel adjustment clauses, and regulatory accounting issues pertaining to depreciation, pensions, and compensation.
- Dr. Villadsen has been involved in several projects evaluating the impact of credit ratings on electric utilities. She was part of a team evaluating the impact of accounting fraud on an energy company's credit rating and assessing the company's credit rating but-for the accounting fraud.
- For a large electric utility, Dr. Villadsen modeled cash flows and analyzed its financing decisions to determine the degree to which the company was in financial distress as a consequence of long-term energy contracts.
- For a large electric utility without generation assets, Dr. Villadsen assisted in the assessment of the risk added from offering its customers a price protection plan and being the provider of last resort (POLR).

Accounting and Corporate Finance

- In arbitration before the International Chamber of Commerce Dr. Villadsen testified regarding the true-up clauses in a sales and purchase agreement, she testified on the distinction between accruals and cash flow measures as well as on the measurement of specific expenses and cash flows.
- On behalf of a taxpayer, Dr. Villadsen recently testified in federal court on the impact of discount rates on the economic value of alternative scenarios in a lease transaction.
- In an arbitration matter before the International Centre for Settlement of Investment Disputes, she provided expert reports and oral testimony on the allocation of corporate overhead costs and damages in the form of lost profit. Dr. Villadsen also reviewed internal book keeping records to assess how various inter-company transactions were handled.

- Dr. Villadsen provided expert reports and testimony in an international arbitration under the International Chamber of Commerce on the proper application of US GAAP in determining shareholders' equity. Among other accounting issues, she testified on impairment of long-lived assets, lease accounting, the equity method of accounting, and the measurement of investing activities.
- In a proceeding before the International Chamber of Commerce, she provided expert testimony on the interpretation of certain accounting terms related to the distinction of accruals and cash flow.
- In an arbitration before the American Arbitration Association, she provided expert reports on the equity method of accounting, the classification of debt versus equity and the distinction between categories of liabilities in a contract dispute between two major oil companies. For the purpose of determining whether the classification was appropriate, Dr. Villadsen had to review the company's internal book keeping records.
- In U.S. District Court, Dr. Villadsen filed testimony regarding the information required to determine accounting income losses associated with a breach of contract and cash flow modeling.
- Dr. Villadsen recently assisted counsel in a litigation matter regarding the determination of fair values of financial assets, where there was a limited market for comparable assets. She researched how the designation of these assets to levels under the FASB guidelines affect the value investors assign to these assets.
- She has worked extensively on litigation matters involving the proper application of mark-to-market and derivative accounting in the energy industry. The work relates to the proper valuation of energy contracts, the application of accounting principles, and disclosure requirements regarding derivatives.
- Dr. Villadsen evaluated the accounting practices of a mortgage lender and the mortgage industry to assess the information available to the market and ESOP plan administrators prior to the company's filing for bankruptcy. A large part of the work consisted of comparing the company's and the industry's implementation of gain-of-sale accounting.

- In a confidential retention matter, Dr. Villadsen assisted attorneys for the FDIC evaluate the books for a financial investment institution that had acquired substantial Mortgage Backed Securities. The dispute evolved around the degree to which the financial institution had impaired the assets due to possible put backs and the magnitude and estimation of the financial institution's contingencies at the time of it acquired the securities.
- In connection with a securities litigation matter she provided expert consulting support and litigation consulting on forensic accounting. Specifically, she reviewed internal documents, financial disclosure and audit workpapers to determine (1) how the balance's sheets trading assets had been valued, (2) whether the valuation was following GAAP, (3) was properly documented, (4) was recorded consistently internally and externally, and (5) whether the auditor had looked at and documented the valuation was in accordance with GAAP.
- In a securities fraud matter, Dr. Villadsen evaluated a company's revenue recognition methods and other accounting issues related to allegations of improper treatment of non-cash trades and round trip trades.
- For a multi-national corporation with divisions in several countries and industries, Dr. Villadsen estimated the appropriate discount rate to value the divisions. She also assisted the company in determining the proper manner in which to allocate capital to the various divisions, when the company faced capital constraints.
- Dr. Villadsen evaluated the performance of segments of regulated entities. She also reviewed and evaluated the methods used for overhead allocation.
- She has worked on accounting issues in connection with several tax matters. The focus of her work has been the application of accounting principles to evaluate intra-company transactions, the accounting treatment of security sales, and the classification of debt and equity instruments.
- For a large integrated oil company, Dr. Villadsen estimated the company's cost of capital and assisted in the analysis of the company's accounting and market performance.
- In connection with a bankruptcy proceeding, Dr. Villadsen provided litigation support for attorneys and an expert regarding corporate governance.

Damages and Valuation

- For the Alaska Industrial Development and Export Authority, Dr. Villadsen co-authored a report that estimated the range of recent acquisition and trading multiples for natural gas utilities.

- On behalf of a taxpayer, Dr. Villadsen testified on the economic value of alternative scenarios in a lease transaction regarding infrastructure assets.

- For a foreign construction company involved in an international arbitration, she estimated the damages in the form of lost profit on the breach of a contract between a sovereign state and a construction company. As part of her analysis, Dr. Villadsen relied on statistical analyses of cost structures and assessed the impact of delays.

- In an international arbitration, Dr. Villadsen estimated the damages to a telecommunication equipment company from misrepresentation regarding the product quality and accounting performance of an acquired company. She also evaluated the IPO market during the period to assess the possibility of the merged company to undertake a successful IPO.

- On behalf of pension plan participants, Dr. Villadsen used an event study estimated the stock price drop of a company that had engaged in accounting fraud. Her testimony conducted an event study to assess the impact of news regarding the accounting misstatements.

- In connection with a FINRA arbitration matter, Dr. Villadsen estimated the value of a portfolio of warrants and options in the energy sector and provided support to counsel on finance and accounting issues.

- She assisted in the estimation of net worth of individual segments for firms in the consumer product industry. Further, she built a model to analyze the segment's vulnerability to additional fixed costs and its risk of bankruptcy.

- Dr. Villadsen was part of a team estimating the damages that may have been caused by a flawed assumption in the determination of the fair value of mortgage related instruments. She provided litigation support to the testifying expert and attorneys.

- For an electric utility, Dr. Villadsen estimated the loss in firm value from the breach of a power purchase contract during the height of the Western electric power crisis. As part of the assignment, Dr. Villadsen evaluated the creditworthiness of the utility before and after the breach of contract.

- Dr. Villadsen modeled the cash flows of several companies with and without specific power contract to estimate the impact on cash flow and ultimately the creditworthiness and value of the utilities in question.

PUBLICATIONS AND REPORTS

"Report on Gas LDC multiples," with Michael J. Vilbert, *Alaska Industrial Development and Export Authority*, May 2015.

"Aurizon Network 2014 Draft Access Undertaking: Comments on Aspects of the WACC," prepared for Aurizon Network and submitted to the *Queensland Competition Authority*, December 2014

"Brattle Review of AE Planning Methods and Austin Task Force Report." (with Frank C. Graves) September 24, 2014.

Report on "Cost of Capital for Telecom Italia's Regulated Business" with Stewart C. Myers and Francesco Lo Passo before the *Communications Regulatory Authority of Italy* ("AGCOM"), March 2014. *Submitted in Italian.*

"Alternative Regulation and Ratemaking Approaches for Water Companies: Supporting the Capital Investment Needs of the 21st Century," (with J. Wharton and H. Bishop), prepared for the *National Association of Water Companies*, October 2013.

"Estimating the Cost of Debt," (with T. Brown), prepared for the Dampier Bunbury Pipeline and filed with the *Economic Regulation Authority*, Western Australia, March 2013.

"Estimating the Cost of Equity for Regulated Companies," (with P.R. Carpenter, M.J. Vilbert, T. Brown, and P. Kumar), prepared for the Australian Pipeline Industry Association and filed with the *Australian Energy Regulator* and the *Economic Regulation Authority*, Western Australia, February 2013.

"Calculating the Equity Risk Premium and the Risk Free Rate," (with Dan Harris and Francesco LoPasso), prepared for *NMa and Opta, the Netherlands*, November 2012.

"Shale Gas and Pipeline Risk: Earnings Erosion in a More Competitive World," (with Paul R. Carpenter, A. Lawrence Kolbe, and Steven H. Levine), *Public Utilities Fortnightly*, April 2012.

"Survey of Cost of Capital Practices in Canada," (with Michael J. Vilbert and Toby Brown), prepared for *British Columbia Utilities Commission*, May 2012.

"Public Sector Discount Rates" (with rank Graves, Bin Zhou), *Brattle* white paper, September 2011

"FASB Accounting Rules and Implications for Natural Gas Purchase Agreements," (with Fiona Wang), *American Clean Skies Foundation*, February 2011.

"IFRS and You: How the New Standards Affect Utility Balance Sheets," (with Amit Koshal and Wyatt Toolson), *Public Utilities Fortnightly*, December 2010.

"Corporate Pension Plans: New Developments and Litigation," (with George Oldfield and Urvashi Malhotra), Finance Newsletter, Issue 01, *The Brattle Group*, November 2010.

"Review of Regulatory Cost of Capital Methodologies," (with Michael J. Vilbert and Matthew Aharonian), *Canadian Transportation Agency*, September 2010.

"Building Sustainable Efficiency Businesses: Evaluating Business Models," (with Joe Wharton and Peter Fox-Penner), *Edison Electric Institute*, August 2008.

"Understanding Debt Imputation Issues," (with Michael J. Vilbert and Joe Wharton and *The Brattle Group* listed as an author), *Edison Electric Institute*, June 2008.

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"The Effect of Debt on the Cost of Equity in a Regulatory Setting," (with A. Lawrence Kolbe and Michael J. Vilbert, and with "*The Brattle Group*" listed as author), *Edison Electric Institute*, April 2005.

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SELECTED PRESENTATIONS

"Capital Structure and Liability Management," *American Gas Association and Edison Electric Institute Public Utility Accounting Course*, August 2015, 2014.

"Current Issues in Cost of Capital," *Edison Electric Institute Advanced Rate School*, July 2015, 2014 and 2013.

"Alternative Regulation and Rate Making Approaches for Water Companies," *Society of Depreciation Professionals Annual Conference*, September 2014.

"Capital Investments and Alternative Regulation," *National Association of Water Companies Annual Policy Forum*, December 2013.

"Accounting for Power Plant," *SNL's Inside Utility Accounting Seminar*, Charlotte, NC, October 2012.

"GAAP / IFRS Convergence," *SNL's Inside Utility Accounting Seminar*, Charlotte, NC, October 2012.

"International Innovations in Rate of Return Determination," *Society of Utility Financial and Regulatory Analysts' Financial Forum*, April 2012.

"Utility Accounting and Financial Analysis: The Impact of Regulatory Initiatives on Accounting and Credit Metrics," 1.5 day seminar, EUCI, Atlanta, May 2012.

"Cost of Capital Working Group Eforum," *Edison Electric Institute webinar*, April 2012.

"Issues Facing the Global Water Utility Industry" Presented to Sensus' Executive Retreat, Raleigh, NC, July 2010.

"Regulatory Issues from GAAP to IFRS," NASUCA *2009 Annual Meeting*, Chicago, November 2009.

"Subprime Mortgage-Related Litigation: What to Look for and Where to Look," *Law Seminars International: Damages in Securities Litigation*, Boston, May 2008.

"Evaluating Alternative Business / Inventive Models," (with Joe Wharton). *EEI Workshop, Making a Business of Energy Efficiency: Sustainable Business Models for Utilities*, Washington DC, December 2007.

"Deferred Income Taxes and IRS's NOPR: Who should benefit?" *NASUCA Annual Meeting*, Anaheim, CA, November 2007.

"Discussion of 'Are Performance Measures Other Than Price Important to CEO Incentives?'" *Annual Meeting of the American Accounting Association*, 2000.

"Contracting and Income Smoothing in an Infinite Agency Model: A Computational Approach," (with R.T. Boylan) *Business and Management Assurance Services Conference*, Austin 2000.

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Written evidence regarding the cost of equity and capital structure for Alberta-based utilities, the Alberta Utilities Commission, Proceeding No. 20622 on behalf of AltaGas Utilities Inc., ENMAX Power Corporation, FortisAlberta Inc., and The ATCO Utilities, February 2016.

Verified Statement, Verified Reply Statement, and Hearing Appearance regarding the cost of capital methodology to be applied to freight railroads, the *Surface Transportation Board* on behalf of the Association of American Railroads, Docket No. EP 664 (Sub-No. 2), July 2015, September and November 2014.

Direct Testimony on cost of capital submitted to the Oregon Public Utility Commission on behalf of Portland General Electric, Docket No. UE 294, February 2015.

Supplemental Direct Testimony and Reply Testimony on cost of capital submitted to the *Regulatory Commission of Alaska* on behalf of Anchorage Water and Wastewater utilities, Docket U-13-202, September 2014, March 2015.

Expert Report and hearing appearance on specific accrual and cash flow items in a Sales and Purchase Agreement in international arbitration before the *International Chamber of Commerce*. Case No. 19651/TO, July and November 2014.

Rebuttal Testimony regarding Cost of Capital before the *Oregon Public Utility Commission* on behalf of Portland General Electric, Docket No. UE 283, July 2014.

Direct Testimony on the rate impact of the pension re-allocation and other items for Upper Peninsula Power Company in connection with the acquisition by BBIP before the *Michigan Public Service Commission* in Docket No. U-17564, March 2014.

Expert Report on cost of equity, non-recovery of operating cost and asset retirement obligations on behalf of oil pipeline in arbitration, April 2013.

Direct Testimony on the treatment of goodwill before the *Federal Energy Regulatory Commission* on behalf of ITC Holdings Corp and ITC Midwest, LLC in Docket No. PA10-13-000, February 2012.

Direct and Rebuttal Testimony on cost of capital before the *Public Utilities Commission of the State of California* on behalf of California-American Water in Application No. 11-05, May 2011.

Direct Testimony, Rebuttal Testimony, and Hearing Appearance on cost of capital before the *New Mexico Public Regulation Commission* on behalf of New Mexico-American Water in Case No. 11-00196-UT, May 2011, November 2011, and December 2011.

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Expert Report and deposition in Civil Action No. 02-618 (GK/JMF) in the *United States District Court for the District of Columbia*, November 2010, January 2011.

Direct Testimony, Rebuttal Testimony, and Rejoinder Testimony on the cost of capital before the *Arizona Corporation Commission* on behalf of Arizona-American Water in Docket No. W-01303A-10-0448, November 2010, July 2011, and August 2011.

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Direct and Rebuttal Testimony and Hearing Appearance on the cost of capital before the *Arizona Corporation Commission* on behalf of Arizona-American Water in Docket No. W-01303A-09-0343, July 2009, March 2010 and April 2010.

Rebuttal Expert Report, Deposition and Oral Testimony re. the impact of alternative discount rate assumptions in tax litigation. *United States Court of Federal Claims*, Case No. 06-628 T, January, February, April 2009. (*Confidential*)

Direct Testimony, Rebuttal Testimony and Hearing Appearance on cost of capital before the *New Mexico Public Regulation Commission* on behalf of New Mexico-American Water in Docket No. 08-00134-UT, June 2008 and January 2009.

Direct Testimony on cost of capital and carrying charge on damages, U.S. Department of Energy, *Bonneville Power Administration*, BPA Docket No. WP-07, March 2008.

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Expert Report on accounting information needed to assess income. *United States District Court* for the District of Maryland (Baltimore Division), Civil No. 1:06cv02046-JFM, June 2007 (*Confidential*)

Expert Report, Rebuttal Expert Report, and Hearing Appearance regarding investing activities, impairment of assets, leases, shareholder' equity under U.S. GAAP and valuation. *International Chamber of Commerce* (ICC), Case No. 14144/CCO, May 2007, August 2007, September 2007. (Joint with Carlos Lapuerta, *Confidential*)

Direct Testimony, Rebuttal Testimony, and Hearing Appearance on cost of capital before the *Arizona Corporation Commission* on behalf of Arizona-American Water in Docket No. W-01303A-06-0491, July 2006, July 2007.

Direct Testimony, Rebuttal Testimony, Rejoinder Testimony, Supplemental Rejoinder Testimony and Hearing Appearance on cost of capital before the *Arizona Corporation Commission* on behalf of Arizona-American Water in Docket No. W-01303A-06-0403, June 2006, April 2007, May 2007.

Direct Testimony, Rebuttal Testimony, Rejoinder Testimony, and Hearing Appearance on cost of capital before *the Arizona Corporation Commission* on behalf of Arizona-American Water in Docket No. W-01303A-06-0014, January 2006, October 2006, November 2006.

Expert report, rebuttal expert report, and deposition on behalf of a major oil company regarding the equity method of accounting and classification of debt and equity, *American Arbitration Association*, August 2004 and November 2004. (*Confidential*).

Appendix B: Technical Appendix

I. Sample Selection

To identify publicly traded companies that engaged in electric utility operations, I rely on industry classifications provided by the *Value Line Investment Survey Plus Edition. Value Line* identifies 47 companies as electric utility companies.

To include a company, I require that over a five year study period and up to the date of the analysis, the sample companies have investment grade credit ratings, a high percentage of regulated assets (greater than 50 percent),[1] no dividend cuts, and no substantial mergers and acquisitions or other activity that could cause the growth rates or beta estimates to be biased. I also require that each of the sample companies has more than $300 million in reported revenue over the last four quarters of available financial data, since very small (in terms of market capitalization) publicly traded companies have been shown to have a higher cost of equity. Finally, I require that data from S&P or Moody's, Value Line, and Bloomberg — each widely known and utilized by investors — be available for all sample companies. These screens result in a sample of 27 companies of which two (Consolidated Edison and Centerpoint) own no or minimal generation. I further consider a subsample of companies, whose nuclear generation mix is of a magnitude that is within +/- 10% of that of APS and therefore constitute 17-37% of the sample company's total generation capacity.

II. CAPM and ECAPM

A. The Capital Asset Pricing Model (CAPM)

The Capital Asset Pricing Model (CAPM) is a theoretical model stating that the collective investment decisions of investors in capital markets will result in equilibrium prices for all risky assets such that the returns investors expect to receive on their investments are commensurate with the risk of those assets relative to the market as a whole. The CAPM posits a risk-return relationship known as the Security Market Line (see Figure 1 in my Written Evidence), in which the required expected return on an asset is proportional to that asset's risk relative to the market

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[1] I use the Edison Electric Institute's classification of electric utilities as Regulated (greater than 80 percent of total assets are regulated), Mostly Regulated (50 to 80 percent of total assets are regulated) or Diversified (less than 50% of total assets are regulated). My sample includes only electric utilities classified by EEI as Regulated or Mostly Regulated.

as measured by its "beta". More precisely, the CAPM states that the cost of capital for an investment *S* (e.g., a particular common stock), is given by the following equation:

$$r_s = r_f + \beta_s \times MRP \quad (1)$$

where r_S is the required return on investment S;
r_f is the risk-free interest rate;
β_S is the beta risk measure for the investment S; and
MRP is the market equity risk premium.

The CAPM is based on portfolio theory, and recognizes two fundamental principles of finance: (1) investors seek to minimize the possible variance of their returns for a given level of expected returns (or alternatively, they demand higher *expected* returns when there is greater uncertainty about those returns), and (2) investors can reduce the variability of their returns by diversifying—constructing portfolios of many assets that do not all go up or down at the same time or to the same degree. Under the assumptions of the CAPM, the market participants will construct portfolios of risky investments that minimize risk for a given return so that the aggregate holdings of all investors represent the "market portfolio". The risk-return trade-off faced by investors then concerns their exposure to the risk inherent in the market portfolio, as they weight their investment capital between the portfolio of risky assets and the risk-free asset.

Because of the effects of diversification, the relevant measure of risk for an individual security is its *contribution* to the risk of the market portfolio. Therefore, beta (β) is defined to capture the sensitivity of the security's returns to the market's returns. Formally,

$$\beta_s = \frac{covariance(r_s, R_m)}{variance(R_m)} \quad (2)$$

where R_m is the return on the market portfolio.

Beta is usually calculated by statistically comparing (using regression analysis) the excess (positive or negative) of the return on the individual security over the government bond rate with the excess of the return on a market index such as the S&P 500 over a government bond rate.

The basic idea behind beta is the risk that cannot be diversified away in large portfolios is what matters to investors. Beta is a measure of the risks that *cannot* be eliminated by diversification. It is this non-diversifiable risk, or "systematic risk", for which investors require compensation in the form of higher expected returns. By definition, a stock with a beta equal to 1.0 has average non-diversifiable risk; its returns vary to the same degree as those on the market as a whole.

According to the CAPM, the required return demanded by investors (i.e., the cost of equity) for investing in that stock will match the expected return on the market as a whole. Similarly, stocks with betas above 1.0 have more than average risk, and so have a cost of equity greater than the expected market return; those with betas below 1.0 have less than average risk, and are expected to earn lower than market levels of return.

B. INPUTS TO THE CAPM

1. The Risk-free Interest Rate

The precise meaning of a "risk-free" asset according to the finance theory underlying the CAPM is an investment whose return is guaranteed, with no possibility that it will vary around its expected value in response to the movements of the broader market. (Equivalently, the CAPM beta of a risk-free asset is zero.) In developed economies like the U.S., government debt are generally considered have no default risk. In this sense they are "risk-free"; however, unless they are held to maturity, the rate of return on government bonds may in fact vary around their stated or expected yields.[2]

The theoretical CAPM is a single period model, meaning that it posits a relationship between risk and return over a single "holding period" of an investment. Because investors can rebalance their portfolios over short horizons, many academic studies and practical applications of the CAPM use the short-term government bond as the measure of the risk-free rate of return. However, regulators frequently use a version based on a measure of the long-term risk-free rate; e.g., a long-term government bond. In accordance with the established practice, I rely on the 20-year Treasury bond as a measure of the risk-free asset in this proceeding. I use the term "risk-free rate" as describing the yield on the 20-year Treasury bond.

However, I do not believe the *current* yield on long-term Treasury bonds is a good estimate for the risk-free rate that will prevail over the time period relevant to this proceeding as currently prevailing bond yields are near historic lows for a variety of circumstances that should not be expected to persist for the reasons discussed in my direct testimony. For this reason I rely on Blue Chip's forecast of 3.4% for the yield on a 10-year Treasury bond for Q1 2017.[3] I adjust this value upward by 53 basis points, which is my estimate of the maturity premium for the 20-year

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[2] This is due to interest rate fluctuations that can change the market value of previously issued debt in relation to the yield on new issuances

[3] Blue Chip Economic Indicators, January 10, 2016.

over the 10-year Treasury Bond.[4] This gives me a base input of 3.93% for the risk-free rate of interest before considering any downward pressure on government bond yields.

Additionally, it is important to recognize the implications of the elevated level of spread between yields on utility bonds and Treasury bonds of the same horizon. Figure A-1 below shows that this yield spread is about 90 basis points higher now than it was on average prior to the 2008 financial crisis. One way to account for this observation is if the prevailing and near-term expected government bond yields are artificially depressed relative to longer-term market expectations. Therefore, I consider a scenario with the risk-free rate (conservatively) 80 basis points higher at 4.73% when performing my CAPM-based analyses.

Figure A-1

Spreads between U.S. Utility Bond (20 year maturity) and U.S. Government Bond (20 year maturity) - %

Periods	A-Rated Utility and Treasury	BBB-Rated Utility and Treasury	Notes
Period 1 - Average Apr-1991 - 2007	0.93	1.23	[1]
Period 2 - Average Aug-2008 - Feb-2016	1.54	2.00	[2]
Period 3 - Average Feb-2016	1.83	2.59	[3]
Period 4 - Average 15-Day (Mar 02, 2016 to Feb 10, 2016)	1.85	2.56	[4]
Spread Increase between Period 2 and Period 1	0.60	0.77	[5] = [2] - [1]
Spread Increase between Period 3 and Period 1	0.90	1.36	[6] = [3] - [1]
Spread Increase between Period 4 and Period 1	**0.92**	**1.33**	[7] = [4] - [1]

Sources and Notes:
Spreads for the periods are calculated from Bloomberg's yield data.
Average monthly yields for the indices were retrieved from Bloomberg as of March 2, 2016.

2. The Market Equity Risk Premium

a. Historical Average Market Risk Premium

Like the cost of capital itself, the market risk premium is a forward-looking concept. It is by definition the premium above the risk-free interest rate that investors can *expect* to earn by investing in a value-weighted portfolio of all risky investments in the market. The premium is not directly observable, and must be inferred or forecasted based on known market information.

[4] This maturity premium is estimated by comparing the average excess yield on 20-year versus 10-year Treasury Bonds over the period 1990 - 2015, using data from Bloomberg. See BV Workpaper 1.

One commonly use method for estimating the MRP is to measure the historical average premium of market returns over the income returns on risk-free government bonds over some long historical period. *Duff and Phelps* performs such a calculation of the MRP using the traditional Ibbotson data. The arithmetic average of annual observed market equity risk premiums from 1926 to the present is 7.0%.[5]

b. Forward Looking Market Equity Risk Premium

An alternative approach to estimating the MRP eschews historical averages in favor of using current market information and forecasts to infer the expected return on the market as a whole, which can then be compared to prevailing government bond yields to estimate the equity risk premium. Bloomberg performs such estimates of country-specific MRPs by implementing the DCF model on the market as a whole—using forecast market-wide dividend yields and current level on market indexes; for the U.S. Bloomberg uses the S&P500 to infer the expected market return.

The forward-looking market-implied MRP is elevated relative to the historical MRS and currently stands at 8.47%. The Bloomberg MRP measure is over a 10-year government bond, so converting that to the forecasted MRP over a 20-year government bond results in about 8%.[6]

c. Yield Spread Adjustments to the Market Equity Risk Premium

Figure A-1 above shows that the yield spreads for A and BBB rated utility debt over Treasury bonds have increased by approximately 90 bps and 130 bps for 20-year maturities relative to its long-term average leading up to the 2008 financial crisis. This means that investors require a higher return on investment grade utility debt relative to the return on t bonds than they did before the crisis and ensuing economic turmoil.

This information can be used to provide a quantitative benchmark for the implied increase in MRP based on a paper by Edwin J. Elton, et al., which documents that the yield spread on corporate bonds is normally a combination of a default premium, a tax premium, and a systematic risk premium.[7] Of these components, it is the systematic risk premium that likely

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5 Duff & Phelps, "2015 Valuation Handbook: Guide to Cost of Capital," p. 3-24.

6 Estimates of the MRP over a 20-year bond is obtained by subtracting the maturity premium of the 20-year over the 10-year government bond from the figure reported by Bloomberg. This maturity premium is about 50 basis points in the U.S.

7 "Explaining the Rate Spread on Corporate Bonds," Edwin J. Elton, Martin J. Gruber, Deepak Agarwal, and Christopher Mann, *The Journal of Finance*, February 2001, pp. 247-277.

explains the vast majority of the yield spread increase. In other words, unless the risk-free rate is underestimated as described above, the market equity risk premium has increased relative to its "normal" level.[8] Therefore, I consider a scenario allocating the majority of the 90 bps increase in A-rated utility spreads to an increase in the MRP (which drives the increase in systematic risk premium on A rated debt). As a conservative measure I allocate 80 bps as the downward bias in the current 20-year Treasury bond yield.

Assuming a beta of 0.25 for A rated debt[9] means that an increase in the MRP of one percentage point translates into a ¼ percentage point increase in the risk premium on A rated debt (i.e., 0.25 (beta) times 1 percentage point (increase in MRP) = ¼ percentage point increase in yield spread). Thus, an 80 bps increase in the yield spread is therefore consistent with a 3.2 percentage point increase in the MRP ($\frac{0.80\%}{0.25} = 3.2\%$). I consider this evidence as confirmation that the current MRP could be much higher than the historical MRP of 7%, but use conservatively 8% based on the recent Bloomberg forecast.

C. THE EMPIRICAL CAPM

1. Description of the ECAPM

Empirical research has shown that the CAPM tends to overstate the actual sensitivity of the cost of capital to beta: low-beta stocks tend to have higher risk premiums than predicted by the CAPM and high-beta stocks tend to have lower risk premiums than predicted. A number of variations on the original CAPM theory have been proposed to explain this finding, but the observation itself can also be used to estimate the cost of capital directly, using beta to measure relative risk by making a direct empirical adjustment to the CAPM.

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[8] In theory, some of the increase in yield spread for A rated debt may be due to an increase in default risk, but the increase in default risk for A rated debt is undoubtedly very small because utilities with A range rated debt have a low default risk. This means that the vast majority—if not all—of the increase in A rated yield spreads is due to a combination of the increased systematic risk premium and the downward pressure on the yields of government debt. Although there is no increase in the tax premium discussed in the Elton et al. paper due to coupon payments, there may be some increase due to a small tax effect resulting from the probability of increased capital gains taxes when the debt matures.

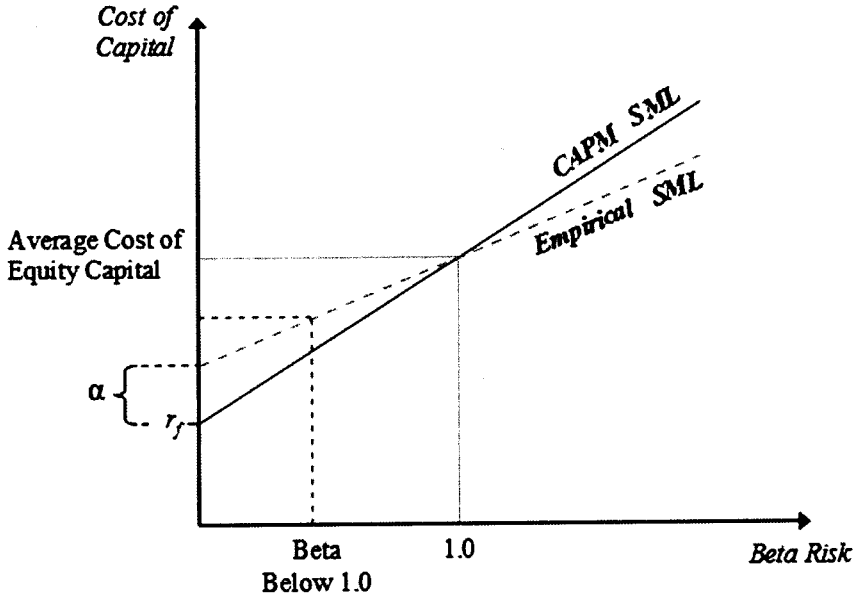
[9] Elton, *et al.* estimates the average beta on BBB-rated corporate debt as 0.26 over the period of their study, and A-rated debt will have a slightly lower beta than BBB-rated debt. I note that 0.25 is a conservatively high estimate of the beta on A-rated utility debt. Most academic estimates, including those presented in *Berk & Demarzo* that I utilize for my Hamada adjustments are significantly lower: in the range of 0.0 – 0.1 percent and would result in a substantially higher MRP estimate.

The Empirical CAPM (ECAPM) makes use of these empirical findings. It estimates the cost of capital with the equation,

$$r_S = r_f + \alpha + \beta_S \times (MRP - \alpha) \quad (3)$$

where α is the "alpha" adjustment of the risk-return line, a constant, and the other symbols are defined as for the CAPM (see Equation (1)). The alpha adjustment has the effect of increasing the intercept but reducing the slope of the Security Market Line, which results in a Security Market Line that more closely matches the results of empirical tests. In other words, the ECAPM produces more accurate predictions of eventual realized risk premiums than does the CAPM.

Figure A-2
The Empirical Security Market Line



2. Academic Evidence on the Alpha Term in the ECAPM

Figure A-3 below summarizes the empirical results of tests of the CAPM, including their estimates of the "alpha" parameter necessary to improve the accuracy of the CAPM's predictions of realized returns.

Figure A-3

EMPIRICAL EVIDENCE ON THE ALPHA FACTOR IN ECAPM*

AUTHOR	RANGE OF ALPHA	PERIOD RELIED UPON
Black (1993)[1]	1% for betas 0 to 0.80	1931-1991
Black, Jensen and Scholes (1972)[2]	4.31%	1931-1965
Fama and McBeth (1972)	5.76%	1935-1968
Fama and French (1992)[3]	7.32%	1941-1990
Fama and French (2004)[4]	N/A	
Litzenberger and Ramaswamy (1979)[5]	5.32%	1936-1977
Litzenberger, Ramaswamy and Sosin (1980)	1.63% to 3.91%	1926-1978
Pettengill, Sundaram and Mathur (1995)[6]	4.6%	1936-1990

*The figures reported in this table are for the longest estimation period available and, when applicable, use the authors' recommended estimation technique. Many of the articles cited also estimate alpha for sub-periods and those alphas may vary.

[1]Black estimates alpha in a one step procedure rather than in an un-biased two-step procedure.
[2]Estimate a negative alpha for the subperiod 1931-39 which contain the depression years 1931-33 and 1937-39.
[3]Calculated using Ibbotson's data for the 30-day treasury yield.
[4]The article does not provide a specific estimate of alpha; however, it supports the general finding that the CAPM underestimates returns for low-beta stocks and overestimates returns for high-beta stocks.
[5]Relies on Lizenberger and Ramaswamy's before-tax estimation results. Comparable after-tax alpha estimate is 4.4%.
[6]Pettengill, Sundaram and Mathur rely on total returns for the period 1936 through 1990 and use 90-day treasuries. The 4.6% figure is calculated using auction averages 90-day treasuries back to 1941 as no other series were found this far back.

Sources:
Black, Fischer. 1993. Beta and Return. *The Journal of Portfolio Management* 20 (Fall): 8-18.
Black, F., Michael C. Jensen, and Myron Scholes. 1972. The Capital Asset Pricing Model: Some Empirical Tests, from Studies in the theory of Capital Markets. In *Studies in the Theory of Capital Markets*, edited by Michael C. Jensen, 79-121. New York: Praeger.
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Litzenberger, Robert H. and Krishna Ramaswamy. 1979. The Effect of Personal Taxes and Dividends on Capital Asset Prices, Theory and Empirical Evidence. *Journal of Financial Economics* XX (June): 163-195.
Litzenberger, Robert H. and Krishna Ramaswamy and Howard Sosin. 1980. On the CAPM Approach to Estimation of a Public Utility's Cost of Equity Capital. *The Journal of Finance* 35 (2): 369-387.

III. DCF Models

A. DCF Estimation of Cost of Equity

The DCF method for estimating the cost of equity capital assumes that the market price of a stock is equal to the present value of the dividends that its owners expect to receive. The method also assumes that this present value can be calculated by the standard formula for the present value of a cash flow stream:

$$P_0 = \frac{D_1}{1+r} + \frac{D_2}{(1+r)^2} + \frac{D_3}{(1+r)^3} + \cdots + \frac{D_T}{(1+r)^T} \quad (4)$$

where P_0 is the current market price of the stock; D_t is the dividend cash flow expected at the end of period t; r is the cost of equity capital; and T is the last period in which a dividend cash flow is to be received. The formula simply says that the stock price is equal to the sum of the expected future dividends, each discounted for the time and risk between now and the time the dividend is expected to be received. Since the current market price is known, it is possible to infer the cost of equity that corresponds to that price and a forecasted pattern of expected future dividends. In terms of Equation (4, if P_0 is known and $D_1, D_2, \ldots D_T$ are estimated, an analyst can "solve for" the cost of equity capital r.

B. Details of the DCF Model

Perhaps the most widely known and used application of the DCF method assumes that the expected rate of dividend growth remains constant forever. In the so-called Gordon Growth Model, the relationship expressed in Equation (4) is such that the present value equation can be rearranged algebraically into a formula for estimating the cost of equity. Specifically, if investors expect a dividend stream that will grow forever at a steady rate, then the market price of the stock will be given by

$$P_0 = \frac{D_1}{r-g} \quad (5)$$

where D_1 is the dividend expected at the end of the first period, g is the perpetual growth rate, and P_0 and r are the market price and the cost of capital, as before. Equation (5) is a simplified version of Equation (4) that can be solved algebraically to yield the well-known "DCF formula" for the cost of equity capital,

$$r = \frac{D_1}{P_0} + g = \frac{D_0 \times (1+g)}{P_0} + g \qquad (6)$$

There are other versions of the DCF model that relax this restrictive assumption and posit a more complex or nuanced pattern of expected future dividend payments. For example, if there is reason to believe that investors do *not* expect a company's dividends to grow at a steady rate forever, but rather have different growth rate expectations in the near term (e.g., over the next five or ten years), compared to the distant future (e.g., a period *starting* ten years from the present moment), a "multi-stage" growth pattern can be modeled in the present value formula (Equation (4)). I do not consider this model in this proceeding.

1. Dividends, Cash Flows, and Share Repurchases

In addition to the DCF model described above, there are many alternative formulations. Notable among these are versions of the model that use cash flows rather than dividends in the present value formula (Equation (4)).[10]

Because investors are interested in cash flow, it is technically important to capture *all* cash flows that are distributed to shareholders when estimating the cost of equity using the DCF method. In some circumstances, investors may expect to receive cash in forms other than dividends. An important example concerns the fact that many companies distribute cash to shareholders through share buybacks in addition to dividends. To the extent such repurchases are expected by investors, but not captured in the forecasted pattern of future dividends; a dividend-based implementation of the DCF model will underestimate the cost of equity.

Similarly, if investors have reason to suspect that a company's dividend payments will not reflect a full distribution of its available cash free cash flows in the period they were generated, it may be appropriate replace the forecasted dividends with estimated free cash flows to equity in the present value formula (Equation (4)). Focusing on *available* cash rather than that actually distributed in the form of dividends can help account for instances when near-term investing and financing activities (e.g., capital expenditures or asset sales, debt issuances or retirements, or share repurchases) may cause dividend growth patterns to diverge from growth in earnings.

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[10] For an example in a regulatory context, the U.S. Surface Transportation Board uses a cash flow based model with three stages to estimate the cost of equity for the railroads. See Surface Transportation Board Decision, "STB Ex Parte No. 664 (Sub-No. 1)," Decided January 23, 2009.

Many utility companies such as those included in my samples have long histories of paying a dividend. In fact, as mentioned in Section I of this Appendix, one of my requirements for inclusion in my samples is that a company pays dividends for 5-years without a gap or a dividend cut (on per share basis). Additionally, although some electric utility companies have recently engaged in share repurchase programs, the companies in my samples do not distribute substantial cash flows by means other than dividends.[11]

C. DCF Model Inputs

1. Dividends and Prices

As described above, DCF models are forward-looking, comparing the *current* price of a stock to its expected *future* dividends to estimate the required expected return demanded by the market for that stock (i.e., the cost of equity). Therefore, the models demand the current market price and currently prevailing forecasts of future dividends as inputs.

The stock price input I employ for each sample company is the average of the closing stock prices for the 15 trading days ending on the date of my analysis. This guards against biases that may arise on a single trading day, yet is consistent with using current stock prices.

2. Company Specific Growth Rates

a. Analysts' Forecasted Growth Rates

Finding the right growth rate(s) is usually the "hard part" of applying the DCF model, which is sometimes criticized due to what has been called "optimism bias" in the earnings growth rate forecasts of security analysts. Optimism bias is related to the observed tendency for analysts to forecast earnings growth rates that are higher than are actually achieved. This tendency to overestimate growth rates is perhaps related to incentives faced by analysts that provide rewards not strictly based upon the accuracy of the forecasts. To the extent optimism bias is present in the analysts' earnings forecasts the cost of capital estimates from the DCF model would be too high.

While academic researchers during the 1990s as well as in early 2000s found evidence of analysts' optimism bias, there is some evidence that regulatory reforms have eliminated the

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[11] While a number of companies in my samples have or have had share repurchase programs (e.g., El Paso), the magnitude tends to be relatively small, so that an inclusion of the cash flow from repurchases would likely have a minimal impact on the average results for the samples. However, it is clear that not including such repurchases downwardly biases the estimated cost of equity.

issue. A recent paper by Hovakimina and Saenyasiri (2010) found that recent efforts to curb analysts' incentive to provide optimistic forecasts have worked, so that "the median forecast bias essentially disappeared."[12] Thus, some recent research indicates that the analyst bias may be a problem of the past.

The findings of several academic studies[13] show that analyst earnings forecasts turn out to be too optimistic for stocks that are more difficult to value, for instance, stocks of smaller firms, firms with high volatility or turnover, younger firms, or firms whose prospects are uncertain. Coincidentally, stocks with greater analyst disagreement have higher analyst optimism bias—all of these describe companies that are more volatile and/or less transparent—none of which is applicable to the majority of utility companies with wide analyst coverage and information transparency.

b. Sources for Forecasted Growth Rates

For the reasons described above, I rely on analyst forecasts of earnings growth for the company-specific growth rate inputs to my implementations of the single- and multi-stage DCF models. All of the companies in my samples have coverage from equity analysts reporting to Thomson Reuters IBES, so I use the consensus 3-5 year EPS growth rate provided by that service. For the U.S. based samples, I supplement these consensus values with growth rates based on EPS estimates from *Value Line*.[14]

IV. Financial Risk and the Cost of Equity

A common issue in regulatory proceedings is how to apply data from a benchmark set of comparable securities when estimating a fair return on equity for the target/regulated company.[15]

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[12] A. Hovakimian and E. Saenyasiri, "Conflicts of Interest and Analyst Behavior: Evidence from Recent Changes in Regulation," *Financial Analysts Journal*, vol. 66, 2010.

[13] These studies include the following: (i) Hribar, P, McInnis, J. "Investor Sentiment and Analysts' Earnings Forecast Errors," *Management Science* Vol. 58, No. 2 (February 2012): pp. 293-307; (ii) Scherbina, A. (2004), "Analyst Disagreement, Forecast Bias and Stock Returns," downloaded from Harvard Business School Working Knowledge: http://hbswk.hbs.edu/item/5418.html; and (iii) Michel, J-S., Pandes J.A. (2012), "Are Analysts Really Too Optimistic?" downloaded from http://www.efmaefm.org.

[14] Specifically, I compute the growth rate implied by *Value Line*'s current year EPS estimate and its projected 3-5 year EPS estimate. I then average this in with the IBES consensus estimate as an additional independent estimate, giving it a weight of 1 and weighting the IBES consensus according to the number of analysts who contributed estimates.

[15] This is also a common valuation problem in general business contexts.

It may be tempting to simply estimate the cost of equity capital for each of the sample companies (using one of the above approaches) and average them. After-all, the companies were chosen to be comparable in their business risk characteristics, so why would an investor necessarily prefer equity in one to the other (on average)?

The problem with this argument is that it ignores the fact that underlying asset risk (i.e., the risk inherent in the lines of business in which the firm invests its assets) for each company is typically divided between debt and equity holders. The firm's debt and equity are therefore financial derivatives of the underlying asset return, each offering a differently structured claim on the cash flows generated by those assets. Even though the risk of the underlying assets may be comparable, a different capital structure splits that risk differently between debt and equity holders. The relative structures of debt and equity claims are such that higher degrees of debt financing increase the variability of returns on equity, *even when the variability of asset returns remains constant.* As a consequence, otherwise identical firms with different capital structures will impose different levels of risk on their equity holders. Stated differently, increased leverage adds financial risk to a company's equity.[16]

A. THE EFFECT OF FINANCIAL LEVERAGE ON THE COST OF EQUITY

To develop an intuition for the manner in which financial leverage affects the risk of equity, it is helpful to consider a concrete example. Figure A-4 and Figure A-5 below demonstrate the impact of leverage on the risk and return for equity by comparing equity's risk when a company uses no debt to finance its assets, and when it uses a 50-50 capital structure (i.e., it finances 50 percent of its assets with equity, 50 percent with debt). For illustrative purposes, the figures assume that the cash flows will be either $5 or $15 and that these two possibilities have the same chance of occurring (e.g., the chance that either occurs is ½).

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[16] I refer to this effect in terms of *financial risk* because the additional risk to equity holders stems from how the company chooses to finance its assets. In this context financial risk is distinct from and independent of the *business risk* associated with the manner in which the firm deploys its cash flow generating assets. The impact of leverage on risk is conceptually no different than that faced by a homeowner who takes out a mortgage. The equity of a homeowner who finances his home with 90% debt is much riskier than the equity of one who only finances with 50% debt.

Figure A-4: All Equity Capital Structure

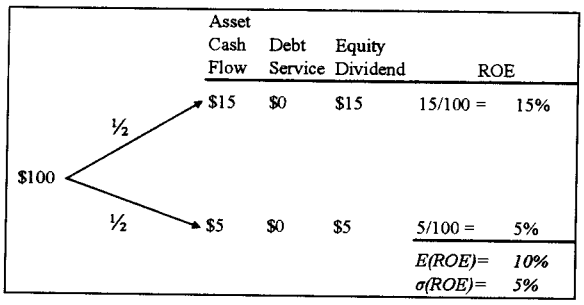
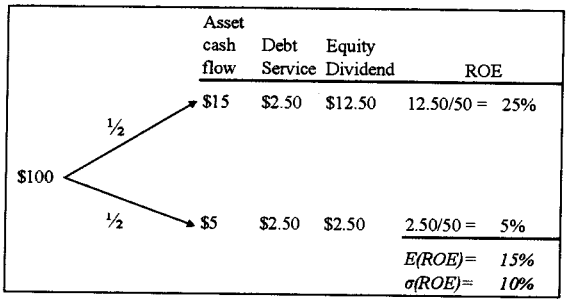


Figure A-5: 50/50 Capital Structure.



In the figures, E(ROE) indicates the mean return and σ(ROE) represents the variance. This simple example illustrates that the introduction of debt increases both the mean (expected) return to equity holders and the variance of that return, even though the firm's expected cash flows—which are a property of the line of business in which its assets are invested—are unaffected by the firm's financing choices. The "magic" of financial leverage is not magic at all—leveraged equity investors can only earn a higher return because they take on greater risk.

B. Methods to Account for Financial Risk

1. Cost of Equity Implied by the Overall Cost of Capital

If the companies in a sample are truly comparable in terms of the systematic risks of the underlying assets, then the overall cost of capital of each company should be about the same across companies (except for sampling error), so long as they do not use extreme leverage or no leverage. The intuition here is as follows. A firm's asset value (and return) is allocated between equity and debt holders.[17] The expected return to the underlying asset is therefore equal to the

[17] Other claimants can be added to the weighted average if they exist. For example, when a firm's capital structure contains preferred equity, the term $\frac{P}{V} \times r_p$ is added to the expression for the overall cost of capital shown in Equation (7), where P refers to the market value of preferred equity, r_p is the cost of preferred equity and $V = E + D + P$. In my analysis, I attribute the same implied yield to the cost of preferred equity as to the cost of debt.

value weighted average of the expected returns to equity and debt holders – which is the overall cost of capital (r^*), or the expected return on the assets of the firm as a whole.[18]

$$r^* = \frac{E}{V} \times r_E + \frac{D}{V} \times r_D(1 - \tau_c) \quad (7)$$

where r_D is the market cost of debt,
r_E is the market cost of equity,
τ_c is the corporate income tax rate,
D is the market value of the firm's debt,
E is the market value of the firm's equity, and
$V = E + D$ is the total market value of the firm.

Since the overall cost of capital is the cost of capital for the underlying asset risk, and this is comparable across companies, it is reasonable to believe that the overall cost of capital of the underlying companies should also be comparable, so long as capital structures do not involve unusual leverage ratios compared to other companies in the industry.[19]

The notion that the overall cost of capital is constant across a broad middle range of capital structures is based upon the Modigliani-Miller theorem that choice of financing does not affect the firm's value. Franco Modigliani and Merton Miller eventually won Nobel Prizes in part for their work on the effects of debt.[20] Their 1958 paper made what is in retrospect a very simple point: if there are no taxes and no risk to the use of excessive debt, use of debt will have no effect on a company's operating cash flows (i.e., the cash flows to investors as a group, debt and equity combined). If the operating cash flows are the same regardless of whether the company finances mostly with debt or mostly with equity, then the value of the firm cannot be affected at

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18 As this is on an after-tax basis, the cost of debt reflects the tax value of interest deductibility. Note that the precise formulation of the weighted average formula representing the required return on the firm's *assets* independent of financing (sometimes called the *unlevered* cost of capital) depends on specific assumptions made regarding the value of tax shields from tax-deductible corporate debt, the role of personal income tax, and the cost of financial distress. See Taggart, Robert A., "Consistent Valuation and Cost of Capital Expressions with Corporate and Personal Taxes," *Financial Management*, 1991; 20(3) for a detailed discussion of these assumptions and formulations. Equation (7) represents the overall cost of capital to the firm, which can be assumed to be constant across a relatively broad range of capital structures.

19 Empirically, companies within the same industry tend to have similar capital structures, while typical capital structures may vary between industries, so whether a leverage ratio is "unusual" depends upon the company's line of business.

20 Franco Modigliani and Merton H. Miller (1958), "The Cost of Capital, Corporation Finance and the Theory of Investment," *American Economic Review*, 48, pp. 261-297.

all by the debt ratio. In cost of capital terms, this means the overall cost of capital is constant regardless of the debt ratio, too.

Obviously, the simple and elegant Modigliani-Miller theorem makes some counterfactual assumptions: no taxes and no cost of financial distress from excessive debt. However, subsequent research, including some by Modigliani and Miller,[21] showed that while taxes and costs to financial distress affect a firm's incentives when choosing its capital structure as well as its overall cost of capital,[22] the latter can still be shown to be constant across a broad range of capital structures.[23]

This reasoning suggests that one could compute the overall cost of capital for each of the sample companies and then average to produce an estimate of the overall cost of capital associated with the underlying asset risk. Assuming that the overall cost of capital is constant, one can then re-arrange the overall cost of capital formula to estimate what the implied cost of equity is at the target company's capital structure on a book value basis.[24]

2. Unlevering and Relevering Betas in the CAPM (Hamada Adjustment)

An alternative approach to account for the impact of financial risk is to examine the impact of leverage on beta. Notice that this means working within the CAPM framework as the methodology cannot be applied directly to the DCF models.

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21 Franco Modigliani and Merton H. Miller (1963), "Corporate Income Taxes and the Cost of Capital: A Correction," *American Economic Review*, 53, pp. 433-443.

22 When a company uses a high level of debt financing, for example, there is significant risk of bankruptcy and all the costs associated with it. The so called costs of financial distress that occurs when a company is over-leveraged can increase its cost of capital. In contrast a company can generally decrease its cost of capital by taking on reasonable levels of debt, owing in part to the deductibility of interest from corporate taxes.

23 This is a simplified treatment of what is generally a complex and on-going area of academic investigation. The roles of taxes, market imperfections and constraints, etc. are areas of on-going research and differing assumptions can yield subtly different formulations for how to formulate the weighted average cost of capital that is constant over all (or most) capital structures.

24 Market value capital structures are used in estimating the overall cost of capital for the sample companies.

Recognizing that under general conditions, the value of a firm can be decomposed into its value with and without a tax shield, I obtain:[25]

$$V = V_U + PV(ITS) \tag{8}$$

where $V = E + D$ is the total value of the firm as in Equation (7),
V_U is the "unlevered" value of the firm—its value if financed entirely by equity
$PV(ITS)$ represents the present value of the interest tax shields associated with debt

For a company with a fixed book-value capital structure and no additional costs to leverage, it can be shown that the formula above implies:

$$r_E = r_U + \frac{D}{E}(1 - \tau_c)(r_U - r_D) \tag{9}$$

where r_U is the "unlevered cost of capital"—the required return on assets if the firm's assets were financed with 100% equity and zero debt—and the other parameters are defined as in Equation (7).

Replacing each of these returns by their CAPM representation and simplifying them gives the following relationship between the "levered" equity beta β_L for a firm (i.e., the one observed in market data as a consequence of the firm's actual market value capital structure) and the "unlevered" beta β_U that would be measured for the same firm if it had no debt in its capital structure:

$$\beta_L = \beta_U + \frac{D}{E}(1 - \tau_c)(\beta_U - \beta_D) \tag{10}$$

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[25] This follows development in Fernandez (2003). Other standard papers in this area include Hamada (1972), Miles and Ezzell (1985), Harris and Pringle (1985), Fernandez (2006). (See Fernandez, P., "Levered and Unlevered Beta," IESE Business School Working Paper WP-488, University of Navarra, Jan 2003 (rev. May 2006); Hamada, R.S., "The Effect of the Firm's Capital Structure on the Systematic Risk of Common Stock," *Journal of Finance*, 27, May 1972, pp. 435-452; Miles, J.A. and J.R. Ezzell, "Reformulating Tax Shield Valuation: A Note," *Journal of Finance*, XL5, Dec 1985, pp. 1485-1492; Harris, R.S. and J.J. Pringle, "Risk-Adjusted Discount Rates Extensions form the Average-Risk Case," *Journal of Financial Research*, Fall 1985, pp. 237-244; Fernandez, P., "The Value of Tax Shields Depends Only on the Net Increases of Debt," IESE Business School Working Paper WP-613, University of Navarra, 2006.) Additional discussion can be found in Brealey, Myers, and Allen (2014).

where β_D is the beta on the firm's debt. The unlevered beta is assumed to be constant with respect to capital structure, reflecting as it does the systematic risk of the firm's assets. Since the beta on an investment grade firm's debt is much lower than the beta of its assets (i.e., $\beta_D < \beta_U$), this equation embodies the fact that increasing financial leverage (and thereby increasing the debt to equity ratio) increases the systematic risk of *levered* equity (β_L).

An alternative formulation derived by Harris and Pringle (1985) provides the following equation that holds when the market value capital structures (rather than book value) are assumed to be held constant:

$$\beta_L = \beta_U + \frac{D}{E}(\beta_U - \beta_D) \qquad (11)$$

Unlike Equation (10), Equation (11) does not include an adjustment for the corporate tax deduction. However, both equations account for the fact that increased financial leverage increases the systematic risk of equity that will be measured by its market beta. And both equations allow an analyst to adjust for differences in financial risk by translating back and forth between β_L and β_U. In principal, Equation (10) is more appropriate for use with regulated utilities, which are typically deemed to maintain a fixed book value capital structure. However, I employ both formulations when adjusting my CAPM estimates for financial risk, and consider the results as sensitivities in my analysis.

It is clear that the beta of debt needs to be determined as an input to either Equation (10), or Equation (11). Rather than estimating debt betas, I rely on the standard financial textbook of Professors Berk & DeMarzo, who report a debt beta of 0.05 for A rated debt and a beta of 0.10 for BBB rated debt.[26]

Once a decision on debt betas is made, the levered equity beta of each sample company can be computed (in this case by Value Line) from market data and then translated to an unlevered beta at the company's market value capital structure. The unlevered betas for the sample companies are comparable on an "apples to apples" basis, since they reflect the systematic risk inherent in the assets of the sample companies, independent of their financing. The unlevered betas are averaged to produce an estimate of the industry's unlevered beta. To estimate the cost of equity for the regulated target company, this estimate of unlevered beta can be "re-levered" to the

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[26] Berk, J. & DeMarzo, P., *Corporate Finance, 2nd Edition.* 2011 Prentice Hall, p. 389.

regulated company's capital structure, and CAPM reapplied with this levered beta, which reflects both the business and financial risk of the target company.

Hamada adjustment procedures—so-named for Professor Robert S. Hamada who contributed to their development[27]—are ubiquitous among finance practitioners when using the CAPM to estimate discount rates.

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[27] Hamada, R.S., "The Effect of the Firm's Capital Structure on the Systematic Risk of Common Stock", *The Journal of Finance*, 27(2), 1971, pp. 435-452.

	Net Income for Common Shareholders	End-of-Year Common Equity (x/NCI)	Return on EOY Equity	Allowed ROE	Under Earning
2002	199,343	2,159,312	9.2%	11.25%	$43,580
2003	180,937	2,203,630	8.2%	11.25%	$66,971
2004	199,627	2,232,402	8.9%	11.25%	$51,518
2005	170,479	2,985,225	5.7%	10.25%	$135,507
2006	269,730	3,207,473	8.4%	10.25%	$59,036
2007	283,940	3,351,441	8.5%	10.75%	$76,340
2008	262,344	3,339,150	7.9%	10.75%	$96,615
2009	251,225	3,445,355	7.3%	10.75%	$119,151
2010	335,663	3,824,953	8.8%	11.00%	$85,082
2011	336,250	3,943,007	8.5%	11.00%	$97,481
2012	395,497	4,093,000	9.7%	10.00%	$13,803
2013	424,969	4,308,884	9.9%	10.00%	$5,919
2014	421,220	4,478,243	9.4%	10.00%	$26,604
2015	450,274	4,663,057	9.7%	10.00%	$16,032
				Total	$893,637.94
				Average	$63,831.28

M3-3.1-SEC-1
Attachment 1

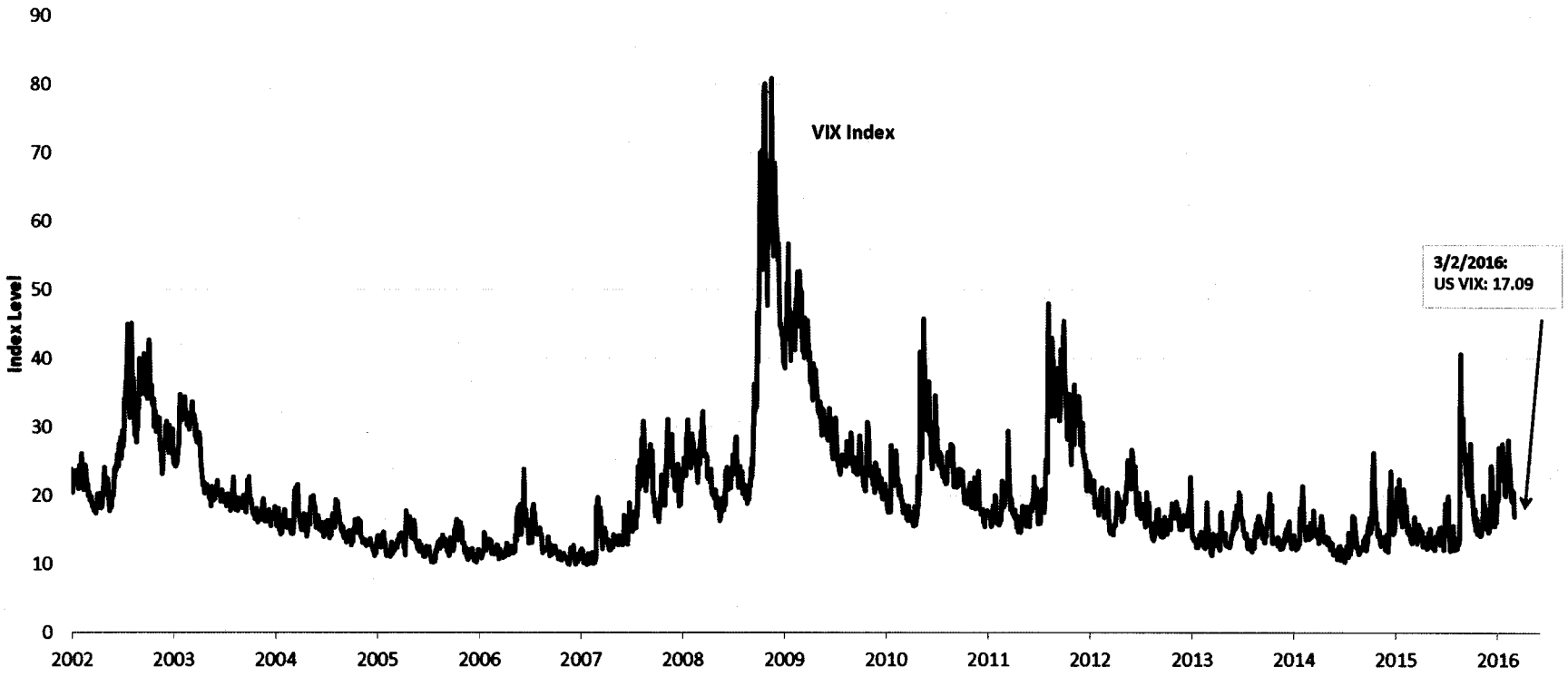
Spreads between U.S. Utility Bond (20 year maturity) and U.S. Government Bond (20 year maturity) - %

Periods	A-Rated Utility and Treasury	BBB-Rated Utility and Treasury	Notes
Period 1 - Average Apr-1991 - 2007	0.93	1.23	[1]
Period 2 - Average Aug-2008 - Feb-2016	1.54	2.00	[2]
Period 3 - Average Feb-2016	1.83	2.59	[3]
Period 4 - Average 15-Day (Mar 02, 2016 to Feb 10, 2016)	1.85	2.56	[4]
Spread Increase between Period 2 and Period 1	0.60	0.77	[5] = [2] - [1]
Spread Increase between Period 3 and Period 1	0.90	1.36	[6] = [3] - [1]
Spread Increase between Period 4 and Period 1	**0.92**	**1.33**	[7] = [4] - [1]

Sources and Notes:

Spreads for the periods are calculated from Bloomberg's yield data.

Average monthly yields for the indices were retrieved from Bloomberg as of March 2, 2016.



Source: Bloomberg.

Company Financials ($Millions)

Company	Integrated Electric Utility	Date of M&A Announcement	Overall Premium	Gross Acquisition Value ($M)
[1]		[2]	[3]	[4]
ITC Holdings Corp		2/9/2016	154%	$11,398
Empire District Electric Co/The	Yes	2/9/2016	97%	$2,399
Questar Corp		2/1/2016	146%	$6,110
Piedmont Natural Gas Co Inc		10/26/2015	138%	$6,854
TECO Energy Inc	Yes	9/4/2015	120%	$10,582
AGL Resources Inc		8/24/2015	93%	$12,801
Oncor Electric Delivery Co LLC		8/10/2015	NA	NA
Dominion Carolina Gas Transmission LLC (a)		4/1/2015	NA	$508
UIL Holdings Corp/Old		2/25/2015	95%	$4,863
New Hampshire Gas Corp		1/2/2015	NA	$3
Dominion Carolina Gas Transmission LLC (b)		12/16/2014	NA	$493
Hawaiian Electric Industries Inc	Yes	12/3/2014	46%	$4,913
Cleco Corp	Yes	10/20/2014	109%	$4,652
Integrys Energy Group Inc	Yes	6/23/2014	75%	$8,889
Upper Peninsula Power Co	Yes	1/20/2014	NA	$299
NV Energy Inc	Yes	5/29/2013	89%	$10,588
Average of Integrated Electic Utilities			**89%**	**$6,046**
Average of All Companies			**106%**	**$5,690**

Sources/Notes:

Company financials were taken from the most recent 10-K filed prior to the acquisition date.

[2],[4]: Bloomberg.

[3]: Calculated.

Company Financials ($Millions)

Company	Integrated Electric Utility	Date of M&A Announcement	Total Assets	Total Long-Term Assets	Net PP&E	Market Cap	Revenue	Net Income	Equity %	Book Equity	Shares Outstanding	Offer Price Per Share ($)	Book Equity per Share ($)	Premium on Equity	Overall Premium	Gross Acquisition Value ($M)
[1]		[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]
ITC Holdings Corp		2/9/2016	$7,406	$7,187	$5,890	$5,882	$273	$66	23%	$1,682	152	$75	$11	678%	154%	$11,398
Empire District Electric Co/The	Yes	2/9/2016	$2,463	$2,262	$2,008	$1,235	$170	$25	33%	$802	44	$55	$18	299%	97%	$2,399
Questar Corp		2/1/2016	$4,187	$3,911	$3,816	$4,369	$142	$33	31%	$1,293	175	$35	$7	472%	146%	$6,110
Piedmont Natural Gas Co Inc		10/26/2015	$4,951	$4,729	$4,226	$4,580	$158	-$8	28%	$1,406	79	$87	$18	487%	138%	$6,854
TECO Energy Inc	Yes	9/4/2015	$8,838	$8,059	$7,242	$4,956	$681	$12	29%	$2,553	235	$45	$11	414%	120%	$10,582
AGL Resources Inc		8/24/2015	$13,835	$12,263	$9,379	$7,375	$674	$42	29%	$3,989	120	$107	$33	321%	93%	$12,801
Oncor Electric Delivery Co LLC		8/10/2015	$19,173	$18,331	$12,229	NA	$938	$98	39%	$7,551	NA	NA	NA	NA	NA	NA
Dominion Carolina Gas Transmission LLC (a)		4/1/2015	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	$508
UIL Holdings Corp/Old		2/25/2015	$5,112	$4,442	$3,293	$2,394	$433	$32	27%	$1,368	57	$86	$24	355%	95%	$4,863
New Hampshire Gas Corp		1/2/2015	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	$3
Dominion Carolina Gas Transmission LLC (b)		12/16/2014	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	$493
Hawaiian Electric Industries Inc	Yes	12/3/2014	$10,670	$5,818	$4,048	$2,891	$867	$48	17%	$1,836	103	$48	$18	268%	46%	$4,913
Cleco Corp	Yes	10/20/2014	$4,256	$3,776	$3,144	$3,214	$371	$71	39%	$1,639	60	$77	$27	284%	109%	$4,652
Integrys Energy Group Inc	Yes	6/23/2014	$11,802	$9,085	$6,301	$5,436	$1,638	$152	29%	$3,406	80	$112	$43	261%	75%	$8,889
Upper Peninsula Power Co	Yes	1/20/2014	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	$299
NV Energy Inc	Yes	5/29/2013	$11,879	$11,034	$9,429	$4,539	$577	$21	30%	$3,544	235	$45	$15	299%	89%	$10,588
Average of Integrated Electic Utilities			**$8,318**	**$6,672**	**$5,362**	**$3,712**	**$717**	**$55**	**29%**	**$2,297**	**$126**	**$64**	**$22**	**304%**	**89%**	**$6,046**

Sources/Notes:
Company financials were taken from the most recent 10-K filed prior to the acquisition date
[3]-[11]: Capital IQ,
[2],[16]: Bloomberg.

Financial Summary of Recent M&A Transactions

Company Name	Ticker	M&A Announce Date	Data from Latest Filing BEFORE Announcement											
			Filing Quarter	Total Long-Term Assets	Total Assets	Total Current Assets	Total PP&E	Market Cap (as of announce date)	Revenue	Operating Income	Net Income	Book Equity	Shares Outstanding	Equity %
ITC Holdings Corp	NYSE:ITC	2/9/2016	FQ3 2015	7,187	7,405.6	218.9	5,890.1	5,882.3	273.2	149.6	65.6	1,681.9	152.2	23%
Empire District Electric Co/The	NYSE:EDE	2/9/2016	FQ3 2015	2,262	2,462.8	200.8	2,008.3	1,235.2	169.7	51.6	25.3	802.5	43.8	33%
Questar Corp	NYSE:STR	2/1/2016	FQ3 2015	3,911	4,187.4	276.3	3,816.0	4,369.4	142.3	62.1	32.6	1,293.3	174.8	31%
Piedmont Natural Gas Co Inc	NYSE:PNY	10/26/2015	FQ3 2015	4,729	4,951.4	222.3	4,225.6	4,579.6	158.3	-1.9	-8.3	1,406.1	79.2	28%
TECO Energy Inc	NYSE:TE	9/4/2015	FQ2 2015	8,059	8,838.4	779.2	7,241.7	4,956.0	680.6	143.3	11.8	2,553.3	235.2	29%
AGL Resources Inc	NYSE:GAS	8/24/2015	FQ2 2015	12,263	13,835.0	1,572.0	9,379.0	7,374.6	674.0	107.0	42.0	3,989.0	120.1	29%
Oncor Electric Delivery Co LLC	IQ3062378	8/10/2015	FQ2 2015	18,331	19,173.0	842.0	12,229.0	NA	938.0	243.0	98.0	7,551.0	NA	39%
Dominion Carolina Gas Transmission LLC (a)	IQ4208869	4/1/2015	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
UIL Holdings Corp/Old	IQ310736	2/25/2015	FQ4 2014	4,442	5,111.9	670.1	3,292.7	2,393.6	433.0	73.8	32.3	1,368.3	56.5	27%
New Hampshire Gas Corp	IQ268216482	1/2/2015	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dominion Carolina Gas Transmission LLC (b)	IQ4208869	12/16/2014	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hawaiian Electric Industries Inc	NYSE:HE	12/3/2014	FQ3 2014	5,818	10,670.5	4,852.8	4,048.1	2,891.2	867.1	92.0	47.8	1,835.7	102.6	17%
Cleco Corp	NYSE:CNL	10/20/2014	FQ3 2014	3,776	4,256.3	480.1	3,144.2	3,214.4	371.4	108.4	70.8	1,638.9	60.4	39%
Integrys Energy Group Inc	IQ315149	6/23/2014	FQ1 2014	9,085	11,802.2	2,717.1	6,301.2	5,436.2	1,638.0	232.3	152.4	3,406.0	79.5	29%
Pepco Holdings Inc	NYSE:POM	4/30/2014	FQ1 2014	13,540	15,004.0	1,464.0	9,906.0	6,706.6	1,330.0	173.0	75.0	4,336.0	250.6	29%
Philadelphia Gas Works operations	IQ8032486	3/3/2014	FY 2013	1,366	1,711.0	345.0	1,155.0	NA	683.5	109.5	60.6	358.6	NA	21%
Upper Peninsula Power Co	IQ4762134	1/20/2014	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NV Energy Inc	IQ109136	5/29/2013	FQ1 2013	11,034	11,878.6	844.8	9,428.8	4,539.4	577.0	99.0	21.0	3,543.9	235.4	30%
New Mexico Gas Co Inc	IQ40117829	5/28/2013	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arizona Public Service	IQ388114	2/16/2016	FQ3 2015	13,788	14,838.1	1,050.2	11,327.5	NA	1,198.4	449.8	261.2	4,894.8	NA	33%

Sources/Notes:
Capital IQ.

Table No. BV-ELEC-1

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Table No. BV-ELEC-2

Classification of Companies by Assets

Company	Company Category
ALLETE	R
Alliant Energy	R
Amer. Elec. Power	R
Ameren Corp.	R
CenterPoint Energy	M
CMS Energy Corp.	R
Consol. Edison	R
Dominion Resources	M
DTE Energy	R
Edison Int'l	R
El Paso Electric	R
Entergy Corp.	R
G't Plains Energy	R
IDACORP Inc.	R
MGE Energy	M
NextEra Energy	M
OGE Energy	R
Otter Tail Corp.	R
PG&E Corp.	R
Pinnacle West Capital	R
Portland General	R
Public Serv. Enterprise	M
SCANA Corp.	M
Sempra Energy	M
Vectren Corp.	M
Westar Energy	R
Xcel Energy Inc.	R

Sources and Notes:
Percent regulated categories and company data are based on Edison Electric Institute: "Rate Case Summary - Q3 2015 Financial Update".
R = Regulated (greater than 80 percent of total assets are regulated).
M = Mostly Regulated (50 to 80 percent of total assets are regulated).
D = Diversified (less than 50 percent of total assets are regulated).

Table No. BV-ELEC-3

Market Value of the U.S. Electric Sample

Panel A: ALLETE

($MM)

	DCF Capital Structure	3rd Quarter, 2015	3rd Quarter, 2014	3rd Quarter, 2013	3rd Quarter, 2012	3rd Quarter, 2011	3rd Quarter, 2010	Notes
MARKET VALUE OF COMMON EQUITY								
Book Value, Common Shareholder's Equity	$1,822	$1,822	$1,529	$1,288	$1,158	$1,051	$975	[a]
Shares Outstanding (in millions) - Common	49	49	45	41	39	37	36	[b]
Price per Share - Common	$52	$49	$46	$48	$42	$38	$36	[c]
Market Value of Common Equity	$2,540	$2,393	$2,048	$1,941	$1,616	$1,384	$1,286	[d] = [b] x [c].
Market Value of GP Equity	n/a	n/a	n/a	n/a	n/a	n/a	n/a	[e]
Total Market Value of Equity	$2,540	$2,393	$2,048	$1,941	$1,616	$1,384	$1,286	[f]= [d]
Market to Book Value of Common Equity	1.39	1.31	1.34	1.51	1.40	1.32	1.32	[g] = [f] / [a].
MARKET VALUE OF PREFERRED EQUITY								
Book Value of Preferred Equity	$0	$0	$0	$0	$0	$0	$0	[h]
Market Value of Preferred Equity	$0	$0	$0	$0	$0	$0	$0	[i] = [h].
MARKET VALUE OF DEBT								
Current Assets	$403	$403	$358	$369	$278	$303	$294	[j]
Current Liabilities	$318	$318	$287	$224	$215	$122	$131	[k]
Current Portion of Long-Term Debt	$49	$49	$85	$38	$67	$13	$2	[l]
Net Working Capital	$135	$135	$156	$183	$131	$194	$165	[m] = [j] - ([k] - [l]).
Notes Payable (Short-Term Debt)	$0	$0	$3	$1	$0	$6	$1	[n]
Adjusted Short-Term Debt	$0	$0	$0	$0	$0	$0	$0	[o] = See Sources and Notes.
Long-Term Debt	$1,549	$1,549	$1,289	$1,064	$948	$844	$784	[p]
Book Value of Long-Term Debt	$1,598	$1,598	$1,375	$1,102	$1,015	$857	$786	[q] = [l] + [o] + [p].
Unadjusted Market Value of Long Term Debt	$1,485	$1,485	$1,132	$1,144	$966	$797	$735	
Carrying Amount	$1,374	$1,374	$1,110	$1,018	$863	$785	$701	
Adjustment to Book Value of Long-Term Debt	$111	$111	$22	$126	$103	$12	$34	[r] = See Sources and Notes.
Market Value of Long-Term Debt	$1,709	$1,709	$1,396	$1,228	$1,118	$869	$820	[s] = [q] + [r].
Market Value of Debt	$1,709	$1,709	$1,396	$1,228	$1,118	$869	$820	[t] = [s].
MARKET VALUE OF FIRM	$4,249	$4,102	$3,444	$3,169	$2,734	$2,253	$2,106	[u] = [f] + [i] + [t].
DEBT AND EQUITY TO MARKET VALUE RATIOS								
Common Equity - Market Value Ratio	59.78%	58.33%	59.47%	61.26%	59.11%	61.43%	61.08%	[v] = [f] / [u].
Preferred Equity - Market Value Ratio	-	-	-	-	-	-	-	[w] = [i] / [u].
Debt - Market Value Ratio	40.22%	41.67%	40.53%	38.74%	40.89%	38.57%	38.92%	[x] = [t] / [u].

Sources and Notes:
Bloomberg as of February 10, 2016
Capital structure from 3rd Quarter, 2015 calculated using respective balance sheet information and 15-day average prices ending at period end.
The DCF Capital structure is calculated using 3rd Quarter, 2015 balance sheet information and a 15-trading day average closing price ending on 2/10/2016.
Prices are reported in Supporting Schedule #1 to Table No. BV-ELEC-6.
[o] =
(1): 0 if [m] > 0.
(2): The absolute value of [m] if [m] < 0 and |[m]| < [n].
(3): [n] if [m] < 0 and |[m]| > [n].
[r]: Difference between fair value of Long-Term debt and carrying amount of Long-Term debt per company 10-K. Data for adjustment is from 2014 10-K.

Table No. BV-ELEC-3

Market Value of the U.S. Electric Sample

Panel B: Alliant Energy

($MM)

	DCF Capital Structure	3rd Quarter, 2015	3rd Quarter, 2014	3rd Quarter, 2013	3rd Quarter, 2012	3rd Quarter, 2011	3rd Quarter, 2010	Notes
MARKET VALUE OF COMMON EQUITY								
Book Value, Common Shareholder's Equity	$3,745	$3,745	$3,436	$3,267	$3,116	$3,002	$2,888	[a]
Shares Outstanding (in millions) - Common	113.36	113	111	111	111	111	111	[b]
Price per Share - Common	65.26	$57	$57	$50	$44	$39	$36	[c]
Market Value of Common Equity	$7,398	$6,434	$6,291	$5,494	$4,871	$4,340	$4,001	[d] = [b] x [c].
Market Value of GP Equity	n/a	n/a	n/a	n/a	n/a	n/a	n/a	[e]
Total Market Value of Equity	$7,398	$6,434	$6,291	$5,494	$4,871	$4,340	$4,001	[f]= [d]
Market to Book Value of Common Equity	1.98	1.72	1.83	1.68	1.56	1.45	1.39	[g] = [f] / [a].
MARKET VALUE OF PREFERRED EQUITY								
Book Value of Preferred Equity	$200	$200	$200	$200	$205	$205	$244	[h]
Market Value of Preferred Equity	$200	$200	$200	$200	$205	$205	$244	[i] = [h].
MARKET VALUE OF DEBT								
Current Assets	$1,088	$1,088	$962	$880	$1,029	$947	$1,168	[j]
Current Liabilities	$991	$991	$1,742	$1,053	$946	$774	$692	[k]
Current Portion of Long-Term Debt	$3	$3	$493	$48	$1	$1	$1	[l]
Net Working Capital	$100	$100	($287)	($124)	$84	$174	$477	[m] = [j] - ([k] - [l]).
Notes Payable (Short-Term Debt)	$109	$109	$354	$237	$70	$22	$0	[n]
Adjusted Short-Term Debt	$0	$0	$287	$124	$0	$0	$0	[o] = See Sources and Notes.
Long-Term Debt	$3,856	$3,856	$2,800	$3,105	$2,828	$2,704	$2,704	[p]
Book Value of Long-Term Debt	$3,859	$3,859	$3,579	$3,278	$2,830	$2,705	$2,705	[q] = [l] + [o] + [p].
Unadjusted Market Value of Long Term Debt	$4,418	$4,418	$3,712	$3,861	$3,325	$2,959	$2,676	
Carrying Amount	$3,790	$3,790	$3,336	$3,138	$2,705	$2,705	$2,506	
Adjustment to Book Value of Long-Term Debt	$629	$629	$376	$722	$621	$254	$170	[r] = See Sources and Notes.
Market Value of Long-Term Debt	$4,487	$4,487	$3,955	$4,000	$3,450	$2,959	$2,875	[s] = [q] + [r].
Market Value of Debt	$4,487	$4,487	$3,955	$4,000	$3,450	$2,959	$2,875	[t] = [s].
MARKET VALUE OF FIRM	$12,085	$11,121	$10,446	$9,694	$8,526	$7,504	$7,119	[u] = [f] + [i] + [t].
DEBT AND EQUITY TO MARKET VALUE RATIOS								
Common Equity - Market Value Ratio	61.21%	57.85%	60.22%	56.68%	57.13%	57.84%	56.20%	[v] = [f] / [u].
Preferred Equity - Market Value Ratio	1.65%	1.80%	1.91%	2.06%	2.41%	2.73%	3.42%	[w] = [i] / [u].
Debt - Market Value Ratio	37.13%	40.35%	37.86%	41.26%	40.47%	39.43%	40.38%	[x] = [t] / [u].

Sources and Notes:
Bloomberg as of February 10, 2016
Capital structure from 3rd Quarter, 2015 calculated using respective balance sheet information and 15-day average prices ending at period end.
The DCF Capital structure is calculated using 3rd Quarter, 2015 balance sheet information and a 15-trading day average closing price ending on 2/10/2016.
Prices are reported in Supporting Schedule #1 to Table No. BV-ELEC-6.
[o] =
(1): 0 if [m] > 0.
(2): The absolute value of [m] if [m] < 0 and |[m]| < [n].
(3): [n] if [m] < 0 and |[m]| > [n].
[r]: Difference between fair value of Long-Term debt and carrying amount of Long-Term debt per company 10-K. Data for adjustment is from 2014 10-K.

Table No. BV-ELEC-3

Market Value of the U.S. Electric Sample

Panel C: Amer. Elec. Power

($MM)

	DCF Capital Structure	3rd Quarter, 2015	3rd Quarter, 2014	3rd Quarter, 2013	3rd Quarter, 2012	3rd Quarter, 2011	3rd Quarter, 2010	Notes
MARKET VALUE OF COMMON EQUITY								
Book Value, Common Shareholder's Equity	$17,699	$17,699	$16,868	$15,762	$15,306	$14,653	$13,656	[a]
Shares Outstanding (in millions) - Common	491	491	489	487	485	483	480	[b]
Price per Share - Common	$60	$55	$53	$43	$44	$38	$36	[c]
Market Value of Common Equity	$29,588	$27,037	$25,812	$21,167	$21,277	$18,174	$17,446	[d] = [b] x [c].
Market Value of GP Equity	n/a	n/a	n/a	n/a	n/a	n/a	n/a	[e]
Total Market Value of Equity	$29,588	$27,037	$25,812	$21,167	$21,277	$18,174	$17,446	[f]= [d]
Market to Book Value of Common Equity	1.67	1.53	1.53	1.34	1.39	1.24	1.28	[g] = [f] / [a].
MARKET VALUE OF PREFERRED EQUITY								
Book Value of Preferred Equity	$0	$0	$0	$0	$0	$60	$60	[h]
Market Value of Preferred Equity	$0	$0	$0	$0	$0	$60	$60	[i] = [h].
MARKET VALUE OF DEBT								
Current Assets	$4,548	$4,548	$4,111	$4,317	$4,648	$4,374	$5,421	[j]
Current Liabilities	$7,058	$7,058	$7,457	$5,692	$6,795	$5,684	$6,148	[k]
Current Portion of Long-Term Debt	$1,826	$1,826	$2,381	$1,366	$2,272	$1,267	$1,286	[l]
Net Working Capital	($684)	($684)	($965)	($9)	$125	($43)	$559	[m] = [j] - ([k] - [l]).
Notes Payable (Short-Term Debt)	$782	$782	$1,282	$1,218	$1,216	$1,279	$1,466	[n]
Adjusted Short-Term Debt	$684	$684	$965	$9	$0	$43	$0	[o] = See Sources and Notes.
Long-Term Debt	$17,600	$17,600	$15,677	$16,202	$14,955	$15,183	$15,995	[p]
Book Value of Long-Term Debt	$20,110	$20,110	$19,023	$17,577	$17,227	$16,493	$17,281	[q] = [l] + [o] + [p].
Unadjusted Market Value of Long Term Debt	$21,075	$21,075	$19,672	$20,907	$19,259	$18,285	$18,479	
Carrying Amount	$18,684	$18,684	$18,377	$17,757	$16,516	$16,811	$17,498	
Adjustment to Book Value of Long-Term Debt	$2,391	$2,391	$1,295	$3,150	$2,743	$1,474	$981	[r] = See Sources and Notes.
Market Value of Long-Term Debt	$22,501	$22,501	$20,318	$20,727	$19,970	$17,967	$18,262	[s] = [q] + [r].
Market Value of Debt	$22,501	$22,501	$20,318	$20,727	$19,970	$17,967	$18,262	[t] = [s].
MARKET VALUE OF FIRM	$52,089	$49,538	$46,130	$41,894	$41,247	$36,201	$35,768	[u] = [f] + [i] + [t].
DEBT AND EQUITY TO MARKET VALUE RATIOS								
Common Equity - Market Value Ratio	56.80%	54.58%	55.95%	50.53%	51.58%	50.20%	48.78%	[v] = [f] / [u].
Preferred Equity - Market Value Ratio	-	-	-	-	-	0.17%	0.17%	[w] = [i] / [u].
Debt - Market Value Ratio	43.20%	45.42%	44.05%	49.47%	48.42%	49.63%	51.06%	[x] = [t] / [u].

Sources and Notes:
Bloomberg as of February 10, 2016
Capital structure from 3rd Quarter, 2015 calculated using respective balance sheet information and 15-day average prices ending at period end.
The DCF Capital structure is calculated using 3rd Quarter, 2015 balance sheet information and a 15-trading day average closing price ending on 2/10/2016.
Prices are reported in Supporting Schedule #1 to Table No. BV-ELEC-6.
[o] =
(1): 0 if [m] > 0.
(2): The absolute value of [m] if [m] < 0 and |[m]| < [n].
(3): [n] if [m] < 0 and |[m]| > [n].
[r]: Difference between fair value of Long-Term debt and carrying amount of Long-Term debt per company 10-K. Data for adjustment is from 2014 10-K.

Table No. BV-ELEC-3

Market Value of the U.S. Electric Sample

Panel D: Ameren Corp.

($MM)

	DCF Capital Structure	3rd Quarter, 2015	3rd Quarter, 2014	3rd Quarter, 2013	3rd Quarter, 2012	3rd Quarter, 2011	3rd Quarter, 2010	Notes
MARKET VALUE OF COMMON EQUITY								
Book Value, Common Shareholder's Equity	$7,014	$7,014	$6,774	$6,574	$7,874	$7,997	$7,754	[a]
Shares Outstanding (in millions) - Common	243	243	243	243	243	242	240	[b]
Price per Share - Common	$45	$40	$38	$34	$33	$30	$28	[c]
Market Value of Common Equity	$10,890	$9,802	$9,318	$8,311	$7,920	$7,286	$6,689	[d] = [b] x [c].
Market Value of GP Equity	n/a	n/a	n/a	n/a	n/a	n/a	n/a	[e]
Total Market Value of Equity	$10,890	$9,802	$9,318	$8,311	$7,920	$7,286	$6,689	[f]= [d]
Market to Book Value of Common Equity	1.55	1.40	1.38	1.26	1.01	0.91	0.86	[g] = [f] / [a].
MARKET VALUE OF PREFERRED EQUITY								
Book Value of Preferred Equity	$0	$0	$0	$0	$0	$0	$0	[h]
Market Value of Preferred Equity	$0	$0	$0	$0	$0	$0	$0	[i] = [h].
MARKET VALUE OF DEBT								
Current Assets	$1,983	$1,983	$1,942	$3,273	$2,406	$2,680	$3,120	[j]
Current Liabilities	$2,489	$2,489	$2,119	$3,228	$1,546	$1,848	$1,914	[k]
Current Portion of Long-Term Debt	$395	$395	$119	$884	$206	$178	$354	[l]
Net Working Capital	($111)	($111)	($58)	$929	$1,066	$1,010	$1,560	[m] = [j] - ([k] - [l]).
Notes Payable (Short-Term Debt)	$783	$783	$753	$0	$5	$350	$125	[n]
Adjusted Short-Term Debt	$111	$111	$58	$0	$0	$0	$0	[o] = See Sources and Notes.
Long-Term Debt	$5,981	$5,981	$5,825	$5,274	$6,781	$6,682	$7,259	[p]
Book Value of Long-Term Debt	$6,487	$6,487	$6,002	$6,158	$6,987	$6,860	$7,613	[q] = [l] + [o] + [p].
Unadjusted Market Value of Long Term Debt	$7,135	$7,135	$6,584	$7,110	$7,800	$7,661	$7,717	
Carrying Amount	$6,240	$6,240	$6,038	$6,157	$6,856	$7,008	$7,315	
Adjustment to Book Value of Long-Term Debt	$895	$895	$546	$953	$944	$653	$402	[r] = See Sources and Notes.
Market Value of Long-Term Debt	$7,382	$7,382	$6,548	$7,111	$7,931	$7,513	$8,015	[s] = [q] + [r].
Market Value of Debt	$7,382	$7,382	$6,548	$7,111	$7,931	$7,513	$8,015	[t] = [s].
MARKET VALUE OF FIRM	$18,272	$17,184	$15,866	$15,422	$15,851	$14,799	$14,704	[u] = [f] + [i] + [t].
DEBT AND EQUITY TO MARKET VALUE RATIOS								
Common Equity - Market Value Ratio	59.60%	57.04%	58.73%	53.89%	49.97%	49.23%	45.49%	[v] = [f] / [u].
Preferred Equity - Market Value Ratio	-	-	-	-	-	-	-	[w] = [i] / [u].
Debt - Market Value Ratio	40.40%	42.96%	41.27%	46.11%	50.03%	50.77%	54.51%	[x] = [t] / [u].

Sources and Notes:
Bloomberg as of February 10, 2016
Capital structure from 3rd Quarter, 2015 calculated using respective balance sheet information and 15-day average prices ending at period end.
The DCF Capital structure is calculated using 3rd Quarter, 2015 balance sheet information and a 15-trading day average closing price ending on 2/10/2016.
Prices are reported in Supporting Schedule #1 to Table No. BV-ELEC-6.
[o] =
(1): 0 if [m] > 0.
(2): The absolute value of [m] if [m] < 0 and |[m]| < [n].
(3): [n] if [m] < 0 and |[m]| > [n].
[r]: Difference between fair value of Long-Term debt and carrying amount of Long-Term debt per company 10-K. Data for adjustment is from 2014 10-K.

Table No. BV-ELEC-3

Market Value of the U.S. Electric Sample

Panel E: CenterPoint Energy

($MM)

	DCF Capital Structure	3rd Quarter, 2015	3rd Quarter, 2014	3rd Quarter, 2013	3rd Quarter, 2012	3rd Quarter, 2011	3rd Quarter, 2010	Notes
MARKET VALUE OF COMMON EQUITY								
Book Value, Common Shareholder's Equity	$4,058	$4,058	$4,473	$4,261	$4,257	$4,207	$3,129	[a]
Shares Outstanding (in millions) - Common	430	430	430	429	427	426	423	[b]
Price per Share - Common	$18	$18	$24	$24	$21	$20	$15	[c]
Market Value of Common Equity	$7,687	$7,692	$10,424	$10,139	$8,997	$8,331	$6,514	[d] = [b] x [c].
Market Value of GP Equity	n/a	n/a	n/a	n/a	n/a	n/a	n/a	[e]
Total Market Value of Equity	$7,687	$7,692	$10,424	$10,139	$8,997	$8,331	$6,514	[f]= [d]
Market to Book Value of Common Equity	1.89	1.90	2.33	2.38	2.11	1.98	2.08	[g] = [f] / [a].
MARKET VALUE OF PREFERRED EQUITY								
Book Value of Preferred Equity	$0	$0	$0	$0	$0	$0	$0	[h]
Market Value of Preferred Equity	$0	$0	$0	$0	$0	$0	$0	[i] = [h].
MARKET VALUE OF DEBT								
Current Assets	$2,400	$2,400	$2,576	$2,319	$2,752	$1,982	$2,143	[j]
Current Liabilities	$3,191	$3,191	$3,008	$2,595	$3,364	$2,319	$2,881	[k]
Current Portion of Long-Term Debt	$938	$938	$722	$553	$1,402	$483	$978	[l]
Net Working Capital	$147	$147	$290	$277	$790	$146	$240	[m] = [j] - ([k] - [l]).
Notes Payable (Short-Term Debt)	$49	$49	$80	$70	$53	$84	$73	[n]
Adjusted Short-Term Debt	$0	$0	$0	$0	$0	$0	$0	[o] = See Sources and Notes.
Long-Term Debt	$7,662	$7,662	$7,797	$7,758	$8,415	$8,497	$8,267	[p]
Book Value of Long-Term Debt	$8,600	$8,600	$8,519	$8,311	$9,817	$8,980	$9,245	[q] = [l] + [o] + [p].
Unadjusted Market Value of Long Term Debt	$9,427	$9,427	$8,670	$10,807	$10,049	$10,071	$10,413	
Carrying Amount	$8,652	$8,652	$8,171	$9,619	$8,994	$9,303	$9,900	
Adjustment to Book Value of Long-Term Debt	$775	$775	$499	$1,188	$1,055	$768	$513	[r] = See Sources and Notes.
Market Value of Long-Term Debt	$9,375	$9,375	$9,018	$9,499	$10,872	$9,748	$9,758	[s] = [q] + [r].
Market Value of Debt	$9,375	$9,375	$9,018	$9,499	$10,872	$9,748	$9,758	[t] = [s].
MARKET VALUE OF FIRM	$17,062	$17,067	$19,442	$19,638	$19,869	$18,079	$16,272	[u] = [f] + [i] + [t].
DEBT AND EQUITY TO MARKET VALUE RATIOS								
Common Equity - Market Value Ratio	45.05%	45.07%	53.62%	51.63%	45.28%	46.08%	40.03%	[v] = [f] / [u].
Preferred Equity - Market Value Ratio	-	-	-	-	-	-	-	[w] = [i] / [u].
Debt - Market Value Ratio	54.95%	54.93%	46.38%	48.37%	54.72%	53.92%	59.97%	[x] = [t] / [u].

Sources and Notes:
Bloomberg as of February 10, 2016
Capital structure from 3rd Quarter, 2015 calculated using respective balance sheet information and 15-day average prices ending at period end.
The DCF Capital structure is calculated using 3rd Quarter, 2015 balance sheet information and a 15-trading day average closing price ending on 2/10/2016.
Prices are reported in Supporting Schedule #1 to Table No. BV-ELEC-6.
[o] =
(1): 0 if [m] > 0.
(2): The absolute value of [m] if [m] < 0 and |[m]| < [n].
(3): [n] if [m] < 0 and |[m]| > [n].
[r]: Difference between fair value of Long-Term debt and carrying amount of Long-Term debt per company 10-K. Data for adjustment is from 2014 10-K.

Table No. BV-ELEC-3

Market Value of the U.S. Electric Sample

Panel F: CMS Energy Corp.

($MM)

	DCF Capital Structure	3rd Quarter, 2015	3rd Quarter, 2014	3rd Quarter, 2013	3rd Quarter, 2012	3rd Quarter, 2011	3rd Quarter, 2010	Notes
MARKET VALUE OF COMMON EQUITY								
Book Value, Common Shareholder's Equity	$3,902	$3,902	$3,670	$3,396	$3,196	$3,043	$2,821	[a]
Shares Outstanding (in millions) - Common	277	277	275	266	264	252	230	[b]
Price per Share - Common	$38	$34	$30	$26	$23	$20	$18	[c]
Market Value of Common Equity	$10,597	$9,338	$8,161	$7,018	$6,141	$4,997	$4,116	[d] = [b] x [c].
Market Value of GP Equity	n/a	n/a	n/a	n/a	n/a	n/a	n/a	[e]
Total Market Value of Equity	$10,597	$9,338	$8,161	$7,018	$6,141	$4,997	$4,116	[f]= [d]
Market to Book Value of Common Equity	2.72	2.39	2.22	2.07	1.92	1.64	1.46	[g] = [f] / [a].
MARKET VALUE OF PREFERRED EQUITY								
Book Value of Preferred Equity	$0	$0	$0	$0	$0	$0	$239	[h]
Market Value of Preferred Equity	$0	$0	$0	$0	$0	$0	$239	[i] = [h].
MARKET VALUE OF DEBT								
Current Assets	$2,123	$2,123	$2,734	$2,401	$2,360	$2,860	$3,086	[j]
Current Liabilities	$1,788	$1,788	$1,648	$1,464	$1,485	$2,214	$2,297	[k]
Current Portion of Long-Term Debt	$741	$741	$690	$532	$510	$1,140	$1,031	[l]
Net Working Capital	$1,076	$1,076	$1,776	$1,469	$1,385	$1,786	$1,820	[m] = [j] - ([k] - [l]).
Notes Payable (Short-Term Debt)	$68	$68	$0	$0	$0	$0	$0	[n]
Adjusted Short-Term Debt	$0	$0	$0	$0	$0	$0	$0	[o] = See Sources and Notes.
Long-Term Debt	$8,014	$8,014	$8,171	$7,229	$6,866	$6,208	$6,203	[p]
Book Value of Long-Term Debt	$8,755	$8,755	$8,861	$7,761	$7,376	$7,348	$7,234	[q] = [l] + [o] + [p].
Unadjusted Market Value of Long Term Debt	$9,285	$9,285	$8,368	$8,347	$8,025	$7,861	$7,013	
Carrying Amount	$8,535	$8,535	$7,642	$7,229	$7,073	$7,174	$6,567	
Adjustment to Book Value of Long-Term Debt	$750	$750	$726	$1,118	$952	$687	$446	[r] = See Sources and Notes.
Market Value of Long-Term Debt	$9,505	$9,505	$9,587	$8,879	$8,328	$8,035	$7,680	[s] = [q] + [r].
Market Value of Debt	$9,505	$9,505	$9,587	$8,879	$8,328	$8,035	$7,680	[t] = [s].
MARKET VALUE OF FIRM	$20,102	$18,843	$17,748	$15,897	$14,469	$13,032	$12,035	[u] = [f] + [i] + [t].
DEBT AND EQUITY TO MARKET VALUE RATIOS								
Common Equity - Market Value Ratio	52.72%	49.56%	45.98%	44.15%	42.44%	38.34%	34.20%	[v] = [f] / [u].
Preferred Equity - Market Value Ratio	-	-	-	-	-	-	1.99%	[w] = [i] / [u].
Debt - Market Value Ratio	47.28%	50.44%	54.02%	55.85%	57.56%	61.66%	63.82%	[x] = [t] / [u].

Sources and Notes:
Bloomberg as of February 10, 2016
Capital structure from 3rd Quarter, 2015 calculated using respective balance sheet information and 15-day average prices ending at period end.
The DCF Capital structure is calculated using 3rd Quarter, 2015 balance sheet information and a 15-trading day average closing price ending on 2/10/2016.
Prices are reported in Supporting Schedule #1 to Table No. BV-ELEC-6.
[o] =
(1): 0 if [m] > 0.
(2): The absolute value of [m] if [m] < 0 and |[m]| < [n].
(3): [n] if [m] < 0 and |[m]| > [n].
[r]: Difference between fair value of Long-Term debt and carrying amount of Long-Term debt per company 10-K. Data for adjustment is from 2014 10-K.

Table No. BV-ELEC-3

Market Value of the U.S. Electric Sample

Panel G: Consol. Edison

($MM)

	DCF Capital Structure	3rd Quarter, 2015	3rd Quarter, 2014	3rd Quarter, 2013	3rd Quarter, 2012	3rd Quarter, 2011	3rd Quarter, 2010	Notes
MARKET VALUE OF COMMON EQUITY								
Book Value, Common Shareholder's Equity	$13,040	$13,040	$12,707	$12,166	$11,842	$11,454	$10,630	[a]
Shares Outstanding (in millions) - Common	293	293	293	293	293	293	284	[b]
Price per Share - Common	$70	$65	$57	$56	$60	$57	$48	[c]
Market Value of Common Equity	$20,617	$18,927	$16,614	$16,301	$17,522	$16,659	$13,687	[d] = [b] x [c].
Market Value of GP Equity	n/a	n/a	n/a	n/a	n/a	n/a	n/a	[e]
Total Market Value of Equity	$20,617	$18,927	$16,614	$16,301	$17,522	$16,659	$13,687	[f]= [d]
Market to Book Value of Common Equity	1.58	1.45	1.31	1.34	1.48	1.45	1.29	[g] = [f] / [a].
MARKET VALUE OF PREFERRED EQUITY								
Book Value of Preferred Equity	$0	$0	$0	$0	$0	$213	$213	[h]
Market Value of Preferred Equity	$0	$0	$0	$0	$0	$213	$213	[i] = [h].
MARKET VALUE OF DEBT								
Current Assets	$3,505	$3,505	$3,519	$3,704	$3,240	$3,458	$3,890	[j]
Current Liabilities	$4,429	$4,429	$3,873	$4,373	$3,724	$2,959	$3,147	[k]
Current Portion of Long-Term Debt	$761	$761	$210	$483	$930	$305	$5	[l]
Net Working Capital	($163)	($163)	($144)	($186)	$446	$804	$748	[m] = [j] - ([k] - [l]).
Notes Payable (Short-Term Debt)	$1,160	$1,160	$1,425	$1,220	$340	$0	$846	[n]
Adjusted Short-Term Debt	$163	$163	$144	$186	$0	$0	$0	[o] = See Sources and Notes.
Long-Term Debt	$11,521	$11,521	$10,986	$10,495	$9,841	$10,371	$10,675	[p]
Book Value of Long-Term Debt	$12,445	$12,445	$11,340	$11,164	$10,771	$10,676	$10,680	[q] = [l] + [o] + [p].
Unadjusted Market Value of Long Term Debt	$13,998	$13,998	$12,082	$12,935	$12,744	$11,761	$10,585	
Carrying Amount	$12,191	$12,191	$10,974	$10,768	$10,673	$10,676	$10,585	
Adjustment to Book Value of Long-Term Debt	$1,807	$1,807	$1,108	$2,167	$2,071	$1,085	$0	[r] = See Sources and Notes.
Market Value of Long-Term Debt	$14,252	$14,252	$12,448	$13,331	$12,842	$11,761	$10,680	[s] = [q] + [r].
Market Value of Debt	$14,252	$14,252	$12,448	$13,331	$12,842	$11,761	$10,680	[t] = [s].
MARKET VALUE OF FIRM	$34,869	$33,179	$29,062	$29,632	$30,364	$28,633	$24,580	[u] = [f] + [i] + [t].
DEBT AND EQUITY TO MARKET VALUE RATIOS								
Common Equity - Market Value Ratio	59.13%	57.05%	57.17%	55.01%	57.71%	58.18%	55.68%	[v] = [f] / [u].
Preferred Equity - Market Value Ratio	-	-	-	-	-	0.74%	0.87%	[w] = [i] / [u].
Debt - Market Value Ratio	40.87%	42.95%	42.83%	44.99%	42.29%	41.07%	43.45%	[x] = [t] / [u].

Sources and Notes:
Bloomberg as of February 10, 2016
Capital structure from 3rd Quarter, 2015 calculated using respective balance sheet information and 15-day average prices ending at period end.
The DCF Capital structure is calculated using 3rd Quarter, 2015 balance sheet information and a 15-trading day average closing price ending on 2/10/2016.
Prices are reported in Supporting Schedule #1 to Table No. BV-ELEC-6.
[o] =
(1): 0 if [m] > 0.
(2): The absolute value of [m] if [m] < 0 and |[m]| < [n].
(3): [n] if [m] < 0 and |[m]| > [n].
[r]: Difference between fair value of Long-Term debt and carrying amount of Long-Term debt per company 10-K. Data for adjustment is from 2014 10-K.

Table No. BV-ELEC-3

Market Value of the U.S. Electric Sample

Panel H: Dominion Resources

($MM)

	DCF Capital Structure	3rd Quarter, 2015	3rd Quarter, 2014	3rd Quarter, 2013	3rd Quarter, 2012	3rd Quarter, 2011	3rd Quarter, 2010	Notes
MARKET VALUE OF COMMON EQUITY								
Book Value, Common Shareholder's Equity	$12,592	$12,592	$11,573	$11,242	$11,818	$11,632	$12,095	[a]
Shares Outstanding (in millions) - Common	595	595	584	580	575	570	581	[b]
Price per Share - Common	$70	$69	$69	$62	$53	$50	$44	[c]
Market Value of Common Equity	$41,731	$41,040	$40,119	$35,768	$30,376	$28,377	$25,488	[d] = [b] x [c].
Market Value of GP Equity	n/a	n/a	n/a	n/a	n/a	n/a	n/a	[e]
Total Market Value of Equity	$41,731	$41,040	$40,119	$35,768	$30,376	$28,377	$25,488	[f]= [d]
Market to Book Value of Common Equity	3.31	3.26	3.47	3.18	2.57	2.44	2.11	[g] = [f] / [a].
MARKET VALUE OF PREFERRED EQUITY								
Book Value of Preferred Equity	$0	$0	$134	$257	$257	$257	$257	[h]
Market Value of Preferred Equity	$0	$0	$134	$257	$257	$257	$257	[i] = [h].
MARKET VALUE OF DEBT								
Current Assets	$4,123	$4,123	$5,446	$5,210	$4,653	$5,267	$5,995	[j]
Current Liabilities	$6,746	$6,746	$7,579	$6,453	$6,562	$5,496	$4,927	[k]
Current Portion of Long-Term Debt	$1,528	$1,528	$1,591	$1,132	$2,175	$1,327	$776	[l]
Net Working Capital	($1,095)	($1,095)	($542)	($111)	$266	$1,098	$1,844	[m] = [j] - ([k] - [l]).
Notes Payable (Short-Term Debt)	$2,555	$2,555	$2,629	$2,145	$1,382	$783	$100	[n]
Adjusted Short-Term Debt	$1,095	$1,095	$542	$111	$0	$0	$0	[o] = See Sources and Notes.
Long-Term Debt	$23,245	$23,245	$20,666	$18,548	$17,144	$17,153	$16,023	[p]
Book Value of Long-Term Debt	$25,868	$25,868	$22,799	$19,791	$19,319	$18,480	$16,799	[q] = [l] + [o] + [p].
Unadjusted Market Value of Long Term Debt	$21,881	$21,881	$19,887	$19,898	$18,936	$16,112	$15,970	
Carrying Amount	$19,723	$19,723	$18,396	$16,841	$16,264	$14,520	$14,867	
Adjustment to Book Value of Long-Term Debt	$2,158	$2,158	$1,491	$3,057	$2,672	$1,592	$1,103	[r] = See Sources and Notes.
Market Value of Long-Term Debt	$28,026	$28,026	$24,290	$22,848	$21,991	$20,072	$17,902	[s] = [q] + [r].
Market Value of Debt	$28,026	$28,026	$24,290	$22,848	$21,991	$20,072	$17,902	[t] = [s].
MARKET VALUE OF FIRM								
	$69,757	$69,066	$64,543	$58,873	$52,624	$48,706	$43,647	[u] = [f] + [i] + [t].
DEBT AND EQUITY TO MARKET VALUE RATIOS								
Common Equity - Market Value Ratio	59.82%	59.42%	62.16%	60.75%	57.72%	58.26%	58.40%	[v] = [f] / [u].
Preferred Equity - Market Value Ratio	-	-	0.21%	0.44%	0.49%	0.53%	0.59%	[w] = [i] / [u].
Debt - Market Value Ratio	40.18%	40.58%	37.63%	38.81%	41.79%	41.21%	41.01%	[x] = [t] / [u].

Sources and Notes:
Bloomberg as of February 10, 2016
Capital structure from 3rd Quarter, 2015 calculated using respective balance sheet information and 15-day average prices ending at period end.
The DCF Capital structure is calculated using 3rd Quarter, 2015 balance sheet information and a 15-trading day average closing price ending on 2/10/2016.
Prices are reported in Supporting Schedule #1 to Table No. BV-ELEC-6.
[o] =
(1): 0 if [m] > 0.
(2): The absolute value of [m] if [m] < 0 and |[m]| < [n].
(3): [n] if [m] < 0 and |[m]| > [n].
[r]: Difference between fair value of Long-Term debt and carrying amount of Long-Term debt per company 10-K. Data for adjustment is from 2014 10-K.

Table No. BV-ELEC-3

Market Value of the U.S. Electric Sample

Panel I: DTE Energy

($MM)

	DCF Capital Structure	3rd Quarter, 2015	3rd Quarter, 2014	3rd Quarter, 2013	3rd Quarter, 2012	3rd Quarter, 2011	3rd Quarter, 2010	Notes
MARKET VALUE OF COMMON EQUITY								
Book Value, Common Shareholder's Equity	$8,812	$8,812	$8,169	$7,876	$7,389	$6,970	$6,646	[a]
Shares Outstanding (in millions) - Common	179	179	177	177	172	169	169	[b]
Price per Share - Common	$84	$78	$76	$67	$59	$49	$47	[c]
Market Value of Common Equity	$15,122	$13,951	$13,475	$11,792	$10,192	$8,372	$7,879	[d] = [b] x [c].
Market Value of GP Equity	n/a	n/a	n/a	n/a	n/a	n/a	n/a	[e]
Total Market Value of Equity	$15,122	$13,951	$13,475	$11,792	$10,192	$8,372	$7,879	[f]= [d]
Market to Book Value of Common Equity	1.72	1.58	1.65	1.50	1.38	1.20	1.19	[g] = [f] / [a].
MARKET VALUE OF PREFERRED EQUITY								
Book Value of Preferred Equity	$0	$0	$0	$0	$0	$0	$0	[h]
Market Value of Preferred Equity	$0	$0	$0	$0	$0	$0	$0	[i] = [h].
MARKET VALUE OF DEBT								
Current Assets	$2,700	$2,700	$2,755	$2,549	$2,730	$2,911	$2,741	[j]
Current Liabilities	$2,273	$2,273	$2,805	$3,008	$2,309	$2,100	$2,513	[k]
Current Portion of Long-Term Debt	$468	$468	$274	$896	$633	$247	$923	[l]
Net Working Capital	$895	$895	$224	$437	$1,054	$1,058	$1,151	[m] = [j] - ([k] - [l]).
Notes Payable (Short-Term Debt)	$185	$185	$653	$271	$98	$275	$20	[n]
Adjusted Short-Term Debt	$0	$0	$0	$0	$0	$0	$0	[o] = See Sources and Notes.
Long-Term Debt	$8,856	$8,856	$7,909	$6,846	$7,120	$7,497	$7,074	[p]
Book Value of Long-Term Debt	$9,324	$9,324	$8,183	$7,742	$7,753	$7,744	$7,997	[q] = [l] + [o] + [p].
Unadjusted Market Value of Long Term Debt	$9,503	$9,503	$8,475	$8,893	$8,757	$8,500	$8,300	
Carrying Amount	$8,606	$8,606	$8,094	$7,813	$7,682	$8,000	$8,000	
Adjustment to Book Value of Long-Term Debt	$897	$897	$381	$1,080	$1,075	$500	$300	[r] = See Sources and Notes.
Market Value of Long-Term Debt	$10,221	$10,221	$8,564	$8,822	$8,828	$8,244	$8,297	[s] = [q] + [r].
Market Value of Debt	$10,221	$10,221	$8,564	$8,822	$8,828	$8,244	$8,297	[t] = [s].
MARKET VALUE OF FIRM	$25,343	$24,172	$22,039	$20,614	$19,020	$16,616	$16,176	[u] = [f] + [i] + [t].
DEBT AND EQUITY TO MARKET VALUE RATIOS								
Common Equity - Market Value Ratio	59.67%	57.71%	61.14%	57.20%	53.59%	50.38%	48.71%	[v] = [f] / [u].
Preferred Equity - Market Value Ratio	-	-	-	-	-	-	-	[w] = [i] / [u].
Debt - Market Value Ratio	40.33%	42.29%	38.86%	42.80%	46.41%	49.62%	51.29%	[x] = [t] / [u].

Sources and Notes:
Bloomberg as of February 10, 2016
Capital structure from 3rd Quarter, 2015 calculated using respective balance sheet information and 15-day average prices ending at period end.
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Prices are reported in Supporting Schedule #1 to Table No. BV-ELEC-6.
[o] =
(1): 0 if [m] > 0.
(2): The absolute value of [m] if [m] < 0 and |[m]| < [n].
(3): [n] if [m] < 0 and |[m]| > [n].
[r]: Difference between fair value of Long-Term debt and carrying amount of Long-Term debt per company 10-K. Data for adjustment is from 2014 10-K.

Table No. BV-ELEC-3

Market Value of the U.S. Electric Sample

Panel J: Edison Int'l

($MM)

	DCF Capital Structure	3rd Quarter, 2015	3rd Quarter, 2014	3rd Quarter, 2013	3rd Quarter, 2012	3rd Quarter, 2011	3rd Quarter, 2010	Notes
MARKET VALUE OF COMMON EQUITY								
Book Value, Common Shareholder's Equity	$11,600	$11,600	$10,736	$9,689	$10,023	$11,015	$10,634	[a]
Shares Outstanding (in millions) - Common	326	326	326	326	326	326	326	[b]
Price per Share - Common	$62	$61	$57	$46	$45	$37	$34	[c]
Market Value of Common Equity	$20,159	$19,740	$18,584	$14,938	$14,719	$12,158	$11,206	[d] = [b] x [c].
Market Value of GP Equity	n/a	n/a	n/a	n/a	n/a	n/a	n/a	[e]
Total Market Value of Equity	$20,159	$19,740	$18,584	$14,938	$14,719	$12,158	$11,206	[f]= [d]
Market to Book Value of Common Equity	1.74	1.70	1.73	1.54	1.47	1.10	1.05	[g] = [f] / [a].
MARKET VALUE OF PREFERRED EQUITY								
Book Value of Preferred Equity	$2,020	$2,020	$2,022	$1,753	$1,759	$1,029	$907	[h]
Market Value of Preferred Equity	$2,020	$2,020	$2,022	$1,753	$1,759	$1,029	$907	[i] = [h].
MARKET VALUE OF DEBT								
Current Assets	$3,792	$3,792	$4,498	$3,603	$4,494	$4,751	$5,041	[j]
Current Liabilities	$5,239	$5,239	$5,849	$5,389	$4,274	$4,161	$3,887	[k]
Current Portion of Long-Term Debt	$295	$295	$704	$401	$565	$51	$43	[l]
Net Working Capital	($1,152)	($1,152)	($647)	($1,385)	$785	$641	$1,197	[m] = [j] - ([k] - [l]).
Notes Payable (Short-Term Debt)	$1,154	$1,154	$1,349	$1,528	$429	$560	$98	[n]
Adjusted Short-Term Debt	$1,152	$1,152	$647	$1,385	$0	$0	$0	[o] = See Sources and Notes.
Long-Term Debt	$10,957	$10,957	$10,133	$9,232	$13,708	$13,010	$12,117	[p]
Book Value of Long-Term Debt	$12,404	$12,404	$11,484	$11,018	$14,273	$13,061	$12,160	[q] = [l] + [o] + [p].
Unadjusted Market Value of Long Term Debt	$12,319	$12,319	$11,084	$10,944	$10,548	$12,360	$10,452	
Carrying Amount	$10,738	$10,738	$10,426	$9,231	$8,834	$12,419	$10,814	
Adjustment to Book Value of Long-Term Debt	$1,581	$1,581	$658	$1,713	$1,714	($59)	($362)	[r] = See Sources and Notes.
Market Value of Long-Term Debt	$13,985	$13,985	$12,142	$12,731	$15,987	$13,002	$11,798	[s] = [q] + [r].
Market Value of Debt	$13,985	$13,985	$12,142	$12,731	$15,987	$13,002	$11,798	[t] = [s].
MARKET VALUE OF FIRM	$36,164	$35,745	$32,748	$29,422	$32,465	$26,189	$23,911	[u] = [f] + [i] + [t].
DEBT AND EQUITY TO MARKET VALUE RATIOS								
Common Equity - Market Value Ratio	55.74%	55.22%	56.75%	50.77%	45.34%	46.42%	46.86%	[v] = [f] / [u].
Preferred Equity - Market Value Ratio	5.59%	5.65%	6.17%	5.96%	5.42%	3.93%	3.79%	[w] = [i] / [u].
Debt - Market Value Ratio	38.67%	39.12%	37.08%	43.27%	49.24%	49.65%	49.34%	[x] = [t] / [u].

Sources and Notes:
Bloomberg as of February 10, 2016
Capital structure from 3rd Quarter, 2015 calculated using respective balance sheet information and 15-day average prices ending at period end.
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Prices are reported in Supporting Schedule #1 to Table No. BV-ELEC-6.
[o] =
(1): 0 if [m] > 0.
(2): The absolute value of [m] if [m] < 0 and |[m]| < [n].
(3): [n] if [m] < 0 and |[m]| > [n].
[r]: Difference between fair value of Long-Term debt and carrying amount of Long-Term debt per company 10-K. Data for adjustment is from 2014 10-K.

Table No. BV-ELEC-3

Market Value of the U.S. Electric Sample

Panel K: El Paso Electric

($MM)

	DCF Capital Structure	3rd Quarter, 2015	3rd Quarter, 2014	3rd Quarter, 2013	3rd Quarter, 2012	3rd Quarter, 2011	3rd Quarter, 2010	Notes
MARKET VALUE OF COMMON EQUITY								
Book Value, Common Shareholder's Equity	$1,021	$1,021	$1,016	$894	$830	$813	$791	[a]
Shares Outstanding (in millions) - Common	40	40	40	40	40	40	42	[b]
Price per Share - Common	$40	$36	$37	$33	$34	$32	$23	[c]
Market Value of Common Equity	$1,624	$1,432	$1,481	$1,328	$1,356	$1,285	$987	[d] = [b] x [c].
Market Value of GP Equity	n/a	n/a	n/a	n/a	n/a	n/a	n/a	[e]
Total Market Value of Equity	$1,624	$1,432	$1,481	$1,328	$1,356	$1,285	$987	[f]= [d]
Market to Book Value of Common Equity	1.59	1.40	1.46	1.49	1.63	1.58	1.25	[g] = [f] / [a].
MARKET VALUE OF PREFERRED EQUITY								
Book Value of Preferred Equity	$0	$0	$0	$0	$0	$0	$0	[h]
Market Value of Preferred Equity	$0	$0	$0	$0	$0	$0	$0	[i] = [h].
MARKET VALUE OF DEBT								
Current Assets	$202	$202	$207	$237	$176	$200	$252	[j]
Current Liabilities	$251	$251	$242	$141	$174	$187	$143	[k]
Current Portion of Long-Term Debt	$0	$0	$15	$0	$33	$33	$14	[l]
Net Working Capital	($48)	($48)	($19)	$96	$35	$46	$123	[m] = [j] - ([k] - [l]).
Notes Payable (Short-Term Debt)	$119	$119	$90	$15	$62	$18	$0	[n]
Adjusted Short-Term Debt	$48	$48	$19	$0	$0	$0	$0	[o] = See Sources and Notes.
Long-Term Debt	$1,134	$1,134	$985	$1,000	$850	$816	$850	[p]
Book Value of Long-Term Debt	$1,182	$1,182	$1,019	$1,000	$883	$850	$864	[q] = [l] + [o] + [p].
Unadjusted Market Value of Long Term Debt	$1,314	$1,314	$1,059	$1,182	$1,057	$883	$850	
Carrying Amount	$1,164	$1,164	$1,014	$1,022	$883	$854	$847	
Adjustment to Book Value of Long-Term Debt	$150	$150	$45	$160	$174	$28	$3	[r] = See Sources and Notes.
Market Value of Long-Term Debt	$1,332	$1,332	$1,064	$1,160	$1,057	$878	$867	[s] = [q] + [r].
Market Value of Debt	$1,332	$1,332	$1,064	$1,160	$1,057	$878	$867	[t] = [s].
MARKET VALUE OF FIRM	$2,957	$2,764	$2,544	$2,487	$2,414	$2,163	$1,854	[u] = [f] + [i] + [t].
DEBT AND EQUITY TO MARKET VALUE RATIOS								
Common Equity - Market Value Ratio	54.94%	51.80%	58.19%	53.38%	56.19%	59.41%	53.23%	[v] = [f] / [u].
Preferred Equity - Market Value Ratio	-	-	-	-	-	-	-	[w] = [i] / [u].
Debt - Market Value Ratio	45.06%	48.20%	41.81%	46.62%	43.81%	40.59%	46.77%	[x] = [t] / [u].

Sources and Notes:
Bloomberg as of February 10, 2016
Capital structure from 3rd Quarter, 2015 calculated using respective balance sheet information and 15-day average prices ending at period end.
The DCF Capital structure is calculated using 3rd Quarter, 2015 balance sheet information and a 15-trading day average closing price ending on 2/10/2016.
Prices are reported in Supporting Schedule #1 to Table No. BV-ELEC-6.
[o] =
(1): 0 if [m] > 0.
(2): The absolute value of [m] if [m] < 0 and |[m]| < [n].
(3): [n] if [m] < 0 and |[m]| > [n].
[r]: Difference between fair value of Long-Term debt and carrying amount of Long-Term debt per company 10-K. Data for adjustment is from 2014 10-K.

Table No. BV-ELEC-3

Market Value of the U.S. Electric Sample

Panel L: Entergy Corp.

($MM)

	DCF Capital Structure	3rd Quarter, 2015	3rd Quarter, 2014	3rd Quarter, 2013	3rd Quarter, 2012	3rd Quarter, 2011	3rd Quarter, 2010	Notes
MARKET VALUE OF COMMON EQUITY								
Book Value, Common Shareholder's Equity	$9,157	$9,157	$10,149	$9,408	$9,191	$8,965	$8,732	[a]
Shares Outstanding (in millions) - Common	178	178	180	178	178	176	182	[b]
Price per Share - Common	$70	$64	$76	$64	$69	$65	$78	[c]
Market Value of Common Equity	$12,443	$11,376	$13,736	$11,359	$12,194	$11,495	$14,071	[d] = [b] x [c].
Market Value of GP Equity	n/a	n/a	n/a	n/a	n/a	n/a	n/a	[e]
Total Market Value of Equity	$12,443	$11,376	$13,736	$11,359	$12,194	$11,495	$14,071	[f]= [d]
Market to Book Value of Common Equity	1.36	1.24	1.35	1.21	1.33	1.28	1.61	[g] = [f] / [a].
MARKET VALUE OF PREFERRED EQUITY								
Book Value of Preferred Equity	$211	$211	$305	$281	$281	$311	$311	[h]
Market Value of Preferred Equity	$211	$211	$305	$281	$281	$311	$311	[i] = [h].
MARKET VALUE OF DEBT								
Current Assets	$4,117	$4,117	$4,265	$3,490	$3,808	$4,154	$5,047	[j]
Current Liabilities	$3,454	$3,454	$4,454	$3,439	$3,924	$4,161	$2,914	[k]
Current Portion of Long-Term Debt	$281	$281	$1,117	$209	$792	$2,026	$592	[l]
Net Working Capital	$945	$945	$927	$260	$675	$2,019	$2,725	[m] = [j] - ([k] - [l]).
Notes Payable (Short-Term Debt)	$782	$782	$891	$1,106	$356	$145	$168	[n]
Adjusted Short-Term Debt	$0	$0	$0	$0	$0	$0	$0	[o] = See Sources and Notes.
Long-Term Debt	$13,080	$13,080	$11,665	$12,308	$11,784	$10,281	$11,487	[p]
Book Value of Long-Term Debt	$13,362	$13,362	$12,782	$12,517	$12,575	$12,307	$12,080	[q] = [l] + [o] + [p].
Unadjusted Market Value of Long Term Debt	$13,607	$13,607	$12,440	$12,849	$12,176	$10,989	$10,728	
Carrying Amount	$13,399	$13,399	$12,596	$12,639	$12,236	$11,617	$11,418	
Adjustment to Book Value of Long-Term Debt	$208	$208	($156)	$210	($60)	($628)	($690)	[r] = See Sources and Notes.
Market Value of Long-Term Debt	$13,569	$13,569	$12,625	$12,728	$12,515	$11,679	$11,390	[s] = [q] + [r].
Market Value of Debt	$13,569	$13,569	$12,625	$12,728	$12,515	$11,679	$11,390	[t] = [s].
MARKET VALUE OF FIRM	$26,224	$25,156	$26,665	$24,367	$24,989	$23,485	$25,772	[u] = [f] + [i] + [t].
DEBT AND EQUITY TO MARKET VALUE RATIOS								
Common Equity - Market Value Ratio	47.45%	45.22%	51.51%	46.62%	48.80%	48.95%	54.60%	[v] = [f] / [u].
Preferred Equity - Market Value Ratio	0.80%	0.84%	1.14%	1.15%	1.12%	1.32%	1.21%	[w] = [i] / [u].
Debt - Market Value Ratio	51.74%	53.94%	47.35%	52.23%	50.08%	49.73%	44.20%	[x] = [t] / [u].

Sources and Notes:
Bloomberg as of February 10, 2016
Capital structure from 3rd Quarter, 2015 calculated using respective balance sheet information and 15-day average prices ending at period end.
The DCF Capital structure is calculated using 3rd Quarter, 2015 balance sheet information and a 15-trading day average closing price ending on 2/10/2016.
Prices are reported in Supporting Schedule #1 to Table No. BV-ELEC-6.
[o] =
(1): 0 if [m] > 0.
(2): The absolute value of [m] if [m] < 0 and |[m]| < [n].
(3): [n] if [m] < 0 and |[m]| > [n].
[r]: Difference between fair value of Long-Term debt and carrying amount of Long-Term debt per company 10-K. Data for adjustment is from 2014 10-K.

Table No. BV-ELEC-3

Market Value of the U.S. Electric Sample

Panel M: G't Plains Energy

($MM)

	DCF Capital Structure	3rd Quarter, 2015	3rd Quarter, 2014	3rd Quarter, 2013	3rd Quarter, 2012	3rd Quarter, 2011	3rd Quarter, 2010	Notes
MARKET VALUE OF COMMON EQUITY								
Book Value, Common Shareholder's Equity	$3,671	$3,671	$3,603	$3,487	$3,365	$2,983	$2,914	[a]
Shares Outstanding (in millions) - Common	154	154	154	154	153	136	136	[b]
Price per Share - Common	$28	$26	$25	$22	$22	$20	$19	[c]
Market Value of Common Equity	$4,321	$3,964	$3,813	$3,406	$3,399	$2,656	$2,561	[d] = [b] x [c].
Market Value of GP Equity	n/a	n/a	n/a	n/a	n/a	n/a	n/a	[e]
Total Market Value of Equity	$4,321	$3,964	$3,813	$3,406	$3,399	$2,656	$2,561	[f]= [d]
Market to Book Value of Common Equity	1.18	1.08	1.06	0.98	1.01	0.89	0.88	[g] = [f] / [a].
MARKET VALUE OF PREFERRED EQUITY								
Book Value of Preferred Equity	$39	$39	$39	$39	$39	$39	$39	[h]
Market Value of Preferred Equity	$39	$39	$39	$39	$39	$39	$39	[i] = [h].
MARKET VALUE OF DEBT								
Current Assets	$824	$824	$753	$762	$821	$665	$693	[j]
Current Liabilities	$823	$823	$937	$689	$1,357	$1,511	$1,101	[k]
Current Portion of Long-Term Debt	$1	$1	$15	$7	$257	$951	$336	[l]
Net Working Capital	$2	$2	($169)	$80	($278)	$105	($72)	[m] = [j] - ([k] - [l]).
Notes Payable (Short-Term Debt)	$341	$341	$396	$249	$648	$134	$327	[n]
Adjusted Short-Term Debt	$0	$0	$169	$0	$278	$0	$72	[o] = See Sources and Notes.
Long-Term Debt	$3,764	$3,764	$3,488	$3,516	$2,763	$2,750	$3,101	[p]
Book Value of Long-Term Debt	$3,765	$3,765	$3,672	$3,523	$3,298	$3,702	$3,509	[q] = [l] + [o] + [p].
Unadjusted Market Value of Long Term Debt	$3,800	$3,800	$3,700	$3,500	$3,900	$3,700	$3,400	
Carrying Amount	$3,500	$3,500	$3,500	$3,000	$3,500	$3,400	$3,200	
Adjustment to Book Value of Long-Term Debt	$300	$300	$200	$500	$400	$300	$200	[r] = See Sources and Notes.
Market Value of Long-Term Debt	$4,065	$4,065	$3,872	$4,023	$3,698	$4,002	$3,709	[s] = [q] + [r].
Market Value of Debt	$4,065	$4,065	$3,872	$4,023	$3,698	$4,002	$3,709	[t] = [s].
MARKET VALUE OF FIRM	$8,424	$8,068	$7,725	$7,467	$7,136	$6,697	$6,309	[u] = [f] + [i] + [t].
DEBT AND EQUITY TO MARKET VALUE RATIOS								
Common Equity - Market Value Ratio	51.29%	49.14%	49.37%	45.61%	47.63%	39.66%	40.59%	[v] = [f] / [u].
Preferred Equity - Market Value Ratio	0.46%	0.48%	0.50%	0.52%	0.55%	0.58%	0.62%	[w] = [i] / [u].
Debt - Market Value Ratio	48.25%	50.38%	50.13%	53.87%	51.83%	59.75%	58.79%	[x] = [t] / [u].

Sources and Notes:
Bloomberg as of February 10, 2016
Capital structure from 3rd Quarter, 2015 calculated using respective balance sheet information and 15-day average prices ending at period end.
The DCF Capital structure is calculated using 3rd Quarter, 2015 balance sheet information and a 15-trading day average closing price ending on 2/10/2016.
Prices are reported in Supporting Schedule #1 to Table No. BV-ELEC-6.
[o] =
(1): 0 if [m] > 0.
(2): The absolute value of [m] if [m] < 0 and |[m]| < [n].
(3): [n] if [m] < 0 and |[m]| > [n].
[r]: Difference between fair value of Long-Term debt and carrying amount of Long-Term debt per company 10-K. Data for adjustment is from 2014 10-K.

Table No. BV-ELEC-3

Market Value of the U.S. Electric Sample

Panel N: IDACORP Inc.

($MM)

	DCF Capital Structure	3rd Quarter, 2015	3rd Quarter, 2014	3rd Quarter, 2013	3rd Quarter, 2012	3rd Quarter, 2011	3rd Quarter, 2010	Notes
MARKET VALUE OF COMMON EQUITY								
Book Value, Common Shareholder's Equity	$2,050	$2,050	$1,949	$1,860	$1,770	$1,657	$1,517	[a]
Shares Outstanding (in millions) - Common	50	50	50	50	50	50	49	[b]
Price per Share - Common	$68	$61	$55	$48	$43	$38	$35	[c]
Market Value of Common Equity	$3,440	$3,087	$2,753	$2,403	$2,151	$1,881	$1,730	[d] = [b] x [c].
Market Value of GP Equity	n/a	n/a	n/a	n/a	n/a	n/a	n/a	[e]
Total Market Value of Equity	$3,440	$3,087	$2,753	$2,403	$2,151	$1,881	$1,730	[f]= [d]
Market to Book Value of Common Equity	1.68	1.51	1.41	1.29	1.21	1.14	1.14	[g] = [f] / [a].
MARKET VALUE OF PREFERRED EQUITY								
Book Value of Preferred Equity	$0	$0	$0	$0	$0	$0	$0	[h]
Market Value of Preferred Equity	$0	$0	$0	$0	$0	$0	$0	[i] = [h].
MARKET VALUE OF DEBT								
Current Assets	$494	$494	$475	$567	$366	$309	$468	[j]
Current Liabilities	$205	$205	$240	$335	$268	$254	$382	[k]
Current Portion of Long-Term Debt	$1	$1	$1	$71	$1	$2	$127	[l]
Net Working Capital	$290	$290	$237	$303	$99	$56	$212	[m] = [j] - ([k] - [l]).
Notes Payable (Short-Term Debt)	$4	$4	$32	$53	$51	$52	$4	[n]
Adjusted Short-Term Debt	$0	$0	$0	$0	$0	$0	$0	[o] = See Sources and Notes.
Long-Term Debt	$1,742	$1,742	$1,614	$1,615	$1,537	$1,487	$1,488	[p]
Book Value of Long-Term Debt	$1,743	$1,743	$1,615	$1,686	$1,538	$1,489	$1,615	[q] = [l] + [o] + [p].
Unadjusted Market Value of Long Term Debt	$1,788	$1,788	$1,600	$1,819	$1,738	$1,623	$1,407	
Carrying Amount	$1,616	$1,616	$1,616	$1,538	$1,492	$1,614	$1,422	
Adjustment to Book Value of Long-Term Debt	$173	$173	($16)	$282	$246	$9	($15)	[r] = See Sources and Notes.
Market Value of Long-Term Debt	$1,916	$1,916	$1,599	$1,968	$1,784	$1,498	$1,600	[s] = [q] + [r].
Market Value of Debt	$1,916	$1,916	$1,599	$1,968	$1,784	$1,498	$1,600	[t] = [s].
MARKET VALUE OF FIRM	$5,356	$5,003	$4,353	$4,370	$3,934	$3,379	$3,329	[u] = [f] + [i] + [t].
DEBT AND EQUITY TO MARKET VALUE RATIOS								
Common Equity - Market Value Ratio	64.23%	61.71%	63.26%	54.97%	54.66%	55.68%	51.95%	[v] = [f] / [u].
Preferred Equity - Market Value Ratio	-	-	-	-	-	-	-	[w] = [i] / [u].
Debt - Market Value Ratio	35.77%	38.29%	36.74%	45.03%	45.34%	44.32%	48.05%	[x] = [t] / [u].

Sources and Notes:
Bloomberg as of February 10, 2016
Capital structure from 3rd Quarter, 2015 calculated using respective balance sheet information and 15-day average prices ending at period end.
The DCF Capital structure is calculated using 3rd Quarter, 2015 balance sheet information and a 15-trading day average closing price ending on 2/10/2016.
Prices are reported in Supporting Schedule #1 to Table No. BV-ELEC-6.
[o] =
(1): 0 if [m] > 0.
(2): The absolute value of [m] if [m] < 0 and |[m]| < [n].
(3): [n] if [m] < 0 and |[m]| > [n].
[r]: Difference between fair value of Long-Term debt and carrying amount of Long-Term debt per company 10-K. Data for adjustment is from 2014 10-K.

Table No. BV-ELEC-3

Market Value of the U.S. Electric Sample

Panel O: MGE Energy

($MM)

	DCF Capital Structure	3rd Quarter, 2015	3rd Quarter, 2014	3rd Quarter, 2013	3rd Quarter, 2012	3rd Quarter, 2011	3rd Quarter, 2010	Notes
MARKET VALUE OF COMMON EQUITY								
Book Value, Common Shareholder's Equity	$689	$689	$654	$613	$578	$550	$522	[a]
Shares Outstanding (in millions) - Common	35	35	35	35	35	35	35	[b]
Price per Share - Common	$49	$40	$39	$36	$35	$27	$26	[c]
Market Value of Common Equity	$1,689	$1,396	$1,340	$1,244	$1,223	$950	$902	[d] = [b] x [c].
Market Value of GP Equity	n/a	n/a	n/a	n/a	n/a	n/a	n/a	[e]
Total Market Value of Equity	$1,689	$1,396	$1,340	$1,244	$1,223	$950	$902	[f]= [d]
Market to Book Value of Common Equity	2.45	2.03	2.05	2.03	2.11	1.73	1.73	[g] = [f] / [a].
MARKET VALUE OF PREFERRED EQUITY								
Book Value of Preferred Equity	$0	$0	$0	$0	$0	$0	$0	[h]
Market Value of Preferred Equity	$0	$0	$0	$0	$0	$0	$0	[i] = [h].
MARKET VALUE OF DEBT								
Current Assets	$242	$242	$225	$214	$220	$174	$150	[j]
Current Liabilities	$74	$74	$82	$79	$60	$52	$102	[k]
Current Portion of Long-Term Debt	$4	$4	$4	$4	$3	$3	$2	[l]
Net Working Capital	$172	$172	$147	$139	$162	$124	$50	[m] = [j] - ([k] - [l]).
Notes Payable (Short-Term Debt)	$0	$0	$0	$0	$0	$0	$49	[n]
Adjusted Short-Term Debt	$0	$0	$0	$0	$0	$0	$0	[o] = See Sources and Notes.
Long-Term Debt	$392	$392	$396	$400	$359	$362	$320	[p]
Book Value of Long-Term Debt	$396	$396	$400	$405	$362	$364	$321	[q] = [l] + [o] + [p].
Unadjusted Market Value of Long Term Debt	$457	$457	$432	$427	$433	$356	$340	
Carrying Amount	$400	$400	$404	$362	$364	$337	$324	
Adjustment to Book Value of Long-Term Debt	$58	$58	$28	$66	$68	$19	$16	[r] = See Sources and Notes.
Market Value of Long-Term Debt	$454	$454	$429	$470	$430	$384	$337	[s] = [q] + [r].
Market Value of Debt	$454	$454	$429	$470	$430	$384	$337	[t] = [s].
MARKET VALUE OF FIRM	$2,143	$1,850	$1,769	$1,714	$1,653	$1,333	$1,240	[u] = [f] + [i] + [t].
DEBT AND EQUITY TO MARKET VALUE RATIOS								
Common Equity - Market Value Ratio	78.81%	75.46%	75.77%	72.56%	73.97%	71.23%	72.78%	[v] = [f] / [u].
Preferred Equity - Market Value Ratio	-	-	-	-	-	-	-	[w] = [i] / [u].
Debt - Market Value Ratio	21.19%	24.54%	24.23%	27.44%	26.03%	28.77%	27.22%	[x] = [t] / [u].

Sources and Notes:
Bloomberg as of February 10, 2016
Capital structure from 3rd Quarter, 2015 calculated using respective balance sheet information and 15-day average prices ending at period end.
The DCF Capital structure is calculated using 3rd Quarter, 2015 balance sheet information and a 15-trading day average closing price ending on 2/10/2016.
Prices are reported in Supporting Schedule #1 to Table No. BV-ELEC-6.
[o] =
(1): 0 if [m] > 0.
(2): The absolute value of [m] if [m] < 0 and |[m]| < [n].
(3): [n] if [m] < 0 and |[m]| > [n].
[r]: Difference between fair value of Long-Term debt and carrying amount of Long-Term debt per company 10-K. Data for adjustment is from 2014 10-K.

Table No. BV-ELEC-3

Market Value of the U.S. Electric Sample

Panel P: NextEra Energy

($MM)

	DCF Capital Structure	3rd Quarter, 2015	3rd Quarter, 2014	3rd Quarter, 2013	3rd Quarter, 2012	3rd Quarter, 2011	3rd Quarter, 2010	Notes
MARKET VALUE OF COMMON EQUITY								
Book Value, Common Shareholder's Equity	$22,318	$22,318	$18,810	$17,409	$15,886	$14,887	$14,151	[a]
Shares Outstanding (in millions) - Common	461	461	436	431	423	423	418	[b]
Price per Share - Common	$111	$97	$95	$80	$69	$54	$54	[c]
Market Value of Common Equity	$51,122	$44,783	$41,205	$34,660	$28,988	$22,955	$22,782	[d] = [b] x [c].
Market Value of GP Equity	n/a	n/a	n/a	n/a	n/a	n/a	n/a	[e]
Total Market Value of Equity	$51,122	$44,783	$41,205	$34,660	$28,988	$22,955	$22,782	[f]= [d]
Market to Book Value of Common Equity	2.29	2.01	2.19	1.99	1.82	1.54	1.61	[g] = [f] / [a].
MARKET VALUE OF PREFERRED EQUITY								
Book Value of Preferred Equity	$0	$0	$0	$0	$0	$0	$0	[h]
Market Value of Preferred Equity	$0	$0	$0	$0	$0	$0	$0	[i] = [h].
MARKET VALUE OF DEBT								
Current Assets	$6,657	$6,657	$5,633	$5,472	$4,437	$6,252	$5,776	[j]
Current Liabilities	$10,371	$10,371	$9,572	$9,213	$7,875	$7,419	$7,187	[k]
Current Portion of Long-Term Debt	$2,497	$2,497	$3,385	$3,933	$2,062	$597	$1,703	[l]
Net Working Capital	($1,217)	($1,217)	($554)	$192	($1,376)	($570)	$292	[m] = [j] - ([k] - [l]).
Notes Payable (Short-Term Debt)	$2,163	$2,163	$1,185	$915	$1,574	$1,835	$1,085	[n]
Adjusted Short-Term Debt	$1,217	$1,217	$554	$0	$1,376	$570	$0	[o] = See Sources and Notes.
Long-Term Debt	$25,604	$25,604	$24,853	$23,862	$22,714	$20,039	$17,680	[p]
Book Value of Long-Term Debt	$29,318	$29,318	$28,792	$27,795	$26,152	$21,206	$19,383	[q] = [l] + [o] + [p].
Unadjusted Market Value of Long Term Debt	$30,337	$30,337	$28,612	$28,874	$23,699	$20,756	$17,256	
Carrying Amount	$27,876	$27,876	$27,728	$26,647	$21,614	$19,929	$16,869	
Adjustment to Book Value of Long-Term Debt	$2,461	$2,461	$884	$2,227	$2,085	$827	$387	[r] = See Sources and Notes.
Market Value of Long-Term Debt	$31,779	$31,779	$29,676	$30,022	$28,237	$22,033	$19,770	[s] = [q] + [r].
Market Value of Debt	$31,779	$31,779	$29,676	$30,022	$28,237	$22,033	$19,770	[t] = [s].
MARKET VALUE OF FIRM	$82,901	$76,562	$70,881	$64,682	$57,225	$44,988	$42,552	[u] = [f] + [i] + [t].
DEBT AND EQUITY TO MARKET VALUE RATIOS								
Common Equity - Market Value Ratio	61.67%	58.49%	58.13%	53.59%	50.66%	51.02%	53.54%	[v] = [f] / [u].
Preferred Equity - Market Value Ratio	-	-	-	-	-	-	-	[w] = [i] / [u].
Debt - Market Value Ratio	38.33%	41.51%	41.87%	46.41%	49.34%	48.98%	46.46%	[x] = [t] / [u].

Sources and Notes:
Bloomberg as of February 10, 2016
Capital structure from 3rd Quarter, 2015 calculated using respective balance sheet information and 15-day average prices ending at period end.
The DCF Capital structure is calculated using 3rd Quarter, 2015 balance sheet information and a 15-trading day average closing price ending on 2/10/2016.
Prices are reported in Supporting Schedule #1 to Table No. BV-ELEC-6.
[o] =
(1): 0 if [m] > 0.
(2): The absolute value of [m] if [m] < 0 and |[m]| < [n].
(3): [n] if [m] < 0 and |[m]| > [n].
[r]: Difference between fair value of Long-Term debt and carrying amount of Long-Term debt per company 10-K. Data for adjustment is from 2014 10-K.

Table No. BV-ELEC-3

Market Value of the U.S. Electric Sample

Panel Q: OGE Energy

($MM)

	DCF Capital Structure	3rd Quarter, 2015	3rd Quarter, 2014	3rd Quarter, 2013	3rd Quarter, 2012	3rd Quarter, 2011	3rd Quarter, 2010	Notes
MARKET VALUE OF COMMON EQUITY								
Book Value, Common Shareholder's Equity	$3,353	$3,353	$3,243	$2,995	$2,769	$2,541	$2,226	[a]
Shares Outstanding (in millions) - Common	200	200	199	198	197	196	195	[b]
Price per Share - Common	$26	$27	$36	$36	$28	$24	$20	[c]
Market Value of Common Equity	$5,171	$5,399	$7,266	$7,104	$5,440	$4,709	$3,899	[d] = [b] x [c].
Market Value of GP Equity	n/a	n/a	n/a	n/a	n/a	n/a	n/a	[e]
Total Market Value of Equity	$5,171	$5,399	$7,266	$7,104	$5,440	$4,709	$3,899	[f]= [d]
Market to Book Value of Common Equity	1.54	1.61	2.24	2.37	1.96	1.85	1.75	[g] = [f] / [a].
MARKET VALUE OF PREFERRED EQUITY								
Book Value of Preferred Equity	$0	$0	$0	$0	$0	$0	$0	[h]
Market Value of Preferred Equity	$0	$0	$0	$0	$0	$0	$0	[i] = [h].
MARKET VALUE OF DEBT								
Current Assets	$753	$753	$740	$758	$857	$727	$709	[j]
Current Liabilities	$587	$587	$869	$942	$1,196	$934	$872	[k]
Current Portion of Long-Term Debt	$110	$110	$0	$0	$0	$0	$0	[l]
Net Working Capital	$276	$276	($129)	($184)	($339)	($208)	($163)	[m] = [j] - ([k] - [l]).
Notes Payable (Short-Term Debt)	$0	$0	$411	$447	$456	$289	$224	[n]
Adjusted Short-Term Debt	$0	$0	$129	$184	$339	$208	$163	[o] = See Sources and Notes.
Long-Term Debt	$2,646	$2,646	$2,510	$2,400	$2,848	$2,587	$2,373	[p]
Book Value of Long-Term Debt	$2,756	$2,756	$2,639	$2,584	$3,188	$2,795	$2,536	[q] = [l] + [o] + [p].
Unadjusted Market Value of Long Term Debt	$2,550	$2,550	$2,653	$3,397	$3,276	$2,579	$2,477	
Carrying Amount	$2,755	$2,755	$2,400	$2,849	$2,737	$2,363	$2,378	
Adjustment to Book Value of Long-Term Debt	($206)	($206)	$253	$548	$539	$216	$99	[r] = See Sources and Notes.
Market Value of Long-Term Debt	$2,550	$2,550	$2,891	$3,132	$3,726	$3,011	$2,634	[s] = [q] + [r].
Market Value of Debt	$2,550	$2,550	$2,891	$3,132	$3,726	$3,011	$2,634	[t] = [s].
MARKET VALUE OF FIRM	$7,720	$7,949	$10,157	$10,236	$9,166	$7,720	$6,533	[u] = [f] + [i] + [t].
DEBT AND EQUITY TO MARKET VALUE RATIOS								
Common Equity - Market Value Ratio	66.97%	67.92%	71.54%	69.41%	59.35%	61.00%	59.68%	[v] = [f] / [u].
Preferred Equity - Market Value Ratio	-	-	-	-	-	-	-	[w] = [i] / [u].
Debt - Market Value Ratio	33.03%	32.08%	28.46%	30.59%	40.65%	39.00%	40.32%	[x] = [t] / [u].

Sources and Notes:
Bloomberg as of February 10, 2016
Capital structure from 3rd Quarter, 2015 calculated using respective balance sheet information and 15-day average prices ending at period end.
The DCF Capital structure is calculated using 3rd Quarter, 2015 balance sheet information and a 15-trading day average closing price ending on 2/10/2016.
Prices are reported in Supporting Schedule #1 to Table No. BV-ELEC-6.
[o] =
(1): 0 if [m] > 0.
(2): The absolute value of [m] if [m] < 0 and |[m]| < [n].
(3): [n] if [m] < 0 and |[m]| > [n].
[r]: Difference between fair value of Long-Term debt and carrying amount of Long-Term debt per company 10-K. Data for adjustment is from 2014 10-K.

Table No. BV-ELEC-3

Market Value of the U.S. Electric Sample

Panel R: Otter Tail Corp.

($MM)

	DCF Capital Structure	3rd Quarter, 2015	3rd Quarter, 2014	3rd Quarter, 2013	3rd Quarter, 2012	3rd Quarter, 2011	3rd Quarter, 2010	Notes
MARKET VALUE OF COMMON EQUITY								
Book Value, Common Shareholder's Equity	$598	$598	$563	$530	$531	$626	$637	[a]
Shares Outstanding (in millions) - Common	38	38	37	36	36	36	36	[b]
Price per Share - Common	$27	$26	$27	$28	$24	$19	$20	[c]
Market Value of Common Equity	$1,027	$972	$1,007	$1,006	$859	$703	$720	[d] = [b] x [c].
Market Value of GP Equity	n/a	n/a	n/a	n/a	n/a	n/a	n/a	[e]
Total Market Value of Equity	$1,027	$972	$1,007	$1,006	$859	$703	$720	[f]= [d]
Market to Book Value of Common Equity	1.72	1.63	1.79	1.90	1.62	1.12	1.13	[g] = [f] / [a].
MARKET VALUE OF PREFERRED EQUITY								
Book Value of Preferred Equity	$0	$0	$0	$0	$16	$16	$16	[h]
Market Value of Preferred Equity	$0	$0	$0	$0	$16	$16	$16	[i] = [h].
MARKET VALUE OF DEBT								
Current Assets	$274	$274	$298	$310	$299	$372	$361	[j]
Current Liabilities	$237	$237	$200	$220	$176	$216	$246	[k]
Current Portion of Long-Term Debt	$0	$0	$0	$0	$0	$3	$1	[l]
Net Working Capital	$37	$37	$98	$91	$123	$159	$116	[m] = [j] - ([k] - [l]).
Notes Payable (Short-Term Debt)	$87	$87	$39	$40	$12	$39	$94	[n]
Adjusted Short-Term Debt	$0	$0	$0	$0	$0	$0	$0	[o] = See Sources and Notes.
Long-Term Debt	$498	$498	$499	$437	$422	$433	$436	[p]
Book Value of Long-Term Debt	$499	$499	$499	$437	$422	$437	$436	[q] = [l] + [o] + [p].
Unadjusted Market Value of Long Term Debt	$601	$601	$428	$491	$525	$473	$458	
Carrying Amount	$499	$499	$390	$422	$472	$434	$436	
Adjustment to Book Value of Long-Term Debt	$102	$102	$38	$69	$53	$39	$22	[r] = See Sources and Notes.
Market Value of Long-Term Debt	$601	$601	$537	$507	$475	$476	$458	[s] = [q] + [r].
Market Value of Debt	$601	$601	$537	$507	$475	$476	$458	[t] = [s].
MARKET VALUE OF FIRM	$1,628	$1,573	$1,544	$1,513	$1,350	$1,195	$1,193	[u] = [f] + [i] + [t].
DEBT AND EQUITY TO MARKET VALUE RATIOS								
Common Equity - Market Value Ratio	63.09%	61.81%	65.24%	66.49%	63.66%	58.84%	60.32%	[v] = [f] / [u].
Preferred Equity - Market Value Ratio	-	-	-	-	1.15%	1.30%	1.30%	[w] = [i] / [u].
Debt - Market Value Ratio	36.91%	38.19%	34.76%	33.51%	35.19%	39.86%	38.38%	[x] = [t] / [u].

Sources and Notes:
Bloomberg as of February 10, 2016
Capital structure from 3rd Quarter, 2015 calculated using respective balance sheet information and 15-day average prices ending at period end.
The DCF Capital structure is calculated using 3rd Quarter, 2015 balance sheet information and a 15-trading day average closing price ending on 2/10/2016.
Prices are reported in Supporting Schedule #1 to Table No. BV-ELEC-6.
[o] =
(1): 0 if [m] > 0.
(2): The absolute value of [m] if [m] < 0 and |[m]| < [n].
(3): [n] if [m] < 0 and |[m]| > [n].
[r]: Difference between fair value of Long-Term debt and carrying amount of Long-Term debt per company 10-K. Data for adjustment is from 2014 10-K.

Table No. BV-ELEC-3

Market Value of the U.S. Electric Sample

Panel S: PG&E Corp.

($MM)

	DCF Capital Structure	3rd Quarter, 2015	3rd Quarter, 2014	3rd Quarter, 2013	3rd Quarter, 2012	3rd Quarter, 2011	3rd Quarter, 2010	Notes
MARKET VALUE OF COMMON EQUITY								
Book Value, Common Shareholder's Equity	$16,568	$16,568	$15,779	$14,008	$13,133	$11,959	$11,023	[a]
Shares Outstanding (in millions) - Common	490	490	475	449	429	405	392	[b]
Price per Share - Common	$55	$51	$46	$41	$43	$42	$45	[c]
Market Value of Common Equity	$26,781	$24,840	$21,682	$18,575	$18,401	$17,105	$17,699	[d] = [b] x [c].
Market Value of GP Equity	n/a	n/a	n/a	n/a	n/a	n/a	n/a	[e]
Total Market Value of Equity	$26,781	$24,840	$21,682	$18,575	$18,401	$17,105	$17,699	[f]= [d]
Market to Book Value of Common Equity	1.62	1.50	1.37	1.33	1.40	1.43	1.61	[g] = [f] / [a].
MARKET VALUE OF PREFERRED EQUITY								
Book Value of Preferred Equity	$252	$252	$252	$252	$252	$252	$252	[h]
Market Value of Preferred Equity	$252	$252	$252	$252	$252	$252	$252	[i] = [h].
MARKET VALUE OF DEBT								
Current Assets	$6,131	$6,131	$6,071	$5,522	$5,593	$5,877	$5,751	[j]
Current Liabilities	$6,108	$6,108	$5,726	$7,644	$5,436	$6,818	$7,184	[k]
Current Portion of Long-Term Debt	$0	$0	$0	$1,288	$110	$468	$899	[l]
Net Working Capital	$23	$23	$345	($834)	$267	($473)	($534)	[m] = [j] - ([k] - [l]).
Notes Payable (Short-Term Debt)	$881	$881	$426	$953	$397	$1,137	$1,076	[n]
Adjusted Short-Term Debt	$0	$0	$0	$834	$0	$473	$534	[o] = See Sources and Notes.
Long-Term Debt	$15,545	$15,545	$14,555	$11,918	$12,915	$11,626	$11,255	[p]
Book Value of Long-Term Debt	$15,545	$15,545	$14,555	$14,040	$13,025	$12,567	$12,688	[q] = [l] + [o] + [p].
Unadjusted Market Value of Long Term Debt	$16,203	$16,203	$13,798	$14,317	$13,356	$12,559	$12,189	
Carrying Amount	$14,128	$14,128	$12,684	$11,994	$11,317	$11,620	$11,050	
Adjustment to Book Value of Long-Term Debt	$2,075	$2,075	$1,114	$2,323	$2,039	$939	$1,139	[r] = See Sources and Notes.
Market Value of Long-Term Debt	$17,620	$17,620	$15,669	$16,363	$15,064	$13,506	$13,827	[s] = [q] + [r].
Market Value of Debt	$17,620	$17,620	$15,669	$16,363	$15,064	$13,506	$13,827	[t] = [s].
MARKET VALUE OF FIRM	$44,653	$42,712	$37,603	$35,190	$33,717	$30,863	$31,778	[u] = [f] + [i] + [t].
DEBT AND EQUITY TO MARKET VALUE RATIOS								
Common Equity - Market Value Ratio	59.98%	58.16%	57.66%	52.78%	54.57%	55.42%	55.70%	[v] = [f] / [u].
Preferred Equity - Market Value Ratio	0.56%	0.59%	0.67%	0.72%	0.75%	0.82%	0.79%	[w] = [i] / [u].
Debt - Market Value Ratio	39.46%	41.25%	41.67%	46.50%	44.68%	43.76%	43.51%	[x] = [t] / [u].

Sources and Notes:
Bloomberg as of February 10, 2016
Capital structure from 3rd Quarter, 2015 calculated using respective balance sheet information and 15-day average prices ending at period end.
The DCF Capital structure is calculated using 3rd Quarter, 2015 balance sheet information and a 15-trading day average closing price ending on 2/10/2016.
Prices are reported in Supporting Schedule #1 to Table No. BV-ELEC-6.
[o] =
(1): 0 if [m] > 0.
(2): The absolute value of [m] if [m] < 0 and |[m]| < [n].
(3): [n] if [m] < 0 and |[m]| > [n].
[r]: Difference between fair value of Long-Term debt and carrying amount of Long-Term debt per company 10-K. Data for adjustment is from 2014 10-K.

Table No. BV-ELEC-3

Market Value of the U.S. Electric Sample

Panel T: Pinnacle West Capital

($MM)

	DCF Capital Structure	3rd Quarter, 2015	3rd Quarter, 2014	3rd Quarter, 2013	3rd Quarter, 2012	3rd Quarter, 2011	3rd Quarter, 2010	Notes
MARKET VALUE OF COMMON EQUITY								
Book Value, Common Shareholder's Equity	$4,654	$4,654	$4,492	$4,276	$4,056	$3,894	$3,717	[a]
Shares Outstanding (in millions) - Common	111	111	110	110	110	109	109	[b]
Price per Share - Common	$66	$62	$56	$55	$53	$43	$41	[c]
Market Value of Common Equity	$7,355	$6,850	$6,196	$6,003	$5,792	$4,719	$4,456	[d] = [b] x [c].
Market Value of GP Equity	n/a	n/a	n/a	n/a	n/a	n/a	n/a	[e]
Total Market Value of Equity	$7,355	$6,850	$6,196	$6,003	$5,792	$4,719	$4,456	[f]= [d]
Market to Book Value of Common Equity	1.58	1.47	1.38	1.40	1.43	1.21	1.20	[g] = [f] / [a].
MARKET VALUE OF PREFERRED EQUITY								
Book Value of Preferred Equity	$0	$0	$0	$0	$0	$0	$0	[h]
Market Value of Preferred Equity	$0	$0	$0	$0	$0	$0	$0	[i] = [h].
MARKET VALUE OF DEBT								
Current Assets	$1,062	$1,062	$1,041	$1,350	$1,099	$1,591	$1,243	[j]
Current Liabilities	$1,523	$1,523	$1,449	$1,447	$949	$1,783	$968	[k]
Current Portion of Long-Term Debt	$411	$411	$369	$566	$90	$876	$239	[l]
Net Working Capital	($50)	($50)	($39)	$470	$240	$684	$514	[m] = [j] - ([k] - [l]).
Notes Payable (Short-Term Debt)	$57	$57	$19	$0	$0	$0	$0	[n]
Adjusted Short-Term Debt	$50	$50	$19	$0	$0	$0	$0	[o] = See Sources and Notes.
Long-Term Debt	$3,257	$3,257	$3,038	$2,820	$3,339	$3,047	$3,463	[p]
Book Value of Long-Term Debt	$3,719	$3,719	$3,426	$3,387	$3,429	$3,923	$3,702	[q] = [l] + [o] + [p].
Unadjusted Market Value of Long Term Debt	$3,839	$3,839	$3,579	$3,875	$3,926	$3,913	$3,774	
Carrying Amount	$3,415	$3,415	$3,337	$3,322	$3,496	$3,678	$3,648	
Adjustment to Book Value of Long-Term Debt	$424	$424	$242	$553	$430	$235	$126	[r] = See Sources and Notes.
Market Value of Long-Term Debt	$4,143	$4,143	$3,668	$3,940	$3,859	$4,158	$3,828	[s] = [q] + [r].
Market Value of Debt	$4,143	$4,143	$3,668	$3,940	$3,859	$4,158	$3,828	[t] = [s].
MARKET VALUE OF FIRM	$11,498	$10,993	$9,864	$9,943	$9,651	$8,877	$8,284	[u] = [f] + [i] + [t].
DEBT AND EQUITY TO MARKET VALUE RATIOS								
Common Equity - Market Value Ratio	63.97%	62.31%	62.81%	60.38%	60.01%	53.16%	53.79%	[v] = [f] / [u].
Preferred Equity - Market Value Ratio	-	-	-	-	-	-	-	[w] = [i] / [u].
Debt - Market Value Ratio	36.03%	37.69%	37.19%	39.62%	39.99%	46.84%	46.21%	[x] = [t] / [u].

Sources and Notes:
Bloomberg as of February 10, 2016
Capital structure from 3rd Quarter, 2015 calculated using respective balance sheet information and 15-day average prices ending at period end.
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Prices are reported in Supporting Schedule #1 to Table No. BV-ELEC-6.
[o] =
(1): 0 if [m] > 0.
(2): The absolute value of [m] if [m] < 0 and |[m]| < [n].
(3): [n] if [m] < 0 and |[m]| > [n].
[r]: Difference between fair value of Long-Term debt and carrying amount of Long-Term debt per company 10-K. Data for adjustment is from 2014 10-K.

Table No. BV-ELEC-3

Market Value of the U.S. Electric Sample

Panel U: Portland General

($MM)

	DCF Capital Structure	3rd Quarter, 2015	3rd Quarter, 2014	3rd Quarter, 2013	3rd Quarter, 2012	3rd Quarter, 2011	3rd Quarter, 2010	Notes
MARKET VALUE OF COMMON EQUITY								
Book Value, Common Shareholder's Equity	$2,232	$2,232	$1,889	$1,792	$1,717	$1,653	$1,585	[a]
Shares Outstanding (in millions) - Common	89	89	78	78	76	75	75	[b]
Price per Share - Common	$39	$36	$33	$28	$27	$24	$20	[c]
Market Value of Common Equity	$3,447	$3,155	$2,567	$2,212	$2,059	$1,798	$1,525	[d] = [b] x [c].
Market Value of GP Equity	n/a	n/a	n/a	n/a	n/a	n/a	n/a	[e]
Total Market Value of Equity	$3,447	$3,155	$2,567	$2,212	$2,059	$1,798	$1,525	[f]= [d]
Market to Book Value of Common Equity	1.54	1.41	1.36	1.23	1.20	1.09	0.96	[g] = [f] / [a].
MARKET VALUE OF PREFERRED EQUITY								
Book Value of Preferred Equity	$0	$0	$0	$0	$0	$0	$0	[h]
Market Value of Preferred Equity	$0	$0	$0	$0	$0	$0	$0	[i] = [h].
MARKET VALUE OF DEBT								
Current Assets	$605	$605	$542	$565	$784	$740	$750	[j]
Current Liabilities	$465	$465	$482	$380	$648	$511	$520	[k]
Current Portion of Long-Term Debt	$0	$0	$70	$50	$200	$0	$0	[l]
Net Working Capital	$140	$140	$130	$235	$336	$229	$230	[m] = [j] - ([k] - [l]).
Notes Payable (Short-Term Debt)	$0	$0	$0	$0	$0	$0	$20	[n]
Adjusted Short-Term Debt	$0	$0	$0	$0	$0	$0	$0	[o] = See Sources and Notes.
Long-Term Debt	$2,204	$2,204	$2,251	$1,761	$1,536	$1,798	$1,808	[p]
Book Value of Long-Term Debt	$2,204	$2,204	$2,321	$1,811	$1,736	$1,798	$1,808	[q] = [l] + [o] + [p].
Unadjusted Market Value of Long Term Debt	$2,901	$2,901	$2,074	$1,949	$2,091	$1,968	$1,818	
Carrying Amount	$2,501	$2,501	$1,916	$1,636	$1,735	$1,808	$1,744	
Adjustment to Book Value of Long-Term Debt	$400	$400	$158	$313	$356	$160	$74	[r] = See Sources and Notes.
Market Value of Long-Term Debt	$2,604	$2,604	$2,479	$2,124	$2,092	$1,958	$1,882	[s] = [q] + [r].
Market Value of Debt	$2,604	$2,604	$2,479	$2,124	$2,092	$1,958	$1,882	[t] = [s].
MARKET VALUE OF FIRM	$6,051	$5,759	$5,046	$4,336	$4,151	$3,756	$3,407	[u] = [f] + [i] + [t].
DEBT AND EQUITY TO MARKET VALUE RATIOS								
Common Equity - Market Value Ratio	56.97%	54.79%	50.87%	51.02%	49.60%	47.87%	44.76%	[v] = [f] / [u].
Preferred Equity - Market Value Ratio	-	-	-	-	-	-	-	[w] = [i] / [u].
Debt - Market Value Ratio	43.03%	45.21%	49.13%	48.98%	50.40%	52.13%	55.24%	[x] = [t] / [u].

Sources and Notes:
Bloomberg as of February 10, 2016
Capital structure from 3rd Quarter, 2015 calculated using respective balance sheet information and 15-day average prices ending at period end.
The DCF Capital structure is calculated using 3rd Quarter, 2015 balance sheet information and a 15-trading day average closing price ending on 2/10/2016.
Prices are reported in Supporting Schedule #1 to Table No. BV-ELEC-6.
[o] =
(1): 0 if [m] > 0.
(2): The absolute value of [m] if [m] < 0 and |[m]| < [n].
(3): [n] if [m] < 0 and |[m]| > [n].
[r]: Difference between fair value of Long-Term debt and carrying amount of Long-Term debt per company 10-K. Data for adjustment is from 2014 10-K.

Table No. BV-ELEC-3

Market Value of the U.S. Electric Sample

Panel V: Public Serv. Enterprise

($MM)

	DCF Capital Structure	3rd Quarter, 2015	3rd Quarter, 2014	3rd Quarter, 2013	3rd Quarter, 2012	3rd Quarter, 2011	3rd Quarter, 2010	Notes
MARKET VALUE OF COMMON EQUITY								
Book Value, Common Shareholder's Equity	$12,933	$12,933	$12,083	$11,338	$10,806	$10,159	$9,557	[a]
Shares Outstanding (in millions) - Common	505	505	506	506	506	506	506	[b]
Price per Share - Common	$41	$40	$38	$33	$32	$34	$32	[c]
Market Value of Common Equity	$20,749	$20,317	$18,979	$16,702	$16,052	$17,084	$16,359	[d] = [b] x [c].
Market Value of GP Equity	n/a	n/a	n/a	n/a	n/a	n/a	n/a	[e]
Total Market Value of Equity	$20,749	$20,317	$18,979	$16,702	$16,052	$17,084	$16,359	[f]= [d]
Market to Book Value of Common Equity	1.60	1.57	1.57	1.47	1.49	1.68	1.71	[g] = [f] / [a].
MARKET VALUE OF PREFERRED EQUITY								
Book Value of Preferred Equity	$0	$0	$0	$0	$0	$0	$0	[h]
Market Value of Preferred Equity	$0	$0	$0	$0	$0	$0	$0	[i] = [h].
MARKET VALUE OF DEBT								
Current Assets	$3,204	$3,204	$3,846	$3,741	$3,978	$4,970	$3,671	[j]
Current Liabilities	$3,604	$3,604	$3,136	$3,235	$3,039	$3,692	$3,018	[k]
Current Portion of Long-Term Debt	$1,106	$1,106	$574	$1,010	$975	$1,489	$1,004	[l]
Net Working Capital	$706	$706	$1,284	$1,516	$1,914	$2,767	$1,657	[m] = [j] - ([k] - [l]).
Notes Payable (Short-Term Debt)	$20	$20	$0	$0	$16	$298	$390	[n]
Adjusted Short-Term Debt	$0	$0	$0	$0	$0	$0	$0	[o] = See Sources and Notes.
Long-Term Debt	$8,132	$8,132	$8,389	$7,476	$7,334	$7,480	$8,152	[p]
Book Value of Long-Term Debt	$9,238	$9,238	$8,963	$8,486	$8,309	$8,969	$9,156	[q] = [l] + [o] + [p].
Unadjusted Market Value of Long Term Debt	$10,149	$10,149	$9,061	$9,324	$9,283	$9,836	$8,973	
Carrying Amount	$9,144	$9,144	$8,643	$7,939	$8,094	$8,940	$8,166	
Adjustment to Book Value of Long-Term Debt	$1,005	$1,005	$418	$1,385	$1,189	$896	$807	[r] = See Sources and Notes.
Market Value of Long-Term Debt	$10,243	$10,243	$9,381	$9,871	$9,498	$9,865	$9,963	[s] = [q] + [r].
Market Value of Debt	$10,243	$10,243	$9,381	$9,871	$9,498	$9,865	$9,963	[t] = [s].
MARKET VALUE OF FIRM	$30,992	$30,560	$28,360	$26,573	$25,550	$26,949	$26,322	[u] = [f] + [i] + [t].
DEBT AND EQUITY TO MARKET VALUE RATIOS								
Common Equity - Market Value Ratio	66.95%	66.48%	66.92%	62.85%	62.83%	63.39%	62.15%	[v] = [f] / [u].
Preferred Equity - Market Value Ratio	-	-	-	-	-	-	-	[w] = [i] / [u].
Debt - Market Value Ratio	33.05%	33.52%	33.08%	37.15%	37.17%	36.61%	37.85%	[x] = [t] / [u].

Sources and Notes:
Bloomberg as of February 10, 2016
Capital structure from 3rd Quarter, 2015 calculated using respective balance sheet information and 15-day average prices ending at period end.
The DCF Capital structure is calculated using 3rd Quarter, 2015 balance sheet information and a 15-trading day average closing price ending on 2/10/2016.
Prices are reported in Supporting Schedule #1 to Table No. BV-ELEC-6.
[o] =
(1): 0 if [m] > 0.
(2): The absolute value of [m] if [m] < 0 and |[m]| < [n].
(3): [n] if [m] < 0 and |[m]| > [n].
[r]: Difference between fair value of Long-Term debt and carrying amount of Long-Term debt per company 10-K. Data for adjustment is from 2014 10-K.

Table No. BV-ELEC-3

Market Value of the U.S. Electric Sample

Panel W: SCANA Corp.

($MM)

	DCF Capital Structure	3rd Quarter, 2015	3rd Quarter, 2014	3rd Quarter, 2013	3rd Quarter, 2012	3rd Quarter, 2011	3rd Quarter, 2010	Notes
MARKET VALUE OF COMMON EQUITY								
Book Value, Common Shareholder's Equity	$5,419	$5,419	$4,948	$4,598	$4,095	$3,838	$3,584	[a]
Shares Outstanding (in millions) - Common	143	143	142	140	132	130	127	[b]
Price per Share - Common	$63	$53	$50	$47	$48	$40	$40	[c]
Market Value of Common Equity	$9,019	$7,565	$7,105	$6,527	$6,379	$5,168	$5,109	[d] = [b] x [c].
Market Value of GP Equity	n/a	n/a	n/a	n/a	n/a	n/a	n/a	[e]
Total Market Value of Equity	$9,019	$7,565	$7,105	$6,527	$6,379	$5,168	$5,109	[f]= [d]
Market to Book Value of Common Equity	1.66	1.40	1.44	1.42	1.56	1.35	1.43	[g] = [f] / [a].
MARKET VALUE OF PREFERRED EQUITY								
Book Value of Preferred Equity	$0	$0	$0	$0	$0	$0	$0	[h]
Market Value of Preferred Equity	$0	$0	$0	$0	$0	$0	$0	[i] = [h].
MARKET VALUE OF DEBT								
Current Assets	$1,221	$1,221	$1,359	$1,351	$1,361	$1,421	$1,476	[j]
Current Liabilities	$1,294	$1,294	$1,536	$1,203	$1,411	$1,686	$1,968	[k]
Current Portion of Long-Term Debt	$16	$16	$52	$19	$176	$285	$631	[l]
Net Working Capital	($57)	($57)	($125)	$167	$126	$20	$139	[m] = [j] - ([k] - [l]).
Notes Payable (Short-Term Debt)	$264	$264	$487	$378	$394	$581	$335	[n]
Adjusted Short-Term Debt	$57	$57	$125	$0	$0	$0	$0	[o] = See Sources and Notes.
Long-Term Debt	$6,018	$6,018	$5,681	$5,431	$4,976	$4,376	$3,865	[p]
Book Value of Long-Term Debt	$6,091	$6,091	$5,858	$5,450	$5,152	$4,661	$4,496	[q] = [l] + [o] + [p].
Unadjusted Market Value of Long Term Debt	$6,592	$6,592	$5,916	$6,115	$5,479	$4,841	$4,726	
Carrying Amount	$5,697	$5,697	$5,449	$5,121	$4,653	$4,488	$4,511	
Adjustment to Book Value of Long-Term Debt	$895	$895	$467	$994	$826	$352	$215	[r] = See Sources and Notes.
Market Value of Long-Term Debt	$6,986	$6,986	$6,325	$6,444	$5,978	$5,013	$4,711	[s] = [q] + [r].
Market Value of Debt	$6,986	$6,986	$6,325	$6,444	$5,978	$5,013	$4,711	[t] = [s].
MARKET VALUE OF FIRM	$16,005	$14,551	$13,430	$12,971	$12,358	$10,181	$9,821	[u] = [f] + [i] + [t].
DEBT AND EQUITY TO MARKET VALUE RATIOS								
Common Equity - Market Value Ratio	56.35%	51.99%	52.90%	50.32%	51.62%	50.76%	52.03%	[v] = [f] / [u].
Preferred Equity - Market Value Ratio	-	-	-	-	-	-	-	[w] = [i] / [u].
Debt - Market Value Ratio	43.65%	48.01%	47.10%	49.68%	48.38%	49.24%	47.97%	[x] = [t] / [u].

Sources and Notes:
Bloomberg as of February 10, 2016
Capital structure from 3rd Quarter, 2015 calculated using respective balance sheet information and 15-day average prices ending at period end.
The DCF Capital structure is calculated using 3rd Quarter, 2015 balance sheet information and a 15-trading day average closing price ending on 2/10/2016.
Prices are reported in Supporting Schedule #1 to Table No. BV-ELEC-6.
[o] =
(1): 0 if [m] > 0.
(2): The absolute value of [m] if [m] < 0 and |[m]| < [n].
(3): [n] if [m] < 0 and |[m]| > [n].
[r]: Difference between fair value of Long-Term debt and carrying amount of Long-Term debt per company 10-K. Data for adjustment is from 2014 10-K.

Table No. BV-ELEC-3

Market Value of the U.S. Electric Sample

Panel X: Sempra Energy

($MM)

	DCF Capital Structure	3rd Quarter, 2015	3rd Quarter, 2014	3rd Quarter, 2013	3rd Quarter, 2012	3rd Quarter, 2011	3rd Quarter, 2010	Notes
MARKET VALUE OF COMMON EQUITY								
Book Value, Common Shareholder's Equity	$11,625	$11,625	$11,333	$10,909	$10,082	$9,630	$8,802	[a]
Shares Outstanding (in millions) - Common	248	248	246	244	242	240	242	[b]
Price per Share - Common	$94	$93	$105	$86	$65	$51	$53	[c]
Market Value of Common Equity	$23,364	$22,956	$25,772	$21,032	$15,801	$12,326	$12,924	[d] = [b] x [c].
Market Value of GP Equity	n/a	n/a	n/a	n/a	n/a	n/a	n/a	[e]
Total Market Value of Equity	$23,364	$22,956	$25,772	$21,032	$15,801	$12,326	$12,924	[f]= [d]
Market to Book Value of Common Equity	2.01	1.97	2.27	1.93	1.57	1.28	1.47	[g] = [f] / [a].
MARKET VALUE OF PREFERRED EQUITY								
Book Value of Preferred Equity	$20	$20	$20	$20	$99	$99	$179	[h]
Market Value of Preferred Equity	$20	$20	$20	$20	$99	$99	$179	[i] = [h].
MARKET VALUE OF DEBT								
Current Assets	$3,606	$3,606	$4,414	$3,712	$3,078	$2,938	$2,495	[j]
Current Liabilities	$5,118	$5,118	$4,292	$4,530	$4,349	$3,995	$3,777	[k]
Current Portion of Long-Term Debt	$1,168	$1,168	$188	$1,441	$709	$137	$313	[l]
Net Working Capital	($344)	($344)	$310	$623	($562)	($920)	($969)	[m] = [j] - ([k] - [l]).
Notes Payable (Short-Term Debt)	$1,097	$1,097	$1,309	$522	$584	$641	$574	[n]
Adjusted Short-Term Debt	$344	$344	$0	$0	$562	$641	$574	[o] = See Sources and Notes.
Long-Term Debt	$12,527	$12,527	$12,437	$10,478	$11,193	$10,033	$8,032	[p]
Book Value of Long-Term Debt	$14,039	$14,039	$12,625	$11,919	$12,464	$10,811	$8,919	[q] = [l] + [o] + [p].
Unadjusted Market Value of Long Term Debt	$13,699	$13,699	$12,676	$13,243	$11,047	$8,883	$8,572	
Carrying Amount	$12,347	$12,347	$12,022	$11,873	$9,826	$8,330	$8,004	
Adjustment to Book Value of Long-Term Debt	$1,352	$1,352	$654	$1,370	$1,221	$553	$568	[r] = See Sources and Notes.
Market Value of Long-Term Debt	$15,391	$15,391	$13,279	$13,289	$13,685	$11,364	$9,487	[s] = [q] + [r].
Market Value of Debt	$15,391	$15,391	$13,279	$13,289	$13,685	$11,364	$9,487	[t] = [s].
MARKET VALUE OF FIRM	$38,775	$38,367	$39,071	$34,341	$29,585	$23,789	$22,590	[u] = [f] + [i] + [t].
DEBT AND EQUITY TO MARKET VALUE RATIOS								
Common Equity - Market Value Ratio	60.26%	59.83%	65.96%	61.25%	53.41%	51.81%	57.21%	[v] = [f] / [u].
Preferred Equity - Market Value Ratio	0.05%	0.05%	0.05%	0.06%	0.33%	0.42%	0.79%	[w] = [i] / [u].
Debt - Market Value Ratio	39.69%	40.12%	33.99%	38.70%	46.26%	47.77%	42.00%	[x] = [t] / [u].

Sources and Notes:
Bloomberg as of February 10, 2016
Capital structure from 3rd Quarter, 2015 calculated using respective balance sheet information and 15-day average prices ending at period end.
The DCF Capital structure is calculated using 3rd Quarter, 2015 balance sheet information and a 15-trading day average closing price ending on 2/10/2016.
Prices are reported in Supporting Schedule #1 to Table No. BV-ELEC-6.
[o] =
(1): 0 if [m] > 0.
(2): The absolute value of [m] if [m] < 0 and |[m]| < [n].
(3): [n] if [m] < 0 and |[m]| > [n].
[r]: Difference between fair value of Long-Term debt and carrying amount of Long-Term debt per company 10-K. Data for adjustment is from 2014 10-K.

Table No. BV-ELEC-3

Market Value of the U.S. Electric Sample

Panel Y: Vectren Corp.

($MM)

	DCF Capital Structure	3rd Quarter, 2015	3rd Quarter, 2014	3rd Quarter, 2013	3rd Quarter, 2012	3rd Quarter, 2011	3rd Quarter, 2010	Notes
MARKET VALUE OF COMMON EQUITY								
Book Value, Common Shareholder's Equity	$1,650	$1,650	$1,581	$1,532	$1,506	$1,452	$1,411	[a]
Shares Outstanding (in millions) - Common	83	83	83	82	82	82	81	[b]
Price per Share - Common	$42	$40	$40	$33	$28	$27	$25	[c]
Market Value of Common Equity	$3,475	$3,324	$3,336	$2,736	$2,334	$2,222	$2,061	[d] = [b] x [c].
Market Value of GP Equity	n/a	n/a	n/a	n/a	n/a	n/a	n/a	[e]
Total Market Value of Equity	$3,475	$3,324	$3,336	$2,736	$2,334	$2,222	$2,061	[f]= [d]
Market to Book Value of Common Equity	2.11	2.02	2.11	1.79	1.55	1.53	1.46	[g] = [f] / [a].
MARKET VALUE OF PREFERRED EQUITY								
Book Value of Preferred Equity	$0	$0	$0	$0	$0	$0	$0	[h]
Market Value of Preferred Equity	$0	$0	$0	$0	$0	$0	$0	[i] = [h].
MARKET VALUE OF DEBT								
Current Assets	$539	$539	$493	$608	$569	$623	$506	[j]
Current Liabilities	$619	$619	$427	$607	$783	$699	$545	[k]
Current Portion of Long-Term Debt	$88	$88	$5	$30	$132	$138	$48	[l]
Net Working Capital	$8	$8	$71	$31	($82)	$62	$9	[m] = [j] - ([k] - [l]).
Notes Payable (Short-Term Debt)	$111	$111	$62	$249	$316	$216	$157	[n]
Adjusted Short-Term Debt	$0	$0	$0	$0	$82	$0	$0	[o] = See Sources and Notes.
Long-Term Debt	$1,523	$1,523	$1,572	$1,627	$1,454	$1,581	$1,590	[p]
Book Value of Long-Term Debt	$1,611	$1,611	$1,577	$1,657	$1,667	$1,719	$1,639	[q] = [l] + [o] + [p].
Unadjusted Market Value of Long Term Debt	$1,755	$1,755	$1,895	$1,873	$1,804	$1,841	$1,720	
Carrying Amount	$1,577	$1,577	$1,807	$1,660	$1,622	$1,716	$1,640	
Adjustment to Book Value of Long-Term Debt	$177	$177	$88	$214	$182	$125	$80	[r] = See Sources and Notes.
Market Value of Long-Term Debt	$1,788	$1,788	$1,665	$1,871	$1,850	$1,844	$1,719	[s] = [q] + [r].
Market Value of Debt	$1,788	$1,788	$1,665	$1,871	$1,850	$1,844	$1,719	[t] = [s].
MARKET VALUE OF FIRM	$5,263	$5,112	$5,001	$4,606	$4,184	$4,066	$3,780	[u] = [f] + [i] + [t].
DEBT AND EQUITY TO MARKET VALUE RATIOS								
Common Equity - Market Value Ratio	66.03%	65.03%	66.70%	59.39%	55.80%	54.64%	54.52%	[v] = [f] / [u].
Preferred Equity - Market Value Ratio	-	-	-	-	-	-	-	[w] = [i] / [u].
Debt - Market Value Ratio	33.97%	34.97%	33.30%	40.61%	44.20%	45.36%	45.48%	[x] = [t] / [u].

Sources and Notes:
Bloomberg as of February 10, 2016
Capital structure from 3rd Quarter, 2015 calculated using respective balance sheet information and 15-day average prices ending at period end.
The DCF Capital structure is calculated using 3rd Quarter, 2015 balance sheet information and a 15-trading day average closing price ending on 2/10/2016.
Prices are reported in Supporting Schedule #1 to Table No. BV-ELEC-6.
[o] =
(1): 0 if [m] > 0.
(2): The absolute value of [m] if [m] < 0 and |[m]| < [n].
(3): [n] if [m] < 0 and |[m]| > [n].
[r]: Difference between fair value of Long-Term debt and carrying amount of Long-Term debt per company 10-K. Data for adjustment is from 2014 10-K.

Table No. BV-ELEC-3

Market Value of the U.S. Electric Sample

Panel Z: Westar Energy

($MM)

	DCF Capital Structure	3rd Quarter, 2015	3rd Quarter, 2014	3rd Quarter, 2013	3rd Quarter, 2012	3rd Quarter, 2011	3rd Quarter, 2010	Notes
MARKET VALUE OF COMMON EQUITY								
Book Value, Common Shareholder's Equity	$3,663	$3,663	$3,265	$3,033	$2,887	$2,588	$2,385	[a]
Shares Outstanding (in millions) - Common	141	141	131	127	126	117	111	[b]
Price per Share - Common	$44	$37	$35	$31	$29	$26	$24	[c]
Market Value of Common Equity	$6,146	$5,239	$4,550	$3,885	$3,718	$3,076	$2,667	[d] = [b] x [c].
Market Value of GP Equity	n/a	n/a	n/a	n/a	n/a	n/a	n/a	[e]
Total Market Value of Equity	$6,146	$5,239	$4,550	$3,885	$3,718	$3,076	$2,667	[f]= [d]
Market to Book Value of Common Equity	1.68	1.43	1.39	1.28	1.29	1.19	1.12	[g] = [f] / [a].
MARKET VALUE OF PREFERRED EQUITY								
Book Value of Preferred Equity	$0	$0	$0	$0	$0	$21	$21	[h]
Market Value of Preferred Equity	$0	$0	$0	$0	$0	$21	$21	[i] = [h].
MARKET VALUE OF DEBT								
Current Assets	$758	$758	$749	$694	$678	$605	$586	[j]
Current Liabilities	$879	$879	$801	$854	$741	$888	$634	[k]
Current Portion of Long-Term Debt	$28	$28	$28	$278	$27	$28	$30	[l]
Net Working Capital	($93)	($93)	($24)	$118	($36)	($255)	($17)	[m] = [j] - ([k] - [l]).
Notes Payable (Short-Term Debt)	$304	$304	$202	$52	$215	$392	$163	[n]
Adjusted Short-Term Debt	$93	$93	$24	$0	$36	$255	$17	[o] = See Sources and Notes.
Long-Term Debt	$3,080	$3,080	$3,382	$3,164	$3,062	$2,742	$2,779	[p]
Book Value of Long-Term Debt	$3,201	$3,201	$3,434	$3,442	$3,124	$3,025	$2,826	[q] = [l] + [o] + [p].
Unadjusted Market Value of Long Term Debt	$3,488	$3,488	$3,294	$3,179	$2,624	$2,571	$2,528	
Carrying Amount	$3,105	$3,105	$3,103	$2,703	$2,373	$2,373	$2,374	
Adjustment to Book Value of Long-Term Debt	$383	$383	$192	$476	$251	$197	$155	[r] = See Sources and Notes.
Market Value of Long-Term Debt	$3,584	$3,584	$3,625	$3,918	$3,375	$3,222	$2,981	[s] = [q] + [r].
Market Value of Debt	$3,584	$3,584	$3,625	$3,918	$3,375	$3,222	$2,981	[t] = [s].
MARKET VALUE OF FIRM	$9,730	$8,824	$8,175	$7,803	$7,093	$6,319	$5,669	[u] = [f] + [i] + [t].
DEBT AND EQUITY TO MARKET VALUE RATIOS								
Common Equity - Market Value Ratio	63.16%	59.38%	55.65%	49.79%	52.42%	48.67%	47.04%	[v] = [f] / [u].
Preferred Equity - Market Value Ratio	-	-	-	-	-	0.34%	0.38%	[w] = [i] / [u].
Debt - Market Value Ratio	36.84%	40.62%	44.35%	50.21%	47.58%	50.99%	52.58%	[x] = [t] / [u].

Sources and Notes:
Bloomberg as of February 10, 2016
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Prices are reported in Supporting Schedule #1 to Table No. BV-ELEC-6.
[o] =
(1): 0 if [m] > 0.
(2): The absolute value of [m] if [m] < 0 and |[m]| < [n].
(3): [n] if [m] < 0 and |[m]| > [n].
[r]: Difference between fair value of Long-Term debt and carrying amount of Long-Term debt per company 10-K. Data for adjustment is from 2014 10-K.

Table No. BV-ELEC-3

Market Value of the U.S. Electric Sample

Panel AA: Xcel Energy Inc.

($MM)

	DCF Capital Structure	3rd Quarter, 2015	3rd Quarter, 2014	3rd Quarter, 2013	3rd Quarter, 2012	3rd Quarter, 2011	3rd Quarter, 2010	Notes
MARKET VALUE OF COMMON EQUITY								
Book Value, Common Shareholder's Equity	$10,545	$10,545	$10,155	$9,547	$8,850	$8,431	$7,606	[a]
Shares Outstanding (in millions) - Common	507	507	505	498	488	485	460	[b]
Price per Share - Common	$38	$34	$31	$28	$28	$25	$23	[c]
Market Value of Common Equity	$19,349	$17,219	$15,664	$13,799	$13,528	$12,021	$10,539	[d] = [b] x [c].
Market Value of GP Equity	n/a	n/a	n/a	n/a	n/a	n/a	n/a	[e]
Total Market Value of Equity	$19,349	$17,219	$15,664	$13,799	$13,528	$12,021	$10,539	[f]= [d]
Market to Book Value of Common Equity	1.83	1.63	1.54	1.45	1.53	1.43	1.39	[g] = [f] / [a].
MARKET VALUE OF PREFERRED EQUITY								
Book Value of Preferred Equity	$0	$0	$0	$0	$0	$105	$105	[h]
Market Value of Preferred Equity	$0	$0	$0	$0	$0	$105	$105	[i] = [h].
MARKET VALUE OF DEBT								
Current Assets	$3,344	$3,344	$3,197	$3,121	$3,371	$2,861	$2,530	[j]
Current Liabilities	$3,085	$3,085	$3,471	$2,839	$3,161	$2,653	$2,199	[k]
Current Portion of Long-Term Debt	$457	$457	$258	$281	$859	$462	$414	[l]
Net Working Capital	$717	$717	($17)	$562	$1,070	$671	$744	[m] = [j] - ([k] - [l]).
Notes Payable (Short-Term Debt)	$64	$64	$697	$302	$304	$50	$40	[n]
Adjusted Short-Term Debt	$0	$0	$17	$0	$0	$0	$0	[o] = See Sources and Notes.
Long-Term Debt	$12,691	$12,691	$11,502	$10,914	$10,106	$9,450	$8,865	[p]
Book Value of Long-Term Debt	$13,148	$13,148	$11,776	$11,195	$10,965	$9,913	$9,279	[q] = [l] + [o] + [p].
Unadjusted Market Value of Long Term Debt	$13,360	$13,360	$11,879	$12,208	$11,735	$10,225	$9,026	
Carrying Amount	$11,757	$11,757	$11,192	$10,402	$9,908	$9,319	$8,432	
Adjustment to Book Value of Long-Term Debt	$1,603	$1,603	$687	$1,806	$1,826	$906	$594	[r] = See Sources and Notes.
Market Value of Long-Term Debt	$14,751	$14,751	$12,463	$13,001	$12,792	$10,819	$9,873	[s] = [q] + [r].
Market Value of Debt	$14,751	$14,751	$12,463	$13,001	$12,792	$10,819	$9,873	[t] = [s].
MARKET VALUE OF FIRM	$34,100	$31,970	$28,128	$26,800	$26,319	$22,945	$20,517	[u] = [f] + [i] + [t].
DEBT AND EQUITY TO MARKET VALUE RATIOS								
Common Equity - Market Value Ratio	56.74%	53.86%	55.69%	51.49%	51.40%	52.39%	51.37%	[v] = [f] / [u].
Preferred Equity - Market Value Ratio	-	-	-	-	-	0.46%	0.51%	[w] = [i] / [u].
Debt - Market Value Ratio	43.26%	46.14%	44.31%	48.51%	48.60%	47.15%	48.12%	[x] = [t] / [u].

Sources and Notes:
Bloomberg as of February 10, 2016
Capital structure from 3rd Quarter, 2015 calculated using respective balance sheet information and 15-day average prices ending at period end.
The DCF Capital structure is calculated using 3rd Quarter, 2015 balance sheet information and a 15-trading day average closing price ending on 2/10/2016.
Prices are reported in Supporting Schedule #1 to Table No. BV-ELEC-6.
[o] =
(1): 0 if [m] > 0.
(2): The absolute value of [m] if [m] < 0 and |[m]| < [n].
(3): [n] if [m] < 0 and |[m]| > [n].
[r]: Difference between fair value of Long-Term debt and carrying amount of Long-Term debt per company 10-K. Data for adjustment is from 2014 10-K.

Table No. BV-ELEC-4

Capital Structure Summary

Company	DCF Capital Structure			5-Year Average Capital Structure		
	Common Equity - Value Ratio [1]	Preferred Equity - Value Ratio [2]	Debt - Value Ratio [3]	Common Equity - Value Ratio [4]	Preferred Equity - Value Ratio [5]	Debt - Value Ratio [6]
ALLETE	59.8%	0.0%	40.2%	60.2%	0.0%	39.8%
Alliant Energy	61.2%	1.7%	37.1%	57.8%	2.3%	39.9%
Amer. Elec. Power	56.8%	0.0%	43.2%	52.0%	0.0%	48.0%
Ameren Corp.	59.6%	0.0%	40.4%	52.6%	0.0%	47.4%
CenterPoint Energy	45.1%	0.0%	54.9%	47.8%	0.0%	52.2%
CMS Energy Corp.	52.7%	0.0%	47.3%	42.6%	0.2%	57.2%
Consol. Edison	59.1%	0.0%	40.9%	56.9%	0.2%	42.9%
Dominion Resources	59.8%	0.0%	40.2%	59.6%	0.4%	40.0%
DTE Energy	59.7%	0.0%	40.3%	55.1%	0.0%	44.9%
Edison Int'l	55.7%	5.6%	38.7%	50.1%	5.2%	44.7%
El Paso Electric	54.9%	0.0%	45.1%	55.9%	0.0%	44.1%
Entergy Corp.	47.5%	0.8%	51.7%	49.2%	1.2%	49.7%
G't Plains Energy	51.3%	0.5%	48.2%	45.4%	0.5%	54.0%
IDACORP Inc.	64.2%	0.0%	35.8%	57.1%	0.0%	42.9%
MGE Energy	78.8%	0.0%	21.2%	73.5%	0.0%	26.5%
NextEra Energy	61.7%	0.0%	38.3%	53.9%	0.0%	46.1%
OGE Energy	67.0%	0.0%	33.0%	65.0%	0.0%	35.0%
Otter Tail Corp.	63.1%	0.0%	36.9%	63.1%	0.6%	36.3%
PG&E Corp.	60.0%	0.6%	39.5%	55.5%	0.7%	43.8%
Pinnacle West Capital	64.0%	0.0%	36.0%	58.9%	0.0%	41.1%
Portland General	57.0%	0.0%	43.0%	49.8%	0.0%	50.2%
Public Serv. Enterprise	66.9%	0.0%	33.1%	64.1%	0.0%	35.9%
SCANA Corp.	56.4%	0.0%	43.6%	51.5%	0.0%	48.5%
Sempra Energy	60.3%	0.1%	39.7%	58.2%	0.3%	41.6%
Vectren Corp.	66.0%	0.0%	34.0%	59.3%	0.0%	40.7%
Westar Energy	63.2%	0.0%	36.8%	51.9%	0.1%	47.9%
Xcel Energy Inc.	56.7%	0.0%	43.3%	52.7%	0.1%	47.1%
Average	59.6%	0.3%	40.1%	55.5%	0.4%	44.0%
Nuclear Subsample Average	59.7%	0.3%	40.0%	55.8%	0.5%	43.7%

Sources and Notes:
[1], [4]: Supporting Schedule #1 to Table No. BV-ELEC-4.
[2], [5]: Supporting Schedule #2 to Table No. BV-ELEC-4.
[3], [6]: Supporting Schedule #3 to Table No. BV-ELEC-4.
Values in this table may not add up exactly to 100% because of rounding.

Table No. BV-ELEC-5

Estimated Growth Rates

Company	ThomsonOne IBES Estimate		Value Line			Combined Growth Rate
	Long-Term Growth Rate	Number of Estimates	EPS Year 2015 Estimate	EPS Year 2018-2020 Estimate	Annualized Growth Rate	
	[1]	[2]	[3]	[4]	[5]	[6]
ALLETE	5.0%	1	$3.50	$4.00	3.4%	4.2%
Alliant Energy	5.6%	2	$3.65	$4.55	5.7%	5.6%
Amer. Elec. Power	4.6%	5	$3.70	$4.25	3.5%	4.4%
Ameren Corp.	6.0%	2	$2.45	$3.50	9.3%	7.1%
CenterPoint Energy	0.4%	3	$1.10	$1.35	5.3%	1.6%
CMS Energy Corp.	6.7%	4	$1.88	$2.25	4.6%	6.3%
Consol. Edison	2.9%	5	$3.95	$4.50	3.3%	3.0%
Dominion Resources	5.5%	6	$3.50	$4.75	7.9%	5.8%
DTE Energy	5.0%	5	$4.60	$5.75	5.7%	5.1%
Edison Int'l	-0.5%	5	$4.40	$5.25	4.5%	0.3%
El Paso Electric	7.0%	1	$1.95	$2.75	9.0%	8.0%
Entergy Corp.	-2.5%	5	$6.00	$5.25	-3.3%	-2.6%
G't Plains Energy	4.8%	3	$1.35	$2.00	10.3%	6.2%
IDACORP Inc.	4.0%	1	$3.90	$4.25	2.2%	3.1%
MGE Energy	4.0%	1	$2.25	$3.15	8.8%	6.4%
NextEra Energy	7.1%	5	$6.05	$7.75	6.4%	7.0%
OGE Energy	2.2%	3	$1.75	$2.25	6.5%	3.2%
Otter Tail Corp.	6.0%	1	$1.60	$2.25	8.9%	7.4%
PG&E Corp.	5.8%	6	$1.90	$4.25	22.3%	8.2%
Pinnacle West Capital	4.9%	4	$3.85	$4.50	4.0%	4.8%
Portland General	4.1%	4	$2.15	$2.75	6.3%	4.6%
Public Serv. Enterprise	1.4%	3	$3.15	$3.50	2.7%	1.7%
SCANA Corp.	4.5%	2	$3.85	$4.50	4.0%	4.3%
Sempra Energy	9.4%	2	$4.80	$7.25	10.9%	9.9%
Vectren Corp.	5.0%	2	$2.35	$3.25	8.4%	6.1%
Westar Energy	3.5%	3	$2.25	$3.10	8.3%	4.7%
Xcel Energy Inc.	4.7%	3	$2.05	$2.50	5.1%	4.8%

Sources and Notes:

[1] - [2]: Updated from ThomsonOne as of Feb 10, 2016.

[3] - [4]: From Valueline Investment Analyzer as of Feb 09, 2016.

[5]: ([4]/[3])^(1/4) - 1, where 4 is the number of years between 2019, the middle year of Value Line's 3-5 year forecast, and our study year 2015.

[6]: Weighted average growth rate.

Table No. BV-ELEC-6

DCF Cost of Equity of the U.S. Electric Sample

Panel A: Simple DCF Method (Quarterly)

Company	Stock Price [1]	Most Recent Dividend [2]	Quarterly Dividend Yield (t+1) [3]	Combined Long-Term Growth Rate [4]	Quarterly Growth Rate [5]	DCF Cost of Equity [6]
ALLETE	$51.84	$0.51	0.98%	4.2%	1.0%	8.3%
Alliant Energy	$65.26	$0.59	0.91%	5.6%	1.4%	9.4%
Amer. Elec. Power	$60.29	$0.56	0.94%	4.4%	1.1%	8.3%
Ameren Corp.	$44.89	$0.43	0.96%	7.1%	1.7%	11.2%
CenterPoint Energy	$17.87	$0.25	1.39%	1.6%	0.4%	7.4%
CMS Energy Corp.	$38.24	$0.31	0.82%	6.3%	1.5%	9.8%
Consol. Edison	$70.35	$0.65	0.93%	3.0%	0.7%	6.9%
Dominion Resources	$70.14	$0.65	0.94%	5.8%	1.4%	9.8%
DTE Energy	$84.26	$0.73	0.88%	5.1%	1.3%	8.8%
Edison Int'l	$61.87	$0.48	0.78%	0.3%	0.1%	3.5%
El Paso Electric	$40.31	$0.30	0.75%	8.0%	1.9%	11.2%
Entergy Corp.	$69.76	$0.85	1.21%	-2.6%	-0.7%	2.2%
G't Plains Energy	$27.99	$0.26	0.95%	6.2%	1.5%	10.2%
IDACORP Inc.	$68.34	$0.51	0.75%	3.1%	0.8%	6.2%
MGE Energy	$48.72	$0.30	0.61%	6.4%	1.6%	9.0%
NextEra Energy	$110.89	$0.77	0.71%	7.0%	1.7%	10.0%
OGE Energy	$25.89	$0.28	1.07%	3.2%	0.8%	7.7%
Otter Tail Corp.	$27.22	$0.31	1.17%	7.4%	1.8%	12.5%
PG&E Corp.	$54.64	$0.46	0.85%	8.2%	2.0%	11.8%
Pinnacle West Capital	$66.36	$0.63	0.95%	4.8%	1.2%	8.8%
Portland General	$38.83	$0.30	0.78%	4.6%	1.1%	7.8%
Public Serv. Enterprise	$41.06	$0.39	0.95%	1.7%	0.4%	5.6%
SCANA Corp.	$63.12	$0.55	0.87%	4.3%	1.1%	7.9%
Sempra Energy	$94.21	$0.70	0.76%	9.9%	2.4%	13.2%
Vectren Corp.	$42.02	$0.40	0.97%	6.1%	1.5%	10.2%
Westar Energy	$43.50	$0.36	0.84%	4.7%	1.2%	8.2%
Xcel Energy Inc.	$38.14	$0.32	0.85%	4.8%	1.2%	8.3%

Sources and Notes:
[1]: Supporting Schedule #1 to Table No. BV-ELEC-6.
[2]: Supporting Schedule #2 to Table No. BV-ELEC-6.
[3]: ([2] / [1]) x (1 + [5]).
[4]: Table No. BV-ELEC-5, [6].
[5]: {(1 + [4]) ^ (1/4)} - 1.
[6]: {([3] + [5] + 1) ^ 4} - 1.

Table No. BV-ELEC-7

Overall After-Tax DCF Cost of Capital of the U.S. Electric Sample

Panel A: Simple DCF Method (Quarterly)

Company	3rd Quarter, 2015 Bond Rating [1]	3rd Quarter, 2015 Preferred Equity Rating [2]	DCF Cost of Equity [3]	DCF Common Equity to Market Value Ratio [4]	Cost of Preferred Equity [5]	DCF Preferred Equity to Market Value Ratio [6]	DCF Cost of Debt [7]	DCF Debt to Market Value Ratio [8]	APS Representative Income Tax Rate [9]	Overall After-Tax Cost of Capital [10]
ALLETE	BBB	-	8.3%	59.8%	-	0.0%	4.7%	40.2%	39.5%	6.10%
Alliant Energy	A	A	9.4%	61.2%	4.1%	1.7%	4.1%	37.1%	39.5%	6.77%
Amer. Elec. Power	BBB	-	8.3%	56.8%	-	0.0%	4.7%	43.2%	39.5%	5.94%
Ameren Corp.	BBB	-	11.2%	59.6%	-	0.0%	4.7%	40.4%	39.5%	7.83%
CenterPoint Energy	A	-	7.4%	45.1%	-	0.0%	4.1%	54.9%	39.5%	4.69%
CMS Energy Corp.	BBB	-	9.8%	52.7%	-	0.0%	4.7%	47.3%	39.5%	6.49%
Consol. Edison	A	-	6.9%	59.1%	-	0.0%	4.1%	40.9%	39.5%	5.08%
Dominion Resources	A	-	9.8%	59.8%	-	0.0%	4.1%	40.2%	39.5%	6.86%
DTE Energy	BBB	-	8.8%	59.7%	-	0.0%	4.7%	40.3%	39.5%	6.39%
Edison Int'l	BBB	BBB	3.5%	55.7%	4.7%	5.6%	4.7%	38.7%	39.5%	~~2.3%~~
El Paso Electric	BBB	-	11.2%	54.9%	-	0.0%	4.7%	45.1%	39.5%	7.41%
Entergy Corp.	BBB	BBB	2.2%	47.5%	4.7%	0.8%	4.7%	51.7%	39.5%	~~2.6%~~
G't Plains Energy	BBB	BBB	10.2%	51.3%	4.7%	0.5%	4.7%	48.2%	39.5%	6.62%
IDACORP Inc.	BBB	-	6.2%	64.2%	-	0.0%	4.7%	35.8%	39.5%	4.99%
MGE Energy	AA	-	9.0%	78.8%	-	0.0%	3.9%	21.2%	39.5%	7.58%
NextEra Energy	A	-	10.0%	61.7%	-	0.0%	4.1%	38.3%	39.5%	7.10%
OGE Energy	A	-	7.7%	67.0%	-	0.0%	4.1%	33.0%	39.5%	5.98%
Otter Tail Corp.	BBB	-	12.5%	63.1%	-	0.0%	4.7%	36.9%	39.5%	8.91%
PG&E Corp.	BBB	BBB	11.8%	60.0%	4.7%	0.6%	4.7%	39.5%	39.5%	8.22%
Pinnacle West Capital	A	-	8.8%	64.0%	-	0.0%	4.1%	36.0%	39.5%	6.50%
Portland General	BBB	-	7.8%	57.0%	-	0.0%	4.7%	43.0%	39.5%	5.67%
Public Serv. Enterprise	BBB	-	5.6%	66.9%	-	0.0%	4.7%	33.1%	39.5%	~~4.69%~~
SCANA Corp.	BBB	-	7.9%	56.4%	-	0.0%	4.7%	43.6%	39.5%	5.70%
Sempra Energy	BBB	BBB	13.2%	60.3%	4.7%	0.1%	4.7%	39.7%	39.5%	9.05%
Vectren Corp.	A	-	10.2%	66.0%	-	0.0%	4.1%	34.0%	39.5%	7.61%
Westar Energy	BBB	-	8.2%	63.2%	-	0.0%	4.7%	36.8%	39.5%	6.23%
Xcel Energy Inc.	A	-	8.3%	56.7%	-	0.0%	4.1%	43.3%	39.5%	5.81%
Simple Full Sample Average			9.3%	59.9%	4.5%	0.1%	4.4%	40.0%	39.5%	6.65%
Simple Nuclear Subsample Average			9.7%	60.3%	4.4%	0.3%	4.4%	39.4%	39.5%	6.92%

Sources and Notes:

[1]: S&P Credit Ratings from Research Insight.

[2]: Preferred ratings were assumed equal to debt ratings.

[3]: Table No. BV-ELEC-6; Panel A, [6].

[4]: Table No. BV-ELEC-4, [1].

[5]: Supporting Schedule #2 to Table No. BV-ELEC-11, Panel C.

[6]: Table No. BV-ELEC-4, [2].

[7]: Supporting Schedule #2 to Table No. BV-ELEC-11, Panel B.

[8]: Table No. BV-ELEC-4, [3].

[9]: APS Effective Corporate Tax Rate.

[10]: ([3] x [4]) + ([5] x [6]) + {[7] x [8] x (1 - [9])}. A strikethrough indicates the utility was excluded from the full sample average calculation as a result of its cost of equity not exceeding its cost of debt by 100 basis points.

Table No. BV-ELEC-8

DCF Cost of Equity at Representative Deemed Capital Structure

	Overall After -Tax Cost of Capital [1]	APS Representative Base Deemed % Debt [2]	Representative Cost of A Rated Utility Debt [3]	APS Representative Income Tax Rate [4]	APS Representative Base Deemed % Equity [5]	Estimated Return on Equity [6]
Full Sample						
Simple DCF Quarterly	6.6%	44.0%	4.1%	39.5%	56.0%	9.9%
Nuclear Subsample						
Simple DCF Quarterly	6.9%	44.0%	4.1%	39.5%	56.0%	10.4%

Sources and Notes:
[1]: Table No. BV-ELEC-7; Panels A-B, [10].
[2]: APS Assumed Capital Structure.
[3]: Based on an A rating. Yield from Bloomberg as of February 10, 2016.
[4]: APS Effective Corporate Tax Rate.
[5]: APS Assumed Capital Structure.
[6]: {[1] - ([2] x [3] x (1 - [4]))} / [5].

Table No. BV-ELEC-9

Risk Free Rate

[1]	Consensus 10-Year Forecast	3.40%
	U.S. Government Bond Yields	
[2]	20-Year	5.21%
[3]	10-Year	4.68%
[4]	Maturity Premium	0.53%
[5]	Consensus 10-Year Forecast Adjusted to 20-year Horizon	3.93%

Sources and Notes:

[1]: Bluechip Consensus Forecast in January 2016.

[2]-[3]: Supporting Schedule # 1 to Table No. BV-ELEC-9. Averages of monthly bond yields from January 1991 through January 2016.

[4]: [2] - [3].

[5]: [1] + [4].

Table No. BV-ELEC-10

Risk Positioning Cost of Equity of the U.S. Electric Sample

Panel A: Scenario 1 - Long-Term Risk Free Rate of 4.73%, Long-Term Market Risk Premium of 7.00%

Company	Long-Term Risk-Free Rate [1]	Value Line Betas [2]	Long-Term Market Risk Premium [3]	CAPM Cost of Equity [4]	ECAPM (1.5%) Cost of Equity [5]
ALLETE	4.73%	0.80	7.00%	10.3%	10.6%
Alliant Energy	4.73%	0.80	7.00%	10.3%	10.6%
Amer. Elec. Power	4.73%	0.70	7.00%	9.6%	10.1%
Ameren Corp.	4.73%	0.75	7.00%	10.0%	10.4%
CenterPoint Energy	4.73%	0.85	7.00%	10.7%	10.9%
CMS Energy Corp.	4.73%	0.75	7.00%	10.0%	10.4%
Consol. Edison	4.73%	0.60	7.00%	8.9%	9.5%
Dominion Resources	4.73%	0.70	7.00%	9.6%	10.1%
DTE Energy	4.73%	0.75	7.00%	10.0%	10.4%
Edison Int'l	4.73%	0.70	7.00%	9.6%	10.1%
El Paso Electric	4.73%	0.75	7.00%	10.0%	10.4%
Entergy Corp.	4.73%	0.70	7.00%	9.6%	10.1%
G't Plains Energy	4.73%	0.85	7.00%	10.7%	10.9%
IDACORP Inc.	4.73%	0.80	7.00%	10.3%	10.6%
MGE Energy	4.73%	0.75	7.00%	10.0%	10.4%
NextEra Energy	4.73%	0.75	7.00%	10.0%	10.4%
OGE Energy	4.73%	0.95	7.00%	11.4%	11.5%
Otter Tail Corp.	4.73%	0.85	7.00%	10.7%	10.9%
PG&E Corp.	4.73%	0.70	7.00%	9.6%	10.1%
Pinnacle West Capital	4.73%	0.75	7.00%	10.0%	10.4%
Portland General	4.73%	0.80	7.00%	10.3%	10.6%
Public Serv. Enterprise	4.73%	0.75	7.00%	10.0%	10.4%
SCANA Corp.	4.73%	0.75	7.00%	10.0%	10.4%
Sempra Energy	4.73%	0.80	7.00%	10.3%	10.6%
Vectren Corp.	4.73%	0.75	7.00%	10.0%	10.4%
Westar Energy	4.73%	0.75	7.00%	10.0%	10.4%
Xcel Energy Inc.	4.73%	0.65	7.00%	9.3%	9.8%
Average				10.0%	10.4%
Nuclear Subsample Average				9.9%	10.3%

Sources and Notes:
[1]: Villadsen Direct Testimony.
[2]: Bloomberg as of February 10, 2016.
[3]: Villadsen Direct Testimony.
[4]: [1] + ([2] x [3]).
[5]: ([1] + 1.5%) + [2] x ([3] - 1.5%).

Table No. BV-ELEC-10

Risk Positioning Cost of Equity of the U.S. Electric Sample

Panel B: Scenario 2 - Long-Term Risk Free Rate of 3.93%, Long-Term Market Risk Premium of 8.00%

Company	Long-Term Risk-Free Rate [1]	Value Line Betas [2]	Long-Term Market Risk Premium [3]	CAPM Cost of Equity [4]	ECAPM (1.5%) Cost of Equity [5]
ALLETE	3.93%	0.80	8.00%	10.3%	10.6%
Alliant Energy	3.93%	0.80	8.00%	10.3%	10.6%
Amer. Elec. Power	3.93%	0.70	8.00%	9.5%	10.0%
Ameren Corp.	3.93%	0.75	8.00%	9.9%	10.3%
CenterPoint Energy	3.93%	0.85	8.00%	10.7%	11.0%
CMS Energy Corp.	3.93%	0.75	8.00%	9.9%	10.3%
Consol. Edison	3.93%	0.60	8.00%	8.7%	9.3%
Dominion Resources	3.93%	0.70	8.00%	9.5%	10.0%
DTE Energy	3.93%	0.75	8.00%	9.9%	10.3%
Edison Int'l	3.93%	0.70	8.00%	9.5%	10.0%
El Paso Electric	3.93%	0.75	8.00%	9.9%	10.3%
Entergy Corp.	3.93%	0.70	8.00%	9.5%	10.0%
G't Plains Energy	3.93%	0.85	8.00%	10.7%	11.0%
IDACORP Inc.	3.93%	0.80	8.00%	10.3%	10.6%
MGE Energy	3.93%	0.75	8.00%	9.9%	10.3%
NextEra Energy	3.93%	0.75	8.00%	9.9%	10.3%
OGE Energy	3.93%	0.95	8.00%	11.5%	11.6%
Otter Tail Corp.	3.93%	0.85	8.00%	10.7%	11.0%
PG&E Corp.	3.93%	0.70	8.00%	9.5%	10.0%
Pinnacle West Capital	3.93%	0.75	8.00%	9.9%	10.3%
Portland General	3.93%	0.80	8.00%	10.3%	10.6%
Public Serv. Enterprise	3.93%	0.75	8.00%	9.9%	10.3%
SCANA Corp.	3.93%	0.75	8.00%	9.9%	10.3%
Sempra Energy	3.93%	0.80	8.00%	10.3%	10.6%
Vectren Corp.	3.93%	0.75	8.00%	9.9%	10.3%
Westar Energy	3.93%	0.75	8.00%	9.9%	10.3%
Xcel Energy Inc.	3.93%	0.65	8.00%	9.1%	9.7%
Average				10.0%	10.4%
Nuclear Subsample Average				9.9%	10.2%

Sources and Notes:
[1]: Villadsen Direct Testimony.
[2]: Bloomberg as of February 10, 2016.
[3]: Villadsen Direct Testimony.
[4]: [1] + ([2] x [3]).
[5]: ([1] + 1.5%) + [2] x ([3] - 1.5%).

Table No. BV-ELEC-11

Overall After-Tax Cost of Capital of the U.S. Electric Sample

Panel A: CAPM Cost of Equity Scenario 1 - Long-Term Risk Free Rate of 4.73%, Long-Term Market Risk Premium of 7.00%

Company	CAPM Cost of Equity [1]	ECAPM (1.5%) Cost of Equity [2]	5-Year Average Common Equity to Market Value Ratio [3]	Weighted - Average Cost of Preferred Equity [4]	5-Year Average Preferred Equity to Market Value Ratio [5]	Weighted-Average Cost of Debt [6]	5-Year Average Debt to Market Value Ratio [7]	APS Representative Income Tax Rate [8]	Overall After-Tax Cost of Capital (CAPM) [9]	Overall After-Tax Cost of Capital (ECAPM 1.5%) [10]
ALLETE	10.3%	10.6%	60.2%	-	0.0%	4.65%	39.8%	39.5%	7.3%	7.5%
Alliant Energy	10.3%	10.6%	57.8%	4.34%	2.3%	4.34%	39.9%	39.5%	7.1%	7.3%
Amer. Elec. Power	9.6%	10.1%	52.0%	4.65%	0.0%	4.65%	48.0%	39.5%	6.4%	6.6%
Ameren Corp.	10.0%	10.4%	52.6%	-	0.0%	4.65%	47.4%	39.5%	6.6%	6.8%
CenterPoint Energy	10.7%	10.9%	47.8%	-	0.0%	4.34%	52.2%	39.5%	6.5%	6.6%
CMS Energy Corp.	10.0%	10.4%	42.6%	-	0.2%	4.65%	57.2%	39.5%	5.9%	6.0%
Consol. Edison	8.9%	9.5%	56.9%	4.13%	0.2%	4.13%	42.9%	39.5%	6.2%	6.5%
Dominion Resources	9.6%	10.1%	59.6%	4.13%	0.4%	4.13%	40.0%	39.5%	6.8%	7.0%
DTE Energy	10.0%	10.4%	55.1%	-	0.0%	4.65%	44.9%	39.5%	6.8%	7.0%
Edison Int'l	9.6%	10.1%	50.1%	4.65%	5.2%	4.65%	44.7%	39.5%	6.3%	6.5%
El Paso Electric	10.0%	10.4%	55.9%	-	0.0%	4.65%	44.1%	39.5%	6.8%	7.0%
Entergy Corp.	9.6%	10.1%	49.2%	4.65%	1.2%	4.65%	49.7%	39.5%	6.2%	6.4%
G't Plains Energy	10.7%	10.9%	45.4%	4.65%	0.5%	4.65%	54.0%	39.5%	6.4%	6.5%
IDACORP Inc.	10.3%	10.6%	57.1%	-	0.0%	4.65%	42.9%	39.5%	7.1%	7.3%
MGE Energy	10.0%	10.4%	73.5%	-	0.0%	3.86%	26.5%	39.5%	8.0%	8.2%
NextEra Energy	10.0%	10.4%	53.9%	-	0.0%	4.13%	46.1%	39.5%	6.5%	6.7%
OGE Energy	11.4%	11.5%	65.0%	-	0.0%	4.34%	35.0%	39.5%	8.3%	8.4%
Otter Tail Corp.	10.7%	10.9%	63.1%	4.65%	0.6%	4.65%	36.3%	39.5%	7.8%	7.9%
PG&E Corp.	9.6%	10.1%	55.5%	4.65%	0.7%	4.65%	43.8%	39.5%	6.6%	6.9%
Pinnacle West Capital	10.0%	10.4%	58.9%	-	0.0%	4.44%	41.1%	39.5%	7.0%	7.2%
Portland General	10.3%	10.6%	49.8%	-	0.0%	4.65%	50.2%	39.5%	6.6%	6.7%
Public Serv. Enterprise	10.0%	10.4%	64.1%	-	0.0%	4.65%	35.9%	39.5%	7.4%	7.6%
SCANA Corp.	10.0%	10.4%	51.5%	-	0.0%	4.65%	48.5%	39.5%	6.5%	6.7%
Sempra Energy	10.3%	10.6%	58.2%	4.65%	0.3%	4.65%	41.6%	39.5%	7.2%	7.4%
Vectren Corp.	10.0%	10.4%	59.3%	-	0.0%	4.13%	40.7%	39.5%	6.9%	7.2%
Westar Energy	10.0%	10.4%	51.9%	4.65%	0.1%	4.65%	47.9%	39.5%	6.5%	6.7%
Xcel Energy Inc.	9.3%	9.8%	52.7%	4.13%	0.1%	4.13%	47.1%	39.5%	6.1%	6.4%
Full Sample Average	10.0%	10.4%	55.5%	4.5%	0.4%	4.5%	44.0%	39.5%	6.8%	7.0%
Nuclear Subsample Average	9.9%	10.3%	55.8%	4.4%	0.5%	4.5%	43.7%	39.5%	6.7%	7.0%

Sources and Notes:

[1]: Table No. BV-ELEC-10; Panel A, [4].
[2]: Table No. BV-ELEC-10; Panel A, [5].
[3]: Table No. BV-ELEC-4, [4].
[4]: Supporting Schedule #2 to Table No. BV-ELEC
[5]: Table No. BV-ELEC-4, [5].
[6]: Supporting Schedule #2 to Table No. BV-ELEC-11, P
[7]: Table No. BV-ELEC-4, [6].
[8]: APS Effective Corporate Tax Rate
[9]: ([1] x [3]) + ([4] x [5]) + {[6] x [7] x (1 - [8])}.
[10]: ([2] x [3]) + ([4] x [5]) + {[6] x [7] x (1 - [8])}.

[9]-[10] A strikethrough indicates the utility was excluded from the full sample average calculation as a result of its cost of equity not exceeding its cost of debt by 100 basis points

Table No. BV-ELEC-11

Overall After-Tax Cost of Capital of the U.S. Electric Sample

Panel B: CAPM Cost of Equity Scenario 2 - Long-Term Risk Free Rate of 3.93%, Long-Term Market Risk Premium of 8.00%

Company	CAPM Cost of Equity [1]	ECAPM (1.5%) Cost of Equity [2]	5-Year Average Common Equity to Market Value Ratio [3]	Weighted - Average Cost of Preferred Equity [4]	5-Year Average Preferred Equity to Market Value Ratio [5]	Weighted-Average Cost of Debt [6]	5-Year Average Debt to Market Value Ratio [7]	APS Representative Income Tax Rate [8]	Overall After-Tax Cost of Capital (CAPM) [9]	Overall After-Tax Cost of Capital (ECAPM 1.5%) [10]
ALLETE	10.3%	10.6%	60.2%	-	0.0%	4.65%	39.8%	39.5%	7.3%	7.5%
Alliant Energy	10.3%	10.6%	57.8%	4.34%	2.3%	4.34%	39.9%	39.5%	7.1%	7.3%
Amer. Elec. Power	9.5%	10.0%	52.0%	4.65%	0.0%	4.65%	48.0%	39.5%	6.3%	6.5%
Ameren Corp.	9.9%	10.3%	52.6%	-	0.0%	4.65%	47.4%	39.5%	6.6%	6.8%
CenterPoint Energy	10.7%	11.0%	47.8%	-	0.0%	4.34%	52.2%	39.5%	6.5%	6.6%
CMS Energy Corp.	9.9%	10.3%	42.6%	-	0.2%	4.65%	57.2%	39.5%	5.8%	6.0%
Consol. Edison	8.7%	9.3%	56.9%	4.13%	0.2%	4.13%	42.9%	39.5%	6.0%	6.4%
Dominion Resources	9.5%	10.0%	59.6%	4.13%	0.4%	4.13%	40.0%	39.5%	6.7%	7.0%
DTE Energy	9.9%	10.3%	55.1%	-	0.0%	4.65%	44.9%	39.5%	6.7%	6.9%
Edison Int'l	9.5%	10.0%	50.1%	4.65%	5.2%	4.65%	44.7%	39.5%	6.3%	6.5%
El Paso Electric	9.9%	10.3%	55.9%	-	0.0%	4.65%	44.1%	39.5%	6.8%	7.0%
Entergy Corp.	9.5%	10.0%	49.2%	4.65%	1.2%	4.65%	49.7%	39.5%	6.1%	6.4%
G't Plains Energy	10.7%	11.0%	45.4%	4.65%	0.5%	4.65%	54.0%	39.5%	6.4%	6.5%
IDACORP Inc.	10.3%	10.6%	57.1%	-	0.0%	4.65%	42.9%	39.5%	7.1%	7.3%
MGE Energy	9.9%	10.3%	73.5%	-	0.0%	3.86%	26.5%	39.5%	7.9%	8.2%
NextEra Energy	9.9%	10.3%	53.9%	-	0.0%	4.13%	46.1%	39.5%	6.5%	6.7%
OGE Energy	11.5%	11.6%	65.0%	-	0.0%	4.34%	35.0%	39.5%	8.4%	8.5%
Otter Tail Corp.	10.7%	11.0%	63.1%	4.65%	0.6%	4.65%	36.3%	39.5%	7.8%	8.0%
PG&E Corp.	9.5%	10.0%	55.5%	4.65%	0.7%	4.65%	43.8%	39.5%	6.6%	6.8%
Pinnacle West Capital	9.9%	10.3%	58.9%	-	0.0%	4.44%	41.1%	39.5%	7.0%	7.2%
Portland General	10.3%	10.6%	49.8%	-	0.0%	4.65%	50.2%	39.5%	6.6%	6.7%
Public Serv. Enterprise	9.9%	10.3%	64.1%	-	0.0%	4.65%	35.9%	39.5%	7.4%	7.6%
SCANA Corp.	9.9%	10.3%	51.5%	-	0.0%	4.65%	48.5%	39.5%	6.5%	6.7%
Sempra Energy	10.3%	10.6%	58.2%	4.65%	0.3%	4.65%	41.6%	39.5%	7.2%	7.4%
Vectren Corp.	9.9%	10.3%	59.3%	-	0.0%	4.13%	40.7%	39.5%	6.9%	7.1%
Westar Energy	9.9%	10.3%	51.9%	4.65%	0.1%	4.65%	47.9%	39.5%	6.5%	6.7%
Xcel Energy Inc.	9.1%	9.7%	52.7%	4.13%	0.1%	4.13%	47.1%	39.5%	6.0%	6.3%
Full Sample Average	10.0%	10.4%	55.5%	4.5%	0.4%	4.5%	44.0%	39.5%	6.8%	7.0%
Nuclear Subsample Average	9.9%	10.2%	55.8%	4.4%	0.5%	4.5%	43.7%	39.5%	6.7%	6.9%

Sources and Notes:

[1]: Table No. BV-ELEC-10, Panel B, [4].
[2]: Table No. BV-ELEC-10, Panel B, [5].
[3]: Table No. BV-ELEC-4, [4].
[4]: Supporting Schedule #2 to Table No. BV-ELEC
[5]: Table No. BV-ELEC-4, [5].
[6]: Supporting Schedule #2 to Table No. BV-ELEC-11, P
[7]: Table No. BV-ELEC-4, [6].
[8]: APS Effective Corporate Tax Rate
[9]: ([1] x [3]) + ([4] x [5]) + {[6] x [7] x (1 - [8])}.
[10]: ([2] x [3]) + ([4] x [5]) + {[6] x [7] x (1 - [8])}.

[9]-[10] A strikethrough indicates the utility was excluded from the full sample average calculation as a result of its cost of equity not exceeding its cost of debt by 100 basis points

Table No. BV-ELEC-12

Risk Positioning Cost of Equity at Representative Deemed Capital Structure

	Overall After-Tax Cost of Capital (Scenario 1) [1]	Overall After-Tax Cost of Capital (Scenario 2) [2]	APS Representative Base Deemed % Debt [3]	Representative Cost of A-Rated Utility Debt [4]	APS Representative Income Tax Rate [5]	APS Representative Base Deemed % Equity [6]	Estimated Return on Equity (Scenario 1) [7]	Estimated Return on Equity (Scenario 2) [8]
Full Sample:								
CAPM	6.8%	6.8%	44.0%	4.1%	39.5%	56.0%	10.2%	10.1%
ECAPM (1.50%)	7.0%	7.0%	44.0%	4.1%	39.5%	56.0%	10.5%	10.5%
Nuclear Subsample:								
CAPM	6.7%	6.7%	44.0%	4.1%	39.5%	56.0%	10.1%	10.0%
ECAPM (1.50%)	7.0%	6.9%	44.0%	4.1%	39.5%	56.0%	10.5%	10.4%

Sources and Notes:

[1]: Table No. BV-ELEC-11; Panel A, [9] - [10]. Scenario 1: Long-Term Risk Free Rate of 4.73%, Long-Term Market Risk Premium of 7.00%.

[2]: Table No. BV-ELEC-11; Panel B, [9] - [10]. Scenario 2: Long-Term Risk Free Rate of 3.93%, Long-Term Market Risk Premium of 8.00%.

[3]: APS Assumed Capital Structure.

[4]: Based on a A rating. Yield from Bloomberg as of February 10, 2016.

[5]: APS Effective Corporate Tax Rate.

[6]: APS Assumed Capital Structure.

[7]: {[1] - ([3] x [4] x (1 - [5])}/ [6].

[8]: {[2] - ([3] x [4] x (1 - [5]))}/ [6].

Table No. BV-ELEC-13

Hamada Adjustment to Obtain Unlevered Asset Beta

Company	Value Line Betas [1]	Debt Beta [2]	5-Year Average Common Equity to Market Value Ratio [3]	5-Year Average Preferred Equity to Market Value Ratio [4]	5-Year Average Debt to Market Value Ratio [5]	APS Representative Income Tax Rate [6]	Asset Beta: Without Taxes [7]	Asset Beta: With Taxes [8]
ALLETE	0.80	0.10	60.2%	0.0%	39.8%	39.5%	0.52	0.60
Alliant Energy	0.80	0.07	57.8%	2.3%	39.9%	39.5%	0.49	0.57
Amer. Elec. Power	0.70	0.10	52.0%	0.0%	48.0%	39.5%	0.41	0.48
Ameren Corp.	0.75	0.10	52.6%	0.0%	47.4%	39.5%	0.44	0.52
CenterPoint Energy	0.85	0.07	47.8%	0.0%	52.2%	39.5%	0.44	0.54
CMS Energy Corp.	0.75	0.10	42.6%	0.2%	57.2%	39.5%	0.38	0.46
Consol. Edison	0.60	0.05	56.9%	0.2%	42.9%	39.5%	0.36	0.43
Dominion Resources	0.70	0.05	59.6%	0.4%	40.0%	39.5%	0.44	0.51
DTE Energy	0.75	0.10	55.1%	0.0%	44.9%	39.5%	0.46	0.54
Edison Int'l	0.70	0.10	50.1%	5.2%	44.7%	39.5%	0.40	0.46
El Paso Electric	0.75	0.10	55.9%	0.0%	44.1%	39.5%	0.46	0.54
Entergy Corp.	0.70	0.10	49.2%	1.2%	49.7%	39.5%	0.39	0.47
G't Plains Energy	0.85	0.10	45.4%	0.5%	54.0%	39.5%	0.44	0.53
IDACORP Inc.	0.80	0.10	57.1%	0.0%	42.9%	39.5%	0.50	0.58
MGE Energy	0.75	0.05	73.5%	0.0%	26.5%	39.5%	0.56	0.62
NextEra Energy	0.75	0.05	53.9%	0.0%	46.1%	39.5%	0.43	0.51
OGE Energy	0.95	0.07	65.0%	0.0%	35.0%	39.5%	0.64	0.73
Otter Tail Corp.	0.85	0.10	63.1%	0.6%	36.3%	39.5%	0.57	0.65
PG&E Corp.	0.70	0.10	55.5%	0.7%	43.8%	39.5%	0.43	0.50
Pinnacle West Capital	0.75	0.08	58.9%	0.0%	41.1%	39.5%	0.47	0.55
Portland General	0.80	0.10	49.8%	0.0%	50.2%	39.5%	0.45	0.54
Public Serv. Enterprise	0.75	0.10	64.1%	0.0%	35.9%	39.5%	0.52	0.59
SCANA Corp.	0.75	0.10	51.5%	0.0%	48.5%	39.5%	0.43	0.51
Sempra Energy	0.80	0.10	58.2%	0.3%	41.6%	39.5%	0.51	0.59
Vectren Corp.	0.75	0.05	59.3%	0.0%	40.7%	39.5%	0.46	0.54
Westar Energy	0.75	0.10	51.9%	0.1%	47.9%	39.5%	0.44	0.52
Xcel Energy Inc.	0.65	0.05	52.7%	0.1%	47.1%	39.5%	0.37	0.44
Full Sample Average	0.76	0.08	55.5%	0.4%	44.0%	39.5%	0.46	0.54
Nuclear Subsample Average	0.74	0.09	55.8%	0.5%	43.7%	39.5%	0.45	0.53

Sources and Notes:

[1]: Supporting Schedule # 1 to Table No. BV-ELEC-10, [1].
[2]: Supporting Schedule #1 to Table No. BV-ELEC-13, [7].
[3]: Table No. BV-ELEC-4, [4].
[4]: Table No. BV-ELEC-4, [5].
[5]: Table No. BV-ELEC-4, [6].
[6]: APS Effective Corporate Tax Rate
[7]: [1]*[3] + [2]*([4] + [5]).
[8]: {[1]*[3] + [2]*([4]+[5]*(1-[6]))} / {[3] + [4] + [5]*(1 -[6])}.

Table No. BV-ELEC-14

Sample Average Asset Beta Relevered at Representative Deemed Capital Structure

	Asset Beta [1]	Assumed Debt Beta [2]	APS Representative Base Deemed % Debt [3]	APS Representative Income Tax Rate [4]	APS Representative Base Deemed % Equity [5]	Estimated Equity Beta [6]
Full Sample:						
Asset Beta Without Taxes	0.46	0.05	44.0%	39.5%	56.0%	0.78
Asset Beta With Taxes	0.54	0.05	44.0%	39.5%	56.0%	0.77
Nuclear Subsample:						
Asset Beta Without Taxes	0.45	0.05	44.0%	39.5%	56.0%	0.77
Asset Beta With Taxes	0.53	0.05	44.0%	39.5%	56.0%	0.75

Sources and Notes:

[1]: Table No. BV-ELEC-13, [7] - [8].

[2]: Debt Beta estimate for A-rated entities.Corporate Finance, Berk and Demarzo, Second Edition, p. 389.

[3]: APS Assumed Capital Structure.

[4]: APS Effective Corporate Tax Rate.

[5]: APS Assumed Capital Structure.

[6]: [1] + [3]/[5]*([1] - [2]) without taxes, [1] + [3]*(1 - [4])/[5]*([1] - [2]) with taxes.

Table No. BV-ELEC-15

Risk-Positioning Cost of Equity using Hamada-Adjusted Betas

Panel A: Scenario 1 - Long-Term Risk Free Rate of 4.73%, Long-Term Market Risk Premium of 7.00%

Company	Long-Term Risk-Free Rate [1]	Hamada Adjusted Equity Betas [2]	Long-Term Market Risk Premium [3]	CAPM Cost of Equity [4]	ECAPM (1.5%) Cost of Equity [5]
Full Sample:				capmlt	ecapmlt2
Asset Beta Without Taxes	4.73%	0.78	7.00%	10.2%	10.5%
Asset Beta With Taxes	4.73%	0.77	7.00%	10.1%	10.5%
Nuclear Subsample:					
Asset Beta Without Taxes	4.73%	0.77	7.00%	10.1%	10.4%
Asset Beta With Taxes	4.73%	0.75	7.00%	10.0%	10.4%

Sources and Notes:
[1]: Villadsen Direct Testimony.
[2]: Table No. BV-ELEC-14, [6].
[3]: Villadsen Direct Testimony.
[4]: [1] + ([2] x [3]).
[5]: ([1] + 1.5%) + [2] x ([3] - 1.5%).

Table No. BV-ELEC-15

Risk-Positioning Cost of Equity using Hamada-Adjusted Betas

Panel B: Scenario 2 - Long-Term Risk Free Rate of 3.93%, Long-Term Market Risk Premium of 8.00%

Company	Long-Term Risk-Free Rate [1]	Hamada Adjusted Equity Betas [2]	Long-Term Market Risk Premium [3]	CAPM Cost of Equity [4]	ECAPM (1.5%) Cost of Equity [5]
Full Sample:				capmlt	ecapmlt2
Asset Beta Without Taxes	3.93%	0.78	8.00%	10.2%	10.5%
Asset Beta With Taxes	3.93%	0.77	8.00%	10.1%	10.4%
Nuclear Subsample:					
Asset Beta Without Taxes	3.93%	0.77	8.00%	10.1%	10.4%
Asset Beta With Taxes	3.93%	0.75	8.00%	10.0%	10.3%

Sources and Notes:
[1]: Villadsen Direct Testimony.
[2]: Table No. BV-ELEC-14, [6].
[3]: Villadsen Direct Testimony.
[4]: [1] + ([2] x [3]).
[5]: ([1] + 1.5%) + [2] x ([3] - 1.5%).

Breakdown of Generation Capacity

Ticker	Company		Nuclear	Coal	Natural Gas	Other	Source
ALE	ALLETE	[a]	0%	56%	0%	44%	Value Line
LNT	Alliant Energy	[b]	17%	47%	4%	32%	Value Line
AEP	Amer. Elec. Power	[c]	0%	83%	13%	4%	2014 10-K, p. 48
AEE	Ameren Corp.	[d]	21%	74%	0%	5%	Value Line
CNP	CenterPoint Energy	[e]	-	-	-	-	2014 10-K
CMS	CMS Energy Corp.	[f]	0%	44%	6%	50%	Value Line
ED	Consol. Edison	[g]	-	-	-	-	Value Line
D	Dominion Resources	[h]	33%	30%	15%	22%	Value Line
DTE	DTE Energy	[i]	17%	67%	1%	15%	Value Line
EIX	Edison Int'l	[j]	6%	0%	8%	86%	Value Line
EE	El Paso Electric	[k]	47%	5%	35%	13%	Value Line
ETR	Entergy Corp.	[l]	33%	11%	28%	28%	Value Line
GXP	G't Plains Energy	[m]	13%	64%	1%	22%	Value Line
IDA	IDACORP Inc.	[n]	0%	34%	7%	59%	Value Line
MGEE	MGE Energy	[o]	0%	48%	6%	46%	Value Line
NEE	NextEra Energy	[p]	23%	5%	67%	5%	Value Line
OGE	OGE Energy	[q]	0%	44%	23%	33%	Value Line
OTTR	Otter Tail Corp.	[r]	0%	69%	13%	17%	2014 10-K, p. 6
PCG	PG&E Corp.	[s]	21%	0%	7%	72%	Value Line
PNW	Pinnacle West Capital	[t]	27%	34%	17%	22%	Value Line
POR	Portland General	[u]	0%	21%	16%	63%	Value Line
PEG	Public Serv. Enterprise	[v]	28%	18%	46%	8%	2014 10-K, p. 6
SCG	SCANA Corp.	[w]	19%	48%	28%	5%	Value Line
SRE	Sempra Energy	[x]	0%	0%	100%	0%	2014 10-K, p.14
VVC	Vectren Corp.	[y]	0%	77%	23%	0%	2014 10-K, p.7
WR	Westar Energy	[z]	8%	48%	44%	0%	Value Line
XEL	Xcel Energy Inc.	[aa]	12%	46%	21%	21%	2014 10-K, p. 30

Sources/Notes:

Value Line and 10-K reports.

[e]: According to their 2014 10-K, CNP does not own or operate any power generation facilities.

[g],[j],[n],[s],[u]: Purchase most of their power as reported by Value Line in 2015.

[x]: According to page 12 of their 2014 10-K, Sempra Energy purchases most of its power. However, all owned generation consists of gas-fired power plants.

[aa]: Percentages are based on total 2014 generation reported in Xcel Energy's 2014 10k as a proxy for generation capacity.

Companies with 17%-37% Nuclear Generation	
Ticker	Company
LNT	Alliant Energy
AEE	Ameren Corp.
D	Dominion Resources
DTE	DTE Energy
ETR	Entergy Corp.
NEE	NextEra Energy
PCG	PG&E Corp.
PNW	Pinnacle West Capital
PEG	Public Serv. Enterprise
SCG	SCANA Corp.

Attachment BV-8DR
Page 1 of 1

Risk Premiums Determined by Relationship Between Authorized ROEs[1] and Long-term Treasury Bond Rates During the Period 1990-2015 - Electric Vertically Integrated Only

Formula: Risk Premium = A_0 + (A_1 x Treasury bond Rate)

R Squared	0.79
Estimate of intercept (A_0)	8.8860%
Estimate of slope (A_1)	-0.593

Equity Cost Estimate for Vertically Integrated Electric		Predicted Risk Premium		Expected Treasury Bond Rate[2]
10.8%	=	6.08%	+	4.73%

Sources and Notes:

[1]: Source of ROE Data: SNL Financia

[2]: 2016 Consensus Forecast Risk-Free Rate + Expected Maturity Premium

See regression results on [Regressions] tab

Attachment BV-9DR
Page 1 of 1

Amount of Distributed PV Generation by State in 2014

Abbr.	State	Total Distributed PV Generation (GWh)	Total Utility-Scale Generation (GWh)	Percent of Total Utility-Scale Generation (%)
[1]	[2]	[3]	[4]	[5]=[3]/[4]
AL	Alabama	0	149,339	0.00%
AK	Alaska	0	6,042	0.00%
AZ	Arizona	916	112,257	0.82%
AR	Arkansas	2	61,591	0.00%
CA	California	3,862	198,808	1.94%
CO	Colorado	353	53,848	0.66%
CT	Connecticut	103	33,677	0.31%
DE	Delaware	60	7,704	0.78%
FL	Florida	102	230,014	0.04%
GA	Georgia	85	125,838	0.07%
HI	Hawaii	532	10,205	5.21%
ID	Idaho	1	15,185	0.01%
IL	Illinois	19	202,145	0.01%
IN	Indiana	10	115,396	0.01%
IA	Iowa	20	56,853	0.04%
KS	Kansas	0	49,728	0.00%
KY	Kentucky	12	90,897	0.01%
LA	Louisiana	101	104,231	0.10%
ME	Maine	12	13,249	0.09%
MD	Maryland	207	37,834	0.55%
MA	Massachusetts	503	31,118	1.62%
MI	Michigan	34	106,817	0.03%
MN	Minnesota	18	56,998	0.03%
MS	Mississippi	0	55,127	0.00%
MO	Montana	11	30,257	0.04%
MT	Missouri	112	87,836	0.13%
NE	Nebraska	0	39,431	0.00%
NV	Nevada	85	36,001	0.24%
NH	New Hampshire	12	19,539	0.06%
NJ	New Jersey	1,106	68,052	1.63%
NM	New Mexico	117	32,307	0.36%
NY	New York	291	137,123	0.21%
NC	North Carolina	73	128,144	0.06%
ND	North Dakota	0	36,464	0.00%
OH	Ohio	71	134,478	0.05%
OK	Oklahoma	0	70,158	0.00%
OR	Oregon	78	60,119	0.13%
PA	Pennsylvania	211	221,060	0.10%
RI	Rhode Island	12	6,283	0.19%
SC	South Carolina	0	97,159	0.00%
SD	South Dakota	0	10,994	0.00%
TN	Tennessee	60	79,507	0.08%
TX	Texas	140	437,631	0.03%
UT	Utah	39	43,785	0.09%
VT	Vermont	33	7,032	0.47%
VA	Virginia	22	77,138	0.03%
WA	Washington	32	116,335	0.03%
WV	West Virginia	0	81,059	0.00%
WI	Wisconsin	23	61,065	0.04%
WY	Wyoming	0	49,695	0.00%
	United States	**9,536**	**4,093,607**	**0.23%**

Sources/Notes:
EIA Electric Power Monthly, Jan. 2016.
Highlighted states have significant amounts of distributed PV generation relative to total utility-scale generation in the state.

Attachment BV-10DR
Page 1 of 1

Sample Companies
Amount of Distributed PV Generation
in States with Decoupling

Company	States with Decoupling	Total Dist. PV Generation as a % of Total Utility-Scale Generation within State
[1]	[2]	[3]
ALLETE		
Alliant Energy		-
Amer. Elec. Power	AR*	0.00%
	IN*	0.01%
	KY*	0.01%
	LA*	0.10%
	OH*	0.05%
	OK*	0.00%
Ameren Corp.	MO*	0.04%
CenterPoint Energy	(AR)	0.00%
	(LA)*	0.10%
	(MN)	0.03%
	(OK)*	0.00%
CMS Energy Corp.		-
Consol. Edison	NY, (NY)	0.21%
Dominion Resources		-
DTE Energy	(MI)*	0.03%
Edison Int'l	CA	1.94%
El Paso Electric		-
Entergy Corp.	AR*	0.00%
	LA*, (LA)	0.10%
	MS*	0.00%
G't Plains Energy	MO*	0.04%
IDACORP Inc.	ID*	0.01%
MGE Energy		-
NextEra Energy		-
OGE Energy	AR*	0.00%
	OK*	0.00%
Otter Tail Corp.		-
PG&E Corp.	CA, (CA)	1.94%
Pinnacle West Capital	AZ*	0.82%
Portland General	OR*	0.13%
Public Serv. Enterprise	(NJ)*	1.63%
SCANA Corp.	(NC)	0.06%
	(SC)*	0.00%
Sempra Energy	(AL)*	0.00%
	CA, (CA)	1.94%
Vectren Corp.	IN*, (IN)	0.01%
Westar Energy	KS*	0.00%
Xcel Energy Inc.	(CO)*	0.66%
	SD*	0.00%

Sources/Notes:
Regulatory Research Associates, "Adjustment Clauses," October 2, 2015.
Highlighted companies are included in our subsample of utilities with 17% to 37% nuclear generation.
"*" indicates partial decoupling.
"( )" indicates decoupling status for associated gas operations.

Regression Output: PE Ratio vs. 20-Year Treasury Rate

	20-Year Treasury				Constant					
	Coef	Std. Error	T-Stat	P-Value	Coef	Std. Error	T-Stat	P-Value	N	R-Squared
Group Results										
Electric (Average)	(1.55)	0.36	(4.26)	0.00	26.40	2.03	13.01	0.000	104	15%
Electric (Median)	(0.89)	0.24	(3.76)	0.00	19.23	1.32	14.52	0.000	104	12%
Nuclear (Average)	(1.31)	0.44	(3.00)	0.00	24.80	2.44	10.18	0.000	104	8%
Nuclear (Median)	(1.04)	0.29	(3.65)	0.00	20.42	1.59	12.82	0.000	104	12%
Individual Results										
Ameren Corp.	(2.47)	2.43	(1.02)	0.312	34.53	11.34	3.04	0.003	66	2%
Amer. Elec. Power	(2.27)	1.31	(1.74)	0.086	29.34	7.31	4.01	0.000	96	3%
ALLETE	(2.78)	0.62	(4.47)	0.000	26.70	3.48	7.68	0.000	103	16%
CMS Energy Corp.	(1.24)	0.96	(1.30)	0.197	23.39	5.25	4.45	0.000	83	2%
CenterPoint Energy	0.42	0.80	0.53	0.599	13.09	4.50	2.91	0.005	88	0%
Dominion Resources	(1.92)	0.63	(3.06)	0.003	29.32	3.53	8.31	0.000	93	9%
DTE Energy	(1.89)	0.59	(3.21)	0.002	24.50	3.30	7.43	0.000	100	10%
Consol. Edison	(0.60)	0.62	(0.96)	0.337	20.68	3.48	5.95	0.000	104	1%
El Paso Electric	(6.71)	1.92	(3.49)	0.001	54.05	9.34	5.79	0.000	72	15%
Edison Int'l	(0.93)	0.56	(1.67)	0.099	19.24	3.17	6.06	0.000	93	3%
Entergy Corp.	(0.53)	0.82	(0.64)	0.522	18.99	4.59	4.14	0.000	95	0%
G't Plains Energy	(2.99)	1.29	(2.31)	0.023	37.99	7.31	5.20	0.000	94	5%
IDACORP Inc.	(1.12)	0.72	(1.56)	0.122	23.53	4.02	5.86	0.000	101	2%
Alliant Energy	(0.69)	0.78	(0.87)	0.384	21.52	4.42	4.86	0.000	96	1%
MGE Energy	(0.71)	0.44	(1.59)	0.114	21.76	2.48	8.78	0.000	103	2%
NextEra Energy	0.00	0.47	0.01	0.994	16.95	2.60	6.52	0.000	101	0%
OGE Energy	(1.07)	1.38	(0.78)	0.439	30.41	7.54	4.03	0.000	90	1%
Otter Tail Corp.	(4.29)	1.05	(4.09)	0.000	44.81	5.92	7.57	0.000	101	14%
PG&E Corp.	(4.08)	1.35	(3.02)	0.003	39.74	7.57	5.25	0.000	98	9%
Public Serv. Enterprise	(0.31)	0.36	(0.87)	0.386	15.12	2.00	7.57	0.000	99	1%
Pinnacle West Capital	(2.15)	2.04	(1.05)	0.295	37.87	11.61	3.26	0.002	92	1%
Portland General	0.20	1.40	0.14	0.888	15.27	5.31	2.88	0.007	37	0%
SCANA Corp.	0.17	0.45	0.38	0.707	14.68	2.47	5.93	0.000	98	0%
Sempra Energy	(2.76)	0.93	(2.97)	0.004	27.32	4.28	6.38	0.000	71	11%
Vectren Corp.	6.15	3.70	1.66	0.102	2.73	16.21	0.17	0.867	60	5%
Westar Energy	(2.04)	1.26	(1.62)	0.109	30.84	7.02	4.39	0.000	95	3%
Xcel Energy Inc.	(0.06)	0.67	(0.09)	0.931	17.36	3.76	4.62	0.000	101	0%

Significant at 5% Level.

BEFORE THE
ALBERTA UTILITIES COMMISSION

REBUTTAL EVIDENCE
OF
BENTE VILLADSEN

FOR
ALTAGAS UTILITIES INC
ENMAX POWER CORPORATION
FORTISALBERTA INC
THE ATCO UTILITIES

2016 Generic Cost of Capital

Proceeding ID No. 20622

May 12, 2016

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BEFORE THE
ALBERTA UTILITIES COMMISSION

2016/2017 Generic Cost of Capital	)	**Proceeding ID No. 20622**

REBUTTAL EVIDENCE OF DR. BENTE VILLADSEN

I. INTRODUCTION AND SUMMARY AND CONCLUSIONS

Q1. Are you the same Bente Villadsen, who filed written evidence in this proceeding on February 1, 2016?

A1. Yes.

Q2. What have you been asked to do in your rebuttal evidence?

A2. I have been asked by AltaGas Utilities Inc. (AUI), ENMAX Power Corporation (ENMAX), FortisAlberta Inc. (FortisAlberta), and The ATCO Utilities (ATCO) (jointly "Utilities") to comment on the ROE and capital structure evidence of (i) Dr. Laurence D. Booth on behalf of the Canadian Association of Petroleum Producers (CAPP) (Booth CAPP Evidence), (ii) Dr. Sean Cleary on behalf of the Utilities Consumer Advocate (UCA) (Clearly Evidence), and (iii) Mr. Jan Thygesen on behalf of the Consumer Coalition of Alberta (CCA) (Thygesen Evidence). I have also been asked to comment on the capital structure evidence of Dr. Laurence D. Booth on behalf of the City of Calgary (Calgary) (Booth Calgary Evidence) and of Mr. Mark Stauft on behalf of UCA (Stauft Evidence).

Q3. Please summarize your findings.

A3. First and foremost, the recommendations of interveners of reducing the allowed ROE to 7 – 7.5 percent and also reducing the equity thickness[1] is out of line with current

[1] Stauft recommends 35% for transmission and ATCO Pipelines, 37% for distribution entities except Altagas (Stauft Evidence p. 3). Booth recommends 35% for ATCO gas and ATCO Pipeline (Booth, Calgary Evidence p. 2 and Booth CAPP Evidence p. 4, respectively.)

market expectations, with what has been approved elsewhere and with maintaining an A range credit rating. I continue to believe that the Utilities face a cost of equity in the range of 9.5-10.5 percent with a point estimate of 10.25 percent and that a reasonable benchmark for the equity thickness is as described in my written evidence, Figure 30, which as a benchmark finds that 40 percent equity is reasonable for electric distribution utilities that pay taxes.

Second, my findings can be summarized as follows:

Impact of the Capital Market Environment on Expected Equity Returns

- All experts acknowledge that the yield spread is higher than usual, which indicates that the premium investors require to hold equity rather than risk-free assets has increased
- As demonstrated by Mr. Buttke in response to Dr. Booth, preferred spreads are elevated, which is evidence that the premium investors require to hold equity rather than risk-free instruments is elevated. Relative to the release of the 2013 GCOC the increase in preferred spread is about 100-200 basis points for an increase in utility ROE in excess of 100-200 basis points.
- Mr. Thygesen's does not provide reliable evidence that forecasted interest rates are systematically upward biased and his claim is not supported by research or data. Therefore, forecasted interest rates are appropriate for use in this proceeding.
- Contrary to some claims, I do not believe interest rates will remain low for an extended period and believe that rates will increase over time, so that a forecasted risk-free rate is appropriate.
- Mr. Thygesen's discussion of current market conditions indicates that he believes that past and current stock price levels predict future returns, which is contrary to empirical evidence well-documented in the finance literature.

Regulatory Precedents

- Dr. Booth lists a number of Alberta Utilities Commission "settled issues." However, his list of issues is selective and in many cases, his characterization of the issues as "settled" is taken out of context. For example, while the Commission has stated it found the CAPM useful,

it has also acknowledged its limitations. Similarly, in discussing some of the specific methods (e.g., DCF implementation), Dr. Booth fails to include a discussion of the evidence presented to the Commission. Some of the evidence on this record addresses specifically the Commission's concerns.

Estimation Methods

- The CAPM estimates presented by the interveners are downward biased since
  - Dr. Booth's and Dr. Cleary's implementation of the CAPM relies on an MERP that fails to recognize the elevated yield and preferred spread as well as lingering market uncertainty. It therefore downward biases the cost of equity estimate.
  - The beta estimates relied upon by Dr. Booth and Dr. Cleary are outdated and statistically inferior to weekly betas.
- The DCF estimates presented by interveners suffers from several problems:
  - The implementations by Dr. Booth and Dr. Cleary fail to recognize that shareholders receive cash not only through dividends but also through share buybacks. This is especially vital when applying the DCF model to the market as a whole, where many S&P/TSX or S&P 500 companies use buybacks. This downward biases the DCF estimate of the market return.
  - The implementation of sustainable growth rates (based on historical accounting ratios) fails to recognize the impact of share issuances and thereby downward biases the DCF-based ROE estimate
  - Dr. Booth's discussion of analysts' optimism bias fails to recognize that recent literature has found that if optimism bias is present, then the degree depends on a host of factors, with the utility industry having characteristics that lead to low or no bias
- Dr. Cleary's bond yield plus risk premium suffers from two flaws that downward biases the estimate:
  - Dr. Cleary uses the yield on A rated utility bonds as of January 2016 and that may be lower than the expected 2016-17 yield

- No evidence for the risk premium of 2-3 percent was provided and this fails to recognize the inverse relationship between yield and risk premiums.

- Dr. Booth's use of pension funds' forecasted return are downward biased
  - The Commission has in the past recognized that such returns are conservative
  - The limited sources provided by Dr. Booth relies on the a DCF model which does not use cash flow that accrue to shareholders
- The discussion by Dr. Booth and Mr. Thygesen fails to recognize pension fund managers' may match assets holdings to the liability profile and their incentive to ensure the fund remains fully-funded based on actuarial calculations

Credit Metrics

- I strongly advise against applying the lowest possible credit ratio benchmarks to determine the capital structure. Doing so affords no cushion for the utilities and fails to recognize that, for example, the FFO to debt ratio of 11.1-14.3 percent is a *minimum range*.
- Flaws in the credit ratio analysis of Mr. Stauft lead him to underestimate the equity ratio that is needed to maintain credit metrics at levels appropriate for an A range rating.

Incorrect / Misguided Capital Structure

- Dr. Booth and Mr. Stauft incorrectly treat preferred equity as debt, while credit rating agencies clearly consider preferred a hybrid security that is generally counted 50-100 percent as equity. Consequently, their claim that (for example) Fortis Inc. is financed with 35 percent equity is misleading, since the equity ratio for credit metric purposes is 40 percent.

Additions to or Subtractions from the Equity Ratio

- Contrary to Mr. Stauft's recommendation, I do not find that adding or subtracting percentage points for specific issues is good policy at this time. Instead, I suggest that all risk factors need to be evaluated to get the equity ratio right if relative adjustments are to be made.

- To address the specific questions, I find, contrary to Mr. Stauft, that the 2 percent adder for tax exempt entities continues to be conservative as such entities have higher earnings volatility would have a lower EBIT coverage ratio without an equity adder.
- A 2 percent reduction in the transmission entities' equity percentage does not have merit as (i) it would be necessary to evaluate aspects other than capex and (ii) although in the process of tapering, the capex program is ongoing.

The remainder of my evidence is organized as follows. Section II responds to Dr. Booth's, Dr. Cleary's, and Mr. Thygesen's discussion of the interaction of capital markets and the expected return on equity. This section also discusses what Dr. Booth has labeled "settled issues." Section III responds to the evidence presented by Dr. Booth, Dr. Cleary, and Mr. Thygesen regarding the estimation of the cost of equity. Section IV responds to the capital structure recommendations presented in the evidence of Dr. Booth, Dr. Cleary, and Mr. Stauft.

II. CAPITAL MARKETS AND REGULATORY PRECEDENTS

A. IMPACT OF THE CAPITAL MARKET ENVIRONMENT ON EXPECTED EQUITY RETURNS

1. Interest Rates and Bond Yields

Q4. What are your reactions to Mr. Thygesen's comments on the risk-free rate of interest in Canada?

A4. Mr. Thygesen relies on sparse historical forecast in a limited time period surrounding the great financial crisis and ensuing global recession to argue that Consensus Forecasts reflect a "systemic [sic] bias or error" and therefore should not be relied on to determine the risk-free rate in this proceeding.[2] However, Mr. Thygesen falls far short of conclusively demonstrating a consistent systematic upward bias in the Consensus Forecasts projections of 10-year Canadian government bond yields. Many of the forecasts he cites as over-predicting the actual yields that prevailed in 2010-

[2] Thygesen Evidence, paragraph 14.

2014 were made before the financial crisis or during the early part of the ensuing recession. Does Mr. Thygesen mean to suggest that failing to anticipate the crisis, the severity of the recession, or the slowness of the recovery constitute evidence of bias? If so, he is at best selecting a superficial interpretation of the definition I provided in response to his information request, which characterized bias as the tendency to "on *average* under or over-predict the *most likely* eventual outcome" [emphasis added], not as the tendency to under or over-predict the eventual *realized* outcome.

To be unbiased, a forecast must reflect the average of all possible outcomes, weighted by their probabilities of occurring. (This is referred to as the "expected value" in statistics.) The possible outcomes may take on a range of values, and their probabilities of occurring must be estimated at the time of the forecast. The eventual realized outcome (i.e., the outcome that actually comes to pass) may not match the ex-ante expected value—indeed it may reflect a low probability event from the perspective of the forecaster. However, just because a forecast is not accurate does not mean it is biased.

Mr. Thygesen has not provided evidence that Consensus Forecasts systematically over-weight high end outcomes (i.e., larger increases or smaller decreases) in projecting bond yields. Rather, he has simply documented a sparse sample of recent instances in which both economic forecasters and financial markets had failed to fully appreciate (in advance) the severity and persistence of the negative effects on global economies and capital markets associated with the financial crisis and its aftermath. In this matter, I agree with Mr. Buttke.[3]

Q5. Are you aware of any academic evidence related to the question of bias in interest rate forecasts?

A5. While Mr. Thygesen relies on a narrow sample to assert that Consensus Forecasts consistently over-predicts actual government bond yields, academic analyses of economic forecasts of government bond yields more generally have found that any

[3] Rebuttal Evidence of Mr. Robert Buttke ("Buttke Rebuttal"), Section III.

"bias" in forecasts is not consistently upward or downward, but rather towards the status quo. In other words, economic forecasters place too much weight on yields prevailing at the time they are predicting future yields. Under the "status quo bias" hypothesis, forecasts will tend to over-predict actual yields when yields are decreasing (as they have done recently) and under-predict yields when yields are increasing. In a study published in the Journal of Applied Finance and Banking, Gubdaydullina, Hein, and Spiwoks studied forecasts of interest rates from the Consensus Forecasts surveys for 12 industrial countries from 1989 to 2009—a much larger sample than that used by Mr. Thygesen. They found that, on average, the forecasted *change* in interest rates was much smaller than the eventual realized change. In other words, the forecasts were too close to the prevailing interest rate at the time the forecast was made.[4] Put differently, they did not find a systematic upward or downward bias, but rather that forecasts systematically under estimated the pace of change.

Federal Reserve Researchers Hafer and Hein found evidence of a similar pattern of status-quo bias in the forecasting of U.S. T-Bills.[5] Figure 1 reproduces a chart from their paper comparing 3-month out forecasts of T-bill rates to the corresponding actual rates during the period 1977-1987. The results showed that survey forecasts (the dotted line in the figure) consistently "lagged" the actuals—under-predicting when yields were rising and over-predicting when yields were falling.[6] However, there is not compelling evidence in the chart that the forecasts are nearly always too high or nearly always too low.[7]

---

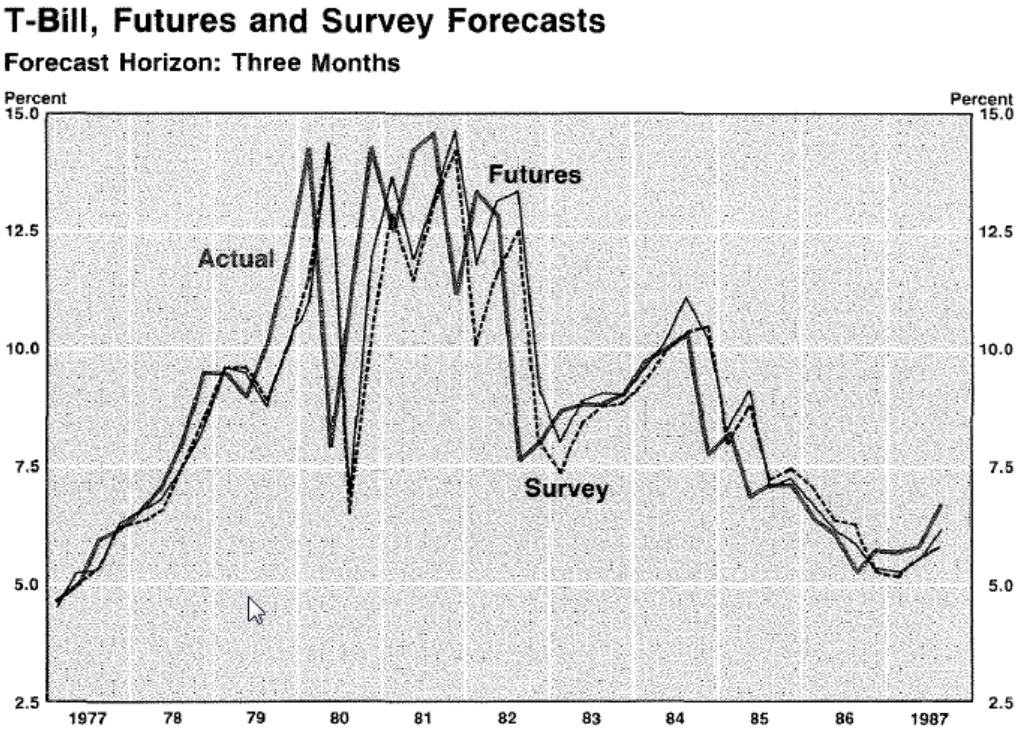
[4] Gubaydullima, Hein, Spiwoks. "The status quo bias of bond market analysts." *Journal of Applied Finance and Banking.* 1.1 (2011)

[5] R.W. Hafer and S.E. Hein. "Comparing Futures and Survey Forecasts of Near-Term Treasury Bill Rates." *Federal Reserve Bank of St. Louis Review.* May/June, (1989), 33-42 ("Hafer and Hein").

[6] Note that the Hafer and Hein paper also evaluated exchange-traded interest rate futures contracts to see whether the collective expectations of market participants served as a more accurate predictor of eventual realized yields. As shown in Figure 1, the futures exhibited the same tendency to lag the actuals as the survey forecasts.

[7] Note also that Hafer and Hein performed the same analysis for a six month forecast horizon, and found a similar pattern, with a longer lag, consistent with forecasters and futures markets placing too much weight on the status quo. *See* Figure 2 on p. 36 of Hafer and Hein.

Figure 1: Figure from "Comparing Futures and Survey Forecasts of Near-Term Treasury Bill Rates"



Source: R.W. Hafer and S.E. Hein. "Comparing Futures and Survey Forecasts of Near-Term Treasury Bill Rates."

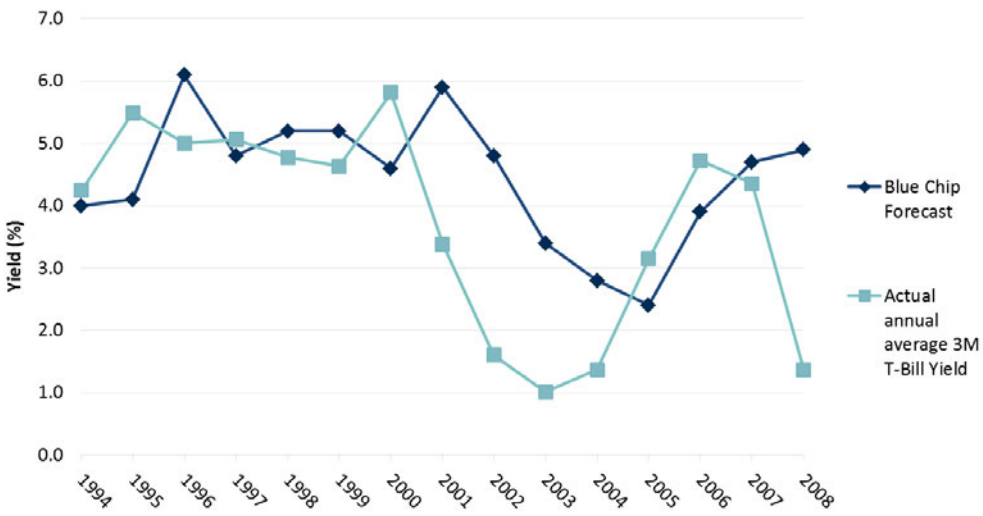
Q6. Have you investigated this hypothesis for any other periods?

A6. Yes. Further examination of economic survey forecasts for U.S. T-bill yields shows additional support for the status-quo bias found by Hafer, Hein, Gubaydullima, and Spiwoks. Every month, Blue Chip Economic Indicators provides "consensus" prediction of three-month U.S. T-bill yields for the upcoming year based on a survey of economic forecasters. Figure 2 below shows forecasts that were made in March of the prior year, as well as the averages of actual three-month U.S. T-bill yields over the years being forecast.

The relationship between the forecasts and actual rates is consistent with the results of the studies discussed above. Figure 2 shows that forecasters often would have been correct had actual rates followed their trends up to the time of the forecast. For example, in 1999, actual yields had been gradually but steadily declining for the last five years. If that trend had continued in 2000, the Blue Chip forecast of 4.6 percent would have been approximately correct. Instead, actual rates increased from 1999 to

2000, such that the 4.6 percent forecast significantly under-predicted the average actual yields in 2000 (5.8 percent). Similarly, after rates had risen from 1999 to 2000, forecasters predicted that rates would increase slightly in 2001, forecasting a three-month T-bill yield of 5.9 percent. Instead, rates fell to an average of 3.39 percent in 2001, resulting in an over-prediction of average actual yields.

Figure 2: Blue Chip Forecasts of 3M T-Bill Yields vs. Actual 3M T-Bills



Sources: Blue Chip Economic Indicators and Federal Reserve Economic Database ("FRED").
See BV Workpaper R01.

Q7. How is the empirical evidence on "status quo bias" relevant to this proceeding?

A7. Accounting for a less selective historical sample than the one Mr. Thygesen analyzed reveals that forecasts of interest rates based on surveys of economic experts are not systemically upwardly biased. Rather, Figure 1 and Figure 2 shows that forecast errors go in both directions. Realized rates can be either over or under-forecasted, depending on the current trend of interest rates. Periods of over-forecasting tend to align with periods of decreasing interest rates, while periods of under-forecasting tend to align with increasing interest rates. This suggests that when interest rates do rise from their current low levels, the Commission should perhaps expect forecasters to *under*estimate the rate of increase.

Mr. Thygesen's results only show consistent over-prediction of Consensus Forecasts bond yield forecasts as an artifact of the period he chose: one in which interest rates Canadian government bond yields declined steadily (and at times steeply) following the onset of the crisis.[8] Therefore, I recommend the Commission place no weight on Mr. Thygesen's selective analysis and unsupported assertion that Consensus Forecasts must be viewed as upwardly biased "until [it] routinely, or at least more frequently starts under and over-forecasting rates."[9]

Q8. What is your response to Mr. Thygesen's and Dr. Booth's assertions that forward interest rates are better predictors of future bond yields than economic forecasts?

A8. Dr. Booth states that interpreting forward interest rates using "unbiased expectations (UBE) theory" constitutes "a market interest rate forecast that has been more accurate than the economic forecasters have for the last several years." [10] However, he provides no support of any kind for his assertion that it has been more accurate.

Similarly, Mr. Thygesen asserts that interest rate "forecasts" based on the forward curve have recently been more accurate ("less biased" in his opinion) than Consensus Forecasts. [11] However, his sole evidence for this claim depends on three forward rates that he "assumes" are for June 30 of 2015; he subtracts a term premium from these rates and compares to the actual 10-year bond yield for that month.[12] Clearly, it is impossible to draw statistically meaningful conclusions based on a sample of three data points, especially when they all relate to the same "actual" date.

I also note that the paper by Hafer and Hein found that "the accuracy of the six-month-ahead futures and survey forecasts is comparable"[13] and goes on to conclude

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8 See Figure 2 in my Written Evidence. Also note in Figure 2 above the substantial over-prediction by Blue Chip of T-bill rates in 2008, reflecting the unanticipated on-set of the financial crisis: this is the *start* of the period sampled by Mr. Thygesen.

9 Thygesen Evidence, paragraph 14.

10 Booth CAPP Evidence, paragraph 57.

11 Thygesen Evidence, paragraphs 7-8.

12 *Ibid.*, paragraphs 5-6 and table on page 6.

13 Hafer and Hein, p. 37.

that the results "generally support the perception that forecasts are unbiased predictors of future rates," and that "futures market forecasts of near-term interest rate usually are as accurate as those produced by professional forecasters."[14] However, the authors are careful to contrast exchange-traded *futures* with forward interest rates, stating

> This conclusion about market efficiency contrasts sharply with that found for the forward market. Previous evidence has shown that the Treasury bill forward rate does not incorporate all of the information contained in the same survey considered here. Such a conclusion, along with the evidence presented in this paper, is consistent with the belief that there is a time varying premium in the forward rate that apparently is absent in the Treasury bill futures rate.[15]

Mr. Thygesen has provided no evidence that contradicts this academic finding. In my opinion, therefore, Mr. Thygesen's statements about forward rates deserve no weight.

Q9. What is your reaction to Mr. Thygesen's and Dr. Booth's views on how long-term interest rates are determined and likelihood of those rates remaining low?

A9. Mr. Thygesen and Dr. Booth both express the view that interest rates and government bond yields are likely to remain at or near their current levels in the near term.[16] However, their stated reasons for holding this belief are diametrically opposed. Dr. Booth argues that the actions of central banks are paramount in determining the level of interest rates:

> What is important to note is that interest rates are not, and probably will not, for the foreseeable future, be set by private investors. Instead, they are being set by what has been termed the "global policy maker."[17]

In contrast, Mr. Thygesen voices skepticism about the ability of central banks to "set" rates:

> It is not clear, given the low forecasts of Canadian GDP growth and low oil prices that the Bank of Canada can raise interest rates. … With Japan and

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14 Hafer and Hein, p. 41.

15 *Ibid*., p. 41.

16 Thygesen Evidence, paragraph 27; Booth CAPP Evidence, paragraph 61.

17 Booth CAPP Evidence, paragraph 56. See also the response to Booth-Utilities-2016Apr12-006.

> Europe continuing to ease it is not clear if or whether the Federal Reserve can raise interest rates. Although there has been ongoing speculation over the past year about hiking rates the Federal Reserve only did so minimally when it finally did increase rates.[18]

To summarize, Dr. Booth seems to be suggesting interest rates are unlikely to increase because the "global policy maker" will maintain quantitative easing programs and/or other accommodative monetary policies. Meanwhile, Mr. Thygesen's statements seems more consistent with the view that central banks are *incapable* of pushing rates upward through tighter policy—rendered so by forces in the global economy.

In my opinion, neither of these views is accurate with respect to how interest rates are determined. Central banks certainly *do* influence interest rates, as Mr. Thygesen's quote of former Fed Chairman Bernanke confirms:

> The Fed's actions determine the money supply and thus short-term interest rates; it has no choice but to set the short-term interest rate *somewhere*.[19]

However, as Mr. Buttke explains, long-term interest rates—while influenced by the influence of central banks on short-term rates and the supply of financial assets—are ultimately determined in the market.[20] I agree with Mr. Buttke that the U.S. Federal Reserve likely will manage monetary policy and the disposition of assets accumulated during its quantitative easing cycles in response to economic activity and capital market conditions. As economic conditions improve, central banks (including the Fed) most likely will move away from quantitative easing and accommodative monetary policy. As a result, interest rates are likely to rise above their current low levels.

I am not convinced that interest rates will remain permanently low, either because (as Mr. Thygesen argues) central banks are powerless to raise them or (as Dr. Booth

18 Thygesen Evidence, paragraph 21.

19 Thygesen Evidence, paragraph 18, quoting Ben S. Bernanke, March 30, 2015, "Why are interest rates so low?"

20 Buttke Rebuttal, Section III.

argues) because the they will act to keep them so. As I stated in response to CCA's information request,

> The prevailing yields on government bonds at a particular moment in time … represent the cost of risk-free debt at that moment. However, it is possible for current yields on government bonds to underestimate (or overestimate) the cost of risk-free borrowing in the future. This will be true if currently prevailing market forces and/or monetary policies enacted by central banks are not expected to prevail in the future.[21]

As Mr. Buttke explains in his Rebuttal Evidence, the current low interest rates are the result of unprecedented actions by global policy makers interacting with investor sentiment in global and North American capital markets.[22] I agree with Mr. Buttke that these policies and conditions are not likely to persist indefinitely. In this context it is not surprising that—as *all* experts in this case acknowledge—Canadian interest rates and long-term bond yields are forecast to rise above their current levels in the near term.

Q10. Do you have other evidence to present concerning factors that can influence long-term interest rates that would suggest that interest rates are likely to increase in the near term?

A10. I believe that our relative position in the business cycle after a recession and the expectation that central bank holdings of debt will begin to decrease both are factors that suggest interest rates will increase. Figure 3 below shows a time series of U.S. interest rates overlaid on a timescale illustrating recessionary periods (shaded), as well as the ratio of Federal Reserve Debt to Total Debt for the United States from 1995 to the present. Figure 3 shows that interest rates tend to decrease during a recession and during the early part of the ensuing recovery, but then begin to rise again. This is evident to different degrees for all of the recessions shown below, except for the most recent recession following the global financial crisis in 2008 and 2009. During the long, slow recovery from this recession, rates have remained

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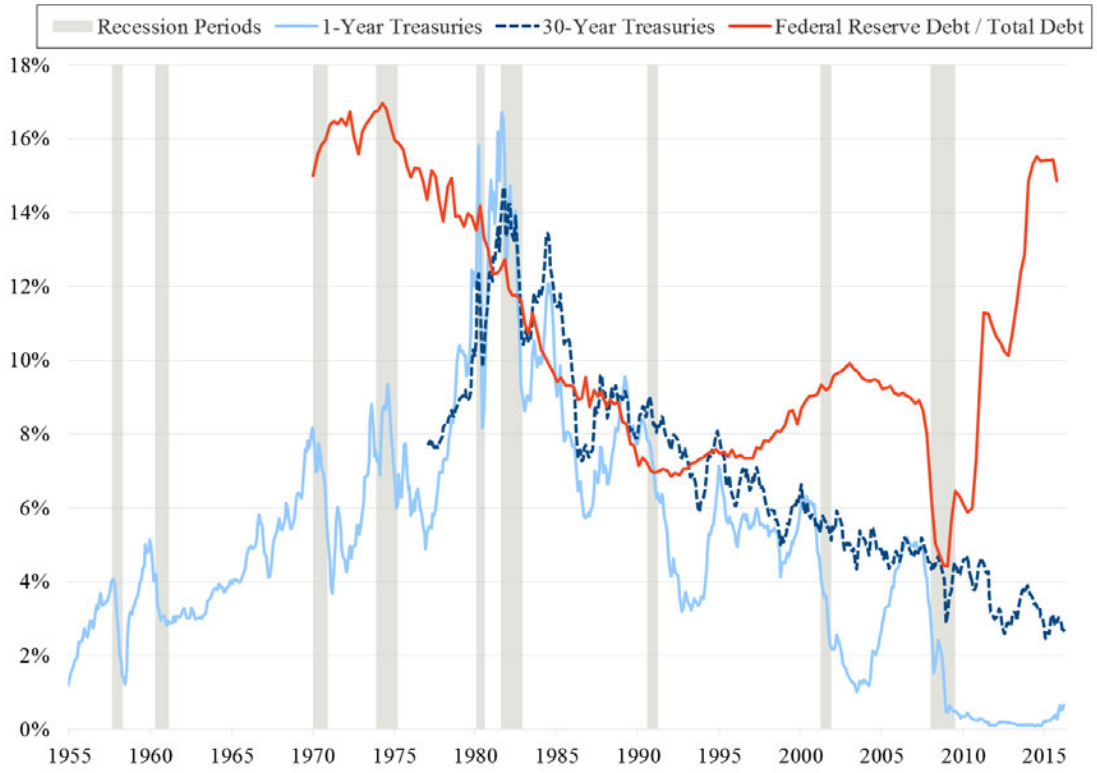
[21] Response to information request CCA-Villadsen-2016FEB18-002 (b). This is the same response that Mr. Thygesen quoted selectively in paragraph 17 of his Evidence.

[22] Buttke Rebuttal Evidence, Section III.

depressed for longer than is usually the case. However, for all the economic expansions pictured in Figure 3, interest rates have never failed to rise above their "trough" prior to the next recession. While there is no guarantee the current recovery will hold to form, I believe the historical pattern indicates that an interest rates will begin to rise as the economy strengthens.

Figure 3: U.S. Government Interest Rates and U.S. Federal Reserve Debt Holdings as Share of Total Debt



Source: Federal Reserve Economic Database (FRED). See BV Workpaper R02.

One reason that U.S. interest rates have not increased following the 2008-2009 recession is the Federal Reserve's quantitative easing programs and investors' expectations regarding the impact on interest rates. From late 2008 to late 2014, the Fed purchased unprecedented numbers of Treasury bonds and other financial assets (including agency mortgage backed securities and other assets not traditionally utilized for monetary policy) in order to keep interest rates low. The concentration of government debt on the Federal Reserve's balance sheet can be seen by the red line on the chart that shows the Federal Reserve's share of government debt jumping from

4 percent during the recession to over 15 percent. However, it is evident from the right-most portion of the graph that the central bank's share of U.S. government debt has begun to decline. As the Fed's influence on Treasury bond markets decreases, yields are likely to rise.

Q11. Please summarize your conclusions regarding interest rates and bond yields.

A11. I do not believe that either Dr. Booth or Mr. Thygesen has presented any evidence that Consensus Forecasts is a systematically upward biased predictor of future bond yields, or that forward interest rates provide more accurate forecasts of those yields. Neither Mr. Thygesen's reason for permanently lower rates due to the inability of national banks to raise them nor Dr. Booth's contrasting view that national banks will keep them lower than in the past is convincing. Ultimately, Dr. Booth, Dr. Cleary, and Mr. Thygesen acknowledge that Canadian interest rates and long-term bond yields are forecast to rise above their current levels in the near term.[23]

2. Mr. Thygesen's Comments on Negative Returns

Q12. What is your reaction to Mr. Thygesen's statements regarding realized versus expected stock market returns?

A12. Mr. Thygesen dedicates an entire section of his testimony (Section 6, entitled "Continously high forecast returns") to a disjointed and conceptually flawed challenge to the fundamental notion that allowed returns should compensate for expected returns based on the observation that ex-post actual stock market returns are sometimes negative:

> One of the issues is that the utilities continuously forecast high expected returns and that it is the expected returns which should be paid. The difficulty is that there are substantial times when ex-post returns are low or negative as the chart below [Exhibit 82 of Mr. Hevert's Evidence] illustrates.

[23] Booth Evidence, p. 25, Cleary Evidence, p. 21; Thygesen Evidence pp. 7-8.

Mr. Thygesen's argument displays fundamental misconceptions about what determines the opportunity cost of capital and how capital markets respond to investment decisions.

Q13. What is the first misconception in Mr. Thygesen's argument?

A13. The central misconception at the heart of Mr. Thygesen's argument is his mistaken belief that ex-post realized stock returns should influence cost of capital estimation—a belief for which he provides no support in the form of academic, empirical, or practitioner evidence.

Fundamentally, the cost of capital represents an opportunity cost for investors; by undertaking one particular investment, the investor foregoes the return they might earn on some other investment of equivalent risk. At the time of the investment, however, the returns (and risks) of such foregone opportunities are unknown. The cost of capital therefore represents the *expected* return that a rational investor would require to make them indifferent between investments that are *expected* to have equivalent risk profiles.

Clearly, it is impossible to ever "know" these expectations. (Indeed, estimating them is a major goal of this proceeding.) And importantly—as articulated above in the context of interest rate forecasts—ex post realized returns are only point observations from the distribution of outcomes that were possible at the time of the investment. They will at times be lower and at other times higher than was expected ex ante. It is therefore inappropriate to judge ex-ante expected returns based on a few observations of ex-post returns.[24]

[24] I note that it *can* be appropriate to consider *averages* of many ex-post realized returns over a long period. For example, this is how "unconditional" or "historical" estimates of the market equity risk premium are developed based on averages of realized annual ex-post returns—some high, some low or even negative—over the longest period of available high quality data.

Q14. How does Mr. Thygesen reveal this misconception?

A14. When asked an information request on the use of realized returns to judge expected returns, I explained the concept via the analogy of a fair coin—pointing out that though any given "trial" of 10 coin flips may result in more or fewer than 5 instances of heads, that does not suggest that "5" is not the ex-ante expected value of the experiment[25] Mr. Thygesen responded as follows:

> The difficulty I have with the analogy is that it is a mechanical analogy. An unbiased coin is not predictable so the [sic] Dr. Villadsen's analogy is not relevant to the utilities. Returns are different. There is generally a lower limit to returns as infinite negative returns means a company goes bankrupt. Infinite positive returns are similarly not positive. This is different from the coin analogy in that infinite heads are possible albeit unlikely.
>
> Secondly, there is no reason to change ones expectations on coin flips since no variable change in the coin flipping environment. However in the investment world things are continually changing.[26]

Mr. Thygesen's response entirely misses the point of the analogy. I did not suggest that the stock market is like a fair coin in that the expected result never changes. Rather, I explained that—as with a fair coin—it is not reasonable to judge ex-ante expected stock returns based on a few ex-post observations of realized returns.

Mr. Thygesen states that "it is not [his] position that investment returns are predictable."[27] However, his evidence seems to contradict this:

> With the S&P at or near record levels, it is difficult to see how forward looking returns can be at the high end of the spectrum. Just as the return on a bond is the inverse of the price (i.e., the higher the bond price, the lower the return on the bond), so too, all else being equal a generally higher overall stock market index should result in a lower future return.[28]

This statement implies that Mr. Thygesen believes the stock market is "generally high overall" and that returns will therefore be low (or negative?) going forward. The implication of this statement is problematic, since high (or low) index levels—

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[25] Response to information request CCA-Villadsen-2016FEB18-001 (d).

[26] Thygesen Evidence, paragraphs 75-76.

[27] Response to IR CCA-Utilities-2016 Apr 28-013(b).

[28] *Ibid.,* paragraph 73

resulting from past positive (or negative) returns—have been found not to have predictive power over future returns.[29] To illustrate the point, Mr. Thygesen could have noted at the start of 2013 that the S&P 500 was "at or near record levels." Presumably, he believed at that time—consistent with his statement above—that returns would be low (or negative) going forward. However, the S&P500 index has continued to earn positive returns since that time.[30]

As Mr. Buttke has also noted, Mr. Thygesen makes an improper comparison of the stock market to the mechanical relationship between the price of a bond and its yield to maturity.[31] The yield to maturity is perfectly predictable, since the face value of the bond is known. By contrast, although Mr. Thygesen seems to disagree, financial economics has shown that stock returns cannot be predicted based on the level of current or past prices.[32]

Q15. What is the second misconception in Mr. Thygesen's argument?

A15. Mr. Thygesen manipulates my fair coin analogy into a straw man, stating

> [T]here is no reason to change ones [sic] expectations on coin flips since no variable [sic] change in the coin flipping environment. However, in the investment world things are continually changing. … Against this backdrop one would not expect investors to continue to have the same expectations year in and year out.[33]

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29 *See*, for example, 2012 Ibbotson SBBI Valuation Yearbook, p. 58: "[T]here is no discernable pattern in the realized equity risk premium—it is virtually impossible to forecast next year's realized risk premium based on the premium of the previous year."

30 See the chart in CCA's response to IR CCA-Utilities-2016 Apr 28-013(a)

31 Buttke Evidence, Section IV.

32 *See* for example: Brealey, R. Myers, S., & Allen, F. (2008), P*rinciples of Corporate Finance* (9th ed.), pp. 355-359; Bodie, Z., Kane, A., & Marcus, A. (2011), *Investments* (9th ed.), pp. 343-345; Ross, S., Westerfield, R., Jaffe, J., & Roberts, G. (2003), *Corporate Finance* (3rd Canadian ed.), pp.364-67, 370-71; Booth, L. & Cleary, W.S. (2008), *Introduction to Corporate Finance*, pp. 390-391.

Note that the observation that stock returns are not predictable based on past prices is often called "weak form market efficiency," and as cited by many textbooks was first documented in the seminal paper "The Analysis of Economic Time Series, Part I: Prices," *Journal of Royal Statistical Society* 96 (1953).

33 Thygesen Evidence, paragraph 76.

Though this statement is true, it is also totally irrelevant, as I have neither stated nor suggested that investors have "the same expectations year in and year out." More to the point, however, the fact that investors *do* modify their expectations in response to changing economic and capital market conditions undermines Mr. Thygesen's entire argument. As Mr. Thygesen acknowledges, investors *act* on changing expectations by changing their investment decisions.[34] If they perceive an asset as offering a particularly attractive return, demand for that asset will increase, causing its price to rise. Conversely, if investors (in aggregate) expect an investment asset to lose value, they will sell (or decline to buy) that asset, thereby causing its price to decrease until it offers an attractive *expected* return. It is by this price-feedback mechanism that stock markets reach equilibrium—an equilibrium at which stocks are priced so as to return a *positive* risk-adjusted required return *in expectation*.

Q16. What about Mr. Thygesen's discussion of negative interest rates?

A16. Mr. Thygesen makes much of the existence of central bank interest rates and sovereign debt yields that are below zero in nominal terms.[35] He states that $7 trillion has been invested in negative-yielding debt instruments in Europe and elsewhere—a fact that seems much less impressive when one recognizes that this constitutes roughly 1 percent of the global pool of investment capital.[36] In emphasizing this point, Mr. Thygesen misleadingly decontextualizes my response to an information request that—based on its preamble—clearly referred to stock market returns. The full text of my response to the question "If there is never a period when forecast returns are negative, how do expected returns deal with or account for the actual negative returns?"[37] was

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34 CCA response to IR CCA-Utilities-2016 Apr 28-013(d)

35 Thygesen Evidence, paragraphs 78 – 83.

36 See the 2012 Bain & Company report "A World Awash in Money: Capital Trends Through 2020", which estimated that the amount of "total financial assets"—defined as "financial holdings of direct owners, as well as financial assets controlled by and held on the balance sheet of banks and other financial intermediaries"—in 2010 was approximately $600 trillion.

37 Information request CCA-Villadsen-2016FEB18-00 (b).

> Dr. Villadsen does not accept that investors expect a negative return as investors most likely would hold cash rather than assets with an expected negative return. However, to be responsive, Dr. Villadsen observes that in a cost of capital context, the terms "expect", "expected", and "expectation" are used in the statistical sense: to imply a probability weighted average of all possible outcomes. For example, when flipping a fair coin 10 times, one would expect to record 5 heads. However, in conducting this experiment, one might actual observe (or realize) any number of heads between 0 and 10. The fact that some ex-post realizations of this experiment result in observations of 2, or 3, or 7, or even 10 heads instead of 5 does not mean that the ex-ante expected value was something other than 5 heads out of 10. Similarly, the fact that ex-post realized stock market returns in some periods were negative does not necessarily mean that the ex-ante expected returns for those periods were negative. In a cost of capital context, the realized market equity risk premium has been positive in most years but certainly has been negative in some years (e.g., 2008). **However, that does not mean that the expected market equity risk premium is negative**. [Emphasis added]

Contrary to Mr. Thygesen's unsupported assertion, I have no "concern"[38] about the existence of negative central bank interest rates or short-term sovereign debt yields. While such rates are largely unprecedented and provide further evidence of the lingering impact of the financial crisis, the existence of negative interest rates on European and Japanese sovereign debt definitely does *not* constitute evidence that investors in North American *equities* expect negative returns from the stock market.

First of all, Mr. Thygesen has presented no evidence that negative interest rates exist in North American markets. Second, his own graphs indicate that negative interest rates are for terms far shorter than 30 years. Third, the Bloomberg "quick takes" article cited by Mr. Thygesen itself acknowledges that it is mostly banks and other large institutions—not retail investors—that are accepting the negative interest rates.[39]

These facts reveal Mr. Thygesen's discussion of negative interest rates to be nothing more than a straw man and a distraction. Even Mr. Thygesen must think so, since he ultimately selects both a *positive* risk-free rate and a *positive* market equity risk premium for his implementation of the CAPM. Though his process for selecting

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[38] Thygesen Evidence, paragraph 82.

[39] http://www.bloombergview.com/quicktake/negative-interest-rates

CAPM parameters (i.e., "[u]sing the same factors as Decision 2191-D01-2015) shows no consideration for current capital market conditions or expectations, it at least reveals that Mr. Thygesen does not himself believe that "expected returns [should] deal with or account for … actual negative returns?"

Q17. Why would investors buy bonds with negative yields?

A17. A recent article in *The Economist* does an excellent job of summarizing the reasons, which it groups into three categories:[40]

- Some investors, such as central banks, commercial banks, insurance companies, and pension funds *have* to own sovereign debt for various practical and legal reasons that are independent of the expected return.
- Other investors *do* expect to earn positive returns on the debt of foreign sovereigns despite the negative stated yields, due to currency movements. Investors expecting price *deflation* might also expect a positive real return from the negative yielding bonds.
- Finally, some negative yield bond purchasers fall into the category of "anxious investors who prefer a small loss on government bonds to a much bigger loss elsewhere." As *The Economist* puts it, "[f]ear makes government bonds appear a haven from turmoil, even when their return is negative."

In his response to an information request from the Commission, Mr. Thygesen acknowledged several of these reasons, including the last one, noting that investors might purchase negative yield bonds if their expectations for the economy are such that "a return of capital rather than a return on capital is considered more important."[41]

Based on this explanation, the fact that there is demand for negative yielding sovereign bonds suggests elevated risk aversion in capital markets, so that investors required risk-premiums are also elevated.

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[40] http://www.economist.com/blogs/economist-explains/2016/02/economist-explains-6

[41] Mr. Thygesen's response to IR CCA-AUC-2016APR28-005.

3. Risk Premiums and Yield Spreads

Q18. What is your opinion of Dr. Booth's estimate of the market equity risk premium?

A18. Dr. Booth estimates the market risk premium of common equities over long-term Canada bonds at 5.0-6.0 percent.[42] Dr. Booth claims that the "simple historic Canadian market risk premium" is less than 5.0 percent. However, Duff & Phelps indicates the historical average since 1935 is 5.7 percent,[43] while the survey evidence cited by Dr. Booth reports an average Canadian market risk premium of 5.9 percent.[44]

Dr. Booth mentions that Duff & Phelps 2016 Valuation Yearbook recently increased its recommended market equity risk premium of 5.5 percent relative to a 4.0 percent normalized bond yield.[45] He comments that this is "bang in the middle of [his] normal range of 5.0-6.0%," but fails to acknowledge that 5.5 percent market equity risk premium relative to a 4.0 percent normalized risk-free rate implies a 9.5 percent expected market return.[46]

Dr. Booth also cites a survey done by Professor Fernandez in 2008, which given the timing of the global financial crises is arguably out-of-date for the current period.[47] Interestingly, the author of the survey cited by Dr. Booth no longer appears to find the CAPM helpful as he recently authored an article entitled "CAPM: An Absurd Model," which argues that

> The CAPM is an absurd model because its assumptions and its predictions/conclusions have no basis in the real world.[48]

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42 Booth CAPP Evidence, p. 46.

43 *Duff and Phelps International Cost of Capital Handbook*, 2015, Exhibit 1-9.

44 Booth CAPP Evidence, p. 48.

45 Booth CAPP Evidence, paragraph 183, citing Duff & Phelps website:
http://www.duffandphelps.com/insights/publications/cost-of-capital/duff-phelps-increases-recommended-us-equity-risk-premium-from-5-0-to-5-5

46 Duff & Phelps confirms this interpretation. See *Duff and Phelps 2016 Valuation Handbook Guide to Cost of Capital*, p. 3-40 and Exhibit 3.15.

47 Booth CAPP Evidence, p. 47.

48 Pablo Fernandez, "CAPM: An Absurd Model," IESE Business School, Spring 2015, p. 1.

Thus, Dr. Booth supports his market risk premium analysis in part based on a survey conducted by an author who appears to not believe in the model for which he surveys input parameters.

Q19. What do you think of Dr. Cleary's "commonly used" 4-6 percent range for the Canadian MERP and his choice to use a 6 percent MERP?

A19. Dr. Cleary mentions a "commonly used" 4-6 percent range for the Canadian MERP but provides inadequate justification for this being typical.[49] His first justification is a long-term average of 5.3 percent for the Canadian MERP from Dimson, Marsh, and Staunton.[50] This estimate is problematic because it uses data before 1936 when Ibbotson suggests Canadian data is only high quality starting in 1936.[51] The Duff and Phelps publication I cite in my initial report looks at an MERP from 1935 to 2014, effectively fixing these problems, and finds an estimate of 5.7 percent, towards the upper end of Dr. Cleary's estimate.[52]

Furthermore, Dr. Cleary explains in his evidence that market uncertainty is above average, during which he says the MERP can be elevated. He accounts for this by electing to use 6 percent instead of 5 percent for the MERP from his 4 to 6 percent range. This adjustment is based on the premise that 4 to 6 percent is a reasonable range for the Canadian MERP. It also does not attempt to estimate how much market uncertainty currently exists. Evidence shows that MERPs for Canada have been elevated very significantly since the global financial crisis and ensuing recession beginning in 2008, ranging from 8 percent to over 12 percent.[53] This is far above Dr. Cleary's estimates. Dr. Cleary does not explain in his evidence why a one percent adjustment is appropriate and why a larger adjustment is not merited based on this evidence.

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[49] Cleary Evidence, page 36.

[50] Cleary Evidence, page 36.

[51] See *Duff and Phelps International Cost of Capital Handbook, 2015,* pp. 3-9.

[52] Villadsen Evidence, page 44.

[53] Villadsen Evidence, Figure 5.

Finally, given evidence that Canadian and U.S. capital markets are integrated, it would also make sense to give weight to the U.S. MERP when assessing the appropriate return investors would require. Dr. Cleary does not address this. The U.S. MERP using a long-term historical average is about 7 percent and I provided evidence in my initial report that it is also elevated.[54]

Q20. What do you think of Dr. Cleary's claim that "double digit 'nominal' returns are no longer the norm for stocks" going forward?

A20. Dr. Cleary says that his return on equity estimate is reasonable "when compared to expected long-term overall stock market returns in the 7-9%, when we consider the low-risk nature of regulated utilities."[55] He goes on to say

> It is important to recognize that overall stock market conditions have changed over the last three decades and double digit "nominal" returns are no longer the norm for stocks, given existing 2% long-run inflation expectations. In other words, long-term nominal stock returns in the 7-9% range are consistent with experienced long-term real stock returns of 6-7%.[56]

Dr. Cleary seems to be asserting that lower inflation in recent decades (and expected going forward) has contributed to expected long-term real stock returns of 6-7 percent and associated expected nominal stock market returns in the 7-9 percent range. However, Dr. Cleary's own evidence undermines this point. With reference to Table 6 in his evidence, he cites average Canadian stock market returns of 11.3 percent from 1938 to 2015,[57] with average inflation of 3.8 percent over the same period. This is consistent with long-term arithmetic average real stock market returns of 7.5 percent, which would be consistent with a 9.5 percent expected nominal return given 2 percent inflation expectations. As both of these numbers are outside Dr. Cleary's ranges of expected real and nominal returns, his own evidence leads to a higher expected return than the 7-9 percent he states.

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54 Villadsen Evidence, page 25, Figure 6.

55 Cleary Evidence, p. 3.

56 *Ibid.*

57 Note that Dr. Cleary's calculations in his Exhibit J are actually for the period 1938-2014.

Given Dr. Cleary's argument that lower inflation has driven changes in stock market conditions over the last three decades, the Utilities requested that he provide stock return and inflation data for that period (1986-2015) and confirm that the Bank of Canada has maintained an inflation target of 1-3 percent since the 1990s. Dr. Cleary complied, indicating that the 1-3 percent inflation target took effect in 1991 and noting that the "[Canadian] CPI has averaged 1.98% since 1992."[58] The data provided by Dr. Cleary reveals that inflation did in fact decline noticeably from 1986-1991 to 1992, such that the average inflation since that time was in line with the "2% inflation expectations" he relies on. I note, however, that according to the data provided by Dr. Cleary, the average nominal stock return for 1992-2015 was 9.5 percent, corresponding to average real returns of 7.5 percent.[59]

Thus, using the low inflation period since the implementation of the Bank of Canada's 1-3 percent inflation target as a basis for expected returns yields an expected nominal return of 9.5 percent, which again is higher than the range cited by Dr. Cleary.

Q21. Is it your position that investors expect real returns of 7.5 percent and nominal returns of 9.5 percent going forward?

A21. No. I merely bring up these historical averages to highlight that Dr. Cleary's argument is internally inconsistent and not supported by his own analysis.

While the long-term historical average Canadian stock returns cited by Dr. Cleary are not totally inconsistent with the unconditional (historical) Canadian MERP estimate of 5.7 percent calculated by Duff & Phelps that I rely on in my CAPM analysis, they do not reflect elevated levels of risk aversion currently affecting financial markets. This is why I also consider forward-looking estimates of the MERP and evidence

[58] IR response Cleary-Utilities-2016APR12-004(d).

[59] See BV Workpaper R03, with calculations based on Attachment A to Cleary-Utilities-004bc.

relating to elevated yield spreads in developing my CAPM inputs. The expected market returns using the forecasted MERP is 10.6 percent.[60]

Q22. What about Dr. Cleary's reporting of geometric mean historical results?

A22. While geometric means are useful for measuring historical performance (in the form of compound annual returns), they are downward biased as estimates of expected future returns. This is because they represent the average of a single ex-post realization of the distribution of possible ex-ante expected returns, and as such do not account for year-to-year variation around the expected value. Empirical evidence and academic opinion supports the use of arithmetic averages (when using historical data) or expectations (for forward-looking models) as the most appropriate forecasts of expected returns.[61] Additionally, the Commission and its predecessor, as well as Dr. Booth, have recognized that near-term expected returns should be calculated on an arithmetic rather than geometric basis.[62] Therefore, Dr. Cleary's geometric averages deserve no weight.

Q23. What are your comments on the evidence presented by Dr. Cleary on yield spreads and debt yield levels for utility bonds?

A23. In my Written Evidence I argued that an increased spread between long-term A range rated utility debt and government bond yields were evidence of elevated risk premiums that affect the return on equity.[63] All of the intervenor experts acknowledge that yield spreads have increased since the last GCOC proceeding in 2013. Dr. Cleary shows in Figure 3 of his evidence that the spread has increased significantly since 2007. While he acknowledges this "slightly heightened risk aversion" and includes a

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60 *See* Villadsen Written Evidence, Sections III and IV.C, with input scenarios summarized in Figure 13, p. 50.

61 *See* for example, Morin, R.A., *New Regulatory Finance*, Public Utilities Report, Inc., 2006, Appendix 4A, which summarizes the theoretical, empirical, practical, and academic evidence on this issue. *See also* Duff & Phelps 2016 Valuation Handbook, p. 3-29 and footnotes 3.56 and 3.57.

62 *See* Alberta EUB Decision 2004-052, p. 19, AUC Decision 2191-D01-2015, paragraph 237. *See* also Booth CAPP Evidence, paragraphs 168 and 169.

63 Villadsen Evidence, pages 19-21.

50 basis points adjustment for it in his max and best CAPM estimate,[64] he discounts it by emphasizing that the cost of debt has decreased over this period and that "much of this increased spread is due to liquidity problems."[65] This argument is flawed and inadequately supported.

First, the "level" of the cost of debt is irrelevant to this point; the spread is what is relevant to assess risk premiums and their impact on estimating return on equity. Second, while it is true that liquidity issues can increase yield spreads, Dr. Cleary overstates its importance at the present time. The paper by Garcia and Yang that Dr. Cleary cites was published in 2009 and the results apply *specifically to the credit crisis of 2007-2008*, where it would be expected that liquidity issues to increase yields spreads.[66] However, Dr. Cleary provides no evidence that these liquidity issues continued after the paper was published in early 2009. There is no reason to believe that substantial liquidity challenges exist in high quality utility debt markets in the current economic environment. Rather, as I explained in Appendix B to my Written Evidence,[67] the elevation in the yield spread is best explained in terms of elevated risk aversion among investors, causing them to demand higher risk premiums when purchasing riskier corporate bonds instead of risk-free government bonds. The higher risk premium results in a higher cost of equity.

Q24. Is Dr. Cleary's 50 basis point adjustment adequate to account for the increased risk premiums indicated by the yield spread?

A24. No, a 50 basis point adjustment is too small to account for the almost full percentage point of elevation in the yield spread. Indeed, even if one were to attribute less than the full amount of the elevation to increased risk aversion, it would be necessary to account for the low beta of corporate debt. For example, if the stock market on

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64 Cleary Evidence, pages 39-40.

65 Cleary Evidence, page 39.

66 A. Garcia and J. Yang, "Understanding Corporate Bond Spreads Using Credit Default Swaps," Bank of Canada Review, Autumn 2009, page 30.

67 Appendix B to the Written Evidence of Dr. Villadsen, pages 18-19.

average (beta of 1) is roughly 4 times riskier than A rated utility bonds (i.e., assuming a conservatively very high beta of 0.25), then according to the risk-return relationship posited by the CAPM, the elevation in the MERP would have to be 4 times the portion of yield spread elevation attributable to increased risk aversion.[68]

Q25. Does Dr. Booth provide a similar treatment of elevated yield spreads?

A25. Yes. In paragraph 138 of his CAPP Evidence, Dr. Booth estimates that the yield spread between 30-year Canadian government bonds and equivalent maturity A range rated utility bonds is "about 1.00% more than the typical average for the business cycle." This estimate of the yield spread elevation is slightly higher than my own. However, Dr. Booth adds only 50 basis points to his CAPM estimates, which he regards as "converting the CAPM into a conditional CAPM."[69] He then notes that "the credit spread adjustment of 0.50 percent is equivalent to increasing the market risk premium by 1.00 percent at the mid-point of [his] beta range of 0.45-0.55."[70]

While Dr. Booth's 1.0 percentage point adjustment to the MERP is higher than Dr. Cleary's 50 basis point adjustment, for the reasons stated above it is still too small to adequately capture the elevated risk aversion and consequent elevated required risk premiums implied by the elevated yield spread. Additionally, I will show below that Dr. Booth's 0.45-0.55 range for beta is unreliable and unreasonably low given more recent market evidence. My initial Written Evidence showed that when betas are appropriately measured, adjusted, and unlevered and relevered to account for the impact of financial leverage, the range for β (beta) is nearer to 0.70-0.90, with the Canadian sample at the upper end of that range. That means that even if a 1.0 percentage point adjustment to the MERP were adequate—which it is not—Dr. Booth's 50 basis point "conditional CAPM" adjustment is too low.

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[68] *Ibid.*, page 19.

[69] Booth CAPP Evidence, paragraph 138.

[70] *Ibid*., paragraph 140.

Q26. Is there other evidence that the required equity return is higher than in the past?

A26. Yes. As shown in the Buttke Evidence, the spread on preferred shares have widened by 100-200 basis points since the release of the 2013 GCOC decision.[71] Just as an increase in the bond yield spread indicates an increase in the MERP, so does an increase in the preferred spread. Bondholders receive payment ahead of preferred shareholders, which in turn receive payment ahead of equity owners. This rank order generally means that the risk premium that common equity shareholders require is higher than that of preferred shareholders, which in turn is higher than that of the bondholders.

It is possible to measure the spread between risk-free securities and utility bonds as well as between risk-free securities and preferred but the required equity return has to be estimated. Therefore, just like an increase in the spread between utility bond yields and risk-free bond yields indicates that the required equity premium over risk-free yield has increased so does an increase in the preferred spread. As discussed in Appendix B to my written evidence the magnitude of the increase can be approximated by the inverse of the beta on the instrument used as a proxy (increase in MERP $\approx$ (increase in preferred spread)/Preferred Beta).[72] As the preferred beta undoubtedly is less than the equity beta, the increase in the required equity return has to be larger than the increase in the preferred spread, so 100-200 basis points is the bare minimum, and likely an underestimate of the appropriate adjustment to the MERP. For example, if the preferred beta were 0.4, then an increase of 100 - 200 basis points in the preferred spread would indicate an increase in the MERP of 250 - 500 basis points. Thus, if the equity beta is 0.65, the increase in the cost of equity is 162.5 to 325 basis points (0.65×250 and 0.65×500, respectively).[73]

As Mr. Buttke points out, in addition to an increase in the spread on preferred equity issuance, non-bank preferred equity has since about September 2015 often been

[71] Buttke Rebuttal Section VII.

[72] *See* Villadsen Evidence, Appendix B, Section II.B.2, pp. 18-19 for a discussion in the context of the yield spread for corporate debt..

[73] *See* Villadsen Evidence, Appendix B, Section II.B.2.

issued with a dividend floor.[74] The presence of a floor reduces the downside risk for preferred equity holders and indicates that regardless of developments in government bond rates, preferred equity holders do not accept returns below a certain level.

B. REGULATORY PRECEDENTS

Q27. What issues does the Booth Evidence claim have been settled?

A27. The Booth Evidence states that a number of issues have been settled in prior decisions by the Commission. Specifically, these issues pertain to (a) the interaction of the Canadian and U.S. market, (b) the CAPM, (c) the DCF, (d) other estimation methods, benchmarks or the implementation of the methods, (e) how capital structure is set, and (f) flotation costs. Below I discuss these in turn except the flotation cost issue, because all witnesses used 0.50 percent. Dr. Booth also comments on the precedents regarding the similarities and differences in regulatory regime in Canada and the U.S. This issue is addressed in Section III of Dr. Carpenter's rebuttal evidence.

1. Interaction of Canadian and U.S. Markets

Q28. What precedents does the Booth Evidence cite on the interaction of the Canadian and U.S. markets?

A28. The Booth Evidence lists the following as a precedent:

> The AUC decided that Alberta utilities largely finance within Canada and that Canadian markets are partially segmented from those in the United States. (2009, paragraph 130).[75]

Looking at the cited paragraph, the Commission first acknowledges an increased ability for Canadians to invest abroad and then a degree of home bias due to exchange rate risk and tax differences between the two countries. The first point is consistent with the data presented in Figure 7 of my written evidence, which shows an increase in the direct investments by Canadians abroad and especially in North America. As the Booth Evidence acknowledges:

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[74] Buttke Rebuttal Section VII.

[75] Booth CAPP Evidence p. 7. The references in parentheses are to the Commission's Decision 2009-216.

> The AUC decided that information on capital market returns on US utilities was useful since investors do have alternatives; (2009, paragraph 136).[76]

More to the point is the Commission statement in the same decision that

> *Alberta regulated utilities must, on a risk-adjusted basis, compete for their capital requirements with alternative investments of comparable risk across North America. Therefore, U.S. information on U.S. utility returns is relevant to a determination of the fair return for Alberta regulated utilities.* If Alberta utilities must compete for investment across North America, the returns available to investors must be competitive enough to attract capital in order to ensure their financial integrity as a going concern.[77] [emphasis added]

Thus, past decisions indicate an acknowledgement that Alberta-based utilities compete for capital across the border and increasingly so as the Canadian direct investments abroad are increasing.

2. Model Specific Issues: CAPM and DCF

Q29. What CAPM issues do you address?

A29. I address following four topics: (i) reliance on the CAPM, (ii) how changes in credit spreads are addressed, (iii) beta estimates, (iv) the applicability of the ECAPM.

Q30. Please address the reliance on the CAPM.

A30. The Booth CAPP Evidence states that the AUC has "confirmed that it felt [the CAPM] was theoretically sound and a useful tool."[78] While the statement regarding the CAPM is accurate, it is also true that the Commission has recognized that "the applicability of CAPM has limitations." This recognition is consistent with the academic literature, where substantial work has been dedicated to studying how well the CAPM fits empirical data or deriving more elaborate models such as the Fama-French model.[79]

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[76] Booth CAPP Evidence p. 7. The references in parentheses are to the Commission's Decision 2009-216.

[77] Decision 2009-216, paragraph 135.

[78] Booth CAPP Evidence, p. 8 citing Decision 2191-D01-2015, paragraph 72.

[79] For a discussion of the pros and cons of the CAPM and alternatives, see, for example, Section IV.C of my written evidence discussing one such model: the Empirical CAPM.

The 2015 GCOC Decision further stated that

> The Commission agrees with the view of Ms. McShane and the Alberta Utilities that the *benchmark generic ROE should be established on the results of multiple tests*, as "each of the tests has its own strengths and weaknesses" and "no single test can pinpoint the fair return."[80] [Emphasis added, footnotes omitted]

Thus, past decisions indicate that the Commission has looked to multiple tests – one of which is the CAPM.

Q31. What does Dr. Booth claim is settled regarding credit spreads?

A31. The Booth CAPP Evidence states that "the AUC indicated that it would adjust the market risk premium for changes in credit spreads etc. rather than directly adjust for this separately."[81] The Commission statement was that

> The Commission considers that it is preferable to base the risk-free estimate on the observed and expected long-term government bond rates, and account for any residual credit spread concerns by way of an adjustment to the MERP estimate …[82]

Thus, the decision regarding adjustments to the MERP estimate is fairly broad. It is important to recognize that credit spread concerns affect the MERP by a multiple of the "residual credit spread." As explained in Appendix B, pp. 18-19 of my written evidence, a credit spread that is 0.80 percent above the norm would result in an increase in the MERP of 0.80 percent divided by the bond beta (for example, 0.80% / .25 = 3.2%), which is substantially higher than the direct credit spread concern (0.80%).

Q32. What do you address regarding beta estimates?

A32. The Booth CAPP Evidence states that the Commission did not accept adjusted betas in its 2009 decision, but modified its position to accept a wider range in 2015.[83] Importantly, in Decision 2191-D01-2015, the Commission was mindful that:

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[80] Decision 2191-D01-2015, paragraph 271.

[81] Booth CAPP Evidence, p. 8 citing Decision 2191-D01-2015.

[82] Decision 2191-D01-2015, paragraph 92.

[83] Booth CAPP Evidence p. 8.

> …betas calculated using historical data may be poor predictors of an investor's required or expected return. The Commission also understands that, as one possible solution to this problem, equity market practitioners may use adjusted betas, which, according to some academic research, are better predictors of returns than "raw" betas (i.e., betas calculated using historical data).[84] [Footnotes omitted]

Based on the evidence in the 2013 Generic Cost of Capital proceeding, the Commission accepted a range of beta estimates from 0.5 to 0.65.[85] Since the time that evidence in the 2013 Generic Cost of Capital proceeding was developed, Canadian utility betas have increased as evidenced by, for example, Figure 11 in my written evidence.[86]

Q33. Please comment on what Booth considers the precedents for ECAPM.

A33. The Booth Evidence cites the Commission's 2004 decision

> the use of long-term Canada bond yields largely adjusts for the tendency of CAPM, when based on short-term interest rates, to under estimate the required returns for lower risk companies. Therefore, the Board will only place limited weight on the results of the ECAPM model.[87]

I searched the more recent decisions for 2009, 2011, and 2013 and found no reference to the ECAPM, so the decision cited by the Booth Evidence pre-dates the financial crisis and this Commission. Further, I note that the evidence presented in by initial Written Evidence, Appendix B, Figure A-4 shows that the average ECAPM adjustment factor is about 4 percent, so if the use of a long-term interest rate accounts for about 1.7 percent (calculated as the difference between the long-term government bond and the treasury bill yield),[88] then a residual ECAPM adjustment of approximately 2.3 percent remains consistent when using the long-term government bond. My ECAPM implementation uses an adjustment factor of 1.5 percent, which

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84 Decision 2191-D01-2015, paragraph 129.

85 Decision 2191-D01-2015, paragraph 131.

86 I note that Figure 11 in my written evidence tracks the betas of market value weighted averages of the utility companies in my sample and such that no one company is driving the results.

87 Booth CAPP Evidence p. 9. Dr. Booth cites the Alberta Energy and Utilities Board's Decision 2004-052 p. 22.

88 As of December 2015 the yield on Canadian long-term benchmark bonds was 2.2 percent, while yield on 3-month bills was 0.5 percent for a spread of 1.7 percent. Source: Bank of Canada.

well below the bounds indicated by research. Thus, even when I take the use of the long-term bond yield into account, my adjustment is consistent with the factor found in empirical research and therefore conservative.

Q34. Which precedents does the Booth Evidence claim for DCF estimates?

A34. The Booth Evidence first comments that the Commission in Decision 2009-216 found estimates from only two Canadian utilities and U.S. multi-stage estimates useful, but acknowledges that Decision 2191-D01-2015 was "broader in accepting a variety of growth estimates," while "being mindful of analysts optimism" and "that long run growth rates equal to GDP may be ambitious."[89]

Q35. What comments do you have on these statements?

A35. First, back in 2009, the Commission was "concerned that many of the proxy companies used by the experts in their DCF analyses are holding companies that are engaged in significant unregulated activities and is also concerned with the potential upward bias in analysts' growth estimates."[90] Importantly, some of the DCF results discussed in 2009 were based on **all** *Value Line* electric or natural gas companies, which include a mix of highly regulated and less regulated companies, whereas the DCF results in my written evidence arise from a group of companies that are selected to be highly regulated. Second, in its most recent decision, the Commission discussed the use of forward looking analysts' growth rates and historic (sustainable) growth rates and concluded that

> each method described by the various experts presents with its own mixture of strengths and weaknesses. For example, analysts' forecasts of growth rates are forward-looking and aim to expressly account for events expected in the future.[91]

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[89] Booth CAPP Evidence p. 8. Dr. Booth cites Decision 2009-216 paragraph 273 and Decision 2191-D01-2016 paragraphs 180 and 41.

[90] Decision 2009-216, paragraph 269.

[91] Decision 2191-D01-2015, paragraph 180.

Consequently, the Commission considered both estimation methods.[92] Third, in its concern that analysts' forecasts might be too optimistic, the Commission cited Dr. Booth's evidence, which in turn cited only one academic paper dating back to 2007.[93] Much research has been undertaken on analysts' forecasts since then and, as I noted in the appendix to my written evidence, some recent research indicates that analysts' bias may be a problem of the past or specific to stocks that are difficult to value, have high volatility, or are generally less transparent.[94] These are not characteristics of utilities. Therefore, it is important to recognize the nuances across industries and analysts regarding concerns about optimistic forecasts. Section III.B below provides a summary of more recent research into whether analyst forecasts display bias.

3. Other Estimation Methods

Q36. What other "settled issues" do you discuss?

A36. Dr. Booth lists that (i) a forward looking estimate of the stock market return was useful, so that the DCF estimates for the market as a whole of 8.0-9.0 percent could be viewed as an upper bound on the utility ROE[95] (ii) the AltaLink purchase indicated the continuation of an ROE no higher than 8.75 percent,[96] (iii) pension forecasts of equity returns were a valid indicator,[97] (iv) the value of the DCF based risk premium test and historic based equity premium were not persuasive,[98] (v) no significant weight was given to the bond-yield plus risk-premium approach,[99] (vi) the allowed ROE from other Canadian regulators were relevant, but not those from foreign

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92 *Ibid.*

93 Decision 2191-D01-2015, footnote 229 cites to paragraphs 181-182 of Dr. Booth's Evidence for CAPP in that proceeding. Paragraphs 181-182 of the Booth Evidence cite only Easton and Summers, "Effect of Analyst's Optimism on Estimates of the Expected Rate of Return Implied by Earnings Forecasts," Journal of Accounting Research, 45-5, December 2007.

94 Villadsen Evidence, Appendix B, pp. 28-29.

95 Booth CAPP Evidence p. 8, citing the 2009 Decision Section 5.10 and the 2013 Decision paragraph 184.

96 Booth CAPP Evidence p. 8, citing Decision 2011-474, paragraph 223.

97 Booth CAPP Evidence p. 8, citing Decision 2004-052.

98 Booth CAPP Evidence p. 8, citing Decision.

99 Booth CAPP Evidence p. 8, citing Decision 2191-D01-2015.

jurisdictions.[100] I do not discuss the claim that (vii) the value of the DCF based risk premium test and historic based equity premium were not persuasive[101] or (viii) comparable earnings are inconsistent with the fair return standard,[102,103] because no evidence using these methods has been put on the record.

First, based on the DCF evidence put forward in the 2013 GCOC, the Commission found a return on the market of 9.0 percent and concluded that the

> ROE estimates for the market as a whole may be viewed as the upper bound of the fair ROE for regulated utilities, given that the average utility company is typically less risky than the average company in the market.[104]

Three aspects of this quote merits commentary. First, the estimates presented to the Commission in the 2013 GCOC were based on the Gordon growth model, developed in the 1950s,[105] which considers dividends only as a source of cash distributions to shareholders. Recent evidence shows that cash distributions to S&P/TSX shareholders come in the form of share buybacks that result in a buyback yield of about 1.5 percent (see Figure 14), so that the Gordon growth model at the present time underestimates the market return on equity by about 1.5 percent for this reason.[106] In addition, I note that the Gordon growth model does take real option value into account, so to the extent that shareholders consider option values, the estimates are understated. Further, the S&P / TSX index in aggregate has an equity percentage of about 58 percent[107] while Alberta-based utilities are deemed 36-42

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[100] Booth CAPP Evidence p. 8, citing Decision 2011-474 and the Commission's July 13, 2013 letter.

[101] Booth CAPP Evidence p. 8, citing Decision 2191-D01-2015, paragraphs 242 and 247.

[102] Booth CAPP Evidence p, 8, citing the 2009 Decision, paragraph 281 and Appendix of the Commission's July 13, 2013 letter

[103] I did not file evidence using these methods.

[104] Decision 2191-D01-2015, paragraph 184.

[105] Myron J. Gordon, "Dividends, Earnings and Stock Prices," *Review of Economics and Statistics*, vol 41, 1959, pp. 99-105.

[106] See Section III.B below for a detailed discussion of this.

[107] Data for TSX members was downloaded and aggregated from S&P's Capital IQ. The equity percentage uses the market value of equity and the book value of debt, where debt is long-term debt and the current portion of long term debt. The S&P500 has a 77 percent equity percentage calculated in an analogous way. See BV Workpaper R04.

percent, so that they have substantially more financial risk. Therefore, the return on the S&P/TSX and the Utilities' required return cannot directly be compared.

Second, in its consideration of the ROE indications of the AltaLink transaction, the Commission was cautious stating that "an examination of a given company's P/B ratio in isolation is unlikely to provide a foundation for definite conclusions regarding the establishment of a specific ROE for regulatory purposes."[108]

Further, in making the comments referenced by Dr. Booth, the Commission did not conclude that 8.75 percent was an upper bound on the allowed ROE but rather that it was one of several factors that gave the Commission comfort in its decision.[109] Thus, it inaccurate to say the 8.75 percent was set as an upper bound due to the AltaLink acquisition.

Third, while the Commission has found forecast pension returns on equity a valid indication, the Commission has noted that such returns potentially are conservative and that forecasts by pension fund managers tend to be rather conservative.[110] I discuss the use of pension fund returns and the forecasts of pension fund managers in more detail in Section III.D.

Regarding the use of allowed returns in other jurisdictions, I observe the following. As discussed in my written evidence pp. 59-60, the Commission has in past decisions had concerns that evidence based on the allowed ROE in other jurisdictions (a) may have occurred during a different interest environment or (b) that some of the presented ROEs were the result of settlements.[111] Consequently, the data I presented took the interest rate into effect and excluded settlements. I respectfully submit that the data takes the Commission's concerns into account, are observable by investors

[108] Decision 2191-D01-2015, paragraph 221.

[109] Decision 2191-D01-2015, paragraph 222-223.

[110] Decision 2191-D01-2015, paragraph 234.

[111] See, for example, Decision 2011-474, p. 20.

and inform their investment decisions. Therefore, the modified data explicitly addresses the Commission's concerns.

4. Deemed Capital Structure

Q37. What do you address in this section?

A37. First, I address the discussion of how selected Canadian regulators have set equity ratios.[112] Second, I address the misplaced use of prior decisions from 2004 and 2009.[113] Third, I address Mr. Stauft's misunderstanding of how U.S. regulators set capital structure.[114,115]

Q38. Please discuss the use of selected Canadian regulators capital structure determinations.

A38. Dr. Booth states that the Québec Régie "has not changed Gas Metro's common equity ratio in recent memory" and that the British Columbia Utilities Commission (BCUC) has concluded that "38.50% [equity] was within the upper end of the range for comparators," yet the BCUC concluded that the 38.5 percent was "reasonable on a comparative basis."[116] Further, Gaz Métro Limited Partnership has a regulatory capital structure of 38.5 percent, so that apparently the utility started at a higher level than ATCO Gas, which currently has less equity at 38 percent. As is shown in Workpaper 09 to the Villadsen Evidence the average and median equity percentage among Canadian natural gas entities is 40.0 percent and 39.25 percent equity, respectively.[117] I note that the median ignores both high and low outliers and therefore is not driven by any one company. Thus, if the equity ratio of ATCO Gas is

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[112] Booth Calgary Evidence p. 11.

[113] Booth Calgary Evidence p. 8.

[114] Stauft Evidence p. 9.

[115] As Dr. Booth does not appear to rely on his cite to AEUB decision U99099, I do not address the cite. Booth Evidence p. 9.

[116] Booth Calgary Evidence p. 11 and p. 12. See also BCUC, "Generic Cost of Capital Proceeding (Stage I): Decision," May 10, 2013, p. 54.

[117] BV Workpaper 09 also shows that the average and median equity ratio for Canadian electric utilities is 38.5% and 40.0%, respectively.

compared to that of the average or median Canadian gas utility, it is currently slightly below the average – just as the benchmark equity percentage is below the average in Canada.[118]

Q39. What is misplaced in the use of the 2004 / 2009 decisions?

A39. Dr. Booth states that

> the AUC noted that the approach it adopted in 2004 of "adopting a common ROE and adjusting for differences in risk by adjusting capital structures recognizes the impact of leverage on the cost of equity and adjusts for differing investment risks."[119]

Dr. Booth's framing of the quotation fails to acknowledge that the 2004 decision recognized that a "utility-specific adjustment to the common ROE" might be needed in exceptional circumstances.[120]

Regarding the statements of Mr. Stauft (p. 9, line 14-17), it is factually incorrect that U.S. regulators "often determine utility capital structures to be used for rate-making purposes by simply accepting whatever actual capital structure the utility in question has, if it is publicly traded, or alternatively the actual capital structure of its nearest publicly traded parent company." U.S. regulators commonly use the regulated entity's actual capital structure – traded or not, but it is always part of the regulatory decision.

III. ESTIMATION METHODS

A. THE CAPM

Q40. What is your opinion of Dr. Cleary's recommended range for a risk free rate between 2.0 percent and 2.6 percent?

A40. Dr. Cleary claims that he arrived at 2.0-2.6 percent as a reasonable range for the risk free rate by following "the approach used by the Commission as described in paragraph 93 of page 19 of its 2013 GCOC Decision." However, Dr. Cleary uses a

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[118] Villadsen Evidence, Figure 21 and BV Workpaper 09.

[119] Booth CAPP Evidence p. 9 citing Decision 2009-216 paragraph 217.

[120] Decision 2004-052, p. 14.

different method to calculate the lower bound of this range in 2016 than the method used by the Commission in 2013. In 2013, the Commission accepted 2.8 percent to be a reasonable lower bound estimate for the risk-free rate. Dr. Cleary estimated this lower bound by taking an average of yields on 30-year Canadian government bonds in 2013. In his evidence filed for the 2016 proceedings, Dr. Cleary uses the February 2016 yield on a 30-year Canadian government bond to arrive at a lower bound of 2.0 percent. Unlike in 2014, the 2016 GCOC proceeding will not be able to benefit from perfect hindsight when determining a reasonable range for the risk free rate. Therefore Dr. Cleary's estimation of the lower bound for the risk-free rate cannot be entirely consistent with the method used by the Commission in 2013. It would be more consistent with the Commission's method used in 2013 to estimate the lower bound of the risk-free rate by calculating the average yield on a 30-year Canadian government bond for 2015. Using this method results in an estimate of the lower bound of 2.1 percent. This would shift the midpoint of Dr. Cleary's range for the risk free rate from 2.3 percent to 2.4 percent.

Q41. What is your opinion on Dr. Cleary's CAPM estimate range, Dr. Cleary's final estimate of 6 percent, and Dr. Booth's low estimates for the return on equity?

A41. Dr. Cleary recommends a range of 4.15 percent to 7.5 percent for the return on equity based on the CAPM method, with a best estimate of 6.0 percent. The lower part of Dr. Cleary's range does not reflect any risk premium over the cost of debt, which is not only illogical but also inconsistent with Dr. Cleary's written evidence as Dr. Cleary specifies in preparing his "Bond Yield Plus Risk Premium" estimates that Canadian regulated utilities should have a risk premium over debt in the 2-3 percent range, recommending a best estimate of 2.5 percent.[121] Dr. Cleary also states that A range rated Canadian utility yields currently sit at around 4 percent. This puts his best estimate for the return on equity of 6 percent at a 2 percent premium over Canadian utility debt yields, which is the lower bound of his appropriate range of risk

[121] Cleary Evidence, page 55.

premium.[122] Therefore, the lower half of his CAPM estimate range has a risk premium that is below what Dr. Cleary himself considers a suitable risk premium for equity over debt.

For example, Dr. Cleary's minimum of his return on equity range from the CAPM method is 4.15 percent. As seen in my Written Evidence, yields for Canadian A and BBB-rated debt is 4.04 percent and 4.36 percent respectively. Dr. Cleary's estimate represents no risk premium or even a negative risk premium over debt, which is implausible based on financial theory.

Dr. Booth also provides DCF estimates that are clearly unsupportable by financial theory in this way. In estimating the return on equity using the DCF method for individual entities, he adjusts his estimates to account for several perceived errors in the estimation methodology. However, his results for several companies fall at or very close to Canadian utility debt yields. As seen in Figure 5 below, the estimates for WGL, Piedmont, Northwest Natural Gas, and New Jersey Resources fall below the 2 percent maturity premium recommended by Dr. Cleary. In addition, his estimate for Northwest Natural Gas has virtually no risk premium at all.

Figure 4: Comparison of Booth DCF Results to Canadian Utility Debt Yields

	ROE [a]	Debt Rating [b]	Canadian Utility Debt Yield [c]	Implied Risk Premium [d]
Booth DCF				
Vectren	7.49%	A-	4.04%	3.45%
WGL	5.82%	A+	4.04%	***1.78%***
Piedmont	4.64%	A	4.04%	***0.60%***
Northwest	4.07%	A+	4.04%	***0.03%***
New Jersey Resources	4.90%	A	4.04%	***0.86%***
Laclede	6.36%	A-	4.04%	2.32%
ATMOS	7.17%	A-	4.04%	3.13%
South West Gas	6.39%	BBB+	4.36%	2.03%

Note: See BV Workpaper R05 for sources and calculations.

[122] Cleary Evidence, page 40.

Q42. What is your opinion on Dr. Booth and Dr. Cleary's recent monthly beta estimates in context of the CAPM?

A42. Dr. Booth says that "In my 2014 testimony, I assessed the then 'recent' beta estimates for Canadian and low risk US utilities at about 0.30. This assessment has not changed materially since then."[123] Dr. Cleary, similarly, finds that recent data suggests betas below 0.45 that he then uses to justify his lower bound on beta of 0.30.[124] The monthly beta estimates of Dr. Booth and Dr. Cleary based on recent data do not support their estimation range for betas of 0.45 to 0.55[125] or 0.65[126] they claim as reasonable and are unrealistically low, leading to their reliance in large part on long-term average historical betas. Dr. Booth estimates Canadian utility betas with a variety of different index measures and averages of individual company measures, none of which (other than those from Yahoo Finance) as of the end of 2015 reach his lower bound of 0.45. At some points the betas included by Dr. Booth are below zero, which would be entirely unreasonable.[127] Dr. Booth acknowledges this, arguing that "[c]urrently, utility betas are very low, but that simply reflects their interest rate sensitivity and the fact that their high dividends cause them to behave like convertible bonds in weak markets."[128] He goes on to explain that the drop in utility betas after the financial crisis is similar to the drop in utility betas in the early 2000s in that it is driven by unusual market conditions.[129]

Similarly, Dr. Cleary admits that "current betas are below the lower bound of this [0.45 to 0.65] range."[130] In addition, Cleary's average estimate for beta for the Canadian Utilities in February 2016 was on average about 0.20.[131]

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123 Booth CAPP Evidence, page 50.
124 Cleary Evidence, pages 36, 38.
125 Booth CAPP Evidence, page 57.
126 Cleary Evidence, page 36.
127 Booth CAPP Evidence, page 53.
128 Booth CAPP Evidence, page 3.
129 Booth CAPP Evidence, page 51.
130 Cleary Evidence, page 36.
131 Cleary Evidence, page 38, Table 8.

Furthermore, these recent monthly beta estimates in the context of the CAPM lead to erroneous results. If Dr. Cleary and Dr. Booth used these monthly beta estimates with their minimum range assumptions for the risk-free rate, MRP, and spread adjustment, their results for the return on equity imply risk premiums over the yield on Canadian A and BBB-rated utility debt far less than 2.5 percent Cleary says is reasonable, if not being less than the return on debt altogether. Neither Dr. Cleary nor Dr. Booth attempt to reconcile the inconsistencies between their recommended cost of equity and their recent beta estimates.

Figure 5: CAPM ROE Estimates Using Intervener Inputs With Contemporaneous Beta Estimates

	Minimum Risk Free Rate	Beta	Minimum MRP	Spread Adjustment	Financial Flexibility Adjustment	Implied RoE	Implied Risk Premium over 4 0% Debt Yield
Booth Estimate	2 25%	0 28	5 00%	0 00%	0 50%	4 15%	0 15%
Cleary Estimate							
Fortis	2 00%	0 03	5 50%	0 00%	0 50%	2 67%	-1 34%
Emera	2 00%	0 02	5 50%	0 00%	0 50%	2 61%	-1 39%
TransAlta Corp	2 00%	0 46	5 50%	0 00%	0 50%	5 03%	1 03%
Northland Power	2 00%	0 09	5 50%	0 00%	0 50%	3 00%	-1 01%
Algonquin Power	2 00%	0 23	5 50%	0 00%	0 50%	3 77%	-0 24%
ATCO Utilities	2 00%	0 39	5 50%	0 00%	0 50%	4 65%	0 65%
Canadian Utilities	2 00%	0 05	5 50%	0 00%	0 50%	2 78%	-1 23%
Enbridge	2 00%	0 22	5 50%	0 00%	0 50%	3 71%	-0 29%
TransCanada Corp	2 00%	0 36	5 50%	0 00%	0 50%	4 48%	0 48%
Average						3 63%	-0 37%
Average excl TransAlta and Northland						3 52%	-0 48%
Average (Fortis, Emera, Enbridge, TransCanada)						3 37%	-0 63%

Note: See BV Workpaper R05 for sources and calculations.

Q43. What is the difference between weekly and monthly betas?

A43. Beta measures the sensitivity of a company's or portfolio's returns to returns on the market. The difference between weekly and monthly betas is the frequency with which the returns are measured. If week-to-week total returns are used, there will be 156 data points over a 3-year estimation window (or 260 over a 5-year window) used to calculate the beta coefficient. In contrast, if returns are measured as the cash return (e.g., dividend) plus capital appreciation from one month to the next, only 60 data points will be used to calculate beta over a 5-year window. While 60 data points is generally sufficient to provide a statistically meaningful estimate, a sample of this size does allow "noise" (i.e., random variation) in the data to exert more influence

compared to a larger sample of weekly returns. This creates the potential—but by no means a guarantee—that weekly returns can deliver more precise beta estimates than monthly returns.[132]

Q44. Is it any more "correct" to estimate monthly betas as done by Dr. Booth and Dr. Cleary than to estimate weekly betas such as those you relied upon in your evidence?

A44. No, monthly and weekly betas do not inherently lead to different estimates of beta, and in most circumstances both monthly and weekly betas are acceptable for estimating a company's beta. For example, Bloomberg by default calculates adjusted betas on a weekly basis over a two-year period, but allows users to calculate betas based on either weekly or monthly returns.[133] Dr. Booth and Dr. Cleary acknowledge in their corporate finance textbook that both monthly and weekly betas are sometimes used as do other finance textbooks.[134] In addition, monthly and weekly betas for Canadian utilities have historically given comparable results when estimated over the same time period length. To illustrate this, in Figure 7 I have reproduced two of Dr. Booth's figures from his evidence, showing unadjusted betas calculated using both monthly and weekly returns for the utility sub index of the TSX and Dr. Booth's sample of "major" Canadian utility holding companies.[135]

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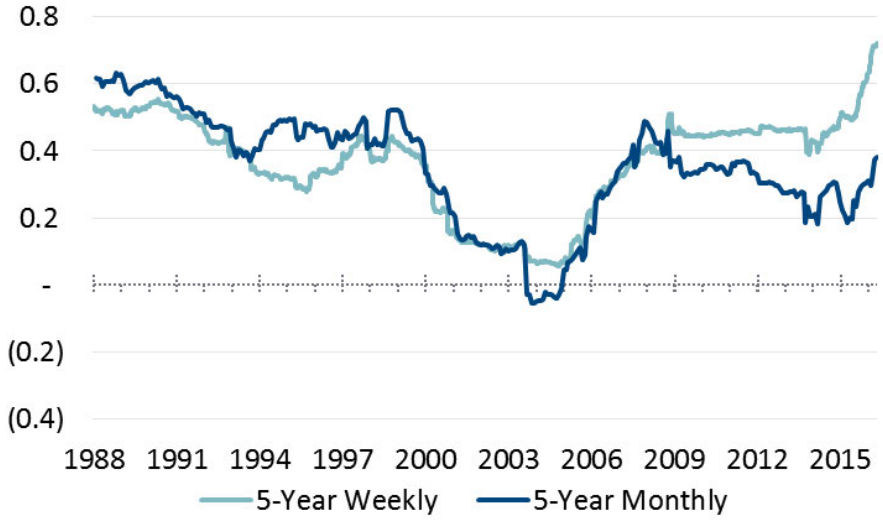
[132] Of course, it would be possible to get a larger sample of monthly returns by expanding the estimation window, but this has the generally undesirable effect of introducing data quite far removed from the moment at which one is trying to measure systematic risk.

[133] See field description for the "EQY_BETA" Bloomberg field.

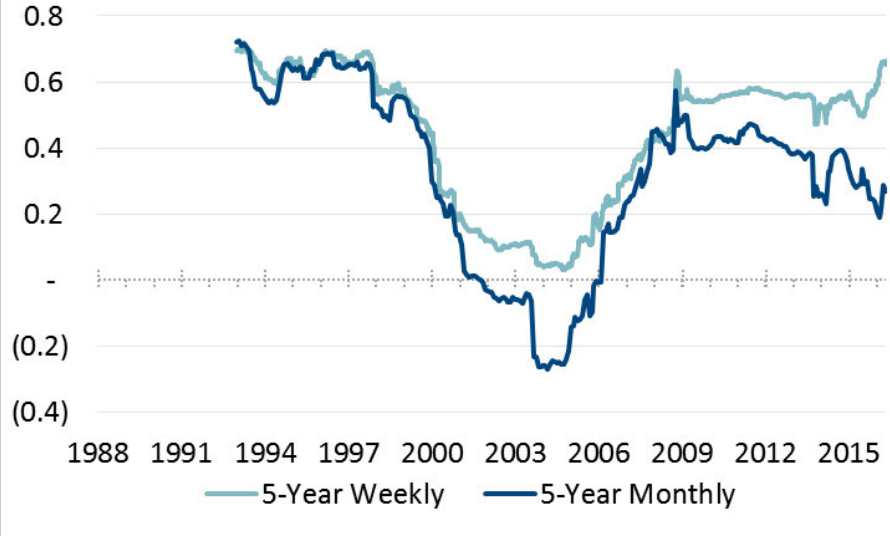
[134] "Typically betas for securities are estimated by using 60 months of monthly returns, but sometimes 52 weekly returns are used." See Booth, Laurence, Cleary, W. Sean, and Drake, Pamela Paterson, *Corporate Finance: Financial Management in a Global Environment* (Hoboken, NJ: Wiley, 2014) ("Booth, Cleary, and Drake"), p. 339. See also the response to CAPP-Villadsen-2016FEB18-005 (b).

[135] Data obtained from Bloomberg. My results in this section consistently show unadjusted betas for proper comparison with Dr. Booth's results. However, based on academic evidence presented in my initial Written Evidence and the associated Appendix, I believe that the use of adjusted betas is more accurate and appropriate when estimating the cost of capital.

Figure 6: Comparison of Historic 5-Year Monthly and Weekly Betas[136]
Panel A: Simple Average of Booth's Major Canadian Utility Holding Companies



Panel B: Utility Sub Index for the S&P TSX



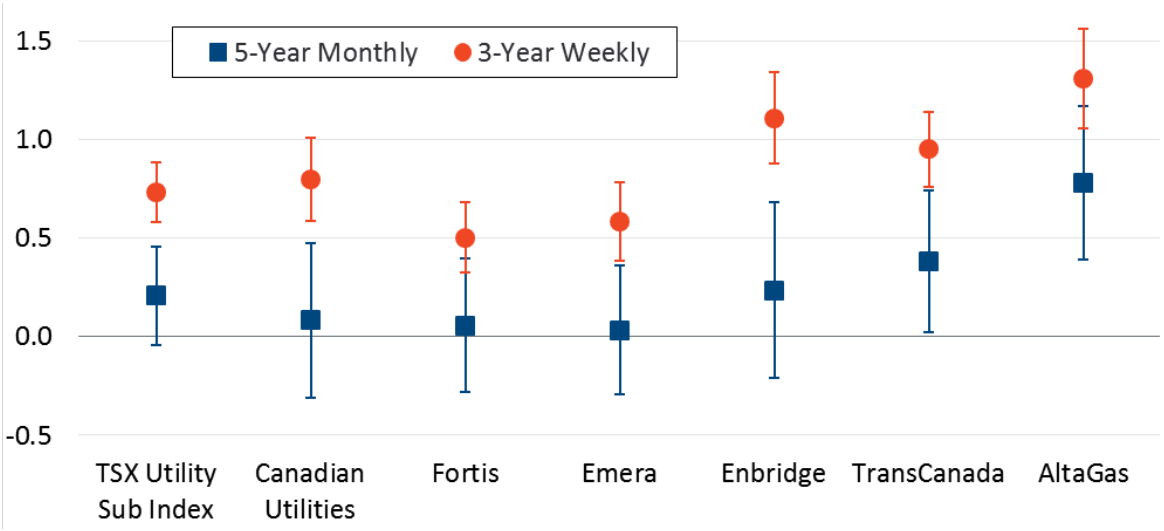
Source: BV Workpaper R06.

[136] The lower (5-Year Weekly) beta line from 1993 through the late 1990s in Panel A is the simple average of weekly betas for the companies in Dr. Booth's analysis. The drop is driven by unusual return data for Pacific Northern Gas, which has some gaps in its time series of weekly returns. This unusual data may lead Pacific Northern Gas to have negative weekly betas, which pull down the average.

Q45. In the recent period, particularly as of the beginning of 2016, do weekly or monthly betas provide more meaningful and reliable estimates of beta?

A45. While both monthly and weekly betas are generally acceptable, Dr. Booth and Dr. Cleary fail to recognize that monthly betas for the majority of the Canadian utilities have become unreliable following the global financial crisis. Figure 8 shows unadjusted betas for Dr. Booth's utility sub index for the TSX and my Canadian sample companies calculated at the beginning of 2016 with three years of weekly returns and with five years of monthly returns. The bars in the figure represent the 95 percent confidence interval for each beta estimate. I also note that if a long period is considered, it appears that the beta estimates in the 1990s were at about 0.7, which is well above Dr. Cleary's long-term average utility beta of 0.5 and his relied upon estimate of .45.[137] Thus, betas clearly change over time and (as can be seen in Figure 7) have recently increased.

Figure 7: Raw Beta Estimates as of January 5th, 2015 with Confidence Intervals



Source: BV Workpaper R06.

The confidence intervals for the weekly estimates are much smaller than the monthly estimates even with only three years of data, indicating that the weekly beta estimates are quite precise while the monthly estimates of beta are subject to much more uncertainty. For example, the monthly beta for Enbridge could reasonably fall

[137] Cleary Evidence p. 38-39.

anywhere between -0.21 to 0.68, giving a nearly 0.90 range for beta with very little precision. This makes the point estimate for Enbridge in the middle of that range unreliable. This is also evident in the r-squared for the regression of utility returns on total market returns that is used to estimate beta, which averages 31 percent for the weekly betas and only 5 percent for the monthly betas.[138]

In addition, the monthly confidence intervals for many of the utilities include zero, which in a statistical sense means that one cannot claim that the beta is non-zero with a high level of certainty. In non-statistical terms, this means that the betas estimated for the majority of the Canadian companies using monthly return data are indistinguishable from zero, which highlights the imprecision of the estimates and suggests that the monthly beta estimates are not reliable in this particular scenario.[139]

The fact that monthly beta estimates used by Dr. Booth and Dr. Cleary are statistically insignificant or have unusually low r-squared values shows that these pieces of evidence, to the extent that they are used to argue that betas are currently low or have decreased since the last GCOC proceeding, should not be relied upon.

Q46. Can you please provide greater detail as to why monthly betas are not reliable and suffer from such imprecision?

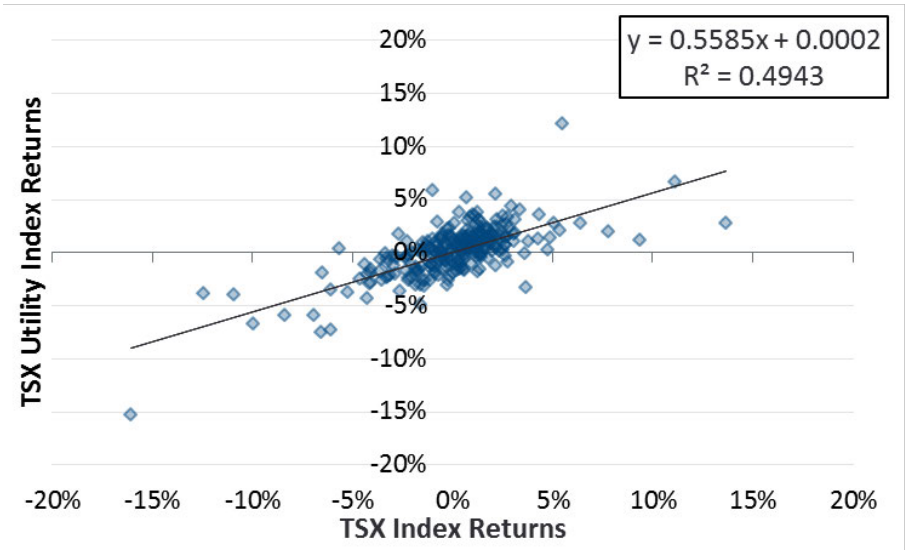
A46. From the financial crisis through early 2016, scatterplots for monthly and weekly beta estimates show why monthly betas are so low and statistically insignificant whereas weekly betas are not. In Figure 9, the scatterplots of weekly and monthly TSX and TSX Utility Index returns that Dr. Booth relied upon are shown from July 2008 through June 2013 in addition to their best fit line, the slope of which represents the beta coefficient unadjusted. Points that fall far to the left in each figure correspond to either the global financial crisis or the sovereign debt crisis in the summer of 2011. The weekly data lie closer to its best fit line than the monthly data, which is reflected by the weekly data having a much higher R-squared. This shows that during these 5

[138] BV Workpaper R06.

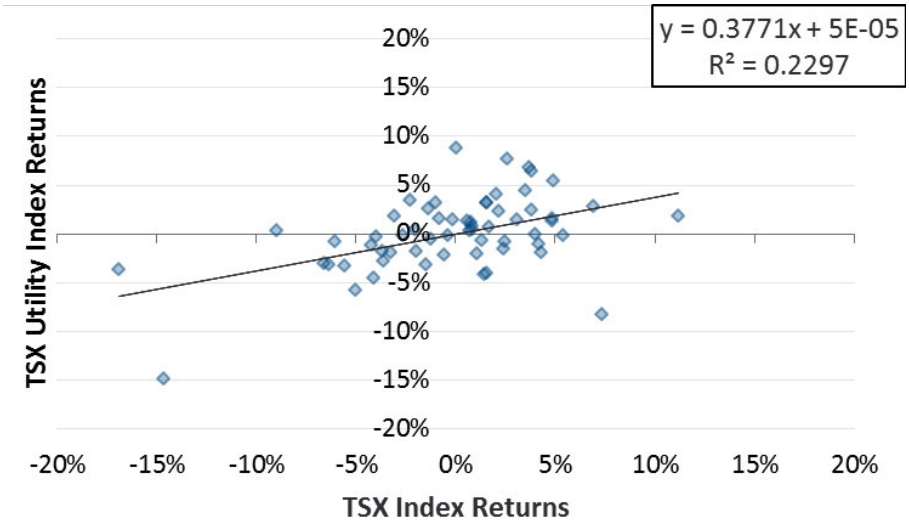
[139] The results above are comparable for weekly betas over 5 years.

years of abnormal market conditions and market volatility, the linear regression of monthly utility returns on monthly market returns provided a weak fit to the data. By contrast, the weekly returns gave a much stronger signal, with less random departures from the linear relationship. Looking at comparable scatterplots for many individual Canadian utility holding companies shows similar results.[140]

Figure 8: Scatterplot for 5-Year Weekly and Monthly Betas: End of June 2013
Panel A: Weekly Betas



Panel B: Monthly Betas



Source: BV Workpaper R06.

[140] Included in BV Workpaper R06.

Q47. What about the most recent estimates of beta?

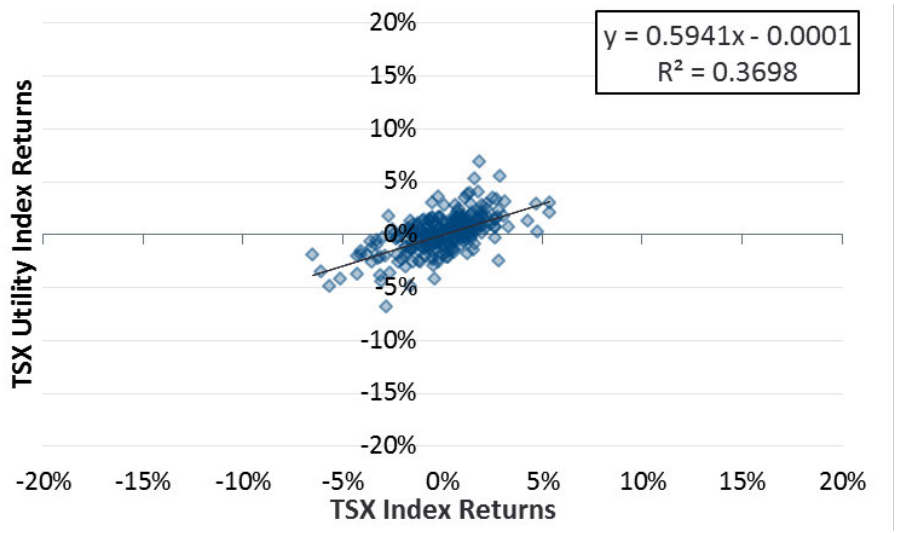
A47. The contrast between weekly and monthly beta estimates is even more distinct in early 2016, even though many of the most distortive events of the global financial crisis have rolled out of the estimation window, as shown in Figure 10. It is clear to see that the monthly and weekly returns are much less volatile than for the 5 years ending June 2013, but the monthly data still implies a low beta with an even worse fit. With an r-squared of just 4.4 percent, it is no surprise that the monthly beta estimate implies "no correlation" between the returns and is not significant. What is also notable is that the standard deviation for the TSX Utility monthly returns (2.75%) is also comparable to that of the TSX Index generally (2.78%), debunking the possibility that the beta is low because utility returns weren't very volatile.

The scatterplots for individual companies like Canadian Utilities, Enbridge, and Fortis are even more striking, and also show that the impact of unusual market conditions on the monthly estimates is strong.[141] Because weekly betas are estimated with many more observations, they are less sensitive to market volatility in a certain period.

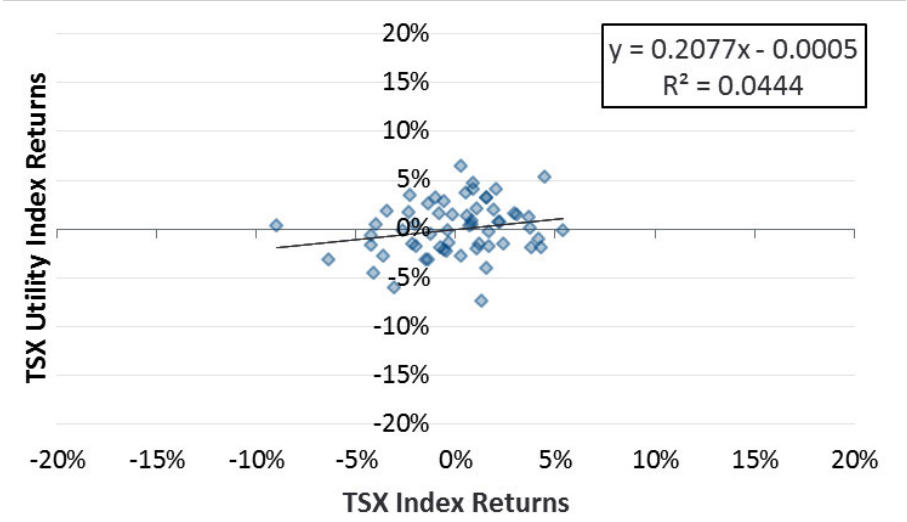
[141] *See* BV Workpaper R06.

Figure 9: Scatterplot for 5-Year Weekly and Monthly Betas: End of December 2015

Panel A: Weekly Betas



Panel B: Monthly Betas



Source: BV Workpaper R06.

Q48. Do the overall levels of weekly betas during the aftermath of the global financial crisis through the current day make sense?

A48. The weekly betas perform quite well in the current market conditions to predict systematic risk in a meaningful way. As demonstrated in Figure 7, the weekly beta results are quite consistent with Dr. Booth and Dr. Cleary's own prior evidence showing unadjusted betas for Canadian utilities between 0.45 to 0.65 based on measurements from the mid-1980s and 1990s, and with their support for using betas

in that range in recent GCOC proceedings since the onset of the crisis. And as shown in Figure 8, Figure 9, and Figure 10, the weekly betas have been much more precise and provided better fits to the data since the onset of the crisis. Therefore, I believe that at this time for Canadian utilities, weekly betas are superior to monthly betas for measuring systematic risk.

Q49. What do current beta estimates say about Canadian utilities' systematic risk?

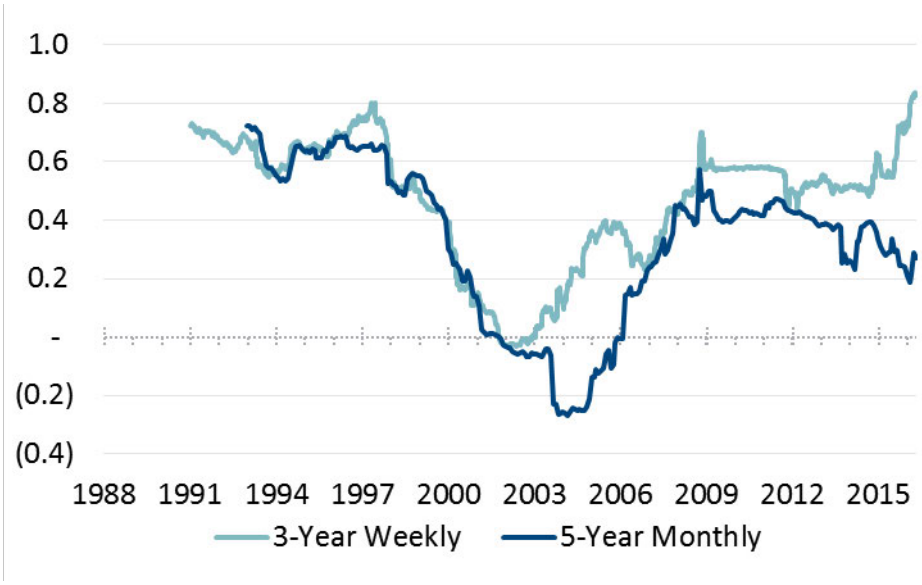
A49. In Figure 11 below, I show the equivalent to Panel B from Figure 7 with 3-year weekly betas comparable to those in my initial evidence but for Dr. Booth's TSX Utility Index and unadjusted.[142] They are more consistent estimates during the volatility of the global financial crisis and its aftermath that are not implausibly low like the monthly betas. There is a striking final trend through April 2016. For the TSX Utility Index that Dr. Booth himself suggested should be relied upon, weekly beta estimates have risen dramatically. This realization, which confirms the evidence I provided using portfolio betas in my initial evidence,[143] is decisive evidence that systematic risk has increased since the last GCOC proceeding to high but not unprecedented levels. This has not been the case for U.S. utilities, as shown in my initial evidence.[144]

[142] Note that while I perform estimates using the TSX Utility sub index for comparison with Dr. Booth's results, I do not necessarily agree with the use of the TSX Utility Index to estimate Canadian Utility systematic risk. This is because the index is composed of a variety of companies including renewable energy companies, independent power producers, and utilities that for various reasons I chose not to include in my sample. However, its main components should be the largest utilities that are included in my Canadian sample.

[143] Villadsen Evidence, page 47.

[144] *Ibid.*.

Figure 10: S&P TSX Utility Sub Index: 5-Year Monthly and 3-Year Weekly Betas



Source: BV Workpaper R06.

Q50. Do you believe that Dr. Booth's concept of a "grand mean" for utility betas is useful for predicting current systematic risk?

A50. The idea that utility betas would be mean reverting or have a "grand mean" that Dr. Booth mentions is interesting in theory but irrelevant in practice. As Drs. Booth and Cleary acknowledge in their co-authored textbook, "Betas change through time as the risk of the underlying asset or portfolio changes."[145] While Dr. Booth and Dr. Cleary then argue in their textbook that this is more relevant to individual assets, one cannot expect that the risk of an industry over 20 years would remain the same.

Some reasons that systematic business risk can change over time are highlighted in the written evidence and rebuttal evidence of Dr. Carpenter.[146] In addition, Dr. Booth points out in his evidence that "risk can increase or decrease, not because of any change in a particular security, but because of changes in the overall portfolio where the most important portfolio is the overall market portfolio as this is the benchmark for evaluating investment funds."[147] Therefore, the idea of a grand mean is an

[145] Booth, Cleary, and Drake, p. 339.

[146] Carpenter Written Evidence, Carpenter Rebuttal.

[147] Booth CAPP Evidence, p. 51.

attempt to use vastly out of date information to justify a beta estimate that may no longer apply. Instead, it is preferable to rely on estimates of the systematic risk for utilities that are based on the current environment and use the more reliable weekly betas. The results of my analysis here and in my initial written evidence clearly demonstrate that betas have increased substantially over the last year or two.

To the extent that Dr. Booth believes in a "grand mean" for beta in the 0.45 to 0.55 range, the following results should not be surprising to him after the impact of the global financial crisis has dropped out of beta estimates. The weekly beta results are far more consistent with his "grand mean" than the monthly betas he estimates. In addition, the recent higher betas are comparable to those during the 1990s, a period where Dr. Booth believed that betas were at reasonable levels and atypical market distortions were not apparent.

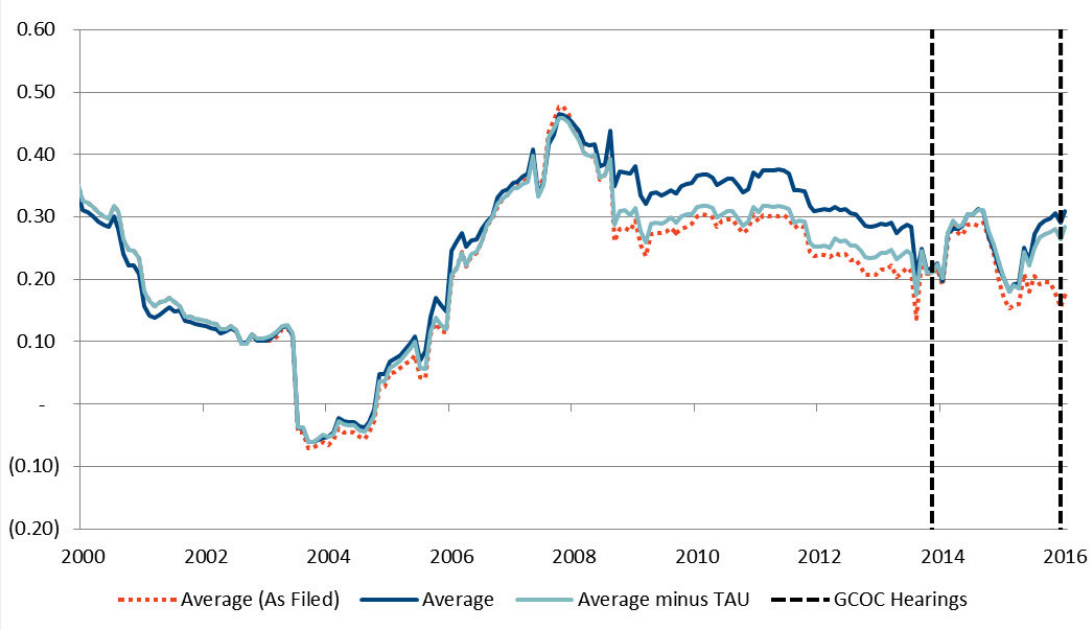
Q51. Despite their dependence on 5-year monthly betas does any intervenor evidence support your claim that betas are increasing, particularly since the 2013 GCOC?

A51. To the extent that the monthly betas based on recent data are useful, Dr. Booth provides evidence concurring that betas have increased since the last GCOC hearing at the beginning of 2014. Below is a figure recreated from page 51 of Dr. Booth's Evidence, where the red dotted line represents Dr. Booth's "Average" line. Contrary to Dr. Booth's description on page 53, the figure (as originally filed) was missing the impact of Veresen,[148] so that when Veresen is included, the average beta increases significantly.[149] What this shows is that since the last GCOC proceeding, betas for Canadian utility companies have increased.

[148] See also the Response to Booth-Utilities-2016APR12-010 (f), where Dr. Booth recognizes his mistake and then truncates his graph range as compared to his CAPP Evidence on page 1. The truncation of the graph makes the increase in betas appear less substantial than it is.

[149] The correct relative positioning of the "Average" and "Average minus TAU" lines can also be seen in Dr. Booth's previous testimony from the 2013 GCOC.

Figure 11: Booth Average Utility Betas



Source: BV Workpaper R06.

Q52. Are there other reasons why intervenor betas are unreliable?

A52. Neither Dr. Booth nor Dr. Cleary adjust their raw historical betas to make them better predictors of systematic risk going forward. As I discussed in my written evidence, empirical research has shown that the historical measure of a company's beta is not the best predictor of what the company's systematic risk will be going forward. Professor Blume applied an adjustment procedure to the historic measures of beta that adjust for statistical sampling error and improved the beta measure.[150] Therefore, it is appropriate to apply the Blume adjustment as many commercial providers do.

Dr. Booth and Dr. Cleary also do not consider the impact of financing on their betas by unlevering and relevering them. It is standard in finance to estimate beta using market data, which are unlevered assuming all assets are equity financed and then relevered to the capital structure of the company or industry being considered.[151] While the exact specification (e.g., the treatment of taxes and the bond beta) is subject

[150] Villadsen Evidence, Appendix B, pp. 19-20. See also the peer-reviewed article of Blume, M. E. (1971), "On the Assessment of Risk," *Journal of Finance*, 26, pp. 1-10.

[151] Details are in my Written Evidence, Appendix B, Section IV.B.2.

to debate, the procedure is taught in virtually all finance textbooks,[152] including the undergraduate text co-authored by Dr. Booth and Dr. Cleary.[153] Since in this proceeding, betas for the publicly traded sample companies are estimated for entities with more equity than the Utilities, omitting the consideration of leverage biases Dr. Booth's and Dr. Cleary's beta estimates downward.

B. DCF MODELS

1. Market Level DCF Estimates

Q53. What is your reaction to Dr. Booth's and Dr. Cleary's Dividend Discount Model estimates of the expected market return.

A53. Dr. Booth's and Dr. Cleary's DCF analyses are flawed in several ways. With respect to their market-level analyses, one important flaw is that they fail to recognize the growth in share repurchases.

When an earnings per share based growth rate is considered, it is important to consider both dividends and share repurchases as ways in which investors receive cash from the company. For example, Figure 13 below shows that for the S&P500 buybacks make up approximately 3 percentage points and dividends only 2 percentage points of the total payout yield for the index.

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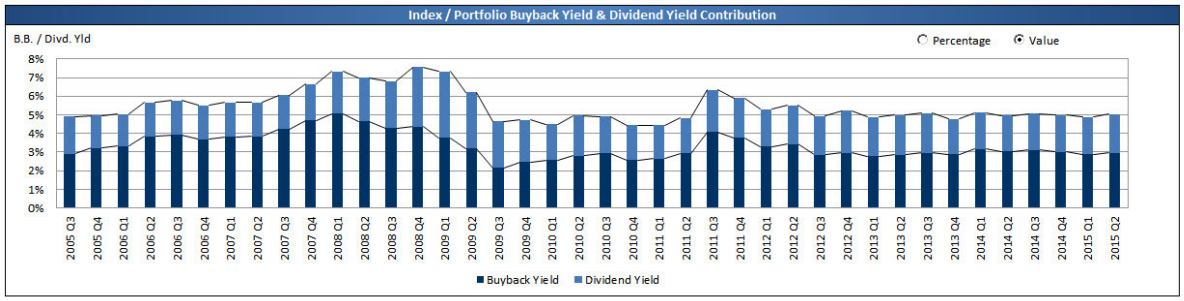
[152] *See* for example: Brealey, R. Myers, S., & Allen, F. (2008), P*rinciples of Corporate Finance* (9th ed.), pp. 541-43; Berk, J & DeMarzo, P. (2011), *Corporate Finance* (2nd ed.), pp. 390-92, 464-65; Ross, S., Westerfield, R., Jaffe, J., & Roberts, G. (2003), *Corporate Finance* (3rd Canadian ed.), pp.492-95.

[153] Booth, Laurence & Cleary, W. Sean (2008), *Introduction to Corporate Finance* ("Booth and Cleary"), p. 838.

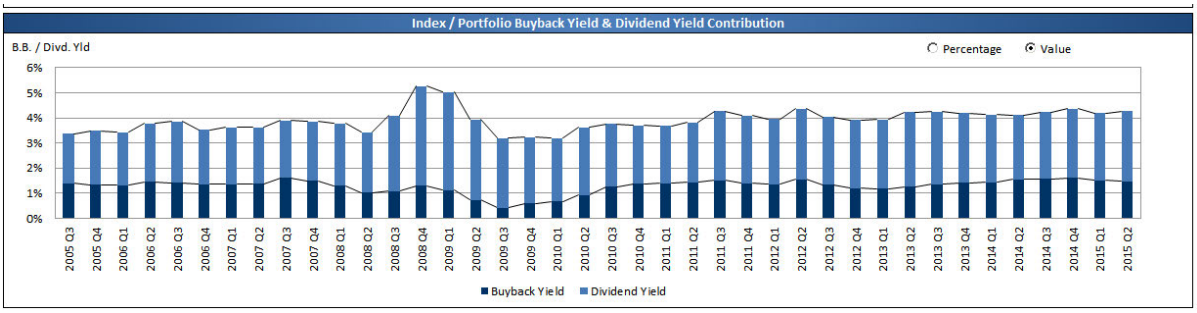
Figure 12: Dividends vs. Buybacks for the S&P 500 Index



Source: Bloomberg.

Buyback yields for the TSX are about 1.5 percent versus dividend yields of about 2.5 percent. In doing their market-level DCF analyses, Dr. Cleary and Dr. Booth fail to consider the impact of share buybacks on their estimates. Considering these would increase their estimates of expected stock market returns.

Figure 13: Dividends vs. Buybacks for the TSX Index



Source: Bloomberg.

For the Utility industry, buybacks represent a smaller share of total yield compared to the broader stock markets, but are still important to consider.

Q54. What are your comments on Dr. Cleary's single-stage estimation of the expected equity return for the market as a whole for 2016?

A54. Dr. Cleary estimates the expected equity return of the market in 2016 in two ways. He first estimates a constant-growth (single stage) dividend discount model (DDM). Dr. Cleary defines the constant-growth rate as the average rate of Canadian GDP growth from 1962-2014, adjusted for inflation. Dr. Cleary does not present evidence in support of his use of this time period. Furthermore, the use of long-term average GDP

growth rates implies that the past is prologue — future growth of dividends will not necessarily follow the past growth of the economy.

Q55. What are your comments on Dr. Cleary's H-model estimation of the expected equity return for the market as a whole in 2016?

A55. The H-model assumes that the growth rate will shift from a short term to a long term stage. For the short term growth rate, Dr. Cleary uses Consensus Forecasts of Canadian GDP growth in 2016-2017. The use of forecasted GDP growth rates for the short term growth rate implicitly assumes that the stock market cannot grow any faster than GDP in the short term. For the long term growth rate, Dr. Cleary uses the long-term average growth rate of GDP. As mentioned in my discussion of Dr. Cleary's single stage estimation for the market, just because GDP grew at a certain rate over the last several decades does not mean that the stock market will grow at a similar rate in the next several years.

Q56. Are you aware of any other multi-stage DCF estimates of expected equity returns for the Canadian market that come from an independent source? If so, how does this estimate differ from that of Dr. Cleary?

A56. Yes. Bloomberg estimates expected returns for the Canadian market for 2016 using a multi-stage DCF model. For the short-term growth rate, instead of using sustainable growth rates like Dr. Cleary, Bloomberg uses the growth rates of the companies' forecasted earnings per share. For the long-term growth rate, like Dr. Cleary, Bloomberg uses sustainable growth rates—albeit forward-looking ones calculated assuming the achieved return on equity is equal to the cost of equity and using payout ratios that taper toward a terminal payout ratio in the mature stage.[154] Yet even while using similar dividend discount methodology to derive long term growth rates, Bloomberg derived an implied expected return on the Canadian market for 2016 of over 12 percent as of December 2015. This estimate is more than 3 percent higher

[154] See Bloomberg documentation included in IR response UCA-Utilities-2016FEB18-031 and the Attachment thereto.

than Dr. Cleary's estimate of 8.92 percent.[155] Thus a well-established commercial provider of data estimates a much higher return than does Dr. Cleary's estimate even after adding flotation costs for an equity market return of 9.4 percent.

2. Individual Company DCF Estimates

Q57. What are your comments on Dr. Cleary's single-stage estimation of the expected equity return for Canadian utilities in 2016?

A57. For his single-stage growth rate, Dr. Cleary calculates a sustainable growth rate. The sustainable growth rate has two components – growth based on retained earnings and growth from new (net) equity issuance. Technically, the growth rate, g, is determined as $g = b \times r + s \times v$, where b is the proportion of earnings that are retained in the company, r is the expected rate of return on book equity, s is the percent of new common equity expected to be issued and v is the equity accretion ratio. Dr. Cleary leaves out the second term, $s \times v$. As s and v commonly are positive among utilities, the absence of this term from Cleary's formula biases the cost of equity estimation downward.[156] In short, by not including the growth from the issuance of new shares, Dr. Cleary biases his results downward.

For his short term growth rates, Dr. Cleary calculates company-specific 2014 sustainable growth rates as he did with his single-stage estimation of returns for Canadian utilities. For his long term growth rates, for each company, Dr. Cleary calculates the historical average of yearly sustainable growth rates dating back to 2006. Dr. Cleary supports his use of historical averages of sustainable growth rates by arguing that "growth rates estimated over a longer period of time are more representative of those that can be expected in the long run."[157] However, Dr. Cleary does not elaborate on why this is the case. For example, why is that historical average sustainable growth rates would be better predictors of companies' growth than

[155] Cleary Evidence, p. 44.

[156] The FERC has in the past used this formula. See FERC Docket EL11-66-001.

[157] Cleary Evidence, page 49.

forecasted GDP growth rates? Dr. Cleary used forecasted GDP growth rates as his short term growth rate in his multi-stage estimation of Canadian market returns. Yet he somehow sees it unfit to use forecasted GDP growth rates in his H-model estimation of Canadian utilities' returns. As a result, Dr. Cleary estimates an equity market return of 9.1 percent[158] after adding 0.50 percent for flotation costs--a figure that is biased downward for the reasons discussed above.

Q58. Please comment on the discussion in Dr. Booth's evidence that equity analysts' forecasts of earnings growth are upwardly biased.

A58. As evidence of the bias, Dr. Booth cites a 2010 Globe and Mail article and a 2016 report from RBC Capital markets.[159] Importantly, these articles studies analysts' potential forecast bias as they pertain to large companies in general (e.g., within the S&P/TSX or S&P 500 indices) with no distinction between industries or other characteristics. Recent empirical research has shown that the characteristics of companies matter for the precision of analysts' forecasts.

As I discussed in Appendix B to my written evidence, empirical research has found that if analyst bias is relevant, then analysts' optimism bias is primarily an issue for smaller firms, firms with high volatility or turnover, younger firms and less transparent firms.[160] Utilities do not fit these descriptions and hence are much less prone to analyst bias than what is generally reported. In addition, firms with high quality accounting auditors (measured as the largest 4 - 6 accounting firms)[161] experience significantly less analyst bias.[162] Among my sample companies, each and every member of the Canadian and Gas LDC sample groups had their most recent financial statements audited by the "Big" accounting firms. As utilities do not share

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158 Cleary Evidence, page 53

159 Booth CAPP Evidence, paragraph 193 and "Boothpage83andSchedule12analystoptimism_0305.pdf".

160 Villadsen Written Evidence, Appendix B, Section III.C.2.a.

161 Because the study used data for a number of years, the companies considered part of the largest group has changed over time. Today the group consists of Deloitte, E&Y, KPMG, and PwC.

162 Bruce K. Behn, Jong-Hag Choi, and Tony Kang, "Audit Quality and Properties of Analyst Earnings Forecast," *The Accounting Review* 83, 2008, 327-349.

any of the characteristics that tend to lead to substantial analysts forecast bias, it is not possible to rely on generic research to determine whether there is any bias in utility analysts' earnings forecasts. Utilities tend to be established, transparent firms with high quality auditors and limited volatility. According to empirical research such firms are less prone to this criticism than companies in general.

Q59. What do you conclude from the discussion above?

A59. Because neither Dr. Cleary nor Dr. Booth consider cash distributed to shareholders other than dividends (such as share buybacks), their DCF estimates of the market return is downward biased by the magnitude shown in Figure 13 and Figure 14 above. Dr. Cleary's estimates further suffer from not recognizing that individual companies or industries may grow at a faster or slower pace than the economy for some years. Lastly, Dr. Booth's critique that analysts' forecasts are biased fails to consider the specific nature of the utility industry and the fact that, if any analyst bias exists, then such bias is linked to industry and firm characteristics, which do not pertain to utilities. Thus, there is no evidence that analysts' growth forecasts for utilities are biased.

C. BOND YIELD PLUS RISK PREMIUM

Q60. Does Dr. Cleary report a bond yield plus risk premium ROE?

A60. Yes. Dr. Cleary estimates a return on equity of 6-7 percent as the sum of the current (February 2016) yield on A rated Canadian utility bonds plus a risk premium of 2-3 percent.[163] There are several problems with this approach. First, it is not clear that the yield as of February 2016 will be relevant for the 2016-17 period for which the cost of equity currently is being set, because bond yields are likely to increase. Second, Dr. Cleary does not provide any analysis to support the range of 2-3 percent and fails to recognize that the risk premium commonly increases as interest rates decline.[164, 165]

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[163] Cleary Evidence, p. 53-55.

[164] Morin, Roger A., *New Regulatory Finance*, Public Utilities Reports, Inc., 2006 pp. 128-129. *See* Villadsen Evidence, pp. 60-61 for an application to allowed risk premiums.

Because the allowed ROE that is being determined in this proceeding is expected to be in effect during 2016 and 2017, the relevant bond yield will be the yield that is expected during that period. The yield on 10-year government bonds is expected to increase as is the yield on A range rated utility bonds. Therefore, using the current yield leads to a downward bias in the estimated ROE.

With no support for the recommended range and no consideration of current economic conditions, I recommend the Commission ignores this estimate.[166]

D. PENSION FUNDS AND SELECTIVE MARKET EVIDENCE

Q61. What do you address in this section?

A61. First, I address Dr. Booth's and Mr. Thygesen's use of pension fund returns or pension fund managers' statements as part of their evidence regarding the Utilities' cost of equity. Second, I correct Mr. Thygesen's use of my evidence.

Q62. How do you respond to the interveners' use of pension fund returns and managers forecast to determine the cost of equity in this case?

A62. While the Commission in the past has deemed pension fund returns indicative, the Commission has also acknowledged that forecast pension returns on equity investments are potentially conservative and geometric forecasts understate the cost of equity.[167] It is therefore imperative that any use of such forecasts is evaluated cautiously and be assigned limited weight. The Thygesen Evidence devotes substantial space to discussing pension returns,[168] but provides no data or studies to support its claims and should therefore be ignored. Further, Mr. Thygesen appears to

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[165] Note that in IR response Cleary-Utilities-2016APR12-021(d), Dr. Cleary states that "the cost of the company's debt reflects changes in risk premiums through time, as reflected in the spread above government bond yields. Therefore, the 2.5% additional risk premium used by Dr. Cleary would not need to be adjusted through time…." This neglects the fact that equity is riskier than corporate debt, and therefore more responsive to changes in the broader market risk premium.

[166] I note that in my use of the risk premium model to estimate the cost of equity, I explicitly considered the interest rate environment at the time of the allowed ROE.

[167] Decision 2191-D01-2015, paragraphs 234 and 237.

[168] Thygesen Evidence pp. 36-40.

rely on the fact that some pension funds own utility stock as evidence that pension fund returns are a proxy for utilities' required return; this does not follow. Simply because a pension fund owns some utility stock does not mean that the return on the pension fund's portfolio of asset is a proxy for utility returns. There is a significant difference between owning utility stocks and having a portfolio of assets, as the composition of these assets will determine their risk and return profile. Further, as Mr. Thygesen acknowledged in response to data request, the fact that a portion of pension funds' assets are invested in utilities is not inconsistent with the notion that pension funds match their holdings to their liabilities.[169] Recent studies have confirmed that pension plans have been de-risking their portfolios,[170] such that portfolio returns will be more heavily weighted towards lower risk assets such as bonds.

The Booth CAPP Evidence cites a report from Aon Hewitt[171] as evidence of an expected Canadian market return of 8.3 percent (7.6% for the U.S.).[172] Looking at how Aon Hewitt describes how they arrived at their estimates is revealing. First, the report authors indicate they are using a DCF model to estimate the expected return and rely on forecasted earnings, but do not reveal the source. Regardless of the source of growth, the reliance on earnings rather than cash flow likely leads to a downward bias in the estimates because it fails to account for the differences between cash flow and earnings. For example, large tax depreciation increases cash flow but not earnings and investors ultimately care about cash flow. Also, the timing of cash distributions to shareholders may vary substantially due to, for example, share buybacks, which are substantial in both the Canadian and U.S. market.

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169 The response to CCA-Utilities-2016 Apr 28-012 acknowledges this fact.

170 Moody's, "CalPERS' de-risking plan does not shield California municipalities from pension asset investment performance," December 18, 2015. Available at: https://www.moodys.com/research/Moodys-CalPERS-de-risking-plan-does-not-shield-California-municipalities--PR_341560

171 Submitted as "Boothpage73AonHewittJanuary2016_0297."

172 Booth CAPP Evidence pp. 71-73.

Second, Aon Hewitt states that the report is used for portfolio allocation, which serves a different purpose than cost of equity estimation. For example, for portfolio allocation purposes the relative return (at equivalent risk) is key. More generally, pension managers' forecasts need to be cautiously reviewed as those forecasts may reflect the expected return on the fund's portfolio rather than the market and, as the Commission has acknowledged, potentially are downward biased due to expectation management or actuarial conservatism (too high a discount rate / expected return could lead the pension fund to become under-funded if the market underperforms the expectation). This is particularly the case in the post financial crisis world. The financial crisis led pension funds to recognize "that short-term volatility can have a devastating impact on mature pension plans."[173]

Pension funds had assumed ambitious market returns before the crisis and as a result became underfunded when returns did not materialize. For example, public pension funds went from being about 86 percent funded in 2007 to 72 percent funded in 2013.[174] When future liabilities are accounted for with more appropriate bond yields this funding level is significantly less.[175] This could lead to several forms of bias where pension funds are decreasing expected returns for their funds.

- Pension funds do not want to repeat their error in the financial crisis of over predicting pension returns when there is already a significant lack of pension funding that allows for less downside risk.
- Pension funds have begun to trend towards reducing their exposure to short-run market volatility, or "de-risking," by pursuing safer assets with lower effective returns, divesting from hedge funds, and finding ways to hedge their risks.[176]

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[173] Krudy, Edward, "U.S. public pension funds slowly wake up to risk," Reuters, New York, October 22, 2015 ("Reuters 2015"), accessible at http://www.reuters.com/article/us-usa-pensions-risk-idUSKCN0SG18320151022.

[174] Public Fund Survey by the National Association of State Retirement Administrators, accessed at http://www.nasra.org/publicfundsurvey.

[175] Buttonwood, "The Pot is Half Full," *The Economist*, June 28, 2013.

[176] Reuters 2015.

Given these pressures to reduce pension return forecasts, it might suggest that to keep their performance targets achievable, managers have an incentive to provide conservatively low forecasts of market expectations. Otherwise there could be the continued desire to fail to meet funding goals in unusual short-run market conditions, and low market expectations are an implicit further justification to pursue "de-risking" strategies.

Q63. Please comment on Mr. Thygesen's statements about pension funds' ownership of utility equity.

A63. Mr. Thygesen in the response to CCA-Utilities-2016 Apr 28-012, pointed to a pension fund's partial ownership of Puget Sound as confirmation that my written evidence discusses pension fund allocation. It does not. The response confuses the allocation of a pension fund's assets with the ownership of one specific utility. The characterization is simply inaccurate, incomplete and without bearing on pension fund's allocation of funds or return requirements.

E. ACHIEVED ROE AND PRICE-TO-BOOK RATIOS

Q64. Have Dr. Booth and Dr. Cleary presented evidence related to the price-to-book ratios of publicly traded companies?

A64. Yes. Dr. Cleary presents average price-to-book ratios for a sample of nine publicly traded Canadian utility holding companies, and notes that they are all above 1.0.[177] He further argues—based on a rearrangement of the Dividend Discount Model relying on restrictive growth rate assumptions—that this constitutes evidence that realized ROEs have exceeded the cost of equity capital for Canadian utilities.[178]

Dr. Booth considers a sample of 15 publicly-traded U.S. electric and gas utility companies. He performs a regression of their achieved ROEs on their price-to-book ratios, and—based on his assertion that "a regulated utility should have a market-to-

[177] Cleary Evidence, pages 58-59.

[178] Cleary Evidence, page 61.

book ratio of no more than 1.15"—uses his regression model to derive an estimate of 7.17 percent for the cost of equity.[179]

Q65. Do you find Dr. Booth's price-to-book ratio evidence convincing?

A65. No. Dr. Booth's not only treats his regression results as evidence of a simple linear relationship between achieved ROE and price-to-book ratio, but also suggests that it has power to predict market expectations about ROE. Specifically, he asserts that when a company's achieved ROE is lower than what his regression model predicts based on its price-to-book ratio, it must be because investors expect the ROE to improve, and vice versa when achieved ROE exceeds that "predicted" by his regression model.[180]

The fact that price-to-book ratio is positively correlated with earned return on equity is unsurprising, since as Dr. Booth points out, investors' demand for a company's stock will increase as its earnings improve, all else equal. However, Dr. Booth's argument attributes too much predictive power to a regression model that—by his own admission—explains only 46 percent of the variation in earned ROEs for his 15 company sample.[181] Dr. Booth ignores other factors that may affect a company's price-to-book, such as the potential for merger and acquisition activity, or "option value" associated with growth opportunities that may arise under certain market circumstances. Indeed, the highest price-to-book ratio in Dr. Booth's data (3.38 per Booth CAPP Evidence, Schedule 15) is for Piedmont Natural Gas Company, Inc. ("Piedmont"), which is an acquisition target of Duke Energy Corp ("Duke"), with an announced deal value of $6.5 billion as of October 2015—nearly 1.5 times Piedmont's 2015 Q3 market capitalization. Although it is not clear when Dr. Booth pulled his data, it is highly likely that Piedmont's market valuation reflects investors' expectations of or reaction to the acquisition announcement, including expectations

[179] Booth CAPP Evidence, paragraphs 199-202.

[180] Booth CAPP Evidence, paragraph 201.

[181] Booth CAPP Evidence, paragraph 200. Note that the adjusted R-squared and t-statistic Dr. Booth cites in paragraph 200 do not agree with the regression results reported in Schedule 14; the actual adjusted R-squared of his regression is 0.46.

for synergies from the merger and / or the possibility of tendering shares, and not merely information about Piedmont's earned ROE. Duke's price-to-book ratio could similarly be influenced by investors' reaction to the announced merger and expectations regarding its implications.

Indeed, the entire premise of Dr. Booth's regression analysis is undermined by the fundamental fact that it is market *expectations* about *future* events or returns that influence price-to-book ratios, not historical earned ROEs. Dr. Booth implicitly acknowledges this fact in discussing the data points that lie "off" his simple line plot, but ignores it—among the 54 percent of the of the variability in price-to-book ratio *not* explained by historical earned ROE—in drawing his conclusions.

Q66. Do you find Dr. Cleary's price-to-book ratio evidence convincing?

A66. No. Dr. Cleary's analysis is unconvincing for several reasons. First, it rests on a form of the Dividend Discount Model that assumes constant perpetual dividend growth equal to the historical earned ROE times the historical retention ratio.[182] As discussed in Section III.B, this "sustainable growth" formulation assumes that retained earnings are the only source of equity capital and that historical average returns on equity are predictive of returns on marginal equity investments. Additionally, Dr. Cleary's DDM ignores alternative forms of distributions, such as stock repurchases, and does not account for option value that may influence stock prices. All of these factors complicate the "simple" relationship between earned ROE and price-to-book ratios posited by Dr. Cleary, and help explain how a company's price-to-book ratio can exceed 1.0 without its historical earned ROE exceeding its cost of equity.

With regard to Dr. Cleary's specific calculations, it is particularly difficult to believe that the "current" price-to-book ratios of the Canadian utility holding companies in his sample are fully explained by "the average 2006-2015 utility index ROE of

[182] Cleary Evidence, page 61, lines 10-11 and footnote 21.

8.7%."[183] The latter figure was apparently derived for companies in the TSX Utilities Index, which has constituents beyond the nine companies for which Dr. Cleary measured price-to-book ratios. These constituents include renewable energy companies and independent power producers, whose earnings are clearly not representative of utilities. Moreover, Dr. Cleary's historical average ROE, calculated over an arbitrarily chosen long-term period, is particularly ill-suited to forecast future growth for Canadian utility companies, since it ignores new growth potential from non-regulated businesses and expansion/acquisition activity, including international investment. In my opinion, the mismatches among companies and time periods in Dr. Cleary's data render his analysis unreliable and uninformative about the adequacy of earned ROEs for Canadian utility companies.[184]

Q67. What has the Alberta Utilities Commission previously found with regard to the type of price-to-book ratio evidence presented by Drs. Booth and Cleary?

A67. The Commission stated in the 2011 GCOC proceeding that it was "unable to derive any useful information about the price-to-book ratios of stand-alone utilities from the price-to-book ratios of utility holding companies."[185] In the 2013 GCOC decision, the Commission reiterated this position and explained that its concern related to the "dirty window" problem associated with "interpreting market-to-book value ratios of corporate shares where the subject company has significant unregulated activities in addition to regulated operations."[186] Clearly, this very concern applies to both the U.S. companies employed in Dr. Booth's regression analysis and the Canadian utility

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[183] Cleary Evidence, Page 61. Note that it is not clear where Dr. Cleary got the "current average P/B ratios of 2.1, 2.3, and 2.5" that he "plugged in" to his DDM equation, since the February 2016 averages reported in his Table 15 range from 2.0 to 2.2. Nor is it clear how Dr. Cleary calculates the 8.7% average ROE, since the data underlying his Figure 16 (provided in Exhibit Z), show that the average annualized quarterly ROE from 2006 through 2015 Q3 was 8.0 percent.

[184] Interestingly, the finance textbooks co-authored by Dr. Booth and Dr. Cleary do not discuss the application of the price-to-book (or market-to-book) ratio as a method for estimating or making inferences about the cost of capital in the Chapters devoted to that topic. *See* Booth, Cleary, and Drake, Chapters 9 ("Asset Pricing") and 14 ("Cost of Capital"). *See also* Booth and Cleary, Chapter 20 ("Cost of Capital").

[185] AUC Decision 2011-474, paragraph 122.

[186] AUC Decision 2191-D01-2015, paragraphs 211-212.

holding companies in Dr. Cleary's analysis. The Commission is correct to recognize that information about the price-to-book ratios of such companies does not provide useful information about the relationship between allowed ROE and the cost of equity for regulated utilities such as the Alberta utilities. Therefore, I recommend that the Commission give no weight to Drs. Booth's and Cleary's arguments in this area.

Q68. Does Dr. Cleary attempt to draw conclusions about the relative riskiness of the Alberta utilities from measurements of historical variability in earned ROE?

A68. Yes. Dr. Cleary computes coefficients of variation ("CV") of the annual achieved book returns on equity form 2005-2014 for 11 Alberta utilities (Table 18), as well as for 37 U.S. gas and electric utility companies (Table 21) and seven Canadian utility companies (Table 23).[187] He then argues that the higher average and median CV(ROE) for the U.S. companies compared to the Alberta utilities "[suggest] that the U.S. utilities possess greater risk than Alberta utilities."[188] Dr. Cleary also draws a similar conclusion comparing the publicly traded Canadian utility companies to the Alberta utilities.

Q69. Do Dr. Cleary's conclusions have merit?

A69. No. I agree with Dr. Carpenter that an analysis based entirely on a very small sampling of annual historic accounting earnings does not provide the market-based perspective that is needed to assess uncertainty in expected returns.

Further, Dr. Cleary's comparison relies on long-term historical information to draw conclusions about risk and return going forward. This is problematic when the fundamental characteristics that affect returns (and variability of returns) may be different in the future. Finance textbooks, including one co-authored by Drs. Cleary and Booth, address this issue in the context of measuring risk through beta:

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[187] Cleary Evidence, pages 69, 78-79, and 85-86. It is not clear why Dr. Cleary examines a different group of Canadian utility companies for this analysis compared to his DCF estimates and analysis of price-to-book ratios.

[188] Cleary Evidence, pages 78-80.

> Estimating beta coefficients is tricky because we are interested in the extent that an asset's returns move with the market over a future period. We typically estimate beta coefficients by using historical data, which assumes that what has happened in the past is a good predictor for the future. Typically, betas for securities are estimated by using 60 months of monthly returns, but sometimes 52 weekly returns are used. Betas change through time as the risk of the underlying asset or portfolio changes. This is particularly important for individual securities, for which betas can change quite dramatically over relatively short periods.[189]

In the context of this proceeding, the underlying assets and operations for the publicly traded U.S. and Canadian utility companies considered by Dr. Cleary may have changed substantially during the period Dr. Cleary studies[190]

I also note that, the coefficient of variation of book ROE is simply not a good measure of the type of risk that affects the cost of equity. It is a fundamental principle of finance that (as Dr. Cleary, Dr. Booth, and their coauthor Dr. Pamela Peterson Drake put it in their textbook) "rational investors are not compensated for unique or diversifiable risk because it can be eliminated through diversification. This implies that market risk is the appropriate measure of risk to determine the risk premium required by investors for holding a risky security."[191] In other words, the non-diversifiable or systematic risk for which investors must be compensated is measured relative to returns on the broader market portfolio, *i.e.,* in terms of a market beta (β). For investors in the equity of a publicly-traded company, it is the sensitivity that company's (market value based) stock returns to returns on the broader market that affect the required risk-adjusted rate of return. By contrast, the total variability in accounting returns on book equity is not informative for comparing systematic risk from an investor's perspective.

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[189] Booth, Cleary, and Drake, p. 339.

[190] For a detailed discussion of this analysis, see Carpenter Rebuttal Evidence, Section II.

[191] Booth, Cleary, and Drake, p. 339.

Q70. Do you have any other comments concerning Dr. Cleary's comparisons of historical variability in earned ROE?

A70. Yes. In addition to the conceptual flaws discussed above, Dr. Cleary's analysis is misleading regarding the variability of achieved book ROEs for the Alberta utilities relative to my U.S. and Canadian proxy group companies. In my analysis, I find that the six companies in my U.S. Gas LDC sample in particular have a much lower coefficient of variation than the U.S. utilities in general, and that their returns are a bit higher on average. Compared to Cleary's Canadian utilities in Table 23, they have a higher return on equity with lower coefficient of variation. When compared to Dr. Cleary's data for the Alberta utilities, the average and median CV(ROE) for my U.S. Gas LDC sample are of similar magnitude. By Dr. Cleary's logic, this would imply that U.S. Gas utilities are in fact quite comparable to the Alberta utilities, and the Alberta utilities earn significantly less than the U.S. Gas LDC sample companies. In addition, if I adapt Dr. Cleary's analysis of Canadian companies to my Canadian proxy group (including data I sourced for Canadian Utilities Limited for which Dr. Cleary does not provide data) I find that the coefficient of variability of ROE is somewhat less than what Dr. Cleary reports.

Figure 14: Comparison of Utility ROE Level and Variation

	Cleary Tables 18, 21, and 23			Adapted to Villadsen Samples		
	Alberta Utilities	U.S. Utilities	Canadian Utilities	Gas Sample	Electric Sample	Canadian Sample
Average of Utility ROE						
Average	9.3%	10.7%	10.5%	11.3%	11.1%	13.1%
Median	9.5%	10.3%	11.3%	10.3%	10.4%	12.8%
Coefficient of Variation for Utility ROEs						
Average	0.17	0.36	0.38	0.19	0.34	0.28
Median	0.15	0.23	0.27	0.17	0.25	0.27

Source: Calculations in BV Workpaper R07 based on Cleary Evidence Exhibits AC, AG, and AI; data for CU Ltd. from S&P's Research Insight (Compustat).

The fact that these relatively minor permutations and adaptations of Dr. Cleary's analysis produce such different results strengthens my belief that the entire exercise is uninformative. Indeed, as Dr. Carpenter demonstrates in his rebuttal, making

relatively minor and reasonable modifications to certain assumptions, inputs, and methods of Dr. Cleary's parallel analysis of variability in operating earnings (EBIT) leads to substantial changes in the results.

Ultimately, Dr. Cleary's assertion that he has "*quantified"* the business and total risk[192] of the companies in his samples is not supported by the data. Because Dr. Cleary's analysis fails to provide the kind of forward-looking, market-based analysis that is needed to study the cost of equity, I recommend the analysis be given no weight.

IV. CAPITAL STRUCTURE

Q71. What are your conclusions regarding capital structure?

A71. The key points I want to emphasize are that (i) I agree with the Commission's goal of maintaining an A range rating for the Utilities, (ii) one-off adjustments are not advisable, (iii) it is a dangerous policy to try to set the capital structure and ROE so that it meets the minimum that would allow an A range rating, (iv) comparable utilities have equity ratios in the 40-50 percent range, and (v) the reasons for granting tax exempt entities a 2 percent equity adder continue to exist, so there is no reason to change the policy. For these reasons I maintain my recommended equity ratios as stated in Figure 30 of my written evidence. The recommendation here took a global approach to determining the capital structure; including the prevailing market and credit conditions. I discuss specific issues that have been raised in evidence or information requests below.

A. CREDIT METRICS

Q72. Do you believe the credit metric thresholds traditionally used by the Commission are adequate to ensure access to affordable debt capital for the Utilities?

A72. No. For the reasons stated in my direct evidence, I believe it is risky to target the Utilities financial performance to the bare minimum credit metrics considered

[192] Cleary Evidence, page 71 lines 10-12 and page78, lines 5-8.

consistent with an A range debt rating.[193] I believe a more appropriate regulatory policy would target the middle of the ranges articulated by the credit rating agencies and representative of Canadian utility operating companies. In my written evidence I recommended the following minimum credit thresholds according to those criteria.[194]

- EBIT Coverage of at least 2.5 times.
- FFO Interest Coverage of 3.5 to 4.0 times with the higher end being preferable.
- FFO to Debt of at least 15 percent.[195]

Q73. Have you nevertheless attempted to analyze the equity percentages for the Alberta utilities that would be required to meet the Commission's minimum credit benchmarks under the ROE recommendations of Dr. Booth and Dr. Cleary?

A73. In Figure 16 below, I present the minimum equity percentages required for a generic Alberta utility, ATCO Gas, and ATCO Pipelines under the ROE recommendations of Dr. Cleary and Dr. Booth. Dr. Cleary recommends an ROE of 7.0 percent for the generic Alberta utility.[196] Using the Alberta utilities' 2014 Rule 005 filings, I calculated the average embedded cost of debt, depreciation rate, and construction work in progress rate for Alberta utilities. Using these averages, and Dr. Cleary's recommended ROE of 7.0 percent, I determined that an equity ratio of approximately 37.5 percent would be required in order for a generic Alberta utility to meet the Commission's credit benchmarks. I performed separate calculations for ATCO Pipelines and ATCO Gas, using their own costs of debt, depreciation rates, and CWIP rates from their 2014 Rule 005 Filings. Dr. Booth recommends an ROE of 7.5 percent for ATCO Pipelines and ATCO Gas.[197] Under Dr. Booth's recommended ROE, 37.5

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193 Villadsen Evidence, pp. 69-70. The Buttke Rebuttal concurs (Q/A 71).

194 Villadsen Evidence, pp. 72.

195 I note that the Commission's threshold of 11.1%-14.3% for FFO to Debt reflects a range of minimum thresholds observed for Canadian utility companies at the time the benchmarks were established. By contrast, my recommended minimum of 15% is slightly below the average and median for Canadian utilities recently reported by DBRS. (See Figure 24 on page 71 of my Written Evidence.)

196 Cleary Evidence, p. 2.

197 Booth CAPP Evidence, p. 3.

percent equity would be required for ATCO Gas, while 38 percent equity would be required for ATCO Pipelines.

More importantly, Figure 16 also shows that—at the unreasonably low ROEs recommended by Drs. Cleary and Booth—a much larger equity percentage would be needed to meet my recommended credit benchmarks necessary to ensure continued access to affordable debt financing for the Utilities.

Figure 15: Minimum Equity Percentage Required to Meet Credit Benchmark at Dr. Booth's and Dr. Cleary's Recommended ROEs

Min. % Equity satisfying benchmarks suggested by:	A.U.C.	Dr. Villadsen
	[1]	[2]
Company		
Generic Alberta Utility [3]	37.5%	50.0%
Atco Gas [4]	37.5%	47.5%
Atco Pipelines [5]	38.0%	50.0%

Notes:
[1]: The minimum equity percentage required to meet the Commission's credit benchmarks of a 2.0x EBIT coverage, 3.0x FFO/Interest, and FFO/Debt of 11.1-14.3%.
[2]: The minimum equity percentage required to meet the credit benchmarks suggested by Dr. Villadsen of a 2.5x EBIT coverage, 3.5-4.5x FFO/Interest, and FFO/Debt of at least 15%.
[3]: 7.0% ROE recommended by Dr. Cleary.
[4]: 7.5% ROE recommended by Dr. Booth.
[5]: 7.5% ROE recommended by Dr. Booth.

Source: BV Workpaper R08.

Q74. Have you also reviewed Mr. Stauft's analysis of the Commission's minimum credit metric thresholds?

A74. I have, and while it is similar to my own analysis presented in my Written Evidence, I believe there is a conceptual flaw in Mr. Stauft's calculations that causes him to inflate the credit metrics that would result from any specific set of financial parameters (i.e., allowed ROE and deemed capital structure, as well as CWIP rate, debt cost, and average depreciation rate). Additionally, I believe his assumed embedded cost of debt is not representative of that faced by the Utilities.

Q75. What is the conceptual flaw you identified in Mr. Stauft's analysis?

A75. Mr. Stauft calculates net income by multiplying the cost of equity by the equity percentage. At the same time, Mr. Stauft calculates interest by multiplying the cost of debt by the debt percentage and multiplies this quantity by one plus the construction work in progress percentage. Including interest payments on only the debt portion of CWIP implies that there exists a portion of CWIP that is financed by equity. If this were the case, the company would earn the allowed ROE on the non-debt portion of equity— but Mr. Stauft does not include an equity return on CWIP in his calculation of net income. Mr. Stauft is correct not to include an equity return on CWIP in his calculation of net income, since CWIP is separate from the rate base of a representative Alberta utility. However, that implies that the company finances all CWIP with debt. By including only a portion of the interest that would have to be paid on CWIP in his calculation of interest coverage ratios, Mr. Stauft artificially decreases the denominators, which inflates the ratios. Similarly, Mr. Stauft includes only the debt ratio times the CWIP balance in debt for purposes of calculating the FFO/Debt metric. This has the effect of understating the true debt and inflating the metric for any assumed equity ratio and ROE.

Q76. Why do you believe Mr. Stauft's assumed cost of debt is not representative, and what would be a better assumption?

A76. Mr. Stauft uses mid-year cost of debt from AltaLink, ATCO, FortisAlberta, AltaGas, ENMAX, and EPCOR. He then weights the average and median costs of debt for these companies based on each individual company's percentage of total 2014 mid-year debt. This weighted average yields his assumed cost of debt of 4.8 percent. As I argued in my written evidence, I believe it would be more accurate to exclude ENMAX from this calculation.[198] The Commission has recognized that ENMAX's embedded cost of debt is lower than that of the typical utility because of its access to Alberta Capital Financing Authority Funds.[199] As I explained in my Written

[198] Villadsen Evidence, page 73, A.90.

[199] 2013 GCOC Decision, p.91.

Evidence, examining the mid-2014 embedded cost of debt for the ATCO companies, AUI, and FortisAlberta reveals a median of 5.22 percent and a mean of 5.26 percent.[200] Therefore, I use 5.2 percent as a representative cost of debt for the generic Alberta utility.

Q77. Have you quantified the impact of correcting these issues with Mr. Stauft's analysis?

A77. Yes. In Figure 17 below I present credit metrics calculated by myself and Mr. Stauft for a range of equity percentages. As discussed above, my calculations use a cost of debt of 5.2 percent, whereas Mr. Stauft uses a cost of debt of 4.8 percent. Both sets of calculations assume an 8.3 percent ROE. The bottom panel of the figure quantifies the degree of overestimation inherent in Mr. Stauft's credit metric calculations.

Figure 16: Credit Metrics for Selected Capital Structures: Contrasting Stauft and Villadsen Calculations

Villadsen - 8.3% ROE, 5.2% Kd

Equity % of Cap Structure	*35%*	*36%*	*37%*	*38%*	*39%*	*40%*	*41%*	*42%*	*43%*	*44%*	*45%*
EBIT Coverage Ratio [1]	2.09	2.14	2.19	2.24	2.29	2.35	2.40	2.46	2.52	2.58	2.64
FFO Interest Coverage [2]	3.17	3.23	3.28	3.34	3.40	3.46	3.52	3.59	3.66	3.73	3.80
FFO to Debt [3]	11.3%	11.6%	11.9%	12.2%	12.5%	12.8%	13.1%	13.5%	13.8%	14.2%	14.6%

Stauft - 8.3% ROE, 4.8% Kd

Equity % of Cap Structure	*35%*	*36%*	*37%*	*38%*	*39%*	*40%*	*41%*	*42%*	*43%*	*44%*	*45%*
EBIT Coverage Ratio [1]	2.17	2.22	2.28	2.34	2.39	2.46	2.52	2.59	2.65	2.72	
FFO Interest Coverage [2]	3.37	3.43	3.49	3.56	3.63	3.70	3.78	3.86	3.94	4.02	
FFO to Debt [3]	11.6%	11.9%	12.2%	12.5%	12.9%	13.2%	13.6%	13.9%	14.3%	14.7%	

Stauft overestimation

Equity % of Cap Structure	*35%*	*36%*	*37%*	*38%*	*39%*	*40%*	*41%*	*42%*	*43%*	*44%*	*45%*
EBIT Coverage Ratio [1]	0.07	0.08	0.09	0.09	0.10	0.11	0.12	0.13	0.14	0.15	
FFO Interest Coverage [2]	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	
FFO to Debt [3]	0.3%	0.3%	0.3%	0.4%	0.4%	0.4%	0.4%	0.5%	0.5%	0.5%	

Footnote:
[1] EBIT Interest Coverage = EBIT / Interest
[2] FFO Interest Coverage = (FFO + Interest)/Interest
[3] FFO to Debt = FFO / Debt

Source: BV Workpaper R09.

As Figure 17 demonstrates, Mr. Stauft's lower cost of debt and his erroneous treatment of CWIP serve to inflate the coverage ratios at various equity percentages by approximately 0.1 to 0.3, and the FFO to Debt ratio by approximately 30 - 50 basis

[200] Calculations are shown in BV Workpaper 11.

points. This underestimation weakens his argument that his recommended equity ratio is adequate.

Q78. Have you analyzed the impact of a utility's taxable status on the minimum equity percentage required to meet the relevant EBIT coverage ratio targets?

A78. Owing to the recovery of taxes in rates, the larger a utility's effective tax rate, the larger its EBIT (required to cover the tax liability). Therefore, as the utility's tax rate increases, its EBIT coverage ratio increases. If a utility has non-taxable status (i.e., an effective tax rate of zero percent), it will have a lower EBIT coverage ratio than if it had a positive effective tax rate. Consequently, a greater equity percentage would be needed to elevate the utility's EBIT coverage.

I have calculated the minimum equity percentages for which a generic Alberta utility would meet the Commission's EBIT coverage benchmark of 2.0, as well as my recommended benchmark of 2.5. I assume an 8.3 percent ROE based on the Commission's 2013 GCOC Decision, and I assume a representative cost of debt, depreciation rate, and CWIP rate for the Alberta utilities. The results are presented in Figure 18 below.

Figure 17: Impact of Non-taxability on Minimum Deemed Equity Percentage Required to Maintaining EBIT Coverage

	Minimum Deemed Equity Percentage for 2.0x EBIT Coverage	Minimum Deemed Equity Percentage for 2.5x EBIT Coverage
27% Tax Rate [1]	33%	43%
0% Tax Rate [2]	41%	51%
Equity Adder Required to Maintain EBIT Coverage at 0% Tax Rate [3]	8%	8%

Notes:
Input parameters for generic Alberta utility -- CWIP Rate: 5.0%; Deprec. Rate: 5.0%; Cost of Debt: 5.2% -- estimated based on 2014 Rule 005 Filings.
[3] = [2] - [1]

Source: BV Workpaper R10.

There are two key takeaways from this analysis. First, a generic non-taxable Alberta utility would require a deemed equity percentage of at least 41 percent—one percentage point higher than the base deemed equity percentage of 40 percent—to meet even the Commission's threshold EBIT coverage ratio of 2.0; the minimum threshold to meet my recommended threshold is a full 10 percentage points higher than that. Second, the adder required to restore a given EBIT coverage ratio when moving from 27 percent to 0 percent tax rate is 8 percentage points, indicating that the 2 percent adder granted to nontaxable entities in the past should at least be maintained if not increased.

B. INCORRECT / MISGUIDED CAPITAL STRUCTURE

Q79. Do you believe that Mr. Stauft's comments regarding "observed capital structures" on pages 10 and 11 of his evidence provide an appropriate representation of the capital structures of the companies in your Canadian sample and of the holding companies of the Utilities?

A79. No, Mr. Stauft does not provide an appropriate representation. He states

> "The parent entities of the ATCO Utilities, Fortis, and AltaLink all maintain actual common equity ratios that are lower than the common equity ratios that have been approved by the Commission for their operating subsidiaries in Alberta… The managers of the parent companies of the ATCO Utilities, Fortis, and AltaLink have all apparently concluded that actual common equity ratios lower than the ratios approved by the Commission are optimal for shareholders and adequate to maintain the financial integrity and creditworthiness of the overall enterprise, while minimizing overall financing costs."[201]

Mr. Stauft is asserting that these publicly traded entities operate with book value common equity ratios substantially lower than the ratio approved by the Commission for the Utilities. The implication is that the ability of the traded companies to maintain their financial integrity and credit-worthiness is evidence that the

[201] Stauft Evidence, page 11.

Commission's deemed equity ratio is more than adequate to ensure the same for the Utilities.

However, Mr. Stauft erroneously neglects to account for the significant levels of preferred equity included in the book value capital structures of the referenced publicly-traded companies. Preferred equity is a hybrid security that can take on varying degrees of equity or debt character depending on the specific provisions of the shares issued. As discussed below, credit rating agencies such as S&P and DBRS generally attribute 50-100 percent common equity character to preferred shares when analyzing a company's credit-worthiness, and it is these agencies and their ratings that ultimately affect the terms of financing available to the Utilities. Therefore, it is not reasonable for Mr. Stauft to treat preferred equity as 100 percent equivalent to debt for purposes of this comparison. Credit metrics that affect access to debt capital measure cash flow relative to total debt, so lumping preferred equity in with debt biases these metrics upward.

Figure 19 reproduces the full table from my workpapers that Mr. Stauft excerpted in his evidence.[202] As the figure shows, when preferred equity is considered alongside common equity,[203] the resulting ratios are not significantly below the Commission's level. Assuming the preferred equity shares in question are essentially the same as common equity shares, my Canadian sample on a book equity basis is 43.5 percent equity on average, which is above that approved by the Commission. Even categorizing only 50 percent of the preferred equity financing as common equity-like results in book equity ratios that are very much in line with the Commission's deemed equity ratios.[204]

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[202] See Stauft Evidence, page 10, lines 5-13, excerpting BV Workpaper 06, sheet "Cap_Struct_Book".

[203] This is labeled as "Q3 2015 Book Equity" in Figure 19.

[204] As Mr. Stauft notes, the lowest book equity ratios in the sample belong to Enbridge, Inc. and TransCanada Corp. Although the majority of these companies' assets are dedicated to regulated activities, making them reasonably comparable to the Utilities in terms of business risk, they are diversified geographically and operationally, and are therefore not necessarily appropriate points of comparison for the Utilities when it comes to financing.

Figure 18: Book Value Capital Structures of the Utilities

Company	Q3 2015 Book Equity	Q3 2015 Pref. Equity	Q3 2015 Book Debt	Total
Canadian Utilities Ltd.	32%	12%	56%	100%
Fortis Inc	36%	8%	55%	100%
Emera Inc	40%	9%	50%	100%
TransCanada Corporation	33%	5%	63%	100%
Enbridge Inc	20%	11%	69%	100%
AltaGas Ltd.	44%	11%	46%	100%
Average	34.1%	9.4%	56.4%	100.0%

Source: BV Workpaper 06, Sheet "Cap_Struct_Book."

Q80. Do you have any other comments with regard to Mr. Stauft's discussion of public entity capital structures?

A80. Yes. First, unlike credit rating agencies such as Standard & Poor's and DBRS, Mr. Stauft fails to recognize that preferred equity is a hybrid instrument with characteristics of debt and equity. Credit rating agencies generally consider 50-100 percent of the preferred equity to function as common equity when performing credit analysis.[205] I discuss this issue in more detail below.

Second, I note that the market-value equity ratios of the companies in my sample are higher than the book value ratios cited by Mr. Stauft. Creditworthiness is judged in part based on cash flows relative to measures of financial leverage, and at present the market values the expected cash flows generated by the assets of the Canadian sample above the original cost recorded on its books. Figure 20 below is from my workpapers supporting the cost of equity estimates presented in my Written Evidence. It reports the market value capital structures—both at the time of my analysis ("DCF Capital Structure") and averaged over the preceding 3-year period—for the Canadian Sample ("3-Year Average Capital Structure"). This table demonstrates that market value leverage ratios of these companies, which determine the financial risk faced by

[205] Standard & Poor's Hybrid Capital Handbook: September 2008 Edition, and DBRS Criteria: Preferred Share and Hybrid Security Criteria for Corporate Issuers, January 2016.

their shareholders, reflect *less* leverage than what is inherent in the Commission's approved equity ratio.

Figure 19: Villadsen Canadian Sample Market-Value Capital Structure Summary

	DCF Capital Structure			3-Year Average Capital Structure		
Company	Common Equity - Value Ratio [1]	Preferred Equity - Value Ratio [2]	Debt - Value Ratio [3]	Common Equity - Value Ratio [4]	Preferred Equity - Value Ratio [5]	Debt - Value Ratio [6]
Canadian Utilities Ltd	44 8%	8 9%	46 4%	52 6%	7 6%	39 9%
Fortis Inc	40 5%	7 0%	52 5%	37 6%	7 3%	55 1%
Emera Inc	55 0%	6 2%	38 7%	49 1%	6 2%	44 7%
TransCanada Corporation	45 4%	3 5%	51 1%	52 2%	2 9%	44 9%
Enbridge Inc	43 8%	7 4%	48 8%	52 2%	7 3%	40 6%
AltaGas Ltd	50 8%	9 1%	40 1%	56 5%	6 6%	37 0%
Average	46 7%	7 0%	46 3%	50 0%	6 3%	43 7%

Source: BV Workpaper 06, Table No. BV-CAN-4.

Q81. Please comment on Mr. Stauft's discussion of potentially adopting parent level capital structures.

A81. On page 12 of the Stauft Evidence, Mr. Stauft states

> If the regulatory strategy of accepting the capital structure chosen by management at the publicly traded parent level were adopted by the Commission, the allowed equity ratios for the Alberta utilities would be lower than they are now. I am not suggesting that the Commission actually adopt that strategy, but this analysis shows that the currently approved equity ratios are not too low, and are probably higher than necessary.

It has been a long standing principle for the Commission to regulate utilities on a stand-alone basis.[206] Mr. Stauft's comments seem to suggest a deviation from that principle. There is no economic justification to deviate from this principle.

Q82. Does Dr. Booth make a similar point to Mr. Stauft's regarding treatment of preferred equity?

A82. Yes. On page 4 of his CAPP Evidence, he states

> In my judgement, there is minimal risk to the equity holders in ATCO Pipelines and I continue to recommend a 35% common equity ratio. As in

[206] See, for example, Decision 2191-D01-2015, paragraph 420.

> 2014, I would point out the double leverage involved in several Alberta utilities. Fortis finances Fortis Alberta with 35% common equity and 10% preferred shares while it maintained an A- S&P bond rating, which it described as "strong."

This quote implies that 35 percent common equity with 10 percent preferred shares is equivalent to Dr. Booth's recommendation of 35 percent common equity and (implicitly) 65 percent debt. As in Mr. Stauft's analysis, Dr. Booth's failure to attribute common equity-like characteristics to the preferred shares constitutes a substantial flaw in his argument. The credit rating agencies do not make this mistake. According to Standard & Poor's,

> In their most common forms, hybrid capital instruments afford equity benefit to issuers, in part, by having ongoing payment requirements that are more flexible than interest payments associated with nondeferrable senior debt, and by being contractually subordinated to such debt. Obviously, these characteristics make the instruments more risky for investors than nondeferrable debt. In assigning issue ratings to equity hybrids, we seek to reflect the incremental risks associated with the issue in terms of payment timeliness and principal recovery compared to nondeferrable debt. We typically reflect these risks in our issue ratings on equity hybrids by assigning them ratings that are lower than those on nondeferrable debt.[207]

In addition to rating hybrid issuances to reflect higher risk relative to true debt instruments, S&P classifies hybrid instruments according to their debt and equity like qualities and attributes them appropriately for purposes of credit analysis. Specifically, for corporate issuers, it treats "minimal equity content" issues as though they were debt and "high equity content" issues as though they were common equity, but attributes "intermediate equity content" hybrids 50 percent to debt and 50 percent to equity. S&P states,

> This approach is followed in our analysis of capital structure, as well as of cash flows and fixed-charge coverage. That is, for "minimal" equity content instruments, all related dividend or interest payments (however defined legally) are treated as a fixed charge; for "intermediate" equity content instruments, 50% of the related payment is treated as a fixed charge and 50% as the equivalent of a common dividend; and for "high" equity content instruments, all related payments are treated as if they were the equivalent of a common dividend—i.e., they are not included in fixed charges.[208]

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[207] Standard & Poor's Hybrid Capital Handbook: September 2008 Edition.

[208] *Ibid.*, pp. 20-21.

Thus, conservatively assuming that Fortis's preferred shares are classified as "intermediate" in terms of equity content, S&P would treat its capital structure—and calculate cash flow to leverage and fixed charge coverage ratios—as though its capitalization were 40 percent equity ($= 35\% \, common \, equity + 0.5 \times 10\% \, preferred$) and 60 percent debt, exactly in line with the Commission's deemed capital structure.

DBRS is even more explicit than S&P in acknowledging the equity character of preferred shares. It states its policy as follows.

> Preferred shares are normally less complicated than hybrids and, next to common equity, typically hold the ranking as the most junior security. Preferred shares are by, definition, equity and typically command a very high level of equity weighting. Preferred shares generally attract a 100% equity weighting, provided that DBRS is satisfied that the issuer has no intention to eventually replace the preferred shares with debt. This acknowledges the key features of the instrument such as permanence, the generally light terms (i.e., non-cumulative, contains no events of default or covenants) and the ability to defer dividends despite typical reluctance among issuers to suspend them.
>
> …
>
> Even when all of these factors are satisfied, DBRS may still assign little or no equity treatment to a hybrid if an issuer uses such securities excessively. Accordingly, irrespective of the equity weighing assigned to a specific instrument, DBRS will treat as debt all incremental preferred shares and hybrids that lead the ratio of preferred equity and hybrids to common equity to exceed 20%.
>
> …
>
> Where the amount of hybrids and preferred shares is material, DBRS will make adjustments to some of its key leverage ratios such as debt-to-EBITDA and cash flow-to-debt to reflect some of the flexibility contributed by these instruments. [209]

So up to a certain threshold, DBRS performs its capital structure and credit ratio analysis treating preferred shares as though they were common equity. In the Fortis example cited by Dr. Booth, DBRS's policy dictates attribution of the majority (specifically 7 percentage points, since that represents 20 percent of the pure common equity financing) to equity, and the rest to debt, for a capitalization of 42 percent

[209] DBRS Criteria: Preferred Share and Hybrid Security Criteria for Corporate Issuers, January 2016, p. 8.

equity / 58 percent debt, reflecting slightly lower financial risk than is imposed by the Commission's deemed structure.[210]

Q83. Please summarize your thoughts on Mr. Stauft's and Dr. Booth's comparisons of capital structures for publicly-traded utility holding companies.

A83. Mr. Stauft and Dr. Booth both ignore the presence of preferred equity in the capital structures of the companies they compare resulting in an overstatement of the debt ratio and an understatement of the equity ratio in the capital structure. As demonstrated above, even a conservative attribution of equity character to these highly subordinated hybrid securities reveals that the capitalization ratios of the publicly-traded entities in my Canadian sample (including the parent companies of some of the Utilities) are actually very much in line with those allowed by the Commission for the Utilities.

C. ADDITIONS TO OR SUBTRACTIONS FROM THE EQUITY RATIO

Q84. What is your reaction to the specific modifications to the equity ratio that Mr. Stauft has proposed?[211]

A84. First and foremost, I do not believe it is a meaningful exercise to add or subtract percentage points to the equity ratio for the suggested specific issue at this point in time. It is important to get the deemed equity ratio right, but the proposed modifications may not be additive meaning that the addition of equity percentages for two risk factors may get the overall risk wrong.

Second, I do not find the specific modifications in the Stauft Evidence compelling. His proposals to (i) eliminate the 2 percent adder for non-taxable entities,[212] (ii)

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[210] This is confirmed according to DBRS's January 6, 2016 Rating Report on Fortis Inc., which notes the preferred treatment in a footnote to the consolidated debt-to-capitalization ratio of 58.2% as of September 30, 2015. (See page 9 of the report.)

[211] Stauft Evidence pp. 50-58.

[212] Stauft Evidence pp. 50-58.

reduce the equity ratio of ATCO Electric Transmission by 2 percent,[213] and (iii) award ATCO Pipeline the same equity ratio as the electric transmission entities are addresses below.[214]

Q85. Please discuss the proposal to eliminate the 2 percent equity adder for tax exempt entities.

A85. As Mr. Stauft acknowledges, the EBIT coverage ratio is lower for tax exempt entities and earnings volatility is higher,[215] so that it is necessary to increase the equity ratio to ensure the benchmark EBIT coverage ratio is met.

Mr. Stauft argues that the 2 percent adder is costly, lead to unusual circumstances when a company faces a low tax rate and that credit metrics are better repaired using a normalized or future income tax (FIT). I disagree for several reasons.

Customers benefit when a utility is tax exempt as they do not pay income taxes and therefore face a lower bill than if they received service from an otherwise identical utility. Further, while there are many arguments for and against flow-through vs. FIT, transitioning from one system to another is non-trivial, so that such a change should only be contemplated if it were expected to be in place for a longer period.

Importantly, I note that my written evidence shows that a tax exempt entity needs a boost in the equity percentage of well over 7 percent to have an EBIT coverage ratio that is comparable to that of a fully taxable entity.[216] Therefore, the 2 percent adder that the Commission historically has relied upon is a very conservative estimate of what is needed to repair the credit metric.

Q86. What are Mr. Stauft's proposals regarding other equity ratio modification?

A86. Mr. Stauft proposed to eliminate

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[213] Stauft Evidence pp. 60-61.

[214] Stauft Evidence p. 61.

[215] Stauft Evidence p. 54 and pp. 55-56.

[216] Villadsen Evidence, p. 79.

> the 2% equity ratio adders that were approved in the 2009 and 2011 GCOC proceedings in connection with their [ATCO Electric Transmission and AltaLink] large capital programs.[217]

He also suggests a reduction of the spread between electric distribution and transmission companies from 4 percent to 2 percent.[218] As I understand it the effect of these two proposals is a reduction in ATCO Transmission's equity ratio by 2 percent. Mr. Stauft cites Dr. Cleary's EBIT volatility analysis as a source.[219] Mr. Stauft further proposes to set ATCO Pipeline's equity ratio equal to that of an electric transmission entity.[220] If I understand this proposal correctly this would result in a reduction in ATCO Pipeline's equity ratio by 3 percent.

Q87. How do you react?

A87. I disagree because adding and subtracting based on one-off issues is not the right approach to determine the capital structure. It is the totality of the risk going forward that needs to be considered, yet neither Mr. Stauft's discussion nor Dr. Cleary's volatility analysis does so.[221] As Dr. Carpenter explained in his written evidence:

> Business risk refers to the underlying risks inherent in a particular company's operations. Although it is a somewhat subjective concept, and there is more than one way of structuring an analysis of business risk, an approach that is commonly taken is to consider five elements of business risk: supply risk, demand (or market) risk, competitive risk, operating risk and regulatory risk.[222]

Thus, the analysis fails to consider all aspects of the Utilities risk characteristics. However, to be responsive to the Commission's questions, I note that the large capex program is ongoing albeit at a lower rate and, for example, the magnitude of Contributions in Aid of Construction has not been evaluated. I note that if I understand the additions and subtractions correctly, Mr. Stauft is proposing 34

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[217] Stauft Evidence p. 58.

[218] Stauft Evidence p. 59

[219] Stauft Evidence p. 60.

[220] Stauft Evidence p. 61.

[221] Carpenter Rebuttal Evidence, Section II.B and III.A.

[222] Written Evidence of Paul R. Carpenter, p. 7.

percent equity for transmission entities, which would make these entities more leveraged than all but one utility among those covered by DBRS in 2014.[223]

From an investor perspective, the risk and return of an investment is evaluated relative to what is available on comparable investments. Mr. Stauft's proposal puts the Utilities at a disadvantage as, for example, Hydro One, an Ontario-based electric distribution and transmission utility, is allowed an equity ratio of 40 percent and an allowed ROE of 9.3 percent.[224]

The discussion above is also applicable to ATCO Pipeline and ATCO Pipeline's integration agreement with NOVA Gas that was known at the last GCOC.[225] I also refer to Dr. Carpenter's rebuttal evidence, which notes that risks may be increasing rather than decreasing.[226] Therefore, there is no reason to change the relative risk positioning of the Utilities.

Q. Does this conclude your testimony?

A. Yes.

[223] Villadsen Evidence, Workpaper 10 based on DBRS Industry Study Canadian Utilities Q3 2014, published January 2015.

[224] Hydro One Limited, "Initial Public Offering," October 9, 2015, p. 10.

[225] Decision 2191-D01-2015, paragraph 464.

[226] Carpenter Rebuttal Evidence, Section IV.

Attachment 7 - The Brattle Group Report

Aurizon Network 2014 Draft Access Undertaking

Comments on Aspects of the WACC

PREPARED FOR

Aurizon Network for submission to the Queensland Competition Authority

PREPARED BY

Bente Villadsen, Ph.D.

17 December 2014

THE Brattle GROUP

This report has been prepared for Aurizon Network Pty Limited (**Aurizon** or **the Company**).

All results and any errors are the responsibility of the authors and do not necessarily represent the opinion of The Brattle Group, Inc. or its clients.

Unless otherwise defined in this report, capitalized terms used in this report have the meaning given in the Queensland Competition Authority "Draft Decision: Aurizon Network 2014 Draft Access Undertaking – Maximum Allowable Revenue", September 2014 (**Draft Decision**).

Acknowledgement: We acknowledge the valuable contributions of many individuals to this report and to the underlying analysis, including members of The Brattle Group for peer review.

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I. Introduction and Background

In September 2014 the Queensland Competition Authority (QCA) issued a Draft Decision in relation to Aurizon Network's Maximum Allowable Revenue.[1] The Draft Decision set forth the parameters proposed by the QCA to determine Aurizon's Weighted Average Cost of Capital (WACC). The WACC is a critical input to the calculation of Aurizon's Maximum Allowable Revenue in the next undertaking period (expected to commence on 1 July 2013), described in the Draft Decision as UT4).

The Brattle Group has been engaged to comment on certain parameters that concern the determination of the WACC, as set out in the Draft Decision. This report is focused on the determination of the parameters that enter the Capital Asset Pricing Model (CAPM) (a component of WACC), namely:

- the equity beta;
- the risk-free rate; and
- the Market Risk Premium (MRP).

Moreover, this report will examine the empirical evidence underlying the application of the CAPM to low-beta (less than one) stock.

This report is limited to providing a discussion of the academic evidence presented in the Draft Decision as well as comment on practitioner and regulatory practice in relation to WACC; it does not provide a quantification of the parameters and it is focused only on key elements rather than all aspects. Accordingly, this report explores the following areas:

- Comparators used to determine the relevant equity beta (systematic risk).
- Horizon of the risk-free rate.

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[1] Queensland Competition Authority, "Draft Decision: Aurizon Network 2014 Draft Access Undertaking – Maximum Allowable Revenue," September 2014 (QCA Draft Decision).

- Determination of the MRP:
    - Implementing the estimation of the historical (Ibbotson) MRP.
    - Use of the Siegel method to estimate the MRP by reference to historic data.
    - Use of the Cornell or other methods to estimate the MRP.
- Empirical evidence regarding modifications to CAPM for low-beta stocks.

For Australian companies to attract capital, they must demonstrate capacity to earn a return that is comparable to that presently available to other businesses with a similar risk profile. In respect of Aurizon, investors necessarily look to the Maximum Allowable Revenue and Aurizon's ability to earn the allowed WACC rather than individual parameters in the WACC calculation. In so doing, prudent investors will compare Aurizon to other entities which exhibit a similar risk profile.

II. Equity Beta

The cost of capital is the rate of return investors require based on the risk-return alternatives available in competitive capital markets. The cost of capital is a type of opportunity cost: it represents the rate of return that investors could expect to earn elsewhere without bearing more risk. The definition of the cost of capital recognizes a tradeoff between risk and return that can be represented by the "security market risk-return line"[2]. This line is depicted in Figure 1, below. As illustrated, the higher the risk, the higher the cost of capital required.

[2] Also known as the "security Market Line".

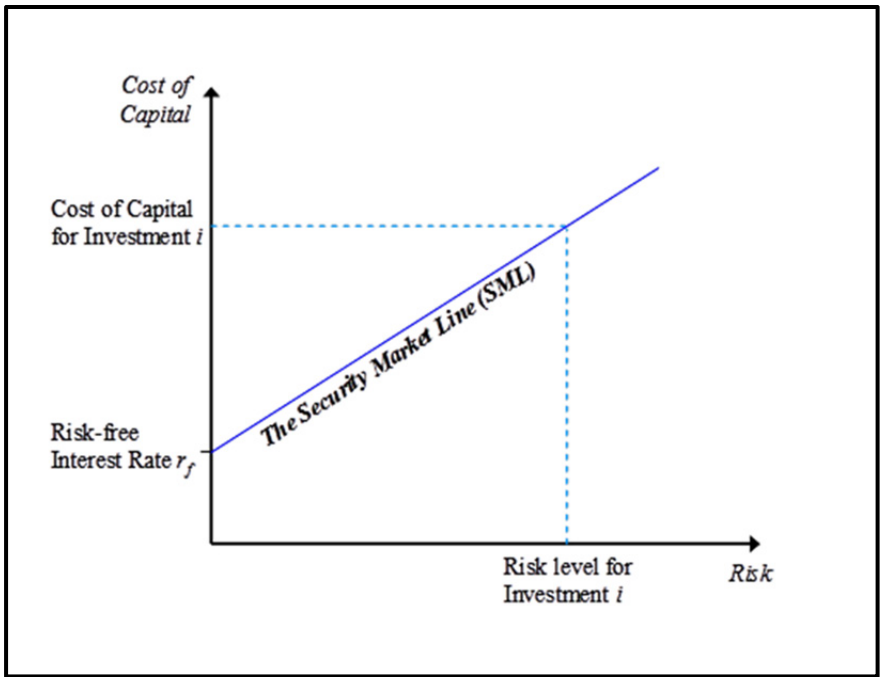

Figure 1: The Security Market Line

The cost of capital for a company depends on the risk of the lines of business in which it is engaged. Because investors consider the risk-return tradeoff and look to comparable companies to assess whether to invest in Aurizon, it is imperative that Aurizon's systematic risk is compared to that of other businesses that face risks similar to Aurizon. As the QCA measures the systematic risk by beta, it is vital that the beta measure is derived from a set of companies that operate businesses that are comparable to that of Aurizon. Further, as financial markets have become more globalized, that comparison is likely to be global rather than being limited to Queensland or Australia.

A common theme in the academic literature is that beta varies with operating leverage, so that the larger the fixed costs are relative to variable costs, the higher the beta. Professors Berk and DeMarzo of Stanford University comment on the effect of increasing fixed costs to variable costs:

> Another factor that can affect the market risk of a project is its degree of operating leverage, which is the relative proportion of fixed versus variable cost.[3]

[3] Jonathan Berk and Peter DeMarzo, "*Corporate Finance: The Core*," 3rd edition, 2014, p. 420.

Similarly, Professors Ross, Westerfield, and Jaffe, state:

> Operating leverage magnifies the effect of the cyclicality of a firm's revenues on beta. That is, a firm with a given sales cyclicality will increase its beta if fixed costs replace variable cost in its production process.[4]

Thus, firms with higher operating leverage (more invested capital) have higher betas. As railroad companies are capital intensive companies relative to most industries, they are expected to have betas that are higher than those of less capital intensive firms.

Along the comparability dimension and especially the use of capital, we note that operating cash flow to capital expenditure and operating cash flow to operating costs for the toll road, Transurban Group, which is included in Incenta's group of toll roads, appears to be an outlier with a very low beta.[5] Specifically, Transurban Group has an unusual profile with Bloomberg data showing Cash Flow to Capital Expenditures at 7.9 and operating cash flow to operating expenses in excess of .80, whereas Aurizon Networks had cash flow to capital expenditure of 0.7 and operating cash flow to operating expenses .68.[6] Thus, measured on the relationship between cash flow and capital expenditures. Aurizon only has 1/10 of the cash available for capital expenditures as does Transurban and cash flow relative to operating costs is low for Aurizon relative to Transurban. Therefore at least one toll road is an outlier relative to Aurizon. At the same time, Bloomberg estimates Transurban Group's beta at .65, while the average beta for the toll roads with available data is 1.04.[7] Without Transurban, the average beta for the toll roads increases by a non-trivial amount; using data for those with a beta estimate available from Bloomberg, the beta increases from .94 to 1.27 when Transurban is eliminated.[8] We also note

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4 Stephen A. Ross, Randolph W. Westerfield, and Jeffrey Jaffe, "*Corporate Finance*," 10th edition, 2013, p. 410.

5 Incenta Economic Consulting, "Review of Regulatory Capital Structure and Asset / Equity Beta for Aurizon Network," p. 72.

6 Transurban Group has a very high asset to revenue measure, but a low beta which is also unusual.

7 Bloomberg data as of December 9, 2014. Bloomberg shows beta estimates for Albertis (1.51), Atlantia (1.04), Gruppo (.57), and Transurban Group (.65).

8 See Figure A-4 attached to this report for details.

that Brisa has an unusually high cash flow to capital expenditure measure, but Bloomberg does not provide a beta estimate for that company, so we cannot assess the impact on the beta estimate for the toll roads. However, the group of toll roads, which are used as an upper bound for Aurizon, includes companies that are not comparable to Aurizon and at least one of the toll roads appears to downward bias the beta estimate.

Another distinguishing factor for railroad businesses relative to, for example, electric, natural gas, or water utilities businesses is that while the electric, natural gas, and water utilities predominantly serve residential customers, freight railroads such as Aurizon serve industrial / commercial customers, whose demand for service is much more variable than that of a larger number of residential customers. North American freight railroads obtain in excess of 92% of their revenues from freight transportation for industrial customers,[9] while electric utilities have in recent years sold 40-41% of their total electricity sales to residential customers[10] and the publicly traded water utilities have an even larger share of residential customers at 50-90%.[11] Aurizon is also an industrial load carrier. Thus, the railroads face a less diversified and more demand varying group of customers than electric or water utilities.

We note that the draft decision cites Incenta's advise that

> Aurizon Network's regulatory arrangements, characterised by a revenue cap with periodic cost reviews, mean variations in demand from its customers does not translate into variations in economic returns. [12]

However, there is no discussion of how this impacts the cash flow for Aurizon. Looking at the U.S. Class 1 railroads, Canadian railroads and data on regulated Aurizon revenue shows that

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9 Bloomberg data.

10 Data from Energy Information Administration at http://www.eia.gov/electricity/annual/html/epa_02_02.html

11 American Water 2013 10-K p. 9; Aqua America 2013 10-K p. 6; California Water 17 January 2014 Value Line Sheet; American States Water Annual Report p. 12; SJW Corp. 2013 Annual Report p. 25.

12 QCA Draft Decision, p. 247.

Aurizon Network's regulatory cash flow has varied **more** than that of the U.S. Class 1 railroads and the Canadian railroads. Aurizon Network's as well as the U.S. Class 1 and the Canadian railroads revenues are shown below in Figure 2 (normalized to 100 for 2007 for comparability).[13] As is evident from the chart, the variability (*e.g.*, Standard Deviation) in Aurizon Network's revenue is substantially higher than that of both the U.S. railroads and the Canadian railroads. Thus, the revenue cap does not imply that the regulatory cash flow is stable – in fact, Aurizon Network's regulatory cash flow has a higher standard deviation than the revenues of the Canadian or U.S. Class 1 railroads. Investors ultimately are interested in expected cash flow and revenue is the top line hereof, so this measure is important and shows that the revenue cap does not translate into lower revenue variability than what is common among US Class 1 railroads..[14,15] Put differently, the railroads provide insights into Aurizon's risk characteristics and should be considered.

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[13] Data for the U.S. Class 1 railroads was obtained from Bloomberg, while data for Aurizon Network was read from Figure 16 in Aurizon, "A Comparator Analysis of Aurizon Network's Commercial and Regulatory Risks," 20 January 2014.

[14] We also note that the cash flow from operations of Aurizon Holdings is more variable than that of the US Class 1 railroads. This is illustrated in Figure A-5 attached to this report.

[15] The QCA Draft Decision, Chapter 10 discusses the characteristics of the U.S. Class I railroads, but not the Canadian or railroads other than the US Class 1 railroads.

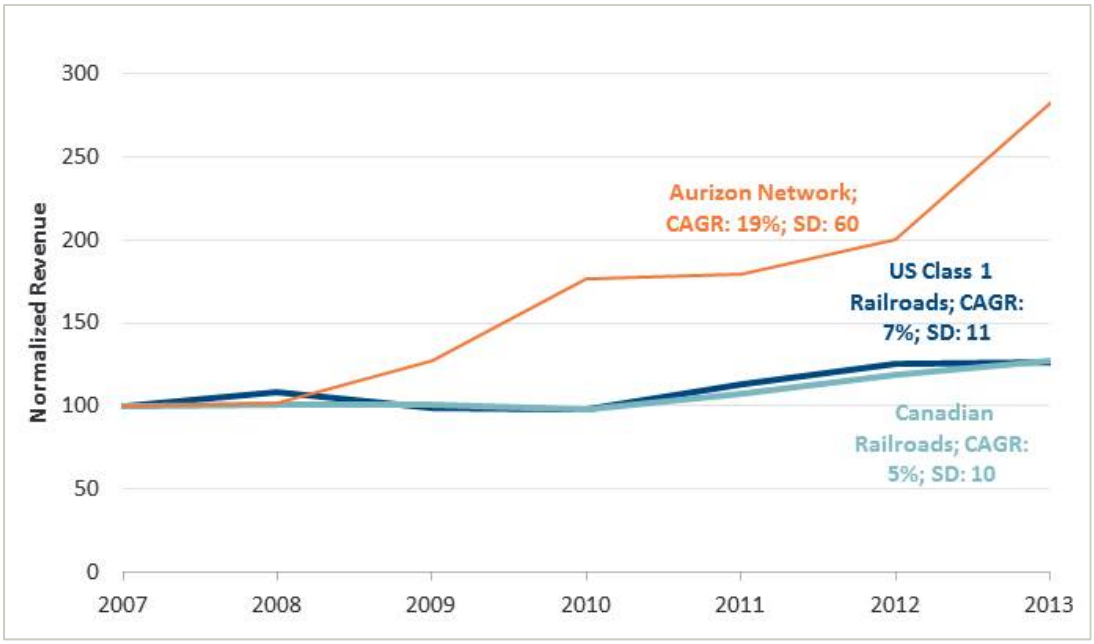

Figure 2: Cash Flow / Revenue for Aurizon Network U.S. Class 1 Railroads and Canadian Railroads

The Australian energy businesses, Electranet, Gasnet, and Aurora Energy, are not market comparables as Electranet is a privately owned company, Gasnet is part of APA Group and therefore has no separately traded stock, and Aurora Energy is a state-owned entity with no public traded stock.[16] Thus, the beta that is cited in the QCA's Draft Decision is based on an indirect estimation rather than market data.[17] Further, I note that Electranet and Gasnet primarily serve regulated entities and not industrials while Aurora Energy is a retail energy provider that serves primarily residential customers. In addition, it appears that these entities expect a relatively low growth in regulated assets going forward whereas Aurizon expect substantial growth in regulated assets.[18] It is therefore not clear that these entities are the *only*

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16 http://www.electranet.com.au/corporate/governance/; http://apa.com.au/about-apa.aspx; and http://www.auroraenergy.com.au/about/about-aurora.

17 See, QCA Draft Decision p. 243.

18 Aurizon, "A Comparator Analysis of Aurizon Network's Commercial and Regulatory Risks," 20 January 2014, p. 75. The Brattle Group has not independently calculated the regulatory asset value.

comparable entities that are relevant for forming an upper bound on beta as suggested by parties such as the QRC.

The use of betas from a regulatory decision to estimate the betas for another regulatory proceeding is quite circular. While the evidence that the regulator relied upon when determining the beta for the Electranet, Gasnet, or Aurora may be relevant, the reliance on the outcome from a decision rather than the empirical evidences may cause important assumptions, facts or the context to be lost. Put differently, it is difficult to assess the applicability of a decided parameter to another proceeding and a different industry.

While electric and gas utilities' comparability is discussed, there is limited discussion of the decisions for railroads regulated by the Economic Regulatory Authority (ERA). In both 2013 and 2014, the ERA found an equity beta of 1.43 for Pilbara infrastructure and an equity beta of 1 for Brookfield Rail.[19] Neither is there a discussion of the findings of the Canadian Transportation Agency, which like QCA determines the cost of equity for Canadian National and Canadian Pacific as it pertains to the transportation of a single bulky raw material.[20]

The QCA's Draft Decision acknowledges the determination of the beta estimates "necessarily involves identifying comparator firms with similar risk profiles to Aurizon Network"[21]. Because no such comparator firms exist in Australia, a sample of comparable railroads will necessarily have to be drawn from overseas. At the same time, companies in the same regulatory environment could be drawn from a set of Australian energy companies. The ultimate placement of Aurizon's beta would be based on a fundamental analysis of these risk components; including lines of business, capital intensity, growth opportunities, and customer composition

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19 See Figure A-2 attached to this report for details.

20 The Canadian Transportation Agency (CTA) determines the cost of capital for rail transportation of western grain and then potentially applies this figure for other purposes. See CTA Decision No. 525-R-2011, paragraphs 10-11.

21 QCA Draft Decision p. 188.

(demand and supply risk). The QCA's Draft Decision has focused on the differences between the U.S. Class 1 railroads and Aurizon, but has not looked at whether the Canadian freight railroads (Canadian National and Canadian Pacific) or companies such as Genesee & Wyoming, which is a U.S. railroad but not a Class 1 railroad, are comparable. The beta for these railroads could then be considered in the evaluation of Aurizon's beta.

Looking to the Canadian Railroads, their regulated services consist of western grain and interswitching with the regulated cost of capital being determined for western grain. Thus, the regulatory regime is similar in that the CTA sets the allowed return on equity for a single raw material. Further, the Canadian railroads (as well as the U.S. Class 1 railroads) have grown substantially in recent years, as has Aurizon.[22] Looking to the raw beta estimates for the Canadian railroads, we found Bloomberg values of 1.01 for Canadian National and 1.30 for Canadian Pacific. This results in asset betas of .89 and 1.10, respectively.[23] It is noteworthy that the lower asset beta is also consistent with that of the lowest estimates for U.S. railroads. Because the business model and customer composition of Aurizon is more comparable to that of the railroad industry than to other comparable companies, some weight should be placed on the beta estimates obtained for railroads. We note that the Canadian Transportation Agency uses the beta estimate for the Canadian railroads to determine the cost of capital for Western grain and interswitching (and a few other purposes).[24]

The lower bound of .35 that the QCA Draft Decision[25] proposes is based on a 2010 indirect estimate for the Dalrymple Bay Coal Terminal (DBCT). I.e., it is not a current estimate based on market data. Because the estimate is not based on current market data and is an indirect

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[22] Using Bloomberg data as well as annual reports from Aurizon, we found that since 2010, the annual growth for Aurizon, the Canadian railroads and U.S. Class 1 railroads was 14%, 27%, and 13%, respectively.

[23] See Figure A-1 attached to this report for details.

[24] CTA Decision No. 525-R-2011.

[25] QCA Draft Decision p. 252.

estimate, it is difficult to assess the accuracy of the estimate or how well it measures current market conditions.

In addition to looking directly to the estimates obtained from railroads in North America, we note that railroads in other parts of Australia have larger equity margins than those proposed in the QCA's Draft Decision.[26] As discussed in this report, investors will look to comparable companies to assess whether to invest in Aurizon, it is crucial to assess what aspects of Aurizon's risk are such that it merits a lower return than other regulated railroads in Australia. Figure A-2 (attached to this report) shows the equity margin for a number of decisions as well as for the proposed margin in the QCA's Draft Decision. It is evident from the table that the equity margin proposed in the draft decision is below that afforded other regulated railroads. With an equity margin of 5.2%, the margin is more than 100 basis points below the lowest in Figure A-2 (Canadian National). In making this comparison, it is important to recognize that while the QCA regulates Aurizon's coal transportation, the Canadian Transportation Agency determines the cost of capital for the transportation of western grain.[27] I.e., both regulatory regimes are setting the allowed cost of capital for a specific raw material. As investors will necessarily look the return available on other investments that share characteristics similar to that of Aurizon, an explanation as to why no railroad companies were considered is needed.

III. Risk-Free Rate

The CAPM can be estimated using a short-term or long-term version of the risk-free rate **and** a comparable term of the MRP. However, it has become common for practitioners and regulators to use the long-term version. The reasons for this include:

(i) the long-term version tend to be more stable; and

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[26] Data from Attachment B to Aurizon, "A Comparator Analysis of Aurizon Network's Commercial and Regulatory Risks."

[27] Canadian Transportation Agency, Decision No. 525-R-2011, paragraphs 10-11.

(ii) regulated assets are long-lived.

Because monetary policy influences short-term government bonds more than long-term bonds, the shorter bonds tend to fluctuate more and thus reliance on them lead to less stable regulatory outcomes.

Regardless of which version is implemented (a longer or shorter term) it is imperative that the risk-free rate used in the CAPM calculation and that used in the determination of the MRP are consistent. If the maturity of these two risk-free rates differs, there will be a systematic bias in the estimated cost of equity. Such a bias will result in an inaccurate decision, which may impact the regulated entity's return and plausibly its ability to attract capital.

The following example illustrates this point using a beta of one for simplicity and also assumes the current spread and the historical spread between 4-year and 10-year government bonds is the same.

Example:

Assumptions:	4-year risk–free rate:	3.25%	
	10-year risk-free rate:	4.07%	
	MPR over 10-year bonds:	6.50%	
	MRP over 4-year bonds:	7.32%	
	Beta:	1.00	(for simplicity)

RFR / MRP horizon	RFR	Beta	MRP	Estimated COE
4 / 4	3.25%	1	7.32%	**10.57%**
4 / 10	3.25%	1	6.50%	9.75%
10 / 4	4.07%	1	7.32%	11.39%
10 / 10	4.07%	1	6.50%	**10.57%**

As the example shows, if the 4-year risk-free rate is used with a 10-year MRP, the estimated cost of equity is downward biased and if the 10-year risk-free rate is used with a 4-year MRP, then the estimated cost of equity is upward biased.

As the historical MRP is often reported over 10 or 20-year government bonds or over 30 or 90-day government bills, it has become customary, in many regulatory jurisdictions, to implement the CAPM using a *comparable* risk-free rate[28], although some regulators adjust the commercially reported MRP to allow for the use of a shorter (e.g., 4-5 year government bond as the risk-free rate).[29]

The QCA's Draft Decision as well some of the expert evidence note that an investor in a regulated asset should expect to earn zero economic profit - this is captured in the NPV-0 proposition set out in the Draft Decision. This proposition was originally developed by Marshall et al. 1981,[30] who showed investors would expect zero economic profit *over the life of the project*.

Clearly, the expected life of Aurizon's network is longer than four years. Schmalense 1989[31] extended the proposition to hold for shorter periods when the firm faces *no cash flow risk, asset value risk and if it is financed 100% by equity*. However, any long-lived company will face cash flow and asset value risk, so Schmalense's extension is of little practical assistance.

The QCA's Draft Decision notes Lally's work on including additional risk sources such as operating cost and demand risk and further notes that his work show that asset revaluations can be dealt with through risk allowances. The results require an annual reset of the regulated price.[32] We note two problems with these results. First, it requires that any asset revaluation (or

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28 The Australian Energy Regulatory has recently relied on the 10-year risk-free rate (See, AER, "Explanatory Statement: Rate of Return Guidelines," December 2013, p. 73). The U.S. Surface Transportation Board uses a 20-year risk-free rate to match Ibbotson's reported long-term historical MRP (see Surface Transportation Board, "Decision Docket No. EP-558 (Sub-No. 17)," issued July 31, 2014, p. 7).

29 Harris, et al. "Calculating the Equity Risk Premium and the Risk-free Rate, prepared for NMa, OPTA" November 2012.

30 Marshall, W, Yawitz, J & Greenberg, E 1981, "Optimal Regulation Under Uncertainty", *Journal of Finance*, vol. 36, pp. 909-921.

31 Schmalensee, R 1989, "An Expository Note on Depreciation and Profitability Under Rate-of-Return Regulation", *Journal of Regulatory Economics*, pp. 293-298.

32 QCA Draft Decision p. 195.

stranded asset risk) is handled through risk allowances, which is a difficult requirement. *Ex ante* the current regulatory entity, the QCA and its members, cannot bind future regulators to grant risk allowances should an asset become stranded or need substantial revaluation. Second, the result requires the regulated price to be reset annually, which plausibly will be obtainable in the current regulatory environment but may not be in the future. Therefore, it seems that the NPV-0 proposition over a 4-year horizon only is truly feasible if there is no risk of stranded assets or substantial asset revaluations.

In summary, the NPV-0 proposition is appropriate for the life of the regulated asset but because of the strong (unrealistic) assumptions used to derive results for the regulatory period, it is of little to no assistance in determining the horizon of the risk-free rate.

As discussed above, (a) the NPV-0 proposition does not help us determine the horizon of the risk-free rate, (b) data on the MRP are commonly calculated over a 10-year (or 20-year in North America) government bond (or over a 90-day bill), (c) practitioners and regulators often use a 10-year government bond, and longer term government bonds are less susceptible to monetary policy than short-term bonds. Therefore, there are multiple benefits to use a long-term government bonds and we do not see the NPV-0 proposition as an argument. We find that a straightforward way to avoid biasing the estimated cost of equity through an inconsistent use of the risk-free rate in the CAPM calculation and in the MRP determination is to rely on the 10-year government bond.

We also note that other Australian regulators such as the AER, ERA (rail) and IPART use the 10-year risk-free rate. Many overseas regulators also use a long-term government bond as the risk-free rate[33]. Because a mismatch of the risk-free rate and the term relied upon in the MRP determination can have a material impact on the cost of equity estimate, it is important to ensure

[33] For example, the U.S. Surface Transportation Board uses a 20-year government bond (consistent with the MRP relied upon by the regulator).

there is no discrepancy between the maturity of the term of the risk-free rate and the term of the MRP.[34]

The author further notes that the QCA has determined to use a 10-year bond to determine the cost of debt, so using a similar horizon for the risk-free rate in the CAPM would be consistent.[35]

IV. Market Risk Premium

As discussed above, the MRP relied upon is estimated over long-term government bonds and that median of the estimates exceeds the QCA's recommended MRP as contained in the QCA's Draft Decision. Table 1 below shows the Draft Decision's point estimate and range for the MRP, which for all methods are measured over the 10-year risk-free rate. The table also shows the implied MRP over a 4-year government bond.[36]

Table 1: QCA Draft Decision Benchmark MRPs[37]

	QCA's MRP Estimate	MRP Range	Implied MRP over 4-Year Bond
Ibbotson	6.50%	5.8 - 6.6%	6.82%
Siegel	5.50%	4.1 – 6.4%	5.82%
Surveys	6.80%	N/A	7.62%
Dividend Growth	7.10%	5.6% - 8.3%	7.92%
Median	6.65%		7.22%
Midpoint	6.30%		6.87%
Average	6.50%		7.05%

[34] Ibbotson as well as the Credit Suisse data calculates the historical MRP over long term bonds and the survey data are consistent with being over a long-term bond. See, for example, Pablo Fernandez, Javier Aguirreamalloa & Pablo Linares, *Market Risk Premium and Risk Free Rate used for 51 countries in 2013: A Survey with 6,237 Answers* (revised June 27, 2013.

http://papers.ssrn.com/sol3/papers.cfm?abstract_id=914160

[35] We recognize that the QCA Draft Decision (see p. 218) attempted to use a 4-year debt rate, but was unable to find credit default swaps that could convert the efficient 10-year rate to a 4-year rate.

[36] The implied MRP is calculated as the QCA's MRP estimate plus the difference between the 10-year and the 4-year risk free rate. For the Ibbotson and Siegel method, I relied on as long a period as I have available (2000-2013), whereas the survey and dividend growth method use the difference over the last 20 days in October 2013 to be contemporaneous and consistent with the risk-free rate estimate.

[37] QCA Draft Decision pp. 230-234.

As shown in Table 1 above, if the QCA uses the 4-year government bond in its CAPM estimation, the MRP needs to be adjusted for the difference between the 10-year and the 4-year government bond yield.

The remainder of this section addresses the determination of the historical MRP (the Ibbotson method) and the use of the Siegel method.

A. HISTORICAL MRP

The historical MRP is commonly determined as the arithmetic difference between the return on a stock index such as the Australian ASX and a risk-free rate over a long period. Ibbotson notes that for the purpose of determining the MRP, it is preferable to apply the longest period for which reliable data are available.[38] Specifically, the authors argue that:

> "some analysts estimate the expected equity risk premium using a shorter, more recent time period on the basis that recent events are more likely to be repeated in the near future; furthermore, they believe that the 1920s, 1930s, and 1940s contain too many unusual events. This view is suspect because all periods contain "unusual" events. Some of the most unusual events of the last hundred years took place quite recently, including the inflation of the late 1970s and early 1980s, the October 1987 stock market crash, the collapse of the high-yield bond market, the major contraction and consolidation of the thrift industry, the collapse of the Soviet Union, the development of the European Economic Community, the attacks of September 11, 2001 and the more recent liquidity crisis of 2008 and 2009."[39]

[38] Morningstar, "*Ibbotson SBBI 2013 Valuation Yearbook*," p. 59.

[39] Morningstar, "*Ibbotson SBBI 2013 Valuation Yearbook*," p. 59.

The QCA's Draft Decision appears to agree with this proposition by its application of a period from 1958 to 2013[40] although the QCA's Draft Decision does not explain why the alternative source from Credit Suisse is not reliable.

In the alternative Credit Suisse source, the authors use data from 1900 to current and find the historical arithmetic MRP for Australia to be 7.6%.[41] Similarly, Professors Ross, Westerfield and Jaffe find that an estimate based on the historical arithmetic average over as long a period as data are available is reasonable and use the Credit Suisse data as their source.[42] As noted above, Credit Suisse reports a historical arithmetic MRP of 7.6% for 1900 to 2013 for Australia.

B. SIEGEL

The Siegel procedure adjusts the Ibbotson estimated MRP by adding the real bond return back and subtracting the expected real bond return. Thus, it attempts to adjust for unexpected inflation.

There are three issues with the Siegel procedure as implemented by the QCA. First, the QCA's Draft Decision prefers to use data from 1958-2013 for the determination of the Ibbotson MRP,[43] but only has data on the expected real bond return from July 1986 to October 2012[44] or approximately half of the relied upon period for determination of the Ibbotson MRP. Second, the research underlying the implementation of the method relied on

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40 QCA Draft Decision p. 230.

41 E. Dimson, P. Marsh, and M. Staunton, "*Credit Suisse Global Investment Returns Sourcebook 2014*," Table 10. The text also provides an alternative measure that makes adjustments for the price-dividend ratio. Using that measure, the Australian MRP is measured at 7.27% (Table 11 in the text). These measures do not take the impact of imputation credits into account, which would increase the measured MRP.

42 Ross, Westerfield and Jaffe 2013, p. 326 discuss the methodology. "*Credit Suisse Global Investment Return Sourcebook 2014*," Table 10 of that text provides the long-term arithmetic MRP referenced above and Table 9 of the text provides the short-term MRP – currently 7.5%.

43 QCA Draft Decision p. 231.

44 Martin Lally, "Response to Submissions on the Risk-Free Rate and the MRP," 22 October 2013, p. 12.

data from 1940 to 1990,[45] which included high inflationary periods. As there has been no follow up on studies, it is not clear what the impact is today. Third, the Siegel procedure is not widely used among practitioners or regulatory settings.

The first two issues are interlinked. While it is always problematic to extrapolate data from a period to a longer period, it is especially troublesome when the period to which it is extrapolated may differ from the period for which data is available. In this case, the Australian inflation rate has varied quite dramatically over the period used to estimate the MRP.[46] Thus, it is not clear that the extrapolation of data provides an accurate implementation of the Siegel procedure. Further, the QCA's Draft Decision cites a study on the inflation from 1940 to 1990 as evidence that inflation forecasts were too low during the high inflation sub-period.[47] However, this does not necessarily mean that the average inflation forecasts were too low for the full period. *I.e.*, there is no evidence that the result is valid for the full period relied upon, 1958-2013.

Specifically, according to data from the RBA, inflation in Australia was 6.37% in the period from 1940-1990, which is higher than the average inflation of 4.96% recorded over the period 1958-2013 and even higher still than the average inflation rate of 4.19% from 1923-2014. In the past 26 years from 1986 – 2012, average inflation has been lower still at 3.50%, suggesting the Siegel method might yield a bias estimate that does not reflect current conditions.[48]

Lastly, as acknowledged in the QCA's Draft Decision, the Siegel procedure is not widely used. Because there are many other MRP estimation methods that are much more widely used than the Siegel procedure, the inclusion of this specific methodology needs additional explanation and empirical support.

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45 QCA Draft Decision p. 230.

46 Figure A-3 (attached to this report) shows the historical inflation as well as the average inflation over selected periods.

47 QCA Draft Report p. 230.

48 Reserve Bank of Australia historical inflation data as of 12/7/2014.

C. ALTERNATIVE METHODS

As noted above, there are methods or data other than those relied upon by the QCA to estimate the MRP. The Draft Decision discusses the use of the Cornell (dividend growth) method, which (i) allows the forecasted dividend growth to converge towards the long-run economy growth over a 10-20 year period, (ii) deduct 0.5 – 1.5% for the creation of new companies and new equity issuance, (iii) incorporate a term structure for the return on equity, and (iv) recognize dividend payments every six months.

We agree that the dividend growth rate long-term plausibly will converge to that of the economy as a whole and that a recognition of the actual periodicity of dividend payments is important. However, the QCA did not cite evidence for the magnitude of the reduction of 0.5% to 1.5% for the creation of new equity. The reduction is particularly worrisome because the model as implemented does not take into account the fact that companies distribute cash to shareholders by other means than dividend distributions. For example, many corporations, including Aurizon and North American railroads are engaged in share buybacks, which is an alternative way to distribute cash to shareholders.[49] Therefore, the model as implemented takes into account a potential upward bias caused by new equity issuances, but does not take the de facto cash distribution though share buybacks into account. This downward biases the estimated MRP. Consistency would require a consideration of all factors that impact the MRP; either though an explicit modeling of such factors or through a demonstration that they are offsetting.

V. Evidence on the CAPM for Low-Beta Stock

One of the challenges to the CAPM has been the empirical observation that low beta stocks have higher average returns than predicted by the CAPM. The empirical estimates seem to require that the security market line in Figure 1 pivot around beta = 1. I.e., the intercept needs to increase while the slope declines. This would lead to higher expected returns for low beta stock

[49] See, for example, Value Line Investment Surveys for the U.S. railroads and Business Spectator, "Aurizon Announces Share Buyback Scheme," 11 November 2014.

and lower returns for high beta stock. There have been many studies on this topic with early papers by Black, Jensen and Scholes (1972) and Fama and MacBeth (1972).[50] Although the realized market returns demonstrated a remarkable linearity in the CAPM beta, as predicted by CAPM, the empirical version of the Security Market Line was pivoted around beta = 1.0. I.e., the intercept was higher and the slope less steep than predicted by theory. Several subsequent studies confirmed the robustness of this result and proposed explanations revolving around market frictions, such as different borrowing and lending rates, and the role of taxes. [51] Nevertheless, the empirical evidence suggested significant movement in the Security Market Line, often flattening, to the point that Fama and French (1992) found a zero slope in the empirical Security Market Line.[52] Fama and French suggested that factors other than the risk relative to the market, such as size and book-to-market value ratios (among others) were significant in explaining the Security Market Line. A string of papers followed the initial work that has culminated in the model now known as the Fama-French model. Although this empirical challenge has motivated important and interesting work, alternatives to using the CAPM remain hotly debated by many.

The Empirical CAPM (**ECAPM**) or the Black CAPM is one way of correcting for the empirical flattening of the Security Market Line. Specifically, the ECAPM directly adjusts the CAPM Security Market Line by a parameter, alpha, that can be controlled for sensitivities, etc. Formally, the ECAPM relation is given by:

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50 F. Black, M.C. Jensen, and M. Scholes, "The Capital Asset Pricing Model: Some Empirical Tests," *Studies in the Theory of Capital Markets*, Praeger Publishers, 1972, pp. 79-121 and E.F. Fama and J.D. MacBeth, "Risk, Returns and Equilibrium: Empirical Tests," *Journal of Political Economy* 81 (3), 1972, pp. 607-636.

51 Figure A-6 attached to the report contains a list of additional articles documenting this result.

52 E.F. Fama and K.R. French, "The Cross-Section of Expected Returns," *Journal of Finance* 47, 1992, pp. 427-465.

$$r_S = r_f + \alpha + \beta_S \times (MRP - \alpha)$$

where α is the "alpha" adjustment of the risk-return line, a constant, and the other symbols are as defined above. The alpha adjustment has the effect of increasing the intercept while reducing the slope of the Security Market Line, resulting in a Security Market Line that more closely matches the results of empirical tests. The model is illustrated in Figure 3 below.

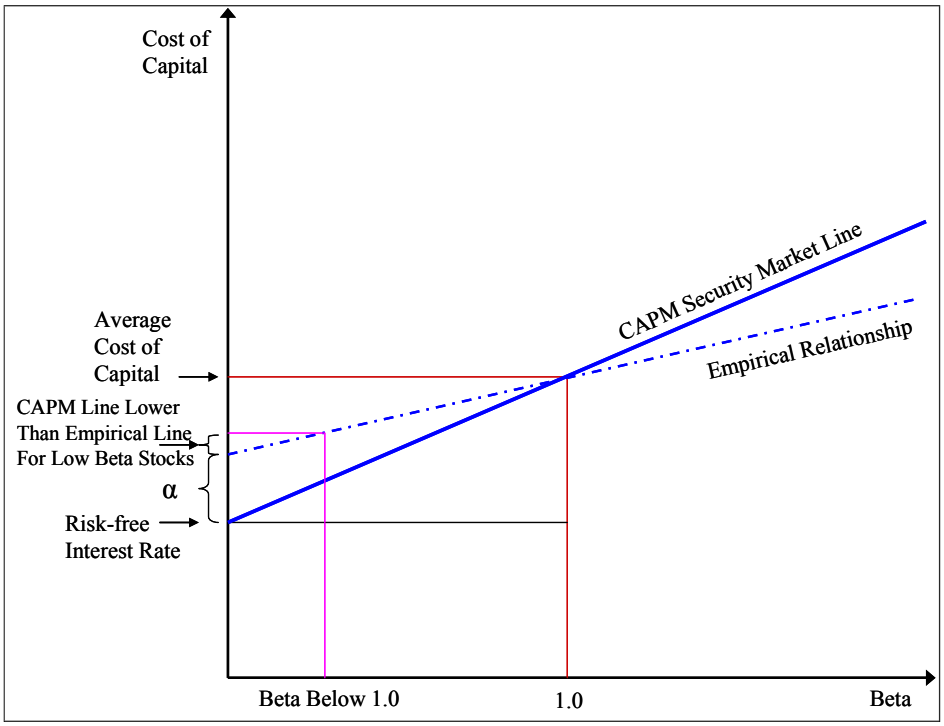


Figure 3: The Empirical Relationship Between Beta and Return

The academic literature has estimated a fairly wide range of alpha parameters, ranging from 1 percent to as much as 7 percent when using short-term government bonds.[53] Thus, while there is no consensus about the magnitude of the needed pivot, the finding that one is needed has been consistent. As a result the AER concluded that "using the Black CAPM theory to inform our

[53] The academic literature that estimates alpha dates back to the 1980s or earlier. Figure A-6 attached to this report lists the relevant academic research and also provides the alpha parameters the research estimated. Recent research in this area has focused on Fama-French multifactor models rather than an adjustment to CAPM.

equity beta estimate may mitigate possible low beta bias."[54] The AER went on to use an alpha parameter of 1.5% and 3.0% to assess the best point estimate for the beta estimate.[55]

The following example illustrates the magnitude using the data from the QCA's Draft Decision.

Example:

Based on the data cited in the QCA's Draft Report for the equity beta, risk-free rate, and MRP along with an alpha parameter of 1.5% or 3.0% as proposed by the AER, we show the impact on the estimated ROE in Table 2 below.

	Alpha	Risk-Free Rate	Beta	MRP	Estimated ROE	Implied Beta
QCA	0.00	3.21	0.8	6.5	8.41	0.80
QCA, alpha = 1.5%	1.50	3.21	0.8	6.5	8.71	0.85
QCA, alpha = 3.0%	3.00	3.21	0.8	6.5	9.01	0.89

Table 2: Impact of Using the ECAPM

Thus, using an alpha of 1.5% to 3.0% as suggested by the AER, the estimated cost of equity increases by 30 – 60 basis points or viewed alternatively, the relied upon beta increases from .8 to 0.85 – 0.89. We note that these alpha estimates are conservative as the academic literature find an impact of one to seven percent.

54 AER, "Explanatory Statement: Rate of Return Guidelines (Appendices)," p. 16.

55 *Ibid.*, p. 106.

APPENDIX: Supporting Figures and Tables

Figure A-1: Details of U.S. and Canadian Betas

Company	Capital Structure Precentages: 2009 - Present Average Percent Debt	2009 - Present Average Percent Equity	2009 - Present Average Percent Preferred Equity	Equity Beta	Tax Rate (Value Line)	Debt +Preferred Beta	Asset Beta	Relevered Beta Equity at 0.45
Union Pacific	13.77%	86.23%	0%	1.00	38%	0.00	0.91	1.56
CSX Corp.	26.66%	73.34%	0%	1.13	36%	0.00	0.92	1.57
Norfolk Southern	25.99%	74.01%	0%	1.18	36%	0.00	0.96	1.65
Kansas City South'n	17.21%	82.73%	0%	1.48	35%	0.00	1.30	2.23
Can. Pacific Railway	20.28%	79.72%	0%	1.30	27%	0.00	1.10	1.88
Can. National Railway	15.08%	84.92%	0%	1.01	27%	0.00	0.89	1.53
Genesee & Wyoming	23.86%	75.45%	1%	1.53	11%	0.00	1.18	2.03
							Average	1.78

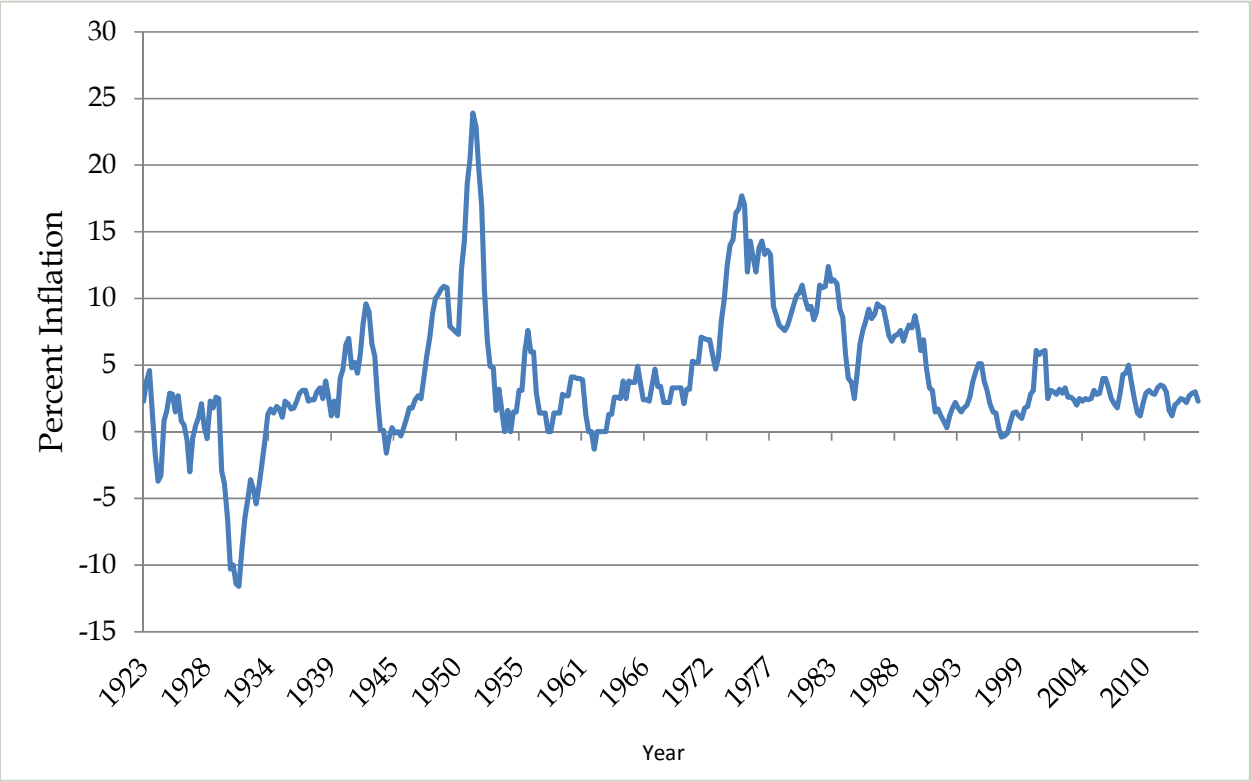
Figure A-2: Regulatory Equity Margins for Railroads

		10 Year Risk Free Rate [a]	Allowed ROE [b]	Equity Margin [c]	Beta [d]	Reference [e]
US Class 1 Railroads - 2012	[1]	1.88	11.12	9.24	1.15	US STB 2012
US Class 1 Railroads - 2013	[2]	1.76	11.32	9.56	1.35	US STB 2013
USA	[3]	**1.82**	**11.22**	**9.40**	**1.25**	Average
Canadian Pacific Railway - 2012	[4]	1.79	10.18	8.39	NA	CTA 2012
Canadian Pacific Railway - 2013	[5]	1.80	11.02	9.22	NA	CTA 2013
Canadian National Railway - 2012	[6]	1.79	8.50	6.71	NA	CTA 2012
Canadian National Railway - 2013	[7]	1.80	9.36	7.56	NA	CTA 2013
Canada	[8]	**1.80**	**9.77**	**7.97**	**NA**	Average
The Pilbara Infrastructure - 2013	[9]	3.27	15.31	12.04	1.43	ERA 2013
The Pilbara Infrastructure - 2014	[10]	4.24	15.91	11.68	1.43	ERA 2013
Brookfield Rail - 2013	[11]	3.27	11.98	8.71	1.00	ERA 2014
Brookfield Rail - 2014	[12]	4.24	12.58	8.35	1.00	ERA 2014
Australia	[13]	**3.75**	**13.95**	**10.19**	**1.22**	Average

Sources and notes:

[a]:	Bloomberg as of 12.10.2014
[1], [b], [d]:	Surface Transportation Board, Railroad Cost of Capital - 2012, Decided August 30, 2013, Docket No. EP 558 (Sub-No. 17)
[2], [b], [d]:	Surface Transportation Board, Railroad Cost of Capital - 2013, Decided July 30, 2014, Docket No. EP 558 (Sub-No. 17)
[3]:	([1] + [2])/2
[4] - [7], [b], [d]:	Canadian Transportatioon Agency, "Agency-approved cost of capital rates for other regulatory purposes", available from: https://www.otc-cta.gc.ca/eng/agency-approved-cost-capital-rates-other
[8], [b], [d]:	([4] + [5] + [6] + [7])/4
[9], [b], [d]:	ERA, Determination on the 2013 Weighted Average Cost of Capital for the Freight and Urban Railway Networks, July 9, 2013. Nominal Allowed ROE and Risk-Free Rate were used.
[10], [b], [d]:	ERA, Determination on the 2014 Weighted Average Cost of Capital for the Freight and Urban Railway Networks, October 24, 2014. Nominal Allowed ROE and Risk-Free Rate were used.
[11], [b], [d]:	ERA, Determination on the 2013 Weighted Average Cost of Capital for the Freight and Urban Railway Networks, July 9, 2013. Nominal Allowed ROE and Risk-Free Rate were used.
[12], [b], [d]:	ERA, Determination on the 2014 Weighted Average Cost of Capital for the Freight and Urban Railway Networks, October 24, 2014. Nominal Allowed ROE and Risk-Free Rate were used.
[13], [b], [d]:	([9] + [10] + [11] + [12])/4
[c]:	[a] - [b]

Figure A-3: Australian Inflation 1923 to 2014



Average Inflation in Australia

Jan-1958 - Dec-2013	4.96
Jan-1940 - Dec-1990	6.37
Jul-1986 - Oct-2012	3.50
Jun-1923 - Sep-2014	4.19

Sources and notes:

RBA Inflation data as of 12/7/2014

Figure A-4:

	Operations Cash Flow/Total Capital Expenditures	Operations Cash Flow/Total Operating Expenditures	Bloomberg Unadjusted Betas
ABERTIS	1.69	0.68	1.51
Atlantia	1.89	0.56	1.04
Gruppe	NA	0.55	0.57
Transurban Group	7.92	0.80	0.65
Toll roads	**5.20**	**0.61**	**0.94**
Toll roads similar to Aurizon	**1.79**	**0.62**	**1.27**
Aurizon	**0.70**	**0.68**	**TBD**

Sources and notes: Bloomberg as of 12.10.2014; Aurizon Financial Report for year ending 6.30.2014.

Figure A-5: Operating Cash Flow for Aurizon Holdings and US Class 1 Railroads

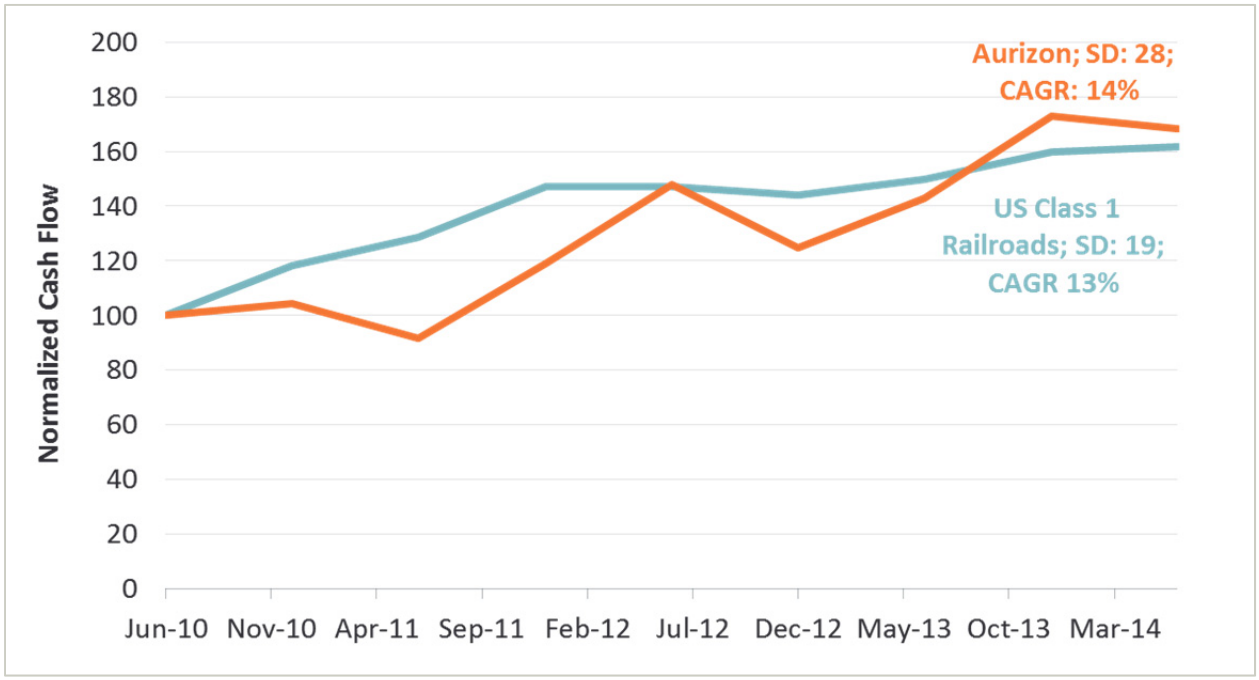


Figure A-6: Empirical Evidence on the Alpha Factor in ECAPM

EMPIRICAL EVIDENCE ON THE ALPHA FACTOR IN ECAPM*

AUTHOR	RANGE OF ALPHA	PERIOD RELIED UPON
Black (1993)[1]	1% for betas 0 to 0.80	1931-1991
Black, Jensen and Scholes (1972)[2]	4.31%	1931-1965
Fama and McBeth (1972)	5.76%	1935-1968
Fama and French (1992)[3]	7.32%	1941-1990
Fama and French (2004)[4]	N/A	
Litzenberger and Ramaswamy (1979)[5]	5.32%	1936-1977
Litzenberger, Ramaswamy and Sosin (1980)	1.63% to 3.91%	1926-1978
Pettengill, Sundaram and Mathur (1995)[6]	4.6%	1936-1990

*The figures reported in this table are for the longest estimation period available and, when applicable, use the authors' recommended estimation technique. Many of the articles cited also estimate alpha for sub-periods and those alphas may vary.

[1]Black estimates alpha in a one-step procedure rather than in an un-biased two-step procedure.

[2]Estimate a negative alpha for the subperiod 1931-39 which contain the depression years 1931-33 and 1937-39.

[3]Calculated using Ibbotson's data for the 30-day treasury yield.

[4]The article does not provide a specific estimate of alpha; however, it supports the general finding that the CAPM underestimates returns for low-beta stocks and overestimates returns for high-beta stocks.

[5]Relies on Lizenberger and Ramaswamy's before-tax estimation results. Comparable after-tax alpha estimate is 4.4%.

[6]Pettengill, Sundaram and Mathur rely on total returns for the period 1936 through 1990 and use 90-day treasuries. The 4.6% figure is calculated using auction averages 90-day treasuries back to 1941 as no other series were found this far back.

Sources:

Black, Fischer. 1993. Beta and Return. *The Journal of Portfolio Management* 20 (Fall): 8-18.

Black, F., Michael C. Jensen, and Myron Scholes. 1972. The Capital Asset Pricing Model: Some Empirical Tests, from Studies in the theory of Capital Markets. In *Studies in the Theory of Capital Markets*, edited by Michael C. Jensen, 79-121. New York: Praeger.

Fama, Eugene F. and James D. MacBeth. 1972. Risk, Returns and Equilibrium: Empirical Tests. *Journal of Political Economy* 81 (3): 607-636.

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CAMBRIDGE
NEW YORK
SAN FRANCISCO
WASHINGTON
LONDON
MADRID
ROME

THE Brattle GROUP

BEFORE THE

SURFACE TRANSPORTATION BOARD

PETITION OF THE WESTERN COAL TRAFFIC LEAGUE TO INSTITUTE A RULEMAKING PROCEEDING TO ABOLISH THE USE OF THE MULTI-STAGE DISCOUNTED CASH FLOW MODEL IN DETERMINING THE RAILROAD INDUSTRY'S COST OF EQUITY CAPITAL	)	Docket No. EP 664 (Sub-No. 2)

VERIFIED STATEMENT

OF

BENTE VILLADSEN

ON BEHALF OF

ASSOCIATION OF AMERICAN RAILROADS

September 5, 2014

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SURFACE TRANSPORTATION BOARD

Docket No. EP 664 (Sub-No. 2)

VERIFIED STATEMENT OF DR. BENTE VILLADSEN

I. Introduction and Summary

My name is Bente Villadsen and I am a principal with The Brattle Group (Brattle) in Cambridge, Massachusetts. I have more than 15 years of experience consulting on regulatory finance for regulated infrastructure companies in a variety of contexts. I have provided expert reports and testified on cost of capital issues in many jurisdictions, including before state regulatory agencies, the Bonneville Power Authority, in U.S. and international arbitrations, U.S. federal court, and overseas in Australia, Canada, Italy, and the Netherlands. This work has pertained to electric utilities, natural gas or oil pipelines, railroads, telecommunications, and water and wastewater utilities. Examples of my recent cost of capital work include reports or testimony on cost of capital methodology for Australian pipelines before the Australian Energy Regulator, cost of equity for regulated U.S. electric and water utilities, and cost of equity for a Canadian pipeline in a private arbitration. I am an instructor at Edison Electric Institute's Advanced Rate School, teaching "Current Issues in Cost of Capital." I hold a Ph.D. from Yale University and a MS and BS joint degree in mathematics and economics from University of Aarhus, Denmark. A full resume is attached as Appendix C.

I have been asked by the Association of American Railroads (AAR) to respond to the request of the Board to "address the cost of capital calculation" that it currently uses in making its annual determinations for the freight railroad industry, including review and comment on the submission of the Western Coal Traffic League (WCTL) and its experts, Professor James E. Hodder (Hodder) and Mr. Daniel L. Fapp (Fapp). In this

statement I accordingly comment on (i) the best practices regarding the use of one or more cost of equity estimation methods, (ii) WCTL's, Hodder's and Fapp's critique of the multi-stage discounted cash flow (MSDCF) model applied by the Board in its cost of capital determinations and (iii) the impact of potential adjustments to the Morningstar / Ibbotson MSDCF as applied by the Board that take key criticisms into account to estimated cost of equity for the railroad industry.

Based on my review of Morningstar / Ibbotson MSDCF as applied by the Board, the submission of the WCTL, Professor Hodder and Mr. Fapp as well as literature, analyses and my professional experience, I conclude as follows:

- Estimating the cost of capital is difficult. The cost of capital represents the *expected* return that a rational investor would require to make her indifferent between investments that are expected to have equivalent risk profiles. But clearly, it is impossible to ever "know" these expectations of rational investors. The best one can do is to estimate the parameters relating to the cost of capital using the techniques of modern finance.

- All financial techniques used to estimate the cost of equity are inherently imprecise. The results vary from year to year and are sensitive to assumptions that are just that, assumptions.

- It is important to use more than one model to estimate the cost of equity and two commonly used methods for regulatory purposes are the Capital Asset Pricing Model (CAPM) and a Discounted Cash Flow (DCF) model.

- The CAPM and MSDCF models take different paths towards estimating the cost of equity. Combining the models improves the estimation.

- It is the combined return on equity estimate—rather than the results from any one model—that matters for the purpose of assessing the cost of equity for the railroad industry. Therefore, the results from the MSDCF cannot and should not be viewed in isolation.

- The criticisms of the WCTL and its experts are selectively one-sided and fail to consider that elements of the model are interlinked. For example,

    - If the growth rates should transition smoothly from company specific to GDP growth in stage 2, then the free cash flow available for shareholders should also transition smoothly to the steady state income (before extraordinary items) during stage 2.

    - If growth rates are to be adjusted to account for decreasing share balances caused by share buybacks, then it is necessary to account for the cash distributed directly via buybacks when calculating free cash flows available for shareholders.

- Modifications of the Morningstar / Ibbotson MSDCF model as applied by the Board to take the criticisms by the WCTL and its experts into account would have *de minimus* impact on the estimated cost of equity.

- The submissions have not presented evidence that sole reliance on the CAPM would result in more accurate or reliable results.

II. Best Practice Is to Use Multiple Methods

A. WHY USING MULTIPLE MODELS IS PREFERABLE

Estimating the cost of capital is difficult. Fundamentally, the cost of capital represents an opportunity cost for investors;[1] by undertaking one particular investment, the investor foregoes the return she might earn on some other investment of equivalent risk. At the time of the investment, however, the returns (and risks) of such foregone opportunities are unknown. The cost of capital therefore represents the *expected* return that a rational investor would require to make her indifferent between investments that are *expected* to have equivalent risk profiles. To precisely measure the cost of capital thus requires precise knowledge of market expectations for risk and return across the universe of tradable risky assets. But clearly, it is impossible to ever "know" these expectations. Even after the fact, realized returns and risk measurements are only point observations from the distribution of outcomes that were possible at the time of the investment. The best one can do is to *estimate* the parameters relating to the cost of capital using the techniques of modern finance.

Financial scholars and practitioners rely on a variety of models to make these estimates. For example, the Capital Asset Pricing Model (CAPM) relies on historical measurements of the risk and returns of assets in the market to forecast the likely future risk-return relationship governing the cost of capital. In contrast, Discounted Cash Flow (DCF) models use prevailing forecasts of cash flows (or earnings) to infer the expected return consistent with current market prices. All models have their advantages and disadvantages, and there is no consensus among academics or practitioners about

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[1] See, for example, Richard A. Brealey, Stewart C. Myers, and Franklin Allen, *Principles of Corporate Finance*, 10th Edition, 2013.

which models are "best." For this reason, best practices use multiple models so as to glean useful information from each one based on its relative strengths.

In January 2009, the Board endorsed using a combination of the Capital Asset Pricing Model (CAPM) and Morningstar / Ibbotson Multi-stage Discounted Cash Flow (MSDCF) model (as applied by the Board) to determine the railroad industry's cost of capital.[2] This was an important step as the Board previously had relied on only one method to estimate the cost of capital for the railroad industry.[3] As my colleague, Stewart C. Myers, Robert C. Merton Professor of Finance of MIT, has so concisely and eloquently stated:

> Use more than one model when you can. Because estimating the opportunity cost of capital is difficult, only a fool throws away useful information.[4]

And when commenting on the sole use of the CAPM, Professor Myers noted:

> Analysts and decision makers should consider estimates from other [non-CAPM] models or sources whenever the estimates are informative.[5]

As I have discussed in other reports, I wholeheartedly agree that it is important to use the information available, and that means using more than one model when possible.[6]

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2 Surface Transportation Board, *STB Ex Parte No. 664 (Sub-No. 1)*, decided January 23, 2009 (STB 2009 Decision).

3 From 1981 – 2005 the Board relied on a single-stage DCF model and for 2006-07, the Board relied on the CAPM. Source: Surface Transportation Board, *STB Ex. Parte No. 664*, decided January 17, 2008 (STB 2008 Decision) pp. 3-4 and p. 7.

4 Stewart C. Myers, "On the Use of Modern Portfolio Theory in Public Utility Rate Cases: Comment," *Financial Management*, Autumn 1978, p. 67.

5 Stewart C. Myers, "Estimating the Cost of Equity: Introduction and Overview," submitted to the *Australian Energy Regulator* on behalf of the Australian Pipeline Industry Association, February 2013 (Myers AER Report) p. 12.

Academic scholars, practitioners and regulators tend to agree that the use of multiple methods is important. For example, professors Berk and DeMarzo of Stanford and Harvard Universities, respectively, in their corporate finance textbook comment on the use of the CAPM, DCF and other models by practitioners as follows:

> It is not difficult to see why there is so little consensus in practice about which technique to use. All the techniques we covered are imprecise. Financial economics has not yet reached the point where we can provide a theory of expected returns that gives a precise estimate of the cost of capital. Consider, too, that all techniques are not equally simple to implement. Because the tradeoff between simplicity and precision varies across sectors, practitioners apply the techniques that best suit their particular circumstances.[7]

The text of Bingham & Houston, *Fundamentals of Financial Management* notes that when the authors work as consultants they generally use several methods including the CAPM and a discounted cash flow model to assess the cost of equity.[8]

Similarly, Roger A. Morin, in the context of U.S. regulation, mentions the use of the CAPM, DCF and other models, concluding:

> No one individual method provides the necessary level of precision for determining a fair return, but each method provides useful evidence to facilitate the exercise of an informed judgment. Reliance on any single method or preset formula is inappropriate when dealing with investor

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Continued from previous page

6 See, for example, Bente Villadsen et al., "Estimating the Cost of Equity for Regulated Companies," submitted to *the Australian Energy Regulator* on behalf of the Australian Pipeline Industry Association, February 2013 (Villadsen et al. AER Report).

7 Jonathan Berk and Peter DeMarzo, *Corporate Finance: The Core*, 3th edition, 2014, (Berk & DeMarzo 2014) p. 466.

8 Eugene F. Bingham and Joel F. Houston, *Fundamentals of Financial Management*, 12th edition, 2009, p. 317.

> expectations because of possible measurement difficulties and vagaries in individual companies' market data.[9]

Looking at the Board's last review of its cost of capital estimation methodology in STB Ex Parte 664 and STB Ex Parte 664 (Sub No. 1), the Board noted:

> While CAPM is a widely accepted tool for estimating the cost of equity, it has certain strengths and weaknesses, and it may be complemented by a DCF model. In theory, both approaches seek to estimate the true cost of equity for a firm, and if applied correctly should produce the same expected result. The two approaches simply take different paths towards the same objective. **Therefore, by taking an average of the results from the two approaches, we might be able to obtain a more reliable, less volatile, and ultimately superior estimate than by relying on either model standing alone**.[10]

In arriving at this conclusion, the Board took notice of comments from the Federal Reserve that "multiple models will improve estimation techniques when each model provides new information,"[11] and also stated that there is "robust economic literature confirming that, in many cases, combining forecasts from different models is more accurate than relying on a single model."[12]

As clearly illustrated above, many academics, practitioners and regulators find it preferable to use more than one estimation method to determine the cost of equity. I agree that it is important to use more than one estimation method and stress that models such as the CAPM and the multi-stage DCF models use different kinds of information. While the CAPM relies on historical information to determine the risk

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9 Roger A. Morin, *New Regulatory Finance*, Public Utilities Reports, Inc., 2006, (Morin 2006) p. 428.

10 STB 2009 Decision, p. 3 (emphasis added).

11 STB 2009 Decision, p. 15.

12 STB 2009 Decision, p. 15. See also, David F. Hendry & Michael P. Clements, "Pooling of Forecasts," VII *Econometrics Journal* 7, 2004, pp. 1-31.

factor, beta (β), of the industry, the multi-stage DCF model uses forward looking growth estimates (and contemporaneous cash flow and price information) to infer the market's expected return for the industry. Thus, the two models attempt to estimate the same figure, but use different information to do so. The Board clearly recognized this in its 2009 decision regarding the use of both models. In Appendix A, I identify a number of other regulators who follow the Board's reasoned approach and use more than a single model to estimate the cost of equity.

In short, the combined use of the CAPM and a MSDCF model is preferable to relying on only the CAPM (or only the MSDCF).

III. WCTL's Criticisms of the Morningstar / Ibbotson MSDCF Model Do Not Warrant Abandoning This Well-Known, Forward-Looking Model.

A. WCTL Does Not Challenge The Validity Of Multi-Stage DCF Models In General – Just As Applied By Morningstar / Ibbotson

Neither Fapp nor Hodder inherently critique the use of a multi-stage DCF model, but rather focus their criticisms on the assumptions in the Morningstar / Ibbotson MSDCF model as applied by the Board. In his conclusions regarding the Board's MSDCF model, Hodder states:

> These problems are not inherent characteristics of MSDCF models generally, but rather results of particular assumptions made by Morningstar/Ibbotson in implementing their version of the more general model.[13]

[13] Hodder, p. 11.

First, no model corresponds exactly to the real world; all models are simplified approximations of reality, and each relies on a set of assumptions to draw useful conclusions about complex or otherwise unknowable phenomena. Cost of capital models are no exception—their assumptions are necessary simplifications used to infer information about market expectations of risk and returns. Thus, it is inappropriate to nit-pick specific assumptions, or favor particular assumptions that might lead to a specific outcome in the current environment. It is the totality of the models and their key assumptions that should properly be evaluated. For example, it is possible that one assumption in the current environment has a slight upward bias while another assumption has a slight downward bias, so that the offsetting biases lead to an accurate overall result. It is also plausible that these same assumptions may bias the results in a different direction in the near future. Thus, to evaluate the appropriateness of the cost of equity for the railroad industry, it is not sufficient to look to one model or a selected set of assumptions. Rather the results of both models and their underlying assumptions need to be examined.[14]

Second, the WCTL references the Board's view that the use of multiple methods may stabilize the cost of equity and argues that ex post the year-to-year variability in the combined cost of equity estimate is higher than the year-to-year variability in the CAPM. This argument is misguided because the CAPM estimates, which are based on five years of historical information, by definition will change relatively little from year to year. The WCTL does not cite other reasons for using both methods provided by the Board such as the inherent uncertainty in any estimation method and that the models

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[14] See, for example, Berk & DeMarzo (2014), p. 466. See also Villadsen et al. AER Report, pp. 51-54.

may provide different information.[15] The Board's view that the two models provide somewhat different information about the railroad industry's cost of equity is important and consistent with the literature and with my own experience. Therefore, the WCTL's focus on only one aspect of the reasons for using two models is misguided. There are, as stated by the Board, multiple reasons why more models may improve the estimation of cost of equity.

Third, the two models have different strengths and weaknesses. I focus on the MSDCF model's strengths and weaknesses next.

B. STRENGTHS AND WEAKNESSES OF THE MORNINGSTAR / IBBOTSON MSDCF MODEL

Like all models, the Morningstar / Ibbotson MSDCF has strengths and weaknesses, which I discuss below. Unless specified otherwise, my discussion pertains to the MSDCF as applied by the Board.

1. Strengths of the model.

A significant strength of the Morningstar / Ibbotson MSDCF is that it is a forward looking model that relies on the expected growth or development in the railroad industry. This is an important aspect of the model because the railroad industry currently is undertaking large capital projects, which will impact railroads and their various constituencies for a long time. In contrast, the CAPM is a backward looking model, so the information conveyed is more likely to reflect the railroad industry as it was in the past rather than as it will be in the future. Second, like most DCF models, the MSDCF uses company-specific growth rates in stage 1 and long-term

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[15] STB 2009 Decision, p. 15.

GDP growth in stage 3. This common feature of the model is a substantial improvement over, for example, single-stage models which assume the growth rate never changes.

Looking to some of the unique features of the Morningstar / Ibbotson model, it is a well-known commercial model that can be used by practitioners to assess the cost of capital for a variety of purposes.[16]

The model relies on free cash flow available for shareholders in stages one and two and on earnings before extraordinary items in stage 3.[17] Because cash ultimately is what accrues to shareholders and what they care about, it is a key valuation metric. This is consistent with the Board's announcement in 2008 that a "broader measure of cash flow or shareholder returns should be incorporated" in a MSDCF.[18]

The main criticisms of the Morningstar / Ibbotson MSDCF model appear to be that (i) the model lacks a smooth transition in growth rates in stage 2; the related criticism that there is a disconnect between cash flows in years 10 and 11 (end of stage 2 and beginning of stage 3, respectively); and (ii) that the buyback of shares implies a potential inconsistency with the growth rates relied upon.[19]

2. Smooth transition to Stage 3

Like most multi-stage DCF models, the Morningstar / Ibbotson MSDCF relies on company-specific growth rates for stage 1 and economy-wide growth in stage 3,

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16 See, for example, STB 2009 Decision p. 4.

17 The merits of this specification were discussed in STB 2009 Decision, pp. 11-12.

18 Surface Transportation Board Notice, "Use of a Multi-Stage Discounted Cash Flow Model in Determining the Railroad Industry's Cost of Capital," *Federal Register* / Vol. 73, No. 158, August 14, 2008, 47643.

19 STB 2009 Decision, pp. 8-9 addresses the stage 2 growth rate, pp.12 addresses the use of earnings used in year 11 and pp.11-12 addresses the share buyback issue.

because in the very long-term growth is expected to normalize to that of the economy, representing a kind of steady state for the companies in question. The rationale for this expectation is that no industry can outpace forever the entire economy or eventually it will swallow the entire GDP. The horizon to stage 3 is not universally agreed upon, however.

Similarly, the model imposes assumptions about the level of capital expenditures the industry will make in the long term. In particular, in the first two stages, the Morningstar / Ibbotson MSDCF determines free cash flow available to equity investors as earnings before extraordinary items, minus capital expenditures in excess of depreciation, plus deferred taxes. However, in steady-state, this assumption changes. In stage 3, the model assumes that capital expenditures will consist just of maintenance capital (no growth capital), so that capital expenditures and depreciation are equal. Further, because deferred taxes are linked to capital expenditures, this amount is expected to disappear as capital expenditures approach maintenance levels in the long term steady-state equilibrium.[20] Therefore, the adjustment to earnings before taxes (depreciation minus capital expenditures plus deferred taxes) will approach zero in the long term. While the Morningstar / Ibbotson MSDCF uses accounting depreciation and capital expenditure, an economic equilibrium would depend on the *economic* depreciation being equal to capital expenditure.

Again, the rationale is that if a company continued to invest in growth capital in excess of economic depreciation, it would expand its share of the economy during the period that the model assumes is the steady state. Therefore, the STB MSDCF implicitly

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[20] Thus, the cash and accrual tax amounts are assumed to be the same.

assumes stage 3 is a steady-state for *both* growth and the impact of (net) investment on cash flow generation.

These are perfectly reasonable assumptions for the long-term.[21] But if practitioners elect to smooth the transition between the first and final stages, they must do so in a consistent manner for the entire model. That is, they must smooth *both* the growth rates *and* the transition to maintenance capital expenditures. Simply put, as growth approaches the steady-state and capital expenditures approaches maintenance levels, the equity cash flows not used for capital expenditures will be available for shareholders. At the same time the deferred taxes will disappear, as they are linked to capital expenditures, and therefore will no longer represent a source of cash flow available to shareholders.[22]

Therefore, the criticism about the lack of a smooth transition from stage 2 growth to stage 3 growth cannot be considered separately from the issue of the transition from

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[21] Two important observations are worth making, however. First, the steady-state of the railroad industry is reached when true economic depreciation, the decline in the *market* value of rail assets attributable to their usage in that year, equals capital expenditures. In the steady-state, the assumption is that economic depreciation and capital expenditures will converge. This is the reason for moving towards a state where there is no net growth in capital. The model relies on an accounting measure of depreciation. It is likely that an observed spread between accounting depreciation and capital expenditures will extend far into the steady-state, because accounting depreciation is based on book values rather than current costs. Second, the use of accounting depreciation—if less than the true economic depreciation of assets—will bias the MSDCF downwards as it is additive in Stages 1 and 2 (while capital expenditures are subtracted). In other words, if the Board MSDCF is understating the current economic depreciation of rail assets, then the Morningstar / Ibbotson MSDCF model will understate the true cost of equity for the railroad industry.

[22] In practice, the timing of the disappearance of the deferred tax may not coincide exactly with the capital expenditures converging to maintenance capital, but may persist for a few years longer than the high capital expenditures. Therefore, ignoring this timing effect is likely to be conservative.

the growth levels of capital expenditures in stages 1 and 2 to maintenance levels of capital expenditures in stage 3. As growth slows over time and capital expenditures become focused primarily on maintenance (i.e., comparable to economic depreciation), the portion of earnings that is available as cash flow to shareholders will increase. Specifically, once the capital expenditures, which are deducted from the cash flow in stages 1 and 2, taper off, the free cash logically would increase. Therefore, if the higher early growth rates driven by high net investment (i.e., capital expenditures in excess of economic depreciation) taper off, the free cash flow available to shareholders increases as capital expenditures are reduced. As a result, a tapering of the growth rates in stage 2 would logically be combined with a transition from the reliance on free cash flow available to shareholders as determined initially to a more stable long-term cash flow (or income) measure. In other words, if the growth rates were to taper off linearly during stage 2, then it would also be reasonable to linearly transition the cash flow measure towards a long-term one such as earnings before extraordinary items over stage 2. The effect of these two changes would be somewhat offsetting. I discuss this issue further in Section IV below.

3. Growth forecasts in the presence of share repurchases

There is similarly no basis to reject the Morningstar / Ibbotson model based on its use of stage 1 growth rates derived from EPS forecasts. WCTL claims this biases the results upward when a company or industry undertakes large share buybacks. But WCTL considers only the potential effect on growth rates and not the effect of cash flows available to shareholders. As shown below, when considering the effect of share buybacks on expected cash flows available to shareholders, the overall bias of ignoring share buybacks is likely downwards, not upwards as suggested by WCTL.

When a company buys back shares at its current stock price, it distributes cash to shareholders who sell their shares; thus cash to shareholders is pulled forward in time. Rational investors would incorporate expectations around share buybacks when considering the purchase of a firm's equity. Thus, leaving out the cash distributed directly via buybacks ignores a source of expected return to shareholders. This biases the cost of equity estimates downward. As I will demonstrate, in the case of the railroad industry, this downward bias likely outweighs any upward bias caused by the application of an EPS-based growth rates.

Because Earnings per Share (EPS) are calculated as earnings divided by the number of shares outstanding, the EPS measure will increase as the number of shares declines. The criticism cited in (iii) above looks only to the impact of stock repurchases on EPS (via the lower number of shares in the denominator) and not to the additional cash flow that is distributed at the time of the buyback. In addition, as noted by Hodder (p. 8), it is not clear how analysts take share buybacks into account when forecasting EPS. However, the real question is not whether analysts forecast the EPS accurately, but whether there is a systematic upward bias in the forecasted cash flow available to shareholders. Specifically, if there is an upward bias in EPS growth rates, is such a bias outweighed by the downward bias in the measure of cash flow available to shareholders? The following table provides illustrative data.

Table 1: Illustration of the Interaction of Share Buybacks and Growth Rates

	EPS_0	EPS_1	Implied Growth	# Shares, t=0	# Shares, t=1	Year 0 Cash Flow	Estimated Year 1 Cash	Actual Year 1 Cash	Stock Price	Buyback Cash	Total Cash to Shareholders
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
Facts	$1.00	$1.12	n/a	100	98	$100	n/a	$110	$5	$10	$120
Analyst 1	$1.00	$1.10	10%	100	98	$100	$110	$110	$5	$10	$120
Analyst 2	$1.00	$1.12	12%	100	98	$100	$112	$110	$5	$10	$120

In Table 1 above, the first "Facts" row represents the actual circumstances, while rows 2 and 3 represent two different analysts' forecasts. Column [1] represents the actual EPS in year 0, while Column [2] shows the actual (Facts row) or analyst forecasted (rows Analyst 1 and Analyst 2) EPS in year 1. Column [3] calculates the implicit growth rate from the forecasted EPS, columns [4] and [5] provide the number of shares outstanding in years 0 and 1 respectively, column [6] shows the year 0 cash flow, columns [7] and [8] show the forecasted and actual free cash flow available to shareholders, column [9] assumes the stock price is 5, so that the price-to-earnings ratio is 5. Finally, columns [10] and [11] show the amount of cash distributed due to share buybacks and the total cash that accrued to shareholders (free equity cash flow plus share buybacks).

The Morningstar / Ibbotson MSDCF determines the free cash flow as illustrated in column [7] and ignores the total cash flow available for shareholders in [11]. Therefore, while the estimated cash flow in year 1 (e.g. Analyst 2, column [7]) may be overstated, the total cash flow that accrued to shareholders (column [11]) is actually understated by the column [7] estimate in year 1. This will be the case provided the price is larger than the forecasted EPS in year 1. As the price-to-earnings ratio for the railroad industry is well above one, the near-term effect of the cash distribution from share buybacks outweighs any impact from the reliance on EPS growth. The cash distributed to shareholders is larger than the forecasted free cash flow to shareholders.[23] This effect is compounded over multiple years in the MSDCF model, where the errors illustrated above for a single year are compounded as buyback are recurring. But the same principle applies in any one year: if the price-to-earnings ratio is consistently greater than 1, any overestimation of cash flows caused by ignoring the effect on

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[23] The price-earnings ratio for the four railroads whose data is used by the Board in making its annual cost of capital determination currently ranges from 15.8 to 22.6, according to *Value Line Investment Survey*, May 30, 2014.

growth rates from a drop in shares outstanding will be more than cancelled out by an underestimation caused by ignoring the value of the cash directly distributed via the share repurchase. According to my modeling of the railroad industry, the cumulative effect of these two corrections stages of the MSDCF model is in an upward movement in the estimated cost of equity. I illustrate this in Section V below.

The MSDCF model estimates the cost of equity from the stock price and the cash flow that accrues to shareholders over time. The basic idea is that if you discount the total cash flow that is expected to accrue to shareholders by the cost of equity, the amount should equal the stock price. The stock price is public knowledge, but the expected cash flow has to be estimated and the larger the expected cash flow is, the higher the cost of equity has to be for the discounted cash flow to equal the stock price. Because the expected cash flow is discounted, cash flow that occurs early contributes more to the current stock price than cash flow that occurs later. This is important because the cash that accrues to shareholders from share buybacks occurs immediately rather than later and therefore makes a substantial contribution to the stock price and hence the cost of equity (i.e., cash flow to shareholders is pulled forward in time). The MSDCF model does not capture the impact of share buybacks. Instead, it assumes the cash flow that shareholders are looking at to set the stock price is column [7] in Table 1: free equity cash flow. If the model uses the actual stock price (which will reflect the anticipated higher returns in the near term from stock repurchases) and forecasts free cash flow, it will understate the true expected return to shareholders (shown in column [11]) and the model will estimate a discount rate (the cost of equity) that is too low.

In sum, it is necessary to consider not only the impact on the growth rate of the share buybacks but also on the cash distributed to shareholders through the buyback. These two factors bias the results in opposite directions and are therefore potentially

offsetting—the overall impact depends not only on the magnitude of the share buybacks but also on the price-to-earnings ratio of the company that buys back shares.

4. Other specific criticisms raised by WCTL

The other criticisms leveled at the Morningstar model are minor and cannot justify a rash decision to throw away the useful information provided by a MSDCF model. Professor Hodder notes that there are relatively few analysts' forecasts and that some of the forecasts are dated.[24] One example he points to is that one forecast used for 2012 was made in 2008, meaning that it was four years old. In reviewing the impact of this, however, it is important to keep in mind that the company in question has a weight of only 20% in the MSDCF model and the MSDCF accounts for only half of the overall cost of capital, so that the MSDCF estimate for the company in question carries a weight of only about 10%. Further, the MSDCF model relies on the median analyst forecast so that extreme forecasts are not considered. It is also important to keep in mind that the capital markets data relied upon in the Board's CAPM uses five years of historical data,[25] so certainly CAPM data are more "dated" than are the growth rates in the MSDCF model. As for the number of analysts, even if there are only a few, they provide additional information as sought by the Board in its decision to use the MSDCF. Therefore, this is not a reason to abandon the method.

Also, according to Professor Hodder, the growth rates for one company varied from 4.6% to 15% in 2012. Looking at the actual data for 2012,[26] it appears that Hodder focused on the only company for which the variation is that large and again, it is a company with a relatively small weight in the overall calculation. For example, the

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[24] Hodder p. 9-10.
[25] STB 2008 Decision, p. 10.
[26] STB Docket No. EP558 (Sub-No. 16) Appendix L, p. 2

largest company used in Board's estimates (whose capitalization is above 50% of the sample) has relied upon growth rates that vary from a low of 15.0% to a high of 16.0%.[27] Further, as the Board is focused on the median forecast, the very low or very high figures for any one company are ignored. Therefore, the variability in growth rates is not a reason to abandon the MSDCF as (i) it only pertains to the growth rates of one company that has a weight of about 10% in the overall ROE and (ii) the Board uses the median, so that extreme observations are ignored (in the examples cited by Hodder, both the low and high figures are ignored).

Lastly, Hodder states that "there is also an issue with how the Morningstar / Ibbotson approach estimates the long-run growth rate for the U.S. economy that is used in stage 3 of the MSDCF estimates."[28] Specifically, Hodder argues that the reliance on the historical real GDP growth plus the current inflation forecast is too optimistic. In support of his argument, Hodder cites several GDP forecasts from various sources that all are substantially lower than the Morningstar / Ibbotson forecasted GDP growth. However, Hodder does not provide information from other sources such as Blue Chip Economic Indicators,[29] which rely on analysts' forecast and predict a higher GDP growth than the sources cited by Hodder.

Witness Fapp points to the estimated Cost of Equity (CoE) being higher than that published by two specific sources: Standard & Poor's (S&P) and MarketGrader. There are several flaws in this critique. First, Mr. Fapp provides no context for either S&P's or

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27 *Ibid,* p. 4.

28 Hodder p. 10.

29 *Blue Chip Economic Indicators: Top Analysts' forecasts of the U.S. Economic Outlook for the Year Ahead,* vol. 39, March 10, 2014. The monthly publication contains consensus forecast on growth rates, Treasury bond yields, etc. and its March and October issues contain long-term forecasts. It is one of the most commonly cited sources for long-term consensus forecasts.

MarketGrader's figures, which are not useful without additional information. Second, Fapp compares the cost of equity from MarketGrader / S&P to the MSDCF figures and not to the STB's cost of equity figures, which are of course based upon both the MSDCF and CAPM—not just the former. Third, Fapp relies on two sources for his discussion, but clearly there are many other analysts who cover the railroad industry.

In summary, none of the criticisms are reasons to abandon the inclusion of a multi-stage DCF model in the determination of the railroad industry's cost of equity capital.

C. STRENGTHS AND WEAKNESSES OF THE CAPM

All models have strengths and weaknesses, which is a key reason to use more than one model. The Villadsen et al. AER report discussed the relative strengths and weaknesses of the CAPM and multi-stage DCF models at length.[30] The following draws upon that discussion.

Among the strengths for both the MSDCF and the CAPM is the fact that the models are transparent and well-documented. In addition, the CAPM is theoretically sound and widely used by both researchers and practitioners. In addition, data are usually available for its estimation.

A characteristic of the CAPM is that it is backward looking. In the Board's application, the CAPM relies on five years of historical data to estimate beta and market data from 1926 to the present to estimate the market risk premium.[31] The backward

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[30] Villadsen et al. AER Report, Chapter III.

[31] STB 2008 Decision p. 9.

looking nature of the CAPM means that it may not capture contemporaneous changes in the market, an industry, or a company.

The CAPM is sensitive to changes in the risk-free rate, which is determined as of the estimation date. Because the risk-free rate enters the CAPM linearly, the impact of a change in the risk-free rate is one-for-one. Further, changes in the risk-free rate may reflect monetary policy rather than changes in the cost of capital for private corporations, so that in times of substantial financial uncertainty, the model may lead to biased results.

The WCTL and its experts fail to even acknowledge a potential downward bias in the CAPM that may be substantial as the 20-year Treasury yield dropped by almost 200 basis points following the financial crisis,[32] which caused the CAPM, everything else equal, to fall by the same amount.

IV. It Is the Combined ROE that Matters

It is important for the Board not to lose perspective in this proceeding. Financial economists can dazzle the Board with an array of ever increasingly complicated techniques to estimate the cost of equity for the railroad industry. And we can debate whether the strengths and weaknesses of the CAPM are greater or lesser than the strengths and weaknesses of a MSDCF model. In the end, I emphasize that the relevant question is not whether the cost of equity for the railroad industry as derived from MSDCF is appropriate, but if the combined CAPM **and** MSDCF estimate adopted by the

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[32] Bloomberg data indicates that the average yield on 20-year Treasury bonds was approximately 4.9% in 2007 (prior to the financial crisis), approximately 4.4% in 2008 and then had dropped to approximately 2.5% in 2012.

Board is appropriate. A unilateral discussion of the potential flaws in MSDCF fails to consider that the CAPM may have been downward biased in recent years due to unique market conditions. As explained recently by Professor Myers,

> Costs of equity derived from multi-stage dividend discount models are particularly useful now. With extremely low current interest rates, routine applications of the CAPM, which use "normal" equity risk premiums, can now yield cost of equity estimates that seem unreasonably low.[33]

In particular, the financial crisis that occurred in 2008 caused Treasury bond yields to decrease substantially and the spread between corporate and Treasury bond yields to widen. Because (i) at least part of the drop in Treasury bond yields was caused by monetary policy rather than market fundamentals and (ii) the yield spread widened, the large drop in Treasury bond yields was not a reflection of a comparable drop in the railroads' (or other corporate entities) cost of capital. Therefore, the cost of equity as estimated by the CAPM has been downward biased during the 2008-12 period considered by WCTL and its experts. This issue was not even acknowledged, let alone addressed in the filings by the WCTL and its experts.

I illustrate the potential severity of the bias in CAPM in these unusual fiscal times in Figure 1 below, which shows the yield spread between corporate composite bond indices of approximately 20-year maturity and 20-year Treasury bonds (used in the Board's CAPM model). As is evident from the figure, both the corporate A and BBB yield increased dramatically relative to the yield on Treasury bonds during the financial crisis of 2008-09 and remains higher than before the financial crisis during the 2008-12 period considered by Fapp and Hodder. The increased yield spread is an indication that the cost of capital for corporations has dropped by less than the drop in the risk-free

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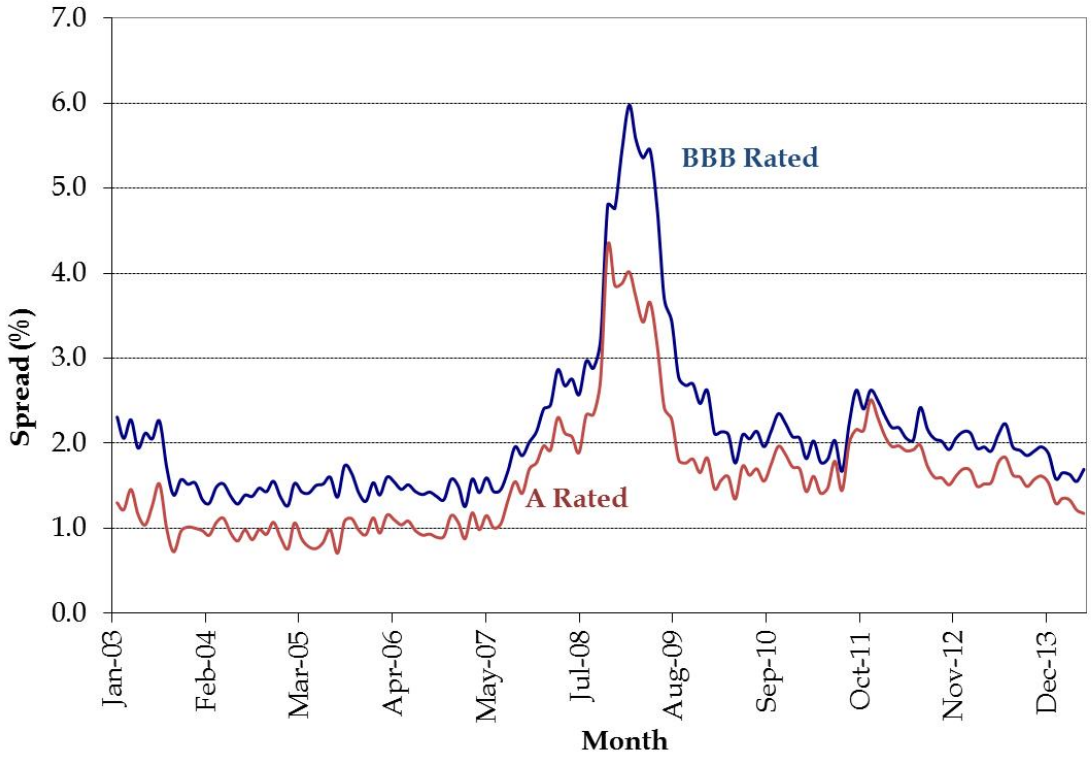
[33] Myers AER Report p. 8.

rate. Therefore, the CAPM, which increases and decreases one-for-one with the risk-free rate, has understated the cost of equity capital during and post the financial crisis. As a result, the difference between the CAPM and MSDCF cost of equity estimates for 2008-12 reflects a downward bias in the CAPM's estimates.

Figure 1: Yield Spread between Corporate Bond Indices (BBB and A-rated) and Treasury Bonds



Source: Spreads calculated from Bloomberg's yield data.

During the height of the financial crisis in 2008-09, the spread between the yield on corporate bonds and government bonds widened dramatically as indicated in Figure 1 above.

Because the CAPM relies directly on the risk-free rate, a 1% increase / decrease in the risk-free rate leads to a 1% increase / decrease in the estimated cost of equity, so that a downward bias in the risk free rate will substantially impact the estimated cost of

equity. Because the yield spread increased after the 2008 financial crisis, reliance on the contemporaneous yield on the 20-year Treasury bond leads to a downward bias in the cost of equity estimated by the CAPM.

As shown in Table 2 below, the spread averaged above 2.6% in 2008-09, while the average from 1991 to 2007 was only a little over 1%. From 2010 onward the spread narrowed, but it has remained above the historical level.

Table 2: Spread between A-Rated Corporate Bonds and 20-Year Treasury Bonds

Period	A-Rated Corporate over Treasury (%)	Increase in spread compared to Jan 2003 - Dec 2007 (%)
Jan 2003 - Dec 2007	1.06	-
Jan 2008 - Dec 2008	2.65	1.59
Jan 2009 - Dec 2009	2.63	1.57
Jan 2010 - Dec 2010	1.66	0.60
Jan 2011 - Dec 2011	1.83	0.78
Jan 2012 - Dec 2012	1.80	0.74
Jan 2013 - Dec 2013	1.61	0.55

Source: Bloomberg

Because financial distress may increase the probability of default, I rely only on the A-rated corporate bonds for this purpose and note that the default risk of A-rated corporate bonds increased modestly between 2007 and 2008-09 and went back down to being measured at zero for 2010-13.[34] Therefore, only a small fraction of the increase in yield spread is explained by default risk. Because default risk increased more in 2008-09, I conservatively assign approximately 0.4% of the increase in spread to default risk

[34] Standard & Poor's, "2013 Annual Global Corporate Default Study and Rating Transitions," March 2014 reports that the default risk for A-rated corporate bonds was 0.38% in 2008, 0.22% in 2009, and zero during 2010-2013.

for 2008-09 and 0.2% for 2010-2013.[35] As a result, the downward bias in the CAPM due to downward pressure on the Treasury bond yield is above 1.1% for 2008-09, at least 0.3% for 2010, at least 0.50% for 2011-2012 and about 0.3% for 2013 for an average of about 0.63%.

In its 2009 decision to use a combination of the CAPM and MSDCF model, the Board explicitly acknowledged that each estimation approach simply approached the problem of determining the cost of equity differently.[36] I agree with the Board. The CAPM and a multi-stage DCF models both aim to determine the cost of equity as accurately as possible using different approaches.

V. If the Board Were To Correct Key Criticisms of the MSDCF Model Raised by the WCTL, the Impact Would Be Small.

Given the valuable information provided by a MSDCF, it would be foolish to throw away all that forward-looking information and rely exclusively on a backwards-looking CAPM, with its own limitations and deficiencies, as suggested by WCTL.[37] However, if the Board were inclined to tinker with its MSDCF, it cannot just look at the assumptions selectively highlighted by WTCL. It must explore all key assumptions in that model.

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[35] Technically, the default rate of 0.38% in 2008 would increase the yield by approximately 0.381% if there were no recovery post default and by less if there were any expected recovery. Therefore, assigning 0.40% of the increase in yield spread to default risk is conservative.

[36] STB 2008, p. 2.

[37] WCTL Petition in EP 664 (Sub-No. 2) p. 1.

To illustrate how this might be done (and to show the *de minimus* nature of the criticisms leveled at the Morningstar / Ibbotson model), I made three changes to the MSCDF model and report the results below, the first two changes address criticisms presented by WCTL and a third change to tailor the length of stages of the MSDCF model to the railroad industry.

First, I address the related criticisms that (i) growth rates in stage 2 do not permit a smooth transition from stage 1 to stage 3 and (ii) cash flow jumps from the end of stage 2 to the beginning of stage 3.[38] The reason for the jump in cash flow is, as explained above, that stages 1 and 2 use free equity cash flow while stage 3 relies on earnings (before extraordinary items) as a steady state measure. I determined the impact of addressing WCTL's criticisms by implementing the following changes to the MSDCF:

a. A linear tapering of the growth rate in stage 2, so that the growth rates moves 1/6 towards the GDP growth rate in each year of stage 2, so that it lands at the GDP growth rate in year 1 of stage 3.
b. A linear smoothing of the transition from reliance on the free cash flow available to shareholders as measured by subtracting capital expenditures in excess of depreciation and deferred taxes from income (before extraordinary items) to simply income before extraordinary items. Specifically, the test assumes that the difference between free cash flows measured in stages 1 and 2 and earnings before extraordinary items, depreciation plus deferred taxes minus capital expenditures (D+DT-CapEx) are eliminated linearly over the stage 2 years. I.e., once stage 3 is reached the (D+DT-CapEx) term has been reduced to zero. Further, I normalized the (D+DT-CapEx) term in the same manner as the Morningstar / Ibbotson model does the free cash flow. Specifically, the average depreciation, deferred tax and capital expenditure is determined using the five years leading up to the year being analyzed, and the total is divided by total sales, which determines the 5-year ratio of (D+DT-CapEx) to Sales. The ratio is

[38] See, Hodder p. 8.

then multiplied by the total sales for the year to determine the average (D+DT-CapEx) for the year. This is done to be consistent with the calculation in the MSDCF model as implemented by the Board.

I refer to the modified model as the 1st Modified MSDCF. It is important to understand that any tapering of the growth rate in stage 2 and a gradual movement towards a steady state where capital expenditures are maintenance only are linked—it would not be appropriate to consider only one smoothing effect without the other. Using the data relied upon by the Board for the years 2008 to 2012, as well as the data submitted for 2013 to determine the 1st Modified MSDCF estimates, the results from the modified model are shown along with the original results in Table 3 below.

Table 3: Comparison of Cost of Equity Estimates from STB MSDCF and 1st Modified MSDCF

	STB MSDCF	1st MODIFIED MSDCF
2008	15.95%	15.16%
2009	13.34%	12.47%
2010	14.13%	13.60%
2011	15.83%	14.96%
2012	16.53%	15.77%
2013	13.40%	12.72%
Average	**14.9%**	**14.1%**

In interpreting the results, it is important to recognize that Table 3 above only addresses one aspect of the criticism against the MSDCF and that the MSDCF is only half of the estimated cost of equity. It is therefore important not to view the results in Table 3 as final, but rather as a step along the way in addressing the WCTL criticism.

Table 3 shows that tapering the growth rates during stage 2 and making a linear transition from the estimate of free equity cash flow to earnings before extraordinary items—such that the jump between year 10 and year 11 cash flows disappears—results in a decrease in the cost of equity estimates from the multi-stage DCF model of on average 0.8%, so that the net impact on the cost of equity from assigning equal weight to the CAPM and the multi-stage DCF would be 0.4% on average. However, as noted above, this is only one step in the analysis of the assumptions in the Morningstar / Ibbotson MSDCF.

Second, I have explored how to model the presence of stock repurchases. As described above, the failure to consider how this practice adjusts the pattern of returns to stockholders is likely biasing the results downwards. To adjust for the fact that growth rates are based on forecasts of earnings per share, I multiplied each year's modeled cash flows by the ratio of the average shares outstanding in that year vs. the prior year. In other words,

$$Cash_t^{adjusted} = Cash_{t-1} * (1 + g) * \left(\frac{shares_t}{shares_{t-1}}\right)$$

In the first stage of the model, I perform this adjustment on the total cash flows to shareholders, $EBEI - (CapEx - Depreciation + Deferred\ Taxes)$. However, in the second stage, I apply the share correction only to the growth in earnings before extraordinary items (EBEI), since I smooth the net effect of capital expenditures, depreciation and deferred taxes toward zero. Finally, I add to each year's equity cash flows the actual dollar value of funds distributed via stock repurchases in that year. In forecasting the cash value of buybacks beyond the period for which I have historical data, I interpolate from forecasts of shares outstanding and stock prices from Value Line during stage 1, but then taper the value of buybacks toward zero in stage 2. Thus, this model is consistent with the other adjustments I have made, and accounts *not only* for

the effect of changes in shares outstanding on forecasting earnings growth, *but also* for the actual cash distributed directly to shareholders during a share repurchase. Again, it is important to consider both effects if share buybacks are to be modeled. I refer to this model as the 2nd Modified Model, when share buybacks are tapered in stage 2 and show the results from this analysis in Table 4 below.

Table 4: Comparison of STB MSDCF, 1st Modified MSDCF, and 2nd Modified MSDCF

	STB MSDCF	1st MODIFIED MSDCF	2nd MODIFIED MSDCF
2008	15.95%	15.16%	15.77%
2009	13.34%	12.47%	13.19%
2010	14.13%	13.60%	13.90%
2011	15.83%	14.96%	15.10%
2012	16.53%	15.77%	16.08%
2013	13.40%	12.72%	12.72%
Average	**14.9%**	**14.1%**	**14.5%**

Table 4 compares the 2008 - 2013 cost of equity estimates resulting from the 2nd Modified Model to those from the 1st Modified Model and to those from the original version used by the Board. As is apparent from the table, the effect of accounting for share buybacks—appropriately incorporating the direct cash flows to shareholders as well as correcting earnings forecasts for the impact of share reductions—along with a tapering of both the growth rates and smoothing of the transition to income in stage 2 – results in a cost of equity estimate that is very close to that of the Morningstar / Ibbotson MSDCF as applied by the Board. The overall results from taking two key criticisms from the WCTL and its experts into account show that the cost of equity estimates from the MSDCF model decrease by an average of 0.4%. When averaged with

the results from CAPM, this would translate into a decrease in the cost of equity of 0.2%.[39]

Finally, I have explored how to tailor the stages of the MSDCF model to the railroad industry. Morningstar / Ibbotson used the same stages for all industries. The value of this approach is that it offers a uniform approach that could be used to compare costs of equity across industries, which is a point the Board appreciated in its 2009 decision. If the MSDCF is to be tailored to the railroad industry, an important consideration is the time horizon over which the growth rates taper towards the economy-wide growth. I have reviewed recent testimony by the AAR in the Board's proceeding on grain rate regulation that discussed the projected traffic growth for the railroad industry.[40] These projections indicate substantial growth in transportation volumes to 2045, so that it is more reasonable to adjust the horizon of stage 2 upward than downward. To illustrate the impact, I adjusted the model to include a longer stage 2, so that the steady state is assumed to be reached in year 16 rather than year 11. Making that adjustment to the model (together with the smoothing between stages and the proper modeling of stock repurchases) leads to the 3rd Modified MSDCF, which assumes stock buybacks taper off in stage 2 as in the 2nd Modified MSDCF. The results of this model are shown in Table 5 below.

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[39] Summary information on growth rates and cash flow in the MSDCF and modified MSDCF for 2012 is provided in Appendix B.

[40] Association of American Railroads, "Rail Transportation of Grain, Rate Regulation Review," STB Ex Parte No. 665 (Sub-No. 1), June 26, 2014, pp. 19-20.

Table 5: Comparison of STB MSDCF, 1st, 2nd and 3rd Modified MSDCF

	STB MSDCF	1st MODIFIED MSDCF	2nd MODIFIED MSDCF	3rd MODIFIED MSDCF
2008	15.95%	15.16%	15.77%	16.61%
2009	13.34%	12.47%	13.19%	13.59%
2010	14.13%	13.60%	13.90%	14.35%
2011	15.83%	14.96%	15.10%	15.79%
2012	16.53%	15.77%	16.08%	16.71%
2013	13.40%	12.72%	12.72%	13.09%
Average	**14.9%**	**14.1%**	**14.5%**	**15.0%**

Looking at Table 5 above it is clear that taking two key criticisms of the WCTL and its experts into account (2nd Modified MSDCF) has *de minimus* impact on the estimated cost of equity, and similarly, extending stage 2 to be more consistent with the railroad industry's growth expectations, also has minimal impact on the cost of equity.

In comparison, the CAPM has, as discussed above, been downward biased over the period due to the impact of monetary policy on government interest rates that are not reflective of corporate capital costs. As noted, this downward bias averaged about 1.1% for 2008-09, 0.3% for 2010, 0.5% for 2011-12 and 0.3% for 2013 or about 0.6% during the period. Taking the fact that the CAPM and MSDCF are weighted equally in the Board's methodology into account, the CAPM impact is of the same magnitude if not larger than making adjustments for the WCTL key criticisms.

In the end, I do not believe the Board needs to expend its limited resources pursuing some kind of "best" MSDCF model for the railroad industry. The elaborations on the MSDCF that I have illustrated above are complex and prone to create

controversy as there are numerous additional data and assumptions that need to be incorporated into the model. All financial techniques used to estimate the cost of equity are inherently imprecise, whether we are speaking about a MSDCF model or CAPM. The results vary from year to year and are sensitive to assumptions that are just that, assumptions. In other words, there is a standard error associated with all models. The tiny difference between the STB's current MSDCF model and the modified versions reported above could readily be attributed to random noise.

Moreover, should the Board seek to make such changes to the Morningstar / Ibbotson MSDCF model, it would need to consider other issues such as how the large capital expenditures by the railroads will translate into higher growth in cash flows in future years, as well as to settle on when the industry is likely to reach its steady state (stage 3), where the massive capital expenditures will no longer be needed to meet current and future demand and will settle down to a steady-state where capital expenditures are roughly equal to total economic depreciation of existing assets. The potential downward bias in the CAPM due to currently very low government interest rates should also be considered.

In my opinion, the search for a MSDCF perfectly tailored to the railroad industry is misguided as there are many standard financial techniques of which the Board has reviewed and selected two. Any financial model will necessarily be a better fit in some years than others, so selecting a railroad specific model based on 2008-13 will necessarily lead to controversy in future years, when industry and market circumstances change. I emphasize that it is important to take a comprehensive view of the cost of equity estimation for the railroad industry (or any industry) and evaluate the allowed return on equity rather than the results from one of two relied upon models.

VI. Conclusion

The STB wisely recognized that "[a]s there are many different ways to estimate the cost of equity, the Board must take great care not to swing back-and-forth between parties' preferred methodologies based on the results of the different approaches."[41] And the sentiment that the Board expressed in its Ex Parte 664 (Sub-No. 1) decision remains valid today:

> [I]f our exploration of this issue has revealed nothing else, it has shown that there is no single simple or correct way to estimate the cost of equity for the railroad industry, and countless reasonable options are available.[42]

As illustrated above, many academics, practitioners and regulators prefer to use more than one technique to estimate the cost of equity.

I agree wholeheartedly that it is important to use more than one estimation method, and it is particularly helpful to use different models (such as the CAPM and the multi-stage DCF models) that use different kinds of information. The Morningstar / Ibbotson MSDCF model remains a sound technique and a relevant tool (along with the CAPM) for estimating the costs of equity for the railroad industry. In my professional opinion, WCTL has not justified a decision to throw away valuable, forward-looking information that can help the Board in the difficult task of estimating the railroad cost of equity.

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41 Surface Transportation Board, Decision STB Ex Parte No. 558 (Sub-No. 9), decided September 15, 2006.

42 STB 2009 Decision p. 15.

APPENDIX A: Regulatory Practice in Using Multiple Models

1. State and Provincial Regulators

In the U.S., rates for a number of regulated entities are determined by several federal entities as well as regulators in each of the fifty states and the District of Columbia. Federal regulators tend to have well-specified methods to determine the cost of equity with the Federal Energy Regulatory Commission relying exclusively on the discounted cash flow model, while the STB and the Federal Reserve both use a combination of the CAPM and the multi-stage discounted cash flow model. While state regulators typically do not specify a particular method or methods, they commonly review evidence from several estimation methods and parties before issuing a decision on the allowed cost of equity. They generally use more than one method but most do not specify the weight assigned to each method.

a) New York

The New York State Public Service Commission (NY PSC) explicitly favors a weighted blend of DCF and CAPM for ROE estimation. The NY PSC has in a recent decision relied on the CAPM and a DCF model to calculate the ROE and assigned a weight of two-thirds to the DCF estimate and one-third to the CAPM estimate.[43,44]

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[43] SNL: *Regulatory Research Associates, New York State Public Service Commission*. Last updated December 14, 2013. Access: http://www.snl.com/interactivex/CommissionDetails.aspx?ID=4081607&Type=1&State=NY

[44] See also Prepared Testimony of Craig E. Henry, *In the Matter of Consolidated Edison Company of New York*, Case 06-G-1332, March 2007, p. 7.

b) British Columbia Utilities Board

Starting in British Columbia in 1994, the British Columbia Utilities Commission (BCUC) completed the first generic cost of capital proceeding in Canada, which established a benchmark ROE and a formulaic approach to updating the allowed ROE annually.[45] Shortly thereafter, other Canadian regulators followed suit and similarly established a benchmark ROE and an annual updating formula. These formulae were linked to the change or forecasted change in Treasury bond yields.

The BCUC's views evolved as the various models arrived at more or less plausible results. For example, in its 2009 decision, the BCUC found:

> The Commission Panel agrees that a single variable is unlikely to capture the many causes of changes in ROE and that in particular the recent flight to quality has driven down the yield on long-term Canada bonds, while the cost of risk has been priced upwards.[46]

As a result, the BCUC assigned less weight to the CAPM than it had previously and higher weight to the DCF.

In May of 2013, the BCUC released its most recent decision regarding the appropriate methodology for determining cost of capital for a benchmark low-risk utility. The BCUC established that "**the DCF and CAPM should be given equal weight**

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45 BCUC Decision in the Matter of Return on Common Equity BC Gas Utility Ltd., Pacific Northern Gas Ltd., West Kootenay Power Ltd., June 10, 1994 (BCUC 1994 Decision), pp. 39-40.

46 BCUC in the Matter of Terasen Gas Inc., Terasen Gas (Vancouver Island) Inc., Terasen Gas (Whistler) Inc. and Return on Equity and Capital Structure Decision, G-158-09, Decided December 16, 2009 (BCUC 2009 Decision), p. 73.

in determining the ROE,"[47] because both have solid theoretical foundations and "explicitly recognize the opportunity cost of capital."[48]

The decision recognizes that both models have advantages and shortcomings and found that the most helpful DCF estimates were the multi-stage estimates.[49] The decision notes that the DCF model assumes "unlike the CAPM, that investors hold realistic investment horizons; both short and long-term investors estimate all dividends that the firm will provide over its lifetime."[50] However, any estimates from this model are only as accurate as the growth rate assumptions used, and these assumptions can be "strong, and hence unlikely to correspond to reality."[51] On the other hand, CAPM estimates, despite strong theoretical underpinnings, might be, for instance, adversely impacted by poor estimates of the risk premium if there is a lack of "conditioning on the current state of the capital markets."[52]

2. State Ad Valorem Taxation

Several U.S. states use a combination of the CAPM and DCF models for the purpose of valuing property of state assessed industries such as airlines, gas, electric and water utilities, pipelines, railroads, and telephone companies. In doing so, the states need to determine a cost of equity for the industry being assessed. Like the rate of return regulators cited above, the states' choice of estimation method for this purpose

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47 BCUC Generic Cost of Capital Proceeding (Stage 1) Decision, Decided May 10, 2013 (BCUC 2013 Decision), p. 80.

48 BCUC 2013 Decision, p. 56.

49 BCUC 2013 Decision p. 71.

50 BCUC 2013 Decision, p. 67.

51 BCUC 2013 Decision, p. 69.

52 BCUC 2013 Decision, p. 65.

provide insight into what estimation methods state regulators use to determine the cost of equity.

According to Pratt and Grabowski,[53] California, Colorado, Oklahoma, Texas, Washington and Wyoming use a combination of the CAPM and discounted cash flow models, while Nevada relies on the discounted cash flow model albeit state statute also allows for the use of the CAPM and a bond-rate plus premium method.[54]

The Board's decision to use a combination of the CAPM and the MSDCF is consistent with the decisions of other regulators, who also combine estimation results. The sentiment that the Board expressed in its Ex Parte 664 (Sub-No. 1) decision remains valid:

> [I]f our exploration of this issue has revealed nothing else, it has shown that there is no single simple or correct way to estimate the cost of equity for the railroad industry, and countless reasonable options are available.[55]

I agree. And many other regulators similarly rely on a combination of models with the most frequently used regulatory cost of equity estimation methods being versions of the CAPM and discounted cash flow models.

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53 Roger J. Grabowski is a managing director at Duff & Phelps LLC, which will publish the Morningstar / Ibbotson MSDCF model and figures going forward.

54 Shannon P. Pratt and Roger J. Grabowski, *Cost of Capital in Litigation: Applications and Examples*, 2011, pp. 206-10.

55 STB 2009 Decision p. 15.

APPENDIX B: Summary Information on Growth Rates and Cash Flow in MSDCF and Modified MSDCF for 2012

Table B-1: 2012 CSX Growth Rate Comparison

Stage	Year	STB Growth Rates	Revised MSDCF Growth Rates
Year 0	2012	-	-
Stage 1	2013	14.70%	14.70%
	2014	14.70%	14.70%
	2015	14.70%	14.70%
	2016	14.70%	14.70%
	2017	14.70%	14.70%
Stage 2	2018	14.07%	13.16%
	2019	14.07%	11.63%
	2020	14.07%	10.09%
	2021	14.07%	8.55%
	2022	14.07%	7.02%
Stage 3	2023 onwards	5.48%	5.48%

Table B-2: 2012 CSX Cash Flow Comparison

Stage	Year	STB Projected Cash Flows	1st Modified MSDCF Projected Cash Flows	2nd Modified MSDCF Projected Cash Flows
Year 0	2012	1,202	1,202	1,936
Stage 1	2013	1,379	1,379	1,704
	2014	1,581	1,581	2,353
	2015	1,814	1,814	2,599
	2016	2,080	2,080	2,769
	2017	2,386	2,386	3,063
Stage 2	2018	2,722	2,986	3,385
	2019	3,105	3,585	3,691
	2020	3,542	4,170	3,938
	2021	4,040	4,727	4,181
	2022	4,609	5,240	4,410
Stage 3	Terminal Value	53,458	45,402	37,524

Table B-3: 2012 NSC Growth Rate Comparison

Stage	Year	STB Growth Rates	Revised MSDCF Growth Rates
Year 0	2012	-	-
Stage 1	2013	12.10%	12.10%
	2014	12.10%	12.10%
	2015	12.10%	12.10%
	2016	12.10%	12.10%
	2017	12.10%	12.10%
Stage 2	2018	14.07%	11.00%
	2019	14.07%	9.89%
	2020	14.07%	8.79%
	2021	14.07%	7.69%
	2022	14.07%	6.58%
Stage 3	2023 onwards	5.48%	5.48%

Table B-4: 2012 NSC Cash Flow Comparison

Stage	Year	STB Projected Cash Flows	1st Modified MSDCF Projected Cash Flows	2nd Modified MSDCF Projected Cash Flows
Year 0	2012	1,160	1,160	2,448
Stage 1	2013	1,300	1,300	1,882
	2014	1,458	1,458	2,051
	2015	1,634	1,634	2,419
	2016	1,832	1,832	2,145
	2017	2,053	2,053	2,352
Stage 2	2018	2,342	2,550	2,680
	2019	2,672	3,047	3,000
	2020	3,048	3,535	3,287
	2021	3,477	4,008	3,570
	2022	3,966	4,456	3,843
Stage 3	Terminal Value	51,388	42,241	36,062

Table B-5: 2012 UNP Growth Rate Comparison

Stage	Year	STB Growth Rates	Revised MSDCF Growth Rates
Year 0	2012	-	-
Stage 1	2013	15.40%	15.40%
	2014	15.40%	15.40%
	2015	15.40%	15.40%
	2016	15.40%	15.40%
	2017	15.40%	15.40%
Stage 2	2018	14.07%	13.75%
	2019	14.07%	12.09%
	2020	14.07%	10.44%
	2021	14.07%	8.79%
	2022	14.07%	7.13%
Stage 3	2023 onwards	5.48%	5.48%

Table B-6: 2012 UNP Cash Flow Comparison

Stage	Year	STB Projected Cash Flows	1st Modified MSDCF Projected Cash Flows	2nd Modified MSDCF Projected Cash Flows
Year 0	2012	2,617	2,617	4,091
Stage 1	2013	3,020	3,020	5,173
	2014	3,485	3,485	5,897
	2015	4,022	4,022	5,544
	2016	4,641	4,641	6,806
	2017	5,356	5,356	7,508
Stage 2	2018	6,109	6,515	7,962
	2019	6,969	7,675	8,382
	2020	7,950	8,805	8,657
	2021	9,068	9,871	8,931
	2022	10,344	10,840	9,178
Stage 3	Terminal Value	137,949	122,147	99,183

APPENDIX C: Resume of Dr. Bente Villadsen

Dr. Bente Villadsen is a principal at The Brattle Group. Her work concentrates in the areas of regulatory finance and accounting. Her recent work has focused on accounting issues, damages, cost of capital and regulatory finance. In the regulatory finance area, Dr. Villadsen has testified on cost of capital and accounting, analyzed credit issues in the utility industry, risk management practices as well the impact of regulatory initiatives such as energy efficiency and de-coupling on cost of capital and earnings. Among her recent accounting work, she has been involved in accounting disclosure issues and principles including impairment testing, fair value accounting, leases, accounting for hybrid securities, accounting for equity investments, cash flow estimation as well as overhead allocation. Dr. Villadsen has estimated damages in the U.S. as well as internationally for companies in the construction, telecommunications, energy, cement, and rail road industry. She has filed testimony and testified in federal and state court, in international and U.S. arbitrations and before state and federal regulatory commissions. Her testimonies and expert reports pertain to accounting issues, damages, discount rates and cost of capital for regulated entities.

Dr. Villadsen holds a Ph.D. from Yale University's School of Management with a concentration in accounting. She has a joint degree in mathematics and economics (BS and MS) from University of Aarhus in Denmark. Prior to joining The Brattle Group, she was a Professor of Accounting at the University of Iowa, University of Michigan, and at Washington University in St. Louis where she taught financial and cost accounting. She has also taught graduate classes in econometrics and quantitative methods. Dr. Villadsen also worked as a consultant for Risoe National Laboratories in Denmark.

AREAS OF EXPERTISE

- Regulatory Finance
  - Cost of Capital
  - Cost of Service (including prudence)
  - Energy Efficiency, De-coupling and the Impact on Utilities Financials
  - Relationship between regulation and credit
  - Risk Management

  - Regulatory Advisory
- Accounting and Corporate Finance
  - Application of Accounting Standards
  - Disclosure Issues
  - Credit Issues in the Utility Industry
- Damages
  - Stock Price Drop
  - Lost Profit

EXPERIENCE

Regulatory Finance

- On behalf of American Water, California Water, EPCOR, Portland General Electric, and other parties, Dr. Villadsen has testified on cost of capital in state regulatory proceedings and before Bonneville Power Authority. In recent proceedings, her testimony included an evaluation of the impact of the financial crisis on the cost of capital and well as testimony on credit metrics and the implication of being non-investment grade.
- On behalf of the Australian Pipeline Industry Association (APIA), she led a study and co-authored a report on cost of equity and debt estimation methods. The equity report was filed with the Australian Energy Regulator as part of the APIA's response to the Australian Energy Regulator's development of rate of return guidelines and both reports were filed with the Economic Regulation Authority by the Dampier Bunbury Pipeline.
- In connection with the AWC Companies application to construct a backbone electric transmission project off the Mid-Atlantic Coast, Dr. Villadsen submitted testimony before the Federal Energy Regulatory Commission on the treatment the accounting and regulatory treatment of regulatory assets, pre-construction costs, construction work in progress, and capitalization issues.
- On behalf of ITC Holdings, she filed testimony with the Federal Energy Regulatory Commission regarding capital structure issues.

- Testimony on the impact of transaction specific changes to pension plans and rate base issues on the cost of service on behalf of Balfour Beatty Infrastructure Partners before the Michigan Public Service Commission.
- Dr. Villadsen has authored or co-authored reports on rate of return in connection with a review of regulatory practice for both regulators and other parties. The reports were submitted to the Netherlands Competition Authority, the British Columbia Utilities Commission, the Canadian Transportation Agency, the Australian Energy Regulator, the Economic Regulation Authority of Western Australia, and the Communications Regulatory Authority of Italy.
- She has advised the private equity arm of two large financial institutions as well as an infrastructure company, a sovereign fund and pension fund in connection with their acquisition of regulated transmission, distribution or integrated electric assets in the U.S. and Canada. For these clients, Dr. Villadsen evaluated the regulatory climate and the treatment of acquisition specific changes affecting the regulated entity, capital expenditures, specific cost items and the impact of regulatory initiatives such as the FERC's incentive return or riders and trackers. She has also reviewed the assumptions or worked directly with the acquirer's financial model.
- In a matter before Bonneville Power Administration, Dr. Villadsen filed expert testimony on behalf of customers regarding the cost of capital for electric utilities and the appropriate discount rate to apply to a government entity's cash flows.
- For several large electric and gas utilities, Dr. Villadsen reviewed the hedging strategies for electricity and gas and modeled the risk mitigation of hedges entered into. She also studies the prevalence and merits of using swaps and options to hedge gas costs. This work was used in connection with prudence reviews of hedging costs in Colorado, Oregon, Utah, West Virginia, and Wyoming. As part of these engagements, hedging workshops for stakeholders were conducted to obtain consensus on hedging policy issues.
- She estimated the cost of capital for major U.S. and Canadian utilities, pipelines, and railroads. The work has been used in connection with the

companies' rate hearings before the Federal Energy Regulatory Commission, the Canadian National Energy Board, the Surface Transportation Board, and state and provincial regulatory bodies. The work has been performed for pipelines, integrated electric utilities, non-integrated electric utilities, gas distribution companies, water utilities, railroads and other parties.

- In a matter pertaining to regulatory cost allocation, Dr. Villadsen assisted counsel in collecting necessary internal documents, reviewing internal accounting records and using this information to assess the reasonableness of the cost allocation.
- She has been engaged to estimate the cost of capital or appropriate discount rate to apply to segments of operations such as the power production segment for utilities.
- In connection with rate hearings for electric utilities, Dr. Villadsen has estimated the impact of power purchase agreements on the company's credit ratings and calculated appropriate compensation for utilities that sign such agreements to fulfill, for example, renewable energy requirements.
- Dr. Villadsen has been part of a team assessing the impact of conservation initiatives, energy efficiency, and decoupling of volumes and revenues on electric utilities financial performance. Specifically, she has estimated the impact of specific regulatory proposals on the affected utilities earnings and cash flow.
- On behalf of Progress Energy, she evaluated the impact of a depreciation proposal on an electric utility's financial metric and also investigated the accounting and regulatory precedent for the proposal.
- For a large integrated utility in the U.S., Dr. Villadsen has for several years participated in a large range of issues regarding the company's rate filing, including the company's cost of capital, incentive based rates, fuel adjustment clauses, and regulatory accounting issues pertaining to depreciation, pensions, and compensation.
- Dr. Villadsen has been involved in several projects evaluating the impact of credit ratings on electric utilities. She was part of a team evaluating the

impact of accounting fraud on an energy company's credit rating and assessing the company's credit rating but-for the accounting fraud.

- For a large electric utility, Dr. Villadsen modeled cash flows and analyzed its financing decisions to determine the degree to which the company was in financial distress as a consequence of long-term energy contracts.
- For a large electric utility without generation assets, Dr. Villadsen assisted in the assessment of the risk added from offering its customers a price protection plan and being the provider of last resort (POLR).

Accounting and Corporate Finance

- On behalf of a taxpayer, Dr. Villadsen recently testified in federal court on the impact of discount rates on the economic value of alternative scenarios in a lease transaction.
- In an arbitration matter before the International Centre for Settlement of Investment Disputes, she provided expert reports and oral testimony on the allocation of corporate overhead costs and damages in the form of lost profit. Dr. Villadsen also reviewed internal book keeping records to assess how various inter-company transactions were handled.
- Dr. Villadsen provided expert reports and testimony in an international arbitration under the International Chamber of Commerce on the proper application of US GAAP in determining shareholders' equity. Among other accounting issues, she testified on impairment of long-lived assets, lease accounting, the equity method of accounting, and the measurement of investing activities.
- In an arbitration matter before the American Arbitration Association, she provided expert reports on the equity method of accounting, the classification of debt versus equity and the distinction between categories of liabilities in a contract dispute between two major oil companies. For the purpose of determining whether the classification was appropriate, Dr. Villadsen had to review the company's internal book keeping records.

- Dr. Villadsen provided an expert report in a matter before the International Chamber of Commerce regarding the calculation of the final adjustment in an acquisition. The specific topic of her expert report was the distinction of accrual and cash flow measures of costs.
- In U.S. District Court, Dr. Villadsen filed testimony regarding the information required to determine accounting income losses associated with a breach of contract and cash flow modeling.
- Dr. Villadsen recently assisted counsel in a litigation matter regarding the determination of fair values of financial assets, where there was a limited market for comparable assets. She researched how the designation of these assets to levels under the FASB guidelines affect the value investors assign to these assets.
- She has worked extensively on litigation matters involving the proper application of mark-to-market and derivative accounting in the energy industry. The work relates to the proper valuation of energy contracts, the application of accounting principles, and disclosure requirements regarding derivatives.
- Dr. Villadsen evaluated the accounting practices of a mortgage lender and the mortgage industry to assess the information available to the market and ESOP plan administrators prior to the company's filing for bankruptcy. A large part of the work consisted of comparing the company's and the industry's implementation of gain-of-sale accounting.
- In a securities fraud matter, Dr. Villadsen evaluated a company's revenue recognition methods and other accounting issues related to allegations of improper treatment of non-cash trades and round trip trades.
- For a multi-national corporation with divisions in several countries and industries, Dr. Villadsen estimated the appropriate discount rate to value the divisions. She also assisted the company in determining the proper manner in which to allocate capital to the various divisions, when the company faced capital constraints.

- Dr. Villadsen evaluated the performance of segments of regulated entities. She also reviewed and evaluated the methods used for overhead allocation.
- She has worked on accounting issues in connection with several tax matters. The focus of her work has been the application of accounting principles to evaluate intra-company transactions, the accounting treatment of security sales, and the classification of debt and equity instruments.
- For a large integrated oil company, Dr. Villadsen estimated the company's cost of capital and assisted in the analysis of the company's accounting and market performance.
- In connection with a bankruptcy proceeding, Dr. Villadsen provided litigation support for attorneys and an expert regarding corporate governance.

Damages

- On behalf of a taxpayer, Dr. Villadsen testified on the economic value of alternative scenarios in a lease transaction regarding infrastructure assets.
- For a foreign construction company involved in an international arbitration, she estimated the damages in the form of lost profit on the breach of a contract between a sovereign state and a construction company. As part of her analysis, Dr. Villadsen relied on statistical analyses of cost structures and assessed the impact of delays.
- In an international arbitration, Dr. Villadsen estimated the damages to a telecommunication equipment company from misrepresentation regarding the product quality and accounting performance of an acquired company. She also evaluated the IPO market during the period to assess the possibility of the merged company to undertake a successful IPO.
- On behalf of pension plan participants, Dr. Villadsen used an event study estimated the stock price drop of a company that had engaged in accounting fraud. Her testimony conducted an event study to assess the impact of news regarding the accounting misstatements.

- In connection with a FINRA arbitration matter, Dr. Villadsen estimated the value of a portfolio of warrants and options in the energy sector and provided support to counsel on finance and accounting issues.

- She assisted in the estimation of net worth of individual segments for firms in the consumer product industry. Further, she built a model to analyze the segment's vulnerability to additional fixed costs and its risk of bankruptcy.

- Dr. Villadsen was part of a team estimating the damages that may have been caused by a flawed assumption in the determination of the fair value of mortgage related instruments. She provided litigation support to the testifying expert and attorneys.

- For an electric utility, Dr. Villadsen estimated the loss in firm value from the breach of a power purchase contract during the height of the Western electric power crisis. As part of the assignment, Dr. Villadsen evaluated the creditworthiness of the utility before and after the breach of contract.

- Dr. Villadsen modeled the cash flows of several companies with and without specific power contract to estimate the impact on cash flow and ultimately the creditworthiness and value of the utilities in question.

PUBLICATIONS AND REPORTS

Report on "Cost of Capital for Telecom Italia's Regulated Business" with Stewart C. Myers and Francesco Lo Passo before the *Communications Regulatory Authority of Italy* ("AGCOM"), March 2014. *Submitted in Italian.*

"Alternative Regulation and Ratemaking Approaches for Water Companies: Supporting the Capital Investment Needs of the 21st Century," (with J. Wharton and H. Bishop), prepared for the *National Association of Water Companies*, October 2013.

"Estimating the Cost of Debt," (with T. Brown), prepared for the Dampier Bunbury Pipeline and filed with the *Economic Regulation Authority*, Western Australia, March 2013.

"Estimating the Cost of Equity for Regulated Companies," (with P.R. Carpenter, M.J. Vilbert, T. Brown, and P. Kumar), prepared for the Australian Pipeline Industry Association and filed with the *Australian Energy Regulator* and the *Economic Regulation Authority*, Western Australia, February 2013.

"Calculating the Equity Risk Premium and the Risk Free Rate," (with Dan Harris and Francesco LoPasso), prepared for *NMa and Opta, the Netherlands*, November 2012.

"Shale Gas and Pipeline Risk: Earnings Erosion in a More Competitive World," (with Paul R. Carpenter, A. Lawrence Kolbe, and Steven H. Levine), *Public Utilities Fortnightly*, April 2012.

"Survey of Cost of Capital Practices in Canada," (with Michael J. Vilbert and Toby Brown), prepared for *British Columbia Utilities Commission*, May 2012.

"Public Sector Discount Rates" (with rank Graves, Bin Zhou), *Brattle* white paper, September 2011

"FASB Accounting Rules and Implications for Natural Gas Purchase Agreements," (with Fiona Wang), *American Clean Skies Foundation*, February 2011.

"IFRS and You: How the New Standards Affect Utility Balance Sheets," (with Amit Koshal and Wyatt Toolson), *Public Utilities Fortnightly*, December 2010.

"Corporate Pension Plans: New Developments and Litigation," (with George Oldfield and Urvashi Malhotra), Finance Newsletter, Issue 01, *The Brattle Group*, November 2010.

"Review of Regulatory Cost of Capital Methodologies," (with Michael J. Vilbert and Matthew Aharonian), *Canadian Transportation Agency*, September 2010.

"Building Sustainable Efficiency Businesses: Evaluating Business Models," (with Joe Wharton and Peter Fox-Penner), *Edison Electric Institute*, August 2008.

"Understanding Debt Imputation Issues," (with Michael J. Vilbert and Joe Wharton and *The Brattle Group* listed as an author), *Edison Electric Institute*, June 2008.

"Measuring Return on Equity Correctly: Why current estimation models set allowed ROE too low," *Public Utilities Fortnightly*, August 2005 (with A. Lawrence Kolbe and Michael J. Vilbert).

"The Effect of Debt on the Cost of Equity in a Regulatory Setting," (with A. Lawrence Kolbe and Michael J. Vilbert, and with "*The Brattle Group*" listed as author), *Edison Electric Institute,* April 2005.

"Communication and Delegation in Collusive Agencies," *Journal of Accounting and Economics*, Vol. 19, 1995.

"Beta Distributed Market Shares in a Spatial Model with an Application to the Market for Audit Services" (with M. Hviid), *Review of Industrial Organization*, Vol. 10, 1995.

SELECTED PRESENTATIONS

"Advanced Capital Structure and Liability Management," *Edison Electric Institute & American Gas Association's Advanced Utility Accounting Seminar*, Denver, August, 2014.

"Capital Investments and Alternative Regulation," *National Association of Water Companies Annual Policy Forum*, December 2013.

"Current Issues in Cost of Capital," *Edison Electric Institute Advanced Rate School*, July 2014, 2013, 2012.

"Accounting for Power Plant," *SNL's Inside Utility Accounting Seminar*, Charlotte, NC, October 2012.

"GAAP / IFRS Convergence," *SNL's Inside Utility Accounting Seminar*, Charlotte, NC, October 2012.

"International Innovations in Rate of Return Determination," *Society of Utility Financial and Regulatory Analysts' Financial Forum*, April 2012.

"Utility Accounting and Financial Analysis: The Impact of Regulatory Initiatives on Accounting and Credit Metrics," 1.5 day seminar, EUCI, Atlanta, May 2012.

"Cost of Capital Working Group Eforum," *Edison Electric Institute webinar*, April 2012.

"Issues Facing the Global Water Utility Industry" Presented to Sensus' Executive Retreat, Raleigh, NC, July 2010.

"Regulatory Issues from GAAP to IFRS," NASUCA *2009 Annual Meeting*, Chicago, November 2009.

"Subprime Mortgage-Related Litigation: What to Look for and Where to Look," *Law Seminars International: Damages in Securities Litigation*, Boston, May 2008.

"Evaluating Alternative Business / Inventive Models," (with Joe Wharton). *EEI Workshop, Making a Business of Energy Efficiency: Sustainable Business Models for Utilities*, Washington DC, December 2007.

"Deferred Income Taxes and IRS's NOPR: Who should benefit?" *NASUCA Annual Meeting*, Anaheim, CA, November 2007.

"Current Issues in Cost of Capital," (with M.J. Vilbert). *EEI Electric Rates Advanced Course*, Madison, 2005.

"Issues for Cost of Capital Estimation," (with M.J. Vilbert). *EEI Cost of Capital Conference*, Chicago, 2004.

"Discussion of 'Are Performance Measures Other Than Price Important to CEO Incentives?'" *Annual Meeting of the American Accounting Association*, 2000.

"Contracting and Income Smoothing in an Infinite Agency Model: A Computational Approach," (with R.T. Boylan) *Business and Management Assurance Services Conference*, Austin 2000.

TESTIMONY

Expert Report on specific accrual and cash flow items in a Sales and Purchase Agreement in international arbitration before the *International Chamber of Commerce*. Case No. 19651/TO, July 2014.

Rebuttal Testimony regarding Cost of Capital before the *Oregon Public Utility Commission* on behalf of Portland General Electric, Docket No. UE 283, July 2014.

Direct Testimony on the rate impact of the pension re-allocation and other items for Upper Peninsula Power Company in connection with the acquisition by BBIP before the *Michigan Public Service Commission* in Docket No. U-17564, March 2014.

Expert Report on cost of equity, non-recovery of operating cost and asset retirement obligations on behalf of oil pipeline in arbitration, April 2013.

Direct Testimony on the treatment of goodwill before the *Federal Energy Regulatory Commission* on behalf of ITC Holdings Corp and ITC Midwest, LLC in Docket No. PA10-13-000, February 2012.

Direct and Rebuttal Testimony on cost of capital before the *Public Utilities Commission of the State of California* on behalf of California-American Water in Application No. 11-05, May 2011.

Direct Testimony, Rebuttal Testimony, and Hearing Appearance on cost of capital before the *New Mexico Public Regulation Commission* on behalf of New Mexico-American Water in Case No. 11-00196-UT, May 2011, November 2011, and December 2011.

Direct Testimony on regulatory assets and FERC accounting before the *Federal Energy Regulatory Commission* on behalf of AWC Companies, ER11-13-000/Eli-1-3-000, December 2010.

Expert Report and deposition in Civil Action No. 02-618 (GK/JMF) in the *United States District Court for the District of Columbia*, November 2010, January 2011.

Direct Testimony, Rebuttal Testimony, and Rejoinder Testimony on the cost of capital before the *Arizona Corporation Commission* on behalf of Arizona-American Water in Docket No. W-01303A-10-0448, November 2010, July 2011, and August 2011.

Direct Testimony on the cost of capital before *the New Mexico Public Regulation Commission* on behalf of New Mexico-American Water in Docket No. 09-00156-UT, August 2009.

Direct and Rebuttal Testimony and Hearing Appearance on the cost of capital before the *Arizona Corporation Commission* on behalf of Arizona-American Water in Docket No. W-01303A-09-0343, July 2009, March 2010 and April 2010.

Rebuttal Expert Report, Deposition and Oral Testimony re. the impact of alternative discount rate assumptions in tax litigation. *United States Court of Federal Claims*, Case No. 06-628 T, January, February, April 2009. (*Confidential*)

Direct Testimony, Rebuttal Testimony and Hearing Appearance on cost of capital before the *New Mexico Public Regulation Commission* on behalf of New Mexico-American Water in Docket No. 08-00134-UT, June 2008 and January 2009.

Direct Testimony on cost of capital and carrying charge on damages, U.S. Department of Energy, *Bonneville Power Administration*, BPA Docket No. WP-07, March 2008.

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BEFORE THE

SURFACE TRANSPORTATION BOARD

PETITION OF THE WESTERN COAL TRAFFIC LEAGUE TO INSTITUTE A RULEMAKING PROCEEDING TO ABOLISH THE USE OF THE MULTI-STAGE DISCOUNTED CASH FLOW MODEL IN DETERMINING THE RAILROAD INDUSTRY'S COST OF EQUITY CAPITAL	)	Docket No. EP 664 (Sub-No. 2)

REPLY VERIFIED STATEMENT

OF

BENTE VILLADSEN

ON BEHALF OF THE

ASSOCIATION OF AMERICAN RAILROADS

November 4, 2014

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I. Introduction and Summary

My name is Bente Villadsen and I am the same Bente Villadsen who filed a Verified Statement in support of the Association of American Railroads (AAR) opening comments in this proceeding on September 5, 2014.

I have been asked by the AAR to review and respond to the Opening Comments by the Western Coal Traffic League (WCTL), the Verified Statement of Dr. Harvey A. Levine (Levine Statement), and the Verified Statement of Professor Alexander J. Triantis (Triantis Statement). I have also been asked to review and respond to the Opening Comments of Arkansas Electric Cooperative Corporation (AECC Comments).

Based on my review of the filed material, as well as some of the cited data and literature, I continue to support the conclusions in my Verified Statement.[1] In addition, I also find that:

- The MSDCF as applied by the Board is not circular, as an increase in cash flow will be reflected in market prices, and not the cost of equity.
- The MSDCF is well-specified and auditable as done annually by the Surface Transportation Board.
- Reliance on the historical average MRP remains a valid method with textbooks, commercial data providers, and cost of capital experts recommending it.

[1] Verified Statement of Bente Villadsen, Docket No. EP 664 (Sub-No. 2), September 5, 2014 (Villadsen Statement), pp. 2-3.

- It is common to estimate the MRP using as many years as there are reliable data for.
- Survey results and literature that pre-date the financial crisis estimate the MRP below its historical average, while forward-looking methodologies estimate the MRP above its historical average. Therefore, the historical average is a reasonable compromise.
- The historical average MRP is objective and easy to implement and audit, whereas surveys are subjective and not auditable.
- Historical data, forecasted MRPs, recent studies, and even surveys show that the MRP exceeds 5%.
- The beta estimate as of the relevant estimation date remains the best proxy for the expected railroad beta. There is no support for restricting the railroad beta to a specific number or range.
- The beta estimate for a portfolio of publicly traded railroads that meets the Board's criteria is the best estimate for the industry.
- Evidence provided by the WCTL indicates that it is equally common for publicly traded companies to use raw and adjusted betas. Hence the Board's practice is in line with industry practice.
- The Board has implemented the CAPM in its original form without any adjustments. The Board should not selectively adjust one parameter without considering all plausible adjustments.

- There is no evidence that railroad betas have increased due to market power; there are plenty of more plausible alternative explanations for why railroad betas may have increased.
- It is a fundamental principle in finance that the cost of capital depends on its use and not on the ownership. BNSF's cost of equity depends on the systematic risk of BNSF's assets and cash flow; **not** on Berkshire Hathaway's or Union Pacific's beta.
- The fairness opinion on the sale of BNSF to Berkshire Hathaway is consistent with the Board's 2009 estimated cost of capital.
- The use of more than one method is endorsed by many utility cost-of-capital experts for regulatory purposes.

II. MSDCF

A. INTRODUCTION

WCTL's Opening Comments repeat many of the same criticisms of the MSDCF that WCTL and its witnesses, Professor Hodder and Mr. Fapp, made in WCTL's petition for a rulemaking proceeding, including the arguments that: (1) the MSDCF values are overstated because they are higher than values determined under the CAPM; (2) the second stage of the MSDCF fails to implement a smooth transition from Stage 1 to Stage 3; (3) Stage 3 of the model is deficient because it fails to achieve a smooth transition in cash flows; and (4) the MSDCF bases growth in firm-wide cash flow on earnings per share that increase faster than firm-wide earnings due to stock buybacks. The testimonies of WCTL's witnesses Dr. Levine and Professor Triantis largely echo the

criticisms made by WCTL's prior witnesses, Professor Hodder and Mr. Fapp. I have already addressed the criticisms noted above in my September Verified Statement.

Therefore the remainder of this section addresses the following new criticisms: (1) that the use of the MSDCF inherently is circular and (2) that the MSDCF is not transparent. This section also addresses the WCTL's use of a report that I co-authored for the Canadian Transportation Agency (CTA). I discuss the claim that the MSDCF is "far from the preferred method of determining the COC among regulatory agencies, the financial community, and academia"[2] in Section IV below.

B. CIRCULARITY

In its Opening Comments, the WCTL argues that there is an inherent "circularity" in the use of the MSDCF model to determine the cost of capital for the railroads. It claims that "the high MSDCF COE enables the railroads to raise their rates, and the rate increases result in projections of high earnings growth that drive the MSDCF COE. In other words, the model derives an increased cost of capital due to the railroads' ability to impose rate increases."[3] This argument is fundamentally flawed in that it ignores the basic finance principle of market efficiency. Specifically, the WCTL assumes that a rate increase by the railroads would lead to an increase in their expected future cash flows *without* a commensurate increase in the market prices of their stock.[4]

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[2] Verified Statement of Harvey A. Levine, Docket No. EP 664 (Sub-No. 2), September 5, 2014 (Levine Statement), p. 20.

[3] Opening Comments of the Western Coal Traffic League, Docket No. EP 664 (Sub-No.2), September 5, 2014 (WCTL), p. 25.

[4] In the Board's MSDCF model, if forecasted cash flows increase and prices remain unchanged, the implied cost of equity capital will increase such that the higher cash flows are more heavily discounted to reach the same present value.

However, unless the rate increase was to somehow substantially increase the railroads' systematic risk, this situation could not occur in an efficient market. Rather, the rise in expected cash flows would make railroad stock more attractive to investors, leading market prices to increase to a level reflecting the higher fundamental value, while the cost of equity capital remains unchanged. In the remainder of this section, I explain how the principle of market efficiency—a core and essential assumption for the implementation of all market models used to estimate the cost of capital,[5] including the CAPM that the WCTL recommends—prevents any possibility of "circularity" in the MSDCF model.

At its most basic, the DCF model sets the value of an asset equal to the present value of its future cash flows. When performing DCF valuation of a stock, the current *fundamental* value (V_0) is determined by taking the sum of all future cash flows (C_t) expected to accrue to the stockholder, discounted at the appropriate cost of equity capital (r).

$$V_0 = \sum_{t=1}^{\infty} \frac{C_t}{(1+r)^t}$$

As I explained in my Verified Statement, the cost of capital represents an opportunity cost for an investor considering a particular investment: it is the return he or she could expect to earn on some other investment of equivalent risk.[6] Therefore, if the current market price of a stock (P_0) were lower than the expected present value of its future cash flows (V_0), rational investors would want to purchase the stock, seeing it as

[5] Stephen A. Ross, Randolph W. Westerfield, and Jeffrey F. Jaffe, *Corporate Finance*, 10th ed, 2013, (Ross, Westerfield and Jaffe 2013), Chapter 11.

[6] Villadsen Statement, p. 4.

an opportunity to earn a return higher than the opportunity cost of capital (r) for an investment of equivalent risk. The resulting increased demand for the stock would tend to drive the price up until it matched the fundamental value (i.e., $P_0 = V_0$). Conversely, if P_0 were higher than V_0, a rational investor would view the stock as "overpriced", since purchasing it at the market price would yield an expected return below the cost of capital, *r*; this would push the stock's price downward toward its fundamental value. Only when $P_0 = V_0$ do investors view the stock as "fairly priced".

Under the *efficient markets hypothesis*,[7] we would expect securities markets to behave in precisely this fashion: investors collectively process the available information (e.g., financial data, price histories, analyst forecasts, etc.) about each security to determine its fundamental value. Their collective investment behavior then ensures that all securities are "fairly priced" such that $P_0 = V_0$ and any individual investment earns a return exactly equal its opportunity cost of capital (r).

Whether markets are in fact efficient is a matter of substantial academic debate.[8] However, market efficiency is an essential assumption when DCF models are used in a regulatory setting to estimate the cost of capital. Estimating r in the DCF requires inputs for the future cash flows C_t and current value V_0 of each company in the proxy group. By setting the latter equal to the current market price ($P_0 = V_0$), regulators *implicitly assume that the stocks are fairly priced by the market*, i.e., that securities markets are efficient.

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[7] See, for example, Richard A. Brealey, Stewart C. Myers, Franklin Allen, "*Principles of Corporate Finance*," 10th ed, 2011 (Brealey, Myers and Allen, 2011), pp. 314-325.

[8] See the discussion in Brealey, Myers, and Allen, 2011.

Under this same assumption, an increase in expected future cash flows (e.g., due to a rate increase by the railroads) would, all else equal, lead to a commensurate increase in the market prices of railroad stocks, *not* an increase in the DCF-estimated cost of capital.

To see this point, consider the example of a hypothetical regulated firm that is expected to generate cash of $5 per share next year ($C_1 = 5$), with perpetual 4% growth ($g = 4\%$) thereafter. If the current market value of the firm's stock is $100 per share, then *assuming the stock is fairly priced*, the implied cost of equity capital is 9% according to the discounted cash flow model[9]:

$$r = \frac{C_1}{P_0} + g = \frac{\$5}{\$100} + 4\% = 9\%$$

Now suppose that the firm is permitted to increase its rates such that it will grow its cash by $g^* = 5\%$ in perpetuity instead of 4%. Since the rate increase is not likely to have changed the firm's systematic risk in any meaningful way, the appropriate cost of capital for investing in the firm will remain at 9%. In an efficient market, investors will incorporate the firm's improved future cash flows into their investing decisions, so that the market will arrive at the new fair value for the stock.

$$P_0^* = \frac{c_1}{r - g^*} = \frac{\$5}{0.09 - 0.05} = \$125$$

[9] The discounted cash flow model is sometimes also called the "constant growth DCF" or "simple DCF" model. Note that this example uses a constant perpetual growth rate for simplicity. The principle demonstrated would be the same under the more complex assumptions of the Board's MSDCF model.

As this example illustrates, it is market prices, and **not** the cost of equity, that increase when forecasted cash flows go up under the assumptions of the Board's MSDCF model. WCTL's argument that the MSDCF has an issue with "circularity" is therefore unsound according to basic finance principles.

C. TRANSPARENCY OF THE MSDCF

WCTL contends that the MSDCF is not transparent but rather "an opaque and presumptuous methodology" that "is effective only when the projections are correct."[10]

First, the MSDCF is clearly transparent. The model is well-specified and all of the parameters that it relies upon are publicly available, so that it readily can be audited.[11] I understand that the Surface Transportation Board reviews and, if needed, adjusts the MSDCF figures annually.[12] That is hardly characteristic of an opaque model.

Second, while the MSDCF model is in fact dependent on the projected growth in cash flow, the CAPM—to which Dr. Levine advocates shifting all weight from the MSDCF—is dependent on the estimated market risk premium, beta, and risk-free rate. Because each cost of capital model has its strengths and weaknesses, no single model is ideal and the implementation of any model necessarily requires choices that involve subjective judgments.[13] Just as the outcome of the MSDCF hinges on the accuracy of

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[10] WCTL, p. 20. See also Levine Statement, p. 16.

[11] As discussed in my co-authored report, "Estimating the Cost of Equity for Regulated Companies" prepared for the Australian Energy Regulator for the Australian Pipeline Industry Association, February 2013 (AER Report) p. 30, when well specified, the MSDCF is easily replicated and therefore easy to audit. Note that the DCF model is referenced as DDM in Australia.

[12] See, for example, Surface Transportation Board Decision, Docket No. EP 558 (Sub-No. 17), Railroad Cost of Capital – 2013, decided July 30, 2014, p. 10.

[13] AER Report, p. 9.

projected growth rates, the CAPM is only effective when the estimated beta reflects the actual forecasted systematic risk, the relied upon risk-free rate reflects the expected risk-free rate, and the market risk premium reflects the actual premium that investors require to hold stock rather than risk-free bonds.

D. CTA REPORT

Finally, the WCTL cites a portion of the Canadian Transportation Agency's (CTA) 2011 decision,[14] which is attributed to a 2010 report that I co-authored regarding cost of capital methodologies.[15] The WCTL uses this quote to support its criticism of the MSDCF. The WCTL quotes from the CTA's decision, but fails to recognize the context in which the statements were made. Therefore, its reliance on the report is misplaced.

The WCTL cites ¶207 of the CTA decision as support that

> the DCF model is highly sensitive to growth rate estimates, which can vary widely among analysts – and that variation may increase in times of greater economic uncertainty. As such, the reliability of DCF methods can be questionable in times of economic turmoil or when an industry is in transition.[16]

While this statement is a quote from the CTA Decision, it pertains to the single-stage DCF model and is taken out of context. The portion of the Brattle CTA Report that the WCTL appears to be referencing continues:

> *If five-year growth rate forecasts are used as the constant growth rate*, as is often the case, then the reliability of the [single-stage DCF]

[14] Canadian Transportation Agency, Decision No. 425-R-2011, December 2011 (CTA Decision).

[15] "Review of Regulatory Cost of Capital Methodologies" by Michael J. Vilbert, Bente Villadsen and Matthew Aharonian, prepared for the *Canadian Transportation Agency*, September 2010 (Brattle CTA Report). The report is attached as Exhibit BV-2.

[16] WCTL p. 16.

> model can be significantly reduced in periods of abnormally high or low growth. Moreover, the results of applying the methodology can be unstable over time, leading to rapid shifts from high cost of capital estimates to low ones. *Some of this sensitivity can be mitigated in the DCF framework by adjusting the growth path more realistically*, but this then opens the DCF model to some of the same subjective parameter concerns raised in implementing the CAPM.[17]
> [emphasis added]

Thus, the CTA Decision was referencing the single-stage DCF and therefore the portion cited by the WCTL leaves out an important qualifier about using the single-stage DCF (with a constant company or industry-specific growth rate) and the ability of the MSDCF to mitigate those outcomes by relying on economy-wide growth in stage 3. In general, the Brattle CTA report simply analyzed the strengths and weaknesses of each model, including the CAPM and MSDCF. It did not endorse the use of only one model, nor did it find that one model was superior to others.

III. CAPM

A. INTRODUCTION

In its Opening Comments, the WCTL argues that "the CAPM is superior to the MSDCF both conceptually and pragmatically."[18] However, the CAPM, like every other model, has its strengths and weaknesses, both of which I discussed in my Verified Statement. Then, the WCTL, despite its overall glowing depiction of CAPM, contends that the CAPM "overstates" the cost of equity and requires certain "modifications" and "adjustments" to correct such "overstatements." However, the discussion is one-sided

[17] Brattle CTA Report, p. 4.

[18] WCTL, p. 14.

in that the WCTL only points to "flaws" that could "overstate" the cost of equity, while failing to point out any aspects of the CAPM implementation that would result in an understatement of the COE. If the implementation of the CAPM is to be re-examined, it is necessary to review all aspects of the model and its performance during different circumstances; e.g., before and after the financial crisis.

The more detailed comments from the WCTL and its experts focus on the market risk premium (MRP) and the beta estimates that the Board's cost of capital methodology relies upon. Therefore my comments on the WCTL filing focus on those parameters, although I caution against looking at the any one of the parameters that enters the CAPM estimate in isolation.

B. MARKET RISK PREMIUM

The WCTL and its experts focus their review of the MRP on surveys and on changing the period over which the historical arithmetic average MRP is estimated. The filing does not provide a literature review, textbook evidence, or evidence of regulatory practice for estimating the MRP. Instead, it references select surveys and a website. The academic literature on the MRP is vast and has changed over time. Much of the literature pertaining to the early 2000s (during the stock market boom) indicates an MRP that is lower than the long-term historical average MRP, while the more recent literature and current forward-looking methods suggest that the MRP is currently higher than the historical average MRP. Thus, there is no true consensus on what the MRP is. But there are reasonable ranges, and the historical average MRP as currently relied upon by the Board is in the middle of that range.

In the following sections, I first discuss the evidence on the plausible range of the MRP and show that the historical average is near the middle of that range. I then respond to particular points in the WCTL and AECC filings. Specifically, I address the claims that the Board's use of data going back to 1926 does not "reflect current investor expectations" and "the 1926 base is no longer the norm for measuring the MRP," as well as the assertion that that the Board should instead rely on 50 years of data. [19] I also address the claims that a 4.7% risk premium is "consistent with, if not somewhat higher than, [the MRP] currently used by financial professionals"[20] and that "the MRP in the current environment should not exceed 4.7%."[21] Finally, I comment on the use of survey data.

1. Evidence on the MRP Range

As noted above, there is currently no real consensus on what the expected MRP is. However, there are a number of articles and textbooks published by academics, estimates provided by commercial vendors, and regulatory precedents. Morningstar / Ibbotson argues to use a period going as far back as 1926 stating that:

> "some analysts estimate the expected equity risk premium using a shorter, more recent time period on the basis that recent events are more likely to be repeated in the near future; furthermore, they believe that the 1920s, 1930s, and 1940s contain too many unusual events. This view is suspect because all periods contain "unusual" events. Some of the most unusual events of the last hundred years

[19] WCTL p. 31, Levine Statement p. 13 and 24, Verified Statement of Prof. Alexander J. Triantis, Docket No. EP 664 (Sub-No. 2), September 5, 2014 (Triantis Statement), pp. 11-12

[20] Triantis Statement, p. 12.

[21] WCTL, p. 7.

> took place quite recently, including the inflation of the late 1970s and early 1980s, the October 1987 stock market crash, the collapse of the high-yield bond market, the major contraction and consolidation of the thrift industry, the collapse of the Soviet Union, the development of the European Economic Community, the attacks of September 11, 2001 and the more recent liquidity crisis of 2008 and 2009."[22]

Similarly, Professors Ross, Westerfield and Jaffe find that an estimate based on the historical U.S. MRP over as long a period as possible to be reasonable. The figure cited by the authors uses the period 1900 – today; for 1900 – 2013 the estimated MRP is 6.6%.[23] The 2014 Valuation Handbook put forth by Duff & Phelps estimates a risk premium of 6.96% for the period 1926 -2013. The text also reports a so-called supply side MRP that adjusts the MRP downward for the growth in the price to earnings ratio, resulting in an MRP of 6.18% for the period 1926 to 2013.[24] Table 1 below shows the historical MRP over 20-year government bonds from the 2013 SBBI Valuation Yearbook, the Credit Suisse Global Investment Returns Sourcebook 2014, and from my calculations using NYSE returns.[25] Only a select 50-year period (i.e., 1964-2013) yields a historical average MRP below 5%, whereas the use of other periods indicates an MRP close to the current 6.96%, regardless of whether the 1926-today period is expanded to include 1900-1925 or restricted to include only the post-war years: 1947-today.

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[22] Morningstar, "*Ibbotson SBBI 2013 Valuation Yearbook*," p. 59.

[23] Ross, Westerfield and Jaffe 2013, p. 326 discuss the methodology. "*Credit Suisse Global Investment Return Sourcebook 2014*," Table 10 of that text provides the long-term arithmetic MRP referenced above and Table 9 of the text provides the short-term MRP – currently 7.5%.

[24] Duff & Phelps, "*2014 Valuation Handbook*,"p. 3 – 19.

[25] Morningstar, "*Ibbotson SBBI 2013 Valuation Yearbook*," p. 46.

Table 1: Historical Long-Term MRP Estimates

Historical Long Term Market Risk Premiums

	NYSE Long Term MRP	S&P Long Term MRP	US Long Term MRP
	[1]	[2]	[3]
1900 - 2013		6.66%	6.60%
1926 - 2013	6.64%	6.96%	
1947 - 2013	6.61%	6.84%	
1964 - 2013	4.68%	4.67%	
1974 - 2013	5.47%	5.50%	

Sources and Notes:

[1]: NYSE Returns from CRSP between 1926 and 2005. NYSE Returns from Bloomberg 2006 onwards. Interest Rates from Ibbotson Associates, *Stocks Bonds Bills and Inflation (SBBI)* 2014 Classic Yearbook.

[2]: Duff & Phelps, *2014 Valuation Handbook* , Exhibit 3-6. S&P refers to Standard & Poor 500 Index. For the period 1947-2013, the 1947-2012 average reported in the 2013 Ibbotson Valuation Yearbook, page 74, was recalculated using the 2013 MRP calculated by taking the S&P 500 total stock returns from Bloomberg and subtracting out the 2013 income return on long-term government bonds taken from Ibbotson.

[3]: Dimson, Marsh and Staunton, *Global Investment Returns Sourcebook 2014* , p. 28.

Long term MRPs are average spreads between market returns and income or total returns on long-term Treasuries.

Academic articles that were written in the late 1990s or early 2000s often found that the MRP was lower than the historical MRP based on various forward-looking models, such as market-wide versions of the DCF model. A recent article by Duarte and Rosa of the Federal Reserve of New York summarizes many of these models and also estimates the MRP from the models each year from 1960 through 2013.[26] The authors

[26] Fernando Duarte and Carlo Rosa, "The Equity Risk Premium: A Consensus of Models," Federal Reserve Bank of New York, 2014 (Duarte & Rosa 2014).

then report the average as well as the 25 and 75-percentile of results. The authors find that the models are converging to provide a more comparable estimate and that the average annual estimate of the MRP is consistent with the academic literature and with forward-looking estimates such as Bloomberg's. Their analysis shows that the MRP was lower than its long-term historical average in the early 2000s, **but** is currently at an all-time high. Figure 1 from Duarte & Rosa 2014 is replicated as Exhibit BV-3, which shows the average estimated MRP (over 30-day T-bills) for 20 models. [27]

For example, the authors estimate that the MRP reached an all-time high of 14.5% over 90-day T-bills in July 2013 for an approximate long-term MRP of 10.2%. Looking at the authors' figures and subtracting the difference between the 20-year government bond[28] and the 90-day T-bill, it appears that they find an MRP over 20-year Treasury bonds of approximately 6.5% during the 2008-10 period, 7.7% for 2010-12 and 8.0 – 8.7% since 2012.[29] These figures are broadly consistent with the forward-looking MRP calculated by Bloomberg and shown in Table 2 below. Bloomberg estimates its forecasted MRP using a DCF model for the market as a whole.[30] The table also shows the forecasted MRP for 2012-13 using Value Line data. The Value Line forecasted MRP was calculated using the basic same methodology as Bloomberg, but relying on Value

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[27] Technically, Figure 1 from Duarte & Rosa plots the "first principal component" of the 20 models. This means that the authors used statistics to compute a weighted average that captures the most variability among the 20 models over time.

[28] The Board uses the yield on a 20-year government bond as its risk-free rate in the CAPM, so that the relevant MRP is over a 20-year government bond.

[29] Duarte & Rosa (2014) Figure 1, p. 18 and Bloomberg data on the yield on 90-day T-Bills and 20-year Government bonds.

[30] Bloomberg measures the market as the S&P 500 and uses the 10-year Treasury bond yield as the risk-free rate.

Line growth rates.[31] For comparison, the table also shows the historical average MRP as reported by Ibbotson.

Table 2: Bloomberg and Value Line Forecasted MRP and Ibbotson Historical MRP[32]

Year	Annual Forecasted MRP (Bloomberg)	Annual Historical MRP (Ibbotson)	Forecasted MRP (Value Line)
	[1]	[2]	[3]
2008	7.83%	6.47%	
2009	8.55%	6.67%	
2010	8.03%	6.72%	
2011	7.97%	6.62%	
2012	8.86%	6.70%	12.52%
2013	7.72%	6.96%	9.97%
Average	*8.16%*	*6.69%*	*nmf*

Sources and Notes:
[1]: Bloomberg as of 10/1/2014; Average of all MRP reported at the end of each month in year of interest. The MRP is calculated over the 10-Year Treasury bond yield.
[2]: Ibbotson SBBI 2014 Classic Yearbook, page 158. Average MRP from 1926 to year of interest.
[3]: Year-end Value Line data pulled 10/22/2014. MRP calculated over the 10-Year Treasury bond yield. Companies with no dividend yield or estimated growth rate were excluded from the analysis.

As Table 2 demonstrates, the forecasted MRP has been consistently higher than the historical average during the 2008-2013 period. I note that Bloomberg's forecasted MRP and the forecasted MRP calculated using Value Line represent the excess market return over the 10-year Treasury bond yield, which merits two comments. First, Ibbotson's historical MRP appropriately uses the realized return on Treasury bonds,

[31] For comparability to the Bloomberg forecast, I used the 10-year Treasury bond yield as the risk-free rate. The details of the calculation are attached as Exhibit BV-4.

[32] I do not have access to Value Line data for 2008-2011, but note that Roger A. Morin found the forward-looking MRP using Value Line data to be 7.7% over long-term bonds in 2008 (Direct Testimony and Exhibits of Roger A. Morin in the matter of the application of ALLETE d/b/a Minnesota Power in Docket E-015/GR-08-415, May 2008, p. 43).

while the forecasted MRP uses the yield on Treasury bonds. For the purpose of measuring a historical MRP it is the realized return rather than the forward-looking yield that is relevant.[33] Similarly, a forward-looking MRP appropriately uses a forward-looking yield as the risk-free measure. Second, the Board uses the 20-year Treasury Bond yield as the risk-free rate in its CAPM. Therefore, the forecasted MRPs in Table 2 should be adjusted downward for the difference between the 20-year and 10-year Treasury bond yields in order to form a valid comparison for the Board's current CAPM (with a 20-year risk-free rate). Even with this adjustment, the forecasted MRP has been well above the historical MRP as reported by Morningstar / Ibbotson every year from 2008 through 2012; the two figures became equal in 2013 (once the difference in yield has been accounted for).[34]

There may be several reasons why the current MRP is estimated to be higher than the historical average. The literature includes studies of the impact of a recession on investors' attitude towards risk, the impact of volatility, and the fear of large disasters to mention a few.

For example, Professor Constatinides studies a classical utility model where consumers are risk averse and also summarizes some of the empirical literature. Constantinides draws from empirical evidence that shows that consumers become risk averse in times of economic recession or downturn, and equity investments accentuate

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[33] Morningstar, "*Ibbotson SBBI 2013 Valuation Yearbook*," pp. 55-56; Leonardo R. Giacchino and Jonathan A. Lesser, "*Principles of Utility Corporate Finance*," Public Utilities Report, Inc., 2011, pp. 234-235.

[34] To illustrate: Bloomberg's MRP for 2013 was 7.72% and the average spread between the 20-year and the 10-year government bonds in 2013 was 0.77%, so the Bloomberg forecasted MRP over a 10-year risk-free rate would be 7.72% minus 0.77% or 6.95%.

this risk.[35] (Increased risk aversion leads to a higher expected return for investors before they will invest.) Specifically, equities are pro-cyclical and decline in value when the probability of a job loss increases; thus, they fail to hedge against income shocks that are more likely to occur during recessions.[36] Consequently, investors require an added risk premium to hold equities during economic downturns. Constantinides writes:

> In economic recessions, investors are exposed to the double hazard of stock market losses and job loss. Investment in equities not only fails to hedge the risk of job loss but also accentuates its implications. Investors require a hefty equity premium in order to be induced to hold equities. This is the argument that I formalize below and address the predictability of asset returns and their unconditional moments.[37]

And

> The first implication of the theory is an explanation of the counter-cyclical behavior of the equity risk premium: the risk premium is highest in a recession because the stock is a poor hedge against the uninsurable income shocks, such as job loss, that are more likely to arrive during a recession.
>
> The second implication is an explanation of the unconditional equity premium puzzle: even though per capita consumption growth is poorly correlated with stocks returns, investors require a hefty premium to hold stocks over short-term bonds because stocks

[35] G.M. Constantinides, "Understanding the equity risk premium puzzle". In R. Mehra, ed., *Handbook of the Equity Risk Premium*, 2008, Elsevier, Amsterdam.

[36] G.M. Constantinides, G.M., and D. Duffie, "Asset Pricing with Heterogeneous Consumers", *Journal of Political Economy*, Vol. 104 (2), 1996: 219-240.

[37] G.M. Constantinides, "Understanding the equity risk premium puzzle." In R. Mehra, ed., *Handbook of the Equity Risk Premium*. 2008 Elsevier, Amsterdam.

> perform poorly in recessions, when the investor is most likely to be laid off.[38]

Empirically, several authors have found that market volatility and the market risk premium are positively related. For example, Kim, Morley and Nelson 2004[39] find that

> When the effects of volatility feedback are fully taken into account, the empirical evidence supports a significant positive relationship between stock market volatility and the equity premium.[40]

Additionally, in their article that won the annual Smith-Breeden Paper Award given by the American Finance Association and the *Journal of Finance*, Bansal and Yaron (2004) demonstrate that economic uncertainty plays an important role in explaining the MRP.[41] In particular, they show that uncertainty is priced in the market. In their model, higher uncertainty (measured in their paper by volatility of consumption) leads to higher conditional MRP. Another implication of the analysis in the Bansal and Yaron paper is that even the unconditional MRP can increase if any of the following materialize: (i) investors become more risk-averse; (ii) shocks to economic uncertainty become more pronounced; (iii) periods of high economic uncertainty becomes longer lasting. To the extent that investors' risk aversion has experienced an adverse shock (i.e., gone up), the MRP must have increased. Furthermore, perception of more severe

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[38] *Ibid*..

[39] C-J. Kim, J.C. Morley and C.R. Nelson (2004), "Is There a Positive Relationship Between Stock Market Volatility and the Equity Premium," *Journal of Money, Credit and Banking*, Vol. 36.

[40] *Ibid*. p. 357. The authors rely on a statistical (Markov-switching) model of the ARCH type and data for the period 1926 to 2000 for their analysis.

[41] Bansal, R., and A. Yaron (2004), "Risks for the Long Run: A Potential Resolution of Asset Pricing Puzzles", *Journal of Finance*, Vol. 59 (4): 1481-1509.

shocks to economic uncertainty and slower decay of higher uncertainty periods are likely to cause the MRP to remain higher even in the absence of any specific shock to the risk aversion parameter.

Finally, survey evidence such as that provided in the WCTL filing generally find the MRP is somewhat lower than the historical arithmetic average although the range of estimates vary widely. For example, the Fernandez et al paper cited by the WCTL finds that the average MRP used by respondents in the U.S. is 5.7%, which is well above the 4.7% suggested by the WCTL and its experts.[42]

There are several methodological problems with surveys. First, it is not clear that the survey captures a representative cross-section of the academics or practitioners who estimate the cost of capital. Second, it is not clear what MRP the respondents have in mind: (a) is the MRP over a short-term or a long-term risk-free rate, (b) are the respondents considering today's economic conditions or expected conditions, and (c) how far into the future are the respondents forecasting the MRP (e.g., for the next month, year, or decade)? Without knowing the answer to these questions, it is difficult to know what the reported MRP measures. Furthermore, even if the average of the reported risk-free rate is consistent with a 10-year government bond yield as indicated by Professor Triantis,[43] it is not clear that this is the benchmark used by the respondents. Third, the surveys cannot be replicated and/or audited by an outsider. These three factors mean that surveys are not transparent. Therefore, surveys are to be used with

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[42] Pablo Fernandez, Javier Aguirreamalloa, and Pablo Linares, "Market Risk Premium and Risk Free Rate Used for 51 Countries in 2013: A Survey with 6.237 Answers," Working paper dated June 26, 2013.

[43] Triantis Statement, p. 14.

caution and the Board **cannot**, as suggested by the WCTL, "rely credibl[y] on surveys of the MRP values."[44]

Having looked at the historical, forecasted, and survey evidence on the MRP, I concur with Professors Ross, Westerfield, and Jaffe that an estimate based on the historical MRP is reasonable.[45]

2. Response to Issues Raised

The WCTL and its experts suggest that the Board relies on 50-years of data to determine the MRP because data going back to 1926 does not "reflect current investor expectations" and is not the current norm.[46] Further, the WCTL and its experts suggest that an MRP above 5% is unreasonable.[47]

Clearly, current investor expectations are not reflected in 50 years of data but rather in today's markets, so a better measure of the *current* investor expectation would be the market forecasted MRP (using Bloomberg or Value Line data) illustrated in Table 2 (above at p. 17). In addition, if it is not the norm to determine the MRP using historical data back to 1926, then why are MBA textbooks such as Ross, Westerfield, and Jaffe (2013), investment banking publications, and cost of capital experts continuing to rely on this data? The reasons are eloquently stated by Professor Morin: "to avoid data mining"[48] and by Ciacchino and Lesser: "since history tends to repeat itself, for good or

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[44] WCTL, p. 7.

[45] See, Ross, Westerfield and Jaffe 2013, p. 326.

[46] WCTL, p. 7 and p. 31.

[47] WCTL, p. 37, Levine Statement, p. 13, and Triantis Statement, p. 12-15.

[48] Roger A. Morin, "*New Regulatory Finance*," Public Utilities Report, Inc., 2006, p. 156.

ill, arbitrary exclusions of certain historic years 'because they can never occur again' strikes us as either naïve, or an exercise in wishful thinking."[49] I concur.

As discussed above, the textbook of Professors Ross, Westerfield and Jaffe uses as long a period as possible (1900 to 2013) to determine the MRP using the commercial data put together by Credit Suisse.[50] The text by Professors Ross, Westerfield and Jaffe is widely used in MBA programs and while the Morningstar / Ibbotson is a commonly used source for the MRP in the U.S., the data by Credit Suisse is commonly used in Europe. It is also common among regulatory cost of capital experts in the U.S. to base the MRP on the historical average MRP back to 1926; often using the Morningstar / Ibbotson data. For example, Professor Morin writes in his textbook that

> to avoid data mining, a reasonable solution is to use the entire period for which reliable data is available.[51]

This approach is echoed by many practitioners who estimate the cost of equity for regulated entities.[52] Put differently, there are certainly many applications that use all

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[49] Leonardo R. Giacchino and Jonathan A. Lesser, "*Principles of Utility Corporate Finance*," Public Utilities Report, Inc., 2011, p. 236.

[50] Ross, Westerfield and Jaffe 2013, p. 326 and "*Credit Suisse Global Investment Return Sourcebook 2014*."

[51] Roger A. Morin, "*New Regulatory Finance*," Public Utilities Report, Inc., 2006, p. 156.

[52] See, for example, Federal Communication Commission, "Prescribing the Authorized Rate of Return: Analysis of Methods for Establishing Just and Reasonable Rates for Local Exchange Carriers," Wireline Competition Bureau, Staff Report, May 16, 2013 (FCC Staff Report), Direct Testimony and Exhibits of Roger A. Morin in the matter of the application of ALLETE d/b/a Minnesota Power in Docket E-015/GR-08-415, May 2008 (Morin Minnesota Testimony) p. 40; Direct Testimony of Paul R. Moul on behalf of Wisconsin Public Service Corporation in Application for Authority to Adjust Electric and Natural Gas Rates, April 1, 2014 (Moul WPS Testimony) p. 36; Direct testimony of Paul R. Moul for CLECO, July 14, 2008 (Moul Cleco

available data to determine the MRP and there is no specific reason for restricting the data to 50 years as opposed to 60, 40 or something else. Therefore, the use historical data back to 1926 continues to be the norm in many settings and I find that the reliance on all available data to be a reasonable approach. I also note that going back to the post-WWII period or all the way back to 1900 does not change the results substantially (See Table 1). It is noteworthy that **only if** the MRP is measured over a 50-year period does it approach the 5% that the WCTL argues is an upper bound; using a longer or shorter period leads to a substantially higher MRP.

3. Conclusions on the MRP

As Professor Triantis acknowledges:

> The standard textbook method to estimate the MRP is to measure the historical difference between returns on an equity index and the returns on a risk-free benchmark.[53]

I concur and further note that, at 6.96%, the historical average MRP estimated over the period 1926 to 2013 is between the survey results of 4-6% and the forward-looking market-based MRP estimates of 7–10%. Therefore, the historical average MRP is not only objective and easy to measure, but also represents a compromise between the survey results / early academic literature and the forecasted results. In addition, I note

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Continued from previous page

Testimony), p. 60-61; Direct Testimony of James H. Vander Weide on behalf of MidAmerican Energy Company, June 25, 2014 (Vander Weide MidAmerican Testimony), p. 36-37. Many of these experts also relied on a forward-looking MRP.

[53] Triantis Statement, p. 9.

that it is actually quite common for textbooks, commercial data providers as well as cost of capital experts to rely on the historical average back to 1926.[54]

C. BETA

1. Magnitude of Beta

The Arkansas Electric Cooperative Corporation (AECC) suggests that the Board

> could consider setting beta at the "0.8 range" estimate originally provided to the Board by AAR's finance experts, or some other fixed estimate lower than 1 that is reasonably reflective of the unique stability of a revenue adequate rail industry relative to the market.[55]

It appears that the AECC uses the .8 railroad industry beta cited by Professor Myers at the hearing on December 4, 2007 in the Ex. Parte 664 proceeding.[56] However, the AECC misrepresents Professor Myers statement, which was a summary of the **empirical results from estimating the railroad beta as of 2007**. Professor Myers made no statements about the plausible railroad beta in future years. Professor Myers goes on to

> recommend the Commission consider weekly betas, betas weighed based on weekly rates of return here, as well as monthly.[57]

The attached Exhibit BV-1 updates the so-called rolling betas that Professor Myers presented to the Board in 2007. The betas are rolling in the sense that each point

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[54] See e.g., footnote 532 and Ross, Westerfield and Jaffe 2013.

[55] AECC Comments Regarding Cost-of-Capital Methodology Issues, p. 7.

[56] Ex Part 664, Transcript from December 4, 2007 Hearing, pp. 39-40.

[57] Ex Part 664, Transcript from December 4, 2007 Hearing, p. 40.

on the Exhibit BV-1 p. 1 shows the beta you would get looking at the weekly returns over the five years ending on each particular week. Clearly, the railroad beta has increased from about .8 in late 2007 to about 1.3 in 2013-14. Page 2 of the same exhibit presents the same data using monthly returns.

I note that the Board has relied on weekly returns since 2008 using market-value weighted data, which is the data shown in Exhibit BV-1. This continues to be a reasonable and commonly used estimation method.

2. Beta Adjustments

The WCTL and its experts, Dr. Levine and Professor Triantis, argue that the Board should adopt the Blume adjustment for the relied-upon betas and suggest that the Board use Blume-adjusted betas from Value Line or Bloomberg.[58] The WCTL also notes that other adjustments are sometimes applied, such as the Vasicek adjustment, which weighs the raw beta and what is believed to be the true beta according to the relative reliability (e.g., standard error) of the estimates.[59] Before discussing the pros and cons of either adjustment, it is important to understand what the adjustments are.

Both Blume (1971)[60] and Vasicek (1973)[61] formulate their adjustments with the goal of making the empirical *measurements* of a particular stock's beta more likely to accurately estimate the "true beta" reflecting that stock's systematic risk in the context

[58] WCTL, p. 7. 40-43; Levine Statement, p. 10-12, and Triantis Statement, p. 8-9 and, p. 22-24.

[59] See, for example, Morningstar, "*Ibbotson SBBI 2013 Valuation Yearbook*," p. 78 for an exposition.

[60] M.E. Blume, "On the Assessment of Risk," *Journal of Finance* 26, 1971, pp. 1-10.

[61] O.A. Vasicek, "A Note on Using Cross-Sectional Information in Bayesian Estimation of Security Betas," *Journal of Finance* 28, 1973, pp. 1233-1239.

of the CAPM. When a company's beta is estimated using historical market data, there is some sampling error caused by "noise" in the data and estimation process. The noise is somewhat reduced when a portfolio is used as is the case for the railroad beta. The market-weighted average beta for all assets is by definition 1.0, and repeated measurements indicate that the betas for **individual stocks** are clustered between 0.5 and 1.5. Given this information about the distribution of true betas across the entire market, an extremely high (e.g., 1.8) or low (e.g., 0.2) estimate of beta is more likely to reflect measurement (sampling) error than an accurate reflection of the security's systematic risk. I note that neither the railroad portfolio nor individual railroad betas are in the extreme range.

The Blume adjustment has an additional explicit goal of accounting for the empirical observation (made by Blume in his 1971 paper) that the beta measure for an individual stock tends to move toward the market-weighted average of 1.0 over time. Blume therefore performed a linear regression analysis comparing betas measured in one time period to betas measured in a subsequent time period.[62] He found that the first period betas were not the best predictor of the subsequent period betas. Rather his 1970s analysis indicated that second-period betas were better predicted by taking a weighted average of the first-period beta estimates and the market-average beta of 1.0. The estimated coefficients of his regression equations suggested a weight of 2/3 on the first-period beta estimate and 1/3 on the market beta of 1.0. This regression analysis

[62] M.E. Blume, "On the Assessment of Risk," *Journal of Finance* 26, 1971, pp. 1-10.

was the basis for calculating a "Blume adjusted" beta from the "raw" beta estimated based on historical market data:[63]

$$\beta_{adj}^{Blume} = \frac{1}{3} \cdot 1 + \frac{2}{3}\beta_{raw}$$

Vasicek's proposed adjustment, by contrast, focuses only on the issue of sampling error. In his 1973 paper on the topic,[64] Vasicek suggested adjusting an **individual company's** estimated beta based on its sampling error (variance), relative to the variance in estimates based on prior knowledge/beliefs about the distribution of betas in the market. The Vasicek-adjusted beta for a company is also a weighted average—this one combining the "raw" beta estimate with an estimate based on the assumed prior distribution.[65] The weights are proportional to the variances of the raw beta estimate and prior beta, such that the estimate with smaller variance (i.e., the one that is estimated with less "noise", and is thus considered more reliable) receives a higher weight:

$$\beta_{adjusted}^{Vasicek} = \frac{var(\beta_{prior})}{var(\beta_{prior}) + var(\beta_{raw})}\beta_{raw} + \left(1 - \frac{var(\beta_{prior})}{var(\beta_{prior}) + var(\beta_{raw})}\right)\beta_{prior}$$

[63] Note that while the "2/3" and "1/3" weightings have been widely adopted as intrinsic to the Blume adjustment, they are really an artifact of Blume's estimates using NYSE data from the 1930s through the 1960s.

[64] O.A. Vasicek, "A Note on Using Cross-Sectional Information in Bayesian Estimation of Security Betas," *Journal of Finance* 28, 1973, pp. 1233-1239.

[65] The term "prior distribution" refers to a concept in Bayesian statistics, in which statistical inference proceeds by updating an initial set of probability estimates—the "prior"—about a quantity to be estimated based on new information available in the data.

It is important to note that the assumed "prior" in a Vasicek adjustment *need not* be the market as a whole. Vasicek (1973, p 1237) suggested that the distribution of betas within a particular industry may be a better prior in some cases:

> In some cases, more can be known about a stock than that it comes from a certain population. … Thus, if a utility stock is considered, and it is known from previous measurement that betas of utilities are centered around 0.8 with a dispersion of 0.3, the [raw beta] estimate b is adjusted toward 0.8…

Under this interpretation,[66] the raw beta estimate for a particular company would be adjusted not necessarily toward 1.0, but rather toward a representative beta for companies in the same industry. This is particularly noteworthy in this proceeding, since the STB estimates beta for a value-weighted portfolio designed to represent the railroad industry; in this context, a Vasicek adjustment with an industry prior that uses the Board's criteria for inclusion in the composite index would not adjust the raw beta at all!

The Blume adjustment, by contrast, always adjusts raw betas towards 1, in accordance with Blume's empirical observations. However, as Professor Martin Lally points out in his 1998 paper weighing the relative merits of the Blume and Vasicek adjustments,

> Blume's explanation for the observed tendency of true betas to regress towards one invites certain doubts. Blume (1973) attributes the regression to the fact that "…new projects taken on by firms may tend to have less extreme risk characteristics than existing

[66] For an extensive discussion of the Blume and Vasicek adjustments, including a discussion of how the "industry prior" interpretation for Vasicek is widespread in the financial literature, see M. Lally, "An examination of Blume and Vasicek betas," *The Financial Review* 33, 1998, pp. 183-198).

> projects."' However there is no reason to believe that this is an immutable law. If it were, all betas would eventually become one! [67]

Lally's critique highlights the fact that the tendency of betas to regress towards 1.0 on a market-wide basis is an empirical artifact; there is no theoretical explanation for why any individual company's systematic risk should become more "average" over time.

As a result, if the railroad industry is restricted to the portfolio of railroads that qualify for inclusion in the composite railroad index,[68] the Vasicek adjusted beta and the raw beta are identical. However, if the railroad industry is expanded to include additional railroads from Value Line Investment Survey (Canadian National, Canadian Pacific, and Genesee & Wyoming),[69] it is possible to illustrate the adjustment. I emphasize that it is an illustration as the additional entities do not meet the Board's criteria for inclusion. I also note that while the larger industry has a slightly lower beta, it also has a higher growth rate, so an inclusion in the CAPM but not the MSDCF would be selective and inappropriate.

The effect of adjusting the railroad portfolio beta towards the beta of a larger railroad industry using Vasicek's method is illustrated in Figure 1.

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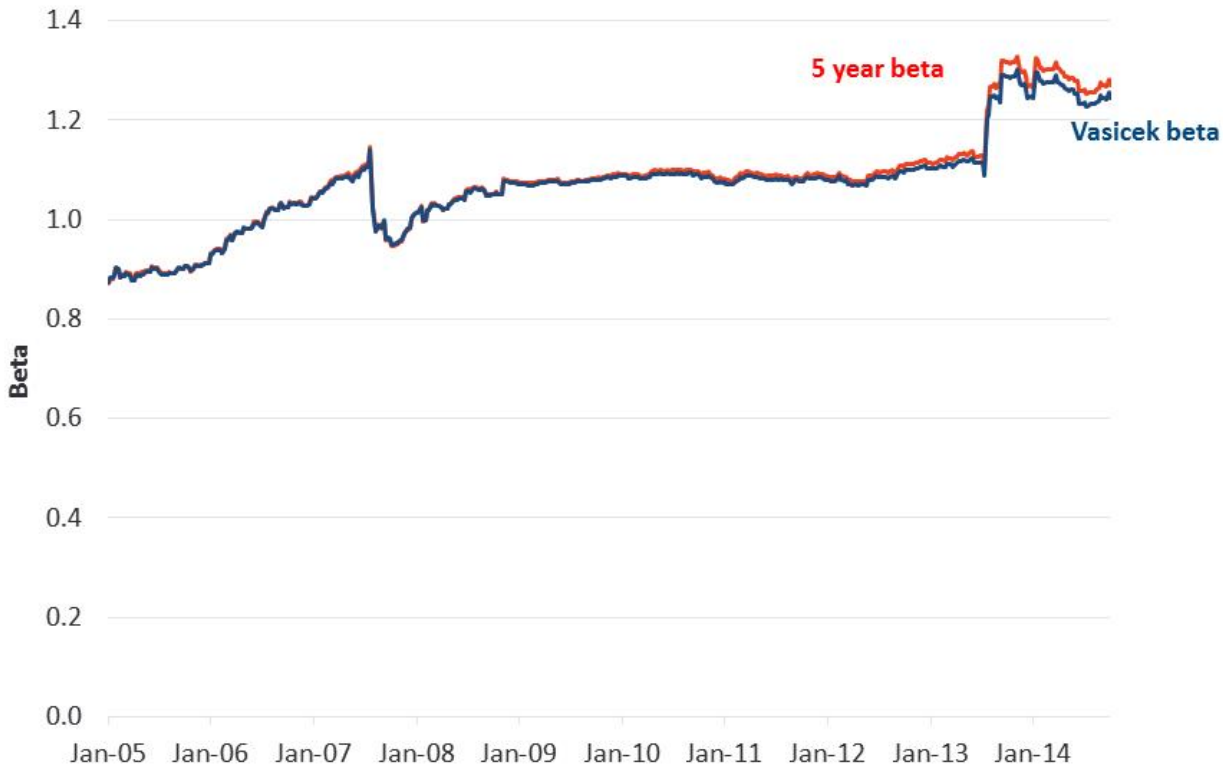
[67] *Ibid.,* p. 189.

[68] Class I carriers that (1) are listed on either the New York or American Stock Exchange, (2) paid dividends throughout the year, (3) had rail assets greater than 50% of their total assets, and (4) had a debt rating of at least BBB (Standard & Poor's) and BAA (Moody's). See Surface Transportation Board, Decision Docket No. EP 558 (Sub-No. 17), Railroad Cost of Capital – 2013, July 31, 2014, footnote 15.

[69] Other entities listed in Value Line's railroad sector (American Railcar, GATX Corp., Greenbrier, and Trinity Inds.) appear to be manufacturing or leasing entities rather than operators of railroads.

Figure 1: Railroad Composite Beta and Vasicek Adjusted Railroad Beta (5-Year Weekly Beta)



As noted in my co-authored report for the CTA, the Vasicek adjustment uses information tailored to the data at hand while the Blume adjustment does not. As a result, the Vasicek adjustment is theoretically preferable but also more complex.[70] I also note that the report discussed available adjustment methodologies as well as their strengths and weaknesses but did not recommend a specific methodology.[71]

[70] Brattle CTA Report, pp. 40-42.

[71] For an extensive discussion of the Blume and Vasicek adjustments, see M. Lally, "An examination of Blume and Vasicek betas," *The Financial Review* 33, 1998, pp. 183-198).

Further, while Value Line report Blume adjusted betas, as stated by Dr. Levine and Professor Triantis,[72] Bloomberg provides both raw and Blume-adjusted betas, so both adjusted and raw betas are commercially available. I also note that the Australian Energy Regulator examined both the Blume and Vasicek adjustment and rejected both.[73]

Finally, while Professor Triantis claims that a study by the Association of Financial Professionals (AFP Study)[74] "confirms the widespread use of the Blume adjustment"[75] he fails to note that the publication finds that of all respondents, the use of adjusted versus unadjusted betas is 50-50.[76]

The Board has chosen to adopt a mainstream form of the CAPM model. Consistency and a balanced approach are important, so betas should not be adjusted for the purpose of lowering the cost of equity. Any modifications to the CAPM as currently implemented would need to consider the downward pressure on the risk-free rate from monetary policy and all evidence on the market risk premium rather than unilaterally complicate the beta estimates. As the methodology is used for a period of time, it is important to consider its performance over time; *e.g.*, before and after the financial crisis. Given that the Board relies on the portfolio beta, which is statistically more robust than company-specific betas, the econometrically-grounded Vasicek adjustment

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[72] WCTL, p. 7; Levine Statement, p. 11, and Triantis Statement, p. 22.

[73] *Australian Energy Regulator*, "Better Regulation: Equity Beta Issues Paper", October 2013, p. 25.

[74] *Association of Financial Professionals*, "2013 AFP Estimating and Applying Cost of Capital: Report of Survey Results." Attached to Triantis Statement as Exhibit 4

[75] Triantis Statement, p. 9.

[76] AFP Study, p. 9.

to beta is not very impactful, as it merely adjusts the beta towards that of the industry. In summary, it would not be appropriate to focus exclusively on beta adjustments or on a specific point in time. Rather, the evaluation of the CAPM implementation should consider both potential upward and downward biases. For betas in particular, it would be important to fully explore the factors that may have impacted the systematic risks of the industry before changing the methodology.

3. Beta and Market Power

The AECC claims that the "CAPM incorrectly interprets an increase in the exercise of rail market power as increased risk"[77] while the WCTL suggest using adjustments to "address the substantial possibility that the high beta for at least 2013 reflects the exercise of market power by the railroads."[78]

Neither the AECC nor the WCTL and its experts cite any academic support for this claim. Instead they criticize a 1994 article on the subject[79] that was provided in prior hearings. The WCTL categorizes the article as "dated,"[80] while the AECC argues that its empirical findings on the relationship between market power and beta were equivocal.[81] Thus, the totality of academic "evidence" provided by the AECC and WCTL for the proposition that beta increases with market power is that a single paper

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[77] AECC, p. 2.

[78] WCTL p. 7, 42-43, and 45.

[79] Paul S. Peyser, "Beta, Market Power, and Wage Uncertainty," *Journal of Industrial Economics* 217, June 1994.

[80] WCTL, p. 43. See also AECC, Appendix A p. 6, note 5.

[81] AECC, Appendix A p. 6, note 5.

from 1994 fails to conclusively demonstrate a relationship between beta and market power.

In place of the academic citations or empirical evidence, the AECC cites its own statements from previous proceedings before the Board, in which it argued that if the exercise of market power were to lead to higher stock returns for the railroad industry, this could drive an increase in betas.[82] This logic is flawed, indicating a fundamental misunderstanding of how beta reflects systematic risk; namely by measuring how company (or portfolio) returns move *relative* to returns on the market. The *level* of returns is immaterial. For an entity's measured beta to increase, its returns would have to increase *more* when the market increases *and decrease more* when the market decreases. If returns were to reach a stable elevated level due to an exercise of market power (or for any other reason), they might reasonably be expected to vary *less* with the market's ups and downs. This would *decrease beta*. Thus, the AECC's claims about the relationship between market power and beta rests on the flawed argument that higher levels of returns would necessarily lead to higher betas.

To the best of my knowledge, there is no literature that finds a positive relationship between market power and systematic risk (beta). The literature on the relationship between beta and market power found that market power reduced beta or that it the relationship could not be measured – **not** that market power increased beta. As a matter of theory, I would expect that a firm that has higher market power and therefore better controls its market would—all else equal—have a lower cost of capital, although it may be impossible to measure the magnitude of the effect. As I discuss

[82] AECC, Appendix A p. 5, note 3.

below, there are many academic studies confirming that systematic risk is decreased by the exercise of market power. But I have yet to find any academic paper that finds a positive relationship between beta and market power.

To elaborate, Moyer and Chatfield (1983) concluded that "industry concentration ratios and market risk (beta) are strongly related. Firms in highly concentrated industries tend to be associated with low levels of systematic risk and vice versa, …"[83] A similar result is found in Sullivan (1978)[84] and confirmed in Lee, Chen & Liaw (1995),[85] who use theoretical model to show that "the firm's systematic risk is negatively correlated with market power in its product market."[86]

While there are papers like the Peyser 1994 paper that found an inconclusive relationship between beta and the market power of a firm or industry,[87] I have not been able to find an academic paper that shows a positive relationship and neither the AECC nor the WCTL or its experts have provided a study that contradicts the existing literature. Therefore, the increase in the industry's beta estimate is more likely to have been caused by other factors such as the financial crisis of 2008 leading the 2008-12 betas to drop, the large capital expenditures in the industry, or the composition of the industry's traffic mix.

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[83] R. Charles Moyer and Robert Chatfield, "Market Power and Systematic Risk," *Journal of Economics and Business* 35, 1983, p. 128-129.

[84] Timothy G. Sullivan, "The Cost of Capital and the Market Power of Firms," *The Review of Economics and Statistics* 60, 1978, pp. 209-217.

[85] This paper is essentially an extension of the 1994 Peyser paper cited by the WCTL.

[86] Cheng-Few Lee, K.C. Chen and K. Thomas Liaw, "Systematic Risk, Wage Rates, and Factor Substitution," *Journal of Economics and Business* 47, 1995, p. 277.

[87] See, for example, Kit Pong Wong, "Cournot Oligopoly and Systematic Risk," *Journal of Economics and Business* 47, 1995 and the Peyser 1994 paper cited by the WCTL.

First, Figure 1 and Exhibit BV-1 attached to this Reply Statement shows that the railroad betas dropped at the start of the financial crisis and then recovered in 2013, when the last data pertaining to 2008 were excluded from the 5-year estimation period. Because beta is measured against the market, the beta of an individual firm or industry is effected by market developments and the composition of the market. Thus, a change could be caused by changes in the industry or by changes in the market. As Figure 1 above shows, the railroad beta dropped substantially at the start of the financial crisis in 2008 and then recovered once the data pertaining to the start of the crisis dropped out of the estimation. *I.e.*, it appears that the railroad beta in 2013 simply went back to its pre-crisis trend. This explains the increase in beta for 2013.

Second, regarding the impact of the increasing capital expenditure, Professors Berk and DeMarzo of Stanford University comment on the effect of increasing fixed costs to variable costs:

> Another factor that can affect the market risk of a project is its degree of operating leverage, which is the relative proportion of fixed versus variable cost.[88]

Professor Morin states:

> Higher margins, due to increased fixed cost or operating leverage, magnify the effect of demand risk on beta.[89]

Similarly, Professors Ross, Westerfield, and Jaffe, state:

> Operating leverage magnifies the effect of the cyclicality of a firm's revenues on beta. That is, a firm with a given sales

[88] Jonathan Berk and Peter DeMarzo, "*Corporate Finance: The Core*," 3rd edition, 2014, p. 420.

[89] Roger A. Morin, "*New Regulatory Finance*", 2006, p. 238.

> cyclicality will increase its beta if fixed costs replace variable cost in its production process.[90]

Thus, to the degree that capital expenditures increase operating leverage, the cost of capital increases. Therefore, it is plausible that the large capital expenditures by the railroad industry in recent years have increased the relative share of fixed costs in the railroad industry's costs.

Third, the beta of the railroad industry depends on systematic risk of the railroad assets and the variability of the industry's returns relative to the market. Therefore, if the composition of the railroad industry's assets or the return that is generated from these assets has changed, the systematic risk has changed. So since 2007 there has been a reduction in the amount of coal, transportation equipment and mixed shipments that the Class I railroads carry, while there has been an increase in chemicals, crude and food products,[91] there may have been a shift in the risk profile of the industry in recent years.

In summary, there is no evidence that the estimated railroad betas have increased due to "market power." It is much more plausible that railroad betas have simply recovered from the impact of the financial crisis. It is also possible that they have increased due to other factors such as capital expansions and / or because of a change in the risk of the railroads' cash flow caused by changing traffic mix.

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[90] Stephen A. Ross, Randolph W. Westerfield, and Jeffrey Jaffe, "*Corporate Finance*," 10th edition, 2013, p. 410.

[91] AAR, "Railroad 10-year trends 2003-2012," pp. 45-46.

D. RISK-FREE RATE AND MRP

The Levine Statement submitted in support of WCTL looks at risk-free rates of varying maturity and states that "the STB employs a relatively high risk-free rate in its CAPM calculation. … Thus, there has been no downward pull on the CAPM results since 2008, emanating from the risk-free, interest rate component."[92] In its Opening Comments, the WTCL argues similarly that "… the AFP 2013 survey indicates that the 5% (or lower) MRP is typically utilized in conjunction with a [risk-free rate] that is lower than the 20-year U.S. Treasury. … Consequently, the total market return expected by the respondents is even further below the return indicated by the Board's CAPM."[93]

This commentary is both confusing and misguided. When Dr. Levine refers to a lack of "downward pull" from the risk-free rate, I believe he means to argue that using a lower risk-free rate would necessarily decrease the CAPM results. The WCTL seems to be making the same claim. However, according to fundamental finance principles, it is incorrect to consider the direct effects of a lower risk-free rate on the CAPM without also considering its impact on the MRP. The MRP must be measured over a certain risk-free rate, so if the maturity of the risk-free rate is reduced, the MRP needs to be measured over that shorter maturity risk-free rate. Because it usually is more costly to borrow long term than short term (the yield curve is increasing), the MRP measured over 10-year Treasury bonds will be higher than the MRP measured over 20-year Treasury bonds. Thus, contrary to the arguments of the WCTL and Dr. Levine, there would two effects on the CAPM from using a shorter-maturity instrument for the risk-

[92] Levine Statement p. 10-11.

[93] WCTL, p. 36.

free rate: a direct decrease due to the lower interest rate *and* an increase due to using a higher MRP.

The Ibbotson MRP relied upon by the Board is measured over long-term government bonds, which Ibbotson defines as bonds having a "maturity near 20 years."[94] Therefore, the Board's use of a 20-year risk-free rate and the Ibbotson long-term MRP is consistent.[95]

IV. OTHER RESPONSES

A. THE COST OF CAPITAL DEPENDS ON ITS USE, NOT ITS OWNER

The Levine Statement on p. 5 states that "the actual cost of capital to the BNSF is the cost of capital to BH [Berkshire Hathaway]." The WCTL cites this statement to support its claim that "[e]xcluding BNSF…inflates the beta of the remaining railroads. This distortion is particularly significant in the case of BNSF itself because BNSF's parent has a very low beta."[96] However, the notion that BNSF's cost of capital is equal to that of its corporate parent is a fundamental misconception. Standard financial economics hold that the cost of capital depends on the risk of the underlying assets and **not** on the owner of the asset. As noted by Professors Ross, Westerfield and Jaffe,

> If a corporation has a number of divisions, each in a different industry, it would be a mistake to assign the same discount rate to each division.[97]

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[94] Morningstar, "*Ibbotson SBBI 2013 Valuation Yearbook*," p. 221.

[95] For additional discussion of this point, see Exhibit BV-2, pp. 22-23.

[96] WCTL, p 42.

[97] Stephen A. Ross, Randolph W. Westerfield, and Jeffrey Jaffe, "*Corporate Finance*," 10th Edition, 2013 (Ross, Westerfield & Jaffe 2013), p. 413.

Professors Brealey, Myers and Allen agree

> The opportunity cost of capital depends on the use to which that capital is put…. The true cost of capital depends on project risk, not on the company undertaking the project.[98]

Thus, using Berkshire Hathaway's beta as a proxy for the beta of BNSF would violate basic financial economics principles.

B. USING MORE THAN ONE METHOD TO ESTIMATE THE COST OF EQUITY IS COMMON AND BEST PRACTICE FOR REGULATORY PURPOSES.

WCTL relies on the Triantis Statement to argue that the CAPM is "vastly preferred to other COE approaches."[99] Yet, the vast majority of U.S. state regulatory commissions look to more than one method when determining utilities' cost of equity and several state tax authorities combine the CAPM and a version of the DCF to determine ad valorem taxes. Also, the Federal Energy Regulatory Commission (FERC) relies exclusively on a version of the discounted cash flow model to estimate the COE. Thus, there is ample precedent for using more than one method among regulatory entities and expert witnesses often present evidence on multiple methods. As expressed by Professor Morin, in a utility rate case in response to the question

> Does the financial literature support the use of more than a single method to determine return on equity?

Dr. Morin replies:

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[98] Richard A. Brealey, Stewart C. Myers, and Franklin Allen, "*Principles of Corporate Finance*," 11th Edition, 2014 (Brealey, Myers & Allen 2014), p. 219-220.

[99] WCTL, p. 20. See also Triantis Statement, p. 5-6.

> Yes. The authoritative financial literature strongly supports the use of multiple methods.[100]

And he explains:

> Each methodology has its own way of examining investor behavior, its own premises, and its own set of simplifications of reality. Investors do not necessarily subscribe to any one method, nor does the stock price reflect the application of any one single method by the price-setting investor. Absent any hard evidence as to which method outperforms the other, all relevant evidence should be used, without discounting the value of any results, in order to minimize judgmental error, measurement error, and conceptual infirmities.[101]

Similarly, many other cost of capital experts recommend using more than one method. [102] A recent report by the staff of the Federal Communication Commission also endorsed the use of more than one method including the CAPM and a DCF model.[103] I wholeheartedly agree with Professor Morin and other cost of capital experts that it is important to use more than one method as discussed in my Verified Statement.[104]

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[100] Morin Minnesota Testimony, page 22.

[101] *Ibid.*, page 21 – 22.

[102] *Ibid.*, page 22. Some other recent examples of the reliance on multiple models for the purpose of determining the cost of equity for regulated companies are found in the Direct Testimony of Paul R. Moul on behalf of Wisconsin Public Service Corporation in Application for Authority to Adjust Electric and Natural Gas Rates, April 1, 2014 (Moul WPS Testimony) p. 5; Direct testimony of Paul R. Moul for CLECO, July 14, 2008 (Moul Cleco Testimony), p. 5; Direct Testimony of Robert B. Hevert on behalf of Union Electric Company, Ameren Missouri, July 3, 2014 (Hevert Ameren Testimony), p. 7; Direct Testimony of Roger A. Morin on behalf of Minnesota Power, May 2, 2008 (Morin Minnesota Power Testimony), p. ; Direct Testimony of James H. Vander Weide on behalf of MidAmerican Energy Company, June 25, 2014 (Vander Weide MidAmerican Testimony).

[103] FCC Staff Report at 7147-7148.

[104] Villadsen Statement p. 4-8 and sources referenced.

C. BNSF'S FAIRNESS OPINION

In its Opening Comments, the WCTL refers to certain cost of capital estimates used in valuation analyses performed by Goldman Sachs and Evercore as part of the SEC Form S-4 for the acquisition of BNSF by Berkshire Hathaway. However, in comparing the Board's 2009 overall (or "composite") cost of capital to the weighted average cost of capital "benchmarks" calculated by Goldman Sachs and Evercore, the WCTL makes a fundamental mischaracterization, resulting in a specious comparison.

The source of the confusion lies in the different goals (and corresponding differences in methodology) of the cost of capital calculations performed by the Board and those performed by BNSF's financial advisors. The 10.43% Composite Cost-of-Capital computed by the Board for 2009 represents a required return on assets independent of financing—what corporate finance textbooks refer to as an "unlevered cost of capital"[105]—that is calculated as a weighted average of the *pre-tax* cost of debt and the *after-tax* cost of equity.[106]

(1) $r_U = (\%E) \bullet r_E + (\%D) \bullet r_D$

In contrast, when financial analysts perform valuation analyses using the Discounted Cash Flow (DCF) method, they typically employ an implicitly *after-tax*

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[105] See, for example, Jonathan Berk and Peter DeMarzo, *Corporate Finance*, 2nd ed. (Prentice Hall, 2011), p. 391 and 398.

[106] Surface Transportation Board Corrected Decision, Docket No. EP 558 (Sub-No. 13) Railroad Cost of Capital—2009, page 12. Note that the reference to "… the 2009 composite after-tax cost of capital" means that the cost of *equity* was computed based on the *levered, after-tax* cash flows of the railroads (in the DCF method) and the *levered* (implicitly after-tax) portfolio beta (in the CAPM). The STB's Composite Cost of Capital incorporates the after-tax cost of equity, but uses the *pre-tax* cost of debt.

version of the weighted average cost of capital (WACC). Indeed, when valuing a firm as the sum of its discounted *unlevered* free cash flows,[107] corporate finance theory *requires* that the discount rate account for the tax deductibility of interest payments. In other words, when discounting unlevered free cash flows, the correct discount rate for this kind of valuation analysis is the *after-tax* WACC.[108]

(2) $r_{WACC} = (\%E) \bullet r_E + (\%D) \bullet r_D(1 - \tau_c)$

Assuming Goldman Sachs and Evercore used standard finance theory, the "weighted average cost of capital" in BNSF's Fairness Opinion must refer to the *after-tax* WACC (r_{WACC}), not the unlevered cost of capital (r_U). The description of Evercore's DCF analysis confirms this. Evercore explicitly states that it is discounting "projected unlevered free cash flows" and a terminal value calculated as a multiple of BNSF's "2014 projected EBITDA" (i.e., earnings *before interest, taxes,* depreciation and amortization) and thus must use a weighted average cost of capital that accounts for the tax deductibility of interest.

> Evercore calculated implied per share equity reference ranges for BNSF … based on the sum of the (i) implied present values, using discount rates ranging from 8.0% to 10.0% derived by taking into consideration, among other

---

[107] *Unlevered free cash flows* (also called *free cash flows to capital* or simply *free cash flows*) represent the cash flows that accrue to all the owners of a firm—both the equity holders and debt holders. They are *unlevered* in the sense that they neither deduct interest payments, nor account for the tax deductibility of those interest payments—they are the cash flows to capital that would occur if the firm had no debt and were 100% financed by equity. When performing DCF valuation analyses, analysts forecast unlevered free cash flows and then use a discount rate—the after tax WACC—that accounts for the actual financing and debt tax benefits of the project.

[108] Jonathan Berk and Peter DeMarzo, *Corporate Finance*, 2nd ed. (Prentice Hall, 2011), p. 596. See also Richard A. Brealey, Stewart C. Myers, Franklin Allen, *Principles of Corporate Finance, 10th ed.* (McGraw-Hill, 2011), p. 433.

> things, a **weighted average cost of capital calculation**, of **BNSF's projected unlevered free cash flows** for calendar years 2010 through 2014 and (ii) implied present values, using discount rates ranging from 8.0% to 10.0%, of the **terminal value of BNSF's future cash flows** beyond calendar year 2014 calculated by applying a range of EBITDA terminal multiples of 6.75x to 8.25x derived from the selected peer companies as described in "Peer Group Trading Analysis" above to BNSF's calendar year **2014 projected EBITDA**.[109]

Goldman Sachs likewise must have performed its DCF analysis using the after-tax WACC. The description of that analysis in the SEC Form S-4 indicates that "Goldman Sachs … calculated the present value of BNSF's terminal value at December 31, 2014 by applying a range of **enterprise value/EBITDA multiples** of 5.5x to 9.5x to **BNSF's estimated 2014 EBITDA**."[110] EBITDA is a common proxy for unlevered free cash flows, in that it also ignores the tax deductibility of interest payments. By using EBITDA to calculate terminal value on an enterprise value (i.e., the value of the entire firm independent of its financing) basis, Goldman Sachs reveals that it was projecting cash flows as they would accrue to BNSF's assets if they were 100% equity financed. Therefore, correct application of fundamental corporate finance principles would again require the analysts to discount those cash flows using the after-tax WACC.

Therefore, the weighted average cost of capital ranges used by Goldman Sachs (7–11%) and Evercore (8-10%) are clearly after-tax WACC (r_{WACC}) numbers, while the

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[109] Amendment No. 2 to SEC Form S-4 ("SEC Form S-4"), filed December 23, 2009 by Berkshire Hathaway, Inc. with respect to its merger agreement with Burlington Northern Santa Fe Corporation, page 61. Emphasis added.

[110] SEC Form S-4, page 49. Emphasis added.

Board's Composite Cost of Capital for the same time period (10.43%) represents the unlevered cost of capital (r_U), calculated using the *pre-tax* cost of debt and the *after-tax* cost of equity. The two are not the same and the former cannot be used directly as valid benchmarks for the latter.

It is, however, a simple matter to restate either estimate to permit a valid comparison. Indeed, the two quantities differ only by the so-called interest tax shield, which is the cost of debt times the tax rate. The after-tax WACC is simply the unlevered cost of capital, less the interest tax shield weighted by the percentage of debt in the capital structure:

(3) $$r_{WACC} = r_U - (\%D) \bullet r_D \bullet \tau_C$$

Or $$r_U = r_{WACC} + (\%D) \bullet r_D \bullet \tau_C$$

To allow for an true "apples-to-apples" comparison between the STB's cost of capital calculation and the weighted average cost of capital ranges used in BNSF's Fairness Opinion, I have used the parameters from the 2009 STB Cost of Capital Decision, along with a representative marginal composite corporate tax rate of 40%, to determine the equivalent unlevered cost of capital corresponding with the discount rates used by Evercore and Goldman Sachs. Table 3 below shows the conversion of several after-tax WACC (r_{WACC}) estimates within the Goldman and Evercore ranges to unlevered cost of capital (r_U) estimates by adding back the weighted value of the interest tax shield.

For example, the "median" discount rate used in both Evercore's and Goldman Sachs's DCF valuation analyses was 9%. As explained above, this is an after-tax WACC (r_{WACC}), which implicitly accounts for the tax-deductibility of interest payments by

subtracting the weighted value interest tax shield from the unlevered cost of capital (r_U). Using the STB's 2009 cost of debt ($r_D = 5.72\%$) and a 40% tax rate, I calculate that the interest tax shield equates to a 2.92% return ($0.40 \bullet 5.72\% = 2.29\%$). Applying the STB's 2009 debt percentage in the railroad capital structure ($\%D = 29.10\%$), provides an estimate of 0.67% as the weighted value of the interest tax shield ($0.2910 \bullet 2.29\% = 0.67\%$). I add this value back to the 9% after-tax WACC to get an unlevered cost of capital of 9.67%. Table 3 below shows this calculation for the full range of Goldman Sachs's estimates. The resulting unlevered cost of capital values run from 7.7% to 11.7%. The 10.43% composite cost of capital for the railroad industry for 2009 is thus well within both the 7.7% to 11.7% range estimated by Goldman Sachs and the narrower 8.7% to 10.7% range estimated by Evercore.

Table 3 – Conversion of After-tax WACC Discount Rates to Unlevered Cost of Capital

Pre-tax Cost of Debt	[a]	5.72%
Tax Rate	[b]	40.00%
Interest Tax Shield	[c] = [a]*[b]	2.29%
Debt Percentage in Capital Structure	[d]	29.10%
Weighted Interest Tax Shield	[e] = [c]*[d]	**0.67%**

After-tax WACC Discount Rate		**Weighted Interest Tax Shield**	**Equivalent Unlevered Cost of Capital**
[1]		[2]	[3] = [1] + [2]
7.0%	[f]	0.67%	7.7%
8.0%	[g]	0.67%	8.7%
9.0%	[h]	0.67%	9.7%
10.0%	[i]	0.67%	10.7%
11.0%	[j]	0.67%	11.7%

Sources & Notes:

[a],[d]: Surface Transportation Board Corrected Decision, Docket No. 558 (Sub-No. 13) Railroad Cost of Capital--2009.

[b]: Representative composite state and federal corporate marginal tax rate

[f]-[j]: Range of discount rates used in Goldman Sachs's DCF valuation analysis per BNSF's Fairness Opinion.

[g]-[i]: Range of discount rates used in Evercore's DCF valuation analysis per BNSF's Fairness Opinion.

The WCTL's mischaracterization of the weighted average cost of capital ranges used by Goldman Sachs and Evercore (i.e., treating them as though they represented an unlevered cost of capital rather than a true after- tax weighted average cost of capital) renders its "benchmarking" of the Board's 10.43% Composite Cost of Capital invalid.

Furthermore, it is possible to estimate the cost of equity implied by a given after-tax WACC. Applying Equation 4 below, I have determined that--using the parameters from the Board's 2009 Cost of Capital Decision and a 40% representative corporate tax rate—the cost of equity consistent with an after-tax weighted average cost of capital of 10.0% is 12.7%. Similarly, the cost of equity implied by an 11.0% after-tax weighted average cost of capital is 14.1%. This means that that 12.37% Cost of Common Equity determined by the Board for 2009 (based on the CAPM and MSDCF models) is consistent with some of the "benchmark" cost of capital estimates considered by BNSF's financial advisors and reported in the SEC Form S-4 for Berkshire Hathaway's acquisition of BNSF.[111]

(4) $$r_E = \frac{r_{WACC} - (\%D) r_D (1 - \tau_c)}{\%E}$$

The WCTL's improper apples-to-oranges comparison also calls into question the its claims that "[t]he Board's MSDCF COE for 2009 … exceeded the highest COE value (12%) considered by either Goldman Sachs or Evercore" and that "[e]ven the CAPM [sic] COE of 11.39% falls substantially above the Goldman Sachs median COE of 10% and also exceeds the Evercore median COE of 11%."[112] As demonstrated above, the

[111] The SEC Form S-4 refers to certain "cost of equity calculations" performed by Evercore and Goldman Sachs in reference to other valuation methods. However, BNSF's financial advisors can be assumed to have considered cost of equity estimates consistent with the after-tax cost of capital discount rates they used for DCF valuation.

[112] WCTL, p. 12.

weighted average cost of capital ranges used by the financial advisors imply COE values as high as 14.1% (for Goldman Sachs) and 12.7% (for Evercore); furthermore, according to Equation 4, the "median" after-tax WACC used by both companies (9%), implies a COE of 11.3%. Thus the WCTL's claims about the relationship of the Board's 2009 cost of equity estimates to the values "considered by either Goldman Sachs or Evercore" are exaggerated at best.

Finally, it is worth noting that these claims are accompanied by a thoroughly misleading statement, namely that "the 13.34% [MSDCF COE] for 2009 was the **lowest** MSDCF COE value during 2008-2013."[113] It would seem the WCTL is implying that other years' MSDCF COE values can meaningfully be compared to the cost of capital estimates used in BNSF's Fairness Opinion. However, since the opinions of Goldman Sachs and Evercore were officially rendered on November 2, 2009,[114] it is reasonable to assume that the cost of capital calculations would rely on data of similar vintage to that used by the STB in determining its 2009 cost of capital for the railroad industry. It defies logic and financial practice to suggest that the financial advisors' 2009 calculations would represent a valid benchmark for the cost of capital in, for example, 2012.

[113] WCTL, p. 12. Emphasis in original.

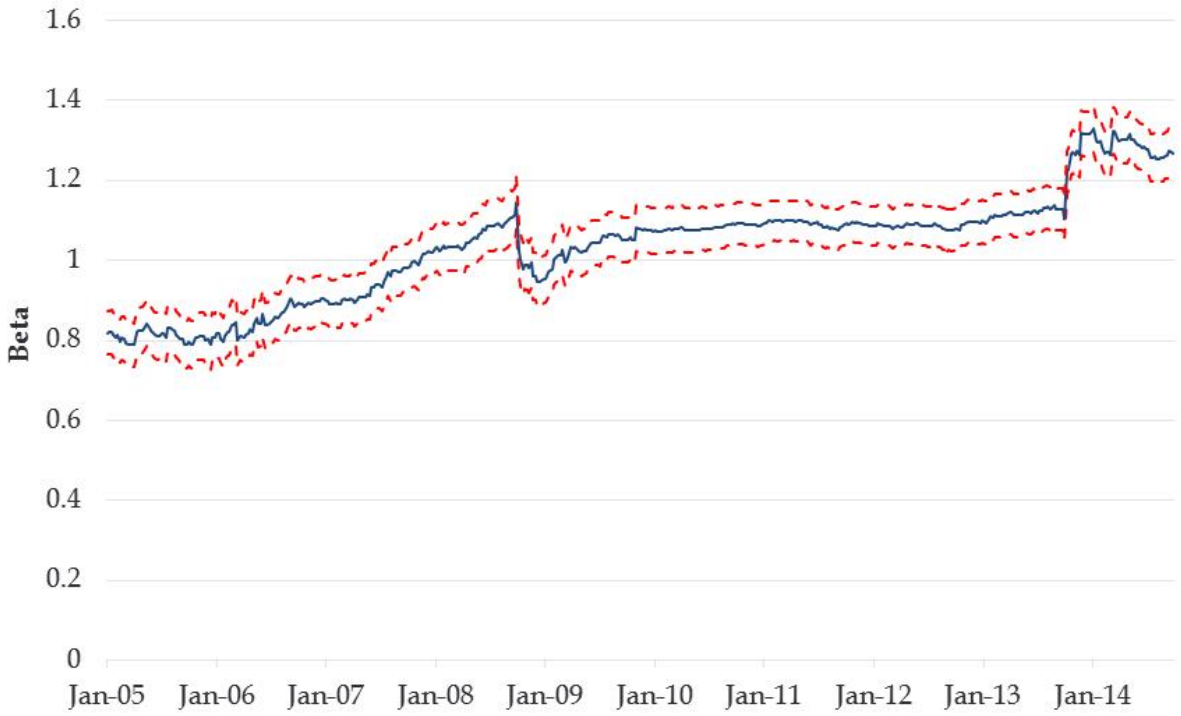
[114] SEC Form S-4, pages C-1 and D-1.

EXHIBIT BV-1
Rolling Five-Year Betas for the Railroad Industry

Exhibit 1, Panel A

Rolling Five-year Betas for the Railroad Industry

Weekly Returns



Sources and notes: Market Capitalization and returns for railroad stocks and the S&P 500 Index from Bloomberg as of 10/10/2014. Betas are calculated from weekly rates of return on a market-value weighted portfolio of the five major US railroads: CSX, NSC, KSU, UNP, and BNI (until February 12, 2010 when BNI was bought). 3-month Treasury bill rates are subtracted from the portfolio and market returns. The Regression equation includes an intercept. Data include returns from 2000. Dashed lines show beta estimates plus and minus one standard error.

Exhibit 1, Panel B

Rolling Five-year Betas for the Railroad Industry

Monthly Returns

Sources and notes: Market Capitalization and returns for railroad stocks and the S&P 500 Index from Bloomberg as of 10/10/2014. Betas are calculated from monthly rates of return on a market-value weighted portfolio of the five major US railroads: CSX, KSU, NSC, UNP, and BNI (until February 12, 2010 when BNI was bought). 3-month Treasury bill rates are subtracted from the portfolio and market returns. The Regression equation includes an intercept. Data include returns from 2000. Dashed lines show beta estimates plus and minus one standard error.

EXHIBIT BV-2

Review of Regulatory Cost of Capital Methodologies

Prepared by: Michael J. Vilbert, Bente Villadsen and Matthew Aharonian

For

The Canadian Transportation Agency

September 2010

EXHIBIT BV-3
Figure 1 from Duarte & Rosa 2014

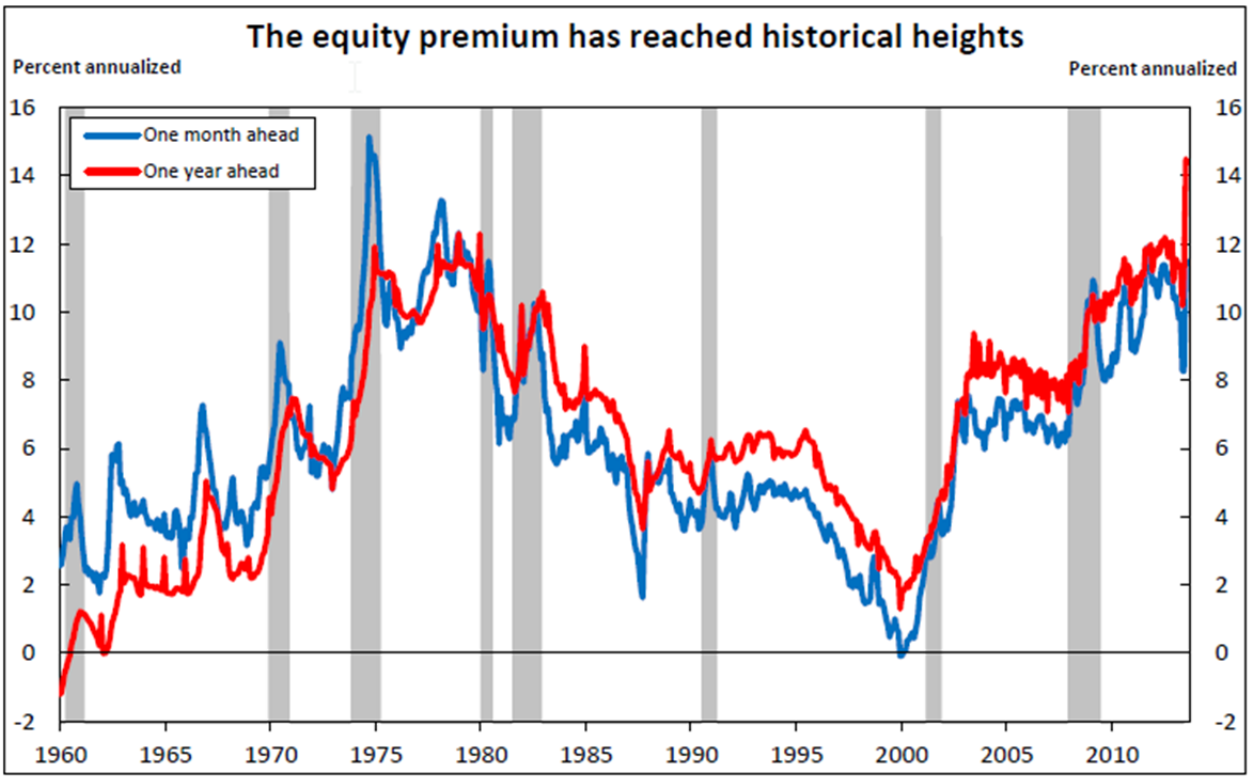


Figure 1 The equity risk premium (expected excess returns) over a one year ahead and one month ahead horizons are the first principal components of 20 models of the equity premium. The models include time-series and cross-sectional regressions, dividend discount models and surveys. Shaded bars are NBER recessions.

Source: Fernando Duarte and Carlo Rosa, "The Equity Risk Premium: A Consensus of Models," Federal Reserve Bank of New York, 2014, Figure 1.

EXHIBIT BV-4
Derivation of the Value Line Forecasted MRP

The Brattle Group

Estimating the Cost of Equity for Regulated Companies

Date : 17 February 2013

Contributors:

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Prepared for

Australian Pipeline Industry Association

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EXECUTIVE SUMMARY

In this report, we discuss the models available for estimating the cost of equity for the purpose of the Natural Gas Rules in Australia. Given that the new Rule 87 requires relevant estimation methods, financial models and market data to be considered, as well as the "prevailing conditions in the market for equity funds", this report focuses on the characteristics of the various models, how they perform under various market conditions, and therefore how to assign weight to a method, model or other data based on prevailing market or industry conditions. Further, the report finds that practitioners, regulators, and textbooks commonly look to several models or data sources before reaching a conclusion on the cost of equity.

All models have relative strengths and weaknesses, with the result that there is no one model that is the most suitable for estimating the cost of equity at any given time or for any given company. As our colleague and MIT professor Stewart Myers has put it eloquently "Use more than one model when you can. Because estimating the opportunity cost of capital is difficult, only a fool throws away useful information." This report provides a set of guidelines that can be used in deciding which models should have more weight than others under different market, industry, or company-specific circumstances.

The focus of the report is on the key characteristics of the various cost of equity estimation methods available for a decision maker and circumstances under which each method may be more or less suitable. It is imperative that the choice of model(s) and their implementation take into account the prevailing economic conditions, industry specifics as well as characteristics of the firm for which the cost of equity is being determined, because, according to the circumstances, each model can show bias. We therefore emphasize that there is no single or formulaic approach to estimating the cost of equity. Evidence from academics, practitioners and regulators alike agree that a mechanistic reliance on a single model, without regard to changing market or industry conditions, may deliver spurious results.

The different models should be applied to a set of comparable firms, rather than the single firm for which the cost of equity is to be determined, because all methods for estimating the cost of

equity introduce significant noise or uncertainty. Applying the models to a set of comparator firms generates a range of cost of equity estimates for each model. Consideration of prevailing economic conditions, industry specifics, and characteristics of the firm for which the cost of equity is to be determined should go to the weight that is put on each model in deriving an overall reasonable range for the cost of equity.

For example, a dividend growth model might have more weight and the Sharpe–Lintner CAPM less weight when (as currently) interest rates on government bonds are unusually low. Conversely, a dividend growth model might have less weight, and the CAPM more weight, in a sector where growth forecasts are considered to be less reliable. In addition, empirical results from the Sharpe–Lintner CAPM suggest that results may be biased for firms with beta significantly different from one. In addition to the traditional Sharpe-Lintner CAPM and dividend growth models, the report also discusses other models such as the Black CAPM, the Fama-French model, the Consumption CAPM, and the Arbitrage Pricing Theory. We also touch upon new developments in implementing the dividend discount model and on other data and evidence that is sometimes used in combination with the models mentioned above.

Once a reasonable range for the cost of equity has been identified, selecting a point within that range is a matter of judgment, but that judgment can be guided by considering the riskiness of the firm at hand relative to the riskiness of the comparable firms used to generate the cost of equity estimates. Only non-diversifiable risks should be included—for example, variation in demand, which might be more highly correlated with general economic growth for a utility with significant industrial load than for a utility serving mostly residential customers.

I. INTRODUCTION

The Australian Energy Market Commission recently changed the rules that guide the regulation of pipelines (and other regulated entities) in Australia. The Australian Pipeline Industry Association (APIA) has therefore asked *The Brattle Group* (*Brattle*) to review the methods that are currently used or could be used to estimate the cost of equity capital for the purposes of the National Gas Rules in Australia. As part of this exercise, the APIA has asked us to review how academics, practitioners and regulators worldwide think models should be used, and how they have been used in determining the cost of equity for regulated entities. Thus, in this report, we discuss examples of regulatory approaches in the U.S., Canada and the U.K. where regulators have considered a number of methods for estimating the cost of equity capital, and have determined the optimal use of these multiple evidence sources in order to provide greater confidence in their results. The report also includes a discussion of the recommendations of academics and practitioners with regards to the use of several cost of equity estimation models.

The report focuses on the new Rule 87 and the new *allowed rate of return objective*, which, in order to be achieved, requires that "regard must be had to relevant estimation methods, financial models, market data and other evidence"[1] in determining the overall rate of return, and that "regard must be had to the prevailing conditions in the market for equity funds"[2] in determining the cost of equity component of the overall rate of return. We therefore focus on introducing a broad set of methods for cost of equity estimation, the risk positioning of a company relative to the industry or other companies, and methods relied upon by regulators and practitioners around the globe.

Section II provides some background for cost of equity estimation. *Section III* focuses on the evolution, theoretical underpinnings, and characteristics of various cost of equity estimation methods including (a) the Sharpe-Lintner Capital Asset Pricing Model (CAPM), (b) variations of the CAPM such as the Empirical CAPM (ECAPM) and the Consumption-Based CAPM, (c) the Fama-French Three-Factor Model, (d) the Arbitrage Pricing Theory, (e) Dividend Discount

1 Rule 87, s.5a.

2 Rule 87, s.7.

Models including both Single-Stage and Multi-Stage models, and (f) Other Models including the so-called Risk Premium method, Residual Income Valuation model, Ibbotson's Build-up method, the Comparable Earnings model, Market-to-Book and Earnings Multiples approaches. We note that the above is not intended to be an exhaustive list of models that regulators or practitioners could feasibly rely upon in determining the cost of equity. We also note that as finance evolves, new estimation methods, financial models, market data and other evidence may become available that could be informative for the purpose of estimating the cost of equity. *Section IV* discusses implementation issues, summarizes the characteristics of the various cost of equity estimation methods, and discusses how to use the models under different market conditions. Additionally, this section includes a description of how to position the target entity relative to a sample based on its relative risk.

II. METHODS, FINANCIAL MODELS, MARKET DATA AND OTHER EVIDENCE USED TO ESTIMATE THE COST OF EQUITY CAPITAL

A. INTRODUCTION

To determine the cost of capital, one must evaluate the cost of equity, the cost of debt (possibly both long-term and short-term) and the capital structure of the company subject to regulation. This report focuses on the estimation of the cost of equity component of a regulated entity's cost of capital.

To determine the cost of equity for a specific utility, decision makers typically look at a range of evidence presented to them. In the case of regulators, they commonly review expert evidence, models and other information presented by experts, the utility and other stakeholders, and also evidence that the regulator itself generates. Ultimately, a degree of judgment is used to arrive at a final determination having considered this evidence. The evidence considered might include different financial models which are used to extract estimates of the cost of equity for similar utilities from market data (stock prices). It might also include estimates from models that take equity analyst forecasts as inputs. For example, three regulators, the Alberta Utilities Commission (AUC), the Ontario Energy Board (OEB), and the U.S. Surface Transportation Board (STB), recently reviewed their cost of equity estimation approach. These three regulators noted that each methodology has its own strengths and weaknesses and subsequently decided to

rely on more than one model or approach to determine the cost of equity.[3] We further note here that in discussing the characteristics of each model or practice, we are pointing to advantages or disadvantages of the models assuming they will inform the ultimate decision, but we do not expect any one model to be the only piece of evidence considered and used by either regulators or practitioners in determining the cost of equity.

This report describes a number of models that can be used to inform the regulator's judgment in determining the cost of equity. It also discusses the views of academics and practitioners with regards to the determination of the cost of equity from multiple estimation models.

Below, we describe methodologies that regulators and practitioners use in Australia, Canada, Europe, the U.K., and the U.S., as well as some more recent methods that have been proposed, albeit it is not clear from the record the extent to which regulators have used these methods. It is important to realize that in many jurisdictions the regulator does not look to a single model, but considers all the evidence in front of it and then makes a decision. In North America, where the consideration of more than one model and possibly other evidence is common, the ultimate decision is often not explicit about the weight assigned to each model or other pieces of evidence.[4]

B. THE USE OF MODELS FOR COST OF CAPITAL ESTIMATION

1. Context

The National Gas Rules set the framework for how the AER (and the ERAWA) determine access arrangements for covered gas pipelines, including the rate of return on capital which is a component of the charges paid by pipeline customers. We understand that the regulators are

[3] Alberta Utilities Commission, Decision 2011-474, p. 27-28, Ontario Energy Board, EB-2009-084, p. 38, Surface Transportation Board, Ex Parte 664 (Sub-No. 1), pp. 3-5.

[4] There are exceptions to this rule such as the Federal Energy Regulatory Commission and the Surface Transportation Board in the U.S., and the Canadian Transportation Agency. However, most U.S. state and Canadian federal and provincial regulators do not have a specified cost of equity estimation method. Instead, they commonly hear evidence from a number of different parties on cost of equity (often including regulatory staff). Based on this information the regulator then makes its decision.

currently developing guidelines as to how the rate of return provisions of the NGR will be applied in future determinations.

The NGR state that "… the rate of return for a service provider is to be commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk… ".[5] In addition, the NGR require that "[I]n determining the allowed rate of return, regard must be had to: (a) relevant estimation methods, financial models, market data and other evidence;…"[6] and that "[i]n estimating the return on equity under subrule (6), regard must be had to the prevailing conditions in the market for equity funds."[7]

In this report, we describe the estimation methods, financial models, market data and other evidence that may be relevant for setting the cost of equity in future access arrangement determinations in Australia.

a) The cost of capital

The cost of capital is a key parameter in regulatory settings, because it contributes to determining the return to the company's investors. Defined as *the expected rate of return in capital markets on alternative investments of equivalent risk*, it is the expected rate of return investors require based on the risk-return alternatives available in competitive capital markets. Stated differently, the cost of capital is a type of opportunity cost: it represents the rate of return that investors could expect to earn elsewhere without bearing more risk.[8, 9]

While the details of energy network regulation are different in different jurisdictions, regulators are in many jurisdictions required to set a cost of capital which provides investors in rate-regulated entities a reasonable opportunity to earn a return on their investment equal to the opportunity cost of capital.

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5 Rule 87(3).

6 Rule 87(5).

7 Rule 87(7).

8 "Expected" is used in the statistical sense: the mean of the distribution of possible outcomes. The terms "expect" and "expected" in this Report, as in the definition of the cost of capital itself, refer to the probability-weighted average over all possible outcomes.

9 The cost of capital is a characteristic of the investment itself, not the investor.

In the U.K., the Gas Act 1986 requires the regulator to have regard to "the need to secure that licence holders are able to finance the[ir] activities.…"[10] Ofgem has also said:

> In setting price controls, we are required to have regard to the ability of efficient network companies to secure financing in a timely way and at a reasonable cost in order to facilitate the delivery of their regulatory obligations.[11]

In Canada, the National Energy Board has explained the "fair return standard" as follows:

> The Board is of the view that the fair return standard can be articulated by having reference to three particular requirements. Specifically, a fair or reasonable return on capital should:
> - be comparable to the return available from the application of the invested capital to other enterprises of like risk (the comparable investment standard);
> - enable the financial integrity of the regulated enterprise to be maintained (the financial integrity standard); and
> - permit incremental capital to be attracted to the enterprise on reasonable terms and conditions (the capital attraction standard).[12]

Finally, in the U.S., the starting point for the Federal Energy Regulatory Commission's approach to determining the cost of equity is Supreme Court precedent, which states that:

> the return to the equity owner should be commensurate with the return on investments in other enterprises having corresponding risks. That return, moreover, should be sufficient to assure confidence in the financial integrity of the enterprise, so as to maintain its credit and to attract capital.[13]

While these legal standards are differently worded, a common thread is that regulated entities are allowed to earn a return that is comparable to that of other enterprises of similar risks and which enables the regulated entity to finance its operations. The legal standards in North America and Europe are not specific about how to accomplish the goal(s).

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[10] Gas Act 1986, s. 4AA(2)(b).

[11] *RIIO-T1: Final Proposals for National Grid Electricity Transmission and National Grid Gas*, Ofgem (December 2012), paragraph 4.6.

[12] RH-2-2004, p. 17. See also the Supreme Court of Canada's decision in Northwestern Utilities Limited v. City of Edmonton [1929] S.C.R. 186.

[13] *FPC v. Hope Natural Gas Co.*, 320 U.S. 591 (1944). *Bluefield Water Works & Improvement Co. v. Public Service Comm'n*, 262 U.S. 679 (1923), cited in FERC policy statement on the *Composition of Proxy Groups for Determining Gas and Oil Pipeline Return on Equity*, April 17 2008, p. 2.

b) What should we expect from models?

It is useful to recognize explicitly at the outset that models are imperfect. All are simplifications of reality, and this is especially true of financial models. Simplification, however, is also what makes them useful. By filtering out various complexities, a model can illuminate the underlying relationships and structures that are otherwise obscured. After all, while a perfect scale model representation of the city might be highly accurate, it would make a poor road map. It is therefore imperative that regulators and other users of the models use sound judgment when implementing and using the models — there is no one model or set of models that are perfect.

The gap between financial models and reality can sometimes be quite significant (as was painfully demonstrated by the recent financial crisis). There is no single, widely accepted, best pricing model to estimate the cost of capital — just as there is still no consensus on some fundamental issues, such as the degree to which markets are efficient. Analysts have a host of potential models at their disposal, and it must be acknowledged that cost of capital estimation continues to require the exercise of judgment. Practitioners, regulators, as well as textbooks therefore often recommend that the "best practice" for ensuring robustness is to look at a totality of information.[14] These practitioners, regulators and texts therefore use or present a variety of methodologies that may be applicable for the determination of the cost of equity in a specific circumstance.

While no model is perfect, there are certain features that make models more useful from a regulatory perspective. For example, it is desirable to have models and methods that i) are consistent with the goal being pursued, ii) are transparent, iii) produce consistent results, iv) are robust to small deviations or sampling error, v) are as simple as possible (while maintaining reliability), vi) can be replicated by others (*e.g.*, data is widely available), and vii) recognize the regulatory context and legislative requirements in which the regulatory body operates. Clearly different models will satisfy these criteria to differing degrees, and different models may be better suited to different regulatory jurisdictions.

[14] See, for example, the Ontario Energy Board's EB-2009-084 decision, December 2009, the U.S. Surface Transportation Board's Ex. Parte 664 (Sub-No. 1) decision, January 2009, Morningstar *Ibbotson Cost of Capital 2012 Yearbook*, and Roger A. Morin, *New Regulatory Finance*, Public Utilities Reports Inc., 2006, Chapter 15.

For example, the CAPM and the Dividend Discount Model (DDM) both are transparent and developed from economic theory. Their results can be replicated easily, since the data required are widely available from many public sources. However, the implementation of the CAPM and DDM requires a number of subjective decisions – decisions which can be hotly contested and can lead to significantly different results. The CAPM, for instance, relies on a risk-free rate that is currently driven unusually low by the recent flight to quality and the easing of monetary policy. The model also requires an estimate of the market risk premium, which may pose difficulties in times of high market volatility.

The single-stage DDM is especially sensitive to the growth rate estimates used, which can vary widely among analysts and over time, contradicting the underlying assumption of growth stability inherent in this model. The variability in growth rates and stock prices may increase when industries are in transition, making the reliability of the DDM more questionable in such periods. In addition, it has become more common to distribute cash to shareholders in a form other than dividends. For example, regulated entities in both the U.S. and the U.K. have had share buyback programs that substantially affected the number of shares, and these are not captured in the standard DDM.[15] Some of the growth rate problems in the DDM are alleviated by the reliance on a multi-stage version of the model as done by, for example, *The Brattle Group*, Morningstar *Ibbotson Cost of Capital Yearbook*, and the U.S. Surface Transportation Board (STB).[16]

Similar problems arise in other models that inherently rely on data for a sample of companies and data for economic phenomena that may be changing quickly; the latter is especially true for models such as the Fama-French, where the reliance on three risk factors can lead to highly variable results across time. As a result, no single model is ideal and the implementation of any model necessarily requires choices that involve subjective judgments. Therefore, it is important to look to the totality of relevant information available from methods, models, market data and

[15] See, for example, National Grid Share Buyback Programme and Spectra Energy Corp's 2008 form 10-K.

[16] *The Brattle Group* is a consulting firm, Morningstar is a commercial provider of data and the STB is a U.S. federal regulator.

other evidence. The relative strengths and weaknesses of the various cost of equity estimation models are outlined in further detail in *Section III* of this report.

c) Model stability and robustness

For an estimation model used to determine the cost of equity, stability and robustness over time are desirable unless economic conditions have truly changed. Stability means that cost of capital estimates done in similar economic environments should be similar, not only period-to-period but also company-to-company within a comparable sample. Robustness is meant here as the ability of a model to estimate the cost of capital across different economic conditions.

In general, all of the models discussed here have characteristics that make them more or less suited to one economic environment versus another. As such, all individual models can be, and often are, subject to some instability over time. For example, the currently very low government bond yields lead to very low cost of equity estimates using the CAPM — sometimes less than the costs of debt of investment-grade companies! During the early 2000s, the DDM was subject to substantial criticism due to allegations of analysts' optimism bias. Similarly, the risk premium model[17] has produced very different results in times of high and low inflation that did not necessarily reflect the true cost of capital. Thus, estimates at any given point of time may seem too high or too low, and it is important to understand whether the estimated figures are driven by actual changes in the systematic risk of the regulated entities, or by something else (*e.g.*, data irregularities). It is for these reasons that regulators in the U.S. and Canada often rely on and analysts recommend relying on the results from at least two estimation models.[18]

A notable example of a regulator that has acknowledged the difficulty in relying on only one model or method is the U.S. Surface Transportation Board. The STB in 1982 started to rely on a single-stage DDM to determine the cost of equity for U.S. railroads. However, in 2006, the shippers on the railroads complained that the estimated cost of equity was out of line with reality,

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[17] The risk premium used in the risk premium model is different from the market risk premium used in the CAPM. The model is frequently used in U.S. regulatory proceedings.

[18] See, for example, U.S. Surface Transportation Board, Ex Parte 664 (Sub-No. 1), served January 28, 2009; Mississippi Power, Performance Evaluation Plan, Rate Schedule 'PEP-5', November 9, 2009 (http://www.mississippipower.com/pricing/pdf/pep-5.pdf); Ontario Energy Board, EB-2009-0084, Report of the Board on the Cost of Capital for Ontario's Regulated Utilities, Issued December 11, 2009.

because forecasted growth rates for railroad companies were substantially higher than the economy-wide forecasted growth. The shippers argued successfully that such high growth rates could not be sustained forever as assumed by the single-stage DDM, and the STB thus initiated a rulemaking proceeding to review and eventually determine how to set the allowed cost of equity going forward. Following several years of expert submissions and proceedings, the STB decided to rely on an equally-weighted average of the Sharpe-Lintner Capital Asset Pricing Model and a specific version of the multi-stage DDM. In doing so, the STB concluded:

> if our exploration of this issue has revealed nothing else, it has shown that there is no single simple or correct way to estimate the cost of equity for the railroad industry, and countless reasonable options are available. Both the CAPM and the multi-stage DCF [DDM] models we propose to use have their own strengths and weaknesses, and both take different paths to estimate the same illusory figure. By using an average of the results produced by both models, we harness the strengths of both models while minimizing their respective weaknesses. The result should be a stable yet precise estimate of the cost of equity that we can use in future regulatory proceedings and to gauge the financial health of the railroad industry.[19]

2. Risk-Return Tradeoff

At its most basic level, an asset (security) is a claim to a stream of future (risky) cash flows and sometimes with potential rights to exert some control over those flows. Financial markets allow investors to exchange these claims, and therefore risks. Through trade, investors are able to create different packages of risks and returns than could be achieved by holding individual securities (or fixed packages of securities), and investors can change their risk exposure over time. Because investors are assumed to be risk-averse, they evaluate the universe of risky investments on the basis of a risk-return trade-off. Investors can only be induced to hold a riskier investment if they expect to earn a higher rate of return on that investment. The essential tradeoff between risk and the cost of capital is depicted in Figure 1 below.

[19] *U.S. Surface Transportation Board, Ex Parte 664 (Sub-No. 1)*, served January 28, 2009, p. 15.

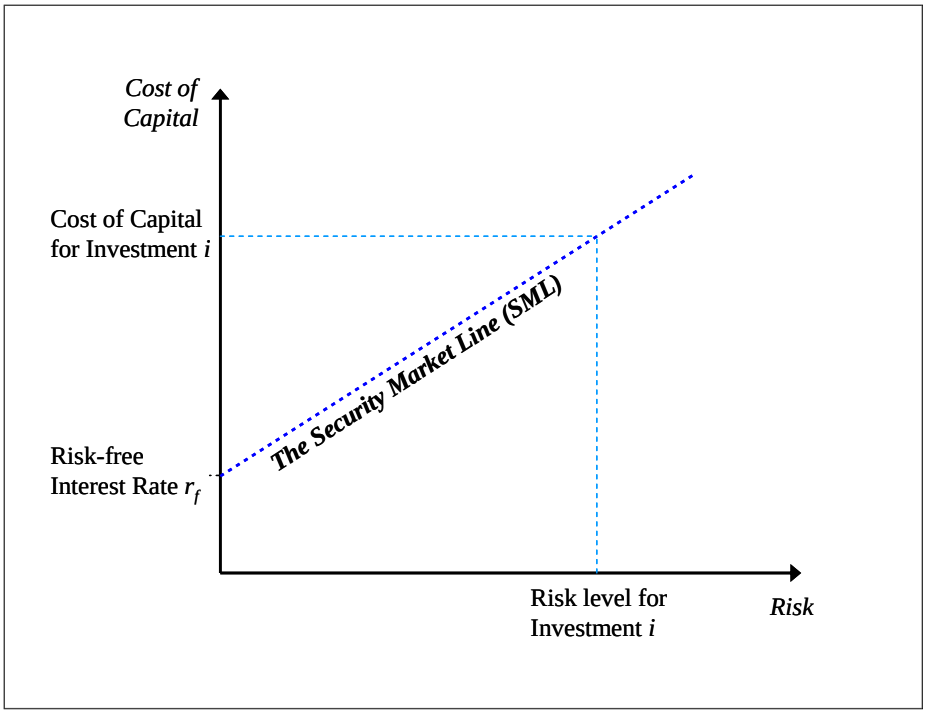

Figure 1: Security Market Line

III. COST OF EQUITY ESTIMATION MODELS

A. SHARPE-LINTNER CAPITAL ASSET PRICING MODEL

One of the most common pricing models used in business valuation and regulatory jurisdictions is the Sharpe-Lintner CAPM, which in its simplest form is depicted in Figure 2 below.

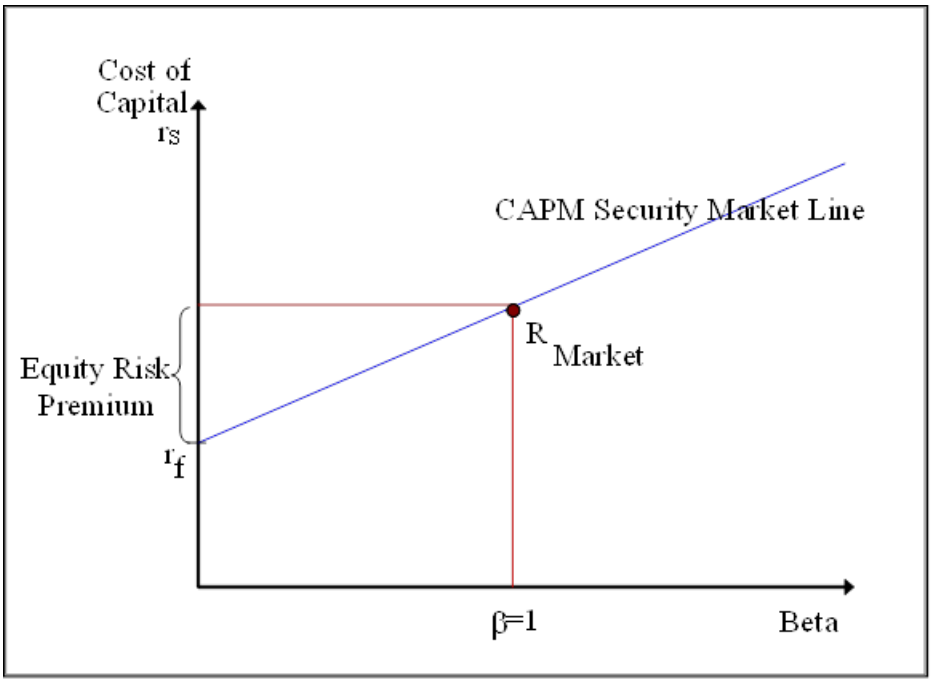

Figure 2: Capital Asset Pricing Model

Thus, in the world in which the CAPM holds, the expected cost of (equity) capital for an investment is a function of the risk-free rate, a measure of systematic risk (beta), and an expected market risk premium (MRP):[20]

$$E(r_S - r_f) = \beta_S \times E(r_M - r_f) \quad \textbf{(1)}$$

where r_S is the cost of capital for investment *S*; r_M is the return on the market portfolio, r_f is the risk-free rate, and β_S is the measure of systematic risk for the investment *S*. The $(r_M - r_f)$ term is known as the market risk premium (MRP),[21] and β_S measures the response of the stock S to systematic risk. Re-arranging this equation produces the CAPM's formula for the cost of (equity) capital of a traded asset:

$$r_S - r_f = \beta_S \times MRP \quad \textbf{(2)}$$

[20] While the CAPM model frequently is applied to equity capital, it applies to all assets.

[21] We note that some European regulators use the term Equity Risk Premium (ERP) instead of MRP.

To implement the CAPM, it is necessary to determine the risk-free rate, r_f, and to estimate the MRP and beta, β_S.

1. Evolution of the CAPM

The CAPM was developed as a theoretical equilibrium model and fits with the intuition of a risk-return tradeoff. The development of the CAPM signaled the first time that economists were able to quantify risk and the reward for bearing it. Under the CAPM, the expected return of an asset must be linearly related to the covariance of its return with the return of the market portfolio.[22]

Markowitz (1959)[23] first laid the groundwork for the CAPM. In his seminal research, he expressed the investor's portfolio selection problem in terms of expected return and variance of return. He argued that investors would optimally hold a mean-variance efficient portfolio, that is, a portfolio with the highest expected return for a given level of variance. Sharpe (1964)[24] and Lintner (1965)[25] built on Markowitz's work to develop economy-wide implications. They showed that if investors have homogeneous expectations and optimally hold mean-variance efficient portfolios, then, in the absence of market frictions, the portfolio of all invested wealth, or the market portfolio, will itself be a mean-variance efficient portfolio. This is the heart of the Sharpe-Lintner CAPM. The standard CAPM equation (as expressed in Equation **(**2)) is a direct implication of this statement.

The Sharpe-Lintner CAPM assumes unrestricted lending and borrowing at a risk-free rate of interest. In the absence of a risk-free asset, Black (1972)[26] derived a more general version of the CAPM which did not rely on this potentially problematic assumption. In this version, known as the Black CAPM, the expected return of an asset in excess of the "zero-beta" return is linearly

[22] For a basic introduction to risk-return models, see R.A. Brealey, S.C. Myers, and F. Allen, Principles of Corporate Finance, 10ed, 2011 (Brealey, Myers & Allen (2011), pp. 192-203.

[23] H. Markowitz, "Portfolio Selection: Efficient Diversification of Investments," 1959, John Wiley, New York.

[24] W. Sharpe, "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk," *Journal of Finance* 19, 1964, pp. 425-442.

[25] J. Lintner, "The Valuation of Risky Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets," Review of Economics and Statistics 47, 1965, pp. 13-37.

[26] F. Black, "Capital Market Equilibrium with Restricted Borrowing," *Journal of Business* 45, 1972, pp. 444-455.

related to its market beta. In essence, the return on the risk-free asset in Equation **(**2) above is substituted with a return on a zero-beta portfolio associated with the market portfolio. This zero-beta portfolio is defined to be the portfolio that has the minimum variance of all portfolios uncorrelated with the market portfolio. The empirical implementation of the Black CAPM is often referred to as the Empirical CAPM or ECAPM.

Empirical tests of the Sharpe-Lintner CAPM have focused on three implications of equation **(**2): (i) The intercept is zero; (ii) The market beta completely captures the cross-sectional variation of expected excess returns; and (iii) The market risk premium is positive.

There is substantial literature on empirical tests of the CAPM since its development in the 1960s, with mixed results. Black, Jensen and Scholes (1972)[27], Fama and Macbeth (1973),[28] and Blume and Friend (1973)[29] found empirical evidence to be consistent with the mean-variance efficiency of the market portfolio. However, Black, Jensen and Scholes (1972) and Fama and MacBeth (1973) identified a fundamental challenge to the CAPM; namely that low-beta stocks have higher average returns than predicted by the CAPM, and high-beta stocks lower average returns. In other words, the empirical estimates are consistent with pivoting the Security Market Line (SML) around beta = 1 compared to the Sharpe-Lintner CAPM. This suggests that the cost of capital for regulated companies, which often have a beta less than one, will be underestimated by the traditional CAPM.[30]

Several subsequent studies confirmed the robustness of this result and proposed explanations revolving around market frictions, such as different borrowing and lending rates, and the role of

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[27] F. Black, M.C. Jensen, and M. Scholes, "The Capital Asset Pricing Model: Some Empirical Tests," *Studies in the Theory of Capital Markets*, Praeger Publishers, 1972, pp. 79-121.

[28] E. Fama and J. Macbeth, "Risk, Return, and Equilibrium: Empirical Tests," *Journal of Political Economy* 81, 1973, pp. 607-636.

[29] M. Blume and I. Friend, "A New Look at the Capital Asset Pricing Model," *Journal of Finance* 28, 1973, pp. 19-33.

[30] Implementing a long-run version of the CAPM which uses (annualized) long-horizon returns (*e.g.*, with long bond rates as risk-free rate) generally produces a flatter SML than obtained by using short-rates, due to the general presence of an upward sloping yield curve. While this partially compensates for the empirically observed flattening, it is not sufficient to explain all of the observed flattening of the SML. That is, even implementations that utilize a long-run risk-free interest rate require a further, albeit smaller, adjustment to match the empirical SML.

taxes. Nevertheless, the empirical evidence suggested significant movement in the SML, often flattening, to the point that Fama and French (1992) found a zero slope in the empirical SML.[31] Fama and French (1992, 1993[32]) in turn suggested that factors other than the risk relative to the market, such as size and book-to-market value ratios (among others) were significant in explaining the observed SML. Fama and French found that firms with high book-to-market ratios and small size have higher average returns than is predicted by the standard CAPM, and vice versa. Their work culminated in the model now known as the Fama-French three-factor model.

The Fama-French papers cited above continued in the vein of the so-called "anomalies" literature that had arisen in the late 1970s. These anomalies can be thought of as firm characteristics that provide incremental explanatory power for the sample's mean returns beyond the market. Earlier anomalies included the price-earnings ratio effect (first reported by Basu (1977)[33]) and the detection of the size effect (Banz (1981)[34]). For example, Basu found that firms with low price-earnings ratios have higher sample returns than those predicted by the standard CAPM. The price-earnings ratio and size anomalies are at least partially related, as low price-earnings-ratio firms tend to be small.

The Empirical CAPM (ECAPM), described further in the section below on variations of the standard CAPM, is an alternative method of correcting for the empirical flattening of the SML. The ECAPM can be viewed from the positive school of thought as a practical adjustment that can be made to measure the cost of capital. It can be applied without knowing the "cause" of the increased intercept and decreased slope of the SML relative to the Sharpe-Lintner CAPM.

To sum up, there has been a wealth of statistical evidence contradicting the Sharpe-Lintner CAPM over the past 40 years or so and controversy remains about how the evidence should be

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31 E.F. Fama and K.R. French, "The Cross-Section of Stock Expected Returns," *Journal of Finance* 47, 1992, pp. 427-465.

32 E.F. Fama and K.R. French, "Common risk factors in the returns on stocks and bonds," *Journal of Financial Economics* 33, 1993, pp. 3-56.

33 S. Basu, "The Investment Performance of Common Stocks in Relation to Their Price to Earnings Ratios: A Test of the Efficient Market Hypothesis," *Journal of Finance* 32, 1977, pp. 663-682.

34 R. Banz, "The Relationship Between Return and Market Value of Common Stocks," *Journal of Financial Economics* 9, 1981, pp. 3-18.

interpreted. Some argue that the standard CAPM should be replaced by multifactor models with several sources of risk, such as the Fama-French model. Others argue that evidence against the CAPM is overstated due to potential mis-measurement of the market portfolio, data mining or sample selection biases. One further key deficiency in the CAPM is that it is a static model which ignores consumption decisions, and treats asset prices as being determined by the portfolio choices of investors who have preferences defined over wealth one period in the future. Implicitly, these models assume that investors consume all their wealth after one period or at least that wealth uniquely determines consumption. This assumption does not match with reality. Therefore, to make the model more realistic, intertemporal equilibrium asset pricing models have been developed that model consumption and portfolio choices simultaneously. An example of such a model is the consumption-based CAPM, which is described further in *Section III.B.2* below.

2. CAPM Implementation Issues

Fundamentally, an analyst using the CAPM must determine three parameters to implement the model: the risk-free rate (r_f), the MRP, and the asset's beta (β_S) as shown in Equation (2) above. Through the determination (or estimation) of the parameters on the right-hand side of Equation **(**2), the analyst obtains an estimate of the cost of equity, r_S.

It is common to choose (i) a forecasted yield on government bonds (as is often done in Canada), (ii) a current measure of local government bond yields (a common practice in the U.S.), or (iii) a regional or global measure of the current yield on government bonds (*e.g.*, the Netherlands).

Like the risk-free rate, the choice of market proxy is local, regional, or global. The choice of risk-free rate and market index should be consistent, so the cost of equity is estimated as either a local, regional, or global figure.

For many years it was common to estimate the MRP from an arithmetic average of historical realized MRPs, measured as the long-term excess of market returns over the risk-free rate in the country or region of interest. European decision makers have in recent years often looked to the study of Dimson, Marsh, and Staunton to determine the MRP, while many in the U.S. commonly

look to evidence from Morningstar (formerly Ibbotson).[35] Some decision makers and analysts also look to either forecasted MRPs or survey results.[36] The estimation of the MRP remains controversial and the resulting cost of equity estimates generated by the standard CAPM are sensitive to the choice of MRP.

3. Characteristics of the CAPM

While the strengths and weaknesses of the CAPM inherently depend on its exact implementation, the following are some generic strengths:

- The model is transparent, well-documented and relies on economic theory.
- Data needed for the model are readily available if applied to companies with a reasonable trading history in well-developed markets. It is therefore also auditable.
- The model is sensitive to economic conditions through risk-free rates and market performance, as well as to changes in companies' systematic risk.

Among the weaknesses of the CAPM are the following:

- The model is very sensitive to developments in the risk-free rate that may reflect monetary policy rather than economic conditions.
- The model is sensitive to different estimation procedures for the MRP.
- Because beta estimates rely on historical data, there may be a delay in incorporating changes in systematic risk. MRP estimates based on historical data are also backward-looking.
- The model may downward bias cost of equity estimates for low-beta stocks and vice versa (see section on ECAPM below).

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[35] Texts such as Morningstar, *Ibbotson SBBI 2012 Yearbook*, p. 55-56 recommends to use the income return rather than total return or yield as the risk-free rate. The income return consists of the coupon payment divided by the bond price rather than the total return as this is the true risk-free component of the bond return. Capital gains or losses carry risk.

[36] For examples, see Bank of England, "Financial Stability Report," June 2012, Chart 1.11 and P. Fernandez, J. Aguirreamolla and L. Corres (2013), "Market Risk Premium used in 82 countries in 2012: a survey with 7,192 answers," IESE Business School, University of Navarra, SSRN 2084213.

- The model incorporates only one source of risk (the market), and therefore does not reflect the effects of, for e.g., consumption or economic growth, technological or regulatory risks.
- The CAPM is a static model and therefore ignores the dynamics of investment behavior and hedging.
- The model is based on the assumption that all investors optimally hold well-diversified portfolios and therefore only care about systematic risks. This assumption does not necessarily hold, however, when investor expectations about returns and investment opportunities are heterogeneous.

Because the model was developed as a generic approach to determining the cost of capital for companies, it does not specifically take industry factors or the context in which it is being used into account. However, the CAPM is a well-founded and commonly used model that relies primarily on readily available information. It may be less stable than ideal because changes in interest rates affect the risk-free rate and market volatility affects the beta estimates. Furthermore, determination of which sample companies to rely upon and the MRP remains controversial.

The CAPM has been widely used for a long period of time for a variety of reasons. The primary reason for the model's widespread use is its solid economic foundation, making it taught in every introductory finance class. The model is also relatively simple to implement. Most market-based models that have been developed since the CAPM take the CAPM as their point of departure to generalize the model. Also, academic researchers have not found any one alternative to the model that is easily applied in practice.

B. VARIATIONS ON THE CAPM

1. The Empirical CAPM

As described above, the ECAPM is one way of correcting for the empirical flattening of the Security Market Line (SML). Specifically, the ECAPM directly adjusts the CAPM SML by a parameter, alpha, that can be controlled for sensitivities, *etc.* Formally, the ECAPM relation is given by Equation (3) below:

$$r_S = r_f + \alpha + \beta_S \times (MRP - \alpha) \quad (3)$$

where α is the "alpha" adjustment of the risk-return line, a constant, and the other symbols are as defined above. The alpha adjustment has the effect of increasing the intercept but reducing the slope of the SML, which results in a security market line that more closely matches the results of empirical tests.

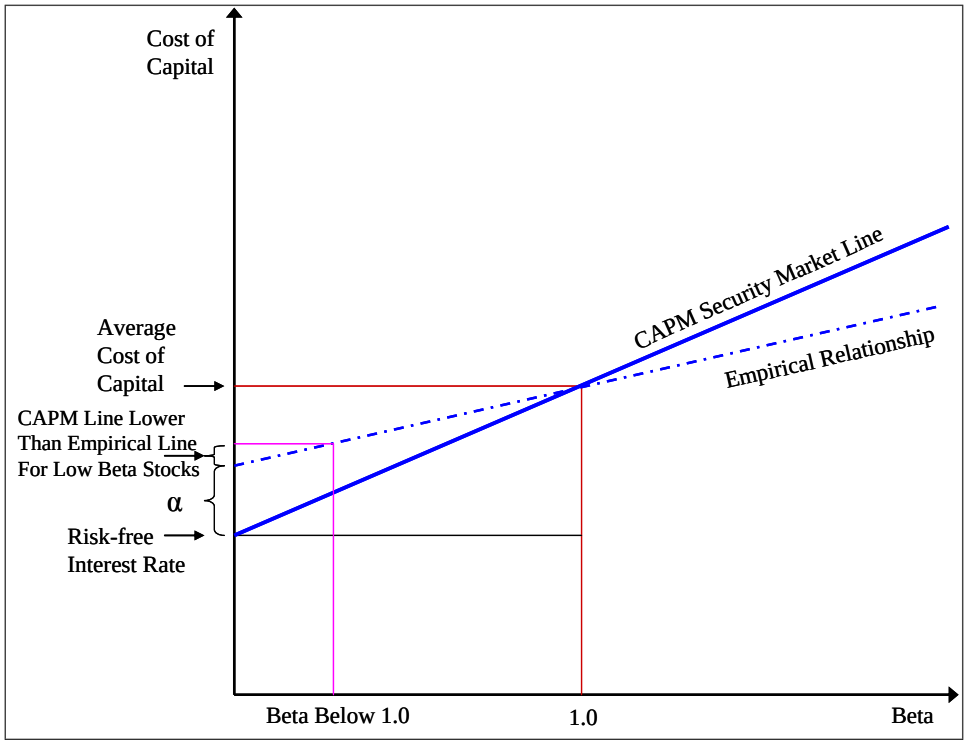

Figure 3: The Empirical Security Market Line

The academic literature has estimated a fairly wide range of alpha parameters, using primarily U.S. data, of approximately 1 to 7 percent.[37] While this is a rather large range, much of the variation between studies arises from differences in methodology and time periods so that the alpha estimates are not strictly comparable. The ECAPM is included among the models relied upon by some decision makers and experts including U.S. state and Canadian provincial regulators.[38]

[37] See Appendix A for details.

[38] The Mississippi Public Service Commission in the U.S. and the Alberta Utilities Commission in Canada have included the ECAPM as one of the models used to determine the cost of equity.

2. The Consumption-Based CAPM

The Consumption CAPM is an example of an intertemporal equilibrium model. This model aggregates investors into a single representative agent and considers a changing investment opportunity set over time, unlike the static standard CAPM. The representative agent is assumed to derive utility from the aggregate consumption of the economy. In this model, the stochastic discount factor, (defined such that the expected product of any asset return with the stochastic discount factor is equal to one), is equal to the intertemporal marginal rate of substitution for the representative agent.[39] Through mathematical equations, (the so-called Euler equations), asset returns and consumption can be linked. Using this setup, the model explains the risk premia on assets using the covariance between their returns and the intertemporal aggregate consumption marginal rate of substitution. As a result, the consumption-based pricing model can help explain the observed phenomenon of predictable variations in asset risk premia over time, and expands the risk-return relation to allow for a time-varying relationship between a stock's risk and return.

An important feature of the consumption model is that the expected conditional risk premium on an asset is related to its predicted conditional volatility. In particular, the relationship between a stock's risk premium and its conditional volatility could be positive or negative, depending on the extent to which the stock is an intertemporal hedge against shocks to the marginal utility of consumption. Furthermore, hedging assets have volatility patterns that could lead to expected rates of return lower than the risk-free rate. Note that this would generally not be the case for public utility stocks, since they are not viewed as defensive stocks.

Several versions of the consumption-based CAPM have been developed. In one of the more applicable versions, the addition of assumptions about the preferences of investors allows the model to explain the risk premia on assets through their covariance with consumption growth, so that the model, to a degree, can explain variations in the excess returns of risky assets over time. Other versions of the model allow time-varying investor risk aversion to explain predictable movements in risk premia.

[39] This is equal to the discounted ratio of marginal utilities for the representative agent in two successive periods.

In a regulatory setting, the consumption CAPM can be used to either project the expected risk premium over the risk-free rate or verify the relied-upon market risk premium. The model has not commonly been used in a regulatory setting, but a recent implementation of Ahern, *et al.* (2012)[40] was developed explicitly to estimate the cost of equity for regulated entities. The description below therefore focuses on this version of the model.

The Ahern model is estimated using a so-called GARCH-in-mean (GARCH-M) model, which unlike the Sharpe-Lintner CAPM allows for the stock returns to depend on a volatility (variance) measure. In particular, the GARCH-M specification is such that the expected risk premium on a stock is a linear function of its conditional volatility. In this model, the parameter of interest, α, which represents the linear relationship between the risk premium on the stock and the conditional volatility in the GARCH-M model, can be translated into the following implication of the theoretical asset pricing model described above:

$\alpha = -\frac{vol_t[M_{t+1}]}{E_t[M_{t+1}]} corr_t[M_{t+1}, R_{t+1}]$		(4)

where R_{t+1} is the expected total return on the public utility stock index or individual utility stock, and M_{t+1} is the stochastic discount factor (SDF), *i.e.*, the (aggregate) consumption intertemporal marginal rate of substitution. The equation above implies that the coefficient on volatility will be positive (*i.e.*, returns and conditional volatility will be positively correlated) if the conditional correlation between the SDF and the asset return is negative, *i.e.*, if the stock is not a hedging asset.

Ahern, *et al.* (2012) estimate the conditional risk-return model using monthly total returns from January 1928 to December 2007 on the S&P Public Utilities stock index, and the monthly Moody's public utility Aa, A, and Baa yields for the cost of debt. The authors then compare the model's performance with the performance of, for example, the Sharpe-Lintner CAPM. The estimates of the cost of common equity from the model are similar to the CAPM values and

[40] P.A. Ahern, F.J. Hanley, R.A. Michelfelder, "New Approach to Estimating the Cost of Common Equity Capital for Public Utilities," *Journal of Regulatory Economics*, 2012 (Ahern, *et al.* 2012)

appear to be stable and consistent over time. Thus, the empirical implementation of the theoretical model resulted in cost of equity estimates that appeared to be within a range of reasonableness. The model has been presented in some U.S. regulatory jurisdictions but regulatory decisions based on the model are either still pending or it is not clear how the regulator used the information. Ahern, *et al.* conclude that the consumption-based asset pricing model "should be used in combination with other cost of common equity pricing models as additional information in the development of a cost of common equity capital recommendation".[41]

3. Characteristics of CAPM Variations

As for the CAPM, the strengths and weaknesses of the variations discussed above depend on the implementation of the models. However, some strengths of the models are:

- Both the ECAPM and the Consumption CAPM allow for empirically observed phenomena to be modeled:
  - The ECAPM recognizes the flatter-than-predicted-by-CAPM Security Market Line.
  - The Consumption-CAPM allows for the expected risk premium to vary with asset and investor characteristics, such as conditional volatility and risk aversion.
- Data needed for the models are usually available if applied to companies with a reasonable trading history in well-developed markets. The models are therefore also auditable.
- The models are sensitive to economic conditions. The Consumption-CAPM considers more factors than does the CAPM.

Among the weaknesses of the models are the following:

[41] Ahern, *et al.* (2012), p. 17.

- The ECAPM has not been tested extensively outside the U.S. or in recent market conditions.
- The Consumption CAPM relies on the use of more data than does the CAPM and requires a refined estimation process, which makes it less accessible to a broader audience.

C. THE FAMA-FRENCH THREE-FACTOR MODEL

The Fama-French model holds that the expected return of a security is described by an augmented CAPM relationship:

$$E(r_S - r_f) = \beta_S \cdot E(r_M - r_f) + s_S \cdot E(SMB) + h_S \cdot E(HML) \quad (5)$$

where $E(r_M - r_f)$ is the market risk premium (MRP) as used in the CAPM, SMB is the difference in returns between small companies and big companies ("*Small Minus Big*"), and HML is the difference in returns between securities of firms with a high book-to-market equity ratio and a low one (*"High Minus Low"*). The factor loadings s_S and h_S represent security *S*'s "holding" of each of these risk factors, which is to say they are the regression coefficients of r_S on each of the factors.

Evolution of the Fama-French Three-Factor Model

Fama and French (1992) was the last influential paper in a series of academic research into the placement of the empirical SML relative to the theoretical CAPM. Controlling for firm size, the authors found no relationship between the market and expected return (zero beta). Stated differently, any explanatory power that the market beta in the CAPM might have is absorbed by using size to explain the cross-sectional variation in returns. Fama and French interpreted this to mean that market beta (and by extension the CAPM) had zero explanatory power for expected returns. Moreover, they found that all of the variation in returns that were (in other research) associated with size, earnings/price ratios, book-to-market equity ratios, and leverage, could be captured by size and the book-to-market equity ratio alone. Fama and French (1993) ultimately settled on a three-factor model that brought the market return back into the model (size, book-to-market ratio, and market return). Their 1993 paper found that this model explained 90 percent of

the variations in the cross-section of returns, and it has since become known as the Fama-French three-factor model.

From an empirical perspective, the Fama-French model is an alternative to the ECAPM – one should not employ a Fama-French model with an alpha adjustment (Equation **(**3)). However, the interpretation of the findings of Fama and French has been critiqued by many academics as the size and book-to-market factors may proxy for other phenomena.[42]

Standard Implementation:

The SMB factor and HML factor are typically created following Fama & French's (1993) approach. Specifically, at each point in time one allocates each firm into the small or big category, according to whether its market cap is in the top or bottom half of all firms considered. The firms in each half are then value-weighted to form two portfolios: small firms and big firms. The difference in realized returns between each of these portfolios is then taken as the SMB realization in that period. Creation of the HML series is similar, but firms are allocated to the "high" category if their book-to-market ratio is in the top 30th percentile and to the "low" category if their book-to-market ratio is in the bottom 30th percentile. These two time series can then be used to estimate the average SMB and HML, as well as the factor loadings for a given security; *i.e.*, the factors in the regression version of Equation (5), β_S, s_S, and h_S are estimated.

As a practical matter, the SMB and HML factors can be obtained free of charge from Professor Kenneth French's website,[43] where he maintains a database of the factors for regional areas such as Asia-Pacific, Europe, and North America.

[42] For a discussion of this critique, see, for example, Black, F., "Beta and return," *Journal of Portfolio Management* 20, 1993, pp. 8-18; A.C. MacKinlay, "Multifactor Models Do Not Explain Deviations from the CAPM," *Journal of Financial Economics* 38, 1995, pp. 3-28; A. Lo and A.C. MacKinlay, "Data-Snooping Biases in Tests of Financial Asset Pricing Models," *Review of Financial Studies* 3, 1990, pp. 431-467; Fama, E. and K.R. French, "Size and Book-to-Market Factors in Earnings and Returns," *Journal of Finance* 50, 1995, pp. 131-155; and Fama, E., and K.R. French, "Industry costs of equity," *Journal of Financial Economics* 43(2), 1997, pp. 153-193.

[43] The website is located at http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

Regulatory Use

The Fama-French model has been submitted in Australia, North America, and the U.K.[44] While U.S. decisions are only rarely explicit about how evidence was weighted, we are not aware of a U.S. decision that primarily relied on the Fama-French model. However, the U.K. Competition Commission used the model to determine whether a small company premium should be included in the cost of capital.[45] The Régie de l'énergie in Québec considered the Fama-French approach and found that the model had not been sufficiently examined to date to be used as a basis for setting the rate of return for a gas distributor.[46]

Characteristics of the Fama-French Three-Factor Model

Many of the Fama-French model characteristics are similar to those of the CAPM. It relies on a risk-free rate and an estimate of the market risk premium, so like the CAPM it is sensitive to developments in risk-free rates. Like the ECAPM, the Fama-French model captures the empirical observation that the Security Market Line predicted by the CAPM is too steep. The Fama-French model has two additional factors, which vary over time and therefore add to the variations in the cost of equity estimates over time.

D. ARBITRAGE PRICING THEORY

The Arbitrage Pricing Theory (APT) was developed by Ross (1976a, 1976b)[47] as a multifactor alternative to the CAPM. The model is a theoretical approach to explaining the cross-section of returns with additional factors beyond the standard market portfolio in the Sharpe-Lintner CAPM. It is a one-period model in which all investors believe the stochastic properties of capital assets' returns are consistent with a factor structure. Assuming equilibrium prices offer no arbitrage opportunities, the expected returns on these capital assets are approximately linearly

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[44] See, for example, Jemena Gas Networks (NSW) Ltd - Initial response to the draft decision - Appendix 5.2 - NERA: Cost of Equity – Fama-French Model; California Public Utilities Commission, "Decision 07-12-049," December 20, 2007; and U.K. Competition Commission, "Market Investigation into Supply of Bulk Liquefied Petroleum Gas for Domestic Use: Provisional Findings Report," August 2005, Appendix K.

[45] See, for example, U.K. Competition Commission, "Market Investigation into Supply of Bulk Liquefied Petroleum Gas for Domestic Use: Provisional Findings Report," August 2005, Appendix K.

[46] Régie de l'énergie, Décision D-2007-116, Gaz Métropolitain, pp. 23-24.

[47] S.A. Ross, "Options and Efficiency," *Quarterly Journal of Economics* 90, 1976, pp. 75-89 and S.A. Ross, "The Arbitrage Theory of Capital Asset Pricing," *Journal of Economic Theory* 13, 1976, pp. 341-360.

related to the factor loadings. The factor loadings are proportional to the returns' covariances with the factors - much like in the CAPM.[48]

The empirical specification of the model is

$$E(r_S) = \beta_1 \cdot E(Factor1) + \beta_2 \cdot E(Factor2) + ... + \beta_N \cdot E(FactorN) \quad (6)$$

The APT is a generalization of the standard CAPM in that it allows for multiple risk factors and does not require the identification of the market portfolio. However, the theoretical APT only provides an approximate relation between expected asset returns and a combination of factors. Therefore, testability of the model depends on imposing several additional assumptions on the conditional distribution of returns. For example, exact factor pricing holds in an equilibrium intertemporal asset pricing framework. In this general model specification, the market portfolio is one pricing factor as in the standard CAPM, and additional factors arise from investors' need to hedge uncertainty about future investment opportunities. These factors can be specified as traded portfolios of assets, or macroeconomic variables that reflect the systematic risks of the economy, such as industrial production growth, changes in bond yield spreads or unanticipated inflation.

The key difference between factor specification in the APT versus the Fama-French model described above, is that the factors in the APT are theoretically motivated as hedging variables that capture economy-wide non-diversifiable risks, whereas the factors in the Fama-French model are empirically motivated, and are instead selected based on observing the firm characteristics that best explain the cross-section of returns over a specific sample period.

E. DIVIDEND DISCOUNT MODEL

Although there are several versions of the Dividend Discount Model (DDM), all versions determine today's stock price as a sum of discounted cash flows that are expected to accrue to shareholders. Assuming that dividends are the only type of cash payment to shareholders, the pricing formula becomes:

[48] For a brief introduction, see Gur Huberman, "Arbitrage Pricing Theory," in *The New Palgrave: Finance*, eds. J. Eatwell, M. Milgate, and P. Newman, 1989, pp. 72-80.

$$P_t = \frac{E_t(D_1)}{(1+r_S)} + \frac{E_t(D_2)}{(1+r_S)^2} + \frac{E_t(D_3)}{(1+r_S)^3} + \cdots \quad (7)$$

where "P_t" is the market price of the stock; "D_i" is the dividend cash flow at the end of period *i*; "r_S" is the cost of capital of asset/security *S* (as before); and the sum is into the infinite future.[49] The formula above says that the current stock price is equal to the sum of the expected future dividends (or cash flows), each discounted for the time and risk between now and the time the dividend is expected to be received – with the cost of capital r_S as the appropriate discount rate. The notion that the current stock "price equals the present value of expected future dividends" was first developed in 1938 by Williams and was then rediscovered by Gordon and Shapiro in 1956.[50]

1. Single-Stage DDM

If the dividend growth rate is constant, then we obtain the standard Gordon Growth model,[51] which can be shown to determine the cost of capital on security *S* as:

$$r_S = \frac{D_O \times (1+g)}{P} + g \quad (8)$$

where g is the constant, periodical growth rate.

This equation says that the cost of capital equals the expected dividend yield (dividend divided by price) plus the (perpetual) expected future growth rate of dividends. As is readily seen from Equation (8) above, an implementation of the constant growth DDM requires a determination of the current stock price, current dividends, and the applicable growth rate.

[49] With the convention that D_i is zero for periods beyond the expected life of the asset.

[50] See Brealey, Myers, and Allen (2011), p. 82.

[51] Named after Myron J. Gordon, who published an early version of the model in "Dividends, Earnings and Stock Prices," *Review of Economics and Statistics*, Vol. 41, 1959, pp. 99-105.

2. Multi-Stage DDM

If the assumption of constant growth is not considered reasonable for several years before settling down to a constant rate, variations of the general present value formula can be used instead. For example, if there is reason to believe that investors do *not* expect a steady growth rate forever, but rather have different growth rate forecasts in the near term (*e.g.*, over the next five or ten years) converging to a constant terminal growth, these forecasts can be used to specify the early dividends in Equation (7). Once the near-term dividends are specified, Equation (8) can be used to specify the share price value at the end of the near term (*e.g.*, at the end of five or ten years), and the resulting cost of capital can be determined using a numerical solver. A standard "multi-stage" DDM approach solves the following equation for r_S:

$$P = \frac{D_1}{(1+r_s)} + \frac{D_2}{(1+r_S)^2} + \ldots + \frac{D_T + P_{TERM}}{(1+r_S)^T} \quad (9)$$

The terminal price, P_{TERM}, is just the discounted value of all of the future dividends after constant growth is reached and T is the last of the periods in which a near-term dividend forecast is made. The implementation of the multi-stage growth model requires, in addition to a current price and current dividend, the selection of growth rates for each stage of the model and a determination of the length of each period.

More recent DDM implementations have focused on variations of the multi-stage model described above. For example, the U.S. Surface Transportation Board relies on a version of the multi-stage DDM that uses cash flow rather than dividends and specifies three growth rates – a near-term company-specific growth rate, an intermediate industry-specific growth rate and a long-term economy-wide growth rate.[52] The STB version is identical to the model developed by Morningstar / Ibbotson, Ibbotson's "three-stage" DDM, which is one of five models calculated for all U.S. SIC codes annually. In Ibbotson's version, dividends are replaced by cash flow (excluding extraordinary items) and the figure is normalized over a three-year period. The model then uses company-specific growth rates from analysts over the first five years, industry growth rates over the next five year and the GDP growth rate after year 10.

[52] See Surface Transportation Board, STB Ex Parte No. 664 (Sub-No. 1), "Use of a Multi-Stage Discounted Cash Flow Model in Determining the Railroad Industry's Cost of Capital," January 28, 2009. The Alberta Utilities Commission, Decision 2009-216 (¶271) also specifies a preference for the multi-stage model.

Another example of more recent multi-stage DDMs used is the version frequently estimated by *Brattle*, where company-specific growth rates are used for the first five years while the long-term GDP growth rate is used from year 10 onwards. In the in-between years (6-10), the model assumes that the growth rates converge linearly from the company-specific rates to the GDP growth rate. Similarly, Professor Myers' report suggests that in many industries it is important to look at the total cash flow that accrues to shareholders rather than on a per share basis, because stock buyback programs make the per share figures less reliable. In this model, the fundamental variable being determined is the market value (total price) of a company rather than the price per share, and instead of looking to dividends per share the model uses total cash flow to shareholders.[53]

3. DDM Implementation Issues

To implement the DDM it is necessary to specify one or more growth rates and to determine whether (i) dividends accurately reflect cash flow to shareholders, (ii) the horizon over which to apply each growth rate if using a multi-stage model, and (iii) the exact determination of the initial stock price. In most applications, the choice of growth rate is the most controversial part of the DDM implementation and the determination of the stock price is the least controversial.

4. Characteristics of the DDM

As for the other models, many of the strengths and weaknesses of the DDM depend on its implementation. However, assuming a reliable implementation, some strengths of the DDM are:

- Both the single-stage and the multi-stage DDM rely on forward-looking information and hence estimate a forward-looking cost of equity.
- The models are usually easily replicated and are therefore easy to audit.

Among the weaknesses of the DDM are the following:

- The DDM relies on growth forecasts, which frequently are available only for 2-5 years.

[53] This revised method is explained in R. A. Brealey, S. C. Myers and F. Allen (2013), *Principles of Corporate Finance*, 11th Ed., McGraw-Hill Irwin, Ch. 16 (forthcoming).

- Because stock prices (and to a degree forecasted growth rates) change frequently, the model results often vary substantially over time.

Among the other issues to consider is the prevalence of stock buybacks, which means that dividends do not reflect all cash payments to shareholders. As mentioned above, some regulated entities have share buyback programs. In the pipeline industry, Spectra Energy, a U.S. based pipeline company, recently authorized share buybacks of $600 million for a little over 6% of its equity capital.[54]

Therefore, it is necessary to modify the model to take into account these cash transfers. In addition, for many companies, growth rates are only available on an infrequent basis, making the cost of equity estimates less forward-looking than ideal.

Both the single-stage and multi-stage DDM are frequently used in U.S. rate regulation to estimate the cost of equity. However, it is important to recognize that few U.S. regulators have a pre-specified methodology, but instead hear and review evidence from a variety of parties prior to issuing a decision on the cost of equity. Therefore, estimates from DDMs are only one of several pieces of evidence considered by most U.S. regulators. In addition, U.S. regulation was in place prior to the development of more market-based models such as the CAPM, and there is therefore a tradition to rely on the DDM.

5. Residual Income Model

One model that can be viewed as an extension of the multi-stage DDM is the residual income model, which relies on earnings or abnormal earnings instead of dividends. Broadly speaking, the model defines price as the sum of the book value of equity and the discounted present value of "abnormal" or "residual" earnings.[55] The model is a forward-looking methodology in that it generally uses analysts' forecasts to determine growth rates, although it uses historical earnings information to derive the current "residual income." The model is based on the so-called Ohlson-Juettner method, which like the multi-stage DDM allows growth rates to vary over time.

[54] See Spectra Energy, Form 10-K, 2008 p. 31.

[55] For an early exposition, see J. Ohlson, "Earnings, book values, and dividends in equity valuation," *Contemporary Accounting Research* 11, pp. 661-687.

Abnormal earnings are typically forecast using earnings estimates for one or two years ahead. Assuming that abnormal earnings in the long run grow at the assumed long-run rate, the model allows for a high short-term earnings growth rate that gradually declines to the long-term level. Technically, the model is appealing because it provides a closed form solution to the cost of equity based on few inputs, so that it is simple to implement.[56]

The Residual Income Valuation (RIV) method has been debated substantially in the accounting literature in recent years. Variations on this model have been cited in recent Australian cases – for example, the "residual income model" proposed by the DBNGP in its most recent access arrangement.[57] The model was also proposed to the STB, albeit the STB instead adopted Ibbotson's three-stage DDM model based on cash flows rather than dividends.

In a recent paper by Nekrasov & Shroff (2009)[58] the authors propose a valuation methodology that applies risk measures based on economic fundamentals directly into the valuation model, aiming to assess the differences in valuation derived from the use of fundamentals-based risk adjustments instead of the commonly used asset pricing models (estimated using historical returns). Note that this paper does not specifically address valuation and cost of equity for the regulated entities.[59]

The authors use the RIV model to derive an accounting-based risk adjustment, which is equal to the covariance between a firm's ROE and economic factors. Accounting risk factors are identified and used to construct a measure of risk adjustment, then applied to calculate firm value. Two components of value are estimated separately: the risk-free present value (RFPV) and

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[56] The model was also submitted for consideration to the U.S. STB; P.S. Mohanram, *Determining an Appropriate Cost of Capital for Railroads*, submission to the Surface Transportation Board, September 2007.

[57] See *Draft Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline*, paragraphs 458-467. Tristan Fitzgerald, Stephen Gray, Jason Hall and Ravi Jeyaraj, 2010 "Unconstrained estimates of the equity risk premium," Working paper, The University of Queensland, http://ssrn.com/abstract=1551748 ("Fitzgerald et al.").

[58] A. Nekrasov & P. Shroff, "Fundamentals-Based Risk Measurement in Valuation," *The Accounting Review* 84, 2009, pp. 1983-2011.

[59] See example or models submitted in regulatory settings; see Fitzgerald et al. and Partha Mohanram, "*Determining an Appropriate Cost of Capital for Railroads*," Submission to the U.S. Surface Transportation Board, September 2007.

the covariance risk adjustment. The RFPV is calculated using a forecast of earnings, book value of equity and the risk-free rate as inputs to the model, while the covariance risk adjustment is estimated by calculating betas on the different risk factors and corresponding factor risk premia.

The authors acknowledge that this methodology "may be more complex to implement than the returns-based cost of equity."[60] However, the authors conclude that the strong empirical performance of the one-factor accounting–beta model, combined with the need of few additional inputs for the estimation, justify its use in valuation applications.

6. Characteristics of the Residual Income Model

The pros and cons of the Residual Income Model are generally similar to those of the DDM model, but we note that the model considers earnings instead of dividends, so that if earnings and cash flows are reasonably consistent, this model better captures the totality of cash flow that accrues to shareholders.

F. Other Models, Methods, Market Data and Evidence

1. Risk Premium Approaches

Some regulators in North America use a simplified version of the CAPM, the so-called risk-premium approach, which collapses the beta and risk premium to one figure and adds this figure to an interest rate. The debt instrument is either government bonds or utility bonds. The risk premium approach calculates the cost of equity, r_S, as:

$$r_S = r_D + \text{estimated risk premium} \quad (10)$$

where r_D is the return on a selected debt instrument. There are many versions of this model depending on the choice of the debt instrument, r_D, and the estimation of the risk premium. It is important to note here that the risk premium approach, while a generalized form of the CAPM, does not have the same level of theoretical support as the standard CAPM. This is because the return on the selected debt instrument used is not necessarily equal to the risk-free rate, and the

[60] *Ibid*. p. 1986.

estimated risk premium used is not explicitly based upon the product of the market beta and the MRP.

Equation **(**10) is frequently implemented using either a historical estimate of the risk premium, or a forward-looking or expected risk premium. The historical risk premium is commonly determined as the historical spread between equity and debt returns, so the primary choices for the analyst become which equity returns and debt instrument to use, as well as the period over which the spread (*i.e.*, the risk premium) is to be measured. It is not uncommon to see this model implemented using long-term government bonds or utility/corporate bonds to measure the cost of debt, while the equity investments used are typically either (a) realized accounting returns of regulated entities in the same industry, (b) realized stock returns of companies in the same industry, or (c) allowed returns on equity for the industry. In choosing a debt instrument to determine r_D, it is important that it be consistent with the debt instrument used to determine the risk premium. In other words, if a 10-year government bond is used to determine the historical risk premium, then r_D must also be measured using a 10-year government bond. The realized risk premium is highly dependent on the time period over which it is estimated, so that choice is also important.

The forward-looking model requires that the analyst determine a proper measure of the expected cost of debt and estimates the expected risk premium going forward, rather than relying on historical data. Determining the expected equity return is more difficult and requires reliance on an estimation technique. It is common to rely on DDM models to determine the risk premium in the forward-looking version of the model. One result originating from these analyses of historical or forward-looking risk-premium approaches is that empirically there is a negative relationship between the risk premium and the yield-to-maturity. Historically, a 1% increase in the yield-to-maturity of government bonds results in less than a 1% increase in the estimated (or realized) return on common equity.[61] The relationship between the return on equity and

[61] For example, Roger A. Morin, "*New Regulatory Finance*," Public Utilities Reports, Inc., 2006 pp. 128-129 summarizes several studies and found that the realized ROE changes approximately 50 basis points when government bond rates change 100 basis points. Regulatory agencies such as the Ontario Energy Board relied on this empirical finding as well as data submitted by experts in its recent hearing to update its annual change in the estimated cost of equity for Ontario utilities by less than the change in government bond rates.

(government or utility) bond yields is depicted in Figure 4 below. The figure is for illustrative purposes only and does not reflect an actual analysis of the relationship.

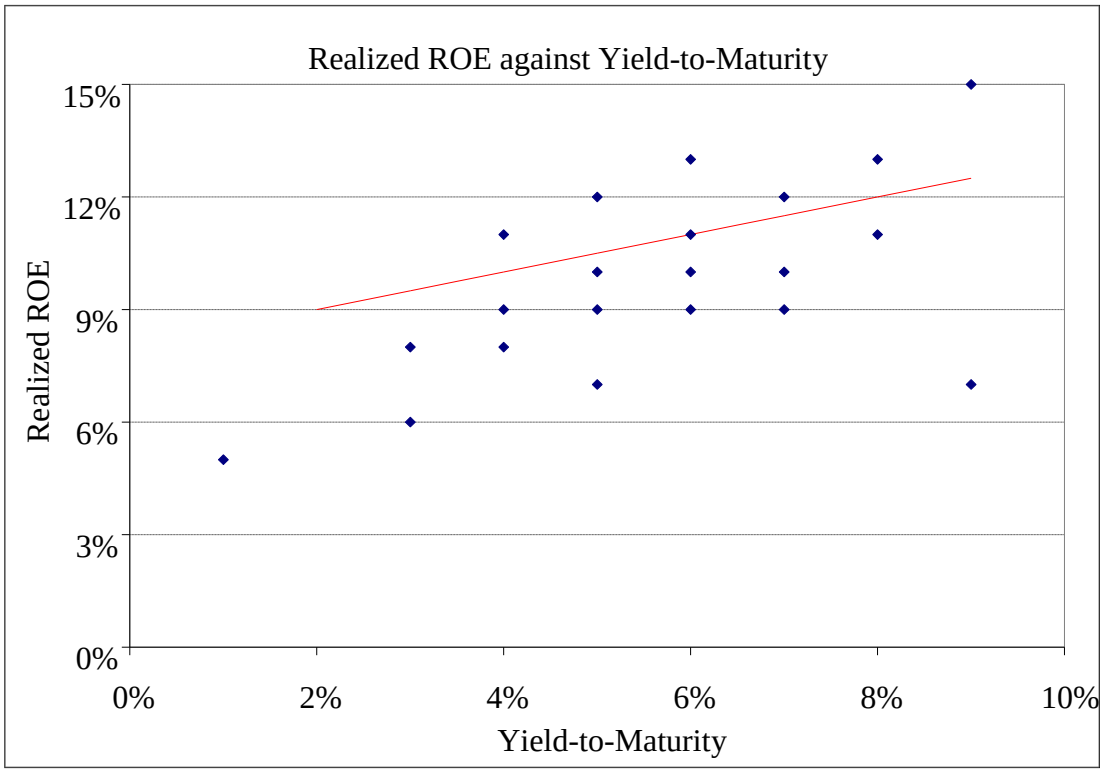

Figure 4

This is a reason why, for example, the Ontario Energy Board (OEB) took evidence from the risk premium approach into consideration when determining its baseline cost of equity in 2009.

2. Build-up Method

The build-up method estimates the return on an asset as the sum of a risk-free rate and one or more risk premia that represent the rewards an investor receives for taking on a specific risk:[62]

Cost of Equity = Risk-Free Rate + Market Risk Premium
+ Firm Size Premium + Industry Premium
+ potentially other factors

[62] *Morningstar Ibbotson SBBI Valuation Edition 2012 Yearbook*, p. 27.

Each of the components of the build-up method is discussed in detail below:

- The Risk-Free Rate is calculated using either Treasury bills ('T-bills") or long-term government bonds.
- The Market Risk Premium reflects the compensation above the return on a risk-free asset that investors require for the additional market risk they bear by investing in a well-diversified market portfolio of risky assets. Ibbotson calculates this as the difference between the total expected return on the market portfolio and the risk-free rate.
- The Firm Size Premium may be included to account for the additional risk inherent in small company stocks. A firm size premium can either be adjusted or unadjusted for the effect that a small company stock's higher beta has on its excess return. To illustrate the magnitude of the size premium, Table 1 below shows the empirically observed size premium for U.S. companies as reported by Ibbotson Associates.

	Beta-Adjusted Size Premia (%)	Non-Beta-Adjusted Small Stock Premia (%)
Mid-Cap	1.1	1.9
Low-Cap	1.9	3.4
Micro-Cap	3.9	6.3
Small Company Stocks	3.1	4.7

Table 1: Ibbotson Associates' Size Premia on a Beta-Adjusted versus Non-Beta-Adjusted Basis, 1926-2011[63]

- An Industry Premium can be determined based on the characteristics of the regulated entity's industry. Research has produced no consensus on this figure and Ibbotson notes that it is important to avoid double-counting industry risk by using other beta-adjusted (hence industry dependent) risk premia (positive or negative) and at the same time adding an industry premium.

63 *Morningstar Ibbotson SBBI Valuation Edition 2012 Yearbook*, p. 27.

In addition to the factors discussed above, some argue for the inclusion of minority discount premia, control premia, key person discount, *etc.* However, these additional premia (positive or negative) are very difficult to measure and we know of no regulator that has included such additional factors. The New Mexico Public Regulation Commission in the U.S. has in the past used the build-up method as one of its methods to estimate the cost of equity.

3. Comparable Earnings

The comparable earnings method requires the analyst to go through three steps. First, a group of *unregulated* companies is required because the realized accounting rate of return of a regulated company depends on its allowed return. Using regulated companies to estimate the comparable earnings cost of capital would be circular, *i.e.*, the allowed rate of return is used to determine the allowed rate of return. However, the use of unregulated companies requires careful consideration of the risk characteristics of the companies and the comparability to those of the target utility.

Second, a time period over which to estimate the return on equity must be selected. Because a company's achieved earnings fluctuate from year to year and depend substantially on both company-specific and economy-wide factors, it is necessary to include companies from several industries, averaged over several periods.

Third, because the comparable companies are unregulated entities, it is necessary to adjust for any risk differences between the sample companies and the target company. There are many ways to adjust for risk differences, so the following is a simplified description of some common approaches rather than an exhaustive review. Analysts often collect information on the comparable companies' and the target company's bond ratings, asset betas, DDM estimates of the cost of equity, and other measurable risk factors. In many instances, this information is also collected for a sample of regulated companies in the same industry as the target company. If the sample companies are found to be consistently more (less) risky than the target company and its industry peers, then an adjustment is made to the required return on equity. This can sometimes be done formally. For example, if the sample companies' DDM estimates of cost of equity are consistently 25 basis points higher (lower) than the DDM estimates for the target company (or industry peers), then a downward (upward) adjustment of 25 basis points is made. For other

measures, it is more difficult to determine the exact adjustment, so it is usually made based on the analyst's experience. For example, does a two notch difference in bond rating require a specific upward or downward adjustment? Thus, while the differences are relatively easy to measure, the adjustment for such differences requires subjective judgment.

A major issue is whether realized book returns are a good proxy for the returns that investors expect going forward. From a statistical perspective, the realized accounting return on book equity for any given period is the realization of a single outcome of a distribution, whereas the expected return represents the probability-weighted average of all possible outcomes of the distribution. These two figures can differ substantially. In addition, there are practical problems with the implementation of this model because financial reporting occurs with a lag, which during times of change can mean that the results are out of date.

4. Market-to-Book and Earnings Multiples

In some regulatory decisions on the cost of capital, regulators have sought to "cross check" a proposed cost of capital estimate by examining the market value of the firms they regulate relative to the value of the regulatory asset base (RAB). The theory behind this approach would be that the only capital on which the regulated firm is earning a return (at the regulator-determined cost of capital) is the RAB. Therefore, if the market value of the firm's returns is greater than the RAB, the belief is that it is a signal that investors are discounting future returns at a lower discount rate than the regulator's cost of capital determination — or, in other words, the regulator's cost of capital is "too high".

This kind of cross check approach was cited by the Australian Energy Regulator in its June 2011 determination on Envestra.[64] In that decision, the AER considered two kinds of evidence: premiums paid in takeover transactions relative to the value of the RAB, and market values (based on share prices) relative to RAB.

[64] *Final Decision - Envestra Ltd Access arrangement proposal for the Qld gas network*, AER (June 2011), p. 35-37.

a) Takeover premiums

The AER reviewed premiums paid in takeover transactions, where the premium was assessed as the sale price relative to the value of the underlying RAB. Premiums were in the range of 20% to 120%. The AER considered that these premiums were too large to be explained by factors such as expected synergies, and instead considered this as evidence that the cost of capital determined by regulators has been at least as high and likely higher, than the actual cost of capital faced by the businesses.

However, there are conceptual problems with this approach so that it has no value as a cross check on a regulator's cost of capital determination. First, the reliance on the approach implicitly assumes that (i) the company to which it is applied consists entirely of regulated businesses and (ii) that the regulator's cost of capital determination is the only factor impacting the market value of the company. In reality the cost of equity is only one component of a broader determination on what the firm's regulated rates should be. Thus, even if it were possible to estimate the impact of the regulator's decision on the market value of the firm, this impact would be associated with the overall decision, not with any one specific component (like the cost of capital). The market value of a regulated firm can be thought of as the expected future cash flows (from providing services at regulated rates), discounted at the firm's actual cost of capital. However, the regulator's cost of capital determination is only one of many factors which determine expected future cash flows, particularly where price determinations are forward-looking (as in Australia):

- If investors expect the firm to "beat" regulator assumptions on any of operating costs, capital costs, or revenue growth, expected future cash flows would be larger than the RAB in net present value terms, even if the discount rate is equal to the regulator-determined cost of capital.
- Investor expectations, which are implicit within the firm's market value, encompass expected cash flows beyond the end of the current price control period.
- Expected future cash flows are also affected by firm-specific factors such as idiosyncratic volatility, which would not be captured in the discount rate.

In addition, there are likely to be other more practical difficulties: for example, many regulated firms have at least some unregulated activities. These activities are valued by investors but are not part of the RAB or the regulator's cost of capital decision.

b) Trading premiums

The AER also considered premiums measured on the basis of market value of listed firms (from share prices) relative to RAB. The AER estimated market-to-RAB trading multiples for four firms (including Envestra).[65] The trading multiples were in the range of 1.21 to 1.81.

The AER stated that these premiums were too high to be the result of factors such as expected synergies, and instead considered this as evidence that the cost of capital determined by regulators has been at least as high and likely higher, than the actual cost of capital faced by the businesses. However, the same difficulties described above for takeover premiums also apply to the consideration of trading premiums. In addition to the takeover premiums difficulties, the use of trading premiums suffers from bias in circumstances where the market is very volatile, where day-to-day changes reflect investor reactions to news such as the collapse of Lehman Brothers in September 2008, the ongoing European debt crisis, or industry factors such as cap and trade initiatives, etc. Therefore, trading premiums also have no value as a cross check on the regulator's cost of capital determination.

5. Other Evidence

Other evidence is a very broad category that does not readily lend itself to a short introduction by method. However, expert evidence can be highly valuable if of high quality, so it will be necessary to use judgment and consider how the expert arrived at his or her recommendations. Similarly, academic research may provide insights into the cost of equity, but bear in mind that most academic research focuses on finding or explaining "interesting facts" and often considers all companies and industries for which data are available. Because a result pertains to the market

[65] The four firms were SP Ausnet, Spark, Duet and Envestra (*Ibid.*, Table 5.5).

as a whole, it does not necessarily pertain to a specific industry, which may have unique characteristics.

Other types of evidence that are sometimes considered are equity analysts' reports on a specific company, an industry, or a market. When such evidence is reviewed, it is important to consider the purpose for which the evidence was produced. For example, equity analysts often produce research documents aimed at stock-buying investors and only rarely are concerned with the cost of equity over, for example, a regulatory period. Instead, equity analysts attempt to determine the current (or future) stock price as the discounted sum of future cash flows with the discount rate being the weighted average sum of the cost of debt and equity; *i.e.*, the focus is not on what the best estimate of the cost of equity is – it is merely one of many inputs to determining the stock price. In addition, because a lower cost of equity increases the estimated stock price, equity analysts have an incentive to, if anything, bias the cost of equity estimates downward.

6. Characteristics of Other Methods, Models, Market Data and Evidence

The methods, models, market data and other evidence in this section differ, so the advantages and disadvantages listed below are method-specific:

- The risk premium model is simple and data for its implementation are readily available.
- If the benchmark interest rate is a utility or corporate bond index, then the risk premium model tends to provide relatively stable results over time and is less impacted by monetary policy or country-specific risks than the CAPM.
- The build-up method recognizes size effects and potentially other risks.
- The comparable earnings method's strength is that it incorporates information from non-regulated entities.

Among the weaknesses of the methods we note the following:

- None of the methods are founded in economic or finance theory.
- The risk premium approach does not consider systematic risk specifically and does not allow for company-specific information to be considered.

- The build-up method generally does not consider systematic risks and treats size effects the same across industries.
- The comparable earnings model relies on historic accounting information, which may not be consistent with investor expectations. Also, the historic accounting information may reflect accounting choices rather than economic fundamentals and may be subject to significant variability over time.

As for other evidence such as expert reports and investment reports, the merits of the derived estimates are highly dependent upon the quality of the reports and the purpose for which the estimates were derived. We caution against placing weights on estimates where the purpose for their derivation is not known, and against placing substantial weight on estimates that were derived for purposes other than to provide an independent assessment of the cost of equity. For example, estimates derived for accounting purposes, stock recommendations, *etc.* may not be suitable for other uses.

This section has summarized the major models, methods and evidence that are currently used and considered by regulators and practitioners. The models described above are not intended to comprise an exhaustive list of all possible methods and evidence that could be relied upon in determining the cost of equity capital. Indeed, as the practice of finance continues to evolve, further relevant evidence may still be found, and certain models may become outdated or less relevant.

IV. USING THE METHODS

In this section, we first discuss implementation issues for estimating the cost of capital and summarize the key characteristics of the models described above in *Section III*. We then address the issue of how and when to use the models to determine an appropriate regulatory return on equity, or range for the regulatory return on equity for the industry or benchmark, based on the views of academic, practitioners and regulators. Finally, we discuss how to position a target entity relative to a sample of companies.

A. IMPLEMENTATION ISSUES

Regardless of the cost of equity estimation method that is used to estimate the cost of capital, there are some key elements of the cost of capital estimation process that must be addressed. This section discusses some of the important issues.

Most analysts rely on a "comparable sample" to determine the cost of equity for the target entity, so it becomes important to determine what is meant by comparable.[66] Although the selection of comparable companies is method and context-specific, it is generally viewed as ideal to have sample companies with business risk similar to that of the target company. Similar business risk generally implies selecting companies in the same line of business. Most researchers and practitioners rely on additional criteria to exclude sample companies that have the potential to bias the cost of capital estimation methodologies. For screening, it is preferable to rely on objective information from publicly available data sources; however, the determination of exactly which criteria to use is subject to the constraint that the sample be "large enough." This, in turn, requires a determination of which criteria are the most important from the many possible criteria that could be considered. Among the criteria typically employed are combinations of the following:

- Include companies with similar business risks (*e.g.*, companies in the same or similar industries);
- Exclude companies that face financial distress;
- Exclude companies that are or have recently been involved in substantial merger and acquisition activity;
- Exclude companies with unique circumstances that may bias the cost of capital estimation (*e.g.*, restatements of financial statements); and
- Exclude companies with insufficient data.

[66] A comparable sample can be used to assess the cost of capital for the target entity by (i) estimating the individual companies' cost of capital and placing the target company's cost of capital in relation to the sample using the average, median, range, or other measure to assess the cost of capital or (ii) using a portfolio approach, where the cost of capital for the portfolio of companies (rather than individual companies) is estimated to assess the cost of capital for the target entity.

There is, however, controversy about how to implement the criteria above. Each element of the sample selection criteria requires some judgment. For example, what size sample is "large enough"? Should the sample include both Australian and foreign companies?[67] How is financial distress measured? How is "substantial merger and acquisition" activity to be defined? The selection criteria are interrelated, because selection of the sample based upon one criterion may immediately reduce the potential sample to a small number of companies. The sample selection process is, therefore, a balancing act between selecting a sample that is "more comparable" and one that is "too small."

Second, decision makers must decide how the components of the cost of capital will be determined. For example, it is possible to estimate (a) the cost of debt, the cost of equity and the capital structure, each separately or (b) an overall cost of capital or (c) a combination of these. Another component of the cost of capital is the allowance for income taxes, which we ignore in this report. Finally, because the dollar amount that accrues to investors in a regulated entity ultimately depends on not only the allowed cost of equity and the size of the rate base but also on the relative share of equity and debt in the capital structure, it is important to consider the overall impact of these capital structure decisions on the individual components. Specifically, it is important to note that cost of equity estimation models provide estimates that reflect both the underlying business risk of the assets but also the financial risk inherent in how those assets have been financed.

B. SUMMARY CHARACTERISTICS OF THE MODELS

Before we discuss how to use the various models and other information that may be available to a decision maker, we summarize in Table 2 below the key characteristics of the discussed models in the form of their economic underpinnings, any potential empirical bias, sensitivity to economic or industry factors, and whether the models are forward or backward-looking.

[67] For example, several Canadian regulators have used beta estimates from U.S. companies. See, for example, the National Energy Board's RH-1-2008 decision p. 67 and Ontario Energy Board's EB-2009-0084 decision, pp. 22-23.

Table 2: Characteristics of Cost of Equity Methods

	Evaluation Criteria			
Cost of Capital Methods	**Economic Underpinnings**	**Bias**	**Impact of Market Conditions**	**Forward or Backward-Looking**
Sharpe-Lintner CAPM	An equilibrium model: Under no arbitrage and in a mean-variance-optimizing world, the expected cost of equity is a function of the risk-free rate, systematic risk (beta) and the expected MRP. Transparent and sensitive to market performance and risk-free rates. Empirical support for explaining cross-sectional returns of average-beta stocks, but failure for low-beta/high-beta/small/high book-to-market firms.	Empirical evidence that CAPM under-estimates the expected return for low-beta stocks. A Portfolio approach to estimate betas provides more consistent results. MRP estimation controversial with some historical measures potentially biased.	Sensitive to monetary policy. Market uncertainty and economic turmoil likely to affect the expected MRP.	Beta estimates are backward-looking. Historical MRP is backward-looking, but forecast MRP (e.g., DDM) are forward-looking.
ECAPM	Same as above, but captures the empirical observation that the SML predicted by CAPM is too steep. Tested in the U.S., but not extensively outside the U.S. or in recent market conditions.	Corrects for the empirical bias induced by the flatter-than-predicted-by-CAPM Security Market Line.	Same as above.	Same as above.

(Table 2 ctd.) Characteristics of Cost of Equity Methods

	Evaluation Criteria			
Cost of Capital Methods	**Economic Underpinnings**	**Bias**	**Impact of Market Conditions**	**Forward or Backward-Looking**
Consumption-Based CAPM	Generalization of the Sharpe-Lintner CAPM that relates the risk premium on the investment to the covariance between the asset return and the intertemporal marginal rate of substitution of the decision maker. The expected conditional risk premium on an asset is related to its predicted conditional volatility. Requires more data and more refined estimation techniques than the Sharpe-Lintner CAPM. Lack of empirical support for most commonly used version (where covariance factor is aggregate consumption growth), but more support for versions with market frictions/time-varying risk aversion.	Allows for expected risk premium to vary with asset and investor characteristics, including conditional volatility and covariance with consumption growth; (considers more factors than the Sharpe-Lintner CAPM). Potentially mitigates empirical biases.	Empirical results appear stable and consistent over time (i.e. more robust to market conditions than standard CAPM).	Models forward-looking equity risk premia based on predicted conditional volatility. More forward-looking than Sharpe-Lintner CAPM.

(Table 2 ctd.) Characteristics of Cost of Equity Methods

	Evaluation Criteria			
Cost of Capital Methods	**Economic Underpinnings**	**Bias**	**Impact of Market Conditions**	**Forward or Backward-Looking**
Fama-French Model	Corrects for empirical biases of Sharpe-Lintner CAPM by adding 2 explanatory risk factors (size and book-to-market). Empirical support for explaining cross-sectional returns of size- and book-to-market-sorted portfolios. Weak empirical support for explaining returns of other portfolios and for out-of-sample predictive power. Fama-French factors (SMB and HML) are empirically motivated.[1]	Captures empirical observation that SML predicted by CAPM is too steep. Adds cross-sectional explanatory power to the standard CAPM.	Sensitive to monetary policy. Estimates of the 3 factor risk premia vary substantially over time and more so when the 3 factors interact.	Betas and factor risk premia estimates are backward-looking.
APT Model	Equilibrium multifactor model which holds under competitive markets, factor structure for asset returns, and absence of arbitrage in large economies. Corrects for empirical biases of Sharpe-Lintner CAPM by adding explanatory risk factors. APT factors are theoretically motivated. Model implemented empirically as intertemporal CAPM (see above for empirical issues).	Same as above.	Sensitive to market uncertainty and economic turmoil via market-related factor. Estimates of factor risk premia can vary substantially over time.	Forward-looking model in theory, but betas and factor risk premia are backward-looking if estimated using historical data.

1) See Fama and French (1993), Kothari, Shanken, and Sloan (1995), Black (1993), MacKinlay (1995), and Lakonishok, Shleifer, and Vishny (1994) for additional detail.

(Table 2 ctd.) Characteristics of Cost of Equity Methods

	Evaluation Criteria			
Cost of Capital Methods	**Economic Underpinnings**	**Bias**	**Impact of Market Conditions**	**Forward or Backward-Looking**
Risk Premium Model	Simplified version of the CAPM, which collapses the beta and market risk premium to one figure and adds this figure to an interest rate. Based on empirical estimation. Does not capture systematic risk or company-specific information.	The relied upon interest rate may be biased due to, *e.g.*, monetary policy. Does not account for changes in the risk premium.	Using a utility or corporate bond index as the benchmark, the risk premium model tends to provide relatively stable results. Reliance on government interest rates makes the model more sensitive to monetary policy. Inflation leads to bias in the risk premium model, because the historical data underlying the estimate of the risk premium may not be consistent with the current level of inflation.	Mostly backward-looking due to reliance on a historic spread of realized equity returns over debt returns to measure the risk premium, and thus does not capture expected changes in the economy.
Single-Stage DDM	Determines today's stock price as the sum of the discounted cash flows that are expected to accrue to shareholders going forward. Assumes that dividends (or cash flows) grow at a constant rate forever. Lack of empirical support for constant dividends/earnings growth rates in perpetuity.	Sensitive to bias in analyst forecasts of earnings growth rates which at best reflect 5 years. Less of an issue for utilities than most other industries. Sensitive to the exact implementation as dividends may not reflect all cash flow if the company engages in share repurchases or borrows to fund dividends. Does not take real options into account and will underestimate the cost of equity for companies with substantial real options.	Model requires the constant-growth assumption. Estimates are sensitive to changes in stock prices and forecasted growth rates, which is especially an issue if the industry is in transition. Stock prices are influenced by the information available to investors. Information about financial distress or merger and acquisition activities may overwhelm fundamental information about growth.	Relies on forecasted (i.e. forward-looking) growth rates and current stock prices. Hence estimates are forward-looking.

(Table 2 ctd.) Characteristics of Cost of Equity Methods

	Evaluation Criteria			
Cost of Capital Methods	**Economic Underpinnings**	**Bias**	**Impact of Market Conditions**	**Forward or Backward-Looking**
Multi-Stage DDM	Extension of single-stage DDM which allows for different growth forecasts over time. Stronger empirical support than constant growth version.	Same as above, but less sensitive to any bias in analyst forecasts than the single-stage DDM, as growth rates usually converge to the GDP growth rate over time.	Requires a series of growth rates; commonly near-term, interim, and for the very long- term. Sensitivity to growth rates is moderated. Similarly to single-stage DDM, less applicable to companies in financial distress or engaged in merger or acquisition activities.	Same as above.
Residual Income Method	Version of the multi-stage DDM that values abnormal or unforeseen earnings instead of dividends. Abnormal earnings are forecast using earnings estimates for one or two years ahead. Allows growth rates to vary over time. Abnormal earnings are based on empirical estimates.	Considers earnings instead of dividends or cash, so if earnings reflect expectations better than dividends or cash, it reduces bias.	Same as above. Performance relative to multi-stage DDM depends on implementation of each.	Same as above.

(Table 2 ctd.) Characteristics of Cost of Equity Methods

	Evaluation Criteria			
Cost of Capital Methods	Economic Underpinnings	Bias	Impact of Market Conditions	Forward or Backward-Looking
Build-up Method	Estimates the return on an asset as the sum of a risk-free rate and several risk premia that measure risks associated with size, industry, etc. Based on empirical estimation.	Recognizes size effects and other industry or company-specific risks. Exposed to same potential biases as standard CAPM and Fama-French models.	Exposed to same market uncertainties as standard CAPM and Fama-French models.	If risk factors and factor loadings are estimated from historical data, then the model is backward-looking.
Comparable Earnings	The model calculates the realized accounting rate of return on book equity of comparable (usually non-regulated) companies. Based on empirical estimation. Uses accounting returns rather than market data.	Selecting a sample of non-regulated comparable companies may lead to bias. Accounting changes can produce changes in model estimates without any change in the underlying cost of capital. The choice of estimation period may bias the accounting return on equity as accounting returns vary with economy, industry and company-specific factors.	Realized accounting returns are sensitive to economic, industry and company-specific events as well as to changes in accounting rules.	Uses backward-looking realized accounting rates of return, hence backward-looking. Can be difficult to find a time period that accurately reflects the expected horizon of the regulated entity.

C. How to Use the Models and Other Information

In this section we discuss how academics, practitioners and regulators think models should be used and how they have been used. The section also discusses the impact of economic conditions, industry factors and company-specific issues on the choice of models. The weight assigned to each model naturally depends on the key characteristics of the cost of equity estimation models described above. Finally, the section discusses how certain regulators have decided to use the models in specific economic environments.

1. Views of Academics, Practitioners and Regulators

Academics, practitioners and regulators have all acknowledged that there is no one way to determine the cost of equity. In the academic literature, several prominent researchers have commented that the use of more than one method is important. For example, Professor Myers of the Massachusetts Institute of Technology commented:

> Use more than one model when you can. Because estimating the opportunity cost of capital is difficult, only a fool throws away useful information. That means you should not use any one model or measure mechanically or exclusively. Beta is helpful as one tool in a kit, to be used in parallel with DCF models or other techniques for interpreting capital market data.[68]

Professors Berk and DeMarzo of Stanford University in their corporate finance textbook comment on the use of the CAPM, DDM, and other models by practitioners, and state:

> In short, there is no clear answer to the question of which technique is used to measure risk in practice — it very much depends on the organization and the sector. It is not difficult to see why there is so little consensus in practice about which technique to use. All the techniques we covered are imprecise. Financial economics has not yet reached the point where we can provide a theory of expected returns that gives a precise estimate of the cost of capital. Consider, too, that all techniques are not equally simple to implement. Because the tradeoff between simplicity and precision varies across sectors, practitioners apply the technique that best suit their particular circumstances.[69]

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[68] Stewart C. Myers, "On the Use of Modern Portfolio Theory in Public Utility Rate Cases: Comment," *Financial Management*, Autumn 1978.

[69] Jonathan Berk and Peter DeMarzo, *Corporate Finance: The Core*, 2009, (Berk & DeMarzo 2009) p. 420.

Looking to practitioners' views, the widely used text, *Ibbotson Cost of Capital Yearbook*,[70] reports results on the cost of equity (and associated weighted average cost of capital) by SIC code in the U.S. and other countries. In doing so, the yearbook reports the estimated cost of equity using five estimation methods: Sharpe-Lintner CAPM, CAPM plus/minus a size premium, Fama-French 3-Factor model, Single-Stage DDM, and 3-Stage DDM. The data source does not provide specifics on how to use the data but states that:

> [r]eaders can select cost of equity from five different models explored in this book. Given the size of the database being analyzed, there will clearly be instances where certain cost of equity models will fail to produce useable numbers. When NMF is displayed in a cost of equity column, it indicates that the model is producing unreasonable numbers, and greater emphasis should be placed on other models.[71]

Similarly, Roger A. Morin, in the context of U.S. regulation, mentions the use of the CAPM, DDM, risk premium models, and the comparable earnings method, concluding:

> No one individual method provides the necessary level of precision for determining a fair return, but each method provides useful evidence to facilitate the exercise of an informed judgment. Reliance on any single method or preset formula is inappropriate when dealing with investor expectations because of possible measurement difficulties and vagaries in individual companies' market data.[72]

Looking to regulators, the U.S. Surface Transportation Board (STB) undertook a review of its cost of equity estimation methodology in 2007-09 in two rounds, focused on the CAPM and DDM respectively. The STB's review resulted in two decisions with detailed instructions on how to estimate the cost of capital for the railway industry.[73]

In connection with this review, the STB noted:

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70 The most recent version is Morningstar, *Ibbotson Cost of Capital 2012 Yearbook* (Ibbotson 2012).

71 Ibbotson 2012, p. 6. The text views cost of equity estimates below the risk-free rate and above 50 percent as being not meaningful.

72 Roger A. Morin, *New Regulatory Finance*, Public Utilities Reports, Inc., 2006, (Morin 2006) p. 428.

73 Surface Transportation Board, STB Ex Parte No. 664, "Methodology to be Employed in Determining the Railroad Industry's Cost of Capital," January 17, 2008 (STB 2008) and STB Ex Parte No. 664 (Sub-No. 1), "Use of a Multi-Stage Discounted Cash Flow Model in Determining the Railroad Industry's Cost of Capital," January 28, 2009 (STB 2009).

> While CAPM is a widely accepted tool for estimating the cost of equity, it has certain strengths and weaknesses, and it may be complemented by a DCF model. In theory, both approaches seek to estimate the true cost of equity for a firm, and if applied correctly should produce the same expected result. The two approaches simply take different paths towards the same objective. **Therefore, by taking an average of the results from the two approaches, we might be able to obtain a more reliable, less volatile, and ultimately superior estimate than by relying on either model standing alone** [emphasis added].[74]

In arriving at this conclusion, the STB took notice of comments from the Federal Reserve that "multiple models will improve estimation techniques when each model provides new information,"[75] and also stated that there is "robust economic literature confirming that, in many cases, combining forecasts from different models is more accurate than relying on a single model."[76]

Similarly, the Ontario Energy Board (OEB) reviewed its cost of capital estimation methodology in 2009 following a year-long process. For context, the OEB does not focus on the cost of equity, but instead determines the premium over the risk-free rate that rate-regulated utilities are allowed. Regarding the methods used to determine the so-called Equity Risk Premium (ERP), the OEB concluded:

> **the use of multiple tests to directly and indirectly estimate the ERP is a superior approach to informing its judgment than reliance on a single methodology**.[77]

Additional examples of regulators who have relied upon multiple cost of equity estimation models and/or judgment based on a range of evidence are discussed in the section below.

To sum up, as clearly illustrated above, many academics, practitioners and regulators find that it is preferable to use more than one estimation method to determine the cost of equity. We agree that it is important to use more than one estimation method and stress that in determining how to

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74 STB 2008, p. 2.

75 STB 2009, p. 15.

76 STB 2009, p. 15.

77 Ontario Energy Board, "EB-2009-0084, Report of the Board on the Cost of Capital for Ontario's Regulated Utilities," Issued December 11, 2009, p. 36 (emphasis in the original).

weigh the estimation results, it is important to consider the degree to which the information from the methods overlaps versus providing additional information, the economic and financial environment that gave rise to the estimates, and the context in which they are being used.

2. Regulatory Practice in using Multiple Models

a) The U.S.

In the U.S., rates for rate-regulated entities are determined by several federal entities as well as regulators in each of the fifty states and the District of Columbia. Federal regulators tend to have well-specified methods to determine the cost of equity although they review all the information put to them. However, state regulators typically do not specify one single method and commonly have evidence from several estimation methods and parties in front of them before issuing a decision on the allowed cost of equity. In most cases the state regulator does not specify which weight was assigned to each method or other evidence. An exception is the determination of the cost of equity in Mississippi Power's Performance Evaluation Plan (PEP), where the Mississippi Public Service Commission annually updated the cost of equity for the company using a combination of the CAPM, ECAPM, risk positioning, and the DDM. In this specific circumstance, the weights assigned to each method are predetermined.[78] Some other examples of U.S. regulators' thought processes are provided below.

Surface Transportation Board

The STB used the constant growth model to track the cost of equity for U.S. railroads for a number of years. However, by 2005 the largest railroads were expanding rapidly and profitability was increasing. Security analysts were forecasting "long-run" earnings growth for some railroads at 15% per year. Such growth could not be sustained, so the constant growth model overstated the true cost of equity by a wide margin. The STB therefore initiated a cost of capital proceeding to consider how to change the determination of the cost of equity. After hearing evidence from academics and practitioners, the STB found that:

[78] http://www.psc.state.ms.us/.

> if our exploration of this issue has revealed nothing else, it has shown that there is no single simple or correct way to estimate the cost of equity for the railroad industry, and countless reasonable options are available.[79]

As a result of its deliberations the STB eventually settled on a blend of the CAPM and a multi-stage DDM.[80]

Georgia

The following example pertaining to Georgia Power, an integrated electric utility, illustrates a common approach in U.S. state regulation.

Georgia Power is regulated by the Georgia Public Service Commission (Georgia PSC), which has no pre-set method to determine the cost of equity. In Georgia Power's 2010 rate case, an expert for Georgia Power as well as for the Georgia PSC submitted evidence on the cost of equity for the company. The company's expert estimated the cost of equity using the Sharpe-Lintner CAPM, a single-stage DDM, and a risk premium approach, and recommended a return on equity of 11.0 to 11.2%. The PSC staff expert estimated the cost of equity using the Sharpe-Lintner CAPM, a sustainable growth DDM and also a comparable earnings model for a recommendation of 9.50 to 10.75%. The Georgia PSC approved a settlement including a cost of equity of 11.15%, but did not specify how it was arrived at.[81]

b) Canada

Until the early 1990s, Canadian regulators, much like U.S. state regulators, heard evidence on a multitude of methods and from various experts before arriving at a decision on the allowed cost of equity. However, starting in British Columbia in 1994, the British Columbia Utilities Commission in the first generic cost of capital proceeding in Canada established a benchmark ROE and a formulaic approach to updating the allowed ROE annually.[82] Shortly thereafter, other Canadian regulators followed suit and similarly established a benchmark ROE and an

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79 *U.S.* Surface *Transportation Board, Ex Parte 664 (Sub-No. 1)*, issued January 28, 2009, p. 15.

80 *Ibid.*

81 Direct Testimony of J.H. Vande Weide in Docket No. 31958; Direct Testimony of D. Parcell in Docket No. 31958, and Settlement Agreement in Docket No. 31958.

82 BCUC Decision in the Matter of Return on Common Equity BC Gas Utility Ltd., Pacific Northern Gas Ltd., West Kootenay Power Ltd., June 10, 1994 (BCUC 1994 Decision), pp. 39-40.

annual updating formula. These formulae were linked to the change or forecasted change in government bond yields.

While the formula used to update the allowed ROE annually was mechanical, the methods used to estimate the benchmark ROE varied across jurisdictions, and in many jurisdictions, the regulator looked to more than one estimation method.[83]

As the yield on government bonds declined, so did the allowed cost of equity, and as the financial crisis of 2008 impacted financial markets, regulators in Canada abandoned or modified the formula or the relied-upon benchmark. As was the case for the originally developed benchmark, the regulators heard evidence on multiple methods from several experts and implicitly or explicitly weighted these methods to arrive at a new or modified cost of equity methodology.[84] Some examples of this regulatory approach in Canada are provided below.

British Columbia

British Columbia Utilities Commission's (BCUC) views on how to determine the appropriate cost of equity capital have evolved over time. In the BCUC 1994 Decision,[85] the BCUC "placed primary reliance on the various risk premium tests presented" whereas the "comparable earnings and DCF test results have been used primarily as a check upon reasonableness."[86] However, in the BCUC 2006 Decision, the BCUC assigned weight to the DCF model and found the comparable earnings methodology useful.[87] The BCUC 2006 Decision did not state how much weight it assigned to each model it considered. The BCUC's views evolved as the various

[83] For example, the BCUC 1994 Decision at p. 17 indicated that while primary reliance should be placed on risk premium tests, comparable earnings and the DDM should be used as checks.

[84] For example, the National Energy Board abandoned the formulaic approach, the Alberta Utilities Board modified the benchmark, and the Ontario Energy Board modified both the benchmark and the formula. Both the Alberta Utilities Board and the Ontario Energy Board used several cost of equity estimation methods to arrive at their revised benchmark. The British Columbia Utilities Commission is in the midst of a generic cost of capital proceeding that will determine the approach going forward.

[85] BCUC Decision in the Matter of Return on Common Equity BC Gas Utility Ltd., Pacific Northern Gas Ltd., West Kootenay Power Ltd., June 10, 1994 (BCUC 1994 Decision).

[86] BCUC 1994 Decision, p. 17.

[87] BCUC In the Matter of Terasen Gas Inc. *et al.* Return on Equity and Capital Structure Decision, December 16, 2009 (BCUC 2009 Decision), pp. 44-45.

models arrived at more or less plausible results. For example, in its 2009 decision, the BCUC found:

> The Commission Panel agrees that a single variable is unlikely to capture the many causes of changes in ROE and that in particular the recent flight to quality has driven down the yield on long-term Canada bonds, while the cost of risk has been priced upwards.[88]

Having acknowledged the influence of the current economic environment, the BCUC in 2009 gave the most weight to the DDM, less weight to the Equity Risk Premium method and CAPM, and a low weight to the comparable earnings model. While the BCUC acknowledged giving weight to the DDM, ERP, CAPM and comparable earnings method, it did not specify the exact weights used.[89] The BCUC is currently undertaking a review of its cost of capital estimation methodology.

Ontario Energy Board

The Ontario Energy Board ("OEB") regulates electric and gas utilities in Ontario and sets rates for electric and natural gas distribution and transmission. The OEB also regulates other aspects of the electric and natural gas sector, but it does not regulate competitive electric or gas supply. In addition to determining the allowed cost of capital, the OEB also determines a deemed (allowed) capital structure for the utilities it regulates, and the allowed cost of equity is applied to the deemed equity portion of the allowed rate base, which is based on historical cost.

The OEB reviewed its approach to determining the cost of capital for Ontario utilities and in December 2009 issued a report on its estimation procedures going forward.[90] Prior to the review, the OEB relied on a formula-based approach using a version of the risk premium approach, or Equity Risk Premium (ERP) method to determine the return on common equity. Although a number of concerns were raised with this approach, the OEB decided to continue

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88 BCUC 2009 Decision, p. 73.

89 BCUC 2009 Decision, p. 45.

90 Ontario Energy Board, "EB-2009-0084, Report of the Board on the Cost of Capital for Ontario's Regulated Utilities," Issued December 11, 2009 (OEB Report 2009).

relying on a formula-based methodology and the ERP method, but the review led to a resetting of the risk premium and an adjustment to the formula used to update the ROE.

The OEB's current approach to cost-of-capital estimation requires that the Board determine a baseline ROE and subsequently update the estimate annually using the determined formula. The baseline ROE was most recently determined in 2009 during the generic proceeding. To arrive at its initial estimate of the ERP for determining the baseline ROE, the OEB reviewed the recommendations of the submissions as part of the 2009 proceeding, and determined each submission's Low, Medium, and High ERP.[91] In determining the initial ERP, the OEB found that:

> **the use of multiple tests to directly and indirectly estimate the ERP is a superior approach to informing its judgment than reliance on a single methodology.[92]**

As a result, the OEB considered all submissions, which included estimates based on the CAPM, DDM, risk premium model, econometric ERP analyses, realized ERP analyses, the difference between awarded ROEs and realized government bond yields, and various forecasts. The OEB averaged the experts' calculations of the risk premium over the long-term government bond and used judgment to determine that an appropriate premium over long-term government bonds was in the low-end of the range determined by the averages of the experts' ranges.

c) The U.K.

The U.K. regulator Ofgem has for many years made its cost of equity decisions within a CAPM framework, and, at least in a formal sense, has published CAPM parameters which correspond to its cost of equity determinations. However, it is also clear that Ofgem does not treat the CAPM estimates mechanistically, and, in any case, Ofgem uses a degree of judgment in determining the equity beta parameter, since there is little direct market evidence that can be relied on. While some of Ofgem's analysis and discussion of utility submissions is framed in terms of the CAPM parameters, it is clear that Ofgem focuses much more on the final cost of equity figure than on

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91 OEB 2009, p. 38.

92 OEB 2009, p. 36 (emphasis in the original).

the mechanistic derivation of that figure, whether in a CAPM framework or otherwise. For example, Ofgem has said: "Overall, our Final Proposals retain the cost of equity assumptions in our Initial Proposals of 7.0 percent for NGET and 6.8 percent for NGGT. Table 3.5 shows our Final Proposals for the cost of equity in terms of the CAPM components. We note, however, that **it is the overall allowed return that matters**. [emphasis added]"[93]

3. Impact of Economic, Industry or Company Factors

It makes sense that multiple cost of equity estimation methods have been developed and remain in use for a variety of reasons as articulated by Professors Berk and DeMarzo: "[a]ll the techniques … are imprecise" and "practitioners apply the technique that best suit their particular circumstances."[94] Because economic, industry, and firm-specific factors vary, it is important to assess the circumstances under which the models discussed in *Section III* are and should be used.

a) Economic Factors

As a pertinent example, due to the flight to quality following the financial crisis and subsequent monetary policy initiatives in many countries, the risk-free rate has been suppressed and is unusually low. Thus, in a standard implementation of the CAPM, the current risk-free rate results in a low cost of equity estimate. At the same time, investors have in recent years faced unusually high market volatility as measured by, for example, the S&P / ASX volatility index or the S&P 500 volatility index.[95] Academic literature finds that investors expect a higher risk premium during more volatile periods. For example, French, Schwert, and Stambaugh (1987) find a positive relationship between the expected market risk premium and volatility:

> We find evidence that the expected market risk premium (the expected return on a stock portfolio minus the Treasury bill yield) is positively related to the predictable volatility of stock returns. There is also evidence that unexpected stock returns are negatively related to the unexpected change in the volatility of

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93 *RIIO-T1: Final Proposals for National Grid Electricity Transmission and National Grid Gas*, Ofgem, 17 December 2012, paragraph 3.45.

94 Berk & DeMarzo 2009, p. 420.

95 The S&P/ASX Volatility Index and the S&P 500 Volatility Index reflect the markets' expected volatility in the benchmark Australian and American equity indices, respectively.

> stock returns. This negative relation provides indirect evidence of a positive relation between expected risk premiums and volatility.[96]

And Kim, Morley and Nelson (2004) find:

> When the effects of volatility feedback are fully taken into account, the empirical evidence supports a significant positive relationship between stock market volatility and the equity premium.[97]

Other academic papers have found a relationship between general economic conditions and the MRP. Constantinides (2008) studies a classical utility model where consumers are risk-averse and also summarizes some of the empirical literature. Empirical evidence shows that consumers become more risk-averse in times of economic recession or downturn, and equity investments accentuate this risk.[98] Increased risk aversion leads to a higher expected return for investors before they will invest. Specifically, equities are pro-cyclical and their performance is positively correlated with the economy's performance. Thus, unlike government bonds, equities fail to hedge against income shocks that are more likely to occur during recessions.[99] As a result, investors require an added risk premium to hold equities during economic downturns.

The very low current risk-free rates make the cost of equity estimates from a standard implementation of the Sharpe-Lintner CAPM also very low at a time when volatility measures indicate that the MRP has increased as well. Therefore, these market circumstances call for a serious consideration of economic factors or other models rather than a mechanical implementation of the Sharpe-Lintner CAPM.

Conditional models such as the Consumption CAPM attempt to incorporate the relationship between market volatility and the MRP in determining the cost of equity. As the model

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96 K. French, W. Schwert and R. Stambaugh (1987), "Expected Stock Returns and Volatility," *Journal of Financial Economics*, Vol. 19, pp. 3.

97 C-J. Kim, J.C. Morley and C.R. Nelson (2004), "Is There a Positive Relationship Between Stock Market Volatility and the Equity Premium?," *Journal of Money, Credit and Banking*, Vol. 36, p. 357.

98 Constantinides, G.M. (2008), "Understanding the equity risk premium puzzle," In R. Mehra, ed., *Handbook of the Equity Risk Premium*, Elsevier, Amsterdam.

99 Constantinides, G.M., and D. Duffie (1996), "Asset Pricing with Heterogeneous Consumers," *Journal of Political Economy*, pp. 219-240. See also E.S. Mayfield (2004), "Estimating the market risk premium," *Journal of Financial Economics*, vol. 73, pp. 465-496.

estimates a relationship between the risk premium of a stock and its conditional volatility, the model allows for a time-varying relationship between risk and return; *i.e.*, the implied cost of equity varies with the degree to which (i) the underlying stock can serve as a hedge against the market and (ii) market volatility. As rate-regulated entities commonly move with the market, the cost of equity estimate usually moves in the same direction as the volatility of the market. Thus, the consumption-based model addresses the finding that volatility impacts the required risk premium. As such, it may be particularly useful to implement this model when market volatility is unusually high or low.[100]

Given the currently very low risk-free rates and the recent market volatility, the DDM may additionally provide useful insights into the cost of equity. This is especially true for versions of the model that take into account (i) all cash that flows to shareholders through not only dividends but also share buybacks and (ii) changes in the forecasted growth rates in the near term and the longer term (*i.e.* multi-stage versions of the DDM).

Table 3 below displays the impact of two key economic factors discussed above, market volatility and risk-free rates, on the choice of cost of equity estimation model. While there is no specific formula that can be proposed to select a particular model under given market circumstances, or a method that can be used to combine the various models mechanistically, there are certain market scenarios under which it is more appropriate to use one model rather than another. For example, in times of either extremely high or low market volatility, (or extreme values of other macroeconomic indicators such as inflation), the consumption-based CAPM becomes more relevant. The DDM model and especially the multi-stage DDM is also less sensitive to variations in the risk-free rate than the standard CAPM, but it can be sensitive to market volatility. This is because in times of economic turmoil, the growth estimates for companies, including rate-regulated entities, are less likely to be stable going forward. Because the multi-stage DDM has more realistic characteristics and is less sensitive to analysts' short-term forecasts, the tables in this section use the term DDM to reflect the multi-stage DDM.

[100] See Ahern, *et al.* (2012) for a discussion of its use in a regulatory setting.

The effect of the risk-free rate and market volatility on model choice is reflected in Table 3 below, which should be viewed as an illustration on the directional choice rather than a prescription.

Table 3: Relationship Between Key Economic Conditions and Weights to be Given to Models

		Prevailing Risk-free Rate in Economy		
Market Volatility		**High**	**Average**	**Low**
	High	Consumption CAPM		
	Average	Consumption CAPM / DDM	CAPM / ECAPM	Consumption CAPM / DDM
	Low	Consumption CAPM / DDM		

b) Industry Factors

As discussed above, empirical research has consistently found that the Security Market Line determined by the Sharpe-Lintner CAPM (as depicted in Figure 2) is too steep.[101] This result is also consistent with the findings of Fama & French (1992), which estimated a zero slope in the empirical SML.[102] Thus, the ECAPM as well as the Fama-French model attempt to find a model that is a better fit with empirical data from tests of the Shape-Lintner CAPM, showing that the latter tends to under estimate the cost of equity for companies with beta estimates below one, and over estimate the cost of equity for companies with beta estimates above one. A better-fitting model flattens the Security Market Line as depicted in Figure 3. Because most rate-regulated entities have beta estimates below one, reliance on the Sharpe-Lintner CAPM tends to bias the

[101] See, for example, F. Black, M.C. Jensen, and M. Scholes, "The Capital Asset Pricing Model: Some Empirical Tests," *Studies in the Theory of Capital Markets*, Praeger Publishers, 1972, pp. 79-121 and E.F. Fama and J.D. MacBeth, "Risk, Returns and Equilibrium: Empirical Tests," *Journal of Political Economy* 81 (3), 1972, pp. 607-636.

[102] E.F. Fama and K.R. French, "The Cross-Section of Expected Returns," *Journal of Finance* 47, 1992, pp. 427-465.

cost of equity estimates for these companies downwards. Therefore, for entities whose beta estimates are farther from one, it becomes important to look to the ECAPM to accurately reflect the cost of equity for the entity.[103] In many countries or regions, including Australia, Canada, Europe and the U.S, estimated betas for rate-regulated entities declined and become statistically insignificant in the early 2000s as the dot.com bubble burst. In such circumstances, the downward bias in the cost of equity estimates from the Sharpe-Lintner CAPM becomes more pronounced and models such as the ECAPM can improve the estimation.

For some industries the future may look like the past, but for others this is not the case. As an example, the outlook for the U.S shale gas industry today is different than it was in 2008. Similarly, the outlook for the nuclear industry in Japan changed dramatically after the 2011 tsunami. In such circumstances, forward-looking estimates of the industry's cost of capital as obtained through, for example, versions of the DDM, may be especially useful. As noted above, the DDM implementation should carefully consider not only the current economic environment but also industry and firm-specific factors, such as the sustainability of the current growth forecasts and whether dividends truly reflect all cash distribution to shareholders. For example, the multi-stage models discussed in *Section III* rely on several growth rates and therefore enable the analyst to consider near-term, intermediate, and long-term growth prospects for the individual company, industry, and economy. Therefore, a multi-stage DDM model, unlike the Sharpe-Lintner CAPM, can capture both near-term and longer-term changes in an industry. This becomes especially important when an industry's expected risk characteristics differ from its past characteristics.

Rate-Regulated Entities vs. Other Industries

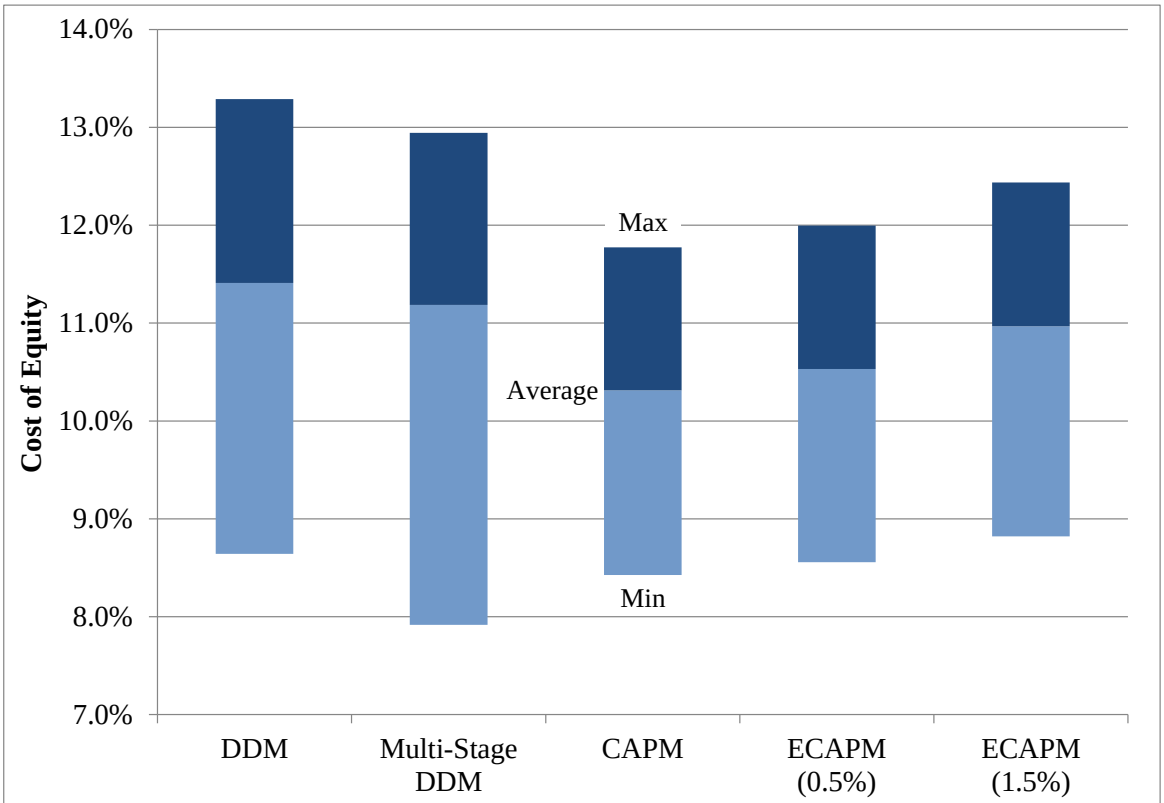
According to empirical studies, the Sharpe-Lintner CAPM remains the most commonly used model across the full spectrum of companies.[104] However, the utility industry and rate-regulated entities have some unique characteristics that make it plausible that the methods that serve other

[103] See Table A-1 in the Appendix for details. Much of the academic literature estimating alpha dates back to the 1980s. Academic research has since turned to the Fama-French multifactor model, which attempts to explicitly capture the empirical pivot of the SML as a function of additional pricing factors.

[104] J.R. Graham and C.R. Harvey, "The Theory and Practice of Corporate Finance: Evidence from the Field," *Journal of Financial Economics* 60, 2001, pp. 187-243.

industries well do not serve this industry nearly as well. For example, the utility industry tends to be relatively stable, so that the DDM (and especially the multi-stage DDM) is much more likely to provide usable results for this industry than for more volatile industries. As the residual income valuation model is a variation of the multi-stage DDM, the same comments pertain to this model.

Prior to the financial crisis, models such as the single-stage DDM, *Brattle*'s multi-stage DDM, the CAPM, and versions of the ECAPM resulted in fairly similar results. Figure 5 below illustrates this for the gas distribution industry in the U.S. towards the end of 2006. Specifically, the figure is based on implementing the constant growth DDM, a 3-stage DDM, the Sharpe-Lintner CAPM, the ECAPM with an alpha of 0.5% and an ECAPM with an alpha of 1.5% for seven gas distribution companies. Figure 5 then shows the range of the cost of equity estimates assuming a 50-50 gearing for the target company. The figure also indicates the average cost of equity obtained from the sample, which is at the split of each bar.



Source: Calculated by The Brattle Group.

Figure 5

It is clear from Figure 5 above that there is substantial overlap in the estimates. We attribute this effect to the fact that the economy was relatively stable in 2006 and so was the gas distribution industry. At the time, these models largely confirmed the range of the cost of equity estimates.

As discussed above, rate-regulated companies also tend to be low-beta entities, so the empirical finding that the SML predicted by the Sharpe-Lintner CAPM is too steep is a serious concern for this industry; *i.e.*, it becomes important to use the ECAPM or other models to ensure that this empirical observation is accurately reflected in the cost of equity estimates.

Analogously to Table 3, Table 4, Panels A and B below summarize the directional weighing of the models depending on various industry characteristics. The two industry factors considered in Table 4, Panel A below are the stability of growth rate forecasts and the average market beta of the industry. For example, as mentioned above, rate-regulated entities tend to have relatively more stable growth forecasts over time and low betas (*i.e.*, beta estimates below one). Therefore, for this industry, the use of the ECAPM or variations of the multi-stage DDM might become valuable in determining the cost of equity capital. The effect of the stability of growth forecasts and the beta value on model choice is reflected in Table 4, Panel A below, which should be viewed as an illustration on the directional choice rather than a prescription.

Table 4: Relationship Between Key Industry Factors and Weights to be given to Models– Panel A

		Stability of Industry Growth Forecasts Over Time		
Market Beta of Industry		**High**	**Average**	**Low**
	High	ECAPM / DDM		ECAPM / Other
	Average	CAPM / DDM		CAPM / Other
	Low	ECAPM / DDM		ECAPM / Other

Another characteristic of the industry that should be considered is whether companies in the industry are exposed to financial distress and/or significant merger and acquisition activity, and

the prevalence of share buybacks. As discussed above, market-based estimation models are relatively more affected when a given company faces financial distress, or unique circumstances that may lead to its stock price decoupling from fundamentals. Therefore, if many companies in an industry are subject to such effects, the whole industry may be affected. Further, companies that engage in a substantial amount of share buybacks will end up distributing cash to shareholders in a form other than dividends, which makes a DDM based on a per share dividend ratio less appropriate. Panel B below illustrates these effects.

Table 4: Relationship Between Key Industry Factors and Weights to be given to Models– Panel B

		Industry Exposure to Financial Distress and/or M&A	
Prevalence of Share Buybacks		**High**	**Low**
	High	Other Models: Risk Premium, comparable earnings, maybe use other industries	CAPM, ECAPM, DDM that includes all cash that accrues to shareholders
	Low		CAPM, ECAPM, DDM

c) Company Factors

In many instances company-specific issues are better dealt with via sample selection or through risk positioning than through the determination of how to estimate the cost of equity. A company that is a potential member of the benchmark sample is often dropped if it faces unique circumstances that may bias the cost of capital estimation process. This is the case if, for example, a company is undergoing significant merger or acquisition activity, which inherently affects the information available in the market and therefore drives the stock price (and thus the results from all market-based models, including the CAPM, ECAPM, Fama-French and DDM).

After a range of cost of equity estimates has been obtained, it is necessary to consider where, from within this range, the final determination on the cost of equity will be. Provided that the range has been developed in an appropriate way that takes account of the market and industry factors described in this section, the final step is to consider the relative risk of the target company compared to the sample of companies from which the cost of equity range has been developed. The cost of equity is adjusted upward or downward depending on the target entity's risk characteristics relative to those of the sample. This issue is the topic of the next section.

D. RISK POSITIONING OF THE TARGET ENTITY

The discussion in the preceding sections covered various models that produce cost of equity estimates. Typically the cost of equity will be estimated for a sample of firms, or all firms in a particular sector, because it usually is not possible to estimate the cost of equity for a single firm with a useful degree of accuracy. To determine a single value for the cost of equity for a specific firm from a range of values for a set of comparator firms, it makes sense to consider the riskiness of the specific firm relative to the riskiness of the sample, since the cost of equity itself is compensating investors for risk.

In the regulatory context, in some cases this process is implicit in the regulator's decision, while in others it is an explicit step in the cost of equity determination process. This step can conveniently be termed "risk positioning", because the regulator considers the risk characteristics of the specific utility relative to the benchmark.

1. Why risk positioning is necessary

While the precise details and wording of the regulator's objective in setting the cost of equity vary from one jurisdiction to another, the underlying idea is that investors will expect a return equivalent to the return that they would expect from other investments of like risk. Utilities generally have low risk relative to the market as a whole, but within the utilities sector, different firms are likely to have somewhat different risk characteristics. "Risk positioning" acknowledges the possibility that different utilities can have somewhat different risks. In this context, "risk" is defined as the characteristic of an investment which determines expected returns which would usually include "systematic" exposure to the wider economy, but not "idiosyncratic" risks associated with specific projects that can be diversified away in an investment portfolio. While

the cost of equity solely captures investors' compensation for bearing systematic risk, the cost of debt reflects total risk, including idiosyncratic risks. Therefore, there are instances of regulatory mechanisms, such as decoupling, which reduce the variability of total revenues and therefore also total risk, (affecting the cost of debt), but which may not impact the cost of equity for a given utility.

One way in which a utility is exposed to systematic risk is through variations in demand. End-user demand tends to be at least somewhat correlated with wider economic activity, and is thus a source of exposure to systematic risk. One utility might have more exposure than other, for example if it has a greater proportion of price-sensitive industrial load.

In some jurisdictions, leverage is considered a source of "financial risk", which affects the risk positioning analysis. This could be so, for example, where the rate of return is generally determined on the basis of actual capital structure. A utility with more debt than the benchmark will require a higher return on equity than the benchmark, even if it otherwise has similar business risk exposure as the benchmark (just as two utilities with the same asset beta would have different equity betas if one has higher gearing than the other). Where this approach is taken, the term "business risk" is used to refer to the other sources of relevant risk differences that are taken into account in the risk positioning analysis.

Once a benchmark rate of return has been defined (whether a point estimate or a range), the risk positioning approach requires an analysis of the particular utility's risk relative to that benchmark. To the extent that the utility is found to have more (or less) risk than the benchmark, the rate of return would be set higher (or lower) than the benchmark rate of return.

2. What risk characteristics are relevant?

The characteristics relevant to risk positioning are those which expose the utility to systematic risk and which therefore have an impact on the rate of return required by investors. Some important sources of uncertainty in revenues and returns to investors may not have an impact on the required return to the extent that investors are able to diversify away exposure to those risks. For example, the weather may be an important source of variability in revenues and returns, but may not be an important source of risk to investors because it is diversifiable.

A good way to think about risk positioning is to consider the extent to which different utilities are protected from risks. A distribution utility can in principle be protected from risks to the extent that it is able to pass on risk to its customers (which depends on the detail of the regulatory framework being applied). Demand risk (which is at least partly non-diversifiable), for example, can be borne by the utility if the regulatory regime sets prices and does not "true up" revenues to account for the difference between forecast and actual demand. Alternatively, demand risk can be passed on to customers through a true-up or balancing account process, which would allow the utility to recover in one year any "missing" revenue from the prior year caused by demand forecasting errors. Protection from demand risk in this way depends on both a regulatory framework that allows for such true-ups and on the existence of franchise customers that will bear the risks passed on to them. Therefore, other things equal, a utility with true-ups for demand risk would be considered less risky than one without.

Distribution utilities typically have franchise customers that rely on the utility and have no alternative supply of energy. However, this is typically not the case for gas pipelines: in many jurisdictions, gas pipelines do not have "franchise" customers: customers may be free to switch to competing pipelines. Even if there is no prospect of competition from other pipelines, it may still be difficult for pipelines to pass on demand risk to their customers, since large end-users may be price sensitive (i.e., if the pipeline increases price in response to a fall in demand, the price increase itself could further cut demand).

Pipeline regulators in both the US and Canada apply a risk-positioning approach in determining the cost of equity.

3. FERC Approach

The Federal Energy Regulatory Commission (FERC) has a standard approach to determining the cost of equity for gas pipelines, set out in a "policy statement",[105] which, together with precedent from prior decisions, guides all decisions on the cost of equity for gas pipelines. The FERC's approach is to use a form of the dividend growth model (typically termed the "DCF" model in

[105] *Composition of Proxy Groups for Determining Gas and Oil Pipeline Return on Equity*, FERC (April 2008).

the US) to estimate the cost of equity for a benchmark group of publicly-traded pipeline companies. The results of the model are a cost of equity estimate for each of the companies in the benchmark (or "proxy") group.

FERC starts by assuming that the median company in the proxy group is the appropriate cost of equity, unless either the pipeline or an intervener in the case demonstrates that the instant pipeline has risk factors which mean that the cost of equity should be set above or below the median:

> *after defining the zone of reasonableness through development of the appropriate proxy group for the pipeline, the Commission assigns the pipeline a rate within that range or zone, to reflect specific risks of that pipeline as compared to the proxy group companies.* [f/n omitted] *The Commission has historically presumed that existing pipelines fall within a broad range of average risk. A pipeline or other litigating party has to show highly unusual circumstances that indicate anomalously high or low risk as compared to other pipelines to overcome the presumption.*[106]

And

> unless *a party makes a very persuasive case in support of the need for an adjustment and the level of the adjustment proposed, the Commission will set the pipeline's [ROE] at the median of the range of reasonable returns.*[107]

In line with this approach, most FERC decisions result in the pipeline receiving a cost of equity equal to the median of the proxy group. A recent decision for El Paso Natural Gas (EPNG),[108] however, illustrates how FERC assesses relative risk and may, on occasion, move away from the median. In this case, the FERC ALJ[109] characterized EPNG's business risk on two related dimensions: competitive risk and regulatory risk. US natural gas pipelines typically secure long-term contractual commitments from shippers to use the pipeline capacity (with relatively high fixed charges, equivalent to a take-or-pay commitment). EPNG had long-term contracts for a smaller proportion of its capacity than did the pipelines in the proxy group, and its contracts were typically shorter. Furthermore, EPNG's throughput had been declining. This is symptomatic of higher business risk, because in the absence of contractual commitments and in the absence of

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106 *Ibid*., p. 4.

107 *El Paso Natural Gas Company*, Initial Decision, docket no. RP10-1398 (June 18, 2012), paragraph 40, quoting prior FERC decisions.

108 *El Paso Natural Gas Company, Initial Decision*, docket no. RP10-1398 (June 18, 2012).

109 A FERC rate case typically results in an "initial decision" issued by an Administrative Law Judge (ALJ). The ALJ's decision is subsequently reviewed by the FERC commissioners, and may be affirmed or varied.

franchise customers, the pipeline is no longer able to pass on risks to its customers. In the limit, the pipeline may be unable to charge rates high enough to recover its authorized revenue requirement (as increasing rates drives throughput lower still).

The ALJ found that EPNG was exposed to competition in its major downstream markets from new pipeline projects, and that this competition was to an extent the result of regulatory policies that favor new pipeline projects to foster competition (possibly harming existing pipelines).

Based on this analysis (and also a finding that EPNG had above-average financial risk, as evidenced by a credit rating of BBB-, lower than all but one of the proxy group companies), the ALJ determined that EPNG's cost of equity should be set "well above the median ROE [of the proxy group]".[110]

4. NEB approach

In Canada, the approach taken by energy regulators (both provincial and national) historically was to set the cost of equity on a formula basis and to us the same cost of equity for all pipelines. Risk positioning was then used to vary the authorized proportion of equity in the capital structure, thereby increasing the overall return on capital for those utilities judged to be riskier. However, in the most recent decision by Canada's National Energy Board (NEB), the NEB moved to an approach which focuses on the overall after-tax return directly, rather than separately determining the cost of equity, the cost of debt, and the proportion of each in the capital structure.[111] The NEB takes a systematic approach to assessing business risk under the headings "supply risk", "market [downstream] risk", "regulatory risk", "competitive risk" and "operating risk", although the NEB said "The various forms of risk are in some cases inextricably linked, and the boundaries between them are subjective".[112] In the RH-1-2008 case,[113] the NEB was concerned with whether the business risk of the pipeline had increased

[110] *Ibid.*, p. 45. The ALJ did not specify an ROE. The final decision on ROE rests with the FERC commissioners.

[111] See RH-1-2008, discussed further below.

[112] *Reasons for Decision, Trans Quebec and Maritimes Pipelines Inc., RH-1-2008*, NEB (March 2009), p. 30.

[113] Concerning the Trans Quebec and Maritimes Pipelines, which predominantly move supplies sourced from the Western Canadian Sedimentary Basin (WCSB) via the TransCanada Mainline, into Quebec and on into New Hampshire.

since the last time that a decision on the cost of capital for the pipeline had been taken. The NEB identified a number of factors as contributing to an increased overall business risk.

- **Supply risk**: the pipeline was mainly supplied from a region with declining conventional production and rising costs. While it was possible that new sources of unconventional supply (shale gas) would be developed, the result was increased uncertainty over the availability of competitively-priced supplies, and hence concerns over the possibility for reduced throughput.
- **Market and competitive risk**: because a large and increased proportion of the pipeline's throughput went to large industrial and electric power generation load, which is more variable than domestic and commercial load. In addition, competition with cheap hydro-power in the Quebec also contributed to increased market risk. Market risk was also increased as a result of the potential for competition with LNG imports in the US market.

Overall, the NEB concluded that business risk had increased as a result of these factors relative to the previous cost of capital decision for the pipeline. Whereas the FERC in the US uses a risk positioning approach to determine the cost of equity relative to a benchmark, the NEB estimated the after-tax weighted average cost of capital directly, principally on the basis of market-based estimates of the cost of capital of various comparator companies. The business risk analysis described above was part of the NEB's determination of where the pipeline's cost of capital should be relative to the sample data.[114]

5. Implementation

In the FERC and NEB examples given above, risk positioning of the target utility within the range of comparator or proxy companies is not analytically precise: the regulator considers evidence (which could be quantitative, such as the proportion of price-sensitive industrial load, or more qualitative) as to exposure to various relevant risk factors. Weighing the risk factors, and determining how the analysis of risk should be reflected in the final cost of equity determination is necessarily imprecise, and relies on judgment. For example, a regulator might determine that a

[114] The NEB's analysis is summarized on p.79 of the decision.

particular utility, having an unusually high proportion of industrial load, was of above average risk, and that as a result the cost of equity should be 50 basis points above the mid-point of a range determined for a sample of utilities. The direction of the adjustment (upwards) is clear, but the magnitude is more a matter of judgment than something that can be derived quantitatively.

APPENDIX: ADDITIONAL TABLES AND FIGURES

Table A-1: Empirical Evidence On The Alpha Factor in ECAPM

AUTHOR	RANGE OF ALPHA	PERIOD RELIED UPON
Black (1993)[1]	1% for betas 0 to 0.80	1931-1991
Black, Jensen and Scholes (1972)[2]	4.31%	1931-1965
Fama and MacBeth (1972)	5.76%	1935-1968
Fama and French (1992)[3]	7.32%	1941-1990
Fama and French (2004)[4]	N/A	
Litzenberger and Ramaswamy (1979)[5]	5.32%	1936-1977
Litzenberger, Ramaswamy and Sosin (1980)	1.63% to 3.91%	1926-1978
Pettengill, Sundaram and Mathur (1995)[6]	4.6%	1936-1990

[*] The figures reported in this table are for the longest estimation period available and, when applicable, use the authors' recommended estimation technique. Many of the articles cited also estimate alpha for sub-periods and those alphas may vary.

[1] Black estimates alpha in a one-step procedure rather than in an un-biased two-step procedure.

[2] Estimate a negative alpha for the sub period 1931-39 which contain the depression years 1931-33 and 1937-39.

[3] Calculated using Ibbotson's data for the 30-day treasury yield.

[4] The article does not provide a specific estimate of alpha; however, it supports the general finding that the CAPM underestimates returns for low-beta stocks and overestimates returns for high-beta stocks.

[5] Relies on Litzenberger and Ramaswamy's before-tax estimation results. Comparable after-tax alpha estimate is 4.4%.

[6] Pettengill, Sundaram and Mathur rely on total returns for the period 1936 through 1990 and use 90-day treasuries. The 4.6% figure is calculated using auction averages 90-day treasuries back to 1941 as no other series were found this far back.

Sources:

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BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION

IN THE MATTER OF THE PETITION BY NEW MEXICO-AMERICAN WATER COMPANY, INC. FOR ADJUSTMENT OF WATER RATES FOR ITS CLOVIS DISTRICT AS FILED UNDER ADVICE NOTICE NO. 32,

NEW MEXICO-AMERICAN WATER COMPANY, INC., Petitioner.

Case No. 11-00___-UT

DIRECT TESTIMONY
OF
DR. BENTE VILLADSEN
ON BEHALF OF
NEW MEXICO-AMERICAN WATER COMPANY

May 6, 2011

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EXECUTIVE SUMMARY

Dr. Bente Villadsen, a Principal at *The Brattle Group*, files testimony on the cost of capital for New Mexico-American Water Company. Dr. Villadsen selects two benchmark samples, water utilities and gas local distribution companies (LDC). Using two versions of the Discounted Cash Flow (DCF) method and three versions of the Capital Asset Pricing Model (CAPM), she estimates the sample companies' after-tax weighted-average cost of capital. The after-tax weighted average cost of capital is the measure that companies most commonly use to evaluate investments and the measure recommended in standard financial textbooks.

Having estimated the after-tax weighted-average cost of capital for the samples, she determines the corresponding cost of equity for New Mexico-American Water Company at its approximate 44 percent equity. In undertaking her analysis, Dr. Villadsen notes that the overall cost of capital is constant within a broad middle range of capital structures although the distribution of costs and risks among debt and equity holders is not. Because the overall cost of capital is the same in a broad range of capital structures, there are no impacts on the rates customers pay from a higher or lower percentage of equity, so ratepayers are not affected by the choice of capital structure within a broad range. However, New Mexico-American Water Company's capital structure includes only 44 percent equity, which is substantially lower than the percentage equity among comparable utilities. Therefore, its financial risk is higher and the return required by investors' increases with the level of risk they carry, but this return is paid on a smaller amount of equity than is typical in the water industry. Therefore, the dollar amount paid by customers is the same as if the Company had a lower return on equity but a higher equity percentage.

Dr. Villadsen discusses the impact of the turmoil in financial markets on utilities' cost of capital and notes that while the yield on government issued bills and bonds is currently very low, the spread between the yield on investment-grade utility bonds and government bonds remains unusually high. As utilities cannot

raise debt (or equity) at the same rates as the government, it is necessary to take the yield on investment grade utility bonds into account in assessing the cost of capital for New Mexico-American Water Company. Specifically, the yields on government bills and bonds have been driven artificially down by monetary policy and a flight to safety, so that the yields on these securities are not reflective of normal economic conditions. Consequently, Dr. Villadsen bases her CAPM models on a normalized risk-free rate which consists of the observed risk-free rate plus an adjustment for the increase in the spread between risk-free rates and investment grade utility bond yields. This ensures that the risk-free rate relied upon is consistent with the consensus forecasted risk-free rate.

In addition to the cost of capital estimation discussed above, Dr. Villadsen reviewed data on New Mexico-American Water Company's financial performance in recent years and calculated various credit metrics based on these figures. She also reviewed New Mexico-American Water Company's earned return and notes that earned returns have been very low and distinctly below the allowed returns. The inability to earn the allowed return on equity and the low credit ratios show that it is vital that New Mexico-American Water Company be allowed an opportunity to earn a reasonable return on equity that would support its credit rating and provide equity investors with a reasonable return on investment.

Based on the evidence from the samples, Dr. Villadsen finds that New Mexico-American Water Company's cost of equity capital is no less than 11¾%.

I. INTRODUCTION AND SUMMARY

Q1. PLEASE STATE YOUR NAME AND ADDRESS FOR THE RECORD.

A1. My name is Bente Villadsen. My business address is *The Brattle Group*, 44 Brattle Street, Cambridge, MA 02138.

Q2. PLEASE DESCRIBE YOUR JOB AND EDUCATIONAL EXPERIENCE.

A2. I am a Principal of *The Brattle Group*, (Brattle), an economic, environmental and management consulting firm with offices in Cambridge, Washington, San Francisco, London, Brussels, and Madrid. My work concentrates on regulatory finance and accounting. I hold a B.S. and M.S. from University of Aarhus, Denmark and a Ph.D. from Yale University.

Q3. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING?

A3. I have been asked by New Mexico-American Water Company ("New Mexico-American Water" or the "Company") to estimate the cost of equity for New Mexico-American Water Company's Clovis District. The cost of equity is the return that the New Mexico Public Regulation Commission ("Commission") should provide the Company an opportunity to earn on the portion of its rate base financed by equity.

To determine the cost of equity for New Mexico-American Water, I first estimate the overall cost of capital for two samples (and two subsamples) of regulated companies using several versions of the discounted cash flow (DCF) and risk-positioning models: Capital Asset Pricing Model ("CAPM) and Empirical CAPM ("ECAPM"). Second, I determine the cost of equity that the estimated overall cost of capital gives rise to at New Mexico-American Water's requested capital structure consisting of about 44 percent equity.[1] Third, I evaluate the relative risk of New Mexico-American Water and the sample companies to determine the recommended cost of equity for New Mexico-American Water. In doing so, I compare the characteristics of New Mexico-American Water to industry benchmarks, noting that New Mexico-American Water has been unable to earn

its allowed return on equity for an extended period of time. This fact needs to be considered in setting its allowed cost of equity as both debt and equity investors ultimately look to the earned return on equity.

Q4. PLEASE SUMMARIZE ANY PARTS OF YOUR BACKGROUND AND EXPERIENCE THAT ARE PARTICULARLY RELEVANT TO YOUR TESTIMONY ON THESE MATTERS.

A4. Brattle's specialties include financial economics, regulatory economics, and the utility industry. I have worked extensively on cost of capital matters for water utilities as well as for electric, natural gas distribution, pipeline, transportation and other industries in state, federal, and foreign jurisdictions. Additionally, I have significant experience in other areas of rate regulation, credit risk in the utilities industry, energy contracts, and accounting issues. I have filed expert testimony and appeared before regulatory commissions and arbitration tribunals as well as in federal and district court concerning cost of capital, accounting questions, and damage issues**.** I have testified on cost of capital before the Arizona Corporation Commission, Bonneville Power Authority, and the New Mexico Public Regulation Commission as well as in litigation settings before the Federal Court of Claims and the International Center for Settlement of Investment Disputes. I have previously filed testimony before the New Mexico Public Regulation Commission in both 2008 and 2009 and also appeared before the Commission in 2009. Appendix A contains more information on my professional qualifications.

Q5. PLEASE SUMMARIZE YOUR ESTIMATION OF THE COST OF CAPITAL FOR NEW MEXICO-AMERICAN WATER.

A5. To assess the cost of capital for New Mexico-American Water, I select two benchmark samples: regulated water utilities and natural gas local distribution companies (LDC). These samples are selected to have risk characteristics comparable to those of New Mexico-American Water. I also

[1] See the Direct Testimony of Sheryl L. Hubbard, Schedule G-1.

report results for a subsample of both the water and the gas LDC sample as the subsample companies are less likely to have unique issues that may affect the cost of capital estimates. For each sample, I estimate the sample companies' cost of equity using several versions of the DCF method as well as the CAPM and ECAPM. Next, based on the cost-of-equity estimates for each company and its market costs of debt and preferred stock, I calculate each firm's overall cost of capital, i.e., its after-tax weighted-average cost of capital (ATWACC), using the company's market value capital structure. I then calculate the samples' average ATWACC and the cost of equity for a capital structure with approximately 44 percent equity. Thus, I present the cost of equity that is consistent with the samples' market information and New Mexico-American Water's regulatory capital structure. (By "regulatory capital structure", I mean the capital structure that New Mexico-American Water proposes in its application.) Looking to the CAPM and ECAPM based estimates; the gas distribution sample and subsample indicate a range of 11¾ to 12¾ percent, while the water sample and subsample is a bit higher at 12 to 12¾ percent. However, the discounted cash flow analysis provides lower numbers of approximately 10 to 11½ percent for the water sample and subsample and at 10½ to 12 percent for the gas distribution sample and subsample. Taking these figures into account, 11¾ percent return on equity is a conservative estimate. Because of the ongoing financial turmoil, I present results for both a baseline case, as described above, and for several scenarios that take the increased risk aversion among investors into account. Note that my estimates rely on the baseline case, and are thus relatively conservative given the current economic conditions.

Q6. ARE THERE ANY UNIQUE ISSUES IN ESTIMATING THE COST OF CAPITAL AT THIS POINT IN TIME?

A6. Yes. While the economic crisis may have lessened and the National Bureau of Economic Research (NBER) has declared the recession over, there is still substantial turmoil in financial markets and investors remain

wary of providing capital. I discuss the impact hereof in more detail in *Section III* below, but in general, the cost of capital is higher for all companies today than it was before the crisis. Therefore, in addition to my standard cost of capital estimates, I also report the results from several benchmarks that take the impact of the financial crisis into account.

Q7. PLEASE SUMMARIZE YOUR CONCLUSIONS REGARDING NEW MEXICO-AMERICAN WATER'S COST OF EQUITY.

A7. My midpoint estimate for New Mexico-American Water's cost of equity capital is 11¾ percent with a range of 11½ to 12½ percent. The recommendation is based on analyses of the return on equity that investors expect as well as on New Mexico-American Water specific analyses. Specifically, I apply Discounted Cash Flow ("DCF") models, the Capital Asset Pricing Model ("CAPM"), and Empirical CAPMs to a sample of eight publicly traded water utilities and a sample of nine gas distribution companies to assess investors expected cost of capital and apply this information to New Mexico-American Water. In addition, I look to New Mexico-American Water's inability to earn its allowed return on equity.

Q8. WHY DO YOU NEED TO CONSIDER NEW MEXICO-AMERICAN WATER'S REGULATORY CAPITAL STRUCTURE?

A8. A firm's cost of equity is a function of both its business risk and its financial risk. The more leveraged a company is the higher its financial risk. Investors holding equity in companies with higher risk require a higher rate of return, so as a company adds debt, the cost of equity goes up at an ever increasing rate. The higher cost of equity offsets the lower cost of debt, so that the after-tax weighted-average overall cost of capital remains constant over a broad range of capital structures.

That is, the associated capital structure affects an estimated cost-of-equity estimate just as a life insurance applicant's age affects the required life-insurance premium. It is therefore necessary to calculate the cost of equity the sample

companies would have had at New Mexico-American Water's regulatory capital structure to report accurately the market evidence on the cost of equity.

Q9. HOW IS THE REMAINDER OF YOUR TESTIMONY ORGANIZED?

A9. The remainder of my testimony is organized as follows:

Section II defines the cost of capital and discusses the principles that relate a company's cost of capital and its capital structure.

Section III discusses the impact on cost of capital of the current turmoil in financial markets and methods to estimate the relevant risk-free rate and market risk premium under current financial market conditions.

Section IV presents the methods used to estimate the cost of capital for the benchmark samples, and the associated numerical analyses. This section also explains the basis of my conclusions for the benchmark samples' returns on equity and overall costs of capital.

Section V focuses on New Mexico-American Water's unique situation such as its inability to earn its allowed return and earned return and the impact on credit metrics.

Section VII summarizes the analysis and discusses the recommendation for New Mexico-American Water.

Appendix A lists my qualifications.

Appendix B discusses in detail the selection procedure for each sample, and the methods used to derive the necessary capital structure market value information.

Appendix C details the risk-positioning method including the numerical analyses.

Appendix D details the DCF method, including the numerical analyses.

Appendix E discusses the effect of debt on the cost of equity.

I repeat portions of my testimony in the appendices in order to give the reader the context of the issues before I present additional technical detail and further discussion.

II. THE COST OF CAPITAL AND RISK

A. The Cost of Capital and Risk

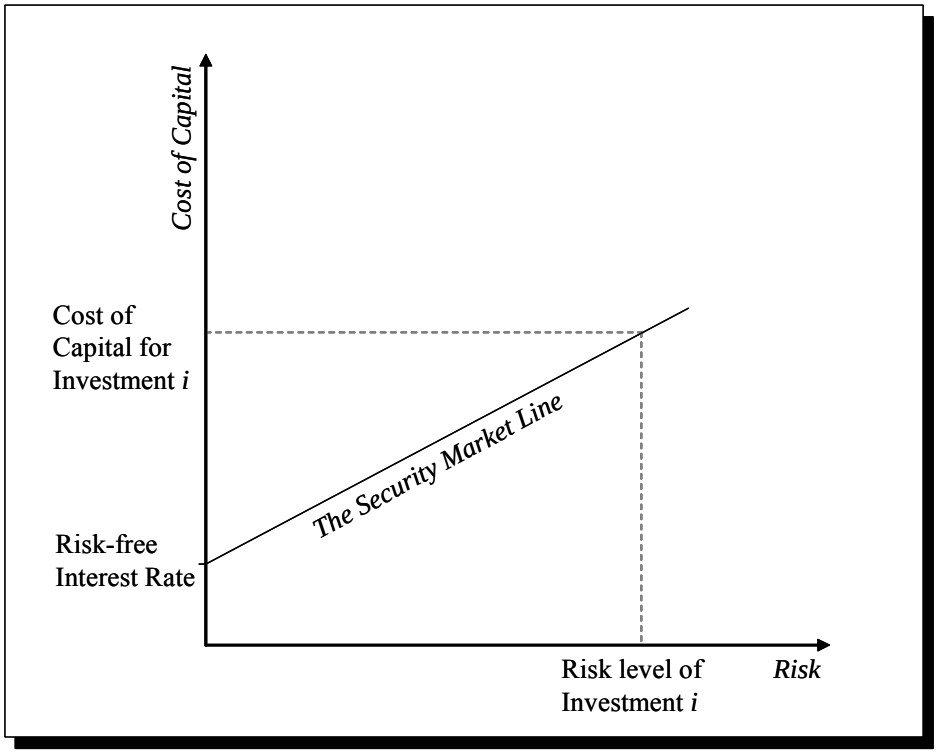
Q10. PLEASE FORMALLY DEFINE THE "COST OF CAPITAL."

A10. The cost of capital is the expected rate of return in capital markets on alternative investments of equivalent risk. In other words, it is the rate of return investors require based on the risk-return alternatives available in competitive capital markets. The cost of capital is a type of opportunity cost: it represents the rate of return that investors could expect to earn elsewhere without bearing more risk.[2]

The definition of the cost of capital recognizes a tradeoff between risk and return that is known as the "security market risk-return line," or "security market line" for short. This line is depicted in Figure 1. Figure 1 shows that the higher the risk, the higher the cost of capital. The risk depicted on the horizontal axis in Figure 1 is often measured by the security's beta, which measures the security's systematic risk in comparison to the market as a whole. The market as a whole has a beta of 1, so betas below one indicate a security with less systematic risk than the market while a beta above 1 indicates a security with higher systematic risk than the market. A version of Figure 1 applies for all investments. However, for different types of securities, the location of the line may depend on corporate and personal tax rates.

It is important to note that the security market line's slope and hence the cost of equity is impacted by systematic risk only. Risks that investors can diversify away do not impact the cost of equity.

Figure 1: The Security Market Line



Q11. WHY IS THE COST OF CAPITAL RELEVANT IN RATE REGULATION?

A11. U.S. rate regulation accepts the "cost of capital" as the right expected rate of return on utility investment.[3] This practice is normally viewed as consistent with the U.S. Supreme Court's opinions in *Bluefield Waterworks & Improvement Co. v. Public Service Commission*, 262 U.S. 678 (1923), and *Federal Power Commission v. Hope Natural Gas*, 320 U.S. 591 (1944).

From an economic perspective, rate levels that give investors a fair opportunity to earn the cost of capital are the lowest levels that compensate investors for the risks they bear. Over the long run, an expected return above the cost of capital

[2] "Expected" is used in the statistical sense: the mean of the distribution of possible outcomes. The terms "expect" and "expected" in this testimony, as in the definition of the cost of capital itself, refer to the probability-weighted average over all possible outcomes.

[3] An early paper that links the cost of capital as defined by financial economics with the correct expected rate of return for utilities is Stewart C. Myers, "Application of Finance Theory to Public Utility Rate Cases," *The Bell Journal of Economics and Management Science*, 3:58-97 (Spring 1972).

makes customers overpay for service. Regulatory authorities normally try to prevent such outcomes, unless there are offsetting benefits (e.g., from incentive regulation that reduces future costs). At the same time, an expected return below the cost of capital does a disservice not just to investors but, more importantly, to customers as well. In the long run, such a return denies the company the ability to attract capital, to maintain its financial integrity, and to expect a return commensurate with that of other enterprises characterized by similar risks and uncertainties.

More important for customers, however, are the economic issues an inadequate return raises for them. In the short run, deviations of the expected rate of return on the rate base from the cost of capital may seemingly create a "zero-sum game"—investors gain if customers are overcharged, and customers gain if investors are shortchanged. But in fact, even in the short run, such action may adversely affect the utility's ability to provide stable and favorable rates because some potential efficiency investments may be delayed or because the company is forced to file more frequent rate cases. In the long run, inadequate returns are likely to cost customers – and society in general – far more than may be gained in the short run. Inadequate returns lead to inadequate investment, whether for maintenance or for new plant and equipment. The costs of an undercapitalized industry can be far greater than the short-run gains from shortfalls in the cost of capital. Moreover, in capital-intensive industries (such as the water industry),[4] systems that take a long time to decay cannot be fixed overnight. Thus, it is in the customers' interest not only to make sure that the return investors expect does not exceed the cost of capital, but also to make sure that it does not fall short of the cost of capital, either.

Of course, the cost of capital cannot be estimated with perfect certainty, and other aspects of the way the revenue requirement is set may mean investors

[4] Water utilities are very capital intensive and have over the last years earned revenues of only $0.26 for each $1 of property, plant of equipment. In comparison, electric utilities earn approximately $0.53 and gas utilities earn $1.09 for each $1 invested in property, plant and equipment. *Value Line Investment Survey*, Industry Sheets, 2010 data.

expect to earn more or less than the cost of capital even if the allowed rate of return equals the cost of capital exactly. However, a commission that sets rates so investors expect to earn the cost of capital on average treats both customers and investors fairly, which is in the long-run interests of both groups.

While it may seem counter-intuitive that the cost of capital has increased in a market where many companies and individuals have seen their income decline, it is important to keep two facts in mind. First, the cost of capital is an *expected* rate of return and thus a forward looking measure as opposed to a measure of the recent past. Therefore, low realized returns in, for example, 2009 do not necessarily reflect the *expected* rate of return. As market volatility and investors' risk aversion has increased, investors are likely to require a higher return for providing capital. Second, it is the expected rate of return that is available in capital markets on alternative investments of equivalent risk that are important to investors, so a key question becomes what the return on alternative investments is. As the spread between utility bond yields and government bond yields increases, the premium that investors expect to earn on utility stock over government bonds is expected to increase, too. Therefore, the cost of equity in today's financial markets is higher than it was before the financial crisis of 2008-09, when bond spreads were lower. Further, the ongoing turmoil in the oil producing countries as well as the sovereign debt crisis in Europe, and Standard & Poor's recent assignment of a negative outlook to U.S. government debt adds to financial markets' uncertainty.[5]

[5] Moody's Investor Service ("Moody's), Standard & Poor's ("S&P") and Fitch Ratings ("Fitch") have all downgraded Portugal's sovereign debt in March 2011. See, for example, Moody's Investor Service, "Moody's downgrades Portugal to A3 and assigns a negative outlook," March 15, 2011. Most recently, S&P on March 29 downgraded both Greece and Portugal; see S&P, "Greece Downgraded to 'BB-' on Confirmed ESM Borrowing Terms; Still on Watch Negative," March 29, 2011 and S&P, "Republic of Portugal Ratings Lowered to 'BBB-/A3' on ESM Borrowing Terms; Outlook Negative," March 29, 2011. Standard & Poor's, "A Closer Look At the Revision Of The Outlook On The U.S. Government Rating," April 18, 2011.

B. Business Risk and Financial Risk: Capital Structure and the Cost of Equity

Q12. WHAT IS THE DIFFERENCE BETWEEN BUSINESS RISK AND FINANCIAL RISK?

A12. Business risk is the risk of a company from its line of business assuming it used no debt financing. When a firm uses debt to finance its assets, the business risk of the assets is shared between the debt holders and the equity holders, but the equity holders bear more of the risk because debt holders have a prior claim on the company's cash flows. Equity holders are residual claimants, which simply mean that equity holders get paid last. In other words, the use of debt imposes financial risk on equity holders. The goal of selecting a sample is to choose companies whose business risk is judged to be comparable to the regulated company in the proceeding. As a result, differences in financial risk must be dealt with explicitly.

Q13. PLEASE EXPLAIN WHY IT IS NECESSARY TO REPORT THE COST OF EQUITY ADJUSTED FOR CAPITAL STRUCTURE.

A13. Rate regulation in the U.S. and Canada has traditionally focused on the components of the rates.[6] In other words, the focus of cost-of-capital estimation is usually on determining the "right" cost of equity, and to a lesser degree on setting the allowed capital structure. While the overall cost of capital depends primarily on the company's line of business, the distribution of the cost of capital among debt and equity depends on their share in total revenues. Debt holders' claim is usually a fixed amount (except in situations of default) while equity holders are residual claimants, meaning that equity holders get paid last. In other words, the use of debt imposes financial risk on the equity holders. Because a company's financial risk depends on its capital structure, the risk shareholders carry increases with the leverage of the company. As shareholders expect to be

[6] The National Energy Board of Canada in its RH-1-2008 decision, issued March 2009, allowed the after-tax weighted average cost of capital rather than a return on equity and a capital structure.

compensated for increased risk, the required rate of return increases with the company's leverage. The increased risk is caused by the fact that debt has a senior claim on a specified portion of earnings and in bankruptcy on assets. As common equity is the most junior security, it gets what is left after everyone else has been paid. In other words, common equity holders carry all residual risk. However, as explained in more detail in Appendix E, the overall cost of capital is constant within a broad middle range of capital structures, although the distribution of costs and risks among debt and equity holders is not.

C. Implications for Analysis

Q14. PLEASE EXPLAIN THE IMPLICATIONS OF THE RELATIONSHIP BETWEEN CAPITAL STRUCTURE AND THE COST OF EQUITY FOR RATE REGULATION.

A14. The risk equity holders carry, and therefore the cost of equity, depends on the capital structure. For example, if a company with $10 million in assets financed all its assets with equity, then there are $10 million to spread the equity risk over. In contrast, if the company financed its assets with $5 million in equity and $5 million in debt, then the equity risk would necessarily be spread over only $5 million.

Q15. TO ASSESS THE MAGNITUDE OF FINANCIAL RISK FOR A RATE REGULATED COMPANY, SHOULD YOU USE THE MARKET-VALUE OR THE BOOK-VALUE CAPITAL STRUCTURE?

A15. The market-value capital structure is the relevant quantity for analyzing the cost-of-equity evidence, which is based on market information.[7] New

[7] The need to use market-value capital structures to analyze the effect of debt on the cost of equity has been recognized in the financial literature for a long time. For example, the initial reconciliation of the Modigliani-Miller theories of capital structure with the Capital Asset Pricing Model, in Robert S. Hamada, "Portfolio Analysis, Market Equilibrium and Corporate Finance," *The Journal of Finance* 24: 13-31 (March 1969) works with market-value capital structures. For a more recent presentation of the concept, see, for example, Richard A. Brealey, Stewart C. Myers, and Franklin Allen, *Principles of Corporate Finance*, New York: McGraw-Hill/Irwin 9th ed. (2008) (Brealey, Myers, and Allen (2008)) pp. 530-533. Book values may

Mexico-American Water Company does not have a market value of equity since it is not publicly traded. However, the water utilities average approximately 60 percent equity, so clearly New Mexico-American Water Company carries more financial risk. As a simple everyday example, consider two homeowners, each of whom purchased a home in 2002 for $150,000, which at the time was the market price. The home is financed with an interest-only mortgage that carries an interest rate of 5 percent. Today the homeowners want to sell their homes, but the market price has dropped to $125,000. The following consider the effect of leverage on these homeowners situation.

Homeowner 1 made a down payment of 30% ($45,000) for a mortgage of $105,000 and a loan to market value of 70 percent. Assuming he sells the home for the market price of $125,000, he gets $20,000 ($125,000 - $105,000) at the time of closing. As the homeowner invested $45,000, he has lost $25,000 for a negative return on the investment of 55.5%. [8]

Homeowner 2 made a down payment of 20 percent or $30,000 for a mortgage of $130,000 and an initial loan to market value of 80 percent. Assuming he sells the home for the market price of $125,000, he gets $5,000 ($125,000 - $120,000) at closing for a loss of $25,000. This corresponds to a negative return on his investment of -83.3%.[9]

Homeowner 3 made a down payment of only 10 percent or $15,000 for a mortgage of $135,000 and an initial loan to market value of 90 percent. Assuming he sells the home for the market price of $125,000, he has to pay $10,000 to sell his home ($125,000 - $135,000). As a result, he has made a

be relevant for some issues, e.g., for covenants on individual bond issues, but as explained in the text, market values are the determinants of the impact of debt on the cost of equity.

[8] Return on Investment = -$25,000 / $45,000 = -55.5%.

[9] Return on Investment = -$25,000 / $30,000 = 16.66%.

negative return of -166.7% on his initial (equity) investment, because his investment is now under water.[10]

The example demonstrates that increasing leverage or debt relative to the market value increases risk. For the homeowners in the above examples, the important price is the market price - - what they can sell the home for. The higher the leverage, the higher their loss on the investment and in the case of the homeowner with a very large mortgage to home value, the home could not be sold at a price high enough to cover the outstanding mortgage. This illustrates the dangers of high levels of debt and the fact that it is the market price that determines the return on investment.

Q16. PLEASE EXPLAIN THE IMPLICATIONS FOR RATE REGULATION AND YOUR TESTIMONY.

A16. Because the market risk, and therefore the cost of equity, depends on the market-value capital structures, one must base the estimation of the sample companies' cost of capital on market value capital structures. An approach that estimates the cost of equity for each of the sample firms without explicit consideration of the market value capital structure (i.e. the financial risk) underlying those costs risks material errors. The cost-of-equity estimates of the sample companies at their actual market-value capital structures are not necessarily reflected in the regulatory capital structure. Therefore, using book values could lead to an incorrect rate of return. I avoid this problem by calculating each sample company's ATWACC using its market-value capital structure. I then use the sample companies' average overall cost of capital to determine the corresponding return on equity at New Mexico-American Water's regulatory capital structure. This procedure ensures that the capital structure and the estimated cost of equity are consistent.

[10] Return on Investment = -$25,000 / $15,000 = -166.7%.

In my analyses, I estimate the cost of equity for each of the sample firms using traditional estimation methods (such as the DCF and CAPM). For each estimation method, I use each sample company's estimated cost of equity, market cost of debt and market-value capital structure along with New Mexico-American Water's marginal tax rate to estimate each sample company's overall cost of capital. I then calculate the samples' average overall cost of capital for each estimation method. Finally, I determine the cost of equity that is associated with the estimated ATWACC at New Mexico-American Water's regulated capital structure. Thus, the samples' overall cost-of-capital and that of New Mexico-American Water is the same.

Q17. IS THE USE OF MARKET VALUES TO CALCULATE THE IMPACT OF CAPITAL STRUCTURE ON THE RISK OF EQUITY INCOMPATIBLE WITH USE OF A BOOK-VALUE RATE BASE FOR A REGULATED COMPANY?

A17. No. Investors buy stock at market prices and expect a reasonable return on their investment. Market-based cost-of-equity estimation methods, such as DCF or CAPM which are frequently used in rate regulation, recognize this and rely on market data. That is, the cost of capital is the fair rate of return on regulatory assets for both investors and customers. Most regulatory jurisdictions in the U.S. measure the rate base using the net book value of assets, not current replacement value or historical cost trended for inflation. But the jurisdictions still apply market-derived measures of the cost of equity to that net book value rate base.

The issue here is "what level of risk is reflected in that cost-of-equity estimate?" That risk level depends on the sample company's market-value capital structure, not its book-value capital structure. *That risk level would be different if the sample company's market-value capital structure exactly equaled its book-value capital structure, so the estimated cost of equity would be different, too.*

Q18. PLEASE SUM UP THE IMPLICATIONS OF THIS SECTION.

A18. The market risk, and therefore the cost of equity depend on the market-value capital structure of the company or asset in question. It therefore is

impossible to validly compare the measured costs of equity of different companies without taking capital structure into account. Capital structure and the cost of equity are unbreakably linked, and any effort to treat the two as separate and distinct questions violates both everyday experience (e.g., with home mortgages) and basic financial principles.

Q19. HOW SHOULD A COST-OF-CAPITAL ANALYST IMPLEMENT THIS PRINCIPLE?

A19. There has been a great deal of financial research on the effects of capital structure on the value of the firm. One of the key conclusions that result from the research is that no narrowly defined optimal capital structure exists within industries, although the typical range of capital structures does vary among industries. Instead, there is a relatively wide range of capital structures within any industry in which fine-tuning the debt ratio makes little or no difference to the value of the firm, and hence to its overall after-tax cost of capital.

Accordingly, it is appropriate to treat the market-value weighted average of the cost of equity and the after-tax current cost of debt, or the "ATWACC" for short, as constant. The economically appropriate cost of equity for a regulated firm is the quantity that, when applied to the regulatory capital structure, produces the same ATWACC, as was derived from the sample companies. That value is the cost of equity that the sample would have, estimation problems aside, if the sample's market-value capital structure had been equal to the regulatory capital structure in question.

Q20. HOW DO YOU CALCULATE THE COST OF EQUITY CONSISTENT WITH THE MARKET-DETERMINED ESTIMATE OF THE SAMPLE'S AVERAGE COST OF CAPITAL?

A20. For simplicity assume that all sample companies have only common stock and debt. Then the ATWACC is calculated as:

$$ATWACC = r_D \times (1 - T_C) \times D + r_E \times E \quad (1)$$

where r_D is the market cost of debt, r_E is the market cost of equity, T_C is the marginal corporate income tax rate, D is the percent debt in the capital structure, and E is the percent equity in capital structure. The cost of equity consistent with the overall cost-of-capital estimate (ATWACC), the market cost of debt and equity, the marginal corporate income tax rate and the amount of debt and equity in the capital structure can be determined by solving equation (1) for r_E.

Q21. CAN YOU PROVIDE AN EXAMPLE OF HOW THIS FORMULA IS USED TO DETERMINE THE COST OF EQUITY?

A21. Yes. Consider a company with a 40 percent marginal corporate income tax rate and a cost of debt equal to 6 percent. For simplicity, I assume there is no difference in the company's embedded cost of debt and the cost at which it currently can issue additional debt. Further, suppose that the ATWACC estimate based on a sample of companies with comparable business risk is 7.5 percent. If the company's capital structure has 50 percent debt and 50 percent equity, equation (1) above yields a cost-of-equity estimate of 11.4 percent. If the equity ratio is lower, for example 45 percent, the cost of equity would instead be 12.3 percent. Conversely, a higher equity ratio such as 55 percent would imply a lower cost-of-equity estimate of 10.7 percent. Table 1 below summarizes these calculations as well as the dollar amount customers have to pay for financing costs.

Table 1. Example of the effect of capital structure on the estimated cost of equity.

Marginal tax rate		40%		
Cost of debt		6%		
Estimated ATWACC		7.50%		
Rate Base	$	1,000,000		
Regulatory Equity Ratio		45%	50%	55%
Regulatory Debt Ratio		55%	50%	45%
Estimated ATWACC		7.50%	7.50%	7.50%
Cost-of-equity		12.3%	11.4%	10.7%
After Tax Cost of Financing[1)]	$	75,000	$ 75,000	$ 75,000
Before Tax Cost of Financing[2)]	$	125,000	$ 125,000	$ 125,000

[1)] Estimated ATWACC × Rate Base.
[2)] Estimated ATWACC × Rate Base / (1 - Tax Rate).

The important point of this example is that the overall cost of capital does not depend on the company's capital structure, as long as the capital structure is in a wide middle range of values. Therefore, the cost to customers does not depend on the capital structure either. A higher equity ratio simply means that a higher percentage return is paid to equity investors, but the fraction of the rate base to which this higher return applies is lower. The equity investors are compensated appropriately for the higher risk, but that has no effect on the overall cost borne by customers. As long as equity investors are correctly compensated for the risk of their investment, the only effect that a higher equity ratio has is on how the return is divided between debt holders and equity holders, and not on how much customers end up paying.

Q22. BUT IS IT NOT THE CASE THAT IF THE ALLOWED RATE OF RETURN ON EQUITY IS LOWER, ALL ELSE EQUAL, RATEPAYERS PAY LESS?

A22. Yes, for a given equity percentage. However, it comes at a cost: if the rate of return on equity for a capital structure with 55 percent equity were applied to a company whose equity ratio is 45 percent, the company's equity investors would not be compensated for the financial risk of their investment. In particular, in this situation the expected return on equity

would be set too low. Such a result would impair the company's ability to attract investors, since they can expect higher returns elsewhere for the same risk level. This may well have negative consequences for the utility's ability to sustain an appropriate level of investment. Ultimately, this translates into a lower quality of the services that the utility can provide to its customers. Alternatively, the company could reduce its equity percentage with possible negative effects on the cost of debt or other credit factors.

III. CURRENT FACTORS TO CONSIDER WHEN SETTING THE COST OF CAPITAL

Q23. WHAT DO YOU DISCUSS IN THIS SECTION?

A23. This section addresses the effect of the recent recession and financial turmoil on the cost of capital.

Q24. HOW DOES THE FINANCIAL TURMOIL IMPACT THE COST OF CAPITAL?

A24. Although the turmoil in the financial markets has lessened, economic conditions are not back to their pre-crisis status. Of critical importance to cost of capital estimation is the two facts. First, the spread between utility bond yields and government bonds yields (yield spread) is larger than it historically has been and especially so for lower-rated bonds, including utility bonds. Second, capital markets remain volatile compared to the historical benchmarks.

Q25. HOW HAS THE YIELD SPREAD BETWEEN GOVERNMENT AND UTILITY BONDS CHANGED IN THE LAST THREE TO FOUR YEARS?

A25. During the height of the financial crisis of 2008-09, the spread between utility bond yields and government bond yields widened dramatically. Although the spread has narrowed from the height of the financial crisis, the yield spread is high relative to its historical level. Figure 2 illustrates an important point: the yield spread increases dramatically during times of

financial distress, which is one reason that the credit ratings of regulated companies should not be allowed to decline to non-investment grade levels. Further, Figure 2 illustrates that the yield spread remain higher than prior to the financial crisis of 2008-09 and also illustrates the sensitivity to turmoil as spread increased in March 2011 following the turmoil in the Middle East and Northern Africa. A supportive regulatory environment coupled with an appropriate allowed ROE are important components to insure that the utility's credit rating remains investment grade.

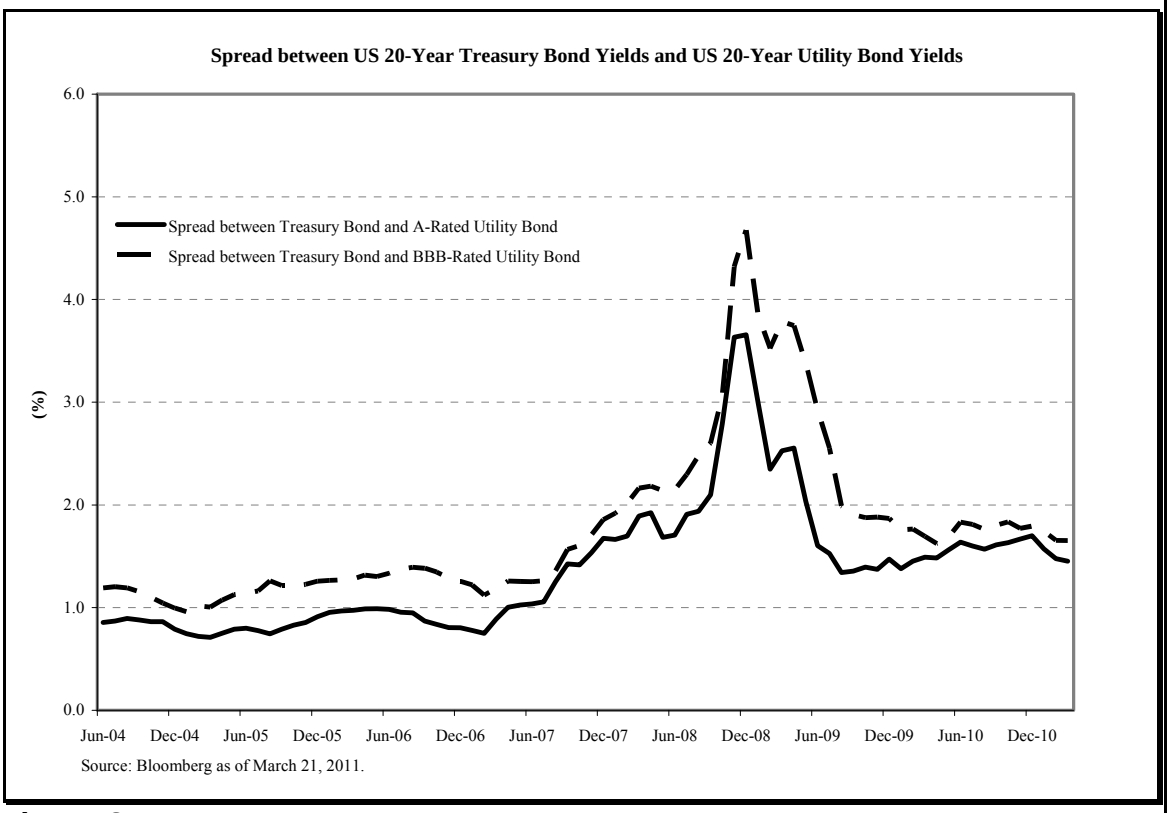


Figure 2

The current spread between the yield on utility bonds and 20-year government is unusually high as illustrated in Table 2 below. The spread between 20-year A-rated utility bond yield and the 20-year government bond yield is currently more than half a percentage point above its normal level.

Table 2

Spreads between US Utility Bond (20 year maturity) and US Treasury Bond (20 year maturity)			
Periods	A-Rated Utility and Treasury	BBB-Rated Utility and Treasury	Notes
Period 1 - Average Apr-1991 - 2007	0.93	1.23	[1]
Period 2 - Average Aug-2008 - 2011	1.84	2.35	[2]
Period 3 - Average Feb-2011	1.32	1.52	[3]
Period 4 - Average 15-Day (Feb 17, 2011 to Mar 10, 2011)	1.48	1.67	[4]
Spread Increase between Period 2 and Period 1	0.90	1.12	[5] = [2] - [1].
Spread Increase between Period 3 and Period 1	0.39	0.29	[6] = [3] - [1].
Spread Increase between Period 4 and Period 1	**0.55**	**0.44**	[7] = [4] - [1].

Source:
Spreads for the periods are calculated from Bloomberg's yield data.
Average monthly yields for the indices were retrieved from Bloomberg as of March 10, 2011.

Q26. WHAT IS THE IMPLICATION OF HIGHER THAN NORMAL YIELD SPREADS?

A26. A higher than normal yield spread is one indication of the higher cost of capital. As investors consider the risk-return tradeoff illustrated in Figure 1, they select investments based on the desired level of risk. Currently, the expected return on utility debt is elevated (relative to government debt). More risky equity is therefore also more costly relative to government debt. As a result, the cost of equity is currently elevated compared to its pre-crisis level. I discuss how to take this fact into account below.

Q27. ARE THE HIGHER THAN NORMAL YIELD SPREADS AN INDICATION OF INVESTORS' "FLIGHT TO SAFETY"?

A27. Yes. When investors become concerned about the economy, they frequently seek to reduce their exposure to investment risk.

Q28. DO REGULATED COMPANIES BENEFIT FROM THE FLIGHT TO SAFETY?

A28. To a degree. However, the required return on all risky investments, including utilities, increases during a time of flight to safety. Stock prices of regulated companies fell along with the market, although not as much in percentage terms as the market, but that is to be expected because regulated companies are of lower risk. The prices of regulated companies have recovered along with the market, but not as quickly or as much in

percentage terms as the market, again as expected by the relative risk of regulated companies compared to the market.[11]

Q29. WHAT EVIDENCE DO YOU HAVE THAT FINANCIAL MARKETS ARE VOLATILE?

A29. Although the day-to-day volatility has decreased from the height of the financial crisis, it remains high by historical standards. As displayed in Figure 3 below, the VIX index is higher its historical level.[12] The VIX index is an indicator of volatility in the market, and a high value indicates substantial uncertainty among investors. The relatively high level of VIX is one important measure demonstrating that financial markets remain more volatile than in the recent past.

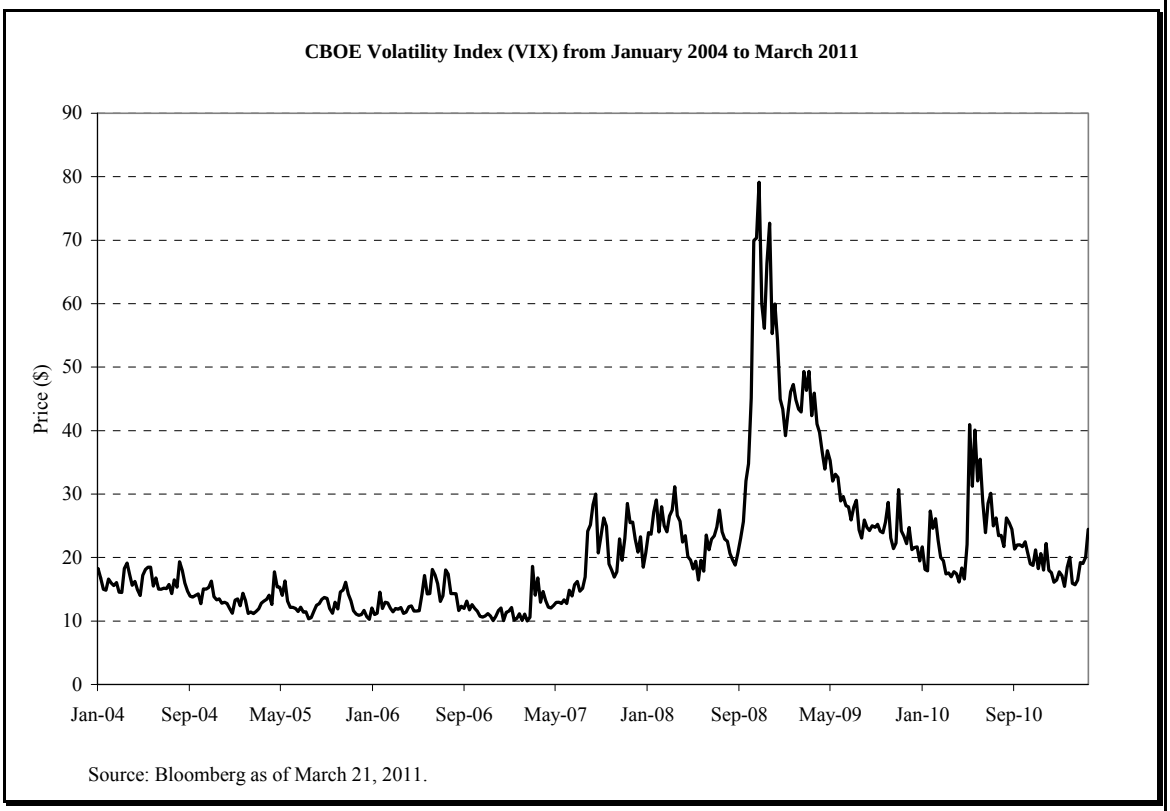


Figure 3

[11] For example, while the Dow Jones Industrial Index and the S&P 500 have gained more than 80% since their low in March 2009, the Dow Jones Utility Index has only increased approximately 40%, as of March 10, 2011.

[12] Trading in futures on the VIX index started in 2004. (http://www.cboe.com/micro/vix/introduction.aspx)

As can be seen from Figure 3, the VIX index (and thus market volatility) remains above pre-crisis levels and has recently increased again to above 20 in response to the ongoing turmoil in the Middle East, the sovereign, and bank debt crisis in Europe.[13]

Q30. PLEASE EXPLAIN WHY STOCK MARKET VOLATILITY MATTERS TO UTILITIES.

A30. Economic research has found that investor risk aversion increases during volatile periods. The higher the risk premium, the higher the required return on equity. For example, French, Schwert, and Stambaugh (1987) find a positive relationship between the expected market risk premium (MRP) and volatility:

> We find evidence that the expected market risk premium (the expected return on a stock portfolio minus the Treasury bill yield) is positively related to the predictable volatility of stock returns. There is also evidence that unexpected stock returns are negatively related to the unexpected change in the volatility of stock returns. This negative relation provides indirect evidence of a positive relation between expected risk premiums and volatility.[14]

One significant implication of this finding is that even if investors' risk aversion had not changed, the MRP would increase simply because market volatility is up.

Q31. WHAT DO YOU MEAN BY THE TERM "RISK AVERSION"?

A31. Risk aversion is the recognition that investors dislike risk. This means that for any given level of risk, investors expect to earn a higher return than before to be induced to invest. An increase in risk aversion means that investors require an even greater return for a given level of risk.

[13] See, for example, Moody's Investor Service, "Moody's downgrades Portugal to A3 and assigns a negative outlook," March 15, 2011 and S&P, "Greece Downgraded to 'BB-' on Confirmed ESM Borrowing Terms; Still on Watch Negative," March 29, 2011 and S&P, "Republic of Portugal Ratings Lowered to 'BBB-/A3' on ESM Borrowing Terms; Outlook Negative," March 29, 2011. See also, Bloomberg News, "Ireland Prepares to Rescue Banks With Stress Tests Aimed at Ending Crisis," March 31, 2011.

[14] K. French, W. Schwert and R. Stambaugh (1987), "Expected Stock Returns and Volatility," *Journal of Financial Economics*, Vol. 19, pp 3.

Q32. HOW DOES AN INCREASE IN INVESTORS' RISK AVERSION AFFECT THE COST OF CAPITAL FOR NEW MEXICO-AMERICAN WATER?

A32. As noted above, any increase in investors' risk aversion leads to a higher required return on capital; thus, the cost of capital increases. Although I believe that some of the increase in yield spread and in the MRP may be temporary, financial markets have yet to return to pre-crisis conditions and it may take a long time to restore investors confidence in the financial markets. Therefore, an estimation of the market cost of capital needs to consider the shift in investors' attitude towards risk.

Q33. ARE THERE OTHER ISSUES THAT MAY AFFECT THE COST OF CAPITAL IN THE LONGER TERM?

A33. Yes, the federal budget deficit is at a record high with the Congressional Budget Office ("CBO") predicting the 2011 fiscal deficit at 1.5 trillion and fiscal 2010 showing a deficit of 1.3 trillion, more than triple that of 2008 and the highest since World War II.[15] The CBO estimates that the budget deficit will remain high over the foreseeable future.[16] It will be difficult to sustain such a high deficit, so it is likely that the magnitude of the federal deficit will affect the inflation and hence the cost of capital going forward. Also, the Fed now holds significant mortgage-backed securities and continues to have substantial holdings related to AIG and other institutions.[17] It is unclear how the unwinding of these positions will affect financial markets, which creates additional uncertainty and market volatility.

[15] Congressional Budget Office: http://www.cbo.gov/ftpdocs/108xx/doc10871/BudgetOutlook2010_Jan.cfm and Douglas W. Elmendorf, Congressional Budget Office, "Outlook for the Economy and the Budget," February 2011.

[16] Congressional Budget Office: http://www.cbo.gov/

[17] Federal Reserve Statistical Release (http://www.federalreserve.gov/releases/h41/).

Q34. CAN YOU SUMMARIZE HOW THE ECONOMIC DEVELOPMENTS DISCUSSED ABOVE HAVE AFFECTED THE RETURN ON EQUITY AND DEBT THAT INVESTORS REQUIRE?

A34. Investors have been dramatically affected by the credit crisis, and companies such as New Mexico-American Water rely on these investors to support efficient business operations. Many have lost their jobs, their homes and/or their savings and some cannot retire as early as hoped or planned. As a result investors' risk aversion has increased. Figure 3 above shows that volatility has increased over its historical level and day-to-day volatility remains high as investors react to financial news. Although the bottom of the economic downturn may have been reached, the speed and duration of economic recovery are highly uncertain as are the effects of the federal budget deficit and the Fed's unwinding of its involvement in providing credit. Uncertainty in the capital markets remains high due in part to the ongoing concern over sovereign debt in Europe, turmoil in the Middle East and the potential impact on oil prices. Therefore, the required level of return is higher today than it was prior to the crisis for all risky investments.

Q35. HOW DO YOU TAKE THE CURRENT ECONOMIC CONDITIONS INTO ACCOUNT WHEN ESTIMATING THE COST OF EQUITY?

A35. Because the risk-free rate currently is unusually low and the spread between the yield on utility bonds and government bonds is high, I recognize the phenomena by adding a "yield spread adjustment" to the current long-term risk-free rate. This has the effect of increasing the intercept of the Security Market Line displayed in Figure 1 above. The normalization of the risk-free rate is consistent with forecasts on the government bond yield, where, the Federal Reserve Bank of Philadelphia recently released a survey, which expects the yield on the 10-year government bond to increase by 50-90 basis points over the next 1-2

years.[18] In addition, I present results for several estimates of the MRP, which has increased due to investors' increased risk aversion. In addition to my baseline results, which rely on an MRP of 6.5%, I also estimate the risk positioning models using an MRP of 7.0% and 7.5%.[19] The sensitivity analyses show that even a relatively small increase in the risk premium investors expect could substantially impact the estimated cost of equity.

Q36. HOW HAVE THE FINANCIAL CONDITIONS DISCUSSED ABOVE AFFECTED THE WATER INDUSTRY?

A36. There is a substantial need for ongoing investment in water industry infrastructure. The EPA has recently updated the spending needs in the water industry from $275 billion to $334.8 billion over the next 20 years.[20] These expenditures are driven by the need for upgrades to the distribution and transmission system as well as by the need to develop new water resources Thus, infrastructure investment in the water industry will require substantial external financing (i.e., new debt and equity). Access to capital requires that investors expect to earn their required return. Failure to provide adequate returns may discourage potential investors.

IV. THE COST OF CAPITAL FOR THE BENCHMARK SAMPLES

Q37. HOW IS THIS SECTION OF YOUR TESTIMONY ORGANIZED?

A37. As noted in *Section I*, I estimate the cost of capital using two samples of comparable risk companies. This section first covers preliminary matters such as sample selection, market-value capital structure determination, and the sample companies' costs of debt. It then covers estimation of the

[18] Federal Reserve Bank of Philadelphia, "Survey of Professional Forecasters: First Quarter 2011," February 11, 2011 comparing the data provided for 2011 with the forecast for 2012 and 2013. Comparing Q1 2011 to Q1 2012 and the year 2012, the forecast increase is 60 and 70 basis points, respectively.

[19] Because it is plausible that the government bond beta against the equity market is different from zero, I adjust the risk-free rate downward in the sensitivity analyses where the MRP is increased. The details of this relationship is explained in Appendix C.

[20] Rudden Energy Strategies Report, May 26, 2009 p. 6.

cost of equity for the sample companies and the resulting estimates of the sample's overall after-tax cost of capital.

A. Preliminary Decisions

Q38. WHAT PRELIMINARY DECISIONS ARE NEEDED TO IMPLEMENT THE ABOVE PRINCIPLES?

A38. I must select the benchmark samples, calculate the sample companies' market-value capital structures, and determine the sample companies' market costs of debt and preferred equity.

1. The Samples: Water Utilities and Gas Local Distribution Companies

Q39. WHY DO YOU USE TWO SAMPLES?

A39. The overall cost of capital for a part of a company depends on the risk of the business in which the part is engaged, not on the overall risk of the parent company on a consolidated basis.

Estimating the cost of capital for New Mexico-American Water's regulated assets is the subject of this proceeding. The ideal sample would be a number of companies that are publicly traded "pure plays" in the water production, storage, treatment, transmission, distribution and wastewater lines of business.[21] "Pure play" is an investment term referring to companies with operations only in one line of business. Publicly traded firms, firms whose shares are freely traded on stock exchanges, are ideal because the best way to infer the cost of capital is to examine evidence from capital markets on companies in the given line of business.

Therefore, for this case, a sample of companies whose operations are concentrated solely in the regulated portion of the water industry would be ideal. Unfortunately, the available sample of "water" utility companies in the U.S. is relatively small and has some data deficiencies.

To select my sample of comparable water and gas LDC companies, I start with those companies that are listed as a water utility or natural gas utility in *Value Line*.[22] Usually, I would apply several selection criteria to delete companies with unusual circumstances that may bias the cost-of-capital estimation and companies whose risk characteristics differ from those of the filing entity. However, the application of such criteria would eliminate many of the water utilities listed in *Value Line*. Therefore, I do not apply selection criteria to the water utility sample although I do apply my usual selection criteria to the gas LDC sample. Specifically, I would only be left with three companies (American States Water, Aqua American and California Water Service), if I were to have the following criteria for water utilities: more than $300 million in revenues, more than $500 million in market capitalization, more than 50% regulated assets, a bond rating and five years of trading data. If I further eliminated companies with substantial merger and acquisition activity as I usually do, I would also lose Aqua America. A sample of the two remaining companies is simply too small a sample. Therefore, I keep all water utilities with data in my water utility sample.[23] Note that the water sample has recently been reduced as Southwest Water has ceased to be a public company and Pennichuck Water has accepted to be acquired by the City of Nashua.

Q40. WHAT DO YOU DO TO OVERCOME THE WEAKNESSES OF THE WATER UTILITY SAMPLE DATA?

A40. To overcome the weaknesses of the water sample, I select a second sample of regulated utilities: gas local distribution companies. Gas LDCs, like water utilities, are regulated by state regulatory bodies, have large distribution investments, and serve a mix of residential, industrial, and commercial customers. In addition, the type of infrastructure operated by

[21] Most of the water utilities in *Value Line* have operations in the water as well as wastewater business.

[22] To select the samples I include both the Standard, the Small and Mid-Cap Editions of *Value Line Investment Survey* and *Value Line Investment Survey - Plus Edition.*

[23] I exclude Pennichuck Water, which will be acquired by the City of Nashua in a few weeks.

water and gas utilities is similar in that it consists of a large distribution system and some storage.

One reason for using the gas LDC sample is to generate a sample of regulated companies whose primary source of revenues is in the regulated portion of the natural gas industry to provide a second set of results for the cost of capital in a heavily regulated distribution industry. Therefore, I start with *Value Line*'s universe of natural gas utilities, and eliminate those companies whose percentage of assets attributed to regulated activities is less than 50 percent. In addition, I only include companies with an investment grade bond rating, no recent sizable mergers or acquisitions, no recent dividend cuts, and no other activity that could cause the estimation parameters to be biased. Additionally, I require the companies to have necessary data available. The final sample includes nine companies.[24] From this sample, I create a subsample of companies that are closer to being pure plays in the regulated gas distribution industry. Additional details of the sample selection process for each sample and subsample are described briefly below with details included in Appendix B.

Q41. IF THE BUSINESS RISK OF THE GAS LDC SAMPLE DIFFERS FROM THE WATER SAMPLE, CAN YOU STILL RELY ON THE COST OF EQUITY ESTIMATED FOR THE GAS LDC SAMPLE?

A41. Yes. If the business and financial risk of the two samples differ, then a cost-of-capital analysis can still make use of the information from the more reliable sample to evaluate the reliability of the estimates from the water sample. The inference would be based on information about the relative risk of the two industries. In this instance, the business operations of water and gas LDC companies are similar, but the water companies tend to have a higher percentage of their assets and revenue subject to regulation.

[24] The number of available companies has recently been reduced as AGL Resources and Nicor Inc., two natural gas utilities, are merging. See, for example, Nicor Press Release, "AGL Resources and Nicor to Combine in $8.6 Billion Transaction," December 7, 2010.

Q42. PLEASE ELABORATE ON THE WAY TWO SAMPLES WITH DIFFERENT BUSINESS AND FINANCIAL RISKS CAN BE COMPARED.

A42. As mentioned above, the overall cost of capital for a part of a company depends on the risk of the business in which the part is engaged, not on the overall risk of the parent company on a consolidated basis. According to financial economics, the overall risk of a diversified company equals the market value weighted-average of the risks of its components.

Calculating the overall after-tax weighted average cost of capital for each sample company as described above allows the analyst to estimate the average overall cost of capital for the sample. The ATWACC captures both the business risk and the financial risk of the sample companies in one number. This allows comparison of the cost of capital between two samples on a much more informed basis. If the alternative (more reliable) sample is judged to have slightly different risk than the water sample, but the results show wide differences in the ATWACC estimates, the analyst should carefully consider the validity of the water sample estimates, whether they are materially higher or lower than the alternative sample's estimates. Of course, the alternative sample could be the source of the error, but that is less likely because the alternative sample has been selected precisely because of its expected reliability.

Q43. PLEASE COMPARE THE CHARACTERISTICS OF THE WATER UTILITY SAMPLE AND THE GAS LDC SAMPLE.

A43. The two samples differ primarily in that they operate in two different (regulated) industries, but they are relatively similar in terms of the percentage of revenues from regulated operations and the customers they serve. On average, both samples earn a large percentage of their revenue from regulated activities and serve a mix of residential, industrial, and other customers. In addition, both industries are characterized by large capital investment and both are operating a large distribution system. Because of their larger size and better data availability, the gas LDC sample has fewer estimation issues than the water sample. Also, both natural gas distribution

companies and water utilities are regulated by the state in which they operate, so the regulatory environment is similar. Please refer to Appendix B for additional details on the two samples.

Q44. PLEASE DESCRIBE HOW YOU CALCULATE THE MARKET VALUES OF COMMON EQUITY, PREFERRED EQUITY AND DEBT.

A44. I estimate the capital structure for each sample company by estimating the market values of common equity, preferred equity and debt from the most recent publicly available data. The details are in Appendix B.

The market value of common equity is the price per share times the number of shares outstanding. For the CAPM and ECAPM, I use the last 15 trading days of each year to calculate the market value of equity for the year. I then calculate the average capital structure over the corresponding five-year period used to estimate the "beta" risk measures for the sample companies. This procedure matches the estimated beta to the degree of financial risk present during its estimation period. In the DCF analyses, I use the average stock price over 15 trading days ending on the release date of the BEst growth rate forecasts utilized.[25] I use 15 trading days to balance the need for a current stock price and avoiding that any one day unduly influences the results.

The market value of debt is estimated at its book value adjusted by the difference between the "estimated fair (market) value" and the "carrying cost" of long-term debt reported in each company's 10-K. The market value of preferred stock for the samples is set equal to its book value.[26]

Q45. HOW DO YOU ESTIMATE THE CURRENT MARKET COST OF DEBT?

A45. The market cost of debt for each company is set equal to the fifteen-day average yield on an index of public utility bonds that have the same credit rating, as reported by Bloomberg. The DCF analyses use the current credit

[25] BEst is Bloomberg's name for its earnings growth rate information. Bloomberg's BEst estimates are comparable to Zacks and I/B/E/S growth estimates. The BEst growth rate forecasts are as of March 2011 for the Gas LDC and the Water sample.

rating whereas the risk-positioning analyses use the current yield of a utility bond that corresponds to the five-year average debt rating of each company so as to match consistently the horizon of information used by *Value Line* to estimate each company's beta. Bond rating information was obtained from Bloomberg which reports Standard & Poor's bond ratings. I calculate the after-tax cost of debt using New Mexico-American's estimated marginal income tax rate of 39.94 percent.[27]

Q46. HOW DO YOU ESTIMATE THE MARKET COST OF PREFERRED EQUITY?

A46. For all sample companies, the preferred rating was assumed equal to the company's bond rating. The cost of a company's preferred equity was set equal to the yield on an index of preferred utility stock with the same rating. The data were obtained from the Mergent Bond Record.[28]

B. Cost-of-Equity Estimation Methods

Q47. HOW DO YOU ESTIMATE THE COST OF EQUITY FOR YOUR SAMPLE COMPANIES?

A47. As discussed earlier, the cost of capital is the expected rate of return in capital markets on alternative investments of equivalent risk. This definition leads me to address three points in my estimation procedures. First, the cost of capital is an expected rate of return – it cannot be directly observed, but must be inferred from available evidence. Second, the cost of capital is determined in capital markets (such as the New York Stock Exchange). Therefore, capital market data provide the best evidence from which to draw inferences. Third, the cost of capital depends on the return

[26] This is unlikely to affect the results as the average percentage of preferred is close to zero for both the water and gas LDC sample.

[27] Calculated as follows: state tax rate + federal tax rate × (1 – state tax rate) = 7.6% + 35% × (1 – 7.6%) = 39.94%.

[28] Published monthly, Mergent's Bond Record offers a comprehensive review of over 68,000 bond issues including coverage of corporate, government, municipal, industrial development/environmental control revenue and international bonds, plus structured finance and equipment trust issues, medium-term notes, convertible issues, preferred stocks and commercial paper issues.

offered by alternative investments of equivalent risk. Consequently, measures of risk that matter in capital markets are part of the evidence that I need to examine. The overall cost of capital that I estimate for the samples is the primary evidence I rely on to determine New Mexico-American Water's overall cost of capital.

Q48. PLEASE EXPLAIN HOW THE DEFINITION HELPS YOU ESTIMATE THE COST OF CAPITAL.

A48. The definition of the cost of capital recognizes a tradeoff between risk and expected return; this is the security market line plotted above in Figure 1 above. Cost-of-capital estimation methods often follow one of two approaches: (1) the method establishes the location of the security market line and estimate the relative risk of the security. The security market line and the relative risk then jointly determine the cost of capital. (2) The method identifies a comparable-risk sample of companies and estimates the cost of capital directly.

The "discounted cash flow" or "DCF" model is an example of the first approach. It indirectly estimates the cost of capital as a function of observed stock price information, dividend information and expected growth. The CAPM is an example of the second type of approach, sometimes known as "equity risk premium approach." It requires an extra step – positioning the security market line. Using the second approach allows me to use information from all traded securities rather than just those included in my sample. While both approaches can work equally well if conditions are right, one may be preferable to the other under certain circumstances. In particular, approaches that rely on the entire security market line are less sensitive to deviations from the assumptions that underlie the model, all else equal. In this case, I examine both DCF and risk-positioning approach evidence for the water utility and gas LDC sample.

1. The Risk-Positioning Approach

Q49. PLEASE EXPLAIN THE RISK-POSITIONING METHOD.

A49. The risk-positioning method estimates the cost of equity as the sum of a current interest rate and a risk premium. It is therefore sometimes also known as the "risk premium" approach. This approach may sometimes be applied more or less formally. As an example of an informal application, an analyst may estimate the spread between interest rates and what is believed to be a reasonable estimate of the cost of capital at a specific time, and then apply that spread to current interest rates to get a current estimate of the cost of capital.

More formal applications of the risk-positioning approach take full advantage of the security market line depicted in Figure 1: they use information on a large number of traded securities to identify the security market line and derive the cost of capital for the individual security based on that security's relative risk. This reliance on the entire security market line makes the method less vulnerable to the kinds of problems that arise from using one stock at a time (such as the DCF method). The risk-positioning approach is widely used and underlies much of the current research published in academic journals on the nature, determinants and magnitude of the cost of capital. The most commonly used version of the formal risk-positioning models is the Capital Asset Pricing Model (CAPM). The equation for the CAPM is:

$$k_s = r_f + \beta_s \times MRP \qquad (2)$$

where k is the cost of capital, r_f is the risk-free interest rate, *MRP* is the market risk premium, and β_s is the measure of relative risk.

Section I of Appendix C to this testimony provides more detail on the principles that underlie the risk-positioning approach. Section II of Appendix C provides the details of the risk-positioning approach empirical estimates I obtain.

Q50. HOW ARE THE "MORE FORMAL" APPLICATIONS OF THE RISK-POSITIONING APPROACH IMPLEMENTED?

A50. The first step is to specify the current values of the benchmarks that determine the security market line. The second is to determine the

security's, or investment's, relative risk. The third is to specify exactly how the benchmarks combine to produce the security market line, so the company's cost of capital can be calculated based on its relative risk.

a) Security Market Line Benchmarks

Q51. WHAT BENCHMARKS ARE USED TO DETERMINE THE LOCATION OF THE SECURITY MARKET LINE?

A51. The essential benchmarks that determine the security market line are the risk-free interest rate and the premium that a security of average risk commands over the risk-free rate. This premium is commonly referred to as the "market risk premium" (MRP), i.e., the excess of the expected return on the average common stock over the risk-free interest rate. In the risk-positioning approach, the risk-free interest rate and MRP are common to all securities. A security-specific measure of relative risk (beta) is estimated separately and combined with the MRP to obtain the company-specific risk premium.

Q52. WHAT BENCHMARK DO YOU USE FOR THE MRP?

A52. For this proceeding I estimate only a long-term version of the risk-positioning model. This version of the risk-positioning model measures the market risk premium as the risk premium of average-risk common stocks over long-term Government bonds. I do not present a short-term version in this proceeding because monetary policy has driven the short-term risk-free rate close to zero. I also report several sensitivity analyses that take into account the increase in the MRP as discussed above in *Section III.*

Q53. HOW DO YOU ESTIMATE THE BASELINE MRP?

A53. Appendix C summarizes academic and empirical research on the MRP. However, as discussed in the appendix, there is currently little consensus on the "best practice" for estimating the MRP even pre-crisis. (Note: this is not the same as saying that all practices are equally good). For example, the leading graduate textbook in corporate finance expresse the view that a

range between 5 to 8 percent is reasonable for the U.S.[29] Morningstar data from 1926 to 2010, the longest period reported, show an MRP average premium of stocks of 8.2 percent over Treasury bills and 6.7 percent over long-term Government bonds. The publication reports a premium of stocks over bonds of 6.6 percent for the period 1947 to 2010.[30] At the same time, *Credit Suisse's Global Investment Return Yearbook 2010* estimates the arithmetic market risk premium for the U.S. over the 1900 to 2009 period at 6.3 percent over bonds.[31] In a regulatory setting, the Surface Transportation Board ("STB") recently decided to use the CAPM (and the DCF) when determining the cost of capital for major railroads in the U.S. As part of its methodology, the STB decided to rely on the long-term market risk premium reported by Morningstar/Ibbotson in its implementation of the CAPM.[32]

My testimony considers both the historical evidence and the results of scholarly studies of the factors that affect the risk premium for average-risk stocks in order to estimate the benchmark risk premium investors currently expect.

Considering all the evidence, I conclude that S&P 500 stocks of average risk commanded 6.5 percent over the long-term Government rate prior to the financial crisis. This estimate is a conservative estimate of the historical average risk-premium in that it is lower than the figure reported over the longest period available and includes the unusual 2008 year. As discussed in *Section III* above, this figure has increased with the current market turmoil, so that the baseline of 6.5 percent likely underestimates the current MRP. However, I choose to use it as a benchmark to be conservative. I do, however, report sensitivity analyses that reflect an increase in the MRP I refer to models that use the 6.5 percent

[29] Richard A. Brealey, Stewart C. Myers, and Franklin Allen, *Principles of Corporate Finance*, McGraw-Hill, 9th edition, 2008, pp. 173-180.

[30] Morningstar, *Ibbotson SBBI Valuation Yearbook 2011*, Appendix A, Tables A-1 and A-3.

[31] Credit Suisse (with E. Dimson, P. Marsh, and M. Staunton), "*Global Investment Returns Yearbook 2010*," Table 10.

[32] *STB Ex Parte No. 664*, Issued January 17, 2008, pp. 8-9.

MRP as the baseline. The estimation of the MRP is discussed in greater detail in Appendix C.

Q54. HOW DO YOU DETERMINE THE RISK-FREE RATE YOU USE?

A54. First, I calculate the yield on long-term Government bonds over a recent 15-day period. Second, I determine the increase in the spread between the yield on A-rated utility bonds and long-term (20-year) Government bonds.[33] As of March 10, 2011 this spread stood at 148 basis points (using Bloomberg's calculated yields) and were 55 basis points above the average for the period 1991 to 2007.[34] I conservatively choose to add 40 basis points to the current long-term risk-free rate and note that this is conservative compared to the increase expected in the Federal Reserve Bank of Philadelphia study cited above, which forecasted an increase in the 10-year Treasury bond yield of 50 to 90 basis points over the next few years.[35]

b) Relative Risk

Q55. WHAT MEASURE OF RELATIVE RISK DO YOU USE?

A55. I examine the "beta" of the stocks in question. Beta is a measure of the "systematic" risk of a stock — the extent to which a stock's value fluctuates more or less than average when the market fluctuates.

The basic idea behind beta is that risks that cannot be diversified away in large portfolios matter more than those that can be eliminated by diversification. Beta is a measure of the risks that cannot be eliminated by diversification. This concept is explored further in Appendix C.

[33] I use the yield on A-rated utility bonds as they are less likely to include a default premium than are lower rated utility bonds.

[34] See Table 3 above.

[35] The Federal Reserve of Philadelphia's Survey of Professional Forecasters expects that the yield on 10-year Treasury bonds will average 4.1 – 4.9% over the 2012 to 2014 period. As the maturity premium of a 20-year Treasury bond over that of a 10-year Treasury bond has averaged 60 basis points since 2000, the corresponding yield on a 20-year Treasury bond is in the range of 4.7 – 5.5 percent (assuming the maturity yield remains constant).

Q56. WHAT DOES A PARTICULAR VALUE OF BETA MEAN?

A56. By definition, a stock with a beta equal to 1.0 has average non-diversifiable risk: it goes up or down by 10 percent on average when the market goes up or down by 10 percent. Stocks with betas above 1.0 exaggerate the swings in the market. A stock with a beta of 2.0 tends to fall 20 percent when the market falls 10 percent, for example. Stocks with betas below 1.0 understate the swings in the market. A stock with a beta of 0.5 tends to rise 5 percent when the market rises 10 percent.

Q57. HOW DO YOU ESTIMATE BETA?

A57. I estimate my betas. Beta estimates are also available from *Value Line* and Bloomberg, but because I have been unable to replicate *Value Line's* estimates for the gas LDC companies, I choose to rely on my own estimates, which are comparable to Bloomberg's estimates for the gas LDC sample and comparable to both Bloomberg's and Value Line's estimates for the water utility sample. I estimate beta using standard techniques and rely on 260 weeks of return data for the sample companies. I use the S&P 500 index as the market index. Additional details regarding the estimation procedure are included in Appendix C.

c) Cost of Equity Capital Calculation

Q58. HOW DO YOU COMBINE THE PRECEDING STEPS TO ESTIMATE THE COST OF EQUITY?

A58. The most widely used approach to combine a risk measure with the benchmark market risk premium on common stocks to find a risk premium for a particular firm or industry is the Capital Asset Pricing Model. However, the CAPM is only one risk-positioning technique.

In addition to the CAPM, I rely on an empirical variety of the model. Empirical research has long shown that the CAPM tends to overstate the actual sensitivity of the cost of capital to beta: low-beta stocks tend to have higher risk premia than predicted by the CAPM and high beta stocks tend to have lower risk premia

than predicted. A number of variations on the original CAPM theory have been proposed to account for this finding.

This finding can be used directly to estimate the cost of capital, using beta to measure relative risk, without simultaneously relying on the CAPM. Here I examine results from both the CAPM and a version of the security market line based on the empirical finding that risk premia are related to beta, but are not as sensitive to beta as the CAPM predicts, to convert the betas into a risk premium. I refer to this latter model as the "ECAPM," where ECAPM stands for Empirical Capital Asset Pricing Model. The formula for the ECAPM is

$$k_s = r_f + \alpha + \beta_s \times (MRP - \alpha) \quad (3)$$

where as before *k* is the cost of capital, r_f is the risk-free interest rate, *MRP* is the market risk premium, β_s is the measure of relative risk, and α is the empirical adjustment factor.

Research supports values for α ranging from one to seven percent when using a short-term interest rate. I use benchmark values of α of 0.5 percent for the long-term risk-free rate as it is in the lower range of what empirical evidence support. I also conduct sensitivity tests for different values of α. For the long-term risk-free rate I use values for α of 0, 0.5 and 1.5 percent. See Appendix C for a more detailed discussion of the ECAPM model and Table C-1 for a summary of the empirical evidence on the size of the required adjustment.

Q59. WHY IS IT APPROPRIATE TO USE THE ECAPM MODEL?

A59. Empirical tests of the CAPM have repeatedly shown that an investment's return is related to systematic risk, but that the increase in return for an increase in risk is less than is predicted. The empirical tests have also shown that the theoretical intercept, as measured by the return on Treasury bills, is too low to fit the data. In other words, the empirical tests indicate that the slope of the CAPM is too steep and the intercept is too low. The empirical data support the ECAPM. The ECAPM recognizes the consistent empirical observation that the CAPM underestimates (overestimates) the cost of capital for low (high) beta stocks. The ECAPM corrects the

predictions of the CAPM to more closely match the results of the empirical tests. Ignoring the results of CAPM tests would lead to an estimate of the cost of capital that is likely to be less accurate than is possible.

Q60. IS THE USE OF THE ECAPM EQUIVALENT TO ADJUSTING THE ESTIMATED BETAS FOR THE SAMPLE COMPANIES?

A60. No. Fundamentally, this is not an adjustment (increase) in beta. This can easily be seen by the fact that the expected return on high beta stocks is lower with the ECAPM than when estimated by the CAPM. The ECAPM model is a recognition that the actual slope of the risk-return tradeoff is flatter than predicted and the intercept higher based upon repeated empirical tests of the model.[36] Even if the beta of the sample companies were estimated accurately, the CAPM would still underestimate the required return for low beta stocks. Even if the ECAPM were used, the costs of equity would be underestimated if the betas were underestimated.

2. Discounted Cash Flow Method

Q61. PLEASE DESCRIBE THE DISCOUNTED CASH FLOW APPROACH.

A61. The DCF model takes the first approach to cost-of-capital estimation, i.e., to attempt to estimate the cost of capital in one step. The method assumes that the market price of a stock is equal to the present value of the dividends that its owners expect to receive over the life of the company. The method also assumes that this present value can be calculated by the standard formula for the present value of a cash flow stream:

$$P = \frac{D_1}{(1+k)} + \frac{D_2}{(1+k)^2} + \frac{D_3}{(1+k)^3} + \cdots + \frac{D_T}{(1+k)^T} \qquad (4)$$

[36] Many investment firms make an adjustment to the beta. A commonly used adjustment is the Merrill Lynch adjustment, which adjusts betas 1/3 toward one. This type of adjustment is intended to compensate for sampling errors in the beta estimation, not for the empirical fact that CAPM tends to overestimate the sensitivity of the cost of capital to beta. See Appendix C for a more detailed explanation.

where "P" is the market price of the stock; "D_t" is the dividend cash flow expected at the end of period t (i.e., subscript period 1, 2, 3 or T in the equation); "k" is the cost of capital; and "T" is the last period in which a dividend cash flow is to be received. The formula just says that the stock price is equal to the sum of the expected future dividends, each discounted for the time and risk between now and the time the dividend is expected to be received.

Most DCF applications go even further, and make very strong (i.e., unrealistic) assumptions that yield a simplification of the standard formula, which then can be rearranged to estimate the cost of capital. Specifically, if investors expect a dividend stream that will grow forever at a steady state, the market price of the stock will be given by a very simple formula,

$$P = \frac{D_1}{(k-g)} \tag{5}$$

where "D_1" is the dividend expected at the end of the first period, "g" is the perpetual growth rate, and "P" and "k" are the market price and the cost of capital, as before. Equation (5) is a simplified version of Equation (4) that can be solved to yield the well known "DCF formula" for the cost of capital:

$$\begin{aligned} k &= \frac{D_1}{P} + g \\ &= \frac{D_0 \times (1+g)}{P} + g \end{aligned} \tag{6}$$

where "D_0" is the current dividend, which investors expect to increase at rate g by the end of the next period, and the other symbols are defined as before. Equation (6) says that if Equation (5) holds, the cost of capital equals the expected dividend yield plus the (perpetual) expected future growth rate of dividends. I refer to this as the simple DCF model. Of course, the "simple" model is simple because it relies on very strong, unrealistic, assumptions.

Q62. CAN YOU ILLUSTRATE THE DCF MODEL?

A62. Yes. For simplicity, I will illustrate the method using annual data although most companies pay dividends quarterly, so that a quarterly model is more

appropriate. If, on an annual basis, a company paid $2 in dividends, D_0, has a current stock price, P, of $30 and an estimated growth rate, g, of 5 percent per year, then the calculations in equations (5) and (6) above are as follows

Dividends next period: $D_1 = D_0 \times (1 + g) = \$2.00 \times (1 + 5\%) = \$2.10$

Dividend Yield: $D_1 / P = \$2.10 / \$30 = 7.0\%$

Cost of equity: $k = D_1 / P + g = 7.0\% + 5\% = 12\%$.

Q63. ARE THERE OTHER VERSIONS OF THE DCF MODELS BESIDES THE "SIMPLE" ONE?

A63. Yes. There are many variations on the DCF models that may rely on less strong (more realistic) assumptions in that they allow growth rates to vary over time. I consider a variant of the DCF model that uses the companies' individual growth rates during the first five years, converges to a perpetual growth rate in years 6-10 and then uses the GDP growth rate as the perpetual growth rate after year 10 for all companies. This is a variant of the "multi-stage" DCF method. The DCF models are described in detail in Section I of Appendix D. (Section II of Appendix D provides the details of my empirical DCF analysis.)

Q64. WHAT ARE THE MERITS OF THE DCF APPROACH?

A64. The DCF approach is conceptually sound if its assumptions are met, but can run into difficulty in practice because those assumptions are so strong, and hence so unlikely to correspond to reality. Two conditions are well known to be necessary for the DCF approach to yield a reliable estimate of the cost of capital: the variant of the present value formula that is used must actually match the variations in investor expectations for the dividend growth path; and the growth rate(s) used in that formula must match current investor expectations. Less frequently noted conditions may also create problems. (See Appendix D for details.)

Q65. WHAT IS THE MOST DIFFICULT PART OF IMPLEMENTING THE DCF APPROACH?

A65. Finding the right growth rate(s) is the usual "hard part" of a DCF application. The original approach to estimation of the growth rate, *g*, relied on average historical growth rates in observable variables, such as dividends or earnings, or on the "sustainable growth" approach, which estimates g as the average book rate of return times the fraction of earnings retained within the firm. But it is highly unlikely that these historical averages over periods with widely varying rates of inflation and costs of capital will equal current growth rate expectations. This is particularly true for the water sample as many companies in the industry are growing fast, engaged in mergers, acquisitions or other restructuring activities.

Moreover, the constant growth rate DCF model requires that dividends and earnings grow at the same rate for companies that on average earn their cost of capital.[37] It is inconsistent with the theory on which the model is based to have different growth rates in earnings and dividends over the period when growth is assumed to be constant. If the growth in dividends and earnings were expected to vary over some number of years before settling down into a constant growth period, then it would be appropriate to estimate a multistage DCF model. In the multistage model, earnings and dividends can grow at different rates, but must grow at the same rate in the final, constant growth rate period. A difference between forecasted dividend and earnings rates therefore is a signal that the facts do not fit the assumptions of the simple DCF model.

[37] Why must the two growth rates be equal in a steady-growth DCF model? Think of earnings as divided between reinvestment, which funds future growth, and dividends. If dividends grow faster than earnings, there is less investment and slower growth each year. Sooner or later dividends will equal earnings. At that point, growth is zero because nothing is being reinvested (dividends are constant). If dividends grow slower than earnings, each year a bigger fraction of earnings are reinvested. That makes for ever faster growth. Both scenarios contradict the steady-growth assumption. So if you observe a company with different expectations for dividend and earnings growth, you know the company's stock price and its dividend growth forecast are inconsistent with the assumptions of the steady-growth DCF model.

Q66. HOW DO YOU ESTIMATE THE GROWTH RATES YOU USE IN YOUR DCF ANALYSIS?

A66. I use earnings growth rate forecasts from Bloomberg and *Value Line*. Analysts' forecasts are superior to using single variables in time series forecasts based upon historical data as has been documented and confirmed extensively in academic research. Please see Section I in Appendix D for a detailed discussion on this issue.

Q67. ARE YOU AWARE OF LITERATURE THAT FINDS THAT ANALYSTS' FORECAST OF EARNINGS GROWTH HISTORICALLY HAVE OVERESTIMATED EARNINGS AND DIVIDEND GROWTH?

A67. Yes. Most of the research underlying this literature was conducted prior to the various reforms aiming to reduce analysts' bias. Thus, while academic researchers during the 1990s as well as in early 2000s found evidence of analysts' optimism bias, it appears that (1) regulatory reforms have largely if not completely eliminated the issue and (2) utilities were never subject to the level of optimism bias as other industries. To elaborate, a recent paper by Hovakimina and Saenyasiri (2010) found that recent efforts to curb analysts' incentive to provide optimistic forecasts have worked, so "the median forecast bias essentially disappeared."[38] In addition, the effect of optimism bias is least likely to affect DCF estimates for rate regulated companies in relatively stable segments of an industry. Take, for example, Chan, Karceski, and Lakonishok (2003)[39] who sort companies on the basis of the size of the I/B/E/S forecasts to test the level of optimism bias. Utilities constitute 25 percent of the companies in lowest quintile. These authors found that the I/B/E/S forecast for the 25 percent quintile showed an upward bias when measured against realized income before extraordinary items using a simple average of the companies in the

[38] A. Hovakimian and E. Saenyasiri, "Conflicts of Interest and Analyst Behavior: Evidence from Recent Changes in Regulation," *Financial Analysts Journal*, vol. 66, 2010.

[39] L. K.C. Chan, J. Karceski, and J. Lakonishok, 2003, "The Level and Persistence of Growth Rates," *Journal of Finance* 58(2):643-684.

quintile, while the same I/B/E/S forecasts showed a downward bias when measured against realized portfolio income before extraordinary items. The latter weigh the sample by company size. Thus, their finding showed mixed results for the segment that includes utilities.

In addition, the use of a two-stage DCF model, which substitutes the forecast growth of GDP, mitigates analyst optimism by substituting the GDP growth rate for the potentially optimistic (or pessimistic) earnings forecasts of analysts.

Q68. HOW WELL ARE THE CONSTANT-GROWTH RATE CONDITIONS NECESSARY FOR THE RELIABLE APPLICATION OF THE DCF LIKELY TO BE MET FOR THE SAMPLE COMPANIES AT PRESENT?

A68. The requisite conditions for the sample companies are not fully met at this time, particularly for the water sample, which include several companies that have limited data available and where acquisitions have been frequent. Of particular concern for this proceeding is the uncertainty about what investors truly expect the long-run outlook for the sample companies to be. The longest time period available for growth rate forecasts of which I am aware is five years. The long-run growth rate (i.e., the growth rate after the water industry settles into a steady state, which may be beyond the next five years for this industry) drives the actual results one gets with the DCF model. Unfortunately, this implies that unless the company or industry in question is stable – so there is little doubt as to the growth rate investors expect – DCF results in practice can end up being driven by the subjective judgment of the analyst who performs the work.

The DCF growth rates, whether estimated from historical data or from analyst forecasts, have likely been affected by several factors: many mergers and acquisitions in the water industry,[40] significant growth in many parts of the country, and a trend towards consolidation. The industry appears to be moving

[40] For example, Pennichuck Corp. has agreed to be acquired by the City of Nashua, NH and Southwest Water was taken private in 2010. In addition, Aqua America made 26 acquisitions in 2010 (*Value Line Investment Survey*, Aqua America, January 21, 2011).

towards a larger degree of consolidation – at least among the privately held water utilities. As pointed out by Value Line Investment Survey,

> Infrastructures are decaying rapidly and, in many cases, need complete overhauls. The costs to make the repairs are astronomical and many operating in this space do not have the funds on hand to foot the bill. Indeed, most are strapped for cash and will have to look to outside financiers to keep up. Although consolidation trends present unique opportunities for those with the financial capabilities to throw their hat in the ring, such as Aqua America, others are just trying to stay afloat.[41]

The American Society of Civil Engineers estimated in 2009 that "drinking water systems face an annual shortfall of at least $11 billion in funding needed to replace aging facilities that are near the end of their useful life and to comply with existing and future federal water regulations"[42] with a total investment need for drinking water and wastewater investments of $255 billion over the next five years.[43] Drinking water is mentioned as the second most important infrastructure concern for New Mexico and the required investments is estimated at $27.87 billion for drinking water and at $18.17 billion for wastewater.[44] Coupled with the rising construction costs of utility infrastructure, this creates uncertainty about future conditions and diverging expectations. The uncertainty associated with these factors increases the industry's business risk. Additionally, environmental regulations impact the industry as standards for water quality evolve over time, and there is potential for new safety and security requirements in the future. The industry has no federal regulator (other than for environmental and health issues), and state public utility commissions regulate most investor owned water utilities. Different regulatory bodies may lead to differing regulatory requirements for companies operating in adjacent parts of the country. Taken together, these

[41] *Value Line*, Water Utility Industry, January 21, 2011.

[42] Report Card for America's Infrastructure, The American Society of Civil Engineers, 2009, p. 1.

[43] *Ibid*., Executive Summary p. 7. According to the document, the investment shortfall is about $108.6 billion for the water industry over the next five years.

[44] Report Card for America's Infrastructure: New Mexico, The American Society of Civil Engineers, 2009. (http://www.infrastructurereportcard.org/state-page/New Mexico)

factors mean that it may be some time before the water industry settles into anything investors will see as a stable equilibrium necessary for the reliable application of the DCF model.

Such circumstances imply that a commission may often be faced with a wide range of DCF estimates, none of which can be well grounded in objective data on true long-run growth expectations, *because no such objective data now exist*. DCF for firms or industries in flux is *inherently* subjective with regard to the most important parameter, the long-run growth rate that drives the answer.

In short, the unavoidable questions about the DCF model's strong assumptions cause me to view the DCF method as less reliable for the water utility sample at this point in time. Relying on historical growth rate does not make the water sample's DCF results reliable, because (1) the DCF method's strength is being forward looking and historical data violates this principle and (2) historical growth rates for the water industry vary as much as do forecasted growth rates. A number of companies in the water industry, which has a relative small number of companies, are in flux and therefore their growth rates are very volatile. Therefore, even minor variations in methodology, timing, or sample composition drives the results which is not consistent with stable rate making.

C. THE SAMPLES AND RESULTS

1. The Water Utility Sample

Q69. EARLIER YOU SAID THAT THE SAMPLE OF WATER UTILITIES HAD DATA WEAKNESSES. PLEASE ELABORATE ON THESE WEAKNESSES.

A69. Currently, only four companies have a market value of equity greater than $500 million. More important, however, is the fact that the stock of these companies trades relatively infrequently. Low trading volume causes concern because there may be a delay between the release of important information and the time that this information is reflected in prices. Such delay is well known to cause beta estimates to be statistically insignificant and possibly biased.

In addition to lack of data and the small size of the companies, there are firm-specific events that render the water utility sample less reliable than would be ideal. First, Aqua America (the second largest of the companies) has gone through a large number of mergers and acquisitions in recent years. Normally, I would not include companies with significant merger or acquisition activity in a sample because the individual information about the progress of the proposed merger is so much more important for the determination of the company's stock price than day-to-day market fluctuations. In practice, beta estimates for such companies tend to be too low. The growth rates for such companies may also be affected. Second, American Water Works, the largest publicly traded water utility, has only been publicly traded since 2008 and therefore has less than five years of data available for examination. In addition, American Water has announced a sale of its Arizona and New Mexico assets. I therefore report my results for both the full sample and for a subsample of companies that differ in the risk positioning and DCF method. Specifically, I exclude Connecticut Water Service from the DCF subsample, because it has a negative growth rate from Value Line. I exclude American Water from the subsample in the CAPM / ECAPM analyses because it has less than five years of trading data.

Q70. HOW IS THIS SECTION OF YOUR TESTIMONY ORGANIZED?

A70. This section first describes the input data used in the CAPM and ECAPM models, then reports the resulting cost-of-equity estimates for the samples. The second section of Appendix C details the empirical analysis.

a) Interest Rate Estimate

Q71. HOW DID YOU DETERMINE THE EXPECTED RISK-FREE INTEREST RATE?

A71. I reviewed current constant maturity U.S. Government bond yield data available from the St. Louis Federal Reserve Bank. For the 15-day period ending March 10, 2011, the average yield on long-term government bonds was 4.34 percent. To that figure I added 40 basis points in the baseline

case as an adjustment for the increase in yield spread.[45] I note that in the sensitivity analyses, I reduce the adjustment for yield spread by 25 basis points for each 1 percent increase in the MRP. This intends to take into account the fact that bond betas may be positive and .25 is a conservative estimate hereof - - i.e., bond betas are likely to be lower, so that a .25 percent adjustment is in the upper end of the needed adjustment.

b) Betas and the Market Risk Premium

Q72. WHAT BETA ESTIMATES DID YOU USE IN YOUR ANALYSIS FOR THE SAMPLES?

A72. I estimate betas for the sample companies using total return data for the most recent 260 weeks. I use the S&P 500 as the market index. The estimated betas are shown in Workpaper #1 to Tables No. BV-10 and BV-20. The tables also show Bloomberg and Value Line betas.

Q73. HOW DO YOU CALCULATE YOUR BETAS?

A73. I use 260 weekly observations of the total return on the sample companies' stock as well as S&P 500 and standard statistical procedures to estimate beta. Consistent with most commercial providers of betas and the academic literature that demonstrate that raw betas tend to underestimate the slope of the market line for low beta stocks (and overestimate the slope of the market line for high beta stocks), I rely on adjusted betas. This is consistent with both Value Line and Bloomberg's standard beta procedure. The average beta for the water sample is .78 while the average beta for the gas LDC sample is .75.

Q74. PLEASE EXPLAIN THE METHOD TO ADJUST FOR DIFFERENCES IN CAPITAL STRUCTURE.

[45] See Table No. BV-9.

A74. Starting with the ATWACC, the cost of equity for any capital structure within a broad range of capital structures can be determined by the following formula:

$$\text{Return on equity} = \frac{\text{ATWACC} - \text{Return on debt} \times \%\ \text{debt in capital structure} \times (1 - \text{tax rate})}{\%\ \text{equity in capital structure}}$$

This is the calculation that is displayed in Tables No. BV-12 and BV-22.[46] The tables display the result of converting the sample average ATWACC to a return on equity for a specific capital structure. It is straightforward to use this method to determine the cost of equity consistent with the capital structure.

c) Risk-Positioning Results

Q75. WHAT ARE THE COST-OF-EQUITY ESTIMATES DERIVED FROM THE RISK-POSITIONING APPROACH FOR THE WATER AND GAS LDC SAMPLE?

A75. Table 3a and Table 3b below display the results for both samples and for the three scenarios. The results for the water sample are slightly higher than for the gas LDC sample.

[46] For companies that have preferred equity, an additional term equal to (Return on preferred equity × % preferred in capital structure) is subtracted from the numerator of this fraction.

Table 3a

Gas LDC Sample
Return on Equity Summary and Sensitivity Analysis
Using Brattle Betas

Estimated Return on Equity	Baseline [1]	Scenario 2 [2]	Scenario 3 [3]
Full Sample			
CAPM	11.9%	12.3%	12.6%
ECAPM (α = 0.5%)	12.1%	12.5%	12.8%
ECAPM (α = 1.5%)	12.5%	12.9%	13.2%
Sub-Sample			
CAPM	12.2%	12.6%	12.9%
ECAPM (α = 0.5%)	12.4%	12.8%	13.1%
ECAPM (α = 1.5%)	12.8%	13.1%	13.5%

Sources and Notes:
Baseline: Long-Term Risk Free Rate of 4.74%, Long-Term Market Risk Premium of 6.50%.
Scenario 2: Long-Term Risk Free Rate of 4.61%, Long-Term Market Risk Premium of 7.00%.
Scenario 3: Long-Term Risk Free Rate of 4.49%, Long-Term Market Risk Premium of 7.50%.

Table 3b

Water Utility Sample
Return on Equity Summary and Sensitivity Analysis
Using Brattle Betas

Estimated Return on Equity	Baseline [1]	Scenario 2 [2]	Scenario 3 [3]
Full Sample			
CAPM	12.5%	12.9%	13.3%
ECAPM (α = 0.5%)	12.7%	13.1%	13.4%
ECAPM (α = 1.5%)	13.0%	13.4%	13.7%
Sub-Sample			
CAPM	13.1%	13.5%	14.0%
ECAPM (α = 0.5%)	13.3%	13.7%	14.1%
ECAPM (α = 1.5%)	13.5%	14.0%	14.4%

Sources and Notes:
Baseline: Long-Term Risk Free Rate of 4.74%, Long-Term Market Risk Premium of 6.50%.
Scenario 2: Long-Term Risk Free Rate of 4.61%, Long-Term Market Risk Premium of 7.00%.
Scenario 3: Long-Term Risk Free Rate of 4.49%, Long-Term Market Risk Premium of 7.50%.

These ROE estimates are based upon the Company's current regulatory capital structure of 44 percent equity. Of the equity risk premium results, the CAPM values deserve the least weight, because this method does not adjust for the empirical finding that the cost of capital is less sensitive to beta than predicted by the CAPM (which my written evidence considers by using the ECAPM). Conversely, the ECAPM numbers deserve the most weight, because this method adjusts for the empirical findings. For my analysis, I conservatively rely on the baseline scenario, which makes no upward adjustment to the MRP. Relying on the baseline case, the CAPM and ECAPM models show a range of 12 to 12¾ percent for the gas LDC sample / subsample and 12½ to 13½ percent for the water sample / subsample with the subsamples being a bit higher than the full sample.[47,48]

2. The DCF Cost-of-Capital Estimates

Q76. WHAT STEPS DO YOU TAKE IN YOUR DCF ANALYSES?

A76. Given the above discussion of DCF principles, the steps are to collect the data, estimate the sample companies' costs of equity at their current capital structures, and then to adjust the sample's estimates to New Mexico-American Water's 44 percent equity ratio.

a) Growth Rates

Q77. WHAT GROWTH RATE INFORMATION DO YOU USE?

A77. For reasons discussed above and in Appendix D, historical growth rates today are not as relevant as forecasts of current investor expectations for these samples. I therefore use rates forecast by security analysts.

[47] Reliance on Value Line betas would reduce the gas LDC sample estimates by 25-50 basis points, but the water sample's estimates would be almost unaffected.

[48] I specify the cost of capital estimate to the nearest ¼ percent because I do not believe that it is possible to estimate the cost of capital more precisely than that. All calculations supporting my analyses are presented in the attached tables labeled Table No. BV-1 to Table No. BV-22.

The ideal in a DCF application would be a detailed forecast of future dividends, year by year well into the future until a true steady state (constant) dividend growth rate was reached, based on a large sample of investment analysts' expectations. I know of no source of such data. Dividends are ultimately paid from earnings, however, and earnings forecasts from a number of analysts are available for a few years. Investors do not expect dividends to grow in lockstep with earnings, but for companies for which the DCF approach can be used reliably (*i.e.*, for relatively stable companies whose prices do not include the option-like values described in Appendix D), they do expect dividends to track earnings over the long-run. Thus, use of earnings growth rates as a proxy for expectations of dividend growth rates is a common practice.

Accordingly, the first step in my DCF analysis is to examine a sample of investment analysts' forecast earnings growth rates from Bloomberg and *Value Line* to the degree such forecasts are available. The details are in Appendix D. At present, *Value Line* data runs through the 2014-2016 time period, representing an average of about four years from the current earning forecasts available for 2011. Bloomberg also provides a long-term earnings growth rate estimate. The longest-horizon forecasted growth rates from these sources underlie the simple DCF model (*i.e.*, the standard perpetual-growth model associated with the "DCF formula," dividend yield plus growth). Unfortunately, the longest growth forecast data only go out four to five years, which is too short a period to make the DCF model completely reliable.

b) Dividend and Price Inputs

Q78. WHAT VALUES DO YOU USE FOR DIVIDENDS AND STOCK PRICES?

A78. Dividends are either for the first or second quarter of 2011, depending on the most recent dividend information available at the time of estimation for each company.[49] This dividend is grown at the estimated growth rate and

[49] The dividend information was obtained from Bloomberg.

divided by the price described below to estimate the dividend yield for the simple DCF model.

Stock prices are an average of closing stock prices for the 15-day trading period ending on the day the BEst forecast was obtained from Bloomberg. A 15-day stock price average is used to guard against anomalous price changes in any single day.

c) DCF Results

Q79. WHAT ARE THE DCF ESTIMATES FOR THE SAMPLES?

A79. Following the procedures outlined earlier, simple and multistage DCF estimates of the cost of equity are obtained for the water and gas LDC sample companies, and are presented in Table 4a and 4b below.[50]

Table 4a

Water Utility Sample DCF Return on Equity Summary		
	DCF	
	Simple	Multi-stage
Full Sample		
Cost of Equity	11.6%	10.0%
Sub-Sample		
Cost of Equity	11.6%	10.1%

[50] See *Section III.B* of above for details of DCF estimation.

Table 4b

Gas LDC Sample DCF Return on Equity Summary		
	DCF	
	Simple	Multi-stage
Full Sample		
Cost of Equity	12.1%	10.6%
Sub-Sample		
Cost of Equity	12.4%	10.5%

For the water sample and subsample, the simple DCF cost estimate is 11.6 percent. The multistage DCF estimates are lower at 10 percent and 10.1 percent for the full sample and subsample, respectively. For the gas LDC sample and subsample, the simple DCF cost estimate is 12.1 percent and 12.4 percent, respectively. The multistage DCF estimates are lower at 10.6 percent and 10.5 percent for the full sample and subsample, respectively.

V. NEW MEXICO-AMERICAN WATER'S UNIQUE CIRCUMSTANCES AND THE REQUIRED RETURN ON EQUITY

Q80. WHAT ARE SOME OF THE CHALLENGES THAT NEW MEXICO-AMERICAN WATER IS FACING?

A80. New Mexico-American Water is facing financial challenges. The Company has been unable to earn its allowed return on equity for an extended period of time. As a result, the Company's financial metrics are challenging.[51] Further, American Water Works recently agreed to sell its Arizona and New Mexico assets to EPCOR. As a multi-state organization, American Water, represents a microcosm of the investment community discussed throughout this testimony and as such, American Water Works, the parent, needs to make decisions about the investment of limited resources. As a prudent investor, it needs to ensure that its operating companies meet

[51] See Table 5 below for a history of New Mexico-American Water's earned return on equity.

environmental and other regulatory requirements **and** also invest its resources where it can achieve the highest returns with the lowest risk, just like the investment community at large. As a result New Mexico-American Water finds itself in competition for capital within the American Water Works organization with operations in states that expect to earn a higher and more predictable return. American Water Works stated in its press release regarding the sale that it allows American Water Works to "direct our focus to those operations where we can best serve customers and meet business objectives.[52]

Q81. PLEASE ELABORATE ON NEW MEXICO-AMERICAN WATER'S FINANCIAL CHALLENGES.

A81. Table 5 below shows the earned return on equity for New Mexico-American Water since 2000 and clearly shows that only in 2000 did New Mexico-American earn its allowed return on equity. In all other years, it has seen a substantially lower earned return on equity.

Table 5

Historical ROE %										
2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
4.39%	4.18%	1.48%	1.98%	1.23%	1.61%	1.44%	9.46%	9.22%	7.56%	15.43%

For 10 years, New Mexico-American Water has been unable to earn its allowed return on equity and since 2004, the earned return on equity has been at or below the yield on government bonds. This is a fundamental problem as New Mexico-American Water cannot raise capital on the terms available to the U.S. government - - its cost of capital is inherently higher and the cost of equity is higher than the cost of debt. On a stand-alone basis, the low realized return means that New Mexico-American Water cannot raise capital on reasonable terms or fund needed investments from internally-generated funds.

[52] American Water Works Press Release January 24, 2011. See also, American Water Works, "Institutional Investor Meeting," April 2011 (www.amwater.com).

Q82. WHY IS THE EARNED RETURN ON EQUITY IMPORTANT TO A COMPANY?

A82. Both debt and equity investors receive their return on investments from the earned return, so investors as well as credit rating agencies look to the earned return to evaluate the value of the investment and the credit worthiness of the company. For example, it is usually necessary for a company to obtain a credit rating to place its bonds (or other debt) with the public. In general, the higher the credit rating, the lower the yield investors require, and the required yield increases at an increasing rate as the credit rating declines. For example, the difference between the yields on BBB and BB rated bonds is larger than is the difference in yield between A and BBB rated bonds. Recently and especially during the height of the financial crisis, the yields on BBB- rated bonds (the lowest investment grade) and on non-investment grade bonds increased much more than did the yields on higher-rated bonds. This observation is illustrated in Figure 4 below for four investment grade bond ratings. From Figure 4, it is clear that while utility bond yields have declined in recent months, the spreads between categories such as between BBB and BBB- rated utility bonds and especially between BBB and BB rated utility bonds have not returned to their pre-crisis levels. The yield spread on BB rated utility debt remains very high, about 315 basis points, compared to less than 160 basis points in April 2007. Thus, a downgrade to the BBB- or worse, the BB range, could result in a substantial increase in the expected cost of debt. Given the ongoing volatility in capital markets, yield spreads for bonds rated BBB- or lower may not return to a more normal range for an extended period of time.

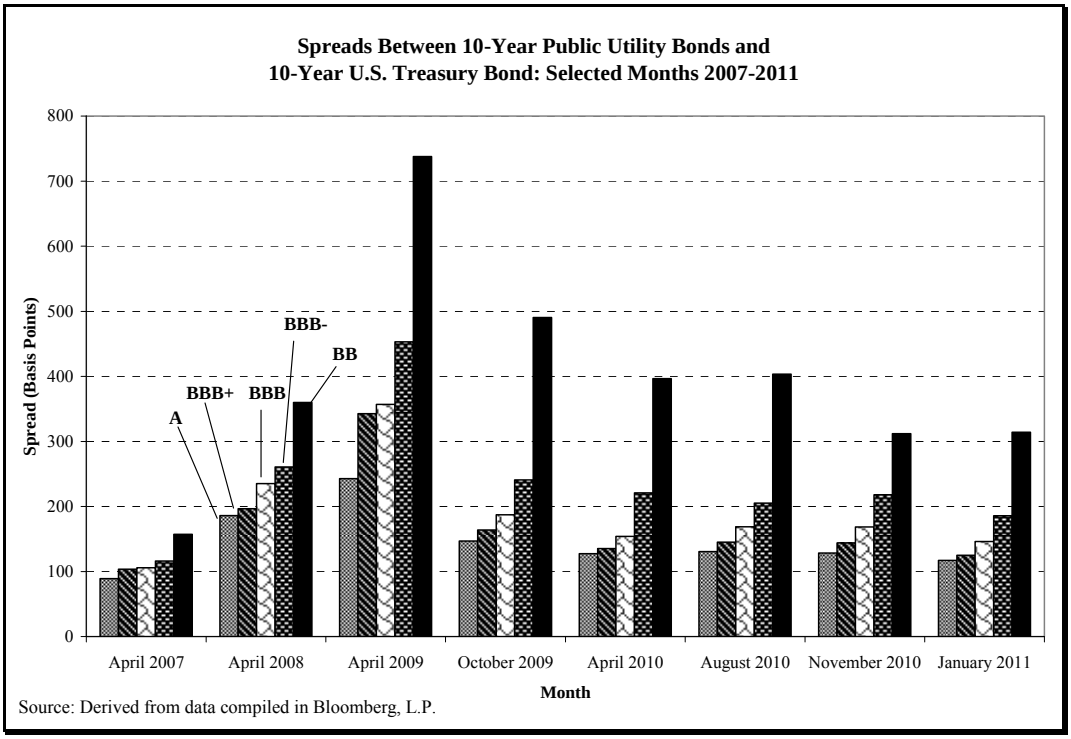


Figure 4

For a company such as New Mexico-American Water, the impact of the widening yield could be very significant. If New Mexico-American Water were to issue debt on a stand alone basis, the difference between issuing debt as a BBB and a BB rated entity is currently about 125 basis points for 10-year bonds. More importantly, BB-rated or even BBB- rated entities have difficulty accessing credit markets during times of limited liquidity, and if they do, they must pay very high interest rates, as illustrated in the April and October 2009 data in Figure 4.

Q83. ARE THERE OTHER COSTS TO HAVING A BORDERLINE INVESTMENT GRADE CREDIT RATING?

A83. Yes. Mutual fund and many other financial institutions cannot hold non-investment grade paper and cannot acquire bonds with a rating below BBB- and some cannot acquire BBB- rated debt. If an entity's debt were downgraded to non-investment grade, many financial institutions are required by their charters to sell all such bonds. The effect of forced sales by financial institutions is likely to be an increase in the required yield on

non-investment grade debt. BBB- rated entities are more vulnerable to economic turmoil because they are 'closer to the edge' than other investment grade rated entities. As a result, yields on BBB- rated debt increase more when financial markets are in turmoil. In addition, companies with non-investment grade credit ratings are considered to be in financial distress and experience additional costs not borne by investment grade companies. These factors underline the importance of improving New Mexico-American Water's credit metric. [53]

Q84. ARE THERE OTHER ISSUES THAT MIGHT NEED CONSIDERATION IN LIGHT OF THE DATA IN TABLE 5?

A84. Yes. Table 5 shows that New Mexico-American Water has been unable to earn its allowed return on equity for a number of years. This indicates that the company may be facing asymmetric risk, which exists when the possibility of a large negative outcome is not balanced by the possibility of a large positive outcome, or if the regulated company consistently fails to earn its allowed return because of the manner in which rates are set. With the presence of asymmetric risk, the regulated entity will expect to earn less than its allowed return on equity. The solution to this problem would be to either add an amount to the allowed ROE to compensate the utility for the asymmetric risk or to remove the source of the asymmetric risk. If an amount is added to the allowed ROE, the amount should be set so as to allow investors to again expect to earn their cost of capital on average in the face of asymmetric risk.

For illustrative purposes, consider the following example of how to compensate for asymmetric risk. Assume that the cost of equity equals the allowed ROE and is set at 11.25 percent. Also assume that the equity portion of the rate base is $100, so that the regulator allows the entity a return on equity of $11.25. Now assume that there is 90 percent chance that the utility will earn 100 basis points

[53] See, for example, Moody's "Global Regulated Water Utilities," December 2009.

below the cost of equity and only 10 percent chance the utility will earn its allowed return on equity. Specifically, with 90 percent chance, a return of $10.25 will be realized and with 10 percent chance the return will be equal to the allowed return on equity, $11.25. Thus, the expected return is

90% × $10.25 + 10% × $11.25 = $10.35.

The expected return is equivalent to only 10.35% ($10.35/$100) rather than the cost of equity of 11.25 percent.

One manner in which the asymmetric risk can be mitigated is to increase the allowed return on equity exactly enough to offset the asymmetric risk. In this example, the asymmetric risk is equivalent to 0.9%. Therefore, the project's asymmetric risk can be mitigated by allowing an ROE adder of 0.9% for a total return of 12.15%. To see this, note that

12.15% × $100 = $12.15 and 11.15% × $100 = $11.15

And

10% × $12.15 + 90% × $11.15 = $11.25.

Increasing the return on equity by 0.9% in this example offsets the asymmetric risk the company faces.

Q85. WHAT IS THE IMPLICATION OF THE ASYMMETRIC RISK EXAMPLE FOR NEW MEXICO-AMERICAN WATER?

A85. As a company subject to asymmetric risk cannot expect to earn its allowed rate of return, it is important that either (1) the asymmetric risk is removed or (2) the company's allowed return on equity is raised. In the case of New Mexico-American Water, the continual inability to earn the allowed return on equity could be offset by allowing New Mexico-American Water a higher return on equity. For example, a number of basis points (e.g., 25 – 75 basis points) could be added to the allowed return on equity.

Q86. PLEASE SUMMARIZE THIS SECTION OF YOUR TESTIMONY AS IT PERTAINS TO NEW MEXICO-AMERICAN WATER.

A86. It is important that New Mexico-American Water is able to earn a reasonable return on its water utility investments to be able to attract capital on a stand alone basis and thus be able to continue to fund its infrastructure investment programs. The recent acquisition of Arizona-American Water and New Mexico-American Water's assets for approximately $470 million speaks to this issue. EPCOR paid approximately $470 million for American Water Works' approximately $450 million equity investment in Arizona-American Water's and New Mexico-American Water's assets. Thus, EPCOR paid approximately $1.04 for each $1 of book equity. In turn, American Water Works market-to-book value was approximately 1.07 at year-end. Thus, EPCOR discounted the Arizona and New Mexico water assets. If the Company consistently is unable to earn a reasonable return on equity, shareholders will question investing in the Company. Therefore, the Commission should consider allowing an ROE at the upper end of the range of reasonableness or add to the ROE for the industry to strengthen the Company's credit metrics and to improve the chance that the ROE actually earned will equal its cost of capital.

VI. NEW MEXICO-AMERICAN WATER'S COST OF EQUITY

Q87. WHAT CONCLUSIONS DO YOU DRAW FROM THE ABOVE DATA REGARDING EACH SAMPLE'S COST OF EQUITY?

A87. The risk-positioning estimates from the water and the gas LDC samples are reasonably in line and indicate a return on equity in the range of 11¾ to above 13 percent, while the DCF estimates quite a bit lower and indicate a range from 10 to 12 percent. I believe the DCF estimates for the water sample deserve little to no weight due to the ongoing merger and acquisition activity and the lack of analysts' following in the industry. Both the M&A activity and the lack of analysts following the water industry is

likely to impact the growth estimates although the direction of the potential bias cannot be predicted. However, the DCF estimates generally point to a lower cost of equity than do the CAPM and ECAPM estimates. Therefore, I believe the best midpoint estimate for the water industry is around 11¾ percent. This estimate does not take into account the potential impact of the financial turmoil or New Mexico-American Water's financial challenges. Thus, the cost of equity for New Mexico-American Water is more likely to be higher than the 11¾ percent midpoint estimate than lower.

Q88. DO YOU HAVE ANY COMMENTS REGARDING THE RESULTS OF THE MODELS?

A88. Yes. If any increase in investors' risk aversion and thus the market risk premium is taken into account, the estimates are well above the baseline figures. Also, as noted in Section V above, the fact that New Mexico-American Water has been unable to earn its allowed return on equity in recent years. Therefore, the allowed return on equity should be placed in the upper end of the reasonable range at no less than 11¾ percent.

Q89. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?

A89. Yes.

BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION

IN THE MATTER OF THE PETITION
BY NEW MEXICO-AMERICAN WATER
COMPANY, INC. FOR ADJUSTMENT OF
WATER RATES FOR ITS EDGEWOOD
DISTRICT,

Case No. 09-00156-UT

NEW MEXICO-AMERICAN WATER
COMPANY, INC., Petitioner.

VOLUME II

DIRECT TESTIMONY OF
BENTE VILLADSEN

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BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION

IN THE MATTER OF THE PETITION BY NEW MEXICO-AMERICAN WATER COMPANY, INC. FOR ADJUSTMENT OF WATER RATES FOR ITS EDGEWOOD DISTRICT

Case No. 09-00156-UT

NEW MEXICO-AMERICAN WATER COMPANY, INC.,
Petitioner.

DIRECT TESTIMONY
OF
BENTE VILLADSEN
ON BEHALF OF
NEW MEXICO-AMERICAN COMPANY
JULY 2009

Case No. 09-00156-UT
New Mexico-American Water Company
Direct Testimony of Bente Villadsen

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APPENDIX E EFFECT OF DEBT ON THE COST OF EQUITY

EXECUTIVE SUMMARY

Dr. Bente Villadsen, a Principal at *The Brattle Group*, files testimony on the cost of capital for New Mexico-American Water Company's Edgewood district.

Dr. Villadsen selects two benchmark samples, water utilities and gas local distribution companies ("LDC"). For the water sample, she primarily relies on a subsample that excluded Southwest Water which recently cut its dividend and also have announced it will restate part of its financials. Using two versions of the Discounted Cash Flow ("DCF") method and three versions of the Capital Asset Pricing Model ("CAPM"), she estimates the sample companies' after-tax weighted-average cost of capital. The after-tax weighted average cost of capital is the measure that companies most commonly use to evaluate investments and the measure recommended in standard financial textbooks. Textbooks, the academic literature as well as businesses weigh debt and equity by the market values in determining the after-tax weighted cost of capital.

Having estimated the samples' after-tax weighted-average cost of capital for the samples, she determines the corresponding cost of equity for New Mexico-American Water at its 45 percent equity. In undertaking her analysis, Dr. Villadsen notes that the overall cost of capital is constant within a broad middle range of capital structures although the distribution of costs and risks among debt and equity holders is not. Because the overall cost of capital is the same in a broad range of capital structures, there are no impacts on the rates customers pay from a higher or lower percentage of equity, so ratepayers are not affected by the choice of capital structure within a broad range. However, as New Mexico-American Water's 45 percent equity is lower than the percentage equity among many utilities, its financial risk is higher and the return required by equity investors increases with the level of risk they carry, but this return is paid on a smaller amount of equity than is typical in the water industry. Therefore, the dollar amount paid by customers is the same as if the Company had a lower return on equity but a higher equity percentage.

Dr. Villadsen discusses the impact of the ongoing financial crisis on utilities' cost of capital and notes that while the yield on government issued bills and bonds is very low at currently, the yield on investment-grade utility bonds is not. As utilities cannot raise debt (or equity) at the same rates as the government, it is necessary to take the yield on investment grade utility bonds into account in assessing the cost of capital for New Mexico-American Water. Specifically, the yields on government bills and bonds have been driven artificially down by monetary policy and a flight to safety, so that the yields on these securities are not reflective of normal economic conditions. Consequently, Dr. Villadsen bases her CAPM models on a normalized risk-free rate which consists of the observed risk-free rate plus an adjustment for the increase in the spread between risk-free rates and investment grade utility bond yields. Further, equity investors have lost substantial value in capital markets over the past ¾ year and stock prices have been extremely volatile. As a result, investors risk aversion has increased and the premium they require to invest in stocks going forward has increased. Therefore, the risk premium associated with equity investments is currently higher than it has been in the recent past. Dr. Villadsen performs several sensitivity analyses on the impact hereof, but the requested return on equity is fully supported by her baseline analysis, which relies on a historical market risk premium. In other words, her recommended return on equity does not include the current higher risk premium making her recommendation more conservative.

Lastly, Dr. Villadsen notes that the water industry has seen substantial stock price drops in recent months, volatility in stock prices, and increased cost of debt. At the same time, the most commonly used measure of companies' systematic risk, the stock's beta, has remained high for water utilities. This indicates that capital markets continue to perceive water utilities as risky investments rather than safe havens. At the same time the water industry, including New Mexico-American Water, needs to invest substantial amounts in infrastructure to develop new water resources. The industry also needs to invest in wastewater collection and treatment. The needed infrastructure investment requires substantial external financing (i.e., new debt and equity) and access to capital requires that investors expect to earn their required return. Failure to provide adequate returns may

discourage potential investors. While it may seem counterintuitive to increase the cost of capital during an economic recession, it is necessary to attract needed capital. Specifically, the increase in investment-grade utility bond yields and the decline in available equity capital show that investors are holding onto their funds and in order to attract investments, they will need to expect that they can earn a sufficient return on their investment that it is worth the risk. The June 2009 sale of American Water stock had been expected by the market for a long time and was priced at 80 percent of American Water's April 2008 Initial Public Offering price. The lower price means that everything else equal, investors expect to realize a higher return on their investment than they did a year ago. Thus, at the same income level as a year ago, it is consistent with an increased market risk premium.

Based on the evidence from the samples, Dr. Villadsen finds that New Mexico-American Water's request for 12.25% return on equity is reasonable and fully supported by her analysis. The financial crisis has made the range of a reasonable return on equity wider and especially increased the upper bound on the range, so the requested return on equity is below the midpoint of the best range estimate of 12 percent to 13 percent.

I. INTRODUCTION AND SUMMARY

Q1. PLEASE STATE YOUR NAME AND ADDRESS FOR THE RECORD.

A1. My name is Bente Villadsen. My business address is *The Brattle Group*, 44 Brattle Street, Cambridge, MA 02138.

Q2. PLEASE DESCRIBE YOUR JOB AND EDUCATIONAL EXPERIENCE.

A2. I am a Principal of *The Brattle Group*, ("Brattle"), an economic, environmental and management consulting firm with offices in Cambridge, Washington, San Francisco, London, Brussels, and Madrid. My work concentrates on regulatory finance and accounting. I have previously prepared and presented cost-of-capital testimony before the New Mexico Public Regulation Commission ("Commission"). I hold a B.S. and M.S. from University of Aarhus, Denmark and a Ph.D. from Yale University.

Q3. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING?

A3. I have been asked by New Mexico-American Water Company ("New Mexico-American Water" or the "Company") to estimate the cost of equity for New Mexico-American Water's water districts. The cost of equity is the return that the New Mexico Public Regulation Commission should provide the New Mexico-American Water's Edgewood District an opportunity to earn on the portion of its rate base financed by equity.

To determine the cost of equity for New Mexico-American Water, I first estimate the overall cost of capital for two samples (and a subsample) of regulated companies using several versions of the discounted cash flow ("DCF") and risk-positioning models. Second, I determine the cost of equity that the estimated overall cost of capital gives rise to at New Mexico-American Water's requested capital structure consisting of 45 percent equity. Third, I evaluate the relative risk of New Mexico-American Water and the sample companies to determine the recommended cost of equity for New Mexico-American Water.

Q4. PLEASE SUMMARIZE ANY PARTS OF YOUR BACKGROUND AND EXPERIENCE THAT ARE PARTICULARLY RELEVANT TO YOUR TESTIMONY ON THESE MATTERS.

A4. Brattle's specialties include financial economics, regulatory economics, and the utility industry. I have worked extensively on cost of capital matters for electric, natural gas distribution, pipeline and water utilities in state, federal, and foreign jurisdictions. Additionally, I have significant experience in other areas of rate regulation, credit risk in the utilities industry, energy contracts, and accounting issues. I have filed expert testimony and appeared before regulatory commissions and arbitration tribunals as well as in federal court concerning cost of capital, accounting questions, and damage issues. I have previously filed cost of capital testimony before this Commission. Appendix A contains more information on my professional qualifications.

Q5. PLEASE SUMMARIZE YOUR APPROACH TO ESTIMATING THE COST OF CAPITAL FOR NEW MEXICO-AMERICAN WATER.

A5. To assess the cost of capital for New Mexico-American Water, I select two benchmark samples, regulated water utilities and natural gas local distribution companies ("LDC"). These samples are selected to have risks characteristics comparable to those of New Mexico-American Water. I also report results for a subsample of the water companies which are less likely to have unique issues that may affect the cost of capital estimates. I give greater weight to the results from the gas LDC sample and the water subsample than to the full water sample. For each sample, I estimate the sample companies' cost of equity using several versions of the DCF method and of the risk-positioning model. Based on data availability and the current state of the water and gas distribution industries I assign the most weight to the risk-positioning models.

Next, based on the cost-of-equity estimates for each company and its market costs of debt and preferred stock, I calculate each firm's overall cost of capital, i.e., its after-tax weighted-average cost of capital ("ATWACC"), using the company's market value capital structure. I then calculate the samples' average ATWACC and the cost of equity for a capital structure with 45 percent equity. Thus, I present the cost of equity that is consistent with the samples' market information and New Mexico-American Water's

regulatory capital structure. (By "regulatory capital structure," I mean the capital structure that New Mexico-American Water proposes in its application.)

Focusing on the overall cost of capital rather than its components avoids potential problems of inconsistency between the estimated cost of equity and the level of financial risk at the regulated company's capital structure.

Q6. ARE THERE ANY UNIQUE ISSUES IN ESTIMATING THE COST OF CAPITAL AT THIS POINT IN TIME?

A6. Yes. I discuss the effect of the credit crisis on the cost of capital in more detail in *Section III* below, but in general, the cost of capital is higher for all companies today than it was before the crisis. Unfortunately, the turmoil in the financial markets also affects the results of the estimation models so that estimating the cost of capital under current conditions is more difficult than it would normally be. Because of the unusual conditions prevailing today, I report the cost of capital from several sensitivity analyses in addition to a baseline result. These analyses are discussed further below.

Q7. USING YOUR BASELINE RESULTS, PLEASE SUMMARIZE YOUR CONCLUSIONS REGARDING NEW MEXICO-AMERICAN WATER'S COST OF EQUITY.

A7. Using the risk positioning models, the baseline cost of equity estimate for both the water subsample and the gas LDC sample is in the range of 12¼ to 13 percent at New Mexico-American Water's regulatory capital structure. The result for the full water sample is approximately 50 basis points higher. The DCF estimates for the gas LDC sample are in the range of 12 to 12¼ percent while the range for the water sample and subsample is very large with estimates ranging from approximately 11½ to 16½ percent. However, because of the variation and volatility of growth rates in the water industry, I put more weight on the risk positioning methods and the results from the gas LDC sample for an overall range of approximately 12 to 13 percent with 12¼ percent being included in all ranges and below the midpoint of the overall range.

The sensitivity analyses that incorporate the impact of the current financial crisis on the cost of equity lead to higher cost of equity estimates. Thus, I believe 12¼ percent is a conservative estimate of the current cost of equity for New Mexico-American water which is fully supported by all analyses. Therefore, in my opinion, New Mexico-American Water's request for 12.25 percent return on equity is very reasonable.

Q8. WHY DO YOU NEED TO CONSIDER NEW MEXICO-AMERICAN WATER'S REGULATORY CAPITAL STRUCTURE?

A8. A firm's cost of equity is a function of both its business risk and its financial risk. The more leveraged a company is the higher its financial risk. Investors holding equity in companies with higher risk require a higher rate of return, so as a company adds debt, the cost of equity goes up at an ever increasing rate. The higher cost of equity offsets the lower cost of debt, so that the after-tax weighted-average overall cost of capital remains constant over a broad range of capital structures.

That is, the associated capital structure affects an estimated cost-of-equity estimate just as a life insurance applicant's age affects the required life-insurance premium. It is therefore necessary to calculate the cost of equity the sample companies would have had at New Mexico-American Water's regulatory capital structure to report accurately the market evidence on the cost of equity.

Q9. HOW IS THE REST OF YOUR TESTIMONY ORGANIZED?

A9. The rest of my testimony is organized as follows:

Section II defines the cost of capital and discusses the principles that relate a company's cost of capital and its capital structure.

Section III discusses the impact on cost of capital of the current turmoil in financial markets and methods to estimate the relevant risk-free rate and market risk premium under current financial market conditions.

Section IV summarizes the analysis and discusses the recommendation for New Mexico-American Water.

Section V summarizes the analysis and discusses the recommendation for New Mexico-American Water.

Appendix A lists my qualifications.

Appendix B discusses in detail the selection procedure for each sample, and the methods used to derive the necessary capital structure market value information.

Appendix C details the risk-positioning method including the numerical analyses.

Appendix D details the DCF method, including the numerical analyses.

Appendix E discusses the impact of leverage on the cost of capital in more detail.

I repeat portions of my testimony in the appendices in order to give the reader the context of the issues before I present additional technical detail and further discussion.

II. THE COST OF CAPITAL AND RISK

A. The Cost of Capital and Risk

Q10. PLEASE FORMALLY DEFINE THE "COST OF CAPITAL."

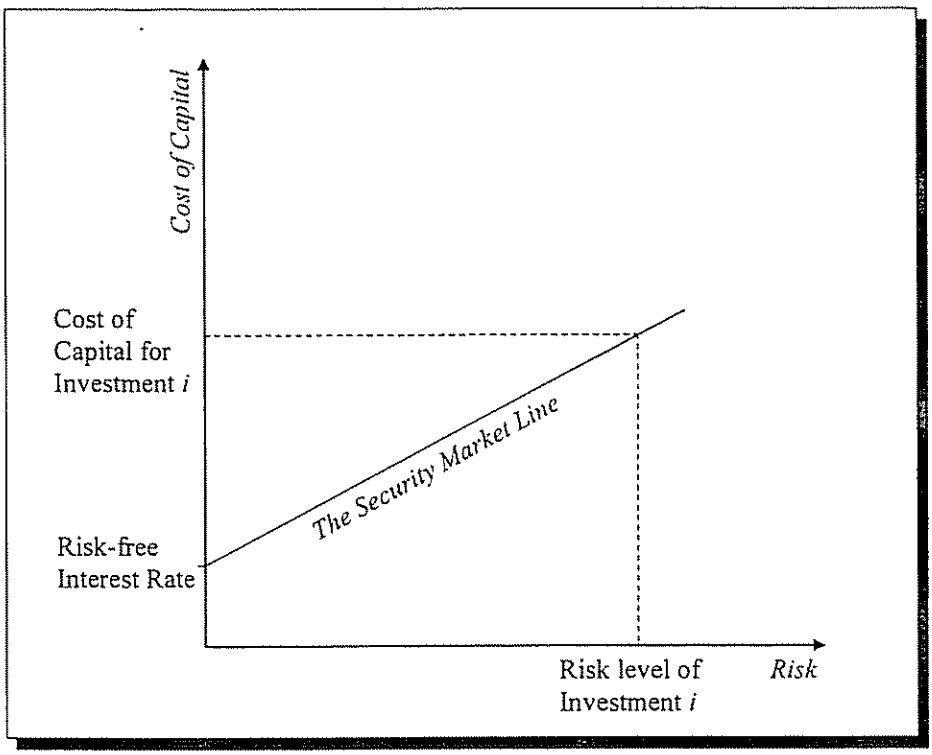
A10. The cost of capital is the expected rate of return in capital markets on alternative investments of equivalent risk. In other words, it is the rate of return investors require based on the risk-return alternatives available in competitive capital markets. The cost of capital is a type of opportunity cost: it represents the rate of return that investors could expect to earn elsewhere without bearing more risk.[1]

The definition of the cost of capital recognizes a tradeoff between risk and return that is known as the "security market risk-return line," or "security market line" for short. This line is depicted in Figure 1. Figure 1 shows that the higher the risk, the higher the cost of capital. The risk depicted on the horizontal axis in Figure 1 is often measured by the

[1] "Expected" is used in the statistical sense: the mean of the distribution of possible outcomes. The terms "expect" and "expected" in this testimony, as in the definition of the cost of capital itself, refer to the probability-weighted average over all possible outcomes.

security's beta, which measures the security's systematic risk in comparison to the market as a whole. The market as a whole has a beta of 1, so betas below one indicate a security with less systematic risk than the market whiles a beta above 1 indicate a security with higher systematic risk than the market. A version of Figure 1 applies for all investments. However, for different types of securities, the location of the line may depend on corporate and personal tax rates.

Figure 1: The Security Market Line



Q11. WHY IS THE COST OF CAPITAL RELEVANT IN RATE REGULATION?

A11. U.S. rate regulation accepts the "cost of capital" as the right expected rate of return on utility investment.[2] This practice is normally viewed as consistent with the U.S. Supreme Court's opinions in *Bluefield Waterworks & Improvement Co. v. Public Service Commission*, 262 U.S. 678 (1923), and *Federal Power Commission v. Hope Natural Gas*, 320 U.S. 591 (1944).

From an economic perspective, rate levels that give investors a fair opportunity to earn the cost of capital are the lowest levels that compensate investors for the risks they bear. Over the long run, an expected return above the cost of capital makes customers overpay for service. Regulatory authorities normally try to prevent such outcomes, unless there are offsetting benefits (e.g., from incentive regulation that reduces future costs). At the same time, an expected return below the cost of capital does a disservice not just to investors but, importantly, to customers as well. In the long run, such a return denies the company the ability to attract capital, to maintain its financial integrity, and to expect a return commensurate with that of other enterprises characterized by commensurate risks and uncertainties.

More important for customers, however, are the economic issues an inadequate return raises for them. In the short run, deviations of the expected rate of return on the rate base from the cost of capital may seemingly create a "zero-sum game"-- investors gain if customers are overcharged, and customers gain if investors are shortchanged. But in fact, even in the short run, such action may adversely affect the utility's ability to provide stable and favorable rates because some potential efficiency investments may be delayed or because the company is forced to file more frequent rate cases. In the long run, inadequate returns are likely to cost customers – and society generally – far more than may be gained in the short run. Inadequate returns lead to inadequate investment, whether for maintenance or for new plant and equipment. The costs of an undercapitalized industry can be far greater than the short-run gains from shortfalls in the cost of capital. Moreover, in capital-intensive industries (such as the water industry),[3] systems that take a long time to decay cannot be fixed overnight. Thus, it is in the customers' interest not only to make sure that the return investors expect does not exceed the cost of capital, but also to make sure that it does not fall short of the cost of capital, either.

[2] An early paper that links the cost of capital as defined by financial economics with the correct expected rate of return for utilities is Stewart C. Myers, "Application of Finance Theory to Public Utility Rate Cases," *The Bell Journal of Economics and Management Science*, 3:58-97 (Spring 1972).

[3] Capital expenditures among water utilities have in the last several years exceeded 3 times income.

Of course, the cost of capital cannot be estimated with perfect certainty, and other aspects of the way the revenue requirement is set may mean investors expect to earn more or less than the cost of capital even if the allowed rate of return equals the cost of capital exactly. However, a commission that sets rates so investors expect to earn the cost of capital on average treats both customers and investors fairly, which is in the long-run interests of both groups.

While it may seem counter-intuitive that the cost of capital has increased in a market where many companies and individuals have seen their income decline, it is important to keep two facts in mind. First, the cost of capital is an *expected* rate of return and thus a forward looking measure as opposed to a measure of the recent past. Therefore, the low realized returns in, for example, 2008 do not necessarily reflect the *expected* rate of return. As market volatility and investors' risk aversion has increased, investors are likely to require a higher return for providing capital. Second, it the expected rate of return that is available in capital markets on alternative investments of equivalent risk, so a key question becomes what the return on alternative investments is. The yields on investment grade utility bonds, which are relatively low risk, have increased, so utility stock would expect a higher rate of return, too. Therefore, the cost of equity in today's financial markets is higher than it was before the financial crisis.

B. Business Risk and Financial Risk: Capital Structure and the Cost of Equity

Q12. WHAT IS THE DIFFERENCE BETWEEN BUSINESS RISK AND FINANCIAL RISK?

A12. Business risk is the risk of a company from its line of business if it used no debt financing. When a firm uses debt to finance its assets, the business risk of the assets is shared between the debt holders and the equity holders, but the equity holders bear more of the risk because debt holders have a prior claim on the company's cash flows. Equity holders are residual claimants, which simply mean that equity holders get paid last. In other words, the use of debt imposes financial risk on equity holders. The goal of selecting a sample is to choose companies whose business risk is judged to be

comparable to the regulated company in the proceeding. As a result, differences in financial risk must be dealt explicitly.

Q13. PLEASE EXPLAIN WHY IT IS NECESSARY TO REPORT THE COST OF EQUITY ADJUSTED FOR CAPITAL STRUCTURE.

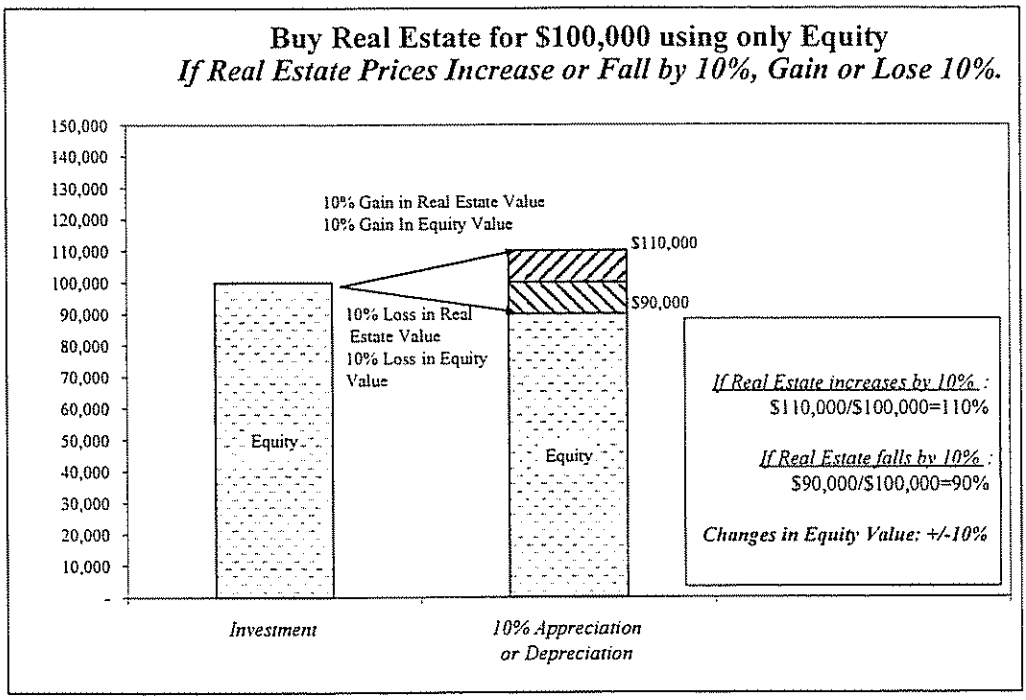
A13. Rate regulation in North America has traditionally focuses on the components of the rates.[4] In other words, the focus of cost-of-capital estimation is usually on determining the "right" cost of equity, and to a lesser degree on setting the allowed capital structure. While the overall cost of capital depends primarily on the company's line of business, the distribution of the cost of capital among debt and equity depends on their share in total revenues. Debt holders' claim is usually a fixed amount (except in situations of default) while equity holders are residual claimants, meaning that equity holders get paid last. In other words, the use of debt imposes financial risk on the equity holders. Because a company's financial risk depends on its capital structure, the risk shareholders carry increases with the leverage of the company. As shareholders expect to be compensated for increased risk, the required rate of return increases with the company's leverage. The increased risk is caused by the fact that debt has a senior claim on a specified portion of earnings and in bankruptcy on assets. As common equity is the most junior security, it gets what's left after everyone else has been paid. In other words, common equity holders carry all residual risk. However, as explained in more detail in Appendix E, the overall cost of capital is constant within a broad middle range of capital structures, although the distribution of costs and risks among debt and equity holders is not.

Q14. PLEASE PROVIDE AN EXAMPLE ON HOW DEBT ADDS RISK TO EQUITY.

A14. As a simple example, think of an investor who takes money out of his savings account and invests $100,000 in real estate. The future value of the real estate is uncertain. If the real estate market booms, he wins. If the real estate market goes down, he loses. Figure 2 below illustrates this.

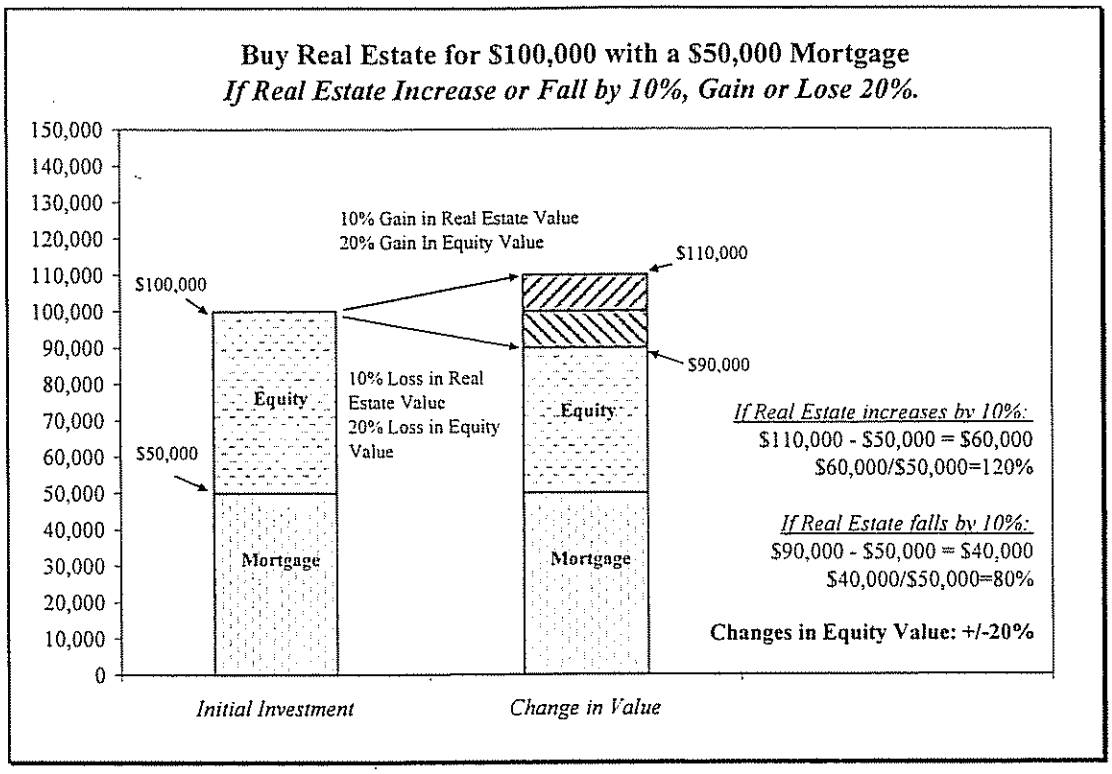
[4] An exception is the recent decision by the National Energy Board of Canada which in its RH-1-2008 decision, issued March 2009, determined the after-tax weighted average cost of capital rather than a return on equity and a capital structure.

Figure 2. Financial risk example – equity financing



In the scenario above, the investor financed his real estate purchase through 100 percent equity. Suppose instead that the investor had financed 50 percent of his real estate investment with a mortgage of $50,000. The mortgage lender does not expect to share in any benefits from increases in real estate values. Neither does the mortgage lender expect to share in any losses from falling real estate values. As a result, the investor carries the entire risk of fluctuating real estate prices. Figure 3 illustrates this effect.

Figure 3. Financial risk example - debt and equity financing



In Figure 3, where the investor financed his purchase through 50 percent equity and 50 percent debt, the variability in the investor's equity return is two times greater than that of Figure 2. The entire fluctuation of 10 percent from rising or falling real estate prices falls on the investor's $50,000 equity investment. The lesson from the example is obvious: debt adds risk to equity.

C. Implications for Analysis

Q15. PLEASE EXPLAIN THE IMPLICATIONS OF THE RELATIONSHIP BETWEEN CAPITAL STRUCTURE AND THE COST OF EQUITY FOR RATE REGULATION.

A15. The risk equity holders carry, and therefore the cost of equity, depends on the capital structure. As illustrated in the example above, as leverage increases, the market risk increases and hence the required return on equity increases.

Q16. TO ASSESS THE MAGNITUDE OF FINANCIAL RISK FOR A RATE REGULATED COMPANY, SHOULD YOU USE THE MARKET-VALUE OR THE BOOK-VALUE CAPITAL STRUCTURE?

A16. The market-value capital structure is the relevant quantity for analyzing the cost-of-equity evidence, which is based on market information.[5]

Q17. PLEASE PROVIDE AN EXAMPLE THAT ILLUSTRATES WHY MARKET VALUES ARE RELEVANT.

A17. Suppose in the previous example that the investor has invested in real estate 10 years ago. Further assume that depreciation has reduced the book value of the real estate from $100,000 to $75,000 and assume the investor has paid off 40 percent of his $50,000 mortgage. Thus, the investor has a remaining mortgage of $30,000 (= 60% × $50,000). The book value of the investor's equity is therefore $45,000 (= $75,000 - $30,000).

What happens now if real estate prices rise or fall 20 percent? To answer that question, we need to know how real estate prices have developed over the past 10 years. If the market value of the real estate now is $200,000, then a 20-percent decrease in the price of real estate ($40,000) is almost equal to the investor's book value equity. However, his market value equity (or net worth) is equal to the value of the real estate minus what he owes on the mortgage. If we assume that the market value of the mortgage equals the unpaid balance ($30,000), then the investor's net worth is calculated as follows:

[5] The need to use market-value capital structures to analyze the effect of debt on the cost of equity has been recognized in the financial literature for a long time. For example, the initial reconciliation of the Modigliani-Miller theories of capital structure with the Capital Asset Pricing Model, in Robert S. Hamada, "Portfolio Analysis, Market Equilibrium and Corporate Finance," *The Journal of Finance* 24: 13-31 (March 1969) works with market-value capital structures. For a more recent presentation of the concept, see, for example, Richard A. Brealey, Stewart C. Myers, and Franklin Allen, *Principles of Corporate Finance*, New York: McGraw-Hill/Irwin 9th ed. (2008) ("Brealey, Myers, and Allen (2008)") pp. 530-533. Book values may be relevant for some issues, e.g., for covenants on individual bond issues, but as explained in the text, market values are the determinants of the impact of debt on the cost of equity.

Net Worth	=	Market Value of Real Estate	-	Remaining Mortgage
	=	$200,000	-	$30,000
	=	$170,000		

Therefore, the rate of return on equity due to a 20 percent decline in real estate prices is calculated as follows:

Table 1. Calculating the Rate of Return on Equity

Decline in Real Estate Value	$40,000
Market-Value Equity	$170,000
Rate of Return on Equity	- $40,000/$170,000 = -23.5%

Q18. PLEASE EXPLAIN THE IMPLICATIONS FOR RATE REGULATION AND YOUR TESTIMONY.

A18. Because the market risk, and therefore the cost of equity, depends on the market-value capital structures, one must base the estimation of the sample companies' cost of capital on market value capital structures. An approach that estimates the cost of equity for each of the sample firms without explicit consideration of the market value capital structure (i.e. the financial risk) underlying those costs risks material errors. The cost-of-equity estimates of the sample companies at their actual market-value capital structures are not necessarily reflected in the regulatory capital structure. Therefore, using book values could lead to an incorrect rate of return. I avoid this problem by calculating each sample company's ATWACC using its market value capital structure. I then use the sample companies' average overall cost of capital to determine the corresponding return on equity at New Mexico-American Water's regulatory capital structure. This procedure ensures that the capital structure and the estimated cost of equity are consistent.

In my analyses, I estimate the cost of equity for each of the sample firms using traditional estimation methods (such as the DCF and Capital Asset Pricing Model ("CAPM")). For

each estimation method, I use each sample company's estimated cost of equity, market cost of debt and market-value capital structure to estimate along with New Mexico-American Water's marginal tax rate to estimate each sample company's overall cost of capital. I then calculate the samples' average overall cost of capital for each estimation method. Finally, I determine the cost of equity that is associated with the estimated ATWACC at New Mexico-American Water's regulated capital structure. Thus, the samples' overall cost-of-capital and that of New Mexico-American Water is the same.

Q19. IS THE USE OF MARKET VALUES TO CALCULATE THE IMPACT OF CAPITAL STRUCTURE ON THE RISK OF EQUITY INCOMPATIBLE WITH USE OF A BOOK-VALUE RATE BASE FOR A REGULATED COMPANY?

A19. No. Investors buy stock at market prices and expect a reasonable return on their investment. Market-based cost-of-equity estimation methods, such as DCF or CAPM which are frequently used in rate regulation, recognize this and rely on market data. That is, the cost of capital is the fair rate of return on regulatory assets for both investors and customers. Most regulatory jurisdictions in the U.S. measure the rate base using the net book value of assets, not current replacement value or historical cost trended for inflation. But the jurisdictions still apply market-derived measures of the cost of equity to that net book value rate base.

The issue here is "what level of risk is reflected in that cost-of-equity estimate?" That risk level depends on the sample company's market-value capital structure, not its book-value capital structure. *That risk level would be different if the sample company's market-value capital structure exactly equaled its book-value capital structure, so the estimated cost of equity would be different, too.*

Q20. PLEASE SUM UP THE IMPLICATIONS OF THIS SECTION.

A20. The market risk, and therefore the cost of equity depends directly on the market-value capital structure of the company or asset in question. It therefore is impossible to validly compare the measured costs of equity of different companies without taking capital structure into account. Capital structure and the cost of equity are unbreakably linked,

and any effort to treat the two as separate and distinct questions violates both everyday experience (e.g., with home mortgages) and basic financial principles.

Q21. HOW SHOULD A COST-OF-CAPITAL ANALYST IMPLEMENT THIS PRINCIPLE?

A21. As discussed further in Appendix E, there has been a great deal of financial research on the effects of capital structure on the value of the firm. One of the key conclusions that result from the research is that no narrowly defined optimal capital structure exists within industries, although the typical range of capital structures does vary among industries. Instead, there is a relatively wide range of capital structures within any industry in which fine-tuning the debt ratio makes little or no difference to the value of the firm, and hence to its overall after-tax cost of capital.

Accordingly, analysts should treat the market-value weighted average of the cost of equity and the after-tax current cost of debt, or the "ATWACC" for short, as constant. Sample evidence should be analyzed to determine the sample's average ATWACC, which can be compared across different firms or industries. The economically appropriate cost of equity for a regulated firm is the quantity that, when applied to the regulatory capital structure, produces the same ATWACC. That value is the cost of equity that the sample would have had, estimation problems aside, if the sample's market-value capital structure had been equal to the regulatory capital structure in question.

Q22. HOW DO YOU CALCULATE THE COST OF EQUITY CONSISTENT WITH THE MARKET-DETERMINED ESTIMATE OF THE SAMPLE'S AVERAGE COST OF CAPITAL?

A22. For simplicity assume that all sample companies have only common stock and debt. Then the ATWACC is calculated as:

$$ATWACC = r_D \times (1 - T_C) \times D + r_E \times E \qquad (1)$$

where r_D is the market cost of debt, r_E is the market cost of equity, T_C is the marginal corporate income tax rate, D is the percent debt in the capital structure, and E is the

percent equity in capital structure. The cost of equity consistent with the overall cost-of-capital estimate (ATWACC), the market cost of debt and equity, the marginal corporate income tax rate and the amount of debt and equity in the capital structure can be determined by solving equation (1) for r_E.

Q23. WHY DOESN'T NEW MEXICO-AMERICAN WATER SIMPLY INCREASE ITS EQUITY RATIO SO THAT NO ADJUSTMENT IS NEEDED?

A23. First, as long as a utility operates within a broad middle range of capital structure the total capital costs are the same, so it is not clear why it would affect rates. Second, the current financial crisis has made it difficult or costly to raise capital and especially equity capital at a time when American Water is working towards an increase in its equity ratio. As stock prices, including that of American Water, have declined, the amount of equity capital that can be raised by increasing the number of shares by, for example, 10 percent declines. Therefore, it is at the moment not straightforward to increase the equity percentage significantly. Third, the higher return on equity at 45 percent equity than at 50 or 60 percent equity is not a reward for having a low equity ratio, but simply a mechanism to guarantee that the overall return on capital is similar for utilities with different capital structure. In summary, there is no harm to ratepayers because rates are affected by the total return rather than the return on equity, so it would be misguided to raise equity capital for the sole purpose of having an average capital structure.

Q24. CAN YOU PROVIDE AN EXAMPLE OF HOW THIS FORMULA IS USED TO DETERMINE THE COST OF EQUITY?

A24. Yes. Consider a company with a 40 percent marginal corporate income tax rate and a cost of debt equal to 6 percent. For simplicity, I assume there is no difference in the company's embedded cost of debt and the cost at which it currently can issue additional debt. Further, suppose that the ATWACC estimate based on a sample of companies with comparable business risk is 7.5 percent. If the company's capital structure has 50 percent debt and 50 percent equity, equation (1) above yields a cost-of-equity estimate of 11.4 percent. If the equity ratio is lower, for example 45 percent, the cost of equity would instead be 12.3 percent. Conversely, a higher equity ratio such as 55 percent would

imply a lower cost-of-equity estimate of 10.7 percent. Table 2 below summarizes these calculations as well as the dollar amount customers have to pay for financing costs.

Table 2. Example of the effect of capital structure on the estimated cost of equity.

Marginal tax rate	40%		
Cost of debt	6%		
Estimated ATWACC	7.50%		
Rate Base	$ 1,000,000		
Regulatory Equity Ratio	45%	50%	55%
Regulatory Debt Ratio	55%	50%	45%
Estimated ATWACC	7.50%	7.50%	7.50%
Cost-of-equity	12.3%	11.4%	10.7%
After Tax Cost of Financing[1)]	$ 75,000	$ 75,000	$ 75,000
Before Tax Cost of Financing[2)]	$ 125,000	$ 125,000	$ 125,000

[1)] Estimated ATWACC × Rate Base.
[2)] Estimated ATWACC × Rate Base / (1 - Tax Rate).

The important point of this example is that the overall cost of capital does not depend on the company's capital structure, as long as the capital structure is in a wide middle range of values. Therefore, the cost to customers does not depend on the capital structure either. A higher equity ratio simply means that a higher percentage return is paid to equity investors, but the fraction of the rate base to which this higher return applies is lower. The equity investors are compensated appropriately for the higher risk, but that has no effect on the overall cost borne by customers. As long as equity investors are correctly compensated for the risk of their investment, the only effect that a higher equity ratio has is on how the return is divided between debt holders and equity holders, and not on how much customers end up paying.

Q25. BUT IS IT NOT THE CASE THAT IF THE ALLOWED RATE OF RETURN ON EQUITY IS LOWER, THEN ALL ELSE EQUAL RATEPAYERS PAY LESS?

A25. Yes, for a given equity percentage. However, it comes at a cost: if the rate of return on equity appropriate for a capital structure with 55 percent equity were applied to a company whose equity ratio is 45 percent, the company's equity investors would not be appropriately compensated for the risk of their investment. In particular, in this situation

the expected return on equity would be set too low. Such a result would impair the company's ability to attract investors, since they can expect higher returns elsewhere for the same risk level. This may well have negative consequences for the utility's ability to sustain an appropriate level of investment. Ultimately, this translates into a lower quality of the services that the utility can provide to its customers. Alternatively, the company could reduce its equity percentage with possibly negative effects on the cost of debt or other credit factors.

Q26. ARE YOU AWARE THAT COMMISSION STAFF PREFERS A SPECIFIC METHDOLOGY?

A26. Yes. In past proceedings, Commission Staff has typically relied on a specific version of the discounted cash flow model. In addition, Staff has in the past taken differences between the sample's and New Mexico-American Water's book-value capital structure into account to ensure that the sample's and the target company's weighted average cost of capital is similar.[6] It is noteworthy that the National Energy Board of Canada in a recent decision granted an ATWACC based on market values rather than a return on equity stating that "the ATWACC approach better utilizes financial market information" and "market values reflect the level of financial risk that equity holders bear for the sample companies."[7] Thus, the National Energy Board and financial economists agree that market values are what determine the financial risk.

III. IMPACT OF CURRENT ECONOMIC TURMOIL ON THE COST OF CAPITAL

Q27. WHAT DO YOU DISCUSS IN THIS SECTION?

A27. This section addresses the effect of the current economic situation on the cost of capital and modifications to my standard procedures that are necessary to estimate the cost of capital more accurately.

[6] See, for example, Prepared Direct Testimony of Thomas C. Patin in Utility Case No. 08-00134-UT and Prepared Direct Testimony of Prepared Direct Testimony of Jacob T. Arnold in Case No. 06-00208-UT.

[7] National Energy Board, RH-1-2008, p. 18 and p. 29.

Q28. PLEASE SUMMARIZE THE EFFECT OF CURRENT ECONOMIC CONDITIONS ON THE COST OF CAPITAL.

A28. The ongoing economic situation in the U.S. as well as most of the rest of the world makes investments highly uncertain. Economic growth has slowed, and it is negative in many countries. Stock markets worldwide have lost substantial value over a short period of time. For example, the S&P 500 fell by about 30 percent over the five month period from the beginning of August 2008 to the end of December 2008. At the same time the volatility of the index and financial markets in general has increased dramatically. (See Figure 4 below.) The likely result of the increased uncertainty is that investors' risk aversion has increased, which, in turn, means that the cost of capital is higher today than in the recent past.

Q29. WHAT DO YOU MEAN BY THE TERM INVESTOR "RISK AVERSION"?

A29. Risk aversion is simply the recognition that investors dislike risk. A fundamental tenet of investing is that investors face a risk-return tradeoff in selecting from among the various investment options. Risk-averse investors can only be induced to accept more risk if the expected return is higher. When investors' risk aversion increases, the expected return (sometimes called the required return) increases for any level of risk.[8] In other words, the market risk premium, the premium required for an average risk stock, is higher today than it was in the recent past.

Q30. WHAT EVIDENCE DO YOU HAVE THAT INVESTORS' RISK AVERSION HAS INCREASED?

A30. A number of readily observable factors indicate an increase in investors' risk aversion. Unprecedented defaults in debt instruments that had previously been highly rated (AA or A), such as collateralized debt obligations and mortgage-backed securities, and the fall in value of most securities caused investors to seek investments that would preserve the value of their investments. As a result, there has been a "flight to safety" by investors

[8] The term "coefficient of risk aversion" is frequently used in academic articles in conjunction with an assumption regarding investors' utility functions. In this testimony, I am using the term in a more generic sense.

seeking to maintain the value of their investments. In general, investors perceive bonds as less risky (safer) than equity and government bonds as safer than corporate bonds. As a result, the demand for bonds, particularly government debt, has increased substantially. In fact, at what *may* have been the height of the crisis, the demand for and hence the price of U.S. Treasury bills was so high that the yield (or return) on U.S. Treasury bills actually fell below zero![9] The flight to safety had two other results. First, the yield spread between corporate bonds and government bonds has increased dramatically. Although the yield spreads have declined somewhat from their highest levels, they remain high by historical standards as can be seen in Table 3 below. Therefore, using the current risk-free rate in the risk-positioning models will not accurately reflect the risk inherent in owning equity. Specifically, the ***increase*** in yield spread has to be taken into account.

Table 3

Spreads between US Utility Bond (20 year maturity) and US Treasury Bond (20 year maturity)					
Periods	Bloomberg A-Rated Utility and Treasury	Bloomberg BBB-Rated Utility and Treasury	Moody's A-Rated Utility and Treasury	Moody's BBB-Rated Utility and Treasury	Notes
Period 1 - Average Apr-1991 - 2007	0.95	1.25	1.13	1.44	[a]
Period 2 - Average Aug-2008 - 2009	2.69	3.55	2.70	3.96	[b]
Period 3 - Average Apr-2009	2.39	3.61	2.53	3.98	[c]
Period 4 - Average 15-Day (April 27, 2009 to May 15, 2009)	2.19	3.41	2.39	3.69	[d]
Spread Increase between Periods 2 and 1	1.74	2.30	1.45	2.71	[e] = [b] - [a].
Spread Increase between Periods 3 and 1	1.43	2.36	1.28	2.73	[f] = [c] - [a].
Spread Increase between Periods 4 and 1	1.24	2.16	1.14	2.44	[g] = [d] - [a].

Source:
Spreads for the periods are calculated from Bloomberg and Moody's yield data.
Average monthly yields for the indices were retrieved from May 18, 2009.

Second, the stock market has plummeted in value as investors attempted to move out of investments considered risky to those of lower risk. Increased risk aversion translates into a requirement for an investment to provide a higher expected return for a given level of risk. Under such circumstances, prices of investments fall until investors can again expect to earn their (now higher) required rate of return. Of course, part of the fall in

[9] "Treasury Bills Trade at Negative Rates as Haven Demand Surges", by Daniel Kruger and Cordell Eddings, *Bloomberg*, December 9, 2008.

prices is the result of a fall in expected cash flows, but it is also the result of increased risk aversion as indicated by the differential decrease in investments of different risk.

Q31. HOW DIFFERENT IS THE OVERALL ECONOMIC ENVIRONMENT NOW COMPARED TO OTHER TIME PERIODS IN WHICH YOU HAVE TESTIFIED?

A31. We now live in a very different economic environment compared to one or two years ago. The U.S. and world economies are in a state of recession triggered by the deep financial crisis that emerged from the housing bubble and from financial institutions' use of sophisticated structures that concealed the true risk faced by the investors. Stock markets are down, market volatility and the spread on corporate debt is high, and for most firms it has become hard to gain access to external financing on reasonable terms.

More specifically, as Figure 4 below indicates, the S&P 500 index is declined by approximately 35 percent between mid-2008 and May 2009. At the same time, the stock price of water utilities fluctuated widely from mid-2008 to May 2009. The average water utility followed by *Value Line* saw its stock price decline by 15-20 percent over the past year, but Southwest Water's stock price was cut in half while, for example, California Water saw only a modest decline.[10]

[10] Southwest Water had as of May 15, 2009 not yet filed its 2008 form 10-K with the Securities and Exchange Commission and has recently cut dividend. Price information was obtained from Bloomberg.

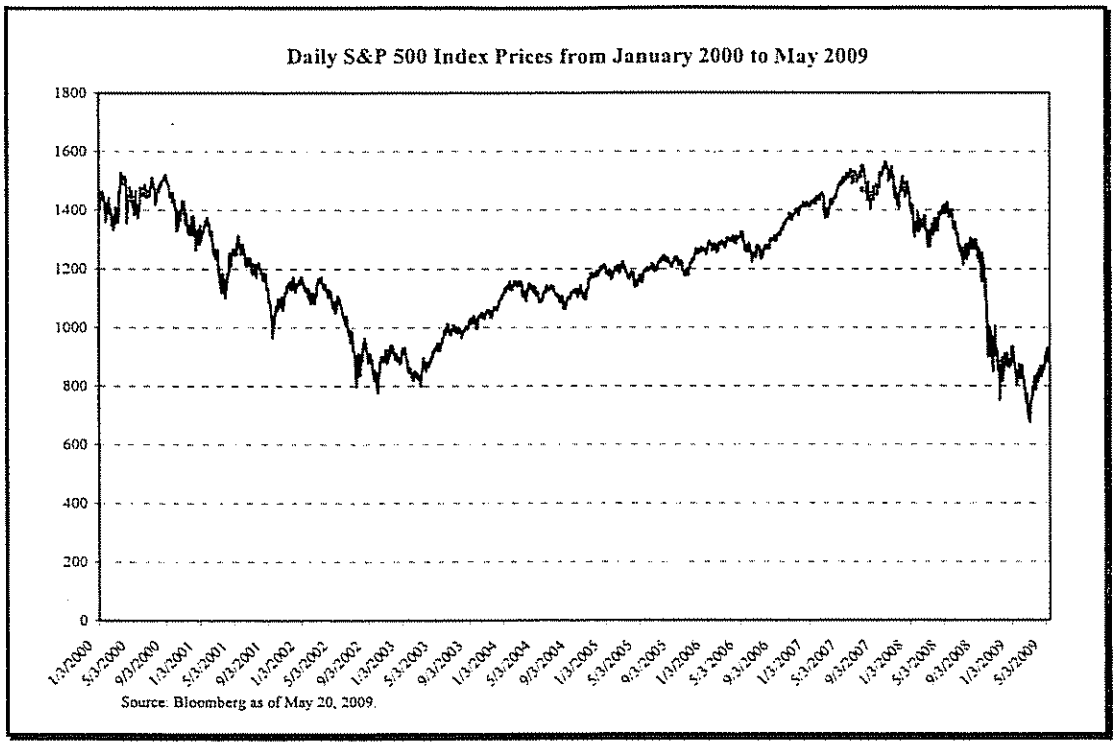


Figure 4

Figure 5 below displays the market volatility, measured by the Chicago Board Options Exchange ("CBOE") Volatility Index (also know as VIX), over the period beginning in 1998 through the first week of May 2009.[11]

[11] The *VIX* is a measure of market expectations of near-term volatility conveyed by S&P 500 stock index option prices.

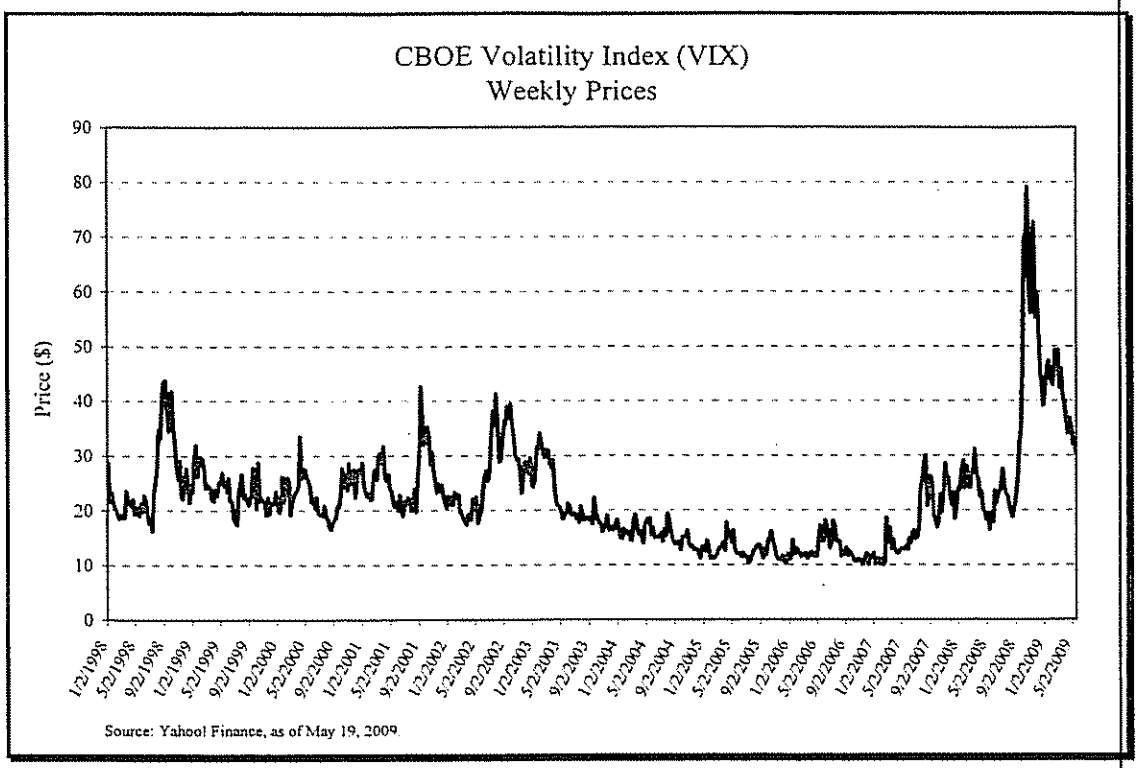


Figure 5

Until relatively recently, average volatility was in the 10-20 percent range, but it spiked 80 percent in late 2008. Although volatility has decreased somewhat over the last couple of months, it is still significantly higher than the average value for the first half of 2008 (prior to the crisis).

At the same time the Federal Reserve has cut interest rates and by now the yield on the Treasury bills is at extraordinarily low levels with yields close to zero. However, the lower yields on government debt have not translated into lower yields on corporate debt (including the yields on investment grade utility bonds). As Figure 6 shows, the spreads over Treasury bonds for long-term A and BBB utility debt remain at historically high levels. Figure 7 displays the yields on A and BBB-rated utility debt relative to government bond yields.

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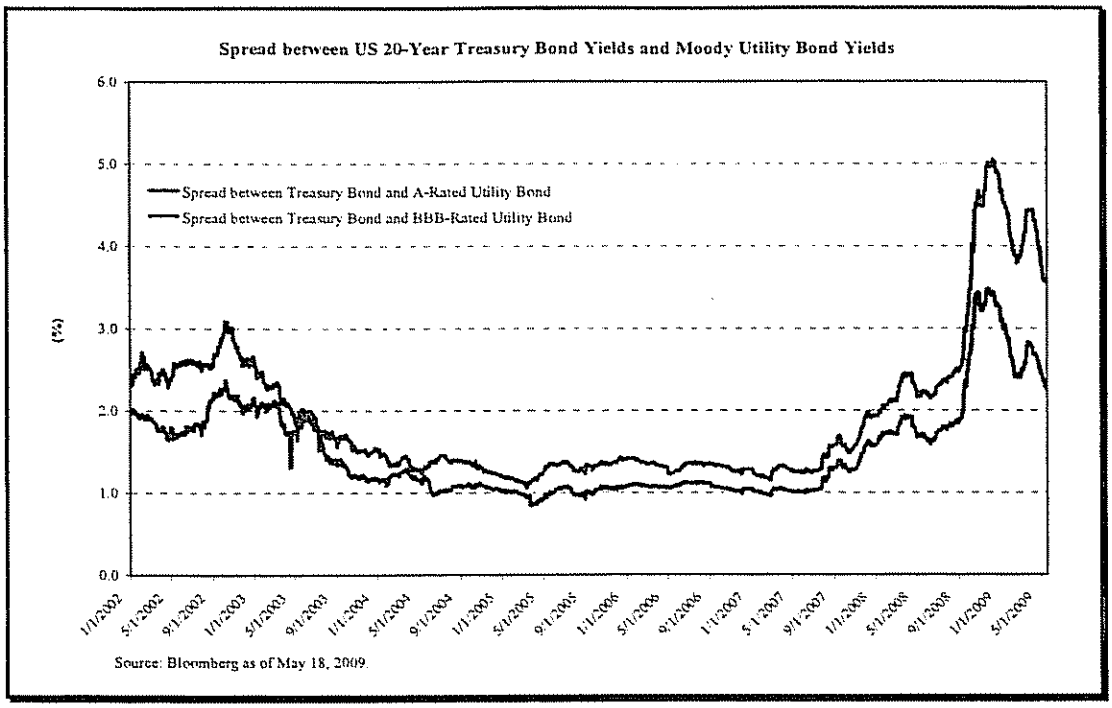

Figure 6

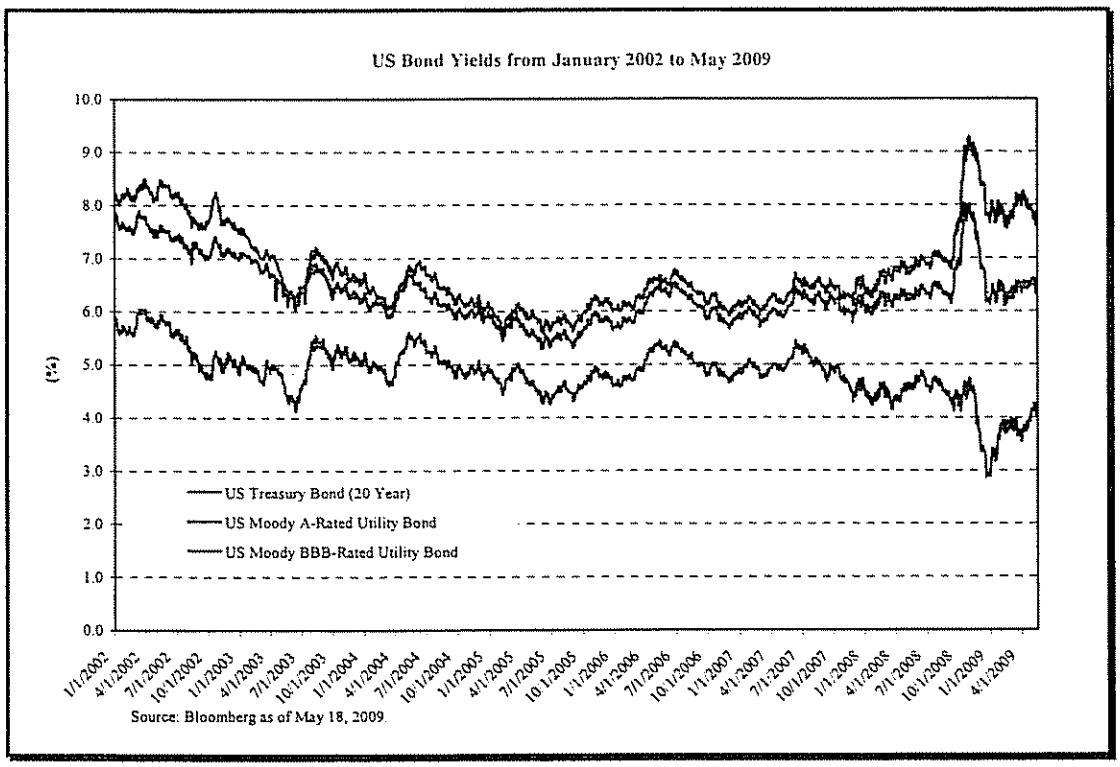

Figure 7

Q32. DO YOU HAVE ANY EVIDENCE ON HOW MUCH THE MARKET RISK PREMIUM ("MRP") HAS INCREASED?

A32. Yes. I have estimated the increase in MRP that is necessary for investors to earn an overall return that is no less than prior to the crisis. The result is that the MRP has increased by at least 1 percent over its level prior to the crisis.

Q33. HOW DID YOU ESTIMATE THE INCREASED MRP?

A33. The method I used to estimate the increased MRP is based upon the recognition that the sharp decrease in the average market price of equity has unexpectedly increased the level of financial risk in the stock market. Higher financial risk leads to a higher required rate of return on equity, so I compute the average capital structure of the stock market as measured by the S&P 500 before the crisis and after the crisis to measure the change in financial risk.

Q34. ONCE YOU ESTIMATE THE CAPITAL STRUCTURE OF THE MARKET AT TWO DIFFERENT TIMES, PLEASE OUTLINE THE STEPS YOU USED TO ESTIMATE THE CHANGE IN MRP.

A34. Once I estimated the average capital structure of the market, I estimated the average cost of equity for the market in August 2008 and calculated an ATWACC for the market using the cost of debt for an A rated company and a 35 percent marginal tax rate. The cost of equity for the market is simply the sum of the long-term risk-free rate and my 6.5 percent estimate of the MRP. I then calculated the ATWACC for the market using Equation 1 above. The next step was to determine how much the market ROE would change solely as a result of the change in financial risk stemming from the drop in market values assuming that the pre-crisis market ATWACC did not change. In the table below, I calculated the ROE corresponding to 60 percent equity instead of 70 or 75 percent equity. These values are roughly comparable to the capital structure of the S&P500 before the crisis and as of today.[12] As shown in the calculations in Table 4 below, the

[12] For example, in August of 2008, about the time the stock market began to decline dramatically, the average capital structure for the companies in the S&P500 was about 72.0 percent equity compared to about 59.3 percent in April 2009. In principle, the appropriate metric would be the average market value capital

estimated MRP increased by more than 1 percent, but this is likely to be lower than the actual increase in the *expected* MRP.

Table 4

Estimating Change in MRP for US Market Based on Data for 500 Companies in S&P 500 Index			
1. Inputs			
Parameters in CAPM:			Source and Notes:
MRP (pre-crisis)	6.5%	[a]	Dr. Villadsen's Tables and Workpapers.
Long-term risk-free rate (pre-crisis)	4.7%	[b]	Dr. Villadsen's Tables and Workpapers.
Parameters for ATWACC:			
Cost of debt for A-Rated Utility (pre-crisis)	6.59%	[c]	15-day average yield ending on 8/8/2008 for A-Rated Utility bond with 20 year maturity
Cost of debt for BBB-Rated Utility (pre-crisis)	7.06%	[d]	15-day average yield ending on 8/8/2008 for BBB-Rated Utility bond with 20 year maturity
Common Equity (pre-crisis)* [see legend below]	70.0%	[f]	Assumption based on actual calculations of S&P 500 data from Bloomberg as of May 20, 2009.
Debt (pre-crisis)	30.0%	[g]	= 1 - [f].
Common Equity (post-crisis)	60.0%	[h]	Assumption based on actual calculations of S&P 500 data from Bloomberg as of May 20, 2009.
Debt (post-crisis)	40.0%	[i]	= 1 - [h].
Tax Rate	35%	[j]	Assumption
2. Estimation Results:			
Step 1: Estimating Return on Equity using pre-crisis data			
ROE (pre-crisis)	11.2%	[k]	= [a] ÷ [b].
Step 2: Estimating ATWACC using pre-crisis data			
ATWACC (pre-crisis)	9.1%	[l]	= (1 - [j]) x [g] x [c] + [f] x [k].
Step 3: Estimating Return on Equity for with Reduced Equity Share			
Assuming ATWACC constant			
(i) ROE - Using Cost of Debt for A-Rated Utility	12.4%	[m]	= {[l] - (1 - [j]) x [i] x [c])} / [h].
(ii) ROE - Using Cost of Debt for BBB-Rated Utility	12.2%	[n]	= {[l] - (1 - [j]) x [i] x [d])} / [h].
Step 4: Estimating MRP with Reduced Equity Share			
(i) MRP (post-crisis) - Using Cost of Debt for A-Rated Utility	7.65%	[o]	= [m] - [b].
(ii) MRP (post-crisis) - Using Cost of Debt for BBB-Rated Utility	7.45%	[p]	= [n] - [b].
Step 5: Estimating change in MRP due to Reduction in Equity Share			
(i) Change in MRP - Using Cost of Debt for A-Rated Utility	1.2%	[q]	= [o] - [a].
(ii) Change in MRP - Using Cost of Debt for BBB-Rated Utility	1.0%	[r]	= [p] - [a].

* If using 75.00% instead of 70.00% [f] for the common equity (pre-crisis) and following the same methodology from Step 1 to Step 5, one will retrieve the following results for changes in MRP: 1.73% [q] and 1.53% [r].

structure of the S&P500 over the period used to estimate the MRP, i.e., 1926 to the present, but this is prohibitively time consuming to calculate.

Q35. WHY DO YOU BELIEVE THAT THE 1 PERCENT ESTIMATED INCREASE IN THE MRP IS LOWER THAN THE ACTUAL INCREASE?

A35. My calculation of the increase in the MRP assumes that the market ATWACC is constant, but the evidence indicates that the price of risk has increased substantially. Research indicates, for example, that the MRP is related to volatility in the stock market, which as shown in Figure 5 above has increased dramatically and currently is well above its pre-crisis level. A higher ATWACC would indicate an even greater increase in the estimated MRP than estimated in Table 4 above.

Q36. IS THE INCREASE IN INVESTORS' RISK AVERSION FROM CURRENT ECONOMIC CONDITIONS LIKELY TO BE A TEMPORARY OR PERMANENT CHANGE?

A36. It is likely that some of the increase in risk aversion stems from the chaotic market conditions and will be transitory in nature, but there is a strong possibility that there will also be a longer-term and perhaps permanent effect as market participants draw conclusions from the crisis on the fundamental risk-return characteristics of investment alternatives.

Q37. IF THE INCREASE IN THE COST OF CAPITAL IS LIKELY TO BE TEMPORARY, SHOULD THE COMMISSION STILL TAKE THE INCREASED COST OF CAPITAL INTO CONSIDERATION WHEN SETTING THE ALLOWED RETURN FOR THE COMPANY?

A37. Yes. I recommend that the Commission recognize the increased cost of capital. Although I believe that some of the increase in yield spread and in the MRP is likely to be temporary, it is very difficult to predict when the capital markets will return to more normal conditions, so it is difficult to predict when the market cost of risk will return to more normal levels. Even when market conditions are more normal, investors' risk aversion may remain higher well into the recovery period until their confidence fully returns. The federal government seems to recognize investors' fears, and it has signaled that it intends to overhaul the financial regulatory environment in order to restrict the

behavior by financial institutions that led to the current crisis. While the success or failure of those actions are unlikely to be observed in the short- to medium-term, in the long run these measures may help alleviate investors concerns. However, it could easily be years before investors regain the confidence prevailing prior to the current crisis. In fact, there may be a "permanent" adjustment in risk tolerance now that investors realize that severe economic conditions are still possible even with the increased tools to manage the economy available to government.

Q38. ARE NOT THE LOW REALIZED RETURNS ON THE MARKET INDEX RECENTLY A CLEAR INDICATION THAT MARKET PARTICIPANTS ARE WILLING TO ACCEPT A LOWER EXPECTED RETURN ON THEIR INVESTMENTS?

A38. Absolutely not. To the contrary – market values have been falling in order to allow an increase in the expected returns on investment. As risk aversion increases, expected returns must increase in order to induce investors to buy, so prices must fall. In other words, realized returns over the last few months are not indicative of investors' required rate of return. Investors have undoubtedly been disappointed recently. This process is well known to bond investors. As the general level of interest rates in the economy increases, the market price of a bond will decrease so that the yield-to-maturity will increase to the level required by the market. The same phenomenon occurs with equities as well. When the required return on investment increases, market prices must fall.

Q39. CAN YOU PROVIDE ANY FACTUAL EVIDENCE THAT THE CONDITIONS IN THE FINANCIAL MARKETS AND THE ECONOMY AS A WHOLE LIMIT THE ACCESS OF UTILITY COMPANIES TO THE FINANCIAL MARKETS?

A39. Yes. The increased yield spreads on utility debt compared to government debt impedes access because the cost of new utility debt is higher. For example, for investment grade debt issued in the fourth quarter of 2008, a recent EEI report shows the impact of the financial crisis on the electric utility industry. The average spread over Treasury bonds

for A-rated debt was 432 basis points, while the coupon rate was 6.96 percent.[13] For the BBB-rated debt these numbers are, respectively, 520 basis points and 8.45 percent.[14] Unfortunately, we do not have access to a similar data covering new issuances for earlier period(s). However, we can observe the change in the yield on utility sector fair market indices published by Bloomberg as well as the corresponding spreads. More specifically, the average A and BBB utility bond yields for 1991 through 2007 interval were, respectively, 6.98 percent and 7.28 percent, while the spreads over 20-year treasuries equaled 93 basis points and 123 basis points, respectively. For comparison, the average spread and yield for the fourth quarter of 2008 obtained from the same data indicates the yields of 7.38 percent and 7.99 percent for A and BBB-rated utilities, respectively; and spreads over 20-year Treasuries of 342 basis points and 402 basis points for A and BBB-rated utilities, respectively. These figures demonstrate not only the increased cost of new utility debt, but also the importance of maintaining strong credit ratings in current market conditions. Utilities with lower credit ratings face proportionally higher debt costs as a result of increased investor risk aversion.

Q40. HOW HAVE THESE CONDITIONS AFFECTED THE WATER INDUSTRY AND AMERICAN WATER?

A40. There is a substantial need for ongoing investment in water industry infrastructure. The EPA has recently updated the spending needs in the water industry from $275 billion to $334.8 billion over the next 20 years.[15] These expenditures are driven by the need for upgrades to the distribution and transmission system as well as by the need to develop new water resources Thus, infrastructure investment in the water industry will require substantial external financing (i.e., new debt and equity). Access to capital requires that investors expect to earn their required return. Failure to provide adequate returns may discourage potential investors.

[13] "The Financial Crisis and Its Impact On the Electric Utility Industry", prepared by Julie Cannell (J.M. Cannell, Inc) for *Edison Electric Institute*, February 2009, p. 6.

[14] *Ibid.*

[15] Rudden Energy Strategies Report, May 26, 2009 p. 6.

Q41. ARE NOT WATER UTILITIES ATTRACTIVE INVESTMENTS IN TODAY'S CLIMATE BECAUSE THEY ARE SAFE AND STABLE?

A41. As noted above, the stock market has responded in a mixed way to water utility stocks, so the industry as a whole does not provide a safe haven for investors. This is true even for a fairly large, geographically diverse water utility such as American Water, which experienced a significant decrease in its stock price and a significant increase in its cost of debt over the past year. American Water Works' recent stock offering has been anticipated by the market for a while, so it is not surprising that American Water Works' stock price moved little on the actual sale. However, it is interesting to note that the offering was priced at 20 percent below the Initial Public Offering ("IPO") price in April 2008 and that the market value of American Water's shares dropped by approximately 14 percent over the same period.[16] Thus, American Water, like most companies in the U.S., has seen a substantial drop in its stock value over the past year. As the stock price declines, investors' expected return increases everything else equal. While American Water has too short a history for me to compare its expected earnings growth a year ago to that expected today, the average and median earnings growth in the water industry is currently very similar to that I found a year ago.[17]

Further, American Water has issued non-secured notes recently at rates quite a bit above its historical debt cost. For example, its November 2008 offering had a 10 percent coupon, its February 2009 offering had an 8.25 percent coupon, and its May 2009 offering had a coupon of 7.21 percent. These issuances traded at a yield near the coupon for a while after issuance. While the rates are down from the height of the credit crisis, they are substantially higher than the embedded cost of debt and indicate that the cost of

[16] For price information, see American Water Works press releases, "American Water Prices Initial Public Offering," April 22, 2008 and "American Water Prices Commons Stock Offering," June 4, 2009. According to American Water's 2008 10-K p. 93, 160 million shares were outstanding as of year end 2008. Thus, at the IPO price of $21.50, the market value of the shares was $3,440 million. The June 2009 stock offering consisted of 11.5 million new shares and 14.5 million shares from RWE AG. At a price of $17.25 per share, the market value of the shares (160 million + 11.5 million) becomes $2,980 million for a drop of approximately 14%.

[17] See Table BV-5 and my Direct Testimony in Case No. 08-00134-UT (Table BV-5).

debt capital for American Water and hence New Mexico-American Water has increased substantially during the financial crisis.

In addition, a common measure of the systematic risk of companies, the so-called beta, has moved very little for water utilities and remains at about 80% of the overall market. As noted by Debra G. Coy in testimony before the California PUC,

> Water utilities have historically been viewed as low-risk, predictable, regulated monopolies, and they have attracted equity investors who appreciated those characteristics. Now, investors are more wary
>
> And
>
> [i]nvestors have come to understand that 'low risk' water utilities in fact carry a variety of potential risks, the largest of which is their raising need to repair and replace aging infrastructure, resulting in high capex requirements, low depreciation rates, and negative free cash flow, along with the negative effects of regulatory lag on earnings.[18]

These facts indicate that investors in the water utility industry are exposed to substantial risks.

Q42. WHAT DO YOU CONCLUDE FROM THE EVIDENCE ON CURRENT ECONOMIC CONDITIONS?

A42. The cost of capital is much higher today than in the relatively recent past. Although some of the increase in the cost of equity capital will hopefully reverse when stable economic conditions return, it may be many years before investors regain the confidence in financial markets and the cost of equity capital returns to its pre-crisis level. Until economic conditions stabilize, it is critical that the major infrastructure investment necessary for regulated utilities not be hampered by inadequate allowed rates of return.

[18] Debra G. Coy, Testimony before the California PUC, p. 7.

As a result, the cost of capital that I estimated for New Mexico-American Water shortly before the crisis in 2008 is below the cost of capital that is currently applicable.[19]

Q43. HOW DO YOU ADJUST YOUR COST OF CAPITAL ESTIMATION METHODS TO CORRECT FOR CURRENT ECONOMIC CONDITIONS?

A43. I make no adjustment to the DCF method because determining whether an adjustment is necessary and if so, what are the appropriate adjustments to the parameters of the DCF model, would be more difficult. Because the DCF results rely on analysts' growth forecasts, I need to know if and how they have incorporated the ongoing financial crisis to determine the appropriate adjustment to growth rates, if any. As financial analysts rarely disclose how they determine the growth rates they publish, I cannot know if an adjustment to the DCF model is warranted.

For the risk positioning method, I recognize the unusually large yield spread on utility debt by adding a "yield spread adjustment" to the current long-term risk-free rate. This has the effect of increasing the intercept of the Security Market Line displayed in Figure 1 above. I present results from the risk positioning model from keeping the MRP at 6.5 percent and by increasing the MRP by 1, 1.5 and 2 percent over the 6.5 percent. I believe that both adjustments are warranted, but New Mexico-American's requested 12.25 percent return on equity is conservative as it ignored the increase in the MRP. Including the adjustment for the increased MRP would increase the estimated cost of equity. Specifically, if I rely on the water subsample and the gas LDC sample, a modest increase of one percent in the MRP, increases the estimate for the cost of equity by 50-75 basis points to no less than 12¾ percent. [See Tables 7 and 8 for details]

[19] In June 2008 (Case No. 08-00134-UT), I estimated a cost of equity of 11¾ percent on the same capital structure as New Mexico-American currently is relying on. Therefore, the current cost of equity capital is necessarily higher than 11¾ percent.

Q44. WOULD YOU PLEASE ILLUSTRATE THE EFFECT ON THE SECURITY MARKET LINE ("SML") OF THE TWO ADJUSTMENTS THAT YOU PROPOSE TO USE?

A44. Yes. The total effect is best illustrated in two steps. The first step is to consider how the SML changes as an adjustment to the yield spread is added to the risk-free interest rate. This is shown in Figure 8 below.

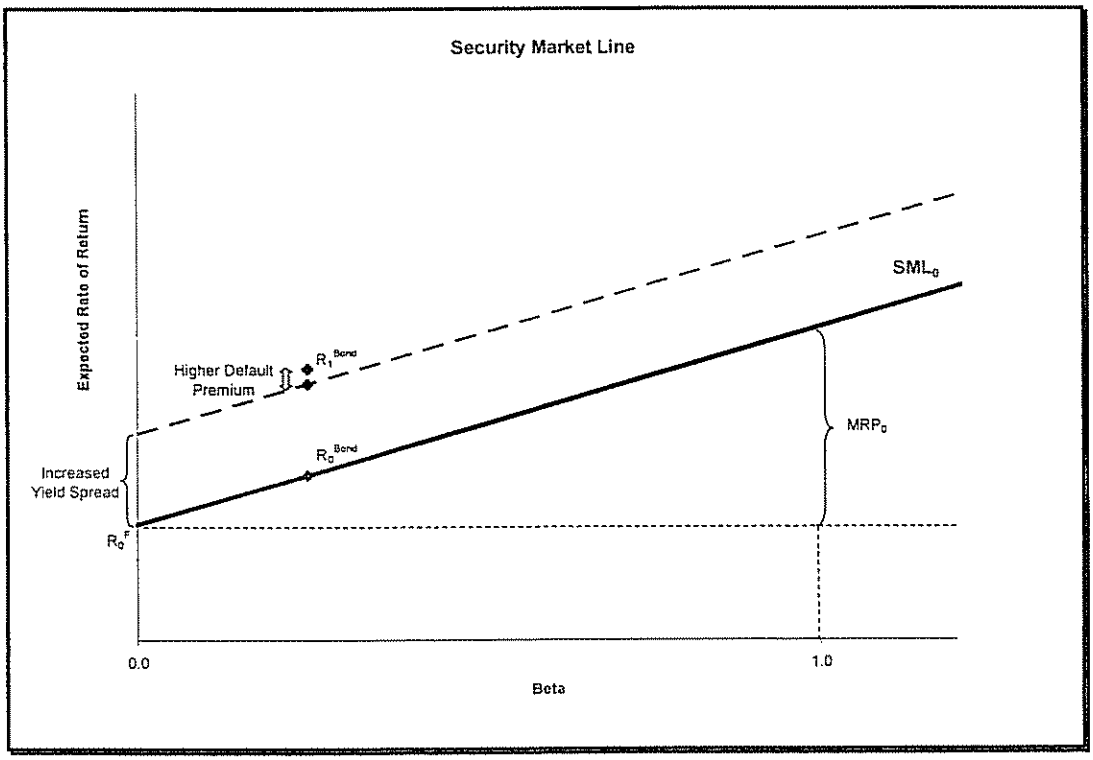

Figure 8

Figure 8 is a modification to Figure 1. Note that the beta of the market is always equal to 1.0 so the difference between the risk-free rate and the return on the market (beta = 1.0) is the market risk premium (MRP_0 in Figure 8). Recognizing the increased yield spread as an adjustment to the risk-free rate has the effect of moving the SML up without affecting the MRP. Note that I only consider the increase in the yield spread for A-rated utility bonds to avoid adding an increase in the default premium on BBB-rated utility bonds to the risk-free rate.

The effect of combining a yield spread adjustment and an increase in the MRP is illustrated in Figure 9 below.

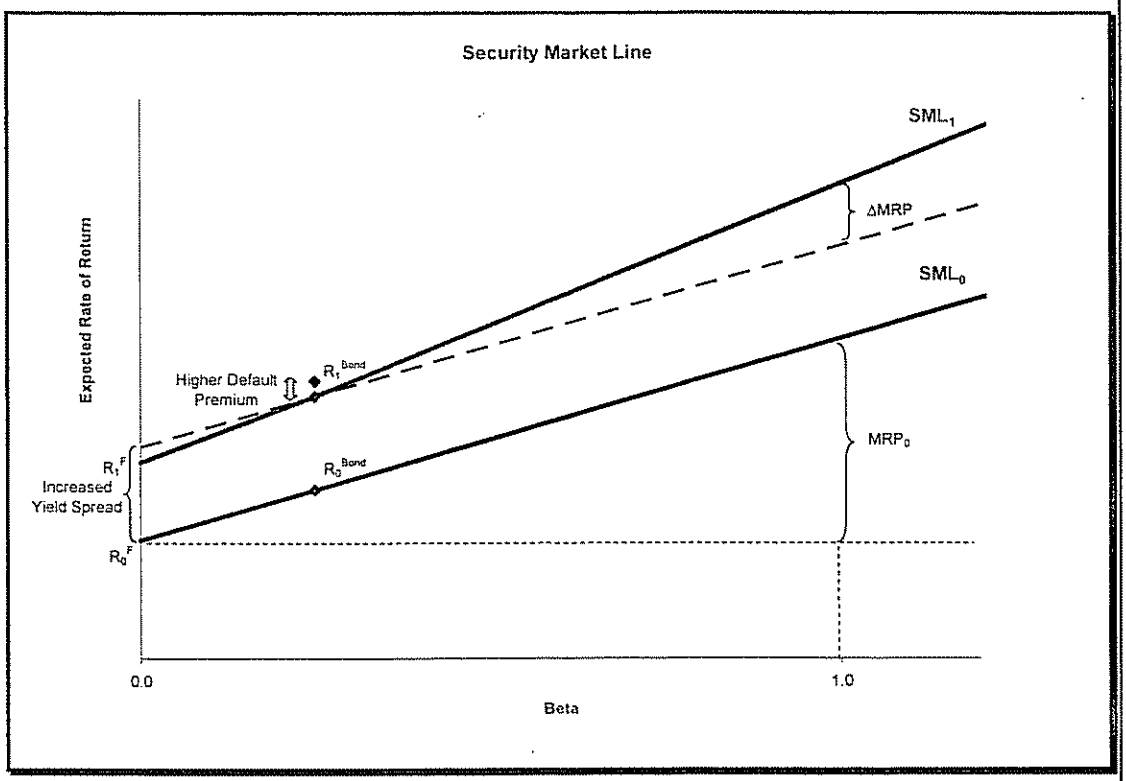

Figure 9

The effect of the MRP adder is to increase the slope of the SML. Note that the SML_1 is rotating through the estimated yield of the utility bond minus the estimate of the increase in default premium. Effectively, this step recognizes that there are three possible components to the increased yield spread: an increased default risk premium, an increased systematic risk premium and an increased premium over the risk-free rate not related to the other two categories. The default risk premium is the premium bond investors require to accept the risk that the bond issuer may default on interest payments and /or the repayment of the principal. The fact that the yield on lower rated bonds (e.g., BBB rated bonds) has increased more than the yield on higher rated bonds (e.g., AA or A rated bonds) indicates that investors are concerned about default risk. However, the increase in the default risk premium is likely to be small for highly (AA or A) rated utility bonds. The systematic risk premium bond investors receive is compensation for the risk they cannot diversify away. It is the bond's systematic risk in comparison to the

market as a whole and therefore measured by the so-called bond beta, which is similar to stock betas. A positive bond beta means that the intercept of the SML is lower than it would have been if there was no increase in the systematic risk premium in the increase in the yield spread. Bond betas are more difficult to estimate than stock betas because data are scarcer but bond betas are substantially lower than stock betas and .25 is likely to be in the upper range. The fraction of the increase that is not either an increase in the default risk premium or related to the bond beta is the unexplained increase.

IV. THE COST OF CAPITAL FOR THE BENCHMARK SAMPLES

Q45. HOW IS THIS SECTION OF YOUR TESTIMONY ORGANIZED?

A45. As noted in *Section I*, I estimate the cost of capital using two samples of comparable risk companies. This section first covers preliminary matters such as sample selection, market-value capital structure determination, and the sample companies' costs of debt. It then covers estimation of the cost of equity for the sample companies and the resulting estimates of the sample's overall after-tax weighted-average cost of capital.

A. Preliminary Decisions

Q46. WHAT PRELIMINARY DECISIONS ARE NEEDED TO IMPLEMENT THE ABOVE PRINCIPLES?

A46. I must select the benchmark samples, calculate the sample companies' market-value capital structures, and determine the sample companies' market costs of debt and preferred equity.

1. The Samples: Water Utilities and Gas Local Distribution Companies

Q47. WHY DO YOU USE TWO SAMPLES?

A47. The overall cost of capital for a part of a company depends on the risk of the business in which the part is engaged, not on the overall risk of the parent company on a consolidated basis.

Estimating the cost of capital for New Mexico-American Water's regulated assets is the subject of this proceeding. The ideal sample would be a number of companies that are publicly traded "pure plays" in the water production, storage, treatment, transmission, distribution and wastewater lines of business.[20] "Pure play" is an investment term referring to companies with operations only in one line of business. Publicly traded firms, firms whose shares are freely traded on stock exchanges, are ideal because the best way to infer the cost of capital is to examine evidence from capital markets on companies in the given line of business.

Therefore, for this case, a sample of companies whose operations are concentrated solely in the regulated portion of the water industry would be ideal. Unfortunately, the available sample of "water" utility companies in the U.S. is relatively small and has data deficiencies. See *Section IV.0.1* for a description of these deficiencies.

To select my sample of comparable water and gas LDC companies, I start with those companies that are listed as a water utility or natural gas utility in *Value Line*.[21] Usually, I would apply several selection criteria to delete companies with unusual circumstances that may bias the cost-of-capital estimation and companies whose risk characteristics differ from those of the filing entity. However, the application of such criteria would eliminate almost all the water utilities listed in *Value Line*. Therefore, I do not apply selection criteria to the water utility sample although I do apply my standard criteria to the gas LDC sample. Specifically, if I eliminate all water utilities with annual revenues below $300 million, less than 50 percent regulated revenues, lack of growth rates (from Bloomberg or *Value Line*), or lack of a bond rating, I would be left with at most three companies (American States Water, Aqua America and California Water Services). A three-company sample is simply too small to provide reliable results. Therefore, I keep all water utilities with data in my water utility sample, but I do report results for a subsample of companies that are more stable. Specifically, this sample excludes Southwest Water which recently cut dividends and at the time the cost of capital estimate

[20] Most of the water utilities in *Value Line* have operations in the water as well as wastewater business.

[21] To select the samples I include both the Standard, the Small and Mid-Cap Editions of *Value Line Investment Survey* and *Value Line Investment Survey - Plus Edition.*

was prepared had not filed its 2008 form 10-K with the Securities and Exchange Commission.[22,23]

Q48. WHAT DO YOU DO TO OVERCOME THE WEAKNESSES OF THE WATER UTILITY SAMPLE?

A48. To overcome the weaknesses of the water sample, I select a second sample of regulated utilities: gas local distribution companies. Gas LDCs, like water utilities, are regulated by state regulatory bodies, have large distribution investments, and serve a mix of residential, industrial, and commercial customers.

One reason for using the gas LDC sample is to generate a sample of regulated companies whose primary source of revenues is in the regulated portion of the natural gas industry to provide a check for the results of the water sample. Therefore, I start with *Value Line*'s universe of natural gas utilities, and eliminate those companies whose percentage of assets attributed to regulated activities is less than 50 percent. In addition, I only include companies with an investment grade bond rating, no recent sizable mergers or acquisitions, no recent dividend cuts, and no other activity that could cause the estimation parameters to be biased. Additionally, I require the companies to have necessary data available. The final sample includes eleven companies. Additional details of the sample selection process for each sample and the water subsample are described below as well as in Appendix B.

Q49. IF THE BUSINESS RISK OF THE GAS LDC SAMPLE DIFFERS FROM THE WATER SAMPLE, CAN YOU STILL RELY ON THE COST OF EQUITY ESTIMATED FOR THE GAS LDC SAMPLE?

A49. Yes. If the business and financial risk of the two samples differ, then a cost-of-capital analyst can still make use of the information from the more reliable sample to evaluate the reliability of the estimates from the water sample. The inference would be based on information about the relative risk of the two industries. In this instance the business

[22] Southwest Water filed its 2008 form 10-K along with a restatement of 2006-07 financials with the Securities and Exchange Commission ("SEC") on July 9, 2009.

[23] The only company followed by *Value Line* that I do not include is Sun Hydraulics. This company's main line of business is the production of industrial equipment, not the water utility business.

operations of water and gas LDC companies are similar, but the water companies tend to have a higher percentage of their assets and revenue subject to regulation.

Q50. PLEASE ELABORATE ON THE WAY TWO SAMPLES WITH DIFFERENT BUSINESS AND FINANCIAL RISKS CAN BE COMPARED.

A50. As mentioned above, the overall cost of capital for a part of a company depends on the risk of the business in which the part is engaged, not on the overall risk of the parent company on a consolidated basis. According to financial economics, the overall risk of a diversified company equals the market value weighted-average of the risks of its components.

Calculating the overall after-tax weighted average cost of capital for each sample company as described above allows the analyst to estimate the average overall cost of capital for the sample. The ATWACC captures both the business risk and the financial risk of the sample companies in one number. This allows comparison of the cost of capital between two samples on a much more informed basis. If the alternative (more reliable) sample is judged to have slightly different risk than the water sample, but the results show wide differences in the ATWACC estimates, the analyst should carefully consider the validity of the water sample estimates, whether they are materially higher or lower than the alternative sample's estimates. Of course, the alternative sample could be the source of the error, but that is less likely because the alternative sample has been selected precisely because of its expected reliability.

Q51. PLEASE COMPARE THE CHARACTERISTICS OF THE WATER UTILITY SAMPLE AND THE GAS LDC SAMPLE.

A51. The two samples differ primarily in that they operate in two different (regulated) industries, but they are relatively similar in terms of the percentage of revenues from regulated operations and the customers they serve. On average, both samples earn a large percentage of their revenue from regulated activities and serve a mix of residential, industrial, and other customers. In addition, both industries are characterized by large capital investment and both are operating a large distribution system. However, it appears that the gas LDC sample's systematic risk has been affected more by the financial crisis

than has the water utility sample in the sense that while the measures of systematic risk, beta, has remained relatively constant for water utilities, it has dropped for gas LDC companies. It is difficult to determine whether the decline in gas LDC betas is due to the financial crisis or to industry specific factors as other utility sectors have not seen the same decline in beta estimates.[24] At the same time, the gas LDC has fewer of the data and estimation issues identified above for the water sample. Please refer to Appendix B for additional details on the two samples.

2. Market-Value Capital Structure

Q52. WHAT CAPITAL STRUCTURE INFORMATION DO YOU REQUIRE?

A52. For reasons discussed below and in Appendix E, explicit evaluation of the market-value capital structures of the sample companies is vital for a correct interpretation of the market evidence on the return on equity. This requires estimates of the market values of common equity, preferred equity and debt, and the current market costs of preferred equity and debt.

Q53. PLEASE DESCRIBE HOW YOU CALCULATE THE MARKET VALUES OF COMMON EQUITY, PREFERRED EQUITY AND DEBT.

A53. I estimate the capital structure for each sample company by estimating the market values of common equity, preferred equity and debt from the most recent publicly available data. The details are in Appendix B.

Briefly, the market value of common equity is the price per share times the number of shares outstanding. For the risk-positioning approach, I use the last 15 trading days of each year to calculate the market value of equity for the year. I then calculate the average capital structure over the corresponding five-year period used to estimate the "beta" risk measures for the sample companies. This procedure matches the estimated beta to the degree of financial risk present during its estimation period. In the DCF analyses, I use the average stock price over 15 trading days ending on the release date of the BEst

[24] According to *Value Line*, gas LDC companies have seen a larger decline in beta than has water utilities, electric utilities, or pipelines.

growth rate forecasts utilized.[25] I use 15 trading days to balance the need for a current stock price and avoiding that any one day unduly influences the results.

The market value of debt is estimated at its book value adjusted by the difference between the "estimated fair (market) value" and the "carrying cost" of long-term debt reported in each company's 10-K.[26] The market value of preferred stock for the samples is set equal to its book value.[27]

3. Market Costs of Debt and Preferred Equity

Q54. HOW DO YOU ESTIMATE THE CURRENT MARKET COST OF DEBT?

A54. The market cost of debt for each company is set equal to the fifteen-day average yield on an index of public utility bonds that have the same credit rating, as reported by Bloomberg. The DCF analyses use the current credit rating whereas the risk-positioning analyses use the current yield of a utility bond that corresponds to the five-year average debt rating of each company so as to match consistently the horizon of information used by *Value Line* to estimate each company's beta. Bond rating information was obtained from Bloomberg which reports Standard & Poor's bond ratings. I calculate the after-tax cost of debt using New Mexico-American's estimated income tax rate of 38.45 percent.

Q55. HOW DO YOU ESTIMATE THE MARKET COST OF PREFERRED EQUITY?

A55. For all sample companies, the preferred rating was assumed equal to the company's bond rating. The cost of a company's preferred equity was set equal to the yield on an index of preferred utility stock with the same rating. The data were obtained from the Mergent Bond Record.[28]

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[25] BEst is Bloomberg's name for its earnings growth rate information. BEst growth rate forecasts are as of May 18, 2009.

[26] The book value of debt from Bloomberg includes all interest-bearing financial obligations that are not current and includes capitalized leases and mandatory redeemable preferred and trust preferred securities in accordance with FASB 150 effective June 2003. See Bloomberg's definition of long-term debt for additional details.

[27] This is unlikely to affect the results as the average percentage of preferred is close to zero for both the water and gas LDC sample.

[28] Published monthly, Mergent's Bond Record offers a comprehensive review of over 68,000 bond issues including coverage of corporate, government, municipal, industrial development/environmental control

B. Cost-of-Equity Estimation Methods

Q56. HOW DO YOU ESTIMATE THE COST OF EQUITY FOR YOUR SAMPLE COMPANIES?

A56. Recall that the cost of capital is the expected rate of return in capital markets on alternative investments of equivalent risk. This definition leads me to address three key points in my estimation procedures. First, the cost of capital is an expected rate of return – it cannot be directly observed, but must be inferred from available evidence. Second, the cost of capital is determined in capital markets (such as the New York Stock Exchange). Therefore, capital market data provide the best evidence from which to draw inferences. Third, the cost of capital depends on the return offered by alternative investments of equivalent risk. Consequently, measures of risk that matter in capital markets are part of the evidence that I need to examine. The overall cost of capital that I estimate for the samples is the primary evidence I rely on to determine New Mexico-American Water's overall cost of capital.

Q57. HOW DOES THE ABOVE DEFINITION HELP YOU ESTIMATE THE COST OF CAPITAL?

A57. The definition of the cost of capital recognizes a tradeoff between risk and expected return; this is the security market line plotted above in Figure 1 above. Cost-of-capital estimation methods usually take one of two approaches: (1) they establish the location of the security market line and estimate the relative risk of the security, which jointly determine the cost of capital, or (2) they try to identify a comparable-risk sample of companies and estimate the cost of capital directly. Looking at Figure 1, the first approach focuses directly on the vertical axis, while the second focuses both on the security's position on the horizontal axis and on the position of the security market line.

The first type of approach is more direct, but ignores the wealth of information available on securities not thought to be of precisely comparable risk. The "discounted cash flow" or "DCF" model is an example. The second type of approach, sometimes known as

revenue and international bonds, plus structured finance and equipment trust issues, medium-term notes, convertible issues, preferred stocks and commercial paper issues.

"equity risk premium approach," requires an extra step – positioning the security market line. Using the second approach allows me to use information from all traded securities rather than just those included in my sample. The capital asset pricing model ("CAPM") is an example. While both approaches can work equally well if conditions are right, one may be preferable to the other under certain circumstances. In particular, approaches that rely on the entire security market line are less sensitive to deviations from the assumptions that underlie the model, all else equal. In this case, I examine both DCF and risk-positioning approach evidence for the water utility and gas LDC sample.

1. The Risk-Positioning Approach

Q58. PLEASE EXPLAIN THE RISK-POSITIONING METHOD.

A58. The risk-positioning method estimates the cost of equity as the sum of a current interest rate and a risk premium. It is therefore sometimes also known as the "risk premium" approach. This approach may sometimes be applied more or less formally. As an example of an informal application, an analyst may estimate the spread between interest rates and what is believed to be a reasonable estimate of the cost of capital at a specific time, and then apply that spread to current interest rates to get a current estimate of the cost of capital.

More formal applications of the risk-positioning approach take full advantage of the security market line depicted in Figure 1: they use information on a large number of traded securities to identify the security market line and derive the cost of capital for the individual security based on that security's relative risk. This reliance on the entire security market line makes the method less vulnerable to the kinds of problems that arise from using one stock at a time (such as the DCF method). The risk-positioning approach is widely used and underlies much of the current research published in academic journals on the nature, determinants and magnitude of the cost of capital. The most commonly used version of the formal risk-positioning models is the Capital Asset Pricing Model ("CAPM"). The equation for the CAPM is:

$$k_s = r_f + \beta_s \times MRP \qquad (2)$$

where k is the cost of capital, r_F is the risk-free interest rate, MRP is the market risk premium, and β is the measure of relative risk.

Section I of Appendix C to this testimony provides more detail on the principles that underlie the risk-positioning approach. Section II of Appendix C provides the details of the risk-positioning approach empirical estimates I obtain.

Q59. HOW ARE THE "MORE FORMAL" APPLICATIONS OF THE RISK-POSITIONING APPROACH IMPLEMENTED?

A59. The first step is to specify the current values of the benchmarks that determine the security market line. The second is to determine the security's, or investment's, relative risk. The third is to specify exactly how the benchmarks combine to produce the security market line, so the company's cost of capital can be calculated based on its relative risk.

a) Security Market Line Benchmarks

Q60. WHAT BENCHMARKS ARE USED TO DETERMINE THE LOCATION OF THE SECURITY MARKET LINE?

A60. The essential benchmarks that determine the security market line are the risk-free interest rate and the premium that a security of average risk commands over the risk-free rate. This premium is commonly referred to as the "market risk premium" ("MRP"), i.e., the excess of the expected return on the average common stock over the risk-free interest rate. In the risk-positioning approach, the risk-free interest rate and MRP are common to all securities. A security-specific measure of relative risk (beta) is estimated separately and combined with the MRP to obtain the company-specific risk premium.

Q61. WHAT BENCHMARK DO YOU USE FOR THE MRP?

A61. For this proceeding I estimate only a long-term version of the risk-positioning model. This version of the risk-positioning model measures the market risk premium as the risk premium of average-risk common stocks over long-term Government bonds. I do not present result on a short-term version in this proceeding because monetary policy has

driven the short-term risk-free rate to zero and at times even below zero.[29] I also report several sensitivity analyses that take into account the increase in the MRP as discussed above in *Section III.*

Q62. HOW DO YOU ESTIMATE THE BASELINE MRP?

A62. Appendix C summarizes academic and empirical research on the MRP. However, as discussed in the appendix, there is currently little consensus on the "best practice" for estimating the MRP; even pre-crisis. (Note: this is not the same as saying that all practices are equally good). For example, the leading graduate textbook in corporate finance expresses the view that a range between 5 to 8 percent is reasonable for the U.S.[30] Morningstar data from 1926 to 2008, the longest period reported, show an MRP average premium of stocks of 7.9 percent over Treasury bills and 6.5 percent over long-term Government bonds. The publication reports a premium of stocks over bonds of 7.6 percent for the period 1947 to 2008.[31] At the same time, Dimson, Marsh and Stauton (2008) estimate the arithmetic market risk premium for the U.S. over the 1900 to 2007 period at 6.5 percent over bonds.[32] In a regulatory setting, the Surface Transportation Board ("STB") recently decided to rely on the CAPM when determining the cost of capital for major railroads in the U.S. As part of its methodology, the STB decided to rely on the long-term market risk premium reported by Morningstar/Ibbotson in its implementation of the CAPM.[33]

My testimony considers both the historical evidence and the results of scholarly studies of the factors that affect the risk premium for average-risk stocks in order to estimate the benchmark risk premium investors currently expect.

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[29] See, for example, "Treasury Bills Trade at Negative Rates as Haven Demand Surges", by Daniel Kruger and Cordell Eddings, *Bloomberg*, December 9, 2008.

[30] Richard A. Brealey, Stewart C. Myers, and Franklin Allen, *Principles of Corporate Finance*, McGraw-Hill, 9th edition, 2008, pp. 173-180.

[31] Morningstar, *Ibbotson SBBI Valuation Yearbook 2009*, Appendix A, Tables A-1 and A-3.

[32] Dimson, Marsh and Staunton, *Global Investment Returns Yearbook 2008*, p. 48.

[33] *STB Ex Parte No. 664*, Issued January 17, 2008, pp. 8-9.

Considering all the evidence, I conclude that S&P 500 stocks of average risk commanded 6.5 percent over the long-term Government rate prior to the financial crisis. This estimate is a relative conservative estimate of the historical average risk-premium in that it is equal to the figure reported over the longest period available and includes the unusual 2008 year. As discussed in *Section III* above, this figure has increased with the current market turmoil, so that the baseline of 6.5 percent likely underestimates the current MRP. However, I choose to use it as a benchmark to be conservative. I do, however, report sensitivity analyses that reflect an increase in the MRP. I refer to models that use the 6.5 percent MRP as the baseline. The estimation of the MRP is discussed in greater detail in Appendix C.

Q63. HOW DO YOU DETERMINE THE RISK-FREE RATE YOU USE?

A63. First, I calculate the yield on long-term Government bonds over a recent 15-day period. Second, I determine the increase in the spread between the yield on A-rated utility bonds and long-term (20-year) Government bonds.[34] As of May 15, 2009 this spread stood at 219 to 239 basis points and had increased by 114 to 145 basis points over the period 1991 to 2007 if I look to Moody's data and by 124 to 174 basis points if I look to Bloomberg's data.[35] As 125 basis points are in the lower end of the range, I conservatively choose to add this to the current estimate of the long-term risk-free rate.

b) Relative Risk

Q64. WHAT MEASURE OF RELATIVE RISK DO YOU USE?

A64. I examine the "beta" of the stocks in question. Beta is a measure of the "systematic" risk of a stock — the extent to which a stock's value fluctuates more or less than average when the market fluctuates.

The basic idea behind beta is that risks that cannot be diversified away in large portfolios matter more than those that can be eliminated by diversification. Beta is a measure of the

[34] I use the yield on A-rated utility bonds as they are less likely to include a default premium than are lower rated utility bonds.

[35] See Table 3 above and Workpaper #2 to Table No. BV-9, Panel B.

risks that cannot be eliminated by diversification. This concept is explored further in Appendix C.

Q65. WHAT DOES A PARTICULAR VALUE OF BETA MEAN?

A65. By definition, a stock with a beta equal to 1.0 has average non-diversifiable risk: it goes up or down by 10 percent on average when the market goes up or down by 10 percent. Stocks with betas above 1.0 exaggerate the swings in the market. A stock with a beta of 2.0 tends to fall 20 percent when the market falls 10 percent, for example. Stocks with betas below 1.0 understate the swings in the market. A stock with a beta of 0.5 tends to rise 5 percent when the market rises 10 percent.

Q66. HOW DO YOU ESTIMATE BETA?

A66. I use beta estimates reported in the *Value Line* for the sample companies.

c) Cost of Equity Capital Calculation

Q67. HOW DO YOU COMBINE THE PRECEDING STEPS TO ESTIMATE THE COST OF EQUITY?

A67. The most widely used approach to combine a risk measure with the benchmark market risk premium on common stocks to find a risk premium for a particular firm or industry is the Capital Asset Pricing Model. However, the CAPM is only one risk-positioning technique.

In addition to the CAPM, I rely on an empirical variety of the model. Empirical research has long shown that the CAPM tends to overstate the actual sensitivity of the cost of capital to beta: low-beta stocks tend to have higher risk premia than predicted by the CAPM and high beta stocks tend to have lower risk premia than predicted. A number of variations on the original CAPM theory have been proposed to account for this finding.

This finding can be used directly to estimate the cost of capital, using beta to measure relative risk, without simultaneously relying on the CAPM. Here I examine results from both the CAPM and a version of the security market line based on the empirical finding that risk premia are related to beta, but are not as sensitive to beta as the CAPM predicts, to convert the betas into a risk premium. I refer to this latter model as the "ECAPM,"

where ECAPM stands for Empirical Capital Asset Pricing Model. The formula for the ECAPM is

$$k_s = r_f + \alpha + \beta_s \times (MRP - \alpha) \quad (3)$$

where as before k is the cost of capital, r_f is the risk-free interest rate, MRP is the market risk premium, β is the measure of relative risk, and α is the empirical adjustment factor.

Research supports values for α ranging from one to seven percent when using a short-term interest rate. I use benchmark values of α of 0.5 percent for the long-term risk-free rate as it is in the lower range of what empirical evidence support. I also conduct sensitivity tests for different values of α. For the long-term risk-free rate I use values for α of 0, 0.5 and 1.5 percent. See Appendix C for a more detailed discussion of the ECAPM model and Table C-1 for a summary of the empirical evidence on the size of the required adjustment.

Q68. WHY IS IT APPROPRIATE TO USE THE ECAPM MODEL?

A68. Empirical tests of the CAPM have repeatedly shown that an investment's return is related to systematic risk, but that the increase in return for an increase in risk is less than is predicted. The empirical tests have also shown that the theoretical intercept, as measured by the return on Treasury bills, is too low to fit the data. In other words, the empirical tests indicate that the slope of the CAPM is too steep and the intercept is too low. The empirical data support the ECAPM. The ECAPM recognizes the consistent empirical observation that the CAPM underestimates (overestimates) the cost of capital for low (high) beta stocks. The ECAPM corrects the predictions of the CAPM to more closely match the results of the empirical tests. Ignoring the results of CAPM tests would lead to an estimate of the cost of capital that is likely to be less accurate than is possible.

Q69. IS THE USE OF THE ECAPM EQUIVALENT TO ADJUSTING THE ESTIMATED BETAS FOR THE SAMPLE COMPANIES?

A69. No. Fundamentally, this is not an adjustment (increase) in beta. This can easily be seen by the fact that the expected return on high beta stocks is lower with the ECAPM than when estimated by the CAPM. The ECAPM model is a recognition that the actual slope of the risk-return tradeoff is flatter than predicted and the intercept higher based upon

repeated empirical tests of the model.[36] Even if the beta of the sample companies were estimated accurately, the CAPM would still underestimate the required return for low beta stocks. Even if the ECAPM were used, the costs of equity would be underestimated if the betas were underestimated.

2. Discounted Cash Flow Method

Q70. PLEASE DESCRIBE THE DISCOUNTED CASH FLOW APPROACH.

A70. The DCF model takes the first approach to cost-of-capital estimation, i.e., to attempt to estimate the cost of capital in one step. The method assumes that the market price of a stock is equal to the present value of the dividends that its owners expect to receive over the life of the company. The method also assumes that this present value can be calculated by the standard formula for the present value of a cash flow stream:

$$P = \frac{D_1}{(1+k)} + \frac{D_2}{(1+k)^2} + \frac{D_3}{(1+k)^3} + \cdots + \frac{D_T}{(1+k)^T} \qquad (4)$$

where "P" is the market price of the stock; "D_t" is the dividend cash flow expected at the end of period t (i.e., subscript period 1, 2, 3 or T in the equation); "k" is the cost of capital; and "T" is the last period in which a dividend cash flow is to be received. The formula just says that the stock price is equal to the sum of the expected future dividends, each discounted for the time and risk between now and the time the dividend is expected to be received.

Most DCF applications go even further, and make very strong (i.e., unrealistic) assumptions that yield a simplification of the standard formula, which then can be rearranged to estimate the cost of capital. Specifically, if investors expect a dividend stream that will grow forever at a steady state, the market price of the stock will be given by a very simple formula,

[36] Many investment firms make an adjustment to the beta. A commonly used adjustment is the Merrill Lynch adjustment, which adjusts betas 1/3 toward one. This type of adjustment is intended to compensate for sampling errors in the beta estimation, not for the empirical fact that CAPM tends to overestimate the sensitivity of the cost of capital to beta. See Appendix C for a more detailed explanation.

$$P = \frac{D_1}{(k-g)} \tag{5}$$

where "D_1" is the dividend expected at the end of the first period, "g" is the perpetual growth rate, and "P" and "k" are the market price and the cost of capital, as before. Equation (5) is a simplified version of Equation (4) that can be solved to yield the well known "DCF formula" for the cost of capital:

$$\begin{aligned} k &= \frac{D_1}{P} + g \\ &= \frac{D_0 \times (1+g)}{P} + g \end{aligned} \tag{6}$$

where "D_0" is the current dividend, which investors expect to increase at rate g by the end of the next period, and the other symbols are defined as before. Equation (6) says that if Equation (5) holds, the cost of capital equals the expected dividend yield plus the (perpetual) expected future growth rate of dividends. I refer to this as the simple DCF model. Of course, the "simple" model is simple because it relies on very strong, unrealistic, assumptions.

Q71. CAN YOU ILLUSTRATE THE DCF MODEL?

A71. Yes. For simplicity, I will illustrate the method using annual data although most companies pay dividends quarterly, so that a quarterly model is more appropriate. If, on an annual basis, a company paid $2 in dividends, D_0, has a current stock price, P, of $30 and an estimated growth rate, g, of 5 percent per year, then the calculations in equations (5) and (6) above are as follows

Dividends next period: $D_1 = D_0 \times (1 + g) = \$2.00 \times (1 + 5\%) = \$2.10$

Dividend Yield: $D_1 / P = \$2.10 / \$30 = 7.0\%$

Cost of equity: $k = D_1 / P + g = 7.0\% + 5\% = 12\%$.

Q72. ARE THERE OTHER VERSIONS OF THE DCF MODELS BESIDES THE "SIMPLE" ONE?

A72. Yes. There are many variations on the DCF models that may rely on less strong (more realistic) assumptions in that they allow growth rates to vary over time. I consider a variant of the DCF model that uses the companies' individual growth rates during the first five years, converges to a perpetual growth rate in years 6-10 and then uses the GDP growth rate as the perpetual growth rate after year 10 for all companies. This is a variant of the "multi-stage" DCF method. The DCF models are described in detail in Section I of Appendix D. (Section II of Appendix D provides the details of my empirical DCF results.)

Q73. WHAT ARE THE MERITS OF THE DCF APPROACH?

A73. The DCF approach is conceptually sound if its assumptions are met, but can run into difficulty in practice because those assumptions are so strong, and hence so unlikely to correspond to reality. Two conditions are well known to be necessary for the DCF approach to yield a reliable estimate of the cost of capital: the variant of the present value formula that is used must actually match the variations in investor expectations for the dividend growth path; and the growth rate(s) used in that formula must match current investor expectations. Less frequently noted conditions may also create problems. (See Appendix D for details.)

Q74. WHAT IS THE MOST DIFFICULT PART OF IMPLEMENTATING THE DCF APPROACH?

A74. Finding the right growth rate(s) is the usual "hard part" of a DCF application. The original approach to estimation of the growth rate, *g*, relied on average historical growth rates in observable variables, such as dividends or earnings, or on the "sustainable growth" approach, which estimates *g* as the average book rate of return times the fraction of earnings retained within the firm. But it is highly unlikely that these historical averages over periods with widely varying rates of inflation and costs of capital will equal current growth rate expectations. This is particularly true for the water sample as many companies in the industry are growing fast, engaged in mergers, acquisitions or other restructuring activities.

Moreover, the constant growth rate DCF model requires that dividends and earnings grow at the same rate for companies that on average earn their cost of capital.[37] It is inconsistent with the theory on which the model is based to have different growth rates in earnings and dividends over the period when growth is assumed to be constant. If the growth in dividends and earnings were expected to vary over some number of years before settling down into a constant growth period, then it would be appropriate to estimate a multistage DCF model. In the multistage model, earnings and dividends can grow at different rates, but must grow at the same rate in the final, constant growth rate period. A difference between forecasted dividend and earnings rates therefore is a signal that the facts do not fit the assumptions of the simple DCF model.

Q75. HOW DO YOU ESTIMATE THE GROWTH RATES YOU USE IN YOUR DCF ANALYSIS?

A75. I use earnings growth rate forecasts from Bloomberg and *Value Line*. Analysts' forecasts are superior to using single variables in time series forecasts based upon historical data as has been documented and confirmed extensively in academic research. Please see Section I in Appendix D for a detailed discussion on this issue.

Q76. ARE YOU AWARE THAT SOME REGULATORY COMMISSIONS RELY ON BOTH HISTORICAL AND FORECAST GROWTH RATES IN THEIR IMPLEMENTATION OF THE DCF MODEL?

A76. Yes, but I do not believe that is the best way to estimate the growth rate for use in the DCF model for the following reasons. First, as mentioned above, the model requires that dividends and earnings grow at the same rate at some point in the future in order to apply the model. The data on historical growth rates do not confirm this condition. Second, analysts have access to historical information and include that information in their

[37] Why must the two growth rates be equal in a steady-growth DCF model? Think of earnings as divided between reinvestment, which funds future growth, and dividends. If dividends grow faster than earnings, there is less investment and slower growth each year. Sooner or later dividends will equal earnings. At that point, growth is zero because nothing is being reinvested (dividends are constant). If dividends grow slower than earnings, each year a bigger fraction of earnings are reinvested. That makes for ever faster growth. Both scenarios contradict the steady-growth assumption. So if you observe a company with different expectations for dividend and earnings growth, you know the company's stock price and its dividend growth forecast are inconsistent with the assumptions of the steady-growth DCF model.

forecast of earnings growth rates. In other words, using historical data provides no additional information than that captured in analyst forecasts. Data providers such as *Value Line* provide information on the going forward payout ratio as well as on other key financial parameters.

Q77. ARE YOU AWARE OF EVIDENCE THAT ANALYSTS' FORECASTS OF EARNINGS GROWTH HAVE HISTORICALLY OVER-ESTIMATED EARNINGS AND DIVIDEND GROWTH?

A77. Yes. Although analyst forecasts have historically been too optimistic, this problem is less acute for regulated companies.[38] Further, according to a recent joint report by NASD and the NYSE,

> ... the SRO Rules have been effective in helping restore integrity to research by minimizing the influences of investment banking and promoting transparency of other potential conflicts of interest. Evidence also suggests that investors are benefiting from more balanced and accurate research to aid their investment decisions.[39]

In addition, the use of a two-stage DCF model, which substitutes the forecast growth of GDP, mitigates analyst optimism by substituting the GDP growth rate for the potentially optimistic (or pessimistic) earnings forecasts of analysts.

Q78. HOW WELL ARE THE CONSTANT-GROWTH RATE CONDITIONS NECESSARY FOR THE RELIABLE APPLICATION OF THE DCF LIKELY TO BE MET FOR THE SAMPLE COMPANIES AT PRESENT?

A78. The requisite conditions for the sample companies are not fully met at this time, particularly for the water sample. Of particular concern for this proceeding is the uncertainty about what investors truly expect the long-run outlook for the sample companies to be. The longest time period available for growth rate forecasts of which I am aware is five years. The long-run growth rate (i.e., the growth rate after the water

[38] See, for example, L.K.C. Chan, J. Karceski, and J. Lakonishok (2003), "The Level and Persistence of Growth Rates," *Journal of Finance* 58(2), pp. 643-684.

[39] Joint Report by NASD and NYSE on the Operation and Effectiveness of the Research Analyst Conflict of Interest Rules, December 2005, p. 44.

industry settles into a steady state, which may be beyond the next five years for this industry) drives the actual results one gets with the DCF model. Unfortunately, this implies that unless the company or industry in question is stable – so there is little doubt as to the growth rate investors expect – DCF results in practice can end up being driven by the subjective judgment of the analyst who performs the work.

Of the nine companies in the water sample, six do not have earnings forecasts from *Value Line* and three do not have *BEst* growth rates. *A*s a result three companies have no forecasted earnings growth and two companies have only one analyst's estimate.[40] The average long-term earnings forecasts from vary from a low of -6.0 percent[41] to a high of 15 percent. The lack of sufficient number of analysts following the sample companies and the large variation in growth forecasts indicate that these forecasts are less reliable than ideal. The growth rates for gas LDC sample vary less from 2.1 to 6.6 percent, and are more consistent with the GDP growth forecast of 4.9 percent. Of the 11 companies in the gas LDC sample, one has only two analysts providing a forecast (one *Value Line* and one BEst). The two-stage DCF model adjusts for any overly optimistic (or pessimistic) growth rate forecasts by adjusting the 5-year growth rate forecasts of the analysts toward the long-term GDP growth rate in the years after year 5, but the available data are not ideal. See Appendix D, *Section I* for a discussion of the two-stage model.

The DCF growth rates, whether estimated from historical data or from analyst forecasts, have likely been affected by several factors: many mergers and acquisitions in the water industry in recent years, significant growth in many parts of the country, and a trend towards consolidation. The industry appears to be moving towards a larger degree of consolidation – at least among the privately held water utilities. The consolidation of the industry may well increase as the industry needs significant infrastructure investments to comply with EPA water purification rules, maintain or replace old infrastructure, and deal with increased threats towards the water systems.[42] The American Society of Civil Engineers' 2009 estimate is that "drinking water systems face an annual shortfall of at

[40] See Table BV-5 for details.

[41] The negative 6 percent pertains to Southwest Water which recently cut dividends.

[42] See, for example, *Value Line*, Water Utility Industry, April 25, 2008.

least $11 billion in funding needed to replace aging facilities that are near the end of their useful life and to comply with existing and future federal water regulations";[43] and that total investment need for drinking water and wastewater investments of $255 billion over the next five years.[44] Drinking water is mentioned as the most important infrastructure concern for New Mexico in the report and the required investments is estimated at $922 million for drinking water and at $160 million for wastewater.[45] Coupled with the rising construction costs of utility infrastructure, this creates uncertainty about future conditions and diverging expectations. The uncertainty associated with these factors increases the industry's business risk. Additionally, environmental regulations impact the industry as standards for water quality evolve over time, and there is potential for new safety and security requirements in the future. The industry has no federal regulator (other than for environmental and health issues), and state public utility commissions regulate most investor owned water utilities. Different regulatory bodies may lead to differing regulatory requirements for companies operating in adjacent parts of the country. Taken together, these factors mean that it may be some time before the water industry settles into anything investors will see as a stable equilibrium necessary for the reliable application of the DCF model.

Such circumstances imply that a commission may often be faced with a wide range of DCF estimates, none of which can be well grounded in objective data on true long-run growth expectations, *because no such objective data now exist*. DCF for firms or industries in flux is *inherently* subjective with regard to the most important parameter, the long-run growth rate that drives the answer.

In short, the unavoidable questions about the DCF model's strong assumptions cause me to view the DCF method as *inherently* less reliable than the risk-positioning approach described above. This is particularly true for the water sample, because of the data problems discussed above. However, because the DCF method has been widely used in

[43] Report Card for America's Infrastructure, The American Society of Civil Engineers, 2009, p. 1.

[44] *Ibid.*, Executive Summary p. 7. According to the document, the investment shortfall is about $108.6 billion for the water industry over the next five years.

[45] *Ibid.*, New Mexico. (http://www.infrastructurereportcard.org/state-page/new-mexico)

the past, I submit DCF evidence in this case. DCF estimates also serve as a check on the values provided by the risk-positioning methods.

In this proceeding, I give no weight to the water sample's DCF estimates, but use the gas LDC DCF estimates as a check on the reasonableness of my risk-positioning estimates. While the Commission Staff in the past has given weight to the water sample's DCF results, I respectfully submit that the high variability of these growth rates makes them very unreliable at this point in time. For example, a year ago, Southwest Water's average growth rate from BEst and *Value Line* was 10 percent, but it is now negative 6.0 percent and York Water had a growth rate of only .7 percent a year ago while it now has a growth rate of 7.0 percent.[46] Relying on historical growth rate does not make the water sample's DCF results reliable, because (1) the DCF method's strength is being forward looking and historical data violates this principle and (2) historical growth rates for the water industry vary a great deal as do forecasted growth rates. For example, Southwest Water's 5-year historical earnings growth was negative 2.5 percent while the company's 10-year historical earnings growth was 8.0 percent.[47] A number of companies in the water industry, which has a relative small number of companies, are in flux and therefore their growth rates are very volatile. Therefore, even minor variations in methodology, timing, or sample composition drives the results which is not consistent with stable rate making.

C. The Samples and Results

1. The Water Utility Sample

Q79. EARLIER YOU SAID THAT THE SAMPLE OF WATER UTILITIES HAD SERIOUS DATA WEAKNESSES. PLEASE ELABORATE ON THESE WEAKNESSES.

A79. In attempting to apply the DCF model to the sample, six companies had no *Value Line* growth forecasts. The size of the companies in the water sample also makes cost-of-capital estimation difficult. Currently, only four companies have more than $500 million

[46] Table No. BV- 5 uses data as of May 18, 2009 and my testimony in Case No. 08-00134-UT used data as of May 8, 2008.

[47] See *Value Line Investment Survey*, Southwest Water, March 13, 2009.

in market value of equity. More important, however, is the fact that the stock of these companies trades relatively infrequently. Low trading volume causes concern because there may be a delay between the release of important information and the time that this information is reflected in prices. Such delay is well known to cause beta estimates to be statistically insignificant and possibly biased.

In addition to lack of data and the small size of the companies, there are firm-specific events that render the water utility sample less reliable than would be ideal. First, Aqua America (the largest of the companies) has gone through a large number of mergers and acquisitions in recent years. Normally, I would not include companies with significant merger or acquisition activity in a sample because the individual information about the progress of the proposed merger is so much more important for the determination of the company's stock price than day-to-day market fluctuations. In practice, beta estimates for such companies tend to be too low. The growth rates for such companies may also be affected. Second, Southwest Water Co. recently cut dividends, restated part of its financials and delayed the issuance of its 2008 10-K. As a result, the figures are likely less representative for a water utility's cost of capital. I therefore report my results for both the full sample and for a subsample of companies that excludes Southwest Water Co.[48]

It is because of these weaknesses in the water sample that I also utilize a sample of natural gas LDCs. However, I believe the comparability of the water utilities and the gas LDC companies is lower than it has been in the recent past because the gas LDC sample's systematic risk measures have diverted not only from those of water utilities but also from those of other utilities. The selection procedure for this sample was summarized earlier and details are provided in Appendix B.

[48] Further, Southwest Water Co. has an unusual negative growth rate and a very high beta.

2. Risk-Positioning Cost-of-Capital Estimates

Q80. HOW IS THIS SECTION OF YOUR TESTIMONY ORGANIZED?

A80. This section first describes the input data used in the CAPM and ECAPM models, then reports the resulting cost-of-equity estimates for the samples. The second section of Appendix C details the empirical analysis.

a) Interest Rate Estimate

Q81. HOW DID YOU DETERMINE THE EXPECTED RISK-FREE INTEREST RATE?

A81. I reviewed current constant maturity U.S. Government bond yield data available from the St. Louis Federal Reserve Bank. For the period April 27 to May 15, 2009, the average yield on long-term government bonds was 4.10 percent. To that figure I added 125 basis points in the baseline case as an adjustment for the increase in yield spread.[49] I note that in the sensitivity analyses, I reduce the adjustment for yield spread by 25 basis points for each 1 percent increase in the MRP. This intends to take into account the fact that bond betas may be positive and .25 is a conservative estimate hereof - - i.e., bond betas are likely to be lower, so that a .25 percent adjustment is in the upper end of the needed adjustment.

b) Betas and the Market Risk Premium

Q82. WHAT BETA ESTIMATES DID YOU USE IN YOUR ANALYSIS FOR THE SAMPLES?

A82. I rely upon the most recent betas estimated by *Value Line* for both the water sample and for the gas LDC sample.

Q83. ARE THE BETA VALUES REPORTED BY *VALUE LINE* ADJUSTED BETAS?

A83. Yes. *Value Line* reports betas that are adjusted towards one. For this proceeding, I reverse the *Value Line* adjustment for water utilities. This is intended to ensure my

[49] See Table No. BV-9.

estimates for the water sample are conservative.[50] *Value Line* and many investment firms adjust the estimated betas. This type of adjustment is intended to compensate for sampling errors in the beta estimation, not for the empirical fact that the CAPM tends to overestimate the sensitivity of the cost of capital to beta. For this proceeding I use unadjusted betas as I have previously for water and wastewater utilities and as reported *Value Line* estimates for the gas LDC sample.

Q84. PLEASE SUMMARIZE THE BETA ESTIMATES YOU RELY ON.

A84. After reversing the *Value Line* adjustment procedure, the average estimated *Value Line* beta for the water sample is about 0.70. The average of the *Value Line* betas for the gas LDC sample is about 0.68. These beta estimates are reported in Workpaper #1 to Tables No. BV-10 and BV-21.

Q85. PLEASE EXPLAIN THE METHOD TO ADJUST FOR DIFFERENCES IN CAPITAL STRUCTURE.

A85. Starting with the ATWACC, the cost of equity for any capital structure within a broad range of capital structures can be determined by the following formula:

$$\text{Return on equity} = \frac{\text{ATWACC} - \text{Return on debt} \times \%\ \text{debt in capital structure} \times (1 - \text{tax rate})}{\%\ \text{equity in capital structure}}$$

This is the calculation that is displayed in Tables No. BV-12 and BV-23.[51] The tables display the result of converting the sample average ATWACC to a return on equity for a specific capital structure. It is straightforward to use this method to determine the cost of equity consistent with the capital structure.

[50] In some prior proceedings I also reversed the gas LDC companies' beta estimates, but the sharp decline in these betas and the divergence from water utility betas indicate that unadjusted betas are too conservative as a measure of water utility risk.

[51] For companies that have preferred equity, an additional term equal to (Return on preferred equity × % preferred in capital structure) is subtracted from the numerator of this fraction.

c) Risk-Positioning Results

Q86. WHAT ARE THE COST-OF-EQUITY ESTIMATES DERIVED FROM THE RISK-POSITIONING APPROACH FOR THE WATER AND GAS LDC SAMPLE?

A86. Using the long-term interest rate in the two risk-positioning models (CAPM and ECAPM), with two values of the ECAPM parameter (0.5% and 1.5%), I obtain three estimates of each sample company's cost of equity (Tables No. BV-10 for the water sample and subsample and BV-21 for the gas LDC sample). The cost-of-equity estimates are combined with the estimates of the company's cost of debt and preferred to calculate the company's ATWACC (Tables No. BV-11 and BV-22). Tables No. BV-12 and BV-23 combine the sample average ATWACC with New Mexico-American Water's capital structure, cost of debt, and tax rate to obtain the cost of equity at New Mexico-American Water's 45 percent equity. Panel A of Table No. BV-12 shows the cost of equity and ATWACC value for all water sample companies, while Panel B shows the results for the subsample of companies without Southwest Water. Similar results for the gas LDC sample are shown in Table No. BV-23. The baseline cost-of-equity results are summarized below in Table 5 for the water sample and subsample and in Table 6 for the gas LDC sample.

Table 5. Baseline Cost-of-Equity Estimates for the Water Sample and Subsample

Regulatory Capital Structure:	*45.1% Equity / 0.0% Preferred / 54.9% Debt*				*Tax Rate: 38.45%*
	METHODS				
	RISK POSITIONING (using Long-Term Risk-Free Rate)			DCF	
Water Sample	CAPM	α = 0.5%	α = 1.5%	Simple	Multi-stage
Cost of Equity	12.8%	13.0%	13.5%	16.5%	11.6%
Average ATWACC	8.0%	8.1%	8.3%	9.6%	7.4%
Sub-Sample					
Cost of Equity	12.3%	12.6%	13.1%	16.5%	11.6%
Average ATWACC	7.8%	7.9%	8.1%	9.6%	7.4%

Risk Positioning Security Market Line Parameters:		Multi-Stage DCF Parameter:	
Long-Term			
Risk Free Rate Estimate:	5.35% (4.1% plus 1.25%)	GDP Growth Estimate:	4.9%
Estimated MRP:	6.5% .		

Sources and Notes:
For the Water Utility Sample, Risk Positioning data from Table No. BV-12 and DCF data from Table No. BV-8.

Table 6: Baseline Cost-of-Equity Estimates for the Gas LDC Sample

Regulatory Capital Structure:	*45.1% Equity / 0.0% Preferred / 54.9% Debt*				*38.45%*
	METHODS				
	RISK POSITIONING (using Long-Term Risk-Free Rate)			DCF	
Gas LDC Sample*	CAPM	α = 0.5%	α = 1.5%	Simple	Multi-stage
Cost of Equity	12.2%	12.5%	12.9%	12.2%	12.1%
Average ATWACC	7.7%	7.8%	8.0%	7.7%	7.7%

Risk Positioning Security Market Line Parameters:			
Long-Term			
Risk Free Rate Estimate:	5.4%	GDP Growth	
Estimated MRP:	6.5%	Estimate:	4.9%

Sources and Notes:
* For the Gas LDC Sample, Risk Positioning data from Table No. BV-23 and DCF data from Table No. BV-20.

Varying the MRP (risk-free rate) over the range 6.5 percent (5.35 percent) to 8.5 percent (4.85 percent), I obtain the estimated displayed in Tables 7-A, 7-B and 8 below.

Table 7-A. Water Sample: Summary of ROE by Adjusting Long-Term Risk-Free Rate and MRP

Estimated Return on Equity	Baseline [1]	Sensitivity Test 1 [2]	Sensitivity Test 2 [3]	Sensitivity Test 3 [4]
CAPM	12.8%	13.5%	13.8%	14.1%
ECAPM (α = 0.5%)	13.0%	13.7%	14.0%	14.4%
ECAPM (α = 1.5%)	13.5%	14.2%	14.5%	14.8%

Sources and Notes:
[1]: Long-term risk-free rate is 4.1% plus 1.25%,
MRP is 6.50%
[2]: Long-term risk-free rate is 4.1% plus 1.00%,
MRP is 6.50% plus 1.00%.
[3]: Long-term risk-free rate is 4.1% plus 0.875% basis points,
MRP is 6.50% plus 1.50%.
[4]: Long-term risk-free rate is 4.1% plus 0.75%,
MRP is 6.50% plus 2.00%.

Table 7-B. Water Subsample: Summary of ROE by Adjusting Long-Term Risk-Free Rate and MRP

Estimated Return on Equity	Baseline [1]	Sensitivity Test 1 [2]	Sensitivity Test 2 [3]	Sensitivity Test 3 [4]
CAPM	12.3%	12.9%	13.2%	13.5%
ECAPM (α = 0.5%)	12.6%	13.2%	13.5%	13.8%
ECAPM (α = 1.5%)	13.1%	13.7%	14.0%	14.3%

Sources and Notes:
[1]: Long-term risk-free rate is 4.1% plus 1.25%,
MRP is 6.50%
[2]: Long-term risk-free rate is 4.1% plus 1.00%,
MRP is 6.50% plus 1.00%.
[3]: Long-term risk-free rate is 4.1% plus 0.875% basis points,
MRP is 6.50% plus 1.50%.
[4]: Long-term risk-free rate is 4.1% plus 0.75%,
MRP is 6.50% plus 2.00%.

Table 8: Gas LDC Sample: Summary of ROE by Adjusting Long-Term Risk-Free Rate and MRP

Estimated Return on Equity	Baseline [1]	Sensitivity Test 1 [2]	Sensitivity Test 2 [3]	Sensitivity Test 3 [4]
CAPM	12.2%	12.8%	13.1%	13.4%
ECAPM (α = 0.5%)	12.5%	13.1%	13.4%	13.7%
ECAPM (α = 1.5%)	12.9%	13.5%	13.8%	14.1%

Sources and Notes:
[1]: Long-term risk-free rate is 4.1 plus 1.25%
MRP is 6.50%.
[2]: Long-term risk-free rate is 4.1% plus 1.00%,
MRP is 6.50% plus 1.00%.
[3]: Long-term risk-free rate is 4.1% plus 0.875% basis points,
MRP is 6.50% plus 1.50%.
[4]: Long-term risk-free rate is 4.1% plus 0.75%,
MRP is 6.50% plus 2.00%.

Q87. PLEASE SUMMARIZE YOUR FINDINGS FROM THE RISK-POSITIONING MODEL.

A87. Focusing on the middle ECAPM (α = .50%) for the long-term risk-positioning model, I find that the water subsample's cost of equity of about 12.6 percent for the baseline case and 13.2 percent if a modest adjustment of 1 percent is applied to the MRP. Looking at the gas LDC sample, the midpoint for the baseline scenario is very similar at 12.5 percent with an adjustment to the MRP of 1 percent resulting in 13.1 percent. However, it is more correct to say that the water subsample and the gas LDC sample indicate a range of 12 to 13 percent if I look at the Baseline scenario. I do not report results from the short-term model in this proceeding as the Treasury bill rate has been driven to zero. This is consistent with, for example, a recent decision by the Surface Transportation Board that decided to rely on the CAPM using 20-year Treasury bonds for the risk-free rate, 5-year weekly beta estimates, and Ibbotson's reported long-term market risk premium when determining railroads' cost of equity.[52]

The best point estimate for the risk positioning model for both the water subsample and the gas LDC sample is 12½ percent in the baseline case with a range of 12 to above 13

[52] *STB Ex Parte No. 664*, Issued January 17, 2008.

percent. I discuss the assessment of New Mexico-American Water's cost of equity in the concluding section.

3. The DCF Cost-of-Capital Estimates

Q88. WHAT STEPS DO YOU TAKE IN YOUR DCF ANALYSES?

A88. Given the above discussion of DCF principles, the steps are to collect the data, estimate the sample companies' costs of equity at their current capital structures, and then to adjust the sample's estimates to New Mexico-American Water's 45 percent equity ratio.

a) Growth Rates

Q89. WHAT GROWTH RATE INFORMATION DO YOU USE?

A89. For reasons discussed above and in Appendix D, historical growth rates today are not as relevant as forecasts of current investor expectations for these samples. I therefore use rates forecast by security analysts.

The ideal in a DCF application would be a detailed forecast of future dividends, year by year well into the future until a true steady state (constant) dividend growth rate was reached, based on a large sample of investment analysts' expectations. I know of no source of such data. Dividends are ultimately paid from earnings, however, and earnings forecasts from a number of analysts are available for a few years. Investors do not expect dividends to grow in lockstep with earnings, but for companies for which the DCF approach can be used reliably (*i.e.*, for relatively stable companies whose prices do not include the option-like values described in Appendix D), they do expect dividends to track earnings over the long-run. Thus, use of earnings growth rates as a proxy for expectations of dividend growth rates is a common practice.

Accordingly, the first step in my DCF analysis is to examine a sample of investment analysts' forecast earnings growth rates from Bloomberg and *Value Line* to the degree such forecasts are available. The details are in Appendix D. At present, *Value Line* data run through the 2012-2014 horizon, representing an average of about four years from the current earning forecasts available for 2009. Bloomberg also provides a long-term

earnings growth rate estimate. The longest-horizon forecasted growth rates from these sources underlie the simple DCF model (*i.e.*, the standard perpetual-growth model associated with the "DCF formula," dividend yield plus growth). Unfortunately, the longest growth forecast data only go out four to five years, which is too short a period to make the DCF model completely reliable.

b) Dividend and Price Inputs

Q90. WHAT VALUES DO YOU USE FOR DIVIDENDS AND STOCK PRICES?

A90. Dividends are either for the first or the second quarter of 2009, depending on the most recent dividend information available at the time of estimation for each company.[53] This dividend is grown at the estimated growth rate and divided by the price described below to estimate the dividend yield for the simple DCF model.

Stock prices are an average of closing stock prices for the 15-day trading period ending on the day the BEst forecast was obtained from Bloomberg. A 15-day stock price average is used to guard against anomalous price changes in any single day.

c) DCF Results

Q91. WHAT ARE THE DCF ESTIMATES FOR THE SAMPLES?

A91. The data are used in the two versions of the DCF method to get sample company estimates at the sample company's capital structure. The resulting cost of equity at New Mexico-American Water's 45 percent equity estimates are shown in Table 5 above. There is a very large difference between the simple and multi-stage DCF results for the water sample (16.5 versus 11.6 percent), confirming the conclusion drawn above that the water industry is not in a stable equilibrium. As a result, DCF results from the water sample are unreliable, and I therefore do not put any weight on them in arriving at my final estimate. However, for the gas LDC sample both DCF models yields very similar results (12.2 and 12.1 percent), suggesting that the gas LDC sample is indeed more homogeneous than the water sample at this time. In addition, DCF estimates for the gas LDC sample are not too different from risk-positioning results, albeit on average a bit

lower than them. It is noteworthy that the DCF estimates have increased since I last filed testimony in this jurisdiction. This confirms that the cost of capital has increased for the gas LDC and water samples.

V. NEW MEXICO-AMERICAN WATER'S COST OF EQUITY

Q92. WHAT CONCLUSIONS DO YOU DRAW FROM THE ABOVE DATA REGARDING EACH SAMPLE'S COST OF EQUITY AT NEW MEXICO-AMERICAN WATER'S 45 PERCENT EQUITY RATIO?

A92. For the gas LDC sample, the estimated costs of equity from the risk-positioning model and from the DCF model are reasonably in line. For the water sample subsample, estimates vary significantly between different methods, and the DCF results are particularly variable. Although I do not rely upon the DCF model results for the water sample or subsample, I believe that DCF cost-of-capital estimates from the gas LDC sample provide a useful check on the risk-positioning results. The relative consistency of the multi-stage DCF and the risk-positioning cost-of-equity estimates for the gas LDC sample indicate that those estimates are reasonable.

Q93. DO YOU HAVE ANY COMMENTS REGARDING THE RESULTS OF THE RISK-POSITIONING MODELS?

A93. The estimated cost of equity displayed in Panel B of Table No. BV-12 for the water subsample is higher than the estimates in Table No. BV-23 for the gas LDC sample. The risk-positioning results are summarized above in Tables 5 and 6 with sensitivity analyses presented in Tables 7 and 8. The CAPM values deserve the least weight, because this method does not adjust for the empirical finding that the cost of capital is less sensitive to beta than predicted by the CAPM (which my testimony considers by using the ECAPM). Conversely, the ECAPM numbers deserve the most weight, because this method adjusts for the empirical findings. Based on the facts discussed in *Section III* as well as the increase in DCF estimates for both samples, it is clear that the cost of capital has increased over the last year. It is more difficult to assess exactly by how much.

[53] The dividend information was obtained from Bloomberg.

Therefore, I rely primarily on my baseline estimates for the water subsample and the gas LDC sample, which provide a conservative estimate of the cost of capital for New Mexico-American Water.

Q94. BASED ON THE EVIDENCE WHAT IS YOUR CONCLUSION REGARDING NEW MEXICO-AMERICAN WATER'S REQUESTED 12.25 PERCENT RETURN ON EQUITY?

A94. Based on the results from my cost-of-capital estimation procedures, I conclude that 12.25 percent return on equity is very reasonable and a conservative request. It is lower than the midpoint of the gas LDC sample and the water subsample's risk positioning estimate using the baseline scenario and within the range estimated by the DCF models. Therefore, I believe it is a reasonable and conservative request in the current environment.

Q95. DOES THIS CONCLUDE YOUR TESTIMONY?

A95. Yes.

BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION

IN THE MATTER OF THE PETITION BY NEW MEXICO-AMERICAN WATER COMPANY, INC. FOR ADJUSTMENT OF WATER RATES FOR ITS EDGEWOOD DISTRICT,

Case No. 09-00156-UT

NEW MEXICO-AMERICAN WATER COMPANY, INC., Petitioner.

AFFIDAVIT OF BENTE VILLADSEN

COMMONWEALTH OF MASSACHUSETTS)
) ss.
COUNTY OF MIDDLESEX)

I, BENTE VILLADSEN, being first duly sworn, depose and state that the foregoing Direct Testimony of Bente Villadsen constitutes my prepared direct testimony in this proceeding, my answers to the questions posed therein are true and correct to the best of my knowledge, information and belief, and the exhibits and schedules attached thereto were prepared or compiled by me or under my direction and supervision.

Date: July 22, 2009

B. Villadsen
BENTE VILLADSEN

SUBSCRIBED AND SWORN TO before me this 22nd day of July, 2009.

Marjorie J. Fischer
Notary Public

My Commission Expires: November 7, 2014.

MARJORIE J. FISCHER
Notary Public
COMMONWEALTH OF MASSACHUSETTS
My Commission Expires
November 7, 2014

APPENDIX A

RESUME OF BENTE VILLADSEN

Bente Villadsen's work concentrates in the areas of regulatory finance and accounting. Her recent work has focused cost of capital, credit issues in the utility industry as well the impact of regulatory initiatives such as energy efficiency and de-coupling. Other recent work has included damage estimation, accounting disclosure and principles including impairment testing, leases, mark-to-market accounting, accounting for hybrid securities, accounting for equity investments, cash flow estimation as well as overhead allocation. She has filed testimony and testified before state and federal regulatory commissions as well in international and U.S. arbitration matters, and in federal and district court. Her testimonies and expert reports pertain to cost of capital for regulated entities, discount rates, accounting issues, tax matters, and damages.

Dr. Villadsen holds a Ph.D. from Yale University's School of Management with a concentration in accounting. She has a joint degree in mathematics and economics (BS and MS) from University of Aarhus in Denmark. Prior to joining *The Brattle Group*, she was a Professor of Accounting at the University of Iowa, University of Michigan, and at Washington University in St. Louis where she taught financial and cost accounting. Dr. Villadsen also worked as a consultant for Risoe National Laboratories in Denmark.

REPRESENTATIVE EXPERIENCE

ENERGY AND PUBLIC UTILITY FINANCE

- Dr. Villadsen has filed several cost of capital testimonies and appeared at hearings for water and wastewater utilities in connection with rate hearings before state regulatory commissions.

- In a matter before Bonneville Power Administration, Dr. Villadsen filed expert testimony on cost of capital for electric utilities and the appropriate discount rate to apply to a government entity's cash flows.

- She has considerable experience in estimating the cost of capital for major U.S. and Canadian utilities, pipelines, and railroads. The work has been used in connection with the companies' rate hearings before the Federal Energy Regulatory Commission, the Canadian National Energy Board, the Surface Transportation Board, and state and provincial regulatory bodies. The work has been performed for pipelines, integrated electric utilities, non-integrated electric utilities, gas distribution companies, water utilities, railroads and other parties.

- In connection with rate hearings for electric utilities, Dr. Villadsen has estimated the impact of power purchase agreements on the company's credit ratings and calculated appropriate compensation for utilities that sign such agreements to fulfill, for example, renewable energy requirements.

- Dr. Villadsen has been part of a team assessing the impact of conservation initiatives, energy efficiency, and decoupling of volumes and revenues on electric utilities financial performance. Specifically, she has estimated the impact of specific regulatory proposals on the affected utilities earnings and cash flow.

- For a large integrated utility in the U.S., Dr. Villadsen participated in all aspects of the company's rate filing, including the company's cost of capital, incentive based rates, and certain regulatory accounting issues.

- Dr. Villadsen has been involved in several projects evaluating the impact of credit ratings on electric utilities. She was part of a team evaluating the impact of accounting fraud on an energy company's credit rating and assessing the company's credit rating but-for the accounting fraud.

- For a large electric utility, Dr. Villadsen modeled cash flows and analyzed its financing decisions to determine the degree to which the company was in financial distress as a consequence of long-term energy contracts.

- For a large electric utility without generation assets, Dr. Villadsen assisted in the assessment of the risk added from offering its customers a price protection plan and being the provider of last resort (POLR).

ACCOUNTING AND **CORPORATE FINANCE**

- On behalf of a taxpayer, Dr. Villadsen recently testified in federal court on the impact of discount rates on the economic value of alternative scenarios in a lease transaction.

- In an arbitration matter before the International Centre for Settlement of Investment Disputes, she testified on the allocation of corporate overhead costs and damages in the form of lost profit.

- Dr. Villadsen provided expert reports and testimony in an international arbitration under the International Chamber of Commerce on the proper application of US GAAP in determining shareholders' equity. Among other accounting issues, she testified on impairment of long-lived assets, lease accounting, the equity method of accounting, and the measurement of investing activities.

- In an arbitration matter before the American Arbitration Association, she provided expert reports on the equity method of accounting, the classification of debt versus equity and the distinction between categories of liabilities in a contract dispute between two major oil companies.

- In U.S. District Court, Dr. Villadsen filed testimony regarding the information required to determine accounting income losses associated with a breach of contract and cash flow modeling.

- She has worked extensively on litigation matters involving the proper application of mark-to-market and derivative accounting in the energy industry. The work relates to the proper valuation of energy contracts, the application of accounting principles, and disclosure requirements regarding derivatives.

- Dr. Villadsen evaluated the accounting practices of a mortgage lender and the mortgage industry to assess the information available to the market and ESOP plan administrators prior to the company's filing for bankruptcy. A large part of the work consisted of comparing the company's and the industry's implementation of gain-of-sale accounting.

- Dr. Villadsen evaluated the performance of segments of regulated entities. She also reviewed and evaluated the methods used for overhead allocation.

- For a large multi-national company, Dr. Villadsen estimated the cost of capital for the company's segments. As part of the assignment, she evaluated the company's decision methods and assessed the country-specific investment risk of projects under consideration.

- She has worked on accounting issues in connection with several tax matters. The focus of her work has been the application of accounting principles to evaluate intra-company transactions, the accounting treatment of security sales, and the classification of debt and equity instruments.

- Dr. Villadsen has modeled the cash flows of several companies to estimate the impact of specific (energy) contracts or to determine the impact of specific loans.

- She assisted in the estimation of net worth of individual segments for firms in the consumer product industry. Further, she built a model to analyze the segment's vulnerability to additional fixed costs and its risk of bankruptcy.

- For a large integrated oil company, Dr. Villadsen estimated the company's cost of capital and assisted in the analysis of the company's accounting and market performance.

- In connection with commercial litigation, Dr. Villadsen estimated the cost of capital for companies in the chemical industry and for companies in the cement industry.

RECENT PUBLICATIONS

"Understanding Debt Imputation Issues," (with Michael J. Vilbert and Joe Wharton and *The Brattle Group* listed as an author), *Edison Electric Institute*, June 2008.

"Building Sustainable Efficiency Businesses: Volume I – Approaches and Models," (with Joe Wharton and Peter Fox-Penner, and with "*The Brattle Group*" listed as author), *Edison Electric Institute*, forthcoming, Spring 2008.

"Measuring Return on Equity Correctly: Why current estimation models set allowed ROE too low," *Public Utilities Fortnightly*, August 2005 (with A. Lawrence Kolbe and Michael J. Vilbert).

"The Effect of Debt on the Cost of Equity in a Regulatory Setting," (with A. Lawrence Kolbe and Michael J. Vilbert, and with "*The Brattle Group*" listed as author), *Edison Electric Institute*, April 2005.

"Communication and Delegation in Collusive Agencies," *Journal of Accounting and Economics*, Vol. 19, 1995.

"Beta Distributed Market Shares in a Spatial Model with an Application to the Market for Audit Services" (with M. Hviid), *Review of Industrial Organization*, Vol. 10, 1995.

REPRESENTATIVE PRESENTATIONS

"Subprime Mortgage-Related Litigation: What to Look for and Where to Look," *Law Seminars International: Damages in Securities Litigation*, Boston, May 2008.

"Evaluating Alternative Business / Inventive Models," (with Joe Wharton). *EEI Workshop, Making a Business of Energy Efficiency: Sustainable Business Models for Utilities*, Washington DC, December 2007.

"Deferred Income Taxes and IRS's NOPR: Who should benefit?", *NASUCA Annual Meeting*, Anaheim, CA, November 2007.

"Current Issues in Cost of Capital," (with M.J. Vilbert). *EEI Electric Rates Advanced Course*, Madison, 2005.

"Issues for Cost of Capital Estimation," (with M.J. Vilbert). *EEI Cost of Capital Conference*, Chicago, 2004.

"Discussion of 'Are Performance Measures Other Than Price Important to CEO Incentives?'" *Annual Meeting of the American Accounting Association*, 2000.

"Contracting and Income Smoothing in an Infinite Agency Model: A Computational Approach," (with R.T. Boylan) *Business and Management Assurance Services Conference*, Austin 2000.

TESTIMONY

Direct Testimony on cost of capital before the Arizona Corporation Commission on behalf of Arizona-American Water in Docket No. W-01303A-09-0343, July 2009.

Rebuttal Expert Report, Deposition, and Oral Testimony re. the impact of alternative discount rate assumptions in tax litigation. United States Court of Federal Claims, Case No. 06-628 T, January, February 2009. (*Confidential*)

Direct Testimony, Rebuttal Testimony and Hearing Appearance on cost of capital before the New Mexico Public Regulation Commission on behalf of New Mexico-American Water in Docket No. 08-00134-UT, June 2008 and January 2009.

Direct Testimony on cost of capital and carrying charge on damages, U.S. Department of Energy, Bonneville Power Administration, BPA Docket No. WP-07, March 2008.

Direct Testimony, Rebuttal Testimony, Rejoinder Testimony and Hearing Appearance on cost of capital before the Arizona Corporation Commission on behalf of Arizona-American Water in Docket No. W-01303A-08-0227, April 2008, February 2009, March 2009.

Expert Report, Supplemental Expert Report, and Hearing Appearance on the allocation of corporate overhead and damages from lost profit. The International Centre for the Settlement of Investment Disputes, Case No. ARB/03/29, February, April, and June 2008 (*Confidential*).

Expert Report on accounting information needed to assess income. United States District Court for the District of Maryland (Baltimore Division), Civil No. 1:06cv02046-JFM, June 2007 (*Confidential*)

Expert Report, Rebuttal Expert Report, and Hearing Appearance regarding investing activities, impairment of assets, leases, shareholder' equity under U.S. GAAP and valuation. International Chamber of Commerce (ICC), Case No. 14144/CCO, May 2007, August 2007, September 2007. (Joint with Carlos Lapuerta, *Confidential*)

Direct Testimony, Rebuttal Testimony, and Hearing Appearance on cost of capital before the Arizona Corporation Commission on behalf of Arizona-American Water in Docket No. W-01303A-06-0491, July 2006, July 2007.

Direct Testimony, Rebuttal Testimony, Rejoinder Testimony, Supplemental Rejoinder Testimony and Hearing Appearance on cost of capital before the Arizona Corporation Commission on behalf of Arizona-American Water in Docket No. W-01303A-06-0403, June 2006, April 2007, May 2007.

Direct Testimony, Rebuttal Testimony, Rejoinder Testimony, and Hearing Appearance on cost of capital before the Arizona Corporation Commission on behalf of Arizona-American Water in Docket No. W-01303A-06-0014, January 2006, October 2006, November 2006.

Expert report, rebuttal expert report, and deposition on behalf of a major oil company regarding the equity method of accounting and classification of debt and equity, August 2004 and November 2004. (*Confidential*).

APPENDIX B

SELECTING THE WATER AND GAS LDC SAMPLES AND THE USE OF MARKET VALUES

I. SAMPLE SELECTION AND THE CHARACTERISTICS OF EACH SAMPLE 2

A. THE WATER SAMPLE 2

B. THE GAS LOCAL DISTRIBUTION COMPANIES SAMPLE 4

II. MARKET VALUE CAPITAL STRUCTURE, COSTS OF DEBT & COSTS OF PREFERRED EQUITY 7

I. SAMPLE SELECTION AND THE CHARACTERISTICS OF EACH SAMPLE

A. The Water Sample

Q1. How did you select your sample of water utilities?

A1. The goal was to create a sample of companies whose primary business is as a regulated water utility with business risk generally similar to that of New Mexico-American Water. To construct this sample, I started with the universe of water utility companies listed by *Value Line Investment Survey - Plus Edition*. I then eliminated Sun Hydraulics because, although listed as a water utility, its operations consist mainly of producing industrial equipment.[1] I also eliminated American Water Works as it only started trading in 2008 and therefore insufficient data available for *Value Line* to estimate its beta or other key figures.[2]

Usually, I apply several additional selection criteria to eliminate companies with unique circumstances that may affect the cost of capital estimates. For example, I normally eliminate companies with annual revenues lower than $300 million in 2008,[3] no or low bond ratings, lack of growth estimates or Bloomberg data, and all companies with announced dividend cuts or that were involved in significant merger activity over the last five years (2004 to today). However, applying these procedures to the nine water utilities followed by *Value Line* would eliminate several companies from a sample that is already limited. I therefore try to balance stringent selection criteria against the need to have a reasonable sample size. This results in the use of all nine companies to form a full sample, as well as the use of eight companies to form a subsample. The nine regulated companies that form the full sample of water utilities are American States Water Co., Aqua America Inc., California Water Service Group, Connecticut Water Service Inc.,

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[1] According to the company's webpage (www.sunhydraulics.com), it develops and manufactures valves and manifolds. Bloomberg lists it as part of its "metal fabricate/hardware" industry group.

[2] See *Value Line Investment Survey*, American Water, April 24, 2009.

[3] Table No. BV-2 and its associated workpapers report the share of regulated assets in 2008 for these companies. (Table No. BV-1 provides an index to the other tables.)

Middlesex Water Co., Pennichuck Corp., SJW Corp., Southwest Water Co., and York Water Co. I eliminate Southwest Water from the subsample because the company recently cut dividend, restated parts of its 2006-07 financials and delayed filing its 2008 10-K with the Securities and Exchange Commission ("SEC"). Therefore, its use may bias the cost of capital estimation.[4]

Q2. Why do you usually eliminate companies currently involved in a merger from your samples?

A2. The stock prices of companies involved in mergers are often more affected by news relating to the merger than by movements in the stock market. In other words, the stock price "decouples" from its normal relationship to the stock market (the economy) which is the basis upon which a company's relative risk is calculated. Instead the stock price of a merger candidate is more affected by the latest speculation on the terms and probability of the merger.

Q3. What are some of the water sample's data problems?

A3. First, of the nine water utilities with sufficient data for analysis that *Value Line* follows, four companies (Connecticut Water, Middlesex Water, Pennichuck, and York Water) have 2008 revenues below $100 million. The stocks of small companies frequently exhibit "thin trading" which means that their stock trades infrequently. Indeed, during the period January 2007 through June 3, 2009, two companies (Pennichuck Corp., and York Water Co.) traded an average of less than 20,000 shares per trading day with York Water trading less than 0.15 percent of its shares outstanding. By contrast, each of the gas LDC sample companies had an average trading volume of at least 160,000 shares per day, which in percentage terms represented more than 0.55 percent of shares outstanding for each company. Greater trading volume gives the expert more confidence in estimates relying on market data since there is less likelihood of a delay between the release of important information and the time that this information is reflected in prices.

[4] At the time the testimony was prepared, Southwest Water had not filed its 2008 10-K. Further, Southwest Water has a negative growth rate which could not be sustained forever and which would lead to a negative

Second, six companies lack long-term earnings forecasts from *Value Line*, and three companies lacks a BEst growth rate forecasts. In addition, the existing growth rates estimates are highly variable, ranging from a low of -6.0 percent to a high of 15 percent. Such highly variable growth rates are not indicative of an industry that is stable and cast doubt on the applicability of the DCF model to this industry at this time.

Third, individual companies in the sample have unique characteristics. For example, the "aggressive acquisition strategy" of Aqua America[5] has impacted the market perception and hence risk measures of the company. Similarly, Southwest Water's recent dividend cut, revisions to prior financial statements and delay in filing its 2008 financial report likely has impacted its stock price, growth rate, and systematic risk.[6]

These factors may all potentially affect the cost of equity estimates in ways not completely predictable. This is especially true for the DCF estimates which rely exclusively on current data, so that recent events impact the measurement 100 percent. Because of the data problems and the lack of a large number of publicly traded water utilities, I include all publicly traded companies with sufficient data in the full sample but also create a subsample without Southwest Water.

B. The Gas Local Distribution Companies Sample

Q4. How do you select your gas local distribution company sample?

A4. To select this sample, I started with the universe of publicly traded natural gas utilities covered by *Value Line Investment Survey – Plus Edition*.[7] This resulted in an initial group of 18 companies that are followed by *Value Line*. I then eliminated companies by applying additional selection criteria designed to eliminate companies with unique circumstances which may bias the cost of capital estimates.

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cost of capital. At the same time, *Value Line* estimates a beta above one for Southwest Water indicating a higher than average cost of capital.

[5] *Value Line Investment Survey*, Water Utility Industry, April 24, 2009.

[6] *Value Line Investment Survey*, Southwest Water Co., April 24, 2009.

[7] *Value Line Investment Survey*, Plus Edition, March 13, 2009.

Q5. What are the selection criteria you applied?

A5. I eliminated all companies whose regulated assets are not greater than 50 percent of their total assets as reported in each company's 2008 10-K form, because one goal for this sample was for the companies to be primarily engaged in regulated activities. I also eliminated companies whose bond rating was less than BBB- as rated by S&P, and companies that had a large merger during the period May 2004 to May 2009.[8] Merger activity is obtained from Bloomberg, which provides a history of past acquisitions and divestitures for each company, and also the size of each transaction, if such information is available.[9] To guard against measurement bias caused by "thin trading,"[10] I also restricted the sample to companies with total operating revenues greater than $300 million in 2008.

Finally, I required that the companies have historical data available from Bloomberg and that they had no dividend cuts or restatement of financial statements in the past five years, since this can be signs of financial distress.

The final sample consists of eleven gas LDC companies: AGL Resources Inc., Atmos Energy Corp., Laclede Group Inc., New Jersey Resources, Nicor Inc., NiSource Inc., Northwest Natural Gas Co., Piedmont Natural Gas Co., South Jersey Industries Inc., Southwest Gas Corp., and WGL Holdings Inc.[11]

Q6. What companies did you eliminate before arriving at the final sample?

A6. First, I eliminated three companies for a combination of having no or a non-investment grade bond rating and revenues below $300 million (Chesapeake Utilities Corp., Energy

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[8] One company included in the sample (Atmos Energy Corp.) did undertake an acquisition in 2004. The merger was announced in June 2004 and completed October 1, 2004, so the announcement date is very close to the cut-off data. I therefore decided to keep the company in the sample. See, *Kansas City Business Journal*, "Atmos, TXU Gas will merge," June 17, 2004 and *Dallas Business Journal*, "Atmos, TXU close on gas transaction," October 1, 2004.

[9] For purposes of sample selection, a sizeable merger is defined to be one which would exceed 30 percent of the total capitalization of the company at the time of the merger announcement.

[10] As noted above, all the gas LDC companies that I include have traded in excess of 160,000 shares per day on average since 2007.

[11] NiSource is a relative new addition to *Value Line Investment Survey*.

West Inc., and RGC Resources Inc.), one company for not having a bond rating (UGI Corp.), and three companies were eliminated due to the lack of a bond rating or a below investment bond rating and for being primarily involved in the sale of propane or heating oil (Amerigas Partners LP, Ferrellgas Partners LP, and Star Gas Partners LP).

Q7. Please compare the characteristics of the water utility sample and the gas LDC sample.

A7. Both samples consist of companies with substantial capital investments in distribution networks and support facilities. Also, companies in both samples earn a large percentage of their revenue from regulated activities and serve a mix of residential, industrial, and other customers. The water subsample excludes Southwest Water which recently cut dividends and as of May 25, 2009 had yet to file its 2009 form 10-K. All nine companies in the water sample had at least 80 percent regulated assets. Among the gas LDC companies, only one company had less than 2/3 of its assets devoted to regulated activities and the average percentage was about 85 percent. (See Tables No. BV-2 and Table No. BV-14). All companies in the water utility sample and the gas LDC sample are regulated by one or more states.

Q8. What do you conclude from the comparison of the water utility and the gas LDC samples?

A8. Water and wastewater utilities like gas LDC companies are state regulated entities that invest in pipes, mains, and storage facilities. In addition, both industries face substantial infrastructure investments going forward, so aspects of their operations are very similar. However, gas LDC companies only rarely develop their commodity (gas), water utilities usually do. Looking at stock market perceptions, gas LDCs have seen their beta measure decline in recent months while water utilities generally have experienced little movement in their beta measure. Therefore, it appears that capital markets' viewed the two utility industries a bit differently during the financial crisis. I continue to believe that gas LDC companies constitute a good second sample to assess the cost of capital for water utilities.

II. MARKET VALUE CAPITAL STRUCTURE, COSTS OF DEBT & COSTS OF PREFERRED EQUITY

Q9. What capital structure information do you require?

A9. For reasons discussed in my written evidence and explained in detail in Appendix E, explicit evaluation of the market-value capital structures of the sample companies versus the capital structure used for rate making is vital for a correct interpretation of the market evidence. This requires estimates of the market values of common and preferred equity and debt, and the current market costs of preferred equity and debt.

Q10. How do you calculate the market-value capital structures of the sample companies?

A10. I estimate the capital structure for each company by estimating the market values of common equity, preferred equity and debt from publicly available data. The calculations are in Panels A to I of Table No. BV-3 and Panels A to K of Table No. BV-15 for the water and gas LDC sample, respectively.

The market value of equity is straightforward: the price per share times the number of shares outstanding. The market value of preferred equity is set equal to its book value because the portion of the capital structure financed with preferred equity is generally small. The market value of debt is estimated at the book value of debt reported by Bloomberg plus or minus the difference in the estimated fair (market) value and book value of long-term debt as reported in the companies' 10-Ks or annual reports.[12]

For purposes of assessing financial risk to common shareholders, I add an adjustment for short-term debt to the debt portion of the capital structure. This adjustment is used only for those companies whose short-term (current) liabilities exceed their short-term (current) assets. I add an amount equal to the minimum of the difference between short-term liabilities and short-term assets or the amount of short-term debt. The reason for

[12] See Panels A through I in Table No. BV-3 and Panels A through K in Table BV-15 for details. The adjustment relies on the difference between the companies' self-reported fair value of long-term debt and the carrying value of the same line items. This information was obtained from the sample companies' annual reports.

this adjustment is to recognize that when current liabilities exceed current assets, a portion of the company's long-term assets are being financed, in effect, by short-term debt.

The market value capital structure is calculated to be consistent with the time period over which the cost of capital is estimated for each sample. The capital structure is determined over the historical period over which the relevant risk positioning parameters were determined and as of the date analysts provide forward looking growth forecasts. Therefore, Tables No. BV-3 and BV-15 report the market value capital structure at year end for the years ending 2004 – 2008.[13] The output of each of these tables is the market equity-to-value, debt-to-value, and preferred equity-to-value ratios. The overall cost of capital calculation for the risk positioning estimates rely on the average of the market value capital structure computed for the years 2004 through 2008, as shown in Tables No. BV-4 and BV-16, respectively. The results in columns [1]-[3] are used in the DCF model calculations, while columns [4]-[6] are for the risk positioning models.

Q11. How do you estimate the current market cost of preferred equity?

A11. For companies with preferred equity, the cost of preferred equity for each company was set equal to the yield on an index of preferred stock as reported in the *Mergent Bond Record* corresponding to the S&P rating of that company's debt. The yields from *Mergent Bond Record* were as of April 2009. In general, the average amount of preferred equity in the sample companies' capital structures is very small and zero for most companies. No company in either sample has more than one percent preferred equity (see Tables BV-4 and BV-16).

Q12. How do you estimate the current market cost of debt?

A12. The market cost of debt for each company in the DCF analysis is the current yield reported by Bloomberg for a public utility company bond corresponding to the sample company's current debt rating as classified by S&P. The risk positioning analysis, on the

[13] For Southwest Water 2008 data that are obtained from the form 10-K were set equal to 2007 data, as the company has yet to file its 2008 form 10-K.

other hand, uses the current yield of a utility bond that corresponds to the five-year average debt rating of each company so as to match consistently the horizon of information used by *Value Line* to estimate company betas. The current S&P debt ratings were obtained from Bloomberg.[14]

The yield on Moody's A-rated Utility bonds was 6.49 percent as of May 15, 2009, and 7.80 percent on Moody's BBB-rated Utility bonds. (See Panel A of Workpaper #2 to Table No. BV-11 for the yields on utility bonds and preferred stock by credit rating.) Based on information from the Company, the corporate tax rate was set at 38.45 percent. Calculation of the after-tax cost of debt uses the tax rate 38.45 percent.

[14] Debt ratings were not available for Pennichuck Corp., SJW Corp, and Southwest Water Co.'s. I assumed a rating in the A category (A+, A, or A-), which is the same as that of all other water utilities in the sample.

APPENDIX C

RISK POSITIONING METHODOLOGY AND EMPIRICAL RESULTS

I. EQUITY RISK PREMIUM METHODOLOGY 2

A. THE BASIC EQUITY RISK PREMIUM MODEL 2
B. MARKET RISK PREMIUM 3
C. RELATIVE RISK 14
D. INTEREST RATE ESTIMATE 17
E. COST OF CAPITAL MODELS 18

II. EMPIRICAL EQUITY RISK PREMIUM RESULTS 20

A. RISK-FREE INTEREST RATE 20
B. BETAS AND THE MARKET RISK PREMIUM 21
1. Beta Estimation Procedures 21
2. Market Risk Premium Estimation 22
C. COST OF CAPITAL ESTIMATES 22

Q1. What is the purpose of this appendix?

A1. This appendix reviews the principles behind the risk positioning methodologies, describes the estimation of the parameters used in the models, and details the cost of capital estimates obtained from these methodologies. This appendix intentionally repeats portions of my direct testimony, because I want the reader to be able to have a full discussion of the issues addressed here, rather than having to continually turn back to the corresponding section of the testimony.

I. EQUITY RISK PREMIUM METHODOLOGY

Q2. How is this section of the appendix organized?

A2. It first reviews the basic nature of the equity risk premium approach. It then discusses the individual components of the model: the risk premium, the relative risk of the company or line of business in question, the appropriate interest rate, and the combination of these elements in a particular equity risk premium model.

A. THE BASIC EQUITY RISK PREMIUM MODEL

Q3. How does the equity risk premium model work?

A3. The equity risk premium approach estimates the cost of equity as the sum of a current interest rate and a risk premium. (It therefore is sometimes also known as the "risk premium" or the "risk positioning" approach.)

This approach may sometimes be applied informally. For example, an analyst or a commission may check the spread between interest rates and what is believed to be a reasonable estimate of the cost of capital at one time, and then apply that spread to changed interest rates to get a new estimate of the cost of capital at another time.

More formal applications of the equity risk premium method implement theoretical finance models of cost of capital. They use information on all securities to identify the security market line (Figure 1 in the body of the testimony) and derive the cost of capital

for the individual security based on that security's relative risk. This equity risk premium approach is widely used and underlies most of the current scholarly research on the nature, determinants and magnitude of the cost of capital.

Q4. How are "more formal applications" put into practice?

A4. The essential benchmarks that determine the security market line are the risk-free interest rate and the premium that a security of average risk commands over the risk-free rate. This premium is commonly referred to as the "market risk premium" ("MRP"), i.e., the excess of the expected return on the average common stock over the risk-free interest rate. In the equity risk premium approach the risk-free interest rate and MRP are common to all securities. A security-specific measure of relative risk (beta) is estimated separately and combined with the MRP to obtain the company-specific risk premium.

In principle, there may be more than one factor affecting the expected stock return, each with its own security-specific measure of relative risk and its own benchmark risk premium. For example, the "arbitrage pricing theory" and other "multi-factor" models have been proposed in the academic literature. These models estimate the cost of capital as the sum of a risk-free rate and several security-specific risk premia. However, none of these alternative models has emerged in practice as "the" improvement to use instead of the original, single-factor model. I use the traditional single-factor model in this testimony.

Accordingly, the required elements in my formal equity risk premium approach are the market risk premium, an objective measure of relative risk, the risk-free rate that corresponds to the measure of the market risk premium, and a specific method to combine these elements into an estimate of the cost of capital.

B. Market Risk Premium

Q5. Why is a risk premium necessary?

A5. Experience (e.g., the ongoing financial crisis and the U.S. market's October Crash of 1987) demonstrates that shareholders, even well diversified shareholders, are exposed to

enormous risks. By investing in stocks instead of risk-free Government bills, investors subject themselves not only to the risk of earning a return well below what they expected in any year but also to the risk that they might lose much of their initial capital. This is why investors demand a risk premium.

Because short-term risk-free rates currently are influenced substantially by monetary policy, I estimate only a long-term version of the Capital Asset Pricing Model ("CAPM") for this proceeding. This version of the CAPM measures the market risk premium as the risk premium of average risk common stocks over the long-term risk-free rate. The use of the long-term version of the CAPM is common regulatory practice.

Q6. Please discuss some of the issues involved in selecting the appropriate MRP.

A6. To determine the cost of capital in a regulatory proceeding, the MRP should be used with an estimate of the same interest rate used to calculate the MRP (i.e., the short-term Treasury bill rate or the long-term Government rate). For example, it would be inconsistent to utilize a short-term risk-free with an estimate of the MRP derived from comparisons to long-term interest rates. In addition, the appropriate measure of the MRP should be based upon the arithmetic mean not the geometric mean return.[1] The arithmetic mean is the simple average while the geometric mean is the compound rate of return between two periods.

Q7. How do you estimate the MRP?

A7. There is presently little consensus on "best practice" for estimating the MRP, which does not mean that each approach is equally valid. For example, the leading graduate textbook in corporate finance, after recommending use of the arithmetic average realized excess return on the market for many years (which for a while was noticeably over 9 percent), now reviews the current state of the research and expresses the view that the a range between 5 to 8 percent is reasonable for the U.S.[2] At the same time, Dimson, Marsh, and

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[1] See, for example, Morningstar, *Ibbotson IBBS Valuation Yearbook 2009*, p. 59.

[2] Richard A. Brealey, Stewart C. Myers, and Franklin Allen, *Principles of Corporate Finance*, McGraw-Hill, 9th edition, 2008, pp. 173-180.

Staunton (2008) estimate that the average arithmetic risk premium of stocks *over bonds* in the U.S. was 6.5% for the period 1900 to 2007.[3] In a recent proceeding the Surface Transportation Board ("STB") decided to switch from a DCF model to the CAPM model when estimating the cost of equity for U.S. railroads. The STB further decided to rely on the arithmetic risk premium of stocks over long-term bonds as reported in Morningstar / Ibbotson.[4]

My testimony considers both the historical evidence and the results of scholarly studies of the factors that affect the risk premium for average-risk stocks in order to estimate the benchmark risk premium investors currently expect. I consider the historical difference in returns between the Standard and Poor's 500 Index ("S&P 500") and the risk-free rate, recent academic literature on the MRP and the results of recent surveys to estimate the market risk premium.

Q8. Please summarize the recent literature on the MRP and the conclusions you draw from it.

A8. Some recent research based upon U.S. data challenges the conventional wisdom of using the arithmetic average historical excess returns to estimate the MRP. However, after reviewing the issues in the debate, I remain skeptical for several reasons that the market risk premium has declined in the U.S. as much as is claimed in some of the literature.

First, despite eye-catching claims like "equity risk premium as low as three percent,"[5] and "the death of the risk premium,"[6] not all recent research arrives at the same conclusion. In his presidential address to the American Finance Association in 2001, Professor Constantinides seeks to estimate the unconditional equity premium based on

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[3] Dimson, Marsh and Staunton, *Global Investment Returns Yearbook 2008*, p. 48.

[4] *STB Ex Parte No. 664*, Issued January 17, 2008, pp. 8-9.

[5] Claus, J. and J. Thomas, (2001), "Equity Risk Premium as Low as Three Percent: Evidence from Analysts' Earnings Forecasts for Domestic and International Stocks," *Journal of Finance* 56:1629-1666.

[6] Arnott, R. and R. Ryan, (2001), "The Death of the Risk Premium," *Journal of Portfolio Management* 27(3):61-84.

average historical stock returns.[7] (Note that this address was based upon evidence just before the major fall in market value.) He adjusts the average returns downward by the change in price-earnings ratio because he assumes no change in valuations in an unconditional state. His estimates for 1926 to 2000 and 1951 to 2000 are 8.0 percent and 6.0 percent, respectively, over the 3-month T-bill rate. In another published study in 2001, Professors Harris and Marston use the DCF method to estimate the market risk premium for the U.S. stocks.[8] Using analysts' forecasts to proxy for investors' expectation, they conclude that over the period 1982-1998 the MRP over the *long-term* risk-free rate is 7.14 percent. As yet another example, the paper by Drs. Ibbotson and Chen (2003) adopts a supply side approach to estimate the forward looking long-term sustainable equity returns and equity risk premium based upon economic fundamentals. Their equity risk premium over the *long-term* risk-free rate is estimated to be 3.97 percent in geometric terms and 5.90 percent on an arithmetic basis. They conclude their paper by stating that their estimate of the equity risk premium is "far closer to the historical premium than being zero or negative."[9]

Second, Professor Ivo Welch surveyed a large group of financial economists in 1998 and 1999. The average of the estimated MRP was 7.1 percent in Prof. Welch's first survey and 6.7 percent in his second survey which was based on a smaller number of individuals. A subsequent survey[10] by Prof. Welch reported only a 5.5 percent MRP.[11] In characterizing these results Prof. Welch notes that "[T]he equity premium consensus forecast of finance and economics professors seems to have dropped during the last 2 to 3

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[7] Constantinides, G.M. (2002), "Rational Asset Prices," *Journal of Finance* 57:1567-1591.

[8] Robert S. Harris and Felicia C. Marston, "The Market Risk Premium: Expectational Estimates Using Analysts' Forecasts," *Journal of Applied Finance* 11 (1) 6-16, 2001.

[9] Ibbotson, R. and P. Chen (2003), "Stock Market Returns in the Long Run: Participating in the Real Economy," *Financial Analyst Journal*, 59(1):88-98. Cited figures are on p. 97.

[10] Ivo Welch (2000), "Views of Financial Economists on the Equity Premium and on Professional Controversies," *Journal of Business*, 73(4):501-537. The cited figures are in Table 2, p. 514.

[11] Ivo Welch (2001), "The Equity Premium Consensus Forecast Revisited," School of Management at Yale University working paper. The cited figure is in Table 2.

years, a period with low realized equity premia."[12] However, in the most recent survey,[13] conducted in December 2007, Prof. Welch finds that the average estimate has increased to about 5.7 percent.

The above quotation from Prof. Welch emphasizes the caution that must attend survey data even from knowledgeable survey participants: the outcome is likely to change quickly with changing market circumstances.

Third, some of the evidence for negative or close to zero market risk premium simply does not make sense. Despite the relatively high valuation levels, stock returns remain much more volatile than Treasury bond returns. I am not aware of any empirical or theoretical evidence showing that investors would rationally hold equities and not expect to earn a positive risk premium for bearing their higher risk.

Fourth, I am unaware of a convincing theory for why the future MRP should have substantially declined. At the height of the stock market bubble in the U.S., many claimed that the only way to justify the high stock prices would be if the MRP had declined dramatically,[14] but this argument was heard less frequently after the market declined substantially from its tech bubble high. All else equal, a high valuation ratio such as price-earnings ratio implies a low required rate of return, hence a low MRP. However, there is considerable debate about whether the high level of stock prices (despite the burst of the internet bubble from its high in the summer of 2000) represents the transition to a new economy or is simply an "irrational exuberance," which cannot be sustained for the long term. If the former case is true, then the MRP may have decreased permanently. Conversely, the long-run MRP may remain the same even if expected market returns in the short-term are smaller.

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[12] *Ibid*, p. 8.

[13] See Ivo Welch (2008), "The Consensus Estimate for the Equity Premium by Academic Financial Economists in December 2007," School of Management at Yale University working paper. The cited figure is in Table 2.

[14] See Robert D. Arnott and Peter L. Bernstein, "What Risk Premium is 'Normal'?," *Financial Analysts Journal* 58:64-85, for an example.

Another common argument for a lower expected MRP is that the U.S. experienced very remarkable growth in the 20th century that was not anticipated at the start of the century. As a result, the average realized excess return is overestimated meaning the standard method of estimating the MRP would be biased upward. However, one recent study by Professors Jorion and Goetzmann finds, under some simplifying assumptions, that the so-called "survivorship bias" is only 29 basis points.[15] Furthermore, "[I]f investors have overestimated the equity premium over the second half of the last century, Constantinides (2002) argues that 'we now have a bigger puzzle on our hands' Why have investors systematically biased their estimates over such a long horizon?"[16]

To sum up the above, I cite two passages from Profs. Mehra and Prescott's review of the theoretical literature on equity premium puzzle:[17]

> Even if the conditional equity premium given current market conditions is small, and there appears to be general consensus that it is, this in itself does not imply that it was obvious either that the historical premium was too high or that the equity premium has diminished.
>
> In the absence of this [knowledge of the future], and based on what we currently know, we can make the following claim: over the long horizon the equity premium is likely to be similar to what it has been in the past and the returns to investment in equity will continue to substantially dominate that in T-bills for investors with a long planning horizon.

Q9. Is there other scholarly support for the conclusion?

A9. Yes. Another line of research was pursued by Steven N. Kaplan and Richard S. Ruback. They estimate the market risk premium in their article, "The Valuation of Cash Flow

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[15] Jorion, P., and W. Goetzmann (1999), "Global Stock Markets in the Twentieth Century," *Journal of Finance* 54:953-980. Dimson, Marsh, and Staunton (2003) make a similar point when they comment on the equity risk premia for 16 countries based on returns between 1900 and 2001: "While the United States and the United Kingdom have indeed performed well, compared to other markets there is no indication that they are hugely out of line." p.4.

[16] Mehra, R., and E.C. Prescott (2003), "The Equity Premium in Retrospect," in *Handbook of the Economics of Finance*, Edited by G.M. Constantinides, M. Harris and R. Stulz, Elsevier B.V, p. 926

[17] *Ibid*, p. 926.

Forecasts: An Empirical Analysis."[18] Professors Kaplan and Ruback compare published cash flow forecasts for management buyouts and leveraged recapitalization over the 1983 to 1989 period against the actual market values that resulted from these transactions. One of their results is an estimate of the market risk premium over the long-term Treasury bond yield that is based on careful analysis of actual major investment decisions, not realized market returns. Their median estimate is 7.78 percent and their mean estimate is 7.97 percent.[19] This is considerably higher than my estimate of 6.5 percent. Even if the maturity premium of Treasury bonds over Treasury bills were only 1 percent, well below the best estimate of 1.5 percent the resulting estimate of the market risk premium over Treasury bills is higher than my estimate of 8.0 percent.

Q10. In addition to the scholarly articles and survey evidence you discussed in Section I of your Direct Testimony, what other evidence do you consider to estimate the MRP?

A10. I also consider the long-run realized equity premia reported in Morningstar's Ibbotson SBBI Valuation Yearbook 2009. The data provided cover the period 1926 through 2008. The results are discussed below.

Q11. What is the "long-run realized risk premium" in the U.S.?

A11. From 1926 to 2008, the full period reported, Morningstar's data show that the average premium of stocks over Treasury bills is 7.9 percent. I also examine the "post-War" period. The risk premium for 1947-2008 is 7.6 percent.[20] (I exclude 1946 because its economic statistics are heavily influenced by the War years; e.g., the end of price controls yielded an inflation rate of 18 percent. It is not really a "post-War" year, from an economic viewpoint.) These averages usually change slightly when another year of data is added to the Ibbotson series, but the effect of adding 2008 was far from trivial due to the ongoing financial turmoil. The average premium of stocks over the income returns on long-term Government bonds is 6.5 percent for the 1926 to 2008 period.

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[18] *Journal of Finance*, 50, September 1995, pp. 1059-1093.

[19] *Ibid*, p. 1082.

Prior to the economic crisis that started in the second half of 2008, there had been a great deal of academic research on the MRP. This research put practitioners in a dilemma: there was nothing close to a consensus about how the MRP should be estimated, but a general agreement in the academic community seemed to be emerging that the old approach of using the average realized return over long periods gave too high an answer. Realized returns were negative in 2008 and caused the observed long-term risk premium to fall, but it is highly likely that the MRP currently exceeds the average of realized returns because of increased risk aversion among investors.

Q12. Do you have any additional comments on your choice of the MRP?

A12. Yes. All of the debate discussed above has taken place before the current financial turmoil, ensuing economic downturn, and highly uncertain timing of recovery. As discussed at length in my direct testimony, the recent events in the financial markets have likely increased investors risk aversion. Therefore, there are strong reasons to expect that the current level of the MRP may in fact be significantly higher than what has been reported traditionally and higher than the base level MRP that I use in my testimony.

Q13. Have any of the prior academic studies shed any light on why the MRP would be higher under current circumstances?

A13. Yes. First and foremost, the standard consumption-based asset pricing theory suggests that, all else equal, higher risk aversion implies higher MRP.[21] To the extent that there has been an adverse shock to risk aversion of investors, the MRP is likely to have increased.

Second, the academic literature contains studies of the impact of recessions on investors' attitude towards risk. These studies find that the risk aversion and hence the risk premium required to hold equity rather than debt increases in economic downturns. Several articles suggest that the market risk premium is higher during times of recession. Constantinides (2008) studies a classical utility model where consumers are risk averse

[20] Morningstar, *Ibbotson SBBI Valuation Yearbook 2009*, Appendix A, Table A-3.

[21] See, for example, Mehra and Prescott (1985).

and also summarizes some of the empirical literature. Constantinides draws from empirical evidence that shows that consumers become risk averse in times of economic recession or downturn, and equity investments accentuate this risk.[22] (Increased risk aversion leads to a higher expected return for investors before they will invest.) Specifically, equities are pro-cyclical and decline in value when the probability of a job loss increases; thus, they fail to hedge against income shocks that are more likely to occur during recessions.[23] Consequently, investors require an added risk premium to hold equities during economic downturns:

> In economic recessions, investors are exposed to the double hazard of stock market losses and job loss. Investment in equities not only fails to hedge the risk of job loss but also accentuates its implications. Investors require a hefty equity premium in order to be induced to hold equities. This is the argument that I formalize below and address the predictability of asset returns and their unconditional moments.[24]

And

> The first implication of the theory is an explanation of the counter-cyclical behavior of the equity risk premium: the risk premium is highest in a recession because the stock is a poor hedge against the uninsurable income shocks, such as job loss, that are more likely to arrive during a recession.
>
> The second implication is an explanation of the unconditional equity premium puzzle: even though per capita consumption growth is poorly correlated with stocks returns, investors require a hefty premium to hold stocks over short-term bonds because stocks perform poorly in recessions, when the investor is most likely to be laid off.[25]

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[22] Constantinides, G. M., "Understanding the equity risk premium puzzle". In R. Mehra, ed., *Handbook of the Equity Risk Premium*, 2008, Elsevier, Amsterdam.

[23] Constantinides, G.M., and D. Duffie (1996), "Asset Pricing with Heterogeneous Consumers", *Journal of Political Economy*, Vol. 104 (2): 219-240.

[24] G.M. Constantinides (2008), "Understanding the equity risk premium puzzle." In R. Mehra, ed., *Handbook of the Equity Risk Premium*. Elsevier, Amsterdam.

[25] *Ibid*, p. 353.

Empirically, several authors have found that market volatility and the market risk premium are positively related. For example, Kim, Morley and Nelson (2004)[26] find that

> When the effects of volatility feedback are fully taken into account, the empirical evidence supports a significant positive relationship between stock market volatility and the equity premium.[27]

Additionally, in their article that won the annual Smith-Breeden Paper Award given by the American Finance Association and the *Journal of Finance*, Bansal and Yaron (2004) demonstrate that economic uncertainty plays an important role in explaining the MRP.[28] In particular, they show that uncertainty is priced in the market. In their model, higher uncertainty (measured in their paper by volatility of consumption) leads to higher conditional MRP. Another implication of the analysis in Bansal and Yaron (2004) is that even the unconditional MRP can increase if any of the following materialize: (i) investors become more risk-averse; (ii) shocks to economic uncertainty become more pronounced; (iii) periods of high economic uncertainty become longer lasting. To the extent that risk aversion has experienced an adverse shock, the MRP must have increased. Furthermore, perception of more severe shocks to economic uncertainty and slower decay of higher uncertainty periods are likely to cause an increase in the MRP even in the absence of any shock to the risk aversion parameter.

Gabaix (2009) provides an alternative explanation for a time-varying risk premium in his newly circulated working paper.[29] The argument is that the MRP is linked to the fear of rare but large "disasters". The time-varying nature of the severity of those disasters leads to time-varying risk premium. To the extent we are experiencing an economic downturn of a magnitude not seen since the times of the Great Depression, the argument presented

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[26] C-J. Kim, J.C. Morley and C.R. Nelson (2004), "Is There a Positive Relationship Between Stock Market Volatility and the Equity Premium," *Journal of Money, Credit and Banking*, Vol. 36.

[27] *Ibid.* p. 357. The authors rely on a statistical (Markov-switching) model of the ARCH type and data for the period 1926 to 2000 for their analysis.

[28] Bansal, R., and A. Yaron (2004), "Risks for the Long Run: A Potential Resolution of Asset Pricing Puzzles", *Journal of Finance*, Vol. 59 (4): 1481-1509.

in this paper is supportive of the idea that the MRP is currently higher than it would be under more normal conditions.

The facts that financial markets are in turmoil and stock market volatility has increased dramatically mean that equity investors face increased uncertainty. Increased uncertainty leads investors to seek lower risk investments or to demand a higher expected rate of return before they are willing to invest their money. In part, this is an explanation of why market prices have fallen. The financial market distress means that the current MRP is *higher* than it would otherwise be. Dimson, Marsh, and Staunton (2008) appear to agree as they note

> Although credit spreads widened, credit fundamentals as measured by low default rates remained at historically strong levels. This may indicate higher defaults to come, an increase in risk aversion, a bigger premium for liquidity, or all three.[30]

As shown in Figure 5 in my direct testimony, the market volatility, measured by the Chicago Board Options Exchange ("CBOE") Volatility Index (also know as *VIX*), was until recently in the 10-20 percent range, but it spiked 80 percent in late 2008. Although volatility has decreased somewhat over the last couple of months, it is still significantly higher than the average value for the first half of 2008 (prior to the crisis). As investors' risk aversion also increases during times of financial distress, there can be little doubt that the MRP is currently higher than in the recent past.

Q14. What is your conclusion regarding the MRP?

A14. Estimation of the MRP remains controversial. There is no consensus on its value or even how to estimate it. Given a careful review of all of the information, I estimate the risk premium for average risk stocks to be 6.5 percent over long-term Government bonds prior to the crisis in the U.S. economy. At this time, an additional upward adjustment likely is warranted in recognition of the unsettled condition of the capital markets.

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[29] Gabaix, X. (2009), "Variable Rare Disasters: An Exactly Solved Framework for Ten Puzzles in Macro Finance", *Working Paper, New York University Stern School of Business* and *NBER*.

[30] Elroy Dimson, Paul Marsh, and Mike Staunton, 2008, *Global Investment Returns Yearbook 2008*, p. 25.

Therefore, I report the sensitivity of the results to an upward adjustment of 1, 1½ and 2 percent in Tables 7 and 8 of my direct testimony. However, my recommendation does not include any adjustments and is therefore conservative.

C. RELATIVE RISK

Q15. How do you measure relative risk?

A15. The risk measure I examine is the "beta" of the stocks in question. Beta is a measure of the "systematic" risk of a stock — the extent to which a stock's value fluctuates more or less than average when the market fluctuates. It is the most commonly used measure of risk in capital market theories.

Q16. Please explain beta in more detail.

A16. The basic idea behind beta is that risks that cannot be diversified away in large portfolios matter more than those that can be eliminated by diversification. Beta is a measure of the risks that cannot be eliminated by diversification.

Diversification is a vital concept in the study of risk and return. (Harry Markowitz won a Nobel Prize for work showing just how important it was.) Over the long run, the rate of return on the stock market has a very high standard deviation, on the order of 15 - 20 percent per year. But many individual stocks have much higher standard deviations than this. The stock market's standard deviation is "only" about 15 - 20 percent because when stocks are combined into portfolios, some of the risk of individual stocks is eliminated by diversification. Some stocks go up when others go down, and the average portfolio return — positive or negative — is usually less extreme than that of individual stocks within it.

In the limiting case, if the returns on individual stocks were completely uncorrelated with one another, the formation of a large portfolio of such stocks would eliminate risk entirely. That is, the market's long-run standard deviation would be not 15-20 percent per year, but virtually zero.

The fact that the market's actual annual standard deviation is so large means that, in practice, the returns on stocks are correlated with one another, and to a material degree. The reason is that many factors that make a particular stock go up or down also affect other stocks. Examples include the state of the economy, the balance of trade, and inflation. Thus some risk is "non-diversifiable". Single-factor equity risk premium models derive conditions in which all of these factors can be considered simultaneously, through their impact on the market portfolio. Other models derive somewhat less restrictive conditions under which several of them might be individually relevant.

Again, the basic idea behind all of these models is that risks that cannot be diversified away in large portfolios matter more than those that can be eliminated by diversification, because there are a large number of large portfolios whose managers actively seek the best risk-reward tradeoffs available. Of course, undiversified investors would like to get a premium for bearing diversifiable risk, but they cannot.

Q17. Why not?

A17. Well-diversified investors compete away any premium rates of return for diversifiable risk. Suppose a stock were priced especially low because it had especially high diversifiable risk. Then it would seem to be a bargain to well diversified investors. For example, suppose an industry is subject to active competition, so there is a large risk of loss of market share. Investors who held a portfolio of all companies in the industry would be immune to this risk, because the loss on one company's stock would be offset by a gain on another's stock. (Of course, the competition might make the whole industry more vulnerable to the business cycle, but the issue here is the diversifiable risk of shifts in market share among firms.)

If the shares were priced especially low because of the risk of a shift in market shares, investors who could hold shares of the whole industry would snap them up. Their buying would drive up the stocks' prices until the premium rates of return for diversifiable risk were eliminated. Since all investors pay the same price, even those who are not diversified can expect no premium for bearing diversifiable risk.

Of course, substantial non–diversifiable risk remains, as the ongoing financial turmoil and the October Crash of 1987 demonstrate. Even an investor who held a portfolio of all traded stocks could not diversify against that type of risk. Sensitivity to such market–wide movements is what beta measures. That type of sensitivity, whether considered in a single- or multi-factor model, determines the risk premium in the cost of equity.

Q18. What does a particular value of beta signify?

A18. By definition, a stock with a beta equal to 1.0 has average non-diversifiable risk: it goes up or down by 10 percent on average when the market goes up or down by 10 percent. Stocks with betas above 1.0 exaggerate the swings in the market: stocks with betas of 2.0 tend to fall 20 percent when the market falls 10 percent, for example. Stocks with betas below 1.0 are less volatile than the market. A stock with a beta of 0.5 will tend to rise 5 percent when the market rises 10 percent.

Q19. How is beta measured?

A19. The usual approach to calculating beta is a statistical comparison of the sensitivity of a stock's (or a portfolio's) return to the market's return. Many investment services report betas, including Merrill Lynch's quarterly Security Risk Evaluation, Bloomberg and the Value Line Investment Survey. Betas are not always calculated the same way, and therefore must be used with a degree of caution, but the basic point that a high beta indicates a risky stock has long been widely accepted by both financial theorists and investment professionals.

Q20. Are there circumstances when the "usual approach to calculating beta" should not be used?

A20. There are at least two cases where the standard estimate of beta should be viewed skeptically.

First, companies in serious financial distress seem to "decouple" from their normal sensitivity to the stock market. The stock prices of financially distressed companies tend to change based more on individual news about their particular circumstances than upon overall market movements. Thus, a risky stock could have a low estimated beta if the

company was in financial distress. Other circumstances that may cause a company's stock to decouple include an industry restructuring or major changes in a company's supply or output markets.

Second, similar circumstances seem to arise for companies "in play" during a merger or acquisition. Once again, the individual information about the progress of the proposed takeover is so much more important for that stock than day-to-day market fluctuations that, in practice, beta estimates for such companies seem to be too low.

Q21. How reliable is beta as a risk measure?

A21. Scholarly studies have long confirmed the importance of beta for a stock's required rate of return. It is widely regarded as the best single risk measure available. The merits of beta seemed to have been challenged by widely publicized work by Professors Eugene F. Fama and Kenneth R. French.[31] However, despite the early press reports of their work as signifying that "beta is dead," it turns out that beta is still a potentially important explanatory factor (albeit one of several) in their work. Thus, beta remains alive and well as the best single measure of relative risk.

D. INTEREST RATE ESTIMATE

Q22. What interest rates do your procedures require?

A22. Modern capital market theories of risk and return use the short-term risk-free rate of return as the starting benchmark. However, as the short-term risk-free rate has dropped to near-zero, the implementation becomes meaningless. Therefore, like many practitioners, I rely on the long-term risk-free rate. Specifically, I calculate the average yield on long-term Government bonds using a 15-day period ending May 15, 2009. To this figure I add 125 basis points to account for the substantial increase in the spread between investment-grade utility bond yields and government bond yields. Workpaper

[31] See for example, "The Capital Asset Pricing Model: Theory and Evidence", Eugene F. Fama and Kenneth R. French, *Journal of Economic Perspectives*, Volume 18, Summer 2004, pp. 25-46.

#1 to Table No. BV-9 provides data on the increase in the spread between utility and government bond yields.

Q23. Do you vary the risk-free rate in your sensitivity analyses?

A23. Yes. In the sensitivity analyses I decrease the risk-free rate by 25 basis points for each 100 basis points increase in the MRP. This is intended to take into account that bond betas may be positive so that part of the increase in the MRP is captured in the increase in yield spread. A bond beta measures the systematic risk of the bond relative to the market and is determined in the same manner as the stock beta. As .25 is in the high end of the likely bond beta, the adjustment is conservative.

E. Cost Of Capital Models

Q24. How do you combine the above components into an estimate of the cost of capital?

A24. By far the most widely used approach to estimation of the cost of capital is the "Capital Asset Pricing Model," and I do calculate CAPM estimates. However, the CAPM is only one equity risk premium approach technique, and I also use another.

Q25. Please start with the CAPM, by describing the model.

A25. As noted above, the modern models of capital market equilibrium express the cost of equity as the sum of a risk-free rate and a risk premium. The CAPM is the longest-standing and most widely used of these theories. The CAPM states that the cost of capital for investment *s* (e.g., a particular common stock) is given by the following equation:

$$k_s = r_f + \beta_s \times MRP \qquad \textbf{(C-1)}$$

where k_s is the cost of capital for investment *s*; r_f is the risk-free rate, β_s is the beta risk measure for the investment *s*; and *MRP* is the market risk premium.

The CAPM relies on the empirical fact that investors price risky securities to offer a higher expected rate of return than safe securities do. It says that the security market line

starts at the risk-free interest rate (that is, that the return on a zero-risk security, the y-axis intercept in Figure 1 in the body of my testimony, equals the risk-free interest rate). Further, it says that the risk premium over the risk-free rate equals the product of beta and the risk premium on a value-weighted portfolio of all investments, which by definition has average risk.

Q26. What other equity risk premium approach model do you use?

A26. Empirical research has long shown that the CAPM tends to overstate the actual sensitivity of the cost of capital to beta: low-beta stocks tend to have higher risk premia than predicted by the CAPM and high-beta stocks tend to have lower risk premia than predicted. A number of variations on the original CAPM theory have been proposed to explain this finding. The difference between the CAPM and the type of relationship identified in the empirical studies is depicted in Figure BV-C1.

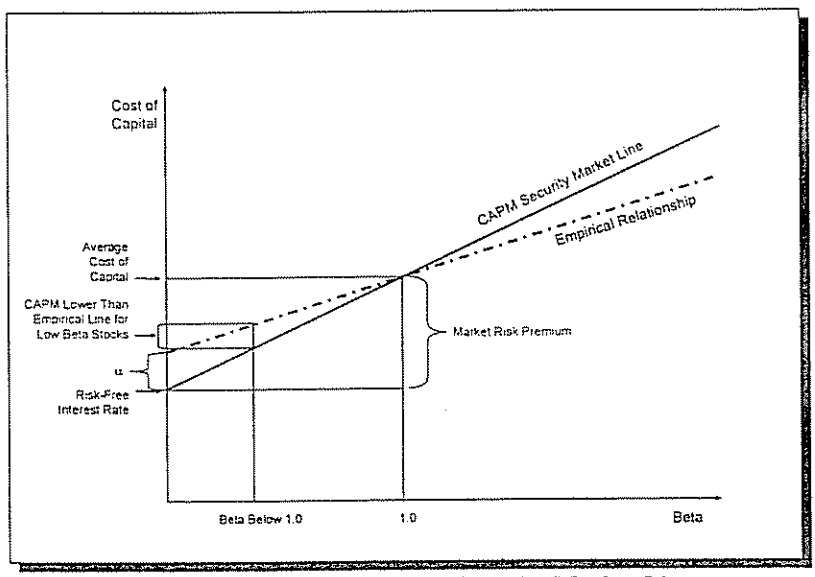

Figure BV-C1: The Empirical Security Market Line

The second model makes use of these empirical findings. It estimates the cost of capital with the equation,

$$k_s = r_f + \alpha + \beta_s \times (MRP - \alpha) \qquad \textbf{(C-2)}$$

where α is the "alpha" of the risk-return line, a constant, and the other symbols are defined as above. I label this model the Empirical Capital Asset Pricing Model, or

"ECAPM." For the short-term risk-free rate models, I set alpha equal to 1, 2, and 3 percent which are values somewhat lower than that estimated empirically. For low-beta stocks such as regulated utilities, the use of a lower value for alpha leads to a lower estimate of the cost of capital. For the long-term risk-free rate models, I set alpha equal to both 0.5 percent and 1.5 percent, but I rely more heavily on the 0.5 percent results. The use of a long-term risk-free rate incorporates some of the desired effect of using the ECAPM. That is, the long-term risk-free rate version of the Security Market Line has a higher intercept and a flatter slope than the short-term risk-free version which has been tested. Thus, it is likely that I do not need to make the same degree adjustment when I use the long-term risk-free rate. A summary of the empirical evidence on the magnitude of alpha is provided in Table No. BV-C1 at the end of the appendix.

II. EMPIRICAL EQUITY RISK PREMIUM RESULTS

Q27. How is this part of the appendix organized?

A27. This section presents the full details of my equity risk premium approach analyses, which are summarized in the body of my testimony. Details behind the estimates of the short-term and the long-term risk-free interest rates are discussed. Next, the beta estimates, and the estimates of the MRP I use in the models are addressed. Finally, this section reports the CAPM and ECAPM results for the sample's costs of equity, and then describes the results of adjusting for differences between the benchmark sample and New Mexico-American's regulated capital structures.

A. RISK-FREE INTEREST RATE

Q28. How do you obtain estimates of the risk-free interest rates over the period the utility rates set here are to be in effect?

A28. I obtain these rates using data provided by Bloomberg. In particular, I use their reported government debt yields from the "constant maturity series". This information is displayed in Table No. BV-9.

Q29. What values do you use for the long-term risk-free interest rate?

A29. I use a baseline value of 5.35 percent for the long-term risk-free interest rate including the baseline adjustment for the increase in the spread between the yield on investment-grade utility bonds and government bonds. This value was determined as of May 15, 2009.

B. Betas And The Market Risk Premium

1. Beta Estimation Procedures

Q30. Which betas do you use in your risk positioning models?

A30. I obtained estimates from the *Value Line Investment Survey* for the sample companies.[32]

Q31. How does *Value Line* estimate the reported betas?

A31. *Value Line* estimates the reported betas using weekly data for a five year period. As a market index, *Value Line* uses the New York Stock Exchange. Also *Value Line* reports so-called adjusted betas, i.e. the betas reported by *Value Line* are calculated as follows:

$$\beta_{Value\ Line} = .67 \times \beta + 0.35 \qquad \text{(C-3)}$$

where β is the standard beta estimate. As a conservative measure of the systematic risk of the comparable water utilities, I reverse the adjustment for the water utility companies. I specifically choose to not reverse the estimates for the gas LDC sample as they are substantially below those of the water utility industry which is the focus of this proceeding. Also, the gas LDC companies do not suffer from the data issues as the water utility sample does.

Q32. Please summarize the beta estimates you rely on.

A32. The unadjusted *Value Line* betas range from .37 to 1.19 for the full water sample and from .37 to .97 for the water subsample. The gas LDC companies' *Value Line* betas fall in a much narrower range from .60 to .80. The beta estimates for individual sample companies are reported in Workpaper #1 to Tables No. BV-10 and BV-21, respectively.

2. Market Risk Premium Estimation

Q33. Given all of the evidence, what MRP do you use in your analysis?

A33. It is clear that market return information is volatile and difficult to interpret in the current environment, but my baseline estimate for the MRP is 6.5 percent. However, this figure does not take the ongoing financial turmoil into account, so I also report results for three alternative sensitivity analyses with an MRP of 7.5, 8.0, and 8.5 percent, respectively.

C. Cost Of Capital Estimates

Q34. Based on these data, what are the values you calculate for the overall cost of capital and the corresponding cost of equity for the samples?

A34. Tables No. BV-10 and BV-21 present the cost of equity results using the equity risk positioning methods at the sample companies' market value capital structures.

Q35. What does the water market data imply about the sample's cost of equity at the proposed 45 percent equity ratio for New Mexico-American Water?

A35. The return on equity and the overall cost of capital for the various equity risk positioning methods are reported in Tables No. BV-12 and BV-23.

Q36. What are the implications of the risk positioning results for New Mexico-American's estimated cost of equity?

A36. I discuss the implications of the risk positioning results for the two samples in the main body of my testimony.

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[32] For each sample I used the *Value Line* beta estimates most recently available. For the water sample, estimates are as of April 24, 2009, while for the gas LDC sample estimates are as of March 13, 2009.

Table BV-C1

EMPIRICAL EVIDENCE ON THE ALPHA FACTOR IN ECAPM*

AUTHOR	RANGE OF ALPHA	PERIOD RELIED UPON
Black (1993)[1]	1% for betas 0 to 0.80	1931-1991
Black, Jensen and Scholes (1972)[2]	4.31%	1931-1965
Fama and McBeth (1972)	5.76%	1935-1968
Fama and French (1992)[3]	7.32%	1941-1990
Litzenberger and Ramaswamy (1979)[4]	5.32%	1936-1977
Litzenberger, Ramaswamy and Sosin (1980)	1.63% to 3.91%	1926-1978
Pettengill, Sundaram and Mathur (1995)[5]	4.6%	1936-1990

*The figures reported in this table are for the longest estimation period available and, when applicable, use the authors' recommended estimation technique. Many of the articles cited also estimate alpha for sub-periods and those alphas may vary.

[1]Black estimates alpha in a one step procedure rather than in an un-biased two-step procedure.

[2]Estimate a negative alpha for the subperiod 1931-39 which contain the depression years 1931-33 and 1937-39.

[3]Calculated using Ibbotson's data for the 30-day treasury yield.

[4]Relies on Lizenberger and Ramaswamy's before-tax estimation results. Comparable after-tax alpha estimate is 4.4%.

[5]Pettengill, Sundaram and Mathur rely on total returns for the period 1936 through 1990 and use 90-day treasuries. The 4.6% figure is calculated using auction averages 90-day treasuries back to 1941 as no other series were found this far back.

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APPENDIX D

DISCOUNTED CASH FLOW METHODOLOGY:

DETAILED PRINCIPLES AND RESULTS

I. DISCOUNTED CASH FLOW METHODOLOGY PRINCIPLES 2

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Q1. What is the purpose of this appendix?

A1. This appendix reviews the principles behind the discounted cash flow or "DCF" methodology and the details of the cost-of-capital estimates obtained from this methodology.

I. DISCOUNTED CASH FLOW METHODOLOGY PRINCIPLES

Q2. How is this section of the appendix organized?

A2. The first part discusses the general principles that underlie the DCF approach. The second portion describes the strengths and weaknesses of the DCF model and why it is generally less reliable for estimating the cost of capital for the sample companies at the present time than the risk positioning method discussed in Appendix C.

A. Simple And Multi-Stage Discounted Cash Flow Models

Q3. Please summarize the DCF model.

A3. The DCF model takes the first approach to cost-of-capital estimation discussed with Figure 1 in Section II-A of my direct testimony. That is, it attempts to measure the cost of equity in one step. The method assumes that the market price of a stock is equal to the present value of the dividends that its owners expect to receive. The method also assumes that this present value can be calculated by the standard formula for the present value of a cash flow stream:

$$P = \frac{D_1}{(1+k)} + \frac{D_2}{(1+k)^2} + \frac{D_3}{(1+k)^3} + \cdots + \frac{D_T}{(1+k)^T} \qquad \textbf{(D-1)}$$

where "P" is the market price of the stock; "D_t" is the dividend cash flow expected at the end of period t; "k" is the cost of capital; and "T" is the last period in which a dividend cash flow is to be received. The formula just says that the stock price is equal to the sum of the expected future dividends, each discounted for the time and risk between now and the time the dividend is expected to be received.

Most DCF applications go even further, and make very strong (*i.e.*, unrealistic) assumptions that yield a simplification of the standard formula, which then can be rearranged to estimate the cost of capital. Specifically, if investors expect a dividend stream that will grow forever at a steady rate, the market price of the stock will be given by a very simple formula,

$$P = \frac{D_1}{(k-g)} \qquad \textbf{(D-2)}$$

where "D_1" is the dividend expected at the end of the first period, "g" is the perpetual growth rate, and "P" and "k" are the market price and the cost of capital, as before. Equation D-2 is a simplified version of Equation D-1 that can be solved to yield the well known "DCF formula" for the cost of capital:

$$\begin{aligned} k &= \frac{D_1}{P} + g \\ &= \frac{D_0 \times (1+g)}{P} + g \end{aligned} \qquad \textbf{(D-3)}$$

where "D_0" is the current dividend, which investors expect to increase at rate g by the end of the next period, and the other symbols are defined as before. Equation D-3 says that if Equation D-2 holds, the cost of capital equals the expected dividend yield plus the (perpetual) expected future growth rate of dividends. I refer to this as the simple DCF model. Of course, the "simple" model is simple because it relies on very strong (*i.e.*, very unrealistic) assumptions.

Q4. Are there other versions of the DCF models besides the "simple" one?

A4. Yes. If Equation D-2 and its underlying assumptions do not hold, sometimes other variations of the general present value formula, Equation D-1, can be used to solve for k in ways that differ from Equation D-3. For example, if there is reason to believe that investors do *not* expect a steady growth rate forever, but rather have different growth rate forecasts in the near term (e.g., over the next five or ten years as compared with subsequent periods), these forecasts can be used to specify the early dividends in Equation D-1. Once the near-term dividends are specified, Equation D-2 can be used to

specify the share price value at the end of the near-term (e.g., at the end of five or ten years), and the resulting cash flow stream can be solved for the cost of capital using Equation D-1.

More formally, the "multistage" DCF approach solves the following equation for k:

$$P = \frac{D_1}{(1+k)} + \frac{D_2}{(1+k)^2} + \frac{D_3}{(1+k)^3} + \cdots + \frac{D_T + P_{TERM}}{(1+k)^T} \quad \textbf{(D-4)}$$

The terminal price, P_{TERM} is estimated as

$$P_{TERM} = \frac{D_{T+1}}{(k - g_{LR})} \quad \textbf{(D-5)}$$

where T is the last of the periods in which a near term dividend forecast is made and g_{LR} is the long-run growth rate. Thus, Equation D-4 defers adoption of the very strong perpetual growth assumptions that underlie Equation D-2 — and hence the simple DCF formula, Equation D-3 — for as long as possible, and instead relies on near term knowledge to improve the estimate of k. I examine both simple and multistage DCF results below.

Q5. Please describe the multi-stage DCF model you use.

A5. The multi-stage model I use is presented in Equations D-4 and D-5 above, and assumes that the long-term perpetual growth rate for all companies in the two samples is the forecast long-term growth rate of the GDP. This model allows growth rates to differ across companies during the first ten years before settling down to a single long-term growth rate. The growth rate for the first five years is the long-term growth rate derived from analysts' reports. After year five, the growth rate is assumed to converge linearly to the GDP growth rate. In other words, the growth rate in year 6 is adjusted by $1/6^{th}$ of the difference between each company's 5-year growth rate forecast and the GDP forecast. The growth rates in years 7 to 10 are adjusted by an additional $1/6^{th}$ so that the earning growth rate pattern converges on the long-term GDP growth rate forecast.

Q6. Why do you assume that the long-term growth rate of the sample companies will converge to the long-term growth rate of GDP?

A6. Recall that the DCF model assumes that dividends grow at a constant rate literally forever. If the growth rate of earnings (and therefore, dividends) were greater than (less than) the long-term growth rate of the economy, mathematically it would mean that the company (and the industry) would become an ever increasing (or decreasing) proportion of the economy. Therefore, the most logical assumption is that the company's earnings grow at the same rate as the economy on average over the long run.

Q7. What are the merits of the DCF model?

A7. The DCF approach is conceptually sound only if its assumptions are met. In actual practice one can run into difficulty because those assumptions are so strong, and hence so unlikely to correspond to reality. Two conditions are well-known to be necessary for the DCF approach to yield a reliable estimate of the cost of capital: the variant of the present value formula, Equation D-1, that is used must actually match the variations in investor expectations for the dividend growth path; and the growth rate(s) used in that formula must match current investor expectations. Less frequently noted conditions may also create problems.

The DCF model assumes that investors expect the cost of capital to be the same in all future years. Investors may not expect the cost of capital to be the same, which can bias the DCF estimate of the cost of capital in either direction.

The DCF model only works for companies for which the standard present value formula works. The standard formula does *not* work for companies that operate in industries or markets options (*e.g.*, puts and calls on common stocks), and so it will not work for companies whose stocks behave as options do. Option-pricing effects will be important for companies in financial distress, for example, which implies the DCF model will *understate* their cost of capital, all else equal.

In recent years even the most basic DCF assumption, that the market price of a stock in the absence of growth options is given by the standard present value formula (*i.e.*, by

Equation D-1 above), has been called into question by a literature on market volatility.[1] In any case, it is still too early to throw out the standard formula, if for no other reasons than that the evidence is still controversial and no one has offered a good replacement. But the evidence suggests that it must be viewed with more caution than financial analysts have traditionally applied. Simple models of stock prices may not be consistent with the available evidence on stock market volatility.

Q8. Normally DCF debates center on the right growth rate. What principles underlie that choice?

A8. Finding the right growth rate(s) is indeed the usual "hard part" of a DCF application. The original approach to estimation of g relied on average historical growth rates in observable variables, such as dividends or earnings, or on the "sustainable growth" approach, which estimates g as the average book rate of return times the fraction of earnings retained within the firm. But it is highly unlikely that historical averages over periods with widely varying rates of inflation, interest rates and costs of capital, such as in the relatively recent past, will equal current growth rate expectations.

A better approach is to use the growth rates currently expected by investment analysts, if an adequate sample of such rates is available. Analysts' forecasts are superior to time series forecasts based upon single variable historical data as has been documented and confirmed extensively in academic research.[2] If this approach is feasible and if the

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[1] See for example, Robert J. Shiller (1981), "Do Stock Prices Move Too Much to be Justified by Subsequent Changes in Dividends?," *The American Economic Review*, Vol. 71, No. 3, pp. 421-436. John Y. Campbell and Robert J. Shiller (1988), "The Dividend-Price Ratio and Expectations of Future Dividends and Discount Factors," *The Review of Financial Studies*, Vol. 1, No. 3, pp. 195-228. Lucy F. Ackert and Brian F. Smith (1993), "Stock Price Volatility, Ordinary Dividends, and Other Cash Flows to Shareholders," *Journal of Finance*, Vol. 48, No. 1, pp. 1147-1160. Eugene F. Fama and Kenneth R. French (2001), "Disappearing Dividends: Changing Firm Characteristics or Lower Propensity to Pay?," *Journal of Financial Economics*, Vol. 60, pp. 3-43. Borja Larrain and Motohiro Yogo (2005), "Does Firm Value Move Too Much to be Justified by Subsequent Changes in Cash Flow?," Federal Reserve Bank of Boston, *Working Paper*, No. 05-18.

[2] Lawrence D. Brown and Michael S. Rozeff (1978), "The Superiority of Analyst Forecasts as Measures of Expectations: Evidence from Earnings," *Journal of Finance*, Vol. XXXIII, No. 1, pp. 1-16. J. Cragg and B.G. Malkiel (1982), *Expectations and the Structure of Share Prices*, National Bureau of Economic Research, University of Chicago Press. R.S. Harris (1986), "Using Analysts' Growth Forecasts to Estimate Shareholder Required Rates of Return," *Financial Management*, Spring Issue, pp. 58-67. J. H. Vander

person estimating the cost of capital is able to select the appropriate version of the DCF formula, the DCF method should yield a reasonable estimate of the cost of capital for companies not in financial distress and without material option-pricing effects (always subject to recent concerns about the applicability of the basic present value formula to stock prices as well as issues of optimism bias). However, for the DCF approach to work, the basic stable-growth assumption must become reasonable and the underlying stable-growth rate must become determinable *within the period for which forecasts are available*.

Q9. What is the so called "optimism bias" in the earnings growth rate forecasts of security analysts and what is its effect on the DCF analysis?

A9. Optimism bias is related to the observed tendency for analysts to forecast earnings growth rates that are higher than are actually achieved. This tendency to over estimate growth rates is perhaps related to incentives faced by analysts that provide rewards not strictly based upon the accuracy of the forecasts. To the extent optimism bias is present in the analysts' earnings forecasts, the cost-of-capital estimates from the DCF model would be too high.

Q10. Does optimism bias mean that the DCF estimates are completely unreliable?

A10. No. The effect of optimism bias is least likely to affect DCF estimates for large, rate regulated companies in relatively stable segments of an industry. Furthermore, the magnitude of the optimism bias (if any) for regulated companies is not clear. This issue is addressed in a paper by Chan, Karceski, and Lakonishok (2003)[3] who sort companies on the basis of the size of the I/B/E/S forecasts to test the level of optimism bias. Utilities constitute 25 percent of the companies in lowest quintile, and by one measure the level of optimism bias is 4 percent. However, the 4 percent figure does not represent the

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Weide and W. T. Carleton (1988), "Investor Growth Expectations: Analysts vs. History," *Journal of Portfolio Management*, spring, pp. 78-82. T. Lys and S. Sohn (1990), "The Association Between Revisions of Financial Analysts Earnings Forecasts and Security Price Changes," *Journal of Accounting and Economics*, vol 13, pp. 341-363.

[3] L. K.C. Chan, J. Karceski, and J. Lakonishok, 2003, "The Level and Persistence of Growth Rates," *Journal of Finance* 58(2):643-684.

complete characterization of the results in the paper. Table IX of the paper shows that the median I/B/E/S forecast for the first (lowest) quintile averages 6.0 percent. The realized "Income before Extraordinary Items" is 2.0 percent (implying a four percent upward bias in I/B/E/S forecasts), but the "Portfolio Income before Extraordinary Items" is 8.0 percent (implying a two percent downward bias in I/B/E/S forecasts).

The difference between the "Income before Extraordinary Items" and "Portfolio Income before Extraordinary Items" is whether individual firms or a portfolio are used in estimating the realized returns. The first is a simple average of all firms in the quintile while the second is a market value weighted-average. Although both measures of bias have their own drawbacks according to the authors,[4] the Portfolio Income measure gives more weight to the larger firms in the quintile such as regulated utilities. In addition, the paper demonstrates that "analysts' forecasts as well as investors' valuations reflect a wide-spread belief in the investment community that many firms can achieve streaks of high growth in earnings."[5] Therefore, it is not clear how severe the problem of optimism bias may be for regulated utilities or even whether there is a problem at all.

Finally, the two-stage DCF model also adjusts for any over optimistic (or pessimistic) growth rate forecasts by substituting the long-term GDP growth rate for the 5-year growth rate forecasts of the analysts in the years beginning in year 11. I linearly trend the 5-year forecast growth rate to the GDP forecast growth rate in years 6 to 10.

Q11. What about the reforms by the National Associate of Security Dealers (NASD) that were designed to reduce the conflicts of interest and pressures brought against security analysts? Have those reforms been generally successful?

A11. Yes. The conclusion from the Joint Report by NASD and the New York Stock Exchange ("NYSE") on the reforms states

> ... the SRO Rules have been effective in helping restore integrity to research by minimizing the influences of investment banking and

[4] Chan, Karceski, and Lakonishok, *op. cit.*, p. 675.

[5] Chan, Karceski, and Lakonishok, *op. cit.*, p. 663.

> promoting transparency of other potential conflicts of interest. Evidence also suggests that investors are benefiting from more balanced and accurate research to aid their investment decisions.[6]

The report does note additional reforms are advisable, but the situation is far different today than during the height of the tech bubble when analyst objectivity was clearly suspect.

B. Conclusions About DCF

Q12. Please sum up the implications of this part of the appendix.

A12. The unavoidable questions about the DCF model's strong assumptions — whether the basic present value formula works for stocks, whether option pricing effects are important for the company, whether the right variant of the basic formula has been found, and whether the true growth rate expectations have been identified — cause me to view the DCF method as *inherently* less reliable than equity risk premium approach, the other approach I use.

II. EMPIRICAL DCF RESULTS

Q13. How is this part of the appendix organized?

A13. This section presents the details of my DCF analyses for the water and gas LDC samples, which are summarized in my written testimony.

Implementation of the simple DCF models described above requires an estimate of the current price, the dividend, and near-term and long-run growth rate forecasts. The simple DCF model relies only on a single growth rate forecast, while the multistage DCF model employs both near-term individual company forecasts and long-run GDP growth rate forecasts. The remaining parts of this section describe each of these inputs in turn.

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[6] Joint Report by NASD and NYSE on the Operation and Effectiveness of the Research Analyst Conflict of Interest Rules, December 2005, p. 44.

A. PRELIMINARY MATTERS

Q14. In Appendix C you discuss estimating cost of capital and implied cost of equity using the risk positioning methodology. What, if anything, is different when you use the DCF method?

A14. The timing of the market value capital structure calculations is different in the DCF method than in the equity risk premium method. The equity risk premium method relies on the average capital structure over the five-year period *Value Line* uses to estimate beta while the DCF approach uses only current data, so the relevant market value capital structure measure is the most recent that can be calculated. This capital structure for the water sample companies is reported in columns [1]-[3] of Table No. BV-4, and for the gas LDC sample companies in columns [1]-[3] of Table No. BV-16.

B. GROWTH RATES

Q15. What growth rates do you use?

A15. For reasons discussed above, historical growth rates today are not useful as forecasts of current investor expectations for the water utility industry. I therefore use rates forecasted by security analysts.

The ideal in a DCF application would be a detailed forecast of future dividends, year by year well into the future, based on a large sample of investment analysts' expectations. I know of no source of such data. Dividends are ultimately paid from earnings, however, and earnings forecasts are available for a few years. Investors do not expect dividends to grow in lockstep with earnings, but for companies for which the DCF approach can be used reliably (*i.e.*, for relatively stable companies whose prices do not include the option-like values described previously), they do expect dividends to track earnings over the long-run. Thus, use of earnings growth rates as a proxy for expectations of dividend growth rates is a common practice.

Accordingly, the first step in my DCF analysis is to examine a sample of investment analysts' forecasted earnings growth rates. In particular, I utilize Bloomberg's BEst and

Value Line's forecasted earnings growth.[7] The projected earnings growth rates for the water sample companies are in Table No. BV-5, and those for the gas LDC sample companies are in Table No. BV-17. Column [1] reports Bloomberg's BEst analysts' forecasts of the long-term earnings growth for the sample companies. Column [2] reports the number of analysts that provided a forecast. Columns [3] and [4] report *Value Line's* forecasted earnings per share ("EPS") value for each company for 2009 and 2012-2014 respectively. Column [5] provides *Value Line's* implied long-term growth rate forecast, and column [6] provides a weighted average growth rate for each company across the two sources. (I treat the *Value Line* forecasts as though they overlap exactly with the forecasts from Bloomberg.) These growth rates underlie my simple and multistage DCF analyses.

In the simple DCF, I use the five-year average annual growth rate as the perpetual growth rate.[8] In the multistage model, I rely on the company-specific growth rate through the first quarter of 2014 and on the long-term GDP forecast from the second quarter of 2019 onwards. During the intervening five-year period, I assume the growth rate converges linearly towards the long-term GDP forecast.[9]

Q16. Do these growth rates correspond to the ideal you mentioned above?

A16. No. While forecasted growth rates are the quantity required in principle, the forecasts need to go far enough out into the future so that it is reasonable to believe that investors expect a stable growth path afterwards. As can be seen from Table No. BV-5 and Table No. BV-17, the growth rate forecasts vary widely from company to company. For example the BEst growth forecast for Southwest Water is negative percent while the BEst growth rate for SJW Corp. is 15 percent.[10] While the differences between BEst and *Value Line* forecasts are lower for the gas LDC sample, there is still significant

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[7] The BEst growth rates were downloaded from Bloomberg on May 18, 2009. *Value Line* estimates are from the most recent report available, dated April 24, 2009 for the water sample utilities, and March 13, 2009 for the gas LDCs.

[8] This growth rate is in column [6] of Table No. BV-5 (Table No. BV-17 for the gas LDC sample).

[9] I use the long-term U.S. GDP growth forecast from *Blue Chip Economic Indicators* (March 10, 2009).

[10] See Table No. BV-5.

variation.[11] Also, for some companies, the five-year growth rate forecasts are significantly above or below the long-term GDP growth rate forecast, indicating lack of stability in growth rates. Overall, the growth rates indicate that some companies and maybe the industries have yet to reach a stable equilibrium which is required for the correct application of the DCF method.

Q17. How well are the conditions needed for DCF reliability met at present?

A17. The requisite conditions for the sample companies are not fully met at this time; especially for the Water utility sample where the growth rates vary widely from company to company or across time.[12] Of particular concern for this proceeding is the uncertainty about what investors truly expect the long-run outlook for the sample companies to be. The longest time period available for growth rate forecasts of which I am aware is five years. The long-run growth rate (*i.e.*, the growth rate after the industry settles into a steady state, which is certainly *beyond* the next five years for water industry) drives the actual results one gets with the DCF model. Unfortunately, this implies that unless the company or industry in question is stable, so there is little doubt as to the growth rate investors expect. DCF results in practice can end up being driven by the subjective judgment of the analyst who performs the work.

This is a problem at present because it is hard to imagine that today's water industry would accurately be described as stable. There is great uncertainty about the costs required to undertake the large investments in infrastructure forecasted for the industry. Indeed, *Value Line* notes the need for investments aimed at replacing the aging infrastructure and complying with increasingly stringent water safety regulations, partially driven by increased fear of bioterrorism. The American Society of Civil Engineers recently estimated that that the drinking water and wastewater shortfall in infrastructure investments needs are $255 billion over the next five years while the expected spending (including the American Recovery and Reinvestment act) is $146.4

[11] See table No. BV-17.

[12] For example, *Value Line's* growth rate for Aqua America was 5.1 percent in April 2008 but 11.8 percent a year later in April 2009. See Table No. BV-5 in this filing as well as in Case No. 08-00134-UT.

for a shortfall of about $108.6 billion.[13] The water industry also has seen a number of mergers and acquisitions, which affects the companies' earnings growth rate estimates. This is one reason why companies heavily involved in mergers and acquisitions are normally excluded from the sample. Taken together, these factors mean that it may be some time before the water industry settles into anything investors will see as a stable equilibrium.

Such circumstances imply that a regulator may often be faced with a wide range of DCF numbers, none of which can be well grounded in objective data on true long-run growth expectations, *because no such objective data now exist*. DCF for firms or industries in flux is *inherently* subjective with regard to a parameter (the long-run growth rate) that drives the answer one gets.

It is clear that much longer detailed growth rate forecasts than currently available from Bloomberg and *Value Line* would be needed to implement the DCF model in a completely reliable way for the water sample at this time; however, the general stability of the 5-year growth rate forecasts for the gas LDC sample indicates a higher degree of reliability than for the water sample at this time.

C. Dividend and Price Inputs

Q18. What values do you use for dividends and stock prices?

A18. Dividends are the most recent recorded dividend payments as reported by Bloomberg. For most companies this is the first quarter 2009 dividend, but for some it is the 2nd quarter 2009. The most recent dividend is grown at the estimated growth rate and divided by the price described below to estimate the dividend yield for the simple and multistage DCF models.

Stock prices are the average of the closing stock prices for the 15 trading days ending on the day the BEst forecasts were released (May 18, 2009). Using these dates ensures that

[13] Report Card for America's Infrastructure, The American Society of Civil Engineers, 2009, p. 7.

the information in growth rates and stock prices are contemporaneous. I use a 15-day average as a compromise. Using a longer period would be inconsistent with the principles that underlie the DCF formula. The DCF approach assumes the stock price is the present value of future expected dividends. Stock prices six months or a year ago reflect expectations at that time, which are different from those that underlie the currently available growth forecasts. At the same time, use of an average over a brief period helps guard against a company's price on a particular day price being unduly influenced by mistaken information, differences in trading frequency, and the like.

The closing stock price is used because it is at least as good as any other measure of the day's outcome, and may be better for DCF purposes. In particular, if there were any single price during the day that would affect investors' decisions to buy or sell a stock, I would suspect that it would be each day's closing price, not the high or low during the day. The daily price changes reported in the financial pages, for example, are from close to close, not from high to high or from low to low.

D. COMPANY-SPECIFIC DCF COST-OF-CAPITAL ESTIMATES

Q19. What DCF estimates do these data yield?

A19. The cost-of-equity results for the simple and multistage DCF models are shown in Table No. BV-6 for the water utility sample and in Table No. BV-18 for the gas LDC sample. In both tables, Panel A reports the results for the simple DCF method while Panel B reports the results for the multistage DCF method using the long-term GDP growth rate as the perpetual growth rate.

Q20. What overall cost-of-capital estimates result from the DCF cost-of-equity estimates?

A20. The capital structure, DCF cost of equity, and cost of debt estimates are combined to obtain the overall after-tax weighted-average cost of capital for each sample company. These results are presented in Table No. BV-7 for the water sample and in Table No. BV-19 for the gas LDC sample. Again, Panel A relies on the simple DCF cost-of-equity results while Panel B relies on the multistage DCF cost-of-equity results.

Q21. What information do you report in Table No. BV-8 and in Table No. BV-20?

A21. These tables report, for each sample, the return on equity consistent with that sample's estimated overall after-tax weighted-average cost of capital and the proposed equity thickness of 45 percent for New Mexico-American Water. For both the simple DCF and multistage DCF methods, the sample's average ATWACC is reported in column [1]. Column [6] reports the return on equity as if the sample companies' average market value capital structure had been that currently proposed for New Mexico-American Water.

Q22. What are the implications of these results?

A22. The implication of these numbers is discussed in my direct testimony, along with the findings of the equity risk premium approach.

APPENDIX E

EFFECT OF DEBT ON THE COST OF EQUITY

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Q1. What is the purpose of this Appendix?

A1. In this appendix, I provide details on the effects of debt on the cost of equity. First, I summarize a fairly large body of financial research on capital structure. Second, I provide an extended example to illustrate the effect of debt on the cost of equity.

I. AN OVERVIEW OF THE ECONOMIC LITERATURE

Q2. What is the focus of the economic literature on the effects of debt?

A2. The economic literature focuses on the effects of debt on the value of a firm. The standard way to recognize one of these effects, the impact of the fact that interest expense is tax-deductible, is to discount the all-equity after-tax operating cash flows generated by a firm or an investment project at a weighted average cost of capital, typically known in textbooks as the "WACC." The textbook WACC equals the *market*-value weighted average of the cost of equity and the *after-tax*, *current* cost of debt. However, rate regulation in North America has a legacy of working with another weighted-average cost of capital, the *book*-value weighted average of the cost of equity and the *before-tax*, *embedded* cost of debt. To distinguish the concepts, I refer to the after-tax weighted-average cost of capital as ATWACC.

Q3. How is this section of the appendix organized?

A3. It starts with the tax effects of debt. It then turns to other effects of debt.

A. TAX EFFECTS

Q4. What are the key findings in the literature regarding tax effects?

A4. Three seminal papers are vital for this literature. The first assumes no taxes and risk-free debt. The second adds corporate income taxes. The third adds personal income taxes.

1. Base Case: No Taxes, No Risk to High Debt Ratios

Q5. Please start by explaining the simplest case of the effect of debt on the value of a firm.

A5. The "base case," no taxes and no costs to excessive debt, was worked out in a classic 1958 paper by Franco Modigliani and Merton Miller, two economists who eventually won Nobel Prizes in part for their body of work on the effects of debt.[1] Their 1958 paper made what is in retrospect a very simple point: if there are no taxes and no risk to the use of excessive debt, use of debt will have no effect on a company's operating cash flows (i.e., the cash flows to investors as a group, debt plus equity combined). If the operating cash flows are the same regardless of whether the company finances mostly with debt or mostly with equity, then the value of the firm cannot be affected at all by the debt ratio. In cost-of-capital terms, this means the overall cost of capital is constant regardless of the debt ratio, too.

In the base case, issuing debt merely divides the cash flows into two pools, one for bondholders and one for shareholders. If the divided pools have different priorities in claims on the cash flows, the risks and costs of capital will differ for each pool. But the risk and overall cost of capital of the entire firm, the sum of the two pools, is constant regardless of the debt ratio. Thus,

$$r_1^* = r_{A1} \qquad \text{(E-1a)}$$

where r_1^* is the overall after-tax cost of capital at any particular capital structure and r_{A1} is the all-equity cost of capital for the firm. (The "1" subscripts distinguish the case where there are no taxes from subsequent equations that consider first corporate and then both corporate and personal taxes.) With no taxes and no risk to debt, the overall cost of capital does not change with capital structure.

This implies that the relationship of the overall cost of capital to the component costs of debt and equity is

[1] Franco Modigliani and Merton H. Miller (1958), "The Cost of Capital, Corporation Finance and the Theory of Investment," *American Economic Review*, 48, pp. 261-297.

$$r_{E1} \times \left(\frac{E}{V}\right) + r_{D1} \times \left(\frac{D}{V}\right) = r_1^* \qquad \text{(E-1b)}$$

with the overall cost of capital (r^*) on the *right* side, as the *independent* variable, and the costs of equity (r_E) and debt (r_D) on the left side, as *dependent* variables determined by the overall cost of capital and by the capital structure (i.e., the shares of equity (E) and debt (D) in overall firm value ($V = E + D$) that the firm happens to choose. Note that if equation (E-1a) were correct, the equation that solved it for the cost of equity would be,

$$r_{E1} = r_1^* + (r_1^* - r_D) \times \left(\frac{D}{E}\right) \qquad \text{(E-1c)}$$

Note also that (D/E) gets exponentially higher in this equation as the debt-to-value ratio increases[2] i.e., the cost of equity increases exponentially with leverage.

2. Corporate Tax Deduction for Interest Expense

Q6. What happens when you add corporate taxes to the discussion?

A6. If corporate taxes exist with risk-free debt (and if only taxes at the corporate level matter, not taxes at the level of the investor's personal tax return), the initial conclusion changes. Debt at the corporate level reduces the company's tax liability by an amount equal to the marginal tax rate times the interest expense. All else equal, this will add value to the company because more of the operating cash flows will end up in the hands of investors as a group. That is, if only corporate taxes mattered, interest would add cash to the firm equal to the corporate tax rate times the interest expense. This increase in cash would increase the value of the firm, all else equal. In cost-of-capital terms, it would reduce the overall cost of capital.

How much the value of the firm would rise and *how far* the overall cost of capital would fall would depend in part on how often the company adjusts its capital structure, but this is a second-order effect in practice. (The biggest effect would be if companies could

[2] For example, at 20-80, 50-50, and 80-20 debt-equity ratios, (D/E) equals, respectively, (20/80) = 0.25, (50/50) = 1.0, and (80/20) = 4.0. The extra 30 percent of debt going from 20-80 to 50-50 has much less impact on (D/E) [i.e., by moving it from 0.25 to 1.0] than the extra 30 percent of debt going from 50-50

issue riskless perpetual debt, an assumption Profs. Modigliani and Miller explored in 1963, in the second seminal paper;[3] this assumption could *not* be true for a real company.) Prof. Robert A. Taggart provides a unified treatment of the main papers in this literature and shows how various cases relate to one another.[4] Perhaps the most useful set of benchmark equations for the case where only corporate taxes matter are:

$$r_2^{\bullet} = r_{A2} - r_D \times t_C \times \left(\frac{D}{V}\right) \tag{E-2a}$$

$$r_2^{\bullet} = r_{E2} \times \left(\frac{E}{V}\right) + r_D \times \left(\frac{D}{V}\right) \times (1 - t_C) \tag{E-2b}$$

which imply for the cost of equity,

$$r_{E2} = r_{A2} + (r_{A2} - r_D) \times \left(\frac{D}{E}\right) \tag{E-2c}$$

where the variables have the same meaning as before but the "2" subscripts indicate the case that considers corporate but not personal taxes.

Note that Equation (E-2a) implies that when only corporate taxes matter, the overall after-tax cost of capital declines steadily as more debt is added, until it reaches a minimum at 100 percent debt (i.e., when $D/V = 1.0$). Note also that Equation (E-2c) still implies an exponentially increasing cost of equity as more and more debt is added. In fact, except for the subscript, Equation (E-2c) looks just like Equation (E-1c). However, whether any value is added and whether the cost of capital changes at all also depends on the effect of taxes at the personal level.

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to 80-20 [i.e., by moving it from 1.0 to 4.0]. Since the cost of equity equals a constant risk premium times the debt-equity ratio, the cost of equity grows ever more rapidly as you add more and more debt.

[3] Franco Modigliani and Merton H. Miller (1963), "Corporate Income Taxes and the Cost of Capital: A Correction," *American Economic Review*, 53, pp. 433-443.

[4] Robert A. Taggart, Jr. (1991), "Consistent Valuation and Cost of Capital Expressions with Corporate and Personal Taxes," *Financial Management* 20, pp. 8-20.

3. Personal Tax Burden on Interest Expense

Q7. How do personal taxes affect the results?

A7. Ultimately, the purpose of investment is to provide income for consumption, so personal taxes affect investment returns. For example, in the U.S., municipal bonds have lower interest rates than corporate bonds because their income is taxed less heavily at the personal level. In general, capital appreciation on common stocks is taxed less heavily than interest on corporate bonds because (1) taxes on unrealized capital gains are deferred until the gains are realized, and (2) the capital gains tax rate is lower. Dividends are taxed less heavily than interest, also, under current tax law.[5] The effects of personal taxes on the cost of common equity are hard to measure, however, because common equity is so risky.

Professor Miller explored how personal taxes affect the overall cost of capital.[6] He found that personal tax effects could offset the effect of corporate taxes entirely.

Q8. Does the effect of personal taxes neutralize the effect of corporate taxes?

A8. The likelihood hereof would be increased if the current federal tax reductions on dividends and capital gains became permanent rather than expiring in 2010. However, personal taxes are important even if they do not make the corporate tax advantage on interest vanish entirely. Capital gains and dividend tax advantages definitely convey some personal tax advantage to equity, and even a partial personal advantage to equity reduces the corporate advantage to debt.

The Taggart paper explores the case of a partial offset, also. With personal taxes, the risk-free rate on the security market line is the after-personal-tax rate, which must be equal for risk-free debt and risk-free equity.[7] Therefore, the pre-personal-tax risk-free

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[5] The current maximum personal tax rate on dividend income was extended to the end of 2010 on May 17, 2006. It is uncertain what the rate on dividend come will be set at after that.

[6] Merton H. Miller (1977), "Debt and Taxes," *The Journal of Finance*, 32: 261-276, the third of the seminal papers mentioned earlier.

[7] As Prof. Taggart notes (his footnote 9), it is not necessary that a specific, risk-free equity security exist as long as one can be created synthetically, through a combination of long and short sales of traded assets. Such constructs are a common analytical tool in financial economics.

rate for equity will generally not be equal to the pre-personal-tax risk-free rate for debt. In particular, $r_{fE} = r_{fD} \times [(1-t_D)/(1-t_E)]$, where r_{fE} and r_{fD} are the risk-free costs of equity and debt and t_E and t_D are the personal tax rates for equity and debt, respectively. In terms of the cost of debt, the Taggart paper's results imply that a formal statement of these effects can be written as:[8]

$$r_3^* = r_{A3} - r_D \times t_N \times \left(\frac{D}{V}\right) \quad \text{(E-3a)}$$

$$= r_{E3} \times \left(\frac{E}{V}\right) + r_D \times \left(\frac{D}{V}\right) \times (1-t_C) \quad \text{(E-3b)}$$

which imply

$$r_{E3} = r_{A3} + \left[r_{A3} - r_D \times \left(\frac{1-t_D}{1-t_E}\right)\right] \times \left(\frac{D}{E}\right) \quad \text{(E-3c)}$$

Suppose, for example, that $t_C = 35$ percent, $t_E = 7.7$ percent and $t_D = 40$ percent. Then $[(1-t_D)/(1-t_E)] = 0.65 = (1-t_C)$. That condition corresponds to Miller's 1977 paper, in which the net personal tax advantage of equity fully offsets the net corporate tax advantage of debt. Note also that in that case, $t_N = 0$.[9] Therefore, if the personal tax advantage on equity fully offsets the corporate tax advantage on debt, Equation (E-3a) confirms that the overall after-tax cost of capital is a constant.

However, it is unlikely that the personal tax advantage of equity fully offsets the corporate tax advantage of debt. If taxes were all that mattered (i.e., if there were no other costs to debt), the overall after-corporate-tax cost of capital would still fall as debt was added, just not as fast.

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[8] The net all-tax effect of debt on the overall cost of capital, t_N, equals $\{[t_C+t_E-t_D-(t_C \times t_E)] / (1-t_E)\}$, where t_D is the personal tax rate on debt, as before. This measure of net tax effect is designed for use with the cost of debt in Equation (E-3a), which seems more useful in the present context. The Taggart paper works with a similar measure, but one which is designed for use with the cost of risk-free equity in the equivalent Taggart equation.

[9] In the above example, $t_N = \{[0.35+0.0770.4(0.35\square 0.077)] / (1.00.077)\} = 0.0/0.923 = 0$.

Finally, note that the overall after-tax cost of capital, Equation (E-3b), still uses the corporate tax rate even when personal taxes matter. Equations (E-2b) and (E-3b) both correspond to the usual formula for the ATWACC. Personal taxes affect the way the cost of equity changes with capital structure – Equation (E-3c) – but not the formula for the overall after-tax cost of capital given that cost of equity.

B. NON-TAX EFFECTS

Q9. Please describe the non-tax effects of debt.

A9. If debt is truly valuable, firms should use as much as possible, and competition should drive firms in a particular industry to the same, optimal capital structure for the industry. If debt is harmful on balance, firms should avoid it. Neither picture corresponds to what we actually see. A large economic literature has evolved to try to explain why.

Part of the answer clearly is the costs of excessive debt. Here the results cannot be reduced to equations, but they are no less real for that fact. As companies add too much debt, the costs come to outweigh the benefits. Too much debt reduces or eliminates financial flexibility, which cuts the firm's ability to take advantage of unexpected opportunities or weather unexpected difficulty. Use of debt rather than internal financing may be taken as a negative signal by the market.

Even if the company is generally healthy, more debt increases the risk that the company cannot use all of the interest tax shields in a bad year. As debt continues to grow, this problem grows and others may crop up. Management begins to worry about meeting debt payments instead of making good operating decisions. Suppliers are less willing to extend trade credit, and a liquidity shortage can translate into lower operating profits. Ultimately, the firm might have to go through the costs of bankruptcy and reorganization. Collectively, such factors are known as the costs of "financial distress."[10]

[10] See, for example, pp. 503-517 of Brealey, Myers and Allen, *Principles of Corporate Finance*, 9th Edition, McGraw-Hill/Irwin, 2008.

The net tax advantage to debt, if positive, is affected by costs such as a growing risk that the firm might have to bear the costs of financial distress. First, the expected present value of these costs offsets the value added by the interest tax shield. Second, since the likelihood of financial distress is greater in bad times when other investments also do poorly, the possibility of financial distress will increase the risks investors bear. These effects increase the variability of the value of the firm. Thus, firms that use too much debt can end up with a higher overall cost of capital than those that use none.

Other parts of the answer include the signals companies send to investors by the decision to issue new securities, and by the type of securities they issue. Other threads of the literature explore cases where management acts against shareholder interests, or where management attempts to "time" the market by issuing specific securities under different conditions. For present purposes, the important point is that no theory, whether based on taxes or on some completely different issue, has emerged as "the" explanation for capital structure decisions by firms. Nonetheless, despite the lack of a single "best" theory, there is a great deal of relevant empirical research.

Q10. What does that research show?

A10. The research does not support the view that debt makes a material difference in the value of the firm, at least not once a modest amount of debt is in place. If debt were truly valuable, competitive firms should use as much debt as possible short of producing financial distress, and competitive firms that use less debt ought to be less profitable. The research shows exactly the opposite.

For example, Kester[11] found that firms in the same industry in both the U.S. and Japan do not band around a single, "optimal" capital structure, and the most profitable firms are the ones that use the *least* debt. This finding comes despite the fact that both countries at the time (unlike the U.S. currently) had fully "classical" tax systems, in which dividends are

[11] Carl Kester (1986), "Capital and Ownership Structure: A Comparison of United States and Japanese Manufacturing Concerns," *Financial Management*, 15:5-16.

taxed fully at both the corporate and personal level. Wald[12] confirms that high profitability implies low debt ratios in France, Germany, Japan, the U.K., and the U.S. Booth *et al.* find the same result for a sample of developing nations.[13] Fama and French[14] analyze over 2000 firms for 28 years (1965-1992, inclusive) and conclude, "Our tests thus produce no indication that debt has net tax benefits."[15] A paper by Graham[16] carefully analyzes the factors that might have led a firm not to take advantage of debt. It confirms that a large proportion of firms that ought to benefit substantially from use of additional debt, including large, profitable, liquid firms, appear not to use it "enough."

This research leaves us with only three options: either (1) apparently good, profit-generating managers are making major mistakes or deliberately acting against shareholder interests, (2) the benefits of the tax deduction on debt are less than they appear, or (3) the non-tax costs to use of debt offset the potential tax benefits. Only the first of these possibilities is consistent with the view that the tax deductibility of debt conveys a material cost advantage. Moreover, if the first explanation were interpreted to mean that otherwise good managers are acting against shareholder interests, either deliberately or by mistake, it would require the additional assumption that their competitors (and potential acquirers) let them get away with it.

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[12] John K. Wald (1999), "How Firm Characteristics Affect Capital Structure: An International Comparison," *Journal of Financial Research*, 22:161-167.

[13] Laurence Booth *et al.* (2001), "Capital Structures in Developing Countries," *The Journal of Finance* Vol. LVI, pp. 87-130, finds at p. 105 that "[o]verall, the strongest result is that profitable firms use less total debt. The strength of this result is striking ..."

[14] Eugene F. Fama and Kenneth R. French (1998), "Taxes, Financing Decisions and Firm Value," *The Journal of Finance*, 53:819-843.

[15] *Ibid.*, p. 841.

[16] John R. Graham (2000), "How Big Are the Tax Benefits of Debt," *The Journal of Finance*, 55:1901-1942.

Q11. Are there any explanations in the financial literature for this puzzle other than stupid or self-serving managers at the most profitable firms?

A11. Yes. For example, Stewart C. Myers, a leading expert on capital structure, made it the topic of his Presidential Address to the American Finance Association.[17] The poor performance of tax-based explanations for capital structure led him to propose an entirely different mechanism, the "pecking order" hypothesis. This hypothesis holds that the net tax benefits of debt (i.e., corporate tax advantage over personal tax disadvantage) are at most of a second order of importance relative to other factors that drive actual debt decisions.[18] Similarly, Baker and Wurgler (2002)[19] observe a strong and persistent impact that fluctuations in market value have on capital structure. They argue that this impact is not consistent with other theories. The authors suggest a new capital structure theory based on market timing -- capital structure is the cumulative outcome of attempts to time the equity market.[20] In this theory, there is no optimal capital structure, so market timing financing decisions just accumulate over time into the capital structure outcome. (Of course, this theory only makes sense if investors do not recognize what managers are doing.)

Q12. Do inter-firm differences within an industry explain the wide variations in capital structure across the firms in an industry?

A12. No. This view is contradicted by the empirical research. As mentioned before, it has long been found that the most profitable firms in an industry, i.e., those in the best position to take advantage of debt, use the least.[21] Graham (2000) carefully examines differences in firm characteristics as possible explanations for why firms use "too little"

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[17] Stewart C. Myers (1984), "The Capital Structure Puzzle," *The Journal of Finance*, 39: 575-592. See also S. C. Myers and N. S. Majluf (1984), "Corporate Financing Decisions When Firms Have Information Investors Do Not Have," *Journal of Financial Economics* 13:187-222.

[18] See also Stewart C. Myers (1989), "Still Searching for Optimal Capital Structure," *Are the Distinctions Between Debt and Equity Disappearing?*, R.W. Kopke and E. S. Rosengren, eds., Federal Reserve Bank of Boston.

[19] Malcolm Baker and Jeffrey Wurgler (2002), "Market Timing and Capital Structure," *The Journal of Finance* 57:1-32.

[20] *Ibid.*, p. 29.

[21] For example, Kester, *op. cit.* and Wald, *op. cit.*

debt and concludes that such differences are *not* the explanation: firms that ought to benefit substantially from more debt by all measurable criteria, if the net tax advantage of debt is truly valuable, voluntarily do not use it.[22]

Nor does the research support the view that firms are constantly trying to adjust their capital structures to optimal levels. Additional research on the pecking order hypothesis demonstrates that firms do not tend towards a target capital structure, or at least do not do so with any regularity, and that past studies that seemed to show the contrary actually lacked the power to distinguish whether the hypothesis was true or not.[23] In the words of the Shyam-Sunder - Myers paper p. 242, "If our sample companies did have well-defined optimal debt ratios, it seems that their managers were not much interested in getting there."

II. EXPANDING THE EXAMPLE FROM THE DIRECT TESTIMONY

Q13. What topics do you cover in this section?

A13. My direct testimony did not detail the impact of different starting points for the level of debt nor did it address income earned on the investment, interest expense, or taxes. This section covers these topics. First, it discusses how the level of debt affects the cost of equity. Second, it addresses the influence of income and interest on the investment. Third, it explains the impact of taxes on capital structure decisions. The final topic covered in this section is the combined consequence of tax and non-tax effects of debt.

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[22] While not contradicting Graham's finding that differences in firm characteristics do not explain capital structure differences, Nengjiu Ju, Robert Parrino, Allen M. Poteshman, and Michael S. Weisbach, "Horses and Rabbits? Trade-Off Theory and Optimal Capital Structure," *Journal of Financial and Quantitative Analysis*, June 2005, pp. 1-24, looks at the issue in a different manner. Their paper uses a dynamic rather than static model to analyze the tradeoff between the tax benefits of debt and the risk of financial distress. It finds that bankruptcy costs by themselves are enough to explain observed capital structures, once dynamic effects are considered. This means debt is not as valuable as suggested by the traditional static analysis (of the sort used by Graham).

[23] Lakshmi Shyam-Sunder and Stewart C. Myers (1999), "Testing static tradeoff against pecking order models of capital structure," *Journal of Financial Economics* 51:219-244.

A. Details Of Different Levels Of Debt

Q14. Please repeat briefly the setup in the example discussed in the direct testimony.

A14. The example considered an investor who purchases $100,000 in real estate. The future value of the real estate is uncertain. Figures 2 and 3 in my direct testimony show how the return on equity to the investor differs if he finances the purchase with 100 percent equity, and if he finances it with 50 percent equity and 50 percent mortgage debt. The example illustrates the fact that debt adds risk to equity.

Q15. What happens if the investor finances the real estate purchase with different proportions of debt?

A15. The equity return becomes more variable when the mortgage percentage is a greater proportion of the initial price. Table E-1 below calculates the return on equity when real estate prices increase by 10 percent when mortgages are 0 percent, 30 percent, 50 percent, and 70 percent of the initial price.

Table E-1: The Impact of Leverage on the Return on Equity

	100% Equity	70% Equity	50% Equity	30% Equity
Debt	$0	$30,000	$50,000	$70,000
Original Equity Investment	$100,000	$70,000	$50,000	$30,000
Increase in Market Value of Equity	$10,000	$10,000	$10,000	$10,000
Return on Equity Investment	10%	14.3%	20%	33.3%

Note that going from 70 percent equity down to 50 percent equity increases the return on the equity investment by 5.7 percent while going from 50 percent equity to 30 percent equity increases the return on equity by 13.3 percent. This illustrates a general point; the rate of return on equity increases more quickly at higher levels of debt than at lower levels. Investors demand a higher equity rate of return to bear more risk and debt magnifies equity's risk at an ever increasing rate. Therefore, the required equity rate of

return goes up at an ever increasing rate as debt is added. This is not only basic finance theory, it is the everyday experience of anyone who buys a home. The bigger the mortgage, the more percentage risk the equity faces from changes in housing prices.

B. The Impact Of Income And Interest

Q16. How does earning income from the investment and paying interest on debt affect the results?

A16. In the following explanation, I ignore income taxes which I deal with in Section C below. Assume the investor is receiving income, e.g., rent, from the real estate. Specifically, assume the investor receives $500 per month in income after all non-interest expenses ($6,000 per year). Also, assume that the expected appreciation is 5 percent per year, so the expected market value is $105,000 after one year. Then the expected rate of return from the real estate with all equity financing is:

$$\text{Expected Return on Equity @ 0\% debt} = \frac{\text{Expected Net Income + Expected Appreciation}}{\text{Initial Investment}}$$

$$= \frac{\$6{,}000 + (\$105{,}000 - \$100{,}000)}{\$100{,}000}$$

$$= 11\%$$

Now suppose that the mortgage interest rate were 5 percent. Then at a mortgage equal to 50 percent, or $50,000, interest expense would be ($50,000 x 0.05), or $2,500. The expected equity rate of return would be:

$$\text{Expected Return on Equity @ 50\% debt} = \frac{\text{Expected (Net Income + Appreciation) – Int. Expense}}{\text{Initial } \textit{Equity} \text{ Investment}}$$

$$= \frac{\$6{,}000 + \$5{,}000 - \$2{,}500}{\$50{,}000}$$

$$= 17\%$$

Notice that the expected return on equity is higher as is the risk carried by equity.

Q17. Can you provide a more general illustration?

Yes. Figure E-1 uses these assumptions at different mortgage levels to plot both (i) the expected rate of return on the equity in the real estate, and (ii) the realized rate of return on that equity in a year if the real estate value increases by 10 percent more than the expected 5 percent rate (i.e., if the value increases by 15 percent) or by 10 percent less than expected (i.e., if it decreases by 5 percent).[24]

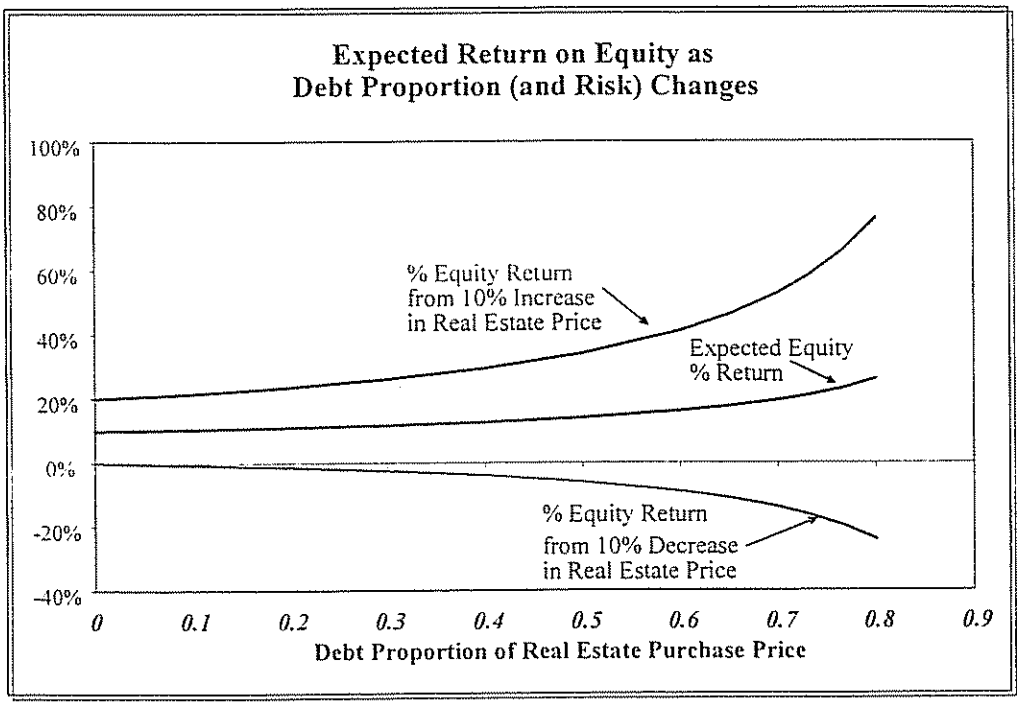

Figure E-1

The expected rate of return on equity increases at an increasing rate as the investor finances more and more of the real estate through loans (e.g., with a mortgage). Since equity bears all the risk of increases or decreases in real estate values (absent financial distress or bankruptcy), the amount of risk the buyer bears grows at an ever increasing rate as the mortgage percentage also increases.

[24] For simplicity, the figure assumes the debt's interest rate is independent of the debt proportion. This might not always be true, and in general would not be true for a corporation that issued debt. However, the general shape of the graphs remains the same.

Q18. What are the implications of this example?

A17. When a company uses debt to finance part an investment, the risk magnifies. For example, if an investor buys stocks "on margin" -- by borrowing part of the money used to buy the stock -- the expected rate of return will be higher as will the risks the investor carries. As an everyday example, imagine investing your retirement savings in a stock portfolio bought with as much margin as possible. If you were lucky, you could end up living very well in retirement. However, it is very risky and likely you would have lost substantial value over the past year. Specifically, your portfolio could decline by more than 100 percent of your initial investment. The same risk-magnifying effects happen when companies borrow to finance part of their investments.

C. The Effect Of Taxes

Q19. What is the impact of taxes?

A18. Analyzing the net effect of taxes in capital structure decisions by corporations is an important part of the financial research. The bottom line is that taxes complicate the picture without changing the basic conclusion.

Q20. Please describe the potential impact of taxes.

A19. Interest expense is tax-deductible for corporations. That increases the pool of cash the corporation gets to keep out of its operating earnings (i.e., its earnings before interest expense). With no debt, 100 percent of operating income is subject to taxes. With debt, only the equity part of the operating income is subject to taxes. All else equal, the extra money kept from operating income increases the value of the corporation. The standard way to recognize that increase in value is to use an after-tax weighted-average cost of capital as a discount rate when valuing a company's operating cash flows.

Q21. Do personal taxes affect the value of debt, too?

A20. Yes, but in the other direction. One offset to debt's tax benefits at the corporate level is its higher tax burden at the personal level. Investors care about the money they get to keep after all taxes are paid, and while the corporation saves taxes by opting for debt over

equity, individuals pay more taxes on interest than on capital gains from equity (and for now, on dividends as well).

Q22. Are there factors other than taxes matter?

A21. Yes. The "all else" does not remain equal as more debt is added. The more debt, the more the non-tax effects of debt offset the tax benefits. Other costs include such effects as a loss of flexibility, the possibility of sending negative signals to investors, and a host of costs and risks associated with the danger of financial distress.

Q23. Does the tradeoff between the tax and non-tax effects of debt mean that firms have well-defined, optimal capital structures?

A22. No, the "tradeoff" model does not explain actual corporate behavior. Economic research confirms that real-world corporations act as if, after a moderate amount of debt is in place, the tax benefits of debt are not worth debt's other costs. In country after country and in industry after industry, the most profitable corporations in an industry tend to use the least debt. Economic research finds that the most profitable companies tend to use the least debt in a given industry. Yet these are the companies with the most operating income to shield from taxes, who would benefit most if interest tax shields were truly valuable net of debt's other costs. They also presumptively are the best-managed on average (else why are they the most profitable?). This means it is unrealistic to suppose that more debt is always better, or that greater tax savings due to higher interest expense always add value to the firm on balance.

Q24. If the tradeoff model doesn't explain capital structure decisions by firms, is there a model that does?

A23. No single model has (yet) emerged as 'the" explanation of capital structure. However, several alternative models attempt to model the tradeoff (e.g., the "pecking order" hypothesis and "agency cost" explanations).

Q25. What does the absence of an agreed theory of capital structure in the financial literature imply about the overall effect of debt on the value of the firm?

A24. The findings of the financial literature mean that within an industry, there is no well-defined optimal capital structure. The use of some debt does convey some value advantage in most industries, but that advantage is offset by other costs as firms add more debt.[25] The range of capital structures over which the value of the firm in any industry is maximized is wide and should be treated as flat. The location and level of that range, however, does vary from industry to industry, just as the overall cost of capital varies from industry to industry.

Figure E-2 illustrates the picture that emerges from the research. This figure shows the present value of an investment in each of four different industries. For simplicity, the investment is expected to yield $1.00 per year forever. For firms in relatively high-risk industries (Industry 1 in the graph, the lowest line), the $1.00 perpetuity is not worth much and any use of debt decreases firm value. For firms in relatively low-risk industries (Industry 4 in the graph), the perpetuity is worth more and substantial amounts of debt make sense. Industries 2 and 3 are intermediate cases.

The maximum net rate at which taxes can increase value in this figure equals 20 percent of interest expense, representing a balance between the corporate tax advantage to debt and the personal tax disadvantage. The figure plots the maximum possible impact of taxes on value as a separate line, starting at the all-equity value of the lowest-risk industry (Industry 4).

[25] Note that if debt did increase the value of the firm materially, competition would tend to take that value away, since issuing debt is an easy-to-copy competitive strategy. Prices would fall as firms copied the strategy, lowering operating earnings and passing the net tax advantages to debt through to customers (just as happens under rate regulation). Therefore, if also there were a narrow range of optimal capital structures within an industry, competition would drive all firms in the industry to capital structures within that range. This does not happen in practice, which contradicts one or both of the assumptions, i.e., (1) that debt adds material value on balance, and/or (2) that there is a narrow range of optimal capital structures.

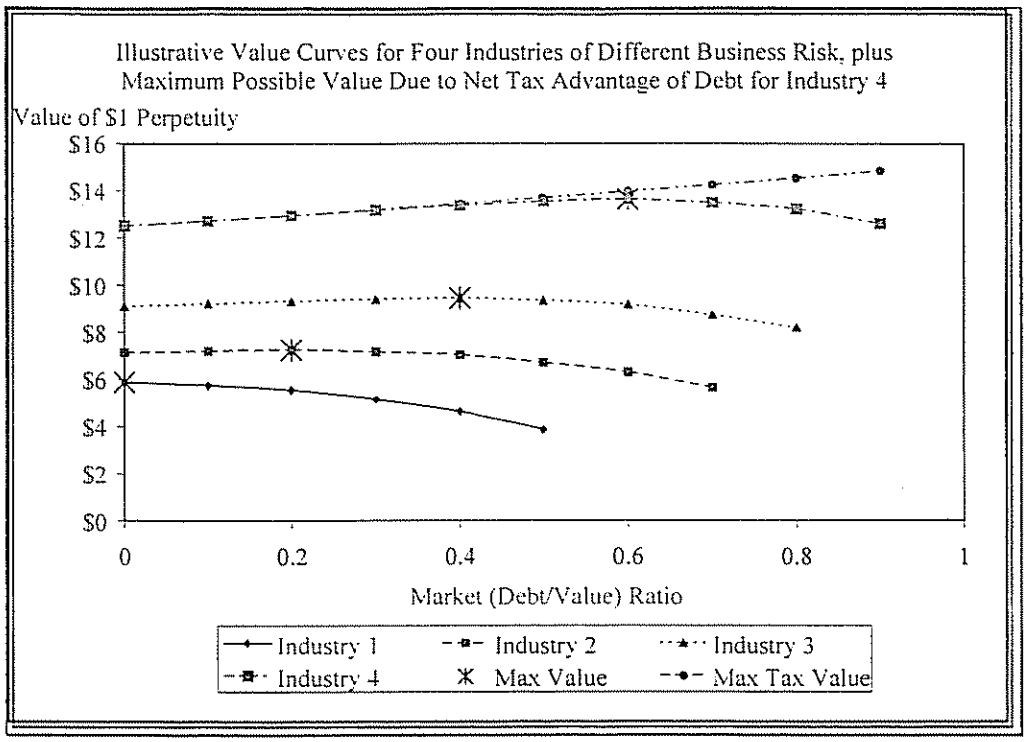

Figure E-2

Figure E-2 identifies a particular point as the maximum value on each of the four curves. However, the research shows that reliable identification of this maximum point, except in the extreme case where no debt should be used, is impossible. In accord with the research, the graph is prepared so that in none of the industries does a change in capital structure make much difference near the top of the curve. Even Industry 4, which increases in value at the maximum rate as quite a lot of debt is added, eventually must reach a broad range where changes in the debt ratio make little difference to firm value, given the research. For Industry 4, debt makes less than a 2 percent difference in the total value of the firm for debt-to-value ratios between 40 and 70 percent.

Q26. What does this imply for the overall cost of capital?

A25. Figure E-3 plots the after-tax weighted-average costs of capital ("ATWACCs") that correspond to the value curves in Figure E-2. This picture just turns Figure E-2 upside down. All the same conclusions remain, except that they are stated in terms of the overall cost of capital instead of the overall firm value. In particular, except for high-risk

industries, the overall cost of capital is essentially flat across a broad middle range of capital structures for each industry, which is the only outcome consistent with the research. For Industry 4, for example, the ATWACC changes by less than 15 basis points for debt-to-value ratios between 40 and 70 percent.

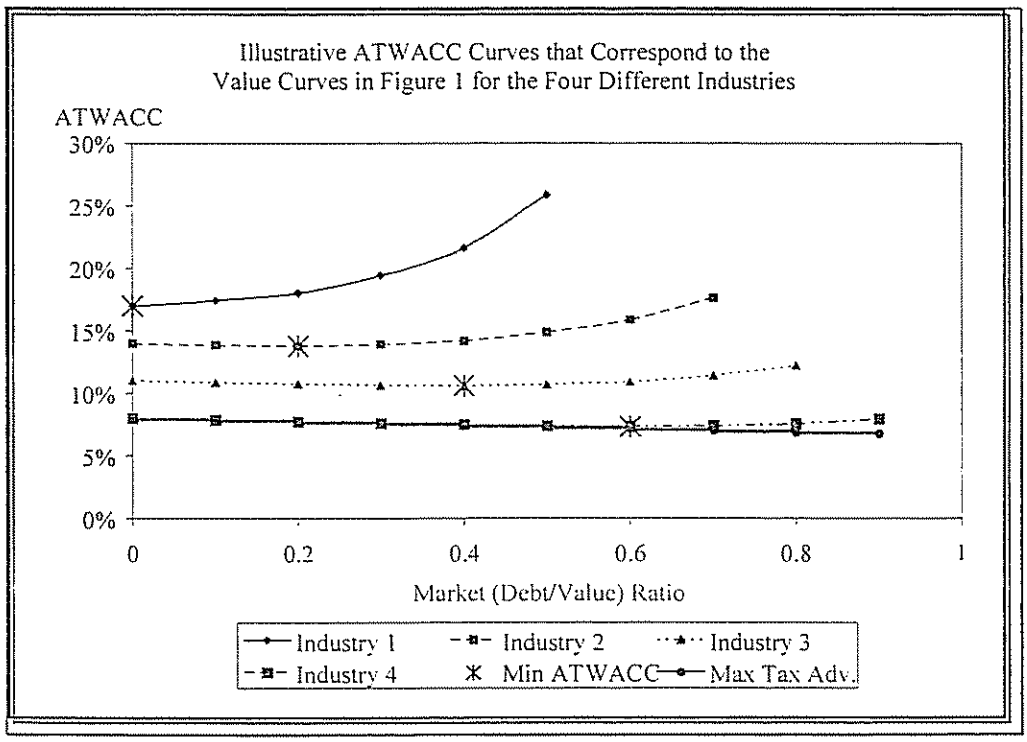

Figure E-3

Q27. How does this discussion relate to estimation of the right cost of equity for ratemaking purposes?

A26. When an analyst estimates the cost of equity for a sample of companies, s/he does so at the sample's actual market-value capital structure. That is, the sample evidence corresponds to ATWACCs that are already out somewhere in the broad middle range in which changes in the debt ratio have little or no impact on the overall value of the firm or the ATWACC.

The ATWACC curve is therefore virtually flat in a broad middle range. This assumption provides the tradeoff between the cost of equity and capital structure.

D. COMBINED EFFECTS

Q28. Please summarize the implications for the combined impact of the tax and non-tax effects of debt.

A27. The most profitable firms do not behave as if the precise amount of debt they use makes any material difference to value, and competition does not force them into an alternative decision, as it would if debt were genuinely valuable. The explanation that fits the facts and the research is that within an industry, there is no well-defined optimal capital structure. Use of some debt does convey an advantage in most industries, but that advantage is offset by other costs as firms add more debt. The range of capital structures over which the value of the firm in any industry is maximized is wide and should be treated as flat. The location and level of that range, however, does vary from industry to industry, just as the overall cost of capital varies from industry to industry. To conclude that more debt does add more value, once the firm is somewhere in the normal range for the industry, is to conclude that corporate management in general is either blind to an easy source of value or otherwise incompetent (and that their competitors let them get away with it).

The finding that there is no narrowly defined optimal capital structure implies that the ATWACCs for a sample of companies in a given industry is independent of capital structure (at least within a broad middle range of capital structures). The cost of equity for a rate-regulated company in the same industry is the number that yields the same ATWACC at the capital structure used to set the revenue requirement, since that is the cost of equity that (estimation problems aside) the sample companies would have had if their market-value capital structures had been equal to the regulatory capital structure.

BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION

IN THE MATTER OF THE PETITION BY NEW MEXICO-AMERICAN WATER COMPANY, INC. FOR ADJUSTMENT OF WATER RATES FOR ITS CLOVIS DISTRICTS,

Case No. 08-00134-UT

NEW MEXICO-AMERICAN WATER COMPANY, INC.,
Petitioner.

DIRECT TESTIMONY
OF
BENTE VILLADSEN
ON BEHALF OF
NEW MEXICO-AMERICAN WATER COMPANY

June 2008

Direct Testimony
of Bente Villadsen
NMPRC Case No. 08-00134-UT

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EXECUTIVE SUMMARY

Dr. Bente Villadsen, a Principal at *The Brattle Group*, files testimony on the cost of capital for New Mexico-American Water Company's water districts in New Mexico ("New Mexico-American Water").

Dr. Villadsen selects two benchmark samples, water utilities and gas local distribution companies ("LDC"). She estimates the sample companies' cost of equity, associated after-tax weighted-average cost of capital, and the corresponding cost of equity at 45 percent equity. In undertaking her analysis, Dr. Villadsen notes that the overall cost of capital is constant within a broad middle range of capital structures although the distribution of costs and risks among debt and equity holders is not. Because New Mexico-American Water's requested target of 45 percent equity is lower than the percentage equity among many utilities, its financial risk is higher and the return required by investors increases with the level of risk they carry.

Based on the evidence from the samples, Dr. Villadsen estimates a cost of equity for the benchmark samples at New Mexico-American Water's capital structure to be in the range of 11¼ to 12¼ percent, so that New Mexico-American Water's request for 11.75 percent return on equity is equal to the midpoint. She therefore finds that New Mexico-American Water's request for 11.75 percent return on equity is reasonable and fully supported by her analysis.

I. INTRODUCTION AND SUMMARY

Q1. PLEASE STATE YOUR NAME AND ADDRESS FOR THE RECORD.

A1. My name is Bente Villadsen. My business address is *The Brattle Group*, 44 Brattle Street, Cambridge, MA 02138.

Q2. PLEASE DESCRIBE YOUR JOB AND EDUCATIONAL EXPERIENCE.

A2. I am a Principal of *The Brattle Group*, ("Brattle"), an economic, environmental and management consulting firm with offices in Cambridge, Washington, San Francisco, London and Brussels. My work concentrates on regulatory finance and accounting. I have previously prepared and presented cost-of-capital testimony before regulatory entities. I hold a B.S. and M.S. from University of Aarhus, Denmark and a Ph.D. from Yale University's School of Management.

Q3. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING?

A3. I have been asked by New Mexico-American Water Company ("New Mexico-American Water" or the "Company") to estimate the cost of equity for New Mexico-American Water's water districts. The cost of equity is the return that the Commission should provide the Company an opportunity to earn on the portion of its rate base financed by equity.

To determine the cost of equity for New Mexico-American Water, I first estimate the overall cost of capital for two samples of regulated companies using several versions of the discounted cash flow ("DCF") and risk-positioning models. Second, I determine the cost of equity that the estimated overall cost of capital gives rise to at New Mexico-American Water's requested capital structure consisting of 45.1 percent equity. Third, I evaluate the relative risk of New Mexico-American Water and the sample companies to determine the recommended cost of equity for New Mexico-American Water.

Q4. PLEASE SUMMARIZE ANY PARTS OF YOUR BACKGROUND AND EXPERIENCE THAT ARE PARTICULARLY RELEVANT TO YOUR TESTIMONY ON THESE MATTERS.

A4. Brattle's specialties include financial economics, regulatory economics, and the utility industry. I have worked extensively on cost of capital matters for electric, natural gas distribution, pipeline and water utilities in state, federal, and foreign jurisdictions. Additionally, I have significant experience in other areas of rate regulation, credit risk in the utilities industry, energy contracts, and accounting issues. I have filed expert testimony and appeared before arbitration tribunals concerning cost of capital, accounting questions, and damage issues**.** Appendix A contains more information on my professional qualifications.

Q5. PLEASE SUMMARIZE YOUR APPROACH TO ESTIMATING THE COST OF CAPITAL FOR NEW MEXICO-AMERICAN WATER.

A5. To assess the cost of capital for New Mexico-American Water, I select two benchmark samples, regulated water utilities and natural gas local distribution companies ("LDC"). These samples are selected to have risks characteristics comparable to those of New Mexico-American Water. I also report results for a subsample of the water companies with a high percentage of regulated revenues. I give greater weight to the results from the gas LDC sample, because the water sample suffers from numerous data issues that make the cost-of-equity estimates based on this sample less reliable at the present time. For each sample, I estimate the sample companies' cost of equity using several versions of the DCF method and of the risk-positioning model. Based on data availability and the current state of the water and gas distribution industries I assign the most weight to the risk-positioning models.

Next, based on the cost-of-equity estimates for each company and its market costs of debt and preferred stock, I calculate each firm's overall cost of capital, i.e., its after-tax weighted-average cost of capital ("ATWACC"), using the company's market value capital structure. I then calculate the samples' average ATWACC and the cost of equity for a capital structure with 45.1 percent equity. Thus, I present the cost of equity that is consistent with the samples' market information and New Mexico-American Water's

regulatory capital structure. (By "regulatory capital structure," I mean the capital structure that New Mexico-American Water proposes in its application.)

Focusing on the overall cost of capital rather than its components avoids potential problems of inconsistency between the estimated cost of equity and the level of financial risk at the regulated company's capital structure.

Q6. PLEASE SUMMARIZE YOUR CONCLUSIONS REGARDING NEW MEXICO-AMERICAN WATER'S COST OF EQUITY.

A6. The cost of equity for the water utility sample is about 14 percent for a range of 13.50 to 14.50 percent at 45.1 percent equity using the long-term risk-positioning method. The corresponding overall after-tax weighted-average cost-of-capital point estimate is 8.5 percent. The gas LDC sample yields a cost-of-equity estimate of about 12 percent for a range of 11.50 to 12.5 percent; again using the long-term risk-positioning method. The corresponding after-tax weighted-average cost-of-capital range is 7.25 to 7.75 percent. I specify a minimum of plus or minus .25 percent (25 basis point) range around the after-tax weighted-average cost of capital because it is not really possible to estimate the cost of capital more precisely than that. The cost-of-equity estimates that result from the multi-stage discounted cash flow method are a bit lower for the water sample than for the gas LDC sample. The estimates based on the simple DCF are similar for the gas LDC sample, but very different and considerably higher for the water sample. Combined, the DCF results imply a range of 11.25 to 11.50 percent for the gas LDC sample and a wide range of 10.75 to 15.75 percent for the water sample.

Based on these results, and considering that I rely mostly on the gas LDC sample estimates due to numerous data problems associated with the water sample, the estimates for New Mexico-American Water's cost of equity indicate a range of 11.25 to 12.25 percent. New Mexico-American Water's request for an 11.75 percent return on equity is within this range and at the midpoint. In my opinion, the request for an 11.75 percent return on equity is near the middle of the range for the gas LDC sample and very reasonable.

Q7. WHY DO YOU NEED TO CONSIDER NEW MEXICO-AMERICAN WATER'S REGULATORY CAPITAL STRUCTURE?

A7. A firm's cost of equity is a function of both its business risk and its financial risk. The more leveraged a company is the higher its financial risk. Investors holding equity in companies with higher risk require a higher rate of return, so as a company adds debt, the cost of equity goes up at an ever increasing rate. The higher cost of equity offsets the lower cost of debt, so that the after-tax weighted-average overall cost of capital remains constant over a broad range of capital structures.

That is, the associated capital structure affects an estimated cost-of-equity estimate just as a life insurance applicant's age affects the required life-insurance premium. It is therefore necessary to calculate the cost of equity the sample companies would have had at New Mexico-American Water's regulatory capital structure to report accurately the market evidence on the cost of equity.

Q8. HOW IS THE REST OF YOUR TESTIMONY ORGANIZED?

A8. The rest of my testimony is organized as follows:

Section II defines the cost of capital and discusses the principles that relate a company's cost of capital and its capital structure.

Section III presents the methods used to estimate the cost of capital for the benchmark samples, and the associated numerical analyses. This section also explains the basis of my conclusions for the benchmark samples' returns on equity and overall costs of capital.

Section IV summarizes the analysis and discusses the recommendation for New Mexico-American Water.

Appendix A lists my qualifications.

Appendix B discusses in detail the selection procedure for each sample, and the methods used to derive the necessary capital structure market value information.

Appendix C details the risk-positioning method including the numerical analyses.

Appendix D details the DCF method, including the numerical analyses.

Appendix E discusses the impact of leverage on the cost of capital in more detail.

I repeat portions of my testimony in the appendices in order to give the reader the context of the issues before I present additional technical detail and further discussion.

II. THE COST OF CAPITAL AND RISK

A. The Cost of Capital and Risk

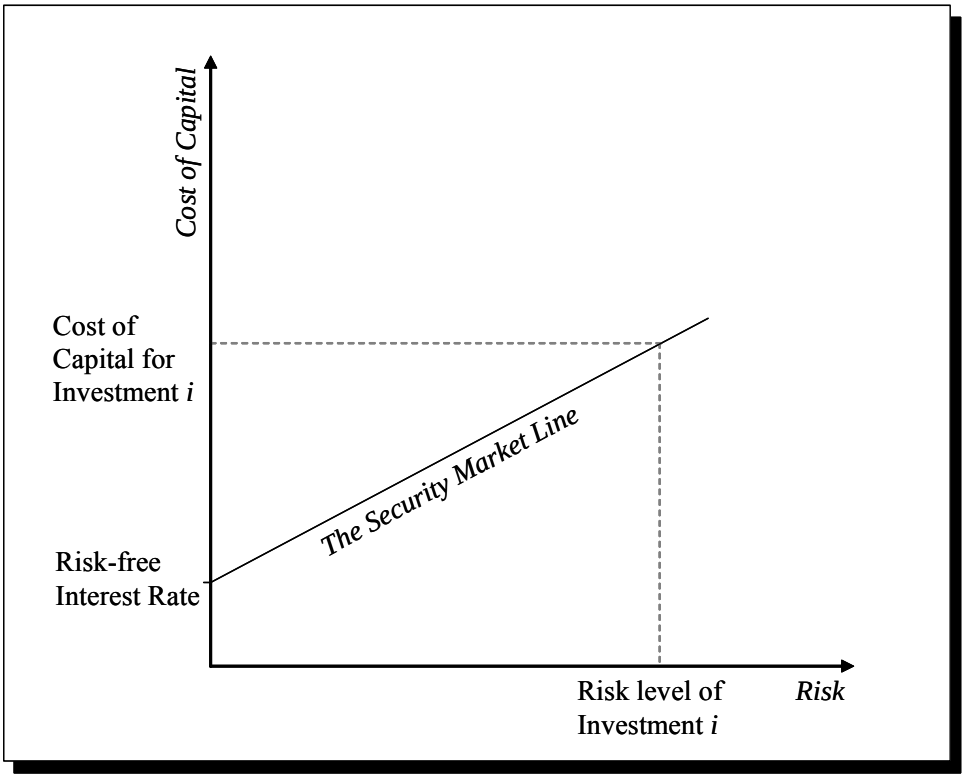
Q9. PLEASE FORMALLY DEFINE THE "COST OF CAPITAL."

A9. The cost of capital is the expected rate of return in capital markets on alternative investments of equivalent risk. In other words, it is the rate of return investors require based on the risk-return alternatives available in competitive capital markets. The cost of capital is a type of opportunity cost: it represents the rate of return that investors could expect to earn elsewhere without bearing more risk.[1]

The definition of the cost of capital recognizes a tradeoff between risk and return that is known as the "security market risk-return line," or "security market line" for short. This line is depicted in Figure 1. Figure 1 shows that the higher the risk, the higher the cost of capital. A version of Figure 1 applies for all investments. However, for different types of securities, the location of the line may depend on corporate and personal tax rates.

[1] "Expected" is used in the statistical sense: the mean of the distribution of possible outcomes. The terms "expect" and "expected" in this testimony, as in the definition of the cost of capital itself, refer to the probability-weighted average over all possible outcomes.

Figure 1: The Security Market Line



Q10. WHY IS THE COST OF CAPITAL RELEVANT IN RATE REGULATION?

A10. U.S. rate regulation accepts the "cost of capital" as the right expected rate of return on utility investment.[2] This practice is normally viewed as consistent with the U.S. Supreme Court's opinions in *Bluefield Waterworks & Improvement Co. v. Public Service Commission*, 262 U.S. 678 (1923), and *Federal Power Commission v. Hope Natural Gas*, 320 U.S. 591 (1944).

From an economic perspective, rate levels that give investors a fair opportunity to earn the cost of capital are the lowest levels that compensate investors for the risks they bear. Over the long run, an expected return above the cost of capital makes customers overpay for service. Regulatory authorities normally try to prevent such outcomes, unless there are offsetting benefits (e.g., from incentive regulation that reduces future costs). At the same time, an expected return below the cost of capital does a disservice not just to

[2] An early paper that links the cost of capital as defined by financial economics with the correct expected rate of return for utilities is Stewart C. Myers, "Application of Finance Theory to Public Utility Rate Cases," *The Bell Journal of Economics and Management Science*, 3:58-97 (Spring 1972).

investors but, importantly, to customers as well. In the long run, such a return denies the company the ability to attract capital, to maintain its financial integrity, and to expect a return commensurate with that of other enterprises characterized by commensurate risks and uncertainties.

More important for customers, however, are the economic issues an inadequate return raises for them. In the short run, deviations of the expected rate of return on the rate base from the cost of capital may seemingly create a "zero-sum game"-- investors gain if customers are overcharged, and customers gain if investors are shortchanged. But in fact, even in the short run, such action may adversely affect the utility's ability to provide stable and favorable rates because some potential efficiency investments may be delayed or because the company is forced to file more frequent rate cases. In the long run, inadequate returns are likely to cost customers – and society generally – far more than may be gained in the short run. Inadequate returns lead to inadequate investment, whether for maintenance or for new plant and equipment. The costs of an undercapitalized industry can be far greater than the short-run gains from shortfalls in the cost of capital. Moreover, in capital-intensive industries (such as the water industry),[3] systems that take a long time to decay cannot be fixed overnight. Thus, it is in the customers' interest not only to make sure that the return investors expect does not exceed the cost of capital, but also to make sure that it does not fall short of the cost of capital, either.

Of course, the cost of capital cannot be estimated with perfect certainty, and other aspects of the way the revenue requirement is set may mean investors expect to earn more or less than the cost of capital even if the allowed rate of return equals the cost of capital exactly. However, a commission that sets rates so investors expect to earn the cost of capital on average treats both customers and investors fairly, which is in the long-run interests of both groups.

[3] Capital expenditures among water utilities have in the last several years exceeded 30% of revenues.

B. The Relationship Between Capital Structure and the Cost of equity

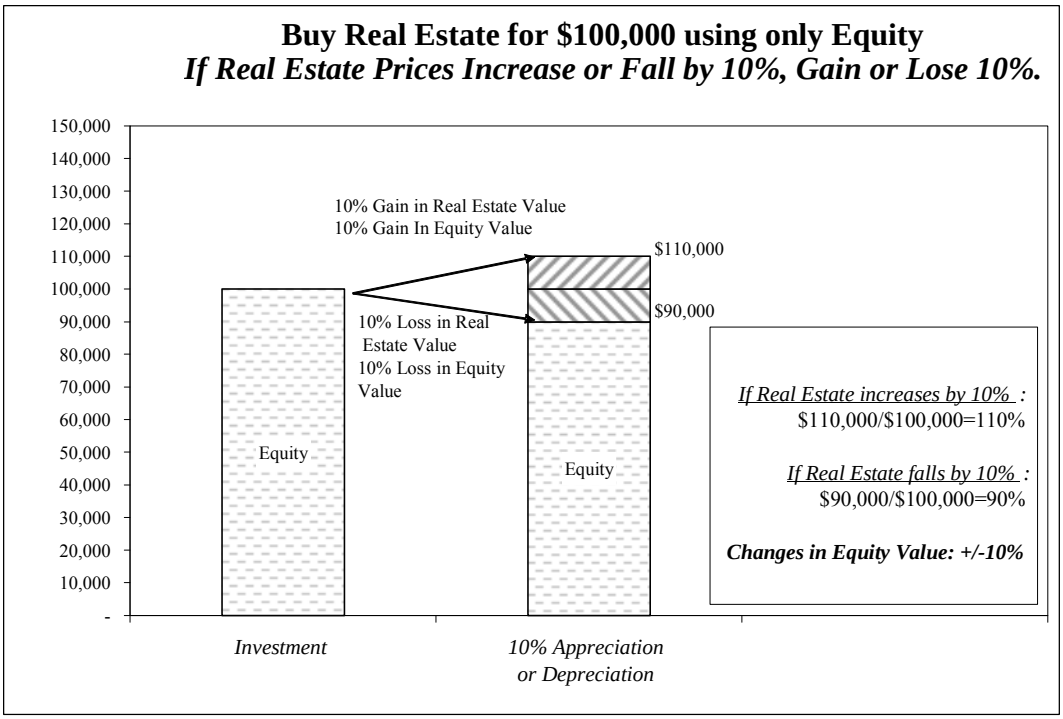
Q11. PLEASE EXPLAIN WHY IT IS NECESSARY TO REPORT THE COST OF EQUITY ADJUSTED FOR CAPITAL STRUCTURE.

A11. In most jurisdictions in North America, rate regulation focuses on the components of the rates. In other words, the focus of cost-of-capital estimation is usually on determining the "right" cost of equity, and to a lesser degree on setting the allowed capital structure. While the overall cost of capital depends primarily on the company's line of business, the distribution of the cost of capital among debt and equity depends on their share in total revenues. Debt holders' claim is usually a fixed amount (except in situations of default) while equity holders are residual claimants, meaning that equity holders get paid last. In other words, the use of debt imposes financial risk on the equity holders. Because a company's financial risk depends on its capital structure, the risk shareholders carry increases with the leverage of the company. As shareholders expect to be compensated for increased risk, the required rate of return increases with the company's leverage. The increased risk is caused by the fact that debt has a senior claim on a specified portion of earnings and in bankruptcy on assets. As common equity is the most junior security, it gets what's left after everyone else has been paid. In other words, common equity holders carry all residual risk. However, as explained in more detail in Appendix E, the overall cost of capital is constant within a broad middle range of capital structures, although the distribution of costs and risks among debt and equity holders is not.

Q12. PLEASE PROVIDE AN EXAMPLE ON HOW DEBT ADDS RISK TO EQUITY.

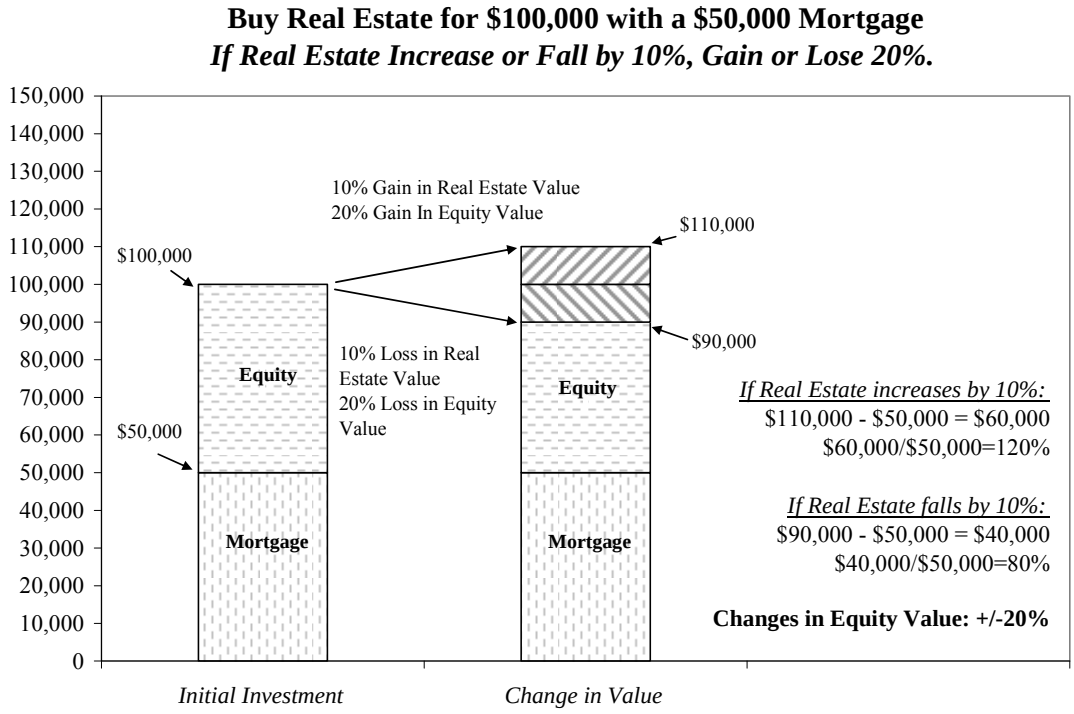
A12. As a simple example, think of an investor who takes money out of his savings account and invests $100,000 in real estate. The future value of the real estate is uncertain. If the real estate market booms, he wins. If the real estate market goes down, he loses. Figure 2 below illustrates this.

Figure 2. Financial risk example – equity financing



In the scenario above, the investor financed his real estate purchase through 100 percent equity. Suppose instead that the investor had financed 50 percent of his real estate investment with a mortgage of $50,000. The mortgage lender does not expect to share in any benefits from increases in real estate values. Neither does the mortgage lender expect to share in any losses from falling real estate values. As a result, the investor carries the entire risk of fluctuating real estate prices. Figure 3 illustrates this effect.

Figure 3. Financial risk example - debt and equity financing



In Figure 3, where the investor financed his purchase through 50 percent equity and 50 percent debt, the variability in the investor's equity return is two times greater than that of Figure 2. The entire fluctuation of 10 percent from rising or falling real estate prices falls on the investor's $50,000 equity investment. The lesson from the example is obvious: debt adds risk to equity.

C. Implications for Analysis

Q13. PLEASE EXPLAIN THE IMPLICATIONS OF THE RELATIONSHIP BETWEEN CAPITAL STRUCTURE AND THE COST OF EQUITY FOR RATE REGULATION.

A13. The risk equity holders carry, and therefore the cost of equity, depends on the capital structure. As illustrated in the example above, as leverage increases, the market risk increases and hence the required return on equity increases.

Q14. TO ASSESS THE MAGNITUDE OF FINANCIAL RISK FOR A RATE REGULATED COMPANY, SHOULD YOU USE THE MARKET-VALUE OR THE BOOK-VALUE CAPITAL STRUCTURE?

A14. The market-value capital structure is the relevant quantity for analyzing the cost-of-equity evidence, which is based on market information.[4]

Q15. PLEASE PROVIDE AN EXAMPLE THAT ILLUSTRATES WHY MARKET VALUES ARE RELEVANT.

A15. Suppose in the previous example that the investor has invested in real estate 10 years ago. Further assume that depreciation has reduced the book value of the real estate from $100,000 to $75,000 and assume the investor has paid off 40 percent of his $50,000 mortgage. Thus, the investor has a remaining mortgage of $30,000 (= 60% × $50,000). The book value of the investor's equity is therefore $45,000 (= $75,000 - $30,000).

What happens now if real estate prices rise or fall 20 percent? To answer that question, we need to know how real estate prices have developed over the past 10 years. If the market value of the real estate now is $200,000, then a 20-percent decrease in the price of real estate ($40,000) is almost equal to the investor's book value equity. However, his market value equity (or net worth) is equal to the value of the real estate minus what he owes on the mortgage. If we assume that the market value of the mortgage equals the unpaid balance ($30,000), then the investor's net worth is calculated as follows:

[4] The need to use market-value capital structures to analyze the effect of debt on the cost of equity has been recognized in the financial literature for a long time. For example, the initial reconciliation of the Modigliani-Miller theories of capital structure with the Capital Asset Pricing Model, in Robert S. Hamada, "Portfolio Analysis, Market Equilibrium and Corporate Finance," *The Journal of Finance* 24: 13-31 (March 1969) works with market-value capital structures. For a more recent presentation of the concept, see, for example, Richard A. Brealey, Stewart C. Myers, and Franklin Allen, *Principles of Corporate Finance*, New York: McGraw-Hill/Irwin 8th ed. (2006) pp. 503-06. Book values may be relevant for some issues, e.g., for covenants on individual bond issues, but as explained in the text, market values are the determinants of the impact of debt on the cost of equity.

Net Worth	=	Market Value of Real Estate	-	Remaining Mortgage
	=	$200,000	-	$30,000
	=	$170,000		

Therefore, the rate of return on equity due to a 20 percent decline in real estate prices is calculated as follows:

Table 1. Calculating the Rate of Return on Equity

Decline in Real Estate Value	$40,000
Market-Value Equity	$170,000
Rate of Return on Equity	- $40,000/$170,000 = -23.5%

Q16. PLEASE EXPLAIN THE IMPLICATIONS FOR RATE REGULATION AND YOUR TESTIMONY.

A16. Because the market risk, and therefore the cost of equity, depends on the market-value capital structures, one must base the estimation of the sample companies' cost of capital on market value capital structures. An approach that estimates the cost of equity for each of the sample firms without explicit consideration of the market value capital structure (i.e. the financial risk) underlying those costs risks material errors. The cost-of-equity estimates of the sample companies at their actual market-value capital structures are not necessarily reflected in the regulatory capital structure. Therefore, using book values could lead to an incorrect rate of return. I avoid this problem by calculating each sample company's ATWACC using its market value capital structure. I then use the sample companies' average overall cost of capital to determine the corresponding return on equity at New Mexico-American Water's regulatory capital structure. This procedure ensures that the capital structure and the estimated cost of equity are consistent.

In my analyses, I estimate the cost of equity for each of the sample firms using traditional estimation methods (such as the DCF and Capital Asset Pricing Model ("CAPM")). I use each company's estimated cost of equity along with New Mexico-American Water's

marginal tax rate and each company's market cost of debt and market-value capital structure to estimate the sample companies' overall cost of capital. I then calculate the sample average overall cost of capital for each equity estimation method for both of the samples. For each estimation method discussed above, I determine the cost of equity at New Mexico-American Water's regulated capital structure, so that is consistent with the sample's overall cost-of-capital information.

Q17. IS THE USE OF MARKET VALUES TO CALCULATE THE IMPACT OF CAPITAL STRUCTURE ON THE RISK OF EQUITY INCOMPATIBLE WITH USE OF A BOOK-VALUE RATE BASE FOR A REGULATED COMPANY?

A17. No. Investors buy stock at market prices and expect a reasonable return on their investment. Market-based cost-of-equity estimation methods, such as DCF or CAPM which are frequently used in rate regulation, recognize this and rely on market data. That is, the cost of capital is the fair rate of return on regulatory assets for both investors and customers. Most regulatory jurisdictions in the U.S. measure the rate base using the net book value of assets, not current replacement value or historical cost trended for inflation. But the jurisdictions still apply market-derived measures of the cost of equity to that net book value rate base.

The issue here is "what level of risk is reflected in that cost-of-equity estimate?" That risk level depends on the sample company's market-value capital structure, not its book-value capital structure. *That risk level would be different if the sample company's market-value capital structure exactly equaled its book-value capital structure, so the estimated cost of equity would be different, too.*

Q18. PLEASE SUM UP THE IMPLICATIONS OF THIS SECTION.

A18. The market risk, and therefore the cost of equity depends directly on the market-value capital structure of the company or asset in question. It therefore is impossible to validly compare the measured costs of equity of different companies without taking capital structure into account. Capital structure and the cost of equity are unbreakably linked, and any effort to treat the two as separate and distinct questions violates both everyday experience (e.g., with home mortgages) and basic financial principles.

Q19. HOW SHOULD A COST-OF-CAPITAL ANALYST IMPLEMENT THIS PRINCIPLE?

A19. As discussed further in Appendix E, there has been a great deal of financial research on the effects of capital structure on the value of the firm. One of the key conclusions that result from the research is that no narrowly defined optimal capital structure exists within industries, although the typical range of capital structures does vary among industries. Instead, there is a relatively wide range of capital structures within any industry in which fine-tuning the debt ratio makes little or no difference to the value of the firm, and hence to its overall after-tax cost of capital.

Accordingly, analysts should treat the market-value weighted average of the cost of equity and the after-tax current cost of debt, or the "ATWACC" for short, as constant. Sample evidence should be analyzed to determine the sample's average ATWACC, which can be compared across different firms or industries. The economically appropriate cost of equity for a regulated firm is the quantity that, when applied to the regulatory capital structure, produces the same ATWACC. That value is the cost of equity that the sample would have had, estimation problems aside, if the sample's market-value capital structure had been equal to the regulatory capital structure in question.

Q20. HOW DO YOU CALCULATE THE COST OF EQUITY CONSISTENT WITH THE MARKET-DETERMINED ESTIMATE OF THE SAMPLE'S AVERAGE COST OF CAPITAL?

A20. For simplicity assume that all sample companies have only common stock and debt. Then the ATWACC is calculated as:

$$ATWACC = r_D \times (1 - T_C) \times D + r_E \times E \quad \textbf{(1)}$$

where r_D is the market cost of debt, r_E is the market cost of equity, T_C is the marginal corporate income tax rate, D is the percent debt in the capital structure, and E is the percent equity in capital structure. The cost of equity consistent with the overall cost-of-capital estimate (ATWACC), the market cost of debt and equity, the marginal corporate

income tax rate and the amount of debt and equity in the capital structure can be determined by solving equation (1) for r_E.

Q21. CAN YOU PROVIDE AN EXAMPLE OF HOW THIS FORMULA IS USED TO DETERMINE THE COST OF EQUITY?

A21. Yes. Consider a company with a 40 percent marginal corporate income tax rate and a cost of debt equal to 6 percent. For simplicity, I assume there is no difference in the company's embedded cost of debt and the cost at which it currently can issue additional debt. Further, suppose that the ATWACC estimate based on a sample of companies with comparable business risk is 7.5 percent. If the company's capital structure has 50 percent debt and 50 percent equity, equation (1) above yields a cost-of-equity estimate of 11.4 percent. If the equity ratio is lower, for example 45 percent, the cost of equity would instead be 12.3 percent. Conversely, a higher equity ratio such as 55 percent would imply a lower cost-of-equity estimate of 10.7 percent. Table 2 below summarizes these calculations as well as the dollar amount customers have to pay for financing costs.

Table 2. Example of the effect of capital structure on the estimated cost of equity.

Marginal tax rate	40%		
Cost of debt	6%		
Estimated ATWACC	7.50%		
Rate Base	$ 1,000,000		
Regulatory Equity Ratio	45%	50%	55%
Regulatory Debt Ratio	55%	50%	45%
Estimated ATWACC	7.50%	7.50%	7.50%
Cost-of-equity	12.3%	11.4%	10.7%
After Tax Cost of Financing[1)]	$ 75,000	$ 75,000	$ 75,000
Before Tax Cost of Financing[2)]	$ 125,000	$ 125,000	$ 125,000

[1)] Estimated ATWACC × Rate Base.

[2)] Estimated ATWACC × Rate Base / (1 - Tax Rate).

The important point of this example is that the overall cost of capital does not depend on the company's capital structure, as long as the capital structure is in a wide middle range of values. Therefore, the cost to customers does not depend on the capital structure either. A higher equity ratio simply means that a higher percentage return is paid to equity investors, but the fraction of the rate base to which this higher return applies is lower.

The equity investors are compensated appropriately for the higher risk, but that has no effect on the overall cost borne by customers. As long as equity investors are correctly compensated for the risk of their investment, the only effect that a higher equity ratio has is on how the return is divided between debt holders and equity holders, and not on how much customers end up paying.

Q22. BUT IS IT NOT THE CASE THAT IF THE ALLOWED RATE OF RETURN ON EQUITY IS LOWER, THEN ALL ELSE EQUAL RATEPAYERS PAY LESS?

A22. Yes, for a given equity percentage. However, it comes at a cost: if the rate of return on equity appropriate for a capital structure with 55 percent equity were applied to a company whose equity ratio is 45 percent, the company's equity investors would not be appropriately compensated for the risk of their investment. In particular, in this situation the expected return on equity would be set too low. Such a result would impair the company's ability to attract investors, since they can expect higher returns elsewhere for the same risk level. This may well have negative consequences for the utility's ability to sustain an appropriate level of investment. Ultimately, this translates into a lower quality of the services that the utility can provide to its customers. Alternatively, the company could reduce its equity percentage with possibly negative effects on the cost of debt or other credit factors.

III. THE COST OF CAPITAL FOR THE BENCHMARK SAMPLES

Q23. HOW IS THIS SECTION OF YOUR TESTIMONY ORGANIZED?

A23. As noted in *Section II*, I estimate the cost of capital using two samples of comparable risk companies. This section first covers preliminary matters such as sample selection, market-value capital structure determination, and the sample companies' costs of debt. It then covers estimation of the cost of equity for the sample companies and the resulting estimates of the sample's overall after-tax cost of capital.

A. Preliminary Decisions

Q24. WHAT PRELIMINARY DECISIONS ARE NEEDED TO IMPLEMENT THE ABOVE PRINCIPLES?

A24. I must select the benchmark samples, calculate the sample companies' market-value capital structures, and determine the sample companies' market costs of debt and preferred equity.

1. The Samples: Water Utilities and Gas Local Distribution Companies

Q25. WHY DO YOU USE TWO SAMPLES?

A25. The overall cost of capital for a part of a company depends on the risk of the business in which the part is engaged, not on the overall risk of the parent company on a consolidated basis.

Estimating the cost of capital for New Mexico-American Water's regulated assets is the subject of this proceeding. The ideal sample would be a number of companies that are publicly traded "pure plays" in the water production, storage, treatment, transmission, distribution and wastewater lines of business.[5] "Pure play" is an investment term referring to companies with operations only in one line of business. Publicly traded firms, firms whose shares are freely traded on stock exchanges, are ideal because the best way to infer the cost of capital is to examine evidence from capital markets on companies in the given line of business.

Therefore, for this case, a sample of companies whose operations are concentrated solely in the regulated portion of the water industry would be ideal. Unfortunately, the available sample of "water" utility companies in the U.S. is relatively small and has serious data deficiencies. See *Section III.C.1* for a description of these deficiencies.

To select my sample of comparable water and gas LDC companies, I start with those companies that are listed as a water utility or natural gas utility in *Value Line*.[6] Usually, I would apply several selection criteria to delete companies with unusual circumstances that may bias the cost-of-capital estimation and companies whose risk characteristics

[5] Most of the water utilities in *Value Line* have operations in the water as well as wastewater business.

[6] To select the samples I include both the Standard, the Small and Mid-Cap Editions of *Value Line Investment Survey* and *Value Line Investment Survey - Plus Edition.*

differ from those of the filing entity. However, the application of such criteria would eliminate almost all the water utilities listed in *Value Line*. Therefore, I do not apply selection criteria to the water utility sample although I do apply my standard criteria to the gas LDC sample. Specifically, if I eliminate all water utilities with annual revenues below $300 million, less than 50 percent regulated revenues, lack of growth rates (from Bloomberg or *Value Line*), or lack of a bond rating, I would be left with at most three companies (American States Water, Aqua America and California Water Services). A three-company sample is simply too small to provide reliable results. Therefore, I keep all water utilities with data in my water utility sample, but I do report results for a subsample of companies that earn a large percentage of revenues from regulated activities.[7]

Q26. WHAT DO YOU DO TO OVERCOME THE WEAKNESSES OF THE WATER UTILITY SAMPLE?

A26. To overcome the weaknesses of the water sample, I select a second sample of regulated utilities: gas local distribution companies. Gas LDCs, like water utilities, are regulated by state regulatory bodies, have large distribution investments, and serve a mix of residential, industrial, and commercial customers.

One reason for using the gas LDC sample is to generate a sample of regulated companies whose primary source of revenues is in the regulated portion of the natural gas industry to provide a check for the results of the water sample. Therefore, I start with *Value Line*'s universe of natural gas utilities, and eliminate those companies whose percentage of assets attributed to regulated activities is less than 50 percent. In addition, I only include companies with an investment grade bond rating, no recent sizable mergers or acquisitions, no recent dividend cuts, and no other activity that could cause the estimation parameters to be biased. Additionally, I require the companies to have necessary data available. The final sample includes ten companies. Additional details of the sample selection process for each sample and subsample are described below as well as in Appendix B.

[7] The only company listed as a water utility in *Value Line* that I do not include is Sun Hydraulics. This

Q27. IF THE BUSINESS RISK OF THE GAS LDC SAMPLE DIFFERS FROM THE WATER SAMPLE, CAN YOU STILL RELY ON THE COST OF EQUITY ESTIMATED FOR THE GAS LDC SAMPLE?

A27. Yes. If the business and financial risk of the two samples differ, then a cost-of-capital analyst can still make use of the information from the more reliable sample to evaluate the reliability of the estimates from the water sample. The inference would be based on information about the relative risk of the two industries.

Q28. PLEASE ELABORATE ON THE WAY TWO SAMPLES WITH DIFFERENT BUSINESS AND FINANCIAL RISKS CAN BE COMPARED.

A28. As mentioned above, the overall cost of capital for a part of a company depends on the risk of the business in which the part is engaged, not on the overall risk of the parent company on a consolidated basis. According to financial economics, the overall risk of a diversified company equals the market value weighted-average of the risks of its components.

Calculating the overall after-tax weighted average cost of capital for each sample company as described above allows the analyst to estimate the average overall cost of capital for the sample. The ATWACC captures both the business risk and the financial risk of the sample companies in one number. This allows comparison of the cost of capital between two samples on a much more informed basis. If the alternative (more reliable) sample is judged to have slightly different risk than the water sample, but the results show wide differences in the ATWACC estimates, the analyst should carefully consider the validity of the water sample estimates, whether they are materially higher or lower than the alternative sample's estimates. Of course, the alternative sample could be the source of the error, but that is less likely because the alternative sample has been selected precisely because of its expected reliability.

Q29. PLEASE COMPARE THE CHARACTERISTICS OF THE WATER UTILITY SAMPLE AND THE GAS LDC SAMPLE.

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company's main line of business is the production of industrial equipment, not the water utility business.

A29. The two samples differ primarily in that they operate in two different (regulated) industries, but they are very similar in terms of the percentage of revenues from regulated operations and the customers they serve. On average, both samples earn a large percentage of their revenue from regulated activities and serve a mix of residential, industrial, and other customers. In addition, both industries are characterized by large capital investment and both are operating a large distribution system. However, the gas LDC sample has fewer of the data and estimation issues identified above for the water sample. Please refer to Appendix B for additional details on the two samples.

2. Market-Value Capital Structure

Q30. WHAT CAPITAL STRUCTURE INFORMATION DO YOU REQUIRE?

A30. For reasons discussed below and in Appendix E, explicit evaluation of the market-value capital structures of the sample companies is vital for a correct interpretation of the market evidence on the return on equity. This requires estimates of the market values of common equity, preferred equity and debt, and the current market costs of preferred equity and debt.

Q31. PLEASE DESCRIBE HOW YOU CALCULATE THE MARKET VALUES OF COMMON EQUITY, PREFERRED EQUITY AND DEBT.

A31. I estimate the capital structure for each sample company by estimating the market values of common equity, preferred equity and debt from the most recent publicly available data. The details are in Appendix B.

Briefly, the market value of common equity is the price per share times the number of shares outstanding. For the risk-positioning approach, I use the last 15 trading days of each year to calculate the market value of equity for the year. I then calculate the average capital structure over the corresponding five-year period used to estimate the "beta" risk measures for the sample companies. This procedure matches the estimated beta to the degree of financial risk present during its estimation period. In the DCF analyses, I use

the average stock price over 15 trading days ending on the release date of the BEst growth rate forecasts utilized.[8]

The market value of debt is estimated at its book value adjusted by the difference between the "estimated fair (market) value" and the "carrying cost" of long-term debt reported in each company's 10-K.[9] The market value of preferred stock for the samples is set equal to its book value.[10]

3. Market Costs of Debt and Preferred Equity

Q32. HOW DO YOU ESTIMATE THE CURRENT MARKET COST OF DEBT?

A32. The market cost of debt for each company is set equal to the fifteen-day average yield on an index of public utility bonds that have the same credit rating, as reported by Bloomberg. The DCF analyses use the current credit rating whereas the risk-positioning analyses use the current yield of a utility bond that corresponds to the five-year average debt rating of each company so as to match consistently the horizon of information used by *Value Line* to estimate each company's beta. Bond rating information was obtained from Bloomberg which reports Standard & Poor's bond ratings. I calculate the after-tax cost of debt using the Company's estimated marginal income tax rate of 39.9 percent.

Q33. HOW DO YOU ESTIMATE THE MARKET COST OF PREFERRED EQUITY?

A33. For all sample companies, the preferred rating was assumed equal to the company's bond rating. The cost of a company's preferred equity was set equal to the yield on an index of

[8] BEst is Bloomberg's name for its earnings growth rate information. BEst growth rate forecasts are as of May 7, 2008.

[9] The book value of debt from Bloomberg includes all interest-bearing financial obligations that are not current and includes capitalized leases and mandatory redeemable preferred and trust preferred securities in accordance with FASB 150 effective June 2003. See Bloomberg's definition of long-term debt for additional details.

[10] This is unlikely to affect the results as the average percentage of preferred is less than .25 percent for both the water and gas sample.

preferred utility stock with the same rating. The data were obtained from the Mergent Bond Record.[11]

B. Cost-of-Equity Estimation Methods

Q34. HOW DO YOU ESTIMATE THE COST OF EQUITY FOR YOUR SAMPLE COMPANIES?

A34. Recall that the cost of capital is the expected rate of return in capital markets on alternative investments of equivalent risk. This definition leads me to address three key points in my estimation procedures. First, the cost of capital is an expected rate of return – it cannot be directly observed, but must be inferred from available evidence. Second, the cost of capital is determined in capital markets (such as the New York Stock Exchange). Therefore, capital market data provide the best evidence from which to draw inferences. Third, the cost of capital depends on the return offered by alternative investments of equivalent risk. Consequently, measures of risk that matter in capital markets are part of the evidence that I need to examine.

Q35. HOW DOES THE ABOVE DEFINITION HELP YOU ESTIMATE THE COST OF CAPITAL?

A35. The definition of the cost of capital recognizes a tradeoff between risk and expected return; this is the security market line plotted above in Figure 1 above. Cost-of-capital estimation methods usually take one of two approaches: (1) they establish the location of the security market line and estimate the relative risk of the security, which jointly determine the cost of capital, or (2) they try to identify a comparable-risk sample of companies and estimate the cost of capital directly. Looking at Figure 1, the first approach focuses directly on the vertical axis, while the second focuses both on the security's position on the horizontal axis and on the position of the security market line.

[11] Published monthly, Mergent's Bond Record offers a comprehensive review of over 68,000 bond issues including coverage of corporate, government, municipal, industrial development/environmental control revenue and international bonds, plus structured finance and equipment trust issues, medium-term notes, convertible issues, preferred stocks and commercial paper issues.

The first type of approach is more direct, but ignores the wealth of information available on securities not thought to be of precisely comparable risk. The "discounted cash flow" or "DCF" model is an example. The second type of approach, sometimes known as "equity risk premium approach," requires an extra step – positioning the security market line. Using the second approach allows me to use information from all traded securities rather than just those included in my sample. The capital asset pricing model ("CAPM") is an example. While both approaches can work equally well if conditions are right, one may be preferable to the other under certain circumstances. In particular, approaches that rely on the entire security market line are less sensitive to deviations from the assumptions that underlie the model, all else equal. In this case, I examine both DCF and risk-positioning approach evidence for the water utility and gas LDC sample.

1. The Risk-Positioning Approach

Q36. PLEASE EXPLAIN THE RISK-POSITIONING METHOD.

A36. The risk-positioning method estimates the cost of equity as the sum of a current interest rate and a risk premium. It is therefore sometimes also known as the "risk premium" approach. This approach may sometimes be applied more or less formally. As an example of an informal application, an analyst may estimate the spread between interest rates and what is believed to be a reasonable estimate of the cost of capital at a specific time, and then apply that spread to current interest rates to get a current estimate of the cost of capital.

More formal applications of the risk-positioning approach take full advantage of the security market line depicted in Figure 1: they use information on a large number of traded securities to identify the security market line and derive the cost of capital for the individual security based on that security's relative risk. This reliance on the entire security market line makes the method less vulnerable to the kinds of problems that arise from using one stock at a time (such as the DCF method). The risk-positioning approach is widely used and underlies much of the current research published in academic journals on the nature, determinants and magnitude of the cost of capital. The most commonly

used version of the formal risk-positioning models is the Capital Asset Pricing Model ("CAPM"). The equation for the CAPM is:

$$k_s = r_f + \beta_s \times MRP \quad \textbf{(2)}$$

where k is the cost of capital, r_F is the risk-free interest rate, *MRP* is the market risk premium, and β is the measure of relative risk.

Section I of Appendix C to this testimony provides more detail on the principles that underlie the risk-positioning approach. Section II of Appendix C provides the details of the risk-positioning approach empirical estimates I obtain.

Q37. HOW ARE THE "MORE FORMAL" APPLICATIONS OF THE RISK-POSITIONING APPROACH IMPLEMENTED?

A37. The first step is to specify the current values of the benchmarks that determine the security market line. The second is to determine the security's, or investment's, relative risk. The third is to specify exactly how the benchmarks combine to produce the security market line, so the company's cost of capital can be calculated based on its relative risk.

a) Security Market Line Benchmarks

Q38. WHAT BENCHMARKS ARE USED TO DETERMINE THE LOCATION OF THE SECURITY MARKET LINE?

A38. The essential benchmarks that determine the security market line are the risk-free interest rate and the premium that a security of average risk commands over the risk-free rate. This premium is commonly referred to as the "market risk premium" ("MRP"), i.e., the excess of the expected return on the average common stock over the risk-free interest rate. In the risk-positioning approach, the risk-free interest rate and MRP are common to all securities. A security-specific measure of relative risk (beta) is estimated separately and combined with the MRP to obtain the company-specific risk premium.

Q39. WHAT BENCHMARK DO YOU USE FOR THE MRP?

A39. I estimate two versions of the risk-positioning model. The first version measures the market risk premium as the risk premium of average-risk common stocks over long-term Government bonds. The second version measures the market risk premium over short-term Treasury bills, which is the usual measure of the MRP used in capital market theories.

Q40. HOW DO YOU ESTIMATE THE MRP?

A40. Appendix C summarizes academic and empirical research on the MRP. However, as discussed in the appendix, there is currently little consensus on the "best practice" for estimating the MRP. (Note: this is not the same as saying that all practices are equally good). For example, the leading graduate textbook in corporate finance expresses the view that a range between 5 to 8 percent is reasonable for the U.S.[12] Morningstar data from 1926 to 2007, the longest period reported, show an MRP average premium of stocks of 8.5 percent over Treasury bills and 7.1 percent over long-term Government bonds.[13] At the same time, Dimson, Marsh and Stauton (2008) estimate the arithmetic market risk premium for the U.S. over the 1900 to 2007 period at 6.5 percent over bonds.[14] In a regulatory setting, the Surface Transportation Board ("STB") recently decided to rely on the CAPM when determining the cost of capital for major railroads in the U.S. As part of its methodology, the STB decided to rely on the long-term market risk premium reported by Morningstar/Ibbotson in its implementation of the CAPM.[15] This approach currently results in a long-term MRP of 7.1 percent.

My testimony considers both the historical evidence and the results of scholarly studies of the factors that affect the risk premium for average-risk stocks in order to estimate the benchmark risk premium investors currently expect.

Considering all the evidence, I conclude that S&P 500 stocks of average risk today command a premium of 8.0 percent over the short-term risk-free rate and 6.5 percent over

[12] Richard A. Brealey, Stewart C. Myers, and Franklin Allen, *Principles of Corporate Finance*, McGraw-Hill, 8th edition, 2006, pp. 151-154.

[13] Morningstar, *Ibbotson SBBI Valuation Yearbook 2008*.

[14] Dimson, Marsh and Staunton, *Global Investment Returns Yearbook 2008*, p. 48.

[15] *STB Ex Parte No. 664*, Issued January 17, 2008, pp. 8-9.

the long-term Government rate. The estimation of the MRP is discussed in greater detail in Appendix C.

Q41. HOW DO YOU DETERMINE THE RISK-FREE RATE YOU USE?

A41. Ideally, the risk-free rate is the estimated risk-free rate over the period where rates will be in effect. For this proceeding, I use the current yield on long-term Government bonds and 30-day T-bills as an estimate for the long-term and short-term risk-free rate, respectively. Using an average of 15 trading days ending May 7, 2008, I obtain a short-term risk-free rate of 1.1 percent and a long-term risk-free rate of 4.5 percent, respectively. However, I do not believe that the short-term interest rate currently is a good measure because it is driven more by recent monetary initiatives by the Federal Reserve than by market forces. [16]

b) Relative Risk

Q42. WHAT MEASURE OF RELATIVE RISK DO YOU USE?

A42. I examine the "beta" of the stocks in question. Beta is a measure of the "systematic" risk of a stock — the extent to which a stock's value fluctuates more or less than average when the market fluctuates.

The basic idea behind beta is that risks that cannot be diversified away in large portfolios matter more than those that can be eliminated by diversification. Beta is a measure of the risks that cannot be eliminated by diversification. This concept is explored further in Appendix C.

Q43. WHAT DOES A PARTICULAR VALUE OF BETA MEAN?

[16] See Table No. BV-9. Throughout the first part of 2008, short-term interest rates have been dropping rapidly as the Federal Reserve has cut interest rates and undertaken other measures to avoid more financial market distress. For example, on April 30, the Federal Reserve dropped the federal funds rate by 25 basis points to 2.0 percent (Federal Reserve, Press Release, April 30, 2008). Earlier, on March 18, the Federal Reserve had dropped the federal funds rate by .75 percent (Federal Reserve, Press Release, March 18, 2008) and on March 14, 2008, the Federal Reserve effectively became creditors of the financially distressed Bear Stearns bank (Craig Torres, Bernanke Discards Monetary History with Bear Stearns Bailout, *Bloomberg*, March 15, 2008).

A43. By definition, a stock with a beta equal to 1.0 has average non-diversifiable risk: it goes up or down by 10 percent on average when the market goes up or down by 10 percent. Stocks with betas above 1.0 exaggerate the swings in the market. A stock with a beta of 2.0 tends to fall 20 percent when the market falls 10 percent, for example. Stocks with betas below 1.0 understate the swings in the market. A stock with a beta of 0.5 tends to rise 5 percent when the market rises 10 percent.

Q44. HOW DO YOU ESTIMATE BETA?

A44. I use beta estimates reported in the *Value Line* for the sample companies.

c) Cost of Equity Capital Calculation

Q45. HOW DO YOU COMBINE THE PRECEDING STEPS TO ESTIMATE THE COST OF EQUITY?

A45. The most widely used approach to combine a risk measure with the benchmark market risk premium on common stocks to find a risk premium for a particular firm or industry is the Capital Asset Pricing Model. However, the CAPM is only one risk-positioning technique.

In addition to the CAPM, I rely on an empirical variety of the model. Empirical research has long shown that the CAPM tends to overstate the actual sensitivity of the cost of capital to beta: low-beta stocks tend to have higher risk premia than predicted by the CAPM and high beta stocks tend to have lower risk premia than predicted. A number of variations on the original CAPM theory have been proposed to account for this finding.

This finding can be used directly to estimate the cost of capital, using beta to measure relative risk, without simultaneously relying on the CAPM. Here I examine results from both the CAPM and a version of the security market line based on the empirical finding that risk premia are related to beta, but are not as sensitive to beta as the CAPM predicts, to convert the betas into a risk premium. I refer to this latter model as the "ECAPM," where ECAPM stands for Empirical Capital Asset Pricing Model. The formula for the ECAPM is

$$k_s = r_f + \alpha + \beta_s \times (MRP - \alpha) \quad \textbf{(3)}$$

where as before *k* is the cost of capital, r_f is the risk-free interest rate, *MRP* is the market risk premium, β is the measure of relative risk, and α is the empirical adjustment factor.

Research supports values for α ranging from one to seven percent when using a short-term interest rate. I use baseline values of α of 2 percent for the short-term risk-free rate and 0.5 percent for the long-term risk-free rate. I also conduct sensitivity tests for different values of α. For the short-term risk-free rate I use values for α of 1, 2 and 3 percent. For the long-term risk-free rate I use values for α of 0, 0.5 and 1.5 percent. See Appendix C for a more detailed discussion of the ECAPM model and Table C-1 for a summary of the empirical evidence on the size of the required adjustment.

Q46. WHY IS IT APPROPRIATE TO USE THE ECAPM MODEL?

A46. Empirical tests of the CAPM have repeatedly shown that an investment's return is related to systematic risk, but that the increase in return for an increase in risk is less than is predicted. The empirical tests have also shown that the theoretical intercept, as measured by the return on Treasury bills, is too low to fit the data. In other words, the empirical tests indicate that the slope of the CAPM is too steep and the intercept is too low. The empirical data support the ECAPM. The ECAPM recognizes the consistent empirical observation that the CAPM underestimates (overestimates) the cost of capital for low (high) beta stocks. The ECAPM corrects the predictions of the CAPM to more closely match the results of the empirical tests. Ignoring the results of CAPM tests would lead to an estimate of the cost of capital that is likely to be less accurate than is possible.

Q47. IS THE USE OF THE ECAPM EQUIVALENT TO ADJUSTING THE ESTIMATED BETAS FOR THE SAMPLE COMPANIES?

A47. No. Fundamentally, this is not an adjustment (increase) in beta. This can easily be seen by the fact that the expected return on high beta stocks is lower with the ECAPM than when estimated by the CAPM. The ECAPM model is a recognition that the actual slope of the risk-return tradeoff is flatter than predicted and the intercept higher based upon

repeated empirical tests of the model.[17] Even if the beta of the sample companies were estimated accurately, the CAPM would still underestimate the required return for low beta stocks. Even if the ECAPM were used, the costs of equity would be underestimated if the betas were underestimated.

2. Discounted Cash Flow Method

Q48. PLEASE DESCRIBE THE DISCOUNTED CASH FLOW APPROACH.

A48. The DCF model takes the first approach to cost-of-capital estimation, i.e., to attempt to estimate the cost of capital in one step. The method assumes that the market price of a stock is equal to the present value of the dividends that its owners expect to receive. The method also assumes that this present value can be calculated by the standard formula for the present value of a cash flow stream:

$$P = \frac{D_1}{(1+k)} + \frac{D_2}{(1+k)^2} + \frac{D_3}{(1+k)^3} + \cdots + \frac{D_T}{(1+k)^T} \quad \textbf{(4)}$$

where "P" is the market price of the stock; "D_t" is the dividend cash flow expected at the end of period t (i.e., subscript period 1, 2, 3 or T in the equation); "k" is the cost of capital; and "T" is the last period in which a dividend cash flow is to be received. The formula just says that the stock price is equal to the sum of the expected future dividends, each discounted for the time and risk between now and the time the dividend is expected to be received.

Most DCF applications go even further, and make very strong (i.e., unrealistic) assumptions that yield a simplification of the standard formula, which then can be rearranged to estimate the cost of capital. Specifically, if investors expect a dividend stream that will grow forever at a steady state, the market price of the stock will be given by a very simple formula,

[17] Many investment firms make an adjustment to the beta. A commonly used adjustment is the Merrill Lynch adjustment, which adjusts betas 1/3 toward one. This type of adjustment is intended to compensate for sampling errors in the beta estimation, not for the empirical fact that CAPM tends to overestimate the sensitivity of the cost of capital to beta. See Appendix C for a more detailed explanation.

$$P = \frac{D_1}{(k-g)} \quad \textbf{(5)}$$

where "D_1" is the dividend expected at the end of the first period, "g" is the perpetual growth rate, and "P" and "k" are the market price and the cost of capital, as before. Equation (5) is a simplified version of Equation (4) that can be solved to yield the well known "DCF formula" for the cost of capital:

$$\begin{aligned} k &= \frac{D_1}{P} + g \\ &= \frac{D_0 \times (1+g)}{P} + g \end{aligned} \quad \textbf{(6)}$$

where "D_0" is the current dividend, which investors expect to increase at rate g by the end of the next period, and the other symbols are defined as before. Equation (6) says that if Equation (5) holds, the cost of capital equals the expected dividend yield plus the (perpetual) expected future growth rate of dividends. I refer to this as the simple DCF model. Of course, the "simple" model is simple because it relies on very strong, unrealistic, assumptions.

Q49. ARE THERE OTHER VERSIONS OF THE DCF MODELS BESIDES THE "SIMPLE" ONE?

A49. Yes. There are many variations on the DCF models that may rely on less strong (more realistic) assumptions in that they allow growth rates to vary over time. I consider a variant of the DCF model that uses the companies' individual growth rates during the first five years, converges to a perpetual growth rate in years 6-10 and then uses the GDP growth rate as the perpetual growth rate after year 10 for all companies. This is a variant of the "multi-stage" DCF method. The DCF models are described in detail in Section I of Appendix D. (Section II of Appendix D provides the details of my empirical DCF results.)

Q50. WHAT ARE THE MERITS OF THE DCF APPROACH?

A50. The DCF approach is conceptually sound if its assumptions are met, but can run into difficulty in practice because those assumptions are so strong, and hence so unlikely to

correspond to reality. Two conditions are well known to be necessary for the DCF approach to yield a reliable estimate of the cost of capital: the variant of the present value formula that is used must actually match the variations in investor expectations for the dividend growth path; and the growth rate(s) used in that formula must match current investor expectations. Less frequently noted conditions may also create problems. (See Appendix D for details.)

Q51. WHAT IS THE MOST DIFFICULT PART OF IMPLEMENTATING THE DCF APPROACH?

A51. Finding the right growth rate(s) is the usual "hard part" of a DCF application. The original approach to estimation of the growth rate, g, relied on average historical growth rates in observable variables, such as dividends or earnings, or on the "sustainable growth" approach, which estimates g as the average book rate of return times the fraction of earnings retained within the firm. But it is highly unlikely that these historical averages over periods with widely varying rates of inflation and costs of capital will equal current growth rate expectations. This is particularly true for the water sample as many companies in the industry are growing fast, engaged in mergers, acquisitions or other restructuring activities.

Moreover, the constant growth rate DCF model requires that dividends and earnings grow at the same rate for companies that on average earn their cost of capital.[18] It is inconsistent with the theory on which the model is based to have different growth rates in earnings and dividends over the period when growth is assumed to be constant. If the growth in dividends and earnings were expected to vary over some number of years before settling down into a constant growth period, then it would be appropriate to estimate a multistage DCF model. In the multistage model, earnings and dividends can

[18] Why must the two growth rates be equal in a steady-growth DCF model? Think of earnings as divided between reinvestment, which funds future growth, and dividends. If dividends grow faster than earnings, there is less investment and slower growth each year. Sooner or later dividends will equal earnings. At that point, growth is zero because nothing is being reinvested (dividends are constant). If dividends grow slower than earnings, each year a bigger fraction of earnings are reinvested. That makes for ever faster growth. Both scenarios contradict the steady-growth assumption. So if you observe a company with different expectations for dividend and earnings growth, you know the company's stock price and its dividend growth forecast are inconsistent with the assumptions of the steady-growth DCF model.

grow at different rates, but must grow at the same rate in the final, constant growth rate period. A difference between forecasted dividend and earnings rates therefore is a signal that the facts do not fit the assumptions of the simple DCF model.

Q52. HOW DO YOU ESTIMATE THE GROWTH RATES YOU USE IN YOUR DCF ANALYSIS?

A52. I use earnings growth rate forecasts from Bloomberg and *Value Line*. Analysts' forecasts are superior to using single variables in time series forecasts based upon historical data as has been documented and confirmed extensively in academic research. Please see Section I in Appendix D for a detailed discussion on this issue.

Q53. ARE YOU AWARE THAT SOME REGULATORY COMMISSIONS RELY ON BOTH HISTORICAL AND FORECAST GROWTH RATES IN THEIR IMPLEMENTATION OF THE DCF MODEL?

A53. Yes, but I do not believe that is the best way to estimate the growth rate for use in the DCF model for the following reasons. First, as mentioned above, the model requires that dividends and earnings grow at the same rate at some point in the future in order to apply the model. The data on historical growth rates do not confirm this condition. Second, analysts have access to historical information and include that information in their forecast of earnings growth rates. In other words, using historical data provides no additional information than that captured in analyst forecasts. Data providers such as *Value Line* provide information on the going forward payout ratio as well as on other key financial parameters.

Q54. ARE YOU AWARE OF EVIDENCE THAT ANALYSTS' FORECASTS OF EARNINGS GROWTH HAVE HISTORICALLY OVER-ESTIMATED EARNINGS AND DIVIDEND GROWTH?

A54. Yes. Although analyst forecasts have historically been too optimistic, this problem is less acute for regulated companies.[19] Further, according to a recent joint report by NASD and the NYSE,

> … the SRO Rules have been effective in helping restore integrity to research by minimizing the influences of investment banking and promoting transparency of other potential conflicts of interest. Evidence also suggests that investors are benefiting from more balanced and accurate research to aid their investment decisions.[20]

In addition, the use of a two-stage DCF model, which substitutes the forecast growth of GDP, mitigates analyst optimism by substituting the GDP growth rate for the potentially optimistic (or pessimistic) earnings forecasts of analysts.

Q55. HOW WELL ARE THE CONSTANT-GROWTH RATE CONDITIONS NECESSARY FOR THE RELIABLE APPLICATION OF THE DCF LIKELY TO BE MET FOR THE SAMPLE COMPANIES AT PRESENT?

A55. The requisite conditions for the sample companies are not fully met at this time, particularly for the water sample. Of particular concern for this proceeding is the uncertainty about what investors truly expect the long-run outlook for the sample companies to be. The longest time period available for growth rate forecasts of which I am aware is five years. The long-run growth rate (i.e., the growth rate after the water industry settles into a steady state, which may be beyond the next five years for this industry) drives the actual results one gets with the DCF model. Unfortunately, this implies that unless the company or industry in question is stable – so there is little doubt as to the growth rate investors expect – DCF results in practice can end up being driven by the subjective judgment of the analyst who performs the work.

Of the nine companies in the water sample, four do not have earnings forecasts from *Value Line,* and as a result three companies have only one analyst forecast of earnings

[19] See, for example, L.K.C. Chan, J. Karceski, and J. Lakonishok (2003), "The Level and Persistence of Growth Rates," *Journal of Finance* 58(2), pp. 643-684.

[20] Joint Report by NASD and NYSE on the Operation and Effectiveness of the Research Analyst Conflict of Interest Rules, December 2005, p. 44.

growth.[21] The average long-term earnings forecasts from vary from a low of 0.9 percent to a high of 14 percent. Additionally, the analysts' forecasts for individual companies range widely. For example, the average BEst growth forecast for Southwest Water Co is 5 percent while the *Value Line* forecast is 15 percent. The lack of sufficient analyst following and the large variation in growth forecasts indicate that these forecasts are less reliable than ideal. The growth rates for gas LDC sample vary less from an average of 3.4 to 7.2 percent, and are more consistent with the GDP growth forecast of 4.8 percent. Of the ten companies in the gas LDC sample, one has only two analysts providing a forecast (one *Value Line* and one BEst), and one has a negative mean BEst estimate, which I treated as unavailable because it does not make sense for the long-term forecast to be negative. Thus, the available data are far from being ideal. As discussed above, the two-stage DCF model adjusts for any overly optimistic (or pessimistic) growth rate forecasts by adjusting the 5-year growth rate forecasts of the analysts toward the long-term GDP growth rate in the years after year 5. See Appendix D, *Section I* for a discussion of the two-stage model.

The DCF growth rates, whether estimated from historical data or from analyst forecasts, have likely been affected by several factors: many mergers and acquisitions in the water industry in recent years, significant growth in many parts of the country, and a trend towards consolidation. The industry appears to be moving towards a larger degree of consolidation – at least among the privately held water utilities. The consolidation of the industry may well increase as the industry needs significant infrastructure investments to comply with EPA water purification rules, maintain or replace old infrastructure, and deal with increased threats towards the water systems.[22] The American Society of Civil Engineers estimated in 2005 that the drinking water infrastructure required "$11 billion annually to replace aging infrastructure […] and to comply with safe drinking water regulations," while the wastewater segment required $390 billion in investments over the following 20 years.[23] Coupled with the rising construction costs of utility infrastructure,

[21] See Table BV-5 for details.

[22] See, for example, *Value Line*, Water Utility Industry, April 25, 2008.

[23] *Report Card for America's Infrastructure*, The American Society of Civil Engineers, 2005, pp. 15, 55.

this creates uncertainty about future conditions and diverging expectations. The uncertainty associated with these factors increases the industry's business risk. Additionally, environmental regulations impact the industry as standards for water quality evolve over time, and there is potential for new safety and security requirements in the future. The industry has no federal regulator (other than for environmental and health issues), and state public utility commissions regulate most investor owned water utilities. Different regulatory bodies may lead to differing regulatory requirements for companies operating in adjacent parts of the country. Taken together, these factors mean that it may be some time before the water industry settles into anything investors will see as a stable equilibrium necessary for the reliable application of the DCF model.

Such circumstances imply that a commission may often be faced with a wide range of DCF estimates, none of which can be well grounded in objective data on true long-run growth expectations, *because no such objective data now exist*. DCF for firms or industries in flux is *inherently* subjective with regard to the most important parameter, the long-run growth rate that drives the answer.

In short, the unavoidable questions about the DCF model's strong assumptions cause me to view the DCF method as *inherently* less reliable than the risk-positioning approach described above. This is particularly true for the water sample, because of the data problems discussed above. However, because the DCF method has been widely used in the past, I submit DCF evidence in this case. DCF estimates also serve as a check on the values provided by the risk-positioning methods.

In this proceeding, I give little weight to the DCF results. However, I use the results as a check on the reasonableness of my risk-positioning estimates.

C. THE SAMPLES AND RESULTS

1. The Water Utility Sample

Q56. EARLIER YOU SAID THAT THE SAMPLE OF WATER UTILITIES HAD SERIOUS DATA WEAKNESSES. PLEASE ELABORATE ON THESE WEAKNESSES.

A56. In attempting to apply the DCF model to the sample, five companies had no *Value Line* growth forecasts. The size of the companies in the water sample also makes cost-of-capital estimation difficult. Currently, only four companies have more than $500 million in market value of equity. More important, however, is the fact that the stock of these companies trades relatively infrequently. For example, four of the nine water utilities traded an average of less than 20,000 shares per trading day since January of 2007. In percentage terms, these companies traded less than 0.15 percent of their shares outstanding.[24] By contrast, each of the gas LDC sample companies had an average trading volume of at least 121,000 shares per day (greater than 180,000 if Laclede Group were excluded), which in percentage terms represented more than 0.45 percent of shares outstanding for each company. Low trading volume causes concern because there may be a delay between the release of important information and the time that this information is reflected in prices. Such delay is well known to cause beta estimates to be statistically insignificant and possibly biased.

In addition to lack of data and the small size of the companies, there are firm-specific events that render the water utility sample less reliable than would be ideal. First, Aqua America (the largest of the companies) has gone through a large number of mergers and acquisitions in recent years. Normally, I would not include companies with significant merger or acquisition activity in a sample because the individual information about the progress of the proposed merger is so much more important for the determination of the company's stock price than day-to-day market fluctuations. In practice, beta estimates for such companies tend to be too low. The growth rates for such companies may also be

[24] The four companies are Connecticut Water Service Co., Middlesex Water Co., Pennichuck Corp., and York Water Co.

affected. Second, Southwest Water Co. earns only 44 percent of its revenue from regulated activities.[25] I therefore report my results for both the full sample and for a subsample of companies that does not include Southwest Water Co.

It is because of these weaknesses in the water sample that I also utilize a sample of natural gas LDCs. The selection procedure for this sample was summarized earlier and details are provided in Appendix B.

2. Risk-Positioning Cost-of-Capital Estimates

Q57. HOW IS THIS SECTION OF YOUR TESTIMONY ORGANIZED?

A57. This section first describes the input data used in the CAPM and ECAPM models, then reports the resulting cost-of-equity estimates for the samples. The second section of Appendix C details the empirical analysis.

a) Interest Rate Estimate

Q58. HOW DID YOU DETERMINE THE EXPECTED RISK-FREE INTEREST RATE?

A58. I reviewed current constant maturity U.S. Government bond yield data available from the St. Louis Federal Reserve Bank. For the period April 17 to May 7, 2008, the average yield on 30-day Treasury bills was 1.07 percent and the average yield on long-term government bonds was 4.54 percent.[26]

b) Betas and the Market Risk Premium

Q59. WHAT BETA ESTIMATES DID YOU USE IN YOUR ANALYSIS FOR THE SAMPLES?

A59. I rely upon the most recent betas estimated by *Value Line* for both the water sample and for the gas LDC sample.

[25] However, the majority of the company's property, plant and equipment belong to its regulated utilities. See Southwest Water Co. 2007 10-K p. F-22.

[26] See Table No. BV-9.

Q60. ARE THE BETA VALUES REPORTED BY *VALUE LINE* ADJUSTED BETAS?

A60. Yes. *Value Line* reports betas that are adjusted about 1/3 towards one. For this proceeding, I reverse the *Value Line* adjustment. *Value Line* and many investment firms adjust the estimated betas. This type of adjustment is intended to compensate for sampling errors in the beta estimation, not for the empirical fact that the CAPM tends to overestimate the sensitivity of the cost of capital to beta. I use adjusted betas when the sample companies display statistically significant sensitivity to interest rate changes or likely would do so short of measurement errors. For this proceeding I use unadjusted betas as I have previously for water and wastewater utilities.

Q61. PLEASE SUMMARIZE THE BETA ESTIMATES YOU RELY ON.

A61. After reversing the *Value Line* adjustment procedure, the average estimated *Value Line* beta for the water sample is about .76 while the average for the gas LDC sample is about .77. These beta estimates are reported in Workpaper #1 to Tables No. BV-10 and BV-20.

Q62. WHAT VALUE DO YOU USE FOR THE MARKET RISK PREMIUM?

A62. For the premium over the short-term risk-free interest rate I use 8.0 percent, while for the premium over the long-term risk-free interest rate I use 6.5 percent, for the reasons discussed before and in Appendix C.

Q63. PLEASE EXPLAIN THE METHOD TO ADJUST FOR DIFFERENCES IN CAPITAL STRUCTURE.

A63. Starting with the ATWACC, the cost of equity for any capital structure within a broad range of capital structures can be determined by the following formula:

$$\text{Return on equity} = \frac{\text{ATWACC - Return on debt} \times \text{\% debt in capital structure} \times (1 - \text{tax rate})}{\text{\% equity in capital structure}}$$

This is the calculation that is displayed in Tables No. BV-12 and BV-22.[27] The tables display the result of converting the sample average ATWACC to a return on equity for a

[27] For companies that have preferred equity, an additional term equal to (Return on preferred equity x % preferred in capital structure) is subtracted from the numerator of this fraction.

specific capital structure. It is straightforward to use this method to determine the cost of equity consistent with the capital structure.

c) Risk-Positioning Results

Q64. WHAT ARE THE COST-OF-EQUITY ESTIMATES DERIVED FROM THE RISK-POSITIONING APPROACH FOR THE WATER SAMPLE?

A64. Using the long-term interest rate in the two risk-positioning models (CAPM and ECAPM), with two values of the ECAPM parameter (0.5% and 1.5%), I obtain three estimates of each sample company's cost of equity (Tables No. BV-10 and BV-20). The cost-of-equity estimates are combined with the estimates of the company's cost of debt and preferred to calculate the company's ATWACC (Tables No. BV-11 and BV-21). Tables No. BV-12 and BV-22 combine the sample average ATWACC with New Mexico-American Water's capital structure, cost of debt, and tax rate to obtain the cost of equity at New Mexico-American Water's 45.1 percent equity. Panel A of Table No. BV-12 shows the cost of equity and ATWACC value for all water sample companies, while Panel B shows the results for the subsample of companies with significant revenue from regulated water utility activities. The cost-of-equity results are summarized below in Table 3 below.

Table 3. Cost-of-Equity Estimates

Regulatory Capital Structure: *45.1% Equity / 0.0% Preferred / 54.9% Debt* *2008 Tax Rate: 39.9%*

		METHODS				
		RISK POSITIONING (using Long-Term Risk-Free Rate)			DCF	
		CAPM	α = 0.5%	α = 1.5%	Simple	Multi-stage
[1]	**Water Sample***					
	Full Sample					
	Cost of Equity	14.1%	14.2%	14.2%	15.7%	10.7%
	Average ATWACC	8.5%	8.5%	8.5%	9.2%	7.0%
	Sub-sample					
	Cost of Equity	14.0%	14.1%	14.2%	15.7%	10.9%
	Average ATWACC	8.4%	8.5%	8.5%	9.2%	7.0%
[2]	**Gas LDC Sample****					
	Cost of Equity	11.9%	12.0%	12.4%	11.4%	11.3%
	Average ATWACC	7.5%	7.5%	7.7%	7.3%	7.2%

[3]	Risk Positioning Security Market Line Parameters:		Multi-Stage DCF Parameter:	
	Long-Term			
	Risk Free Rate Estimate:	4.5%	GDP Growth	
	Estimated MRP:	6.5%	Estimate	4.8%

Sources and Notes:

* For the Water Sample, Risk Positioning data from Table No. BV-12 and DCF data from Table No. BV-8.

** For the Gas LDC Sample, Risk Positioning data from Table No. BV-22 and DCF data from Table No. BV-19.

[1] The full water sample consists of American States Water Co, Aqua America Inc, California Water Service Group, Connecticut Water Service Inc, Middlesex Water Co, SJW Corp, Southwest Water Co, York Water Co, and Pennichuck Corp. The subsample excludes Southwest Water Co. Results exclude companies whose estimated cost of equity is less than their cost of debt plus 25 basis points.

[2] The gas LDC sample consists of AGL Resources, Atmos Energy Corp, Laclede Group, New Jersey Resources, Nicor Inc., Northwest Natural Gas, Piedmont Natural Gas, South Jersey

[3] See Appendices C and D for details on Risk Positioning and DCF parameters used in estimates.

Using the short-term interest rate in the two risk-positioning models (CAPM and ECAPM) and using different values for the ECAPM parameter, α , I obtain four estimates of each sample companies' cost of equity. These estimates are also displayed in Tables No. BV-12 and BV-22. Because I do not believe these estimates currently represent longer term market expectations, I do not include the results in Table 3 above.

Q65. PLEASE SUMMARIZE YOUR FINDINGS FROM THE RISK-POSITIONING MODEL.

A65. Focusing on the middle ECAPM (α = .50%) for the long-term risk-positioning model, I find that the water sample's cost of equity of about 14.25 percent. However, it is more

correct to say that the sample results indicate a range of values from about 13.5 to 14.5 percent for the long-term model. Looking at the gas LDC sample, the results are lower, for a range of approximately 11.50 to 12.5 percent for the long-term risk-positioning model. Because short-term interest rates have been repeatedly driven down by the Federal Reserve in an effort to prevent the economy from sliding into a recession and to provide liquidity in the credit markets in the wake of the subprime mortgage crisis,[28] I assign no weight to the short-term model in this proceeding. This is consistent with, for example, a recent decision by the Surface Transportation Board that decided to rely on the CAPM using 20-year Treasury bonds for the risk-free rate, 5-year weekly beta estimates, and Ibbotson's reported long-term market risk premium when determining railroads' cost of equity.[29] Additionally, as discussed previously, I place very little weight on the water sample results because of numerous data problems. Therefore, I conclude that the risk-positioning model provides cost-of-equity estimates in the range of 11.50 to 12.5 percent. I discuss the assessment of New Mexico-American Water's cost of equity in the concluding section.

3. The DCF Cost-of-Capital Estimates

Q66. WHAT STEPS DO YOU TAKE IN YOUR DCF ANALYSES?

A66. Given the above discussion of DCF principles, the steps are to collect the data, estimate the sample companies' costs of equity at their current capital structures, and then to adjust the sample's estimates to New Mexico-American Water's 45.1 percent equity ratio.

a) Growth Rates

Q67. WHAT GROWTH RATE INFORMATION DO YOU USE?

[28] On April 30, 2008, the Federal Reserve cut the Federal Funds rate by .25 percent, so that it now (May 31, 2008) stands at 2 percent. Also, on March 14, 2008 the Federal Reserve joined forces with JPMorgan to bail out the failing Bear Stearns bank. See, for example, Craig Torres, Bernanke Discards Monetary History with Bear Stearns Bailout, *Bloomberg*, March 15, 2008. See also, *Business Week*, A Sweeter Bear Bid May Sour the Fed, March 24, 2008.

[29] *STB Ex Parte No. 664*, Issued January 17, 2008.

A67. For reasons discussed above and in Appendix D, historical growth rates today are not as relevant as forecasts of current investor expectations for these samples. I therefore use rates forecast by security analysts.

The ideal in a DCF application would be a detailed forecast of future dividends, year by year well into the future until a true steady state (constant) dividend growth rate was reached, based on a large sample of investment analysts' expectations. I know of no source of such data. Dividends are ultimately paid from earnings, however, and earnings forecasts from a number of analysts are available for a few years. Investors do not expect dividends to grow in lockstep with earnings, but for companies for which the DCF approach can be used reliably (*i.e.*, for relatively stable companies whose prices do not include the option-like values described in Appendix D), they do expect dividends to track earnings over the long-run. Thus, use of earnings growth rates as a proxy for expectations of dividend growth rates is a common practice.

Accordingly, the first step in my DCF analysis is to examine a sample of investment analysts' forecast earnings growth rates from Bloomberg and *Value Line* to the degree such forecasts are available. The details are in Appendix D. At present, *Value Line* data run through a 2011-2013 horizon, representing an average of about four years from the current earning forecasts available for 2008. Bloomberg also provides a long-term earnings growth rate estimate. The longest-horizon forecasted growth rates from these sources underlie the simple DCF model (*i.e.*, the standard perpetual-growth model associated with the "DCF formula," dividend yield plus growth). Unfortunately, the longest growth forecast data only go out four to five years, which is too short a period to make the DCF model completely reliable.

b) Dividend and Price Inputs

Q68. WHAT VALUES DO YOU USE FOR DIVIDENDS AND STOCK PRICES?

A68. Dividends are either for the first or the second quarter of 2008, depending on the most recent dividend information available at the time of estimation for each company.[30] This

[30] The dividend information was obtained from Bloomberg.

dividend is grown at the estimated growth rate and divided by the price described below to estimate the dividend yield for the simple DCF model.

Stock prices are an average of closing stock prices for the 15-day trading period ending on the day the BEst forecast was obtained from Bloomberg. A 15-day stock price average is used to guard against anomalous price changes in any single day.

c) DCF Results

Q69. WHAT ARE THE DCF ESTIMATES FOR THE SAMPLES?

A69. The data are used in the two versions of the DCF method to get sample company estimates at the sample company's capital structure. The resulting cost of equity at New Mexico-American Water's 45.1 percent equity estimates are shown in Table 3 above. There is a very large difference between the simple and multi-stage DCF results for the water sample (15.7 versus 10.7 percent), confirming the conclusion drawn above that the water industry is not in a stable equilibrium. As a result, DCF results from the water sample are unreliable, and I therefore do not put any weight on them in arriving at my final estimate. However, for the gas LDC sample both DCF models yields very similar results (11.3 and 11.4 percent), suggesting that the gas LDC sample is indeed of better quality than the water sample at this time. In addition, DCF estimates for the gas LDC sample are not too different from risk-positioning results, albeit on average lower than them.

IV. NEW MEXICO-AMERICAN WATER'S COST OF EQUITY

Q70. WHAT CONCLUSIONS DO YOU DRAW FROM THE ABOVE DATA REGARDING EACH SAMPLE'S COST OF EQUITY AT NEW MEXICO-AMERICAN WATER'S 45.1 PERCENT EQUITY RATIO?

A70. For the gas LDC sample, the estimated costs of equity from the risk-positioning model and from the DCF model are reasonably in line. For the water sample, estimates vary more significantly between different methods, and the DCF results are particularly variable. Although I do not rely upon the DCF model results for the water sample, I believe that DCF cost-of-capital estimates provide a useful check on the risk-positioning

results for the gas LDC sample. The consistency of the multi-stage DCF and the risk-positioning cost-of-equity estimates for the gas LDC sample indicate that those estimates are reasonable.

Q71. DO YOU HAVE ANY COMMENTS REGARDING THE RESULTS OF THE RISK-POSITIONING MODELS?

A71. The estimated cost of equity displayed in Panel B of Table No. BV-12 compared to Table No. BV-22 is significantly higher on average for the water sample. The risk-positioning results are summarized above in Table 3. Of those results, the CAPM values deserve the least weight, because this method does not adjust for the empirical finding that the cost of capital is less sensitive to beta than predicted by the CAPM (which my testimony considers by using the ECAPM). Conversely, the ECAPM numbers deserve the most weight, because this method adjusts for the empirical findings.

Additionally, the estimates based upon the short-term risk-free rate are currently not very reliable for reasons discussed above. If the Fed believes further action is necessary, short-term rates are likely to fall further. On the other hand, if inflation becomes a concern, as it appears to be the case,[31] then short-term rates could remain constant or even start increasing. Because of this uncertainty, I give only weight to the estimates using the long-term risk-free rate at this time, because long-term interest rates are generally less responsive to Fed actions than short-term rates.

Q72. BASED ON THE EVIDENCE WHAT IS YOUR CONCLUSION REGARDING NEW MEXICO-AMERICAN WATER'S REQUESTED 11.75 PERCENT RETURN ON EQUITY?

A72. Based on the results from my cost-of-capital estimation procedures, I conclude that an 11.75 percent return on equity is very reasonable.

Q73. DOES THIS CONCLUDE YOUR TESTIMONY?

A73. Yes.

[31] "Rising Inflation Limits the Fed as Growth Lags," *The New York Times*, February 21, 2008.

APPENDIX A

RESUME OF DR. BENTE VILLADSEN

Bente Villadsen's work concentrates in the areas of regulatory finance and accounting. Her recent work has focused cost of capital, credit issues in the utility industry as well the impact of regulatory initiatives such as energy efficiency and de-coupling. Other recent work has included damage estimation, accounting disclosure and principles including impairment testing, leases, mark-to-market accounting, accounting for hybrid securities, accounting for equity investments, cash flow estimation as well as overhead allocation. She has testified on cost of capital, accounting issues, and damages.

Dr. Villadsen holds a Ph.D. from Yale University's School of Management with a concentration in accounting. She has a joint degree in mathematics and economics (BS and MS) from University of Aarhus in Denmark. Prior to joining *The Brattle Group*, she was a Professor of Accounting at the University of Iowa, University of Michigan, and at Washington University in St. Louis where she taught financial and cost accounting. Dr. Villadsen also worked as a consultant for Risoe National Laboratories in Denmark.

REPRESENTATIVE EXPERIENCE

ENERGY AND PUBLIC UTILITY FINANCE

- Dr. Villadsen has filed several cost of capital testimonies and appeared at hearings for water, wastewater and electric utilities in connection with rate hearings before regulatory commissions.

- She has considerable experience in estimating the cost of capital for major U.S., Canadian and European utilities, pipelines, and railroads. The work has been used in connection with the companies' rate hearings before the Federal Energy Regulatory Commission, the Canadian National Energy Board, the Surface Transportation Board, and state and provincial regulatory bodies. The work has been performed for pipelines, integrated electric utilities, non-integrated electric utilities, gas distribution companies, water utilities, railroads and other parties.

- In connection with rate hearings for electric utilities, Dr. Villadsen has estimated the impact of power purchase agreements on the company's credit ratings and calculated appropriate compensation for utilities that sign such agreements to fulfill, for example, renewable energy requirements.

- Dr. Villadsen has been part of a team assessing the impact of conservation initiatives, energy efficiency, and decoupling of volumes and revenues on electric utilities financial

performance. Specifically, she has estimated the impact of specific regulatory proposals on the affected utilities earnings and cash flow.

- For a large integrated utility in the U.S., Dr. Villadsen participated in all aspects of the company's rate filing, including the company's cost of capital, incentive based rates, and certain regulatory accounting issues.

- Dr. Villadsen has been involved in several projects evaluating the impact of credit ratings on electric utilities. She was part of a team evaluating the impact of accounting fraud on an energy company's credit rating and assessing the company's credit rating but-for the accounting fraud.

- For a large electric utility, Dr. Villadsen modeled cash flows and analyzed its financing decisions to determine the degree to which the company was in financial distress as a consequence of long-term energy contracts.

- For a large electric utility without generation assets, Dr. Villadsen assisted in the assessment of the risk added from offering its customers a price protection plan and being the provider of last resort (POLR).

ACCOUNTING AND CORPORATE FINANCE

- In a recent international arbitration matter, Dr. Villadsen filed expert testimony on the allocation of corporate overhead costs and damages in the form of lost profit.

- Dr. Villadsen has provided expert reports and testimony on several accounting issues in international and domestic arbitrations or court proceedings. In a recent international arbitration, she testified on the proper application of US GAAP in determining shareholders' equity. Among other topics, she testified regarding impairment of long-lived assets, lease accounting, the equity method of accounting, and the measurement of investing activities. In a U.S. arbitration, she provided expert reports on the equity method of accounting, the classification of debt versus equity and the distinction between categories of liabilities in a contract dispute between two major oil companies.

- In U.S. District Court, Dr. Villadsen filed testimony regarding the information required to determine accounting income losses associated with a breach of contract and cash flow modeling.

- She has worked extensively on litigation matters involving the proper application of mark-to-market and derivative accounting in the energy industry. The work relates to the proper valuation of energy contracts, the application of accounting principles, and disclosure requirements regarding derivatives.

- Dr. Villadsen evaluated the accounting practices of a mortgage lender and the mortgage industry to assess the information available to the market and ESOP plan administrators prior to the company's filing for bankruptcy. A large part of the work consisted of comparing the company's and the industry's implementation of gain-of-sale accounting.

- Dr. Villadsen evaluated the performance of segments of regulated entities. She also reviewed and evaluated the methods used for in overhead allocation.

- She has worked on accounting issues in connection with several tax shelter cases. The focus of her work has been the application of accounting principles to evaluate intra-company transactions, the accounting treatment of security sales, and the classification of debt and equity instruments.

- Dr. Villadsen has modeled the cash flows of several companies to estimate the impact of specific (energy) contracts or to determine the impact of specific loans.

- She assisted in the estimation of net worth of individual segments for firms in the consumer product industry. Further, she built a model to analyze the segment's vulnerability to additional fixed costs and its risk of bankruptcy.

- For a large integrated oil company, Dr. Villadsen estimated the company's cost of capital and assisted in the analysis of the company's accounting and market performance.

- In connection with commercial litigation, Dr. Villadsen estimated the cost of capital for companies in the chemical industry and for companies in the cement industry.

RECENT PUBLICATIONS

"Understanding Debt Imputation Issues," (with Michael J. Vilbert and Joe Wharton and *The Brattle Group* listed as an author), *Edison Electric Institute*, forthcoming, Summer 2008.

"Building Sustainable Efficiency Businesses: Volume I – Approaches and Models," (with Joe Wharton and Peter Fox-Penner, and with "*The Brattle Group*" listed as author), *Edison Electric Institute*, forthcoming, Summer 2008.

"Measuring Return on Equity Correctly: Why current estimation models set allowed ROE too low," *Public Utilities Fortnightly*, August 2005 (with A. Lawrence Kolbe and Michael J. Vilbert).

"The Effect of Debt on the Cost of Equity in a Regulatory Setting," (with A. Lawrence Kolbe and Michael J. Vilbert, and with "*The Brattle Group*" listed as author), *Edison Electric Institute*, April 2005.

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APPENDIX B

SELECTING THE WATER AND GAS LDC SAMPLES AND THE USE OF MARKET VALUES

I. SAMPLE SELECTION AND THE CHARACTERISTICS OF EACH SAMPLE B-2

A. THE WATER SAMPLE B-2

B. THE GAS LOCAL DISTRIBUTION COMPANIES SAMPLE B-5

II. MARKET VALUE CAPITAL STRUCTURE, COSTS OF DEBT & COSTS OF PREFERRED EQUITY B-8

I. SAMPLE SELECTION AND THE CHARACTERISTICS OF EACH SAMPLE

A. The Water Sample

Q1. How did you select your sample of water utilities?

A1. The goal was to create a sample of companies whose primary business is as a regulated water utility with business risk generally similar to that of New Mexico-American Water. To construct this sample, I started with the universe of ten water utility companies listed as such in the *Value Line Investment Survey - Plus Edition*. I then eliminated Sun Hydraulics because, although listed as a water utility by *Value Line*, its operations consist mainly of producing industrial equipment.[1]

Normally, I would apply several additional selection criteria to eliminate companies with unique circumstances that may affect the cost of capital estimates. For example, I would normally eliminate companies with annual revenues lower than $300 million in 2007,[2] no or low bond ratings, lack of growth estimates or Bloomberg data, and all companies with announced dividend cuts or that were involved in significant merger activity over the last five years (2003 to today). However, applying these procedures to the nine water utilities followed by *Value Line* would result in a sample of at most three companies. (The areas of concern associated with the companies included in the sample are detailed below.) I try to balance my standard criteria against the need to have a reasonable sample size. This results in the use of all nine companies to form a full sample, as well as the use of eight companies to form a subsample with a high percentage of regulated revenues.[3] The nine companies that form the full sample of water utilities are American States Water Co., Aqua America Inc., California Water Service Group, Connecticut Water Service Inc.,

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[1] According to the company's webpage (www.sunhydraulics.com), it develops and manufactures valves and manifolds. Bloomberg lists it as part of its "metal fabricate/hardware" industry group.

[2] Table No. BV-2 and its associated workpapers report the share of operating revenues from different lines of business in 2007 for these companies. (Table No. BV-1 provides an index to the other tables.)

[3] Southwest Water Company is dropped from the subsample because it only earns an estimated 44 percent of its 2007 revenues from regulated activities. The remaining companies in the subsample earn at least an estimated 88 percent of their 2007 revenues through regulated activities.

Middlesex Water Co., Pennichuck Corp., SJW Corp., Southwest Water Co., and York Water Co.[4]

Q2. Why do you usually eliminate companies currently involved in a merger from your samples?

A2. The stock prices of companies involved in mergers are often more affected by news relating to the merger than by movements in the stock market. In other words, the stock price "decouples" from its normal relationship to the stock market (the economy) which is the basis upon which a company's relative risk is calculated. Instead the stock price of a merger candidate is more affected by the latest speculation on the terms and probability of the merger.

Q3. What are some of the water sample's data problems?

A3. First, of the nine water utilities followed by *Value Line*, four companies (Connecticut Water, Middlesex Water, Pennichuck, and York Water) have 2007 revenues below $100 million. If I were to consider the threshold of $300 million I usually rely on, then six of the nine companies would fall under it. The stocks of small companies frequently exhibit "thin trading" which means that their stock trades infrequently. Indeed, since January of 2007, the four companies listed above have traded an average of less than 20,000 shares per trading day. In percentage terms, these companies traded less than 0.15 percent of their shares outstanding. By contrast, each of the gas LDC sample companies had an average trading volume of at least 120,000 shares per day (180,000 if Laclede Group were excluded), which in percentage terms represented more than 0.45 percent of shares outstanding for each company. Greater trading volume gives the expert more confidence in estimates relying on market data since there is less likelihood of a delay between the release of important information and the time that this information is reflected in prices. For example, such delay is well known to cause beta estimates to be statistically insignificant and possibly biased.

[4] Pennichuck Corp. is a recent addition to *Value Line's* water utilities group.

Second, five companies lack long-term earnings forecasts from *Value Line*, and four companies only have one analyst providing BEst growth rate forecasts. In addition, the existing growth rates estimates are highly variable, ranging from a low of 0.9 percent to a high of 14 percent. Such highly variable growth rates are not indicative of an industry that is stable and cast doubt on the applicability of the DCF model to this industry at this time.

Third, only three companies have significant revenue, stocks with substantial trading, a bond rating and more than one long-term growth forecast from BEst.

Fourth, many companies have significant merger activity over the last five years, leading *Value Line* to note that "the acquisitions market has been white hot."[5] For example, Aqua America acquired more than two dozen smaller companies in 2007, while Southwest Water Co. completed six small acquisitions in the last three years, the most recent of which in February 2008.[6] The large number of mergers and acquisitions is an indication of an industry in flux which will certainly affect the DCF estimates and perhaps the risk positioning estimates as well.

These factors may all potentially affect the cost of equity estimates in ways not completely predictable. Because of the substantial data problems and the lack of a large number of publicly traded water utilities, without considering the gas LDC sample I would be forced to rely either on a sample with significant data problems, or on a sample with at most three companies (American States Water Company, Aqua America Inc., and California Water Services Group).[7]

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[5] *Value Line Investment Survey*, Water Utility Industry, April 25, 2008.

[6] Sources: *Value Line Investment Survey*, April 25, 2008, Bloomberg mergers and acquisitions historical search, performed March 24, 2008.

[7] Several companies have multiple problems. For example, Connecticut Water has revenues below $100 million, exhibits thin trading and lacks *Value Line* long-term earnings growth forecasts. Middlesex Water has revenues below $100 million, no long-term *Value Line* earnings forecast, and had a dividend cut in 2003. York Water has revenues below $100 million, exhibits thin trading and has no long-term *Value Line* earnings forecast.

B. The Gas Local Distribution Companies Sample

Q4. How do you select your gas local distribution company sample?

A4. To select this sample, I started with the universe of publicly traded natural gas utilities covered by *Value Line Investment Survey – Plus Edition*. This resulted in an initial group of 18 companies. I then eliminated companies by applying additional selection criteria designed to eliminate companies with unique circumstances which may bias the cost of capital estimates.

Q5. What are the selection criteria you applied?

A5. I eliminated all companies whose regulated assets are not greater than 50 percent of their total assets as reported in each company's 2007 10-K form, because one goal for this sample was for the companies to be primarily engaged in regulated activities. I also eliminated all companies whose bond rating was less than BBB- as rated by S&P, and companies that had a large merger during the period May 2003 to May 2008.[8] Merger activity is obtained from Bloomberg, which provides a history of past acquisitions and divestitures for each company, and also the size of each transaction, if such information is available.[9] To guard against measurement bias caused by "thin trading," I also restricted the sample to companies with total operating revenues greater than $300 million in 2007.

Finally, I required that the companies have historical data available from Bloomberg and that they had no dividend cuts or restatement of financial statements in the past five years, since the latter can be signs of financial distress.

The final sample consists of ten gas LDC companies: AGL Resources Inc., Atmos Energy Corp., Laclede Group Inc., Nicor Inc., New Jersey Resources Corp., Northwest Natural Gas Co., Piedmont Natural Gas Co., South Jersey Industries Inc., Southwest Gas Corp., and WGL Holdings Inc.

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[8] One company included in the sample (Atmos Energy Corp.) did undertake an acquisition in 2004. I discuss below the reasons for keeping it in the sample.

[9] For purposes of sample selection, a sizeable merger is defined to be one which would exceed 30 percent of the total capitalization of the company at the time of the merger announcement.

Q6. What companies did you eliminate before arriving at the final sample?

A6. I eliminated four companies because they had no bond rating and their annual revenues were less than $300 million (Chesapeake Utilities Corp., Energy West Inc., EnergySouth Inc., and RGC Resources Inc.), three companies because their credit ratings were below investment grade, and were involved primarily in the sale of propane or heating oil (Amerigas Partners LP, Ferrellgas Partners LP, and Star Gas Partners LP), and lastly one company because it had significant M&A activity in the last five years, was not rated by S&P, and is involved primarily in the sale of propane (UGI Corp.).

Q7. Are there any issues with the remaining companies in your sample?

A7. Possibly. Atmos Energy acquired TXU Gas Company in 2004 for $1.925 billion, making it a candidate for exclusion from the sample because of significant M&A activity. In balancing the goal to have a larger sample with the desire to have a problem-free sample, I decided to include Atmos in the gas LDC sample because the acquisition occurred relatively close to the five-year threshold that I consider relevant for this criterion. However, excluding Atmos Energy from the sample would raise cost of equity estimates by approximately 10 basis points. As a result, my estimates are conservative, and the inclusion of Atmos Energy is not a source of concern about sample quality.

Q8. Please compare the characteristics of the water utility sample and the gas LDC sample.

A8. Both samples consist of companies with substantial capital investments in distribution facilities. Also, companies in both samples earn a large percentage of their revenue from regulated activities and serve a mix of residential, industrial, and other customers. The water subsample includes only those companies with a higher percent of their revenues from regulated utilities and fewer data problems which was at least 88 percent of revenues from regulated activities in 2007. Companies in the gas LDC sample had at least 70 percent of their assets attributable to regulated activities. (See Table No. BV-2

and Table No. BV-13).[10] All companies in the water utility sample and the gas LDC sample are regulated by one or more states.

For both the water/wastewater industry and the gas distribution industry, environmental compliance costs and infrastructure investments are of importance. Many gas LDC companies discuss environmental clean-up requirements in their 10-K. Similarly, the companies in the water industry also face regulatory requirements from federal and local authorities through, for example, the Clean Water Act of 1974 and EPA enforcement, which will likely require the water industry to invest substantial amounts in infrastructure going forward.[11]

Q9. What do you conclude from the comparison of the water utility and the gas LDC samples?

A9. The two samples differ primarily in that they operate in two different (regulated) industries, but they are very similar in terms of the magnitude of regulated activities, the customers mix they serve, and the magnitude and type of infrastructure needed. The gas LDC sample provides a reasonable comparison sample for the water utility industry but without the substantial data issues.

[10] Water utilities often do not report the percentage of assets subject to regulatory activities, while gas LDCs do. Both measures are likely to be good indicators of the relative magnitude of regulated activities, which is relevant to gauge the risk of the entities. Therefore, Table No. BV-2 and its associated workpapers report the share of operating revenues from different lines of business in 2007 for water utilities while Table No. BV-13 reports the share of regulated assets for gas LDC companies. (Table No. BV-1 provides an index to the other tables.)

[11] The *Value Line Investment Survey* (Water Utility Industry, April 25, 2008) mentions that infrastructure-related costs "are likely to remain at exorbitant levels and climb into the hundreds of millions of dollars in the coming decade."

II. MARKET VALUE CAPITAL STRUCTURE, COSTS OF DEBT & COSTS OF PREFERRED EQUITY

Q10. What capital structure information do you require?

A10. For reasons discussed in my written evidence and explained in detail in Appendix E, explicit evaluation of the market-value capital structures of the sample companies versus the capital structure used for rate making is vital for a correct interpretation of the market evidence. This requires estimates of the market values of common and preferred equity and debt, and the current market costs of preferred equity and debt.

Q11. How do you calculate the market-value capital structures of the sample companies?

A11. I estimate the capital structure for each company by estimating the market values of common equity, preferred equity and debt from publicly available data. The calculations are in Panels A to I of Table No. BV-3 and Panels A to J of Table No. BV-14 for the water and gas LDC sample, respectively.

The market value of equity is straightforward: the price per share times the number of shares outstanding. The market value of preferred equity is set equal to its book value because the portion of the capital structure financed with preferred equity is generally small. The market value of debt is estimated at the book value of debt reported by Bloomberg plus or minus the difference in the estimated fair (market) value and book value of long-term debt as reported in the companies' 10-Ks or annual reports.[12]

For purposes of assessing financial risk to common shareholders, I add an adjustment for short-term debt to the debt portion of the capital structure. This adjustment is used only for those companies whose short-term (current) liabilities exceed their short-term (current) assets. I add an amount equal to the minimum of the difference between short-term liabilities and short-term assets or the amount of short-term debt. The reason for

[12] See Panels A through I in Table No. BV-3 and Panels A through J in Table BV-14 for details. The adjustment relies on the difference between the companies' self-reported fair value of long-term debt and the carrying value of the same line items. This information was obtained from the sample companies' annual reports.

this adjustment is to recognize that when current liabilities exceed current assets, a portion of the company's long-term assets are being financed, in effect, by short-term debt.

The market value capital structure is calculated to be consistent with the time period over which the cost of capital is estimated for each sample. The capital structure is determined over the historical period over which the relevant risk positioning parameters were determined and as of the date analysts provide forward looking growth forecasts. Therefore, Tables No. BV-3 and BV-14 report the market value capital structure at year end for the years ending 2003 – 2007. The output of each of these tables is the market equity-to-value, debt-to-value, and preferred equity-to-value ratios. The overall cost of capital calculation for the risk positioning estimates rely on the average of the market value capital structure computed for the years 2003 through 2007, as shown in Tables No. BV-4 and BV-15, respectively. The results in columns [1]-[3] are used in the DCF model calculations, while columns [4]-[6] are for the risk positioning models.

Q12. How do you estimate the current market cost of preferred equity?

A12. For companies with preferred equity, the cost of preferred equity for each company was set equal to the yield on an index of preferred stock as reported in the *Mergent Bond Record* corresponding to the S&P rating of that company's debt. The yields from *Mergent Bond Record* were as of March 2008.[13] In general, the average amount of preferred equity in the sample companies' capital structures is very small and frequently zero. No company in either sample has more than one percent preferred equity (see Tables BV-4 and BV-15).

Q13. How do you estimate the current market cost of debt?

A13. The market cost of debt for each company in the DCF analysis is the current yield reported by Bloomberg for a public utility company bond corresponding to the sample company's current debt rating as classified by S&P. The risk positioning analysis, on the other hand, uses the current yield of a utility bond that corresponds to the five-year

[13] As of the time of estimation, March data were the most recent available on preferred yields.

average debt rating of each company so as to match consistently the horizon of information used by *Value Line* to estimate company betas. The current S&P debt ratings were obtained from Bloomberg.[14]

The fifteen day average yield on A-rated Public Utility bonds was 6.41 percent as of May 7, 2008, and 6.76 percent on average for BBB-rated Public Utility bonds. (See Panel A of Workpaper #1 to Table No. BV-11 for the yields on utility bonds and preferred stock by credit rating.) Based on information from the Company, the corporate tax rate was set at 39.9 percent which corresponds to the corporate tax rate in New Mexico. Calculation of the after-tax cost of debt uses the marginal tax rate 39.9 percent.

[14] Debt ratings were not available for Pennichuck Corp., SJW Corp, and Southwest Water Co.'s. I assumed a rating of A, which is the same as that of all other water utilities in the sample.

APPENDIX C

RISK POSITIONING METHODOLOGY AND EMPIRICAL RESULTS

I. EQUITY RISK PREMIUM METHODOLOGY C-2

A. THE BASIC EQUITY RISK PREMIUM MODEL C-2
B. MARKET RISK PREMIUM C-3
C. RELATIVE RISK C-10
D. INTEREST RATE ESTIMATE C-14
E. COST OF CAPITAL MODELS C-14

II. EMPIRICAL EQUITY RISK PREMIUM RESULTS C-17

A. RISK-FREE INTEREST RATE C-17
B. BETAS AND THE MARKET RISK PREMIUM C-18
1. Beta Estimation Procedures C-18
2. Market Risk Premium Estimation C-19
C. COST OF CAPITAL ESTIMATES C-19

Q1. What is the purpose of this appendix?

A1. This appendix reviews the principles behind the risk positioning methodologies, describes the estimation of the parameters used in the models, and details the cost of capital estimates obtained from these methodologies. This appendix intentionally repeats portions of my direct testimony, because I want the reader to be able to have a full discussion of the issues addressed here, rather than having to continually turn back to the corresponding section of the testimony.

I. EQUITY RISK PREMIUM METHODOLOGY

Q2. How is this section of the appendix organized?

A2. It first reviews the basic nature of the equity risk premium approach. It then discusses the individual components of the model: the benchmark risk premium, the relative risk of the company or line of business in question, the appropriate interest rate, and the combination of these elements in a particular equity risk premium model.

A. THE BASIC EQUITY RISK PREMIUM MODEL

Q3. How does the equity risk premium model work?

A3. The equity risk premium approach estimates the cost of equity as the sum of a current interest rate and a risk premium. (It therefore is sometimes also known as the "risk premium" or the "risk positioning" approach.)

This approach may sometimes be applied informally. For example, an analyst or a commission may check the spread between interest rates and what is believed to be a reasonable estimate of the cost of capital at one time, and then apply that spread to changed interest rates to get a new estimate of the cost of capital at another time.

More formal applications of the equity risk premium method implement theoretical finance models of cost of capital. They use information on all securities to identify the security market line (Figure 1 in the body of the testimony) and derive the cost of capital

for the individual security based on that security's relative risk. This equity risk premium approach is widely used and underlies most of the current scholarly research on the nature, determinants and magnitude of the cost of capital.

Q4. How are "more formal applications" put into practice?

A4. The essential benchmarks that determine the security market line are the risk-free interest rate and the premium that a security of average risk commands over the risk-free rate. This premium is commonly referred to as the "market risk premium" ("MRP"), i.e., the excess of the expected return on the average common stock over the risk-free interest rate. In the equity risk premium approach the risk-free interest rate and MRP are common to all securities. A security-specific measure of relative risk (beta) is estimated separately and combined with the MRP to obtain the company-specific risk premium.

In principle, there may be more than one factor affecting the expected stock return, each with its own security-specific measure of relative risk and its own benchmark risk premium. For example, the "arbitrage pricing theory" and other "multi-factor" models have been proposed in the academic literature. These models estimate the cost of capital as the sum of a risk-free rate and several security-specific risk premia. However, none of these alternative models has emerged in practice as "the" improvement to use instead of the original, single-factor model. I use the traditional single-factor model in this testimony.

Accordingly, the required elements in my formal equity risk premium approach are the market risk premium, an objective measure of relative risk, the risk-free rate that corresponds to the measure of the market risk premium, and a specific method to combine these elements into an estimate of the cost of capital.

B. MARKET RISK PREMIUM

Q5. Why is a risk premium necessary?

A5. Experience (e.g., the U.S. market's October Crash of 1987) demonstrates that shareholders, even well diversified shareholders, are exposed to enormous risks. By

investing in stocks instead of risk-free Government bills, investors subject themselves not only to the risk of earning a return well below those they expected in any year but also to the risk that they might lose much of their initial capital. This is why investors demand a risk premium.

I estimate and show two versions of the Capital Asset Pricing Model ("CAPM"). The first version measures the market risk premium as the risk premium of average risk common stocks over the long-term risk-free rate. Because short-term risk-free rates currently are influenced substantially by monetary policy, I do not rely on the numbers from this version of the CAPM. Specifically, the short-term risk-free rates are unusually low and likely driven by the Federal Reserve's recent interest rate cuts.[1] It is also noteworthy that the Surface Transportation Board ("STB") in a recent decision decided to rely exclusively on long-term risk-free rates in the implementation of the CAPM.[2]

Q6. Please discuss some of the issues involved in selecting the appropriate MRP.

A6. To determine the cost of capital in a regulatory proceeding, the MRP should be used with an estimate of the same interest rate used to calculate the MRP (i.e., the short-term Treasury bill rate or the long-term Government rate). For example, it would be inconsistent to utilize a short-term risk-free with an estimate of the MRP derived from comparisons to long-term interest rates. In addition, the appropriate measure of the MRP should be based upon the arithmetic mean not the geometric mean return.[3] The arithmetic mean is the simple average while the geometric mean is the compound rate of return between two periods.

Q7. How do you estimate the MRP?

A7. There is presently little consensus on "best practice" for estimating the MRP, which does not mean that each approach is equally valid. For example, the leading graduate textbook

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[1] According to the Federal Reserve Board: *Monetary Policy, Open Market Operations*, June 13, 2008, the Federal Reserve has cut interest rates seven times for a total of 275 basis points since September 2007, so that the Federal Funds Rate now (June 13, 2008) stands at 2%.

[2] See, *STB Ex Parte No. 664*, issued January 17, 2008, p. 7.

[3] See, for example, Morningstar, *Ibbotson SBBI Valuation Yearbook 2008*, pp. 77-79.

in corporate finance, after recommending use of the arithmetic average realized excess return on the market for many years (which for a while was noticeably over 9 percent), now reviews the current state of the research and expresses the view that the a range between 5 to 8 percent is reasonable for the U.S.[4,5] At the same time, Dimson, Marsh, and Staunton (2008) estimate that the average arithmetic risk premium of stocks *over bonds* in the U.S. was 6.5% for the period 1900 to 2007.[6] In a recent proceeding the Surface Transportation Board ("STB") decided to switch from a DCF model to the CAPM model when estimating the cost of equity for U.S. railroads. The STB further decided to rely on the arithmetic risk premium of stocks over long-term bonds as reported in Morningstar / Ibbotson (currently 7.1 percent).[7]

My written testimony considers both the historical evidence and the results of scholarly studies of the factors that affect the risk premium for average-risk stocks in order to estimate the benchmark risk premium investors currently expect. I consider the historical difference in returns between the Standard and Poor's 500 Index ("S&P 500") and the risk-free rate, recent academic literature on the MRP and the results of recent surveys to estimate the market risk premium.

Q8. Please summarize the recent literature on the MRP and the conclusions you draw from it.

A8. Some recent research based upon U.S. data challenges the conventional wisdom of using the arithmetic average historical excess returns to estimate the MRP. However, after reviewing the issues in the debate, I remain skeptical for several reasons that the market risk premium has declined in the U.S. as much as is claimed in some of the literature.

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[4] Richard A. Brealey, Stewart C. Myers, and Franklin Allen, *Principles of Corporate Finance*, McGraw-Hill, 8th edition, 2006, pp. 151-154.

[5] In past editions, the authors expressed the view that they are "most comfortable" with values toward the upper end of that range, but this language does not appear in the 8th edition. Although Professor Myers still holds this view, this language and other sections were dropped to accommodate a request to reduce the length of the text.

[6] Dimson, Marsh and Staunton, *Global Investment Returns Yearbook 2008*, p. 48.

[7] *STB Ex Parte No. 664*, Issued January 17, 2008, pp. 8-9.

First, despite eye-catching claims like "equity risk premium as low as three percent,"[8] and "the death of the risk premium,"[9] not all recent research arrives at the same conclusion. In his presidential address to the American Finance Association in 2001, Professor Constantinides seeks to estimate the unconditional equity premium based on average historical stock returns.[10] (Note that this address was based upon evidence just before the major fall in market value.) He adjusts the average returns downward by the change in price-earnings ratio because he assumes no change in valuations in an unconditional state. His estimates for 1926 to 2000 and 1951 to 2000 are 8.0 percent and 6.0 percent, respectively, over the 3-month T-bill rate. In another published study in 2001, Professors Harris and Marston use the DCF method to estimate the market risk premium for the U.S. stocks.[11] Using analysts' forecasts to proxy for investors' expectation, they conclude that over the period 1982-1998 the MRP over the *long-term* risk-free rate is 7.14 percent. As yet another example, the paper by Drs. Ibbotson and Chen (2003) adopts a supply side approach to estimate the forward looking long-term sustainable equity returns and equity risk premium based upon economic fundamentals. Their equity risk premium over the *long-term* risk-free rate is estimated to be 3.97 percent in geometric terms and 5.90 percent on an arithmetic basis. They conclude their paper by stating that their estimate of the equity risk premium is "far closer to the historical premium than being zero or negative."[12] Morningstar has in recent years updated part of the Ibbotson and Chen analysis and found in the 2007 edition that the arithmetic MRP was approximately 6.35 percent over government bonds.[13]

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[8] Claus, J. and J. Thomas, (2001), "Equity Risk Premium as Low as Three Percent: Evidence from Analysts' Earnings Forecasts for Domestic and International Stocks," *Journal of Finance* 56:1629-1666.

[9] Arnott, R. and R. Ryan, (2001), "The Death of the Risk Premium," *Journal of Portfolio Management* 27(3):61-84.

[10] Constantinides, G.M. (2002), "Rational Asset Prices," *Journal of Finance* 57:1567-1591.

[11] Robert S. Harris and Felicia C. Marston, "The Market Risk Premium: Expectational Estimates Using Analysts' Forecasts," *Journal of Applied Finance* 11 (1) 6-16, 2001.

[12] Ibbotson, R. and P. Chen (2003), "Stock Market Returns in the Long Run: Participating in the Real Economy," *Financial Analyst Journal*, 59(1):88-98. Cited figures are on p. 97.

[13] Morningstar, Morningstar, SBBI Valuation Edition 2007 Yearbook, p. 97.

Second, Professor Ivo Welch surveyed a large group of financial economists in 1998 and 1999. The average of the estimated MRP was 7.1 percent in Prof. Welch's first survey and 6.7 percent in his second survey which was based on a smaller number of individuals. A subsequent survey[14] by Prof. Welch reported only a 5.5 percent MRP.[15] In characterizing these results Prof. Welch notes that "[T]he equity premium consensus forecast of finance and economics professors seems to have dropped during the last 2 to 3 years, a period with low realized equity premia."[16] However, in the most recent survey,[17] conducted in December 2007, Prof. Welch finds that the average estimate has increased to about 5.7 percent.

The above quotation from Prof. Welch emphasizes the caution that must attend survey data even from knowledgeable survey participants: the outcome is likely to change quickly with changing market circumstances.

Third, some of the evidence for negative or close to zero market risk premium simply does not make sense. Despite the relatively high valuation levels, stock returns remain much more volatile than Treasury bond returns. I am not aware of any empirical or theoretical evidence showing that investors would rationally hold equities and not expect to earn a positive risk premium for bearing their higher risk.

Fourth, I am unaware of a convincing theory for why the future MRP should have substantially declined. At the height of the stock market bubble in the U.S., many claimed that the only way to justify the high stock prices would be if the MRP had

[14] Ivo Welch (2000), "Views of Financial Economists on the Equity Premium and on Professional Controversies," *Journal of Business*, 73(4):501-537. The cited figures are in Table 2, p. 514.

[15] Ivo Welch (2001), "The Equity Premium Consensus Forecast Revisited," School of Management at Yale University working paper. The cited figure is in Table 2.

[16] *Ibid*, p. 8.

[17] See Ivo Welch (2008), "The Consensus Estimate for the Equity Premium by Academic Financial Economists in December 2007," School of Management at Yale University working paper. The cited figure is in Table 2.

declined dramatically,[18] but this argument was heard less frequently after the market declined substantially from its tech bubble high. All else equal, a high valuation ratio such as price-earnings ratio implies a low required rate of return, hence a low MRP. However, there is considerable debate about whether the high level of stock prices (despite the burst of the internet bubble from its high in the summer of 2000) represents the transition to a new economy or is simply an "irrational exuberance," which cannot be sustained for the long term. If the former case is true, then the MRP may have decreased permanently. Conversely, the long-run MRP may remain the same even if expected market returns in the short-term are smaller.

Another common argument for a lower expected MRP is that the U.S. experienced very remarkable growth in the 20th century that was not anticipated at the start of the century. As a result, the average realized excess return is overestimated meaning the standard method of estimating the MRP would be biased upward. However, one recent study by Professors Jorion and Goetzmann finds, under some simplifying assumptions, that the so-called "survivorship bias" is only 29 basis points.[19] Furthermore, "[I]f investors have overestimated the equity premium over the second half of the last century, Constantinides (2002) argues that 'we now have a bigger puzzle on our hands' Why have investors systematically biased their estimates over such a long horizon?"[20]

To sum up the above, I cite two passages from Profs. Mehra and Prescott's review of the theoretical literature on equity premium puzzle:[21]

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[18] See Robert D. Arnott and Peter L. Bernstein, "What Risk Premium is 'Normal'?," *Financial Analysts Journal* 58:64-85, for an example.

[19] Jorion, P., and W. Goetzmann (1999), "Global Stock Markets in the Twentieth Century," *Journal of Finance* 54:953-980. Dimson, Marsh, and Staunton (2003) make a similar point when they comment on the equity risk premia for 16 countries based on returns between 1900 and 2001: "While the United States and the United Kingdom have indeed performed well, compared to other markets there is no indication that they are hugely out of line." p.4.

[20] Mehra, R., and E.C. Prescott (2003), "The Equity Premium in Retrospect," in *Handbook of the Economics of Finance*, Edited by G.M. Constantinides, M. Harris and R. Stulz, Elsevier B.V, p. 926

[21] *Ibid*, p. 926.

> Even if the conditional equity premium given current market conditions is small, and there appears to be general consensus that it is, this in itself does not imply that it was obvious either that the historical premium was too high or that the equity premium has diminished.
>
> In the absence of this [knowledge of the future], and based on what we currently know, we can make the following claim: over the long horizon the equity premium is likely to be similar to what it has been in the past and the returns to investment in equity will continue to substantially dominate that in T-bills for investors with a long planning horizon.

Q9. Is there other scholarly support for the conclusion?

A9. Yes. Another line of research was pursued by Steven N. Kaplan and Richard S. Ruback. They estimate the market risk premium in their article, "The Valuation of Cash Flow Forecasts: An Empirical Analysis."[22] Professors Kaplan and Ruback compare published cash flow forecasts for management buyouts and leveraged recapitalization over the 1983 to 1989 period against the actual market values that resulted from these transactions. One of their results is an estimate of the market risk premium over the long-term Treasury bond yield that is based on careful analysis of actual major investment decisions, not realized market returns. Their median estimate is 7.78 percent and their mean estimate is 7.97 percent.[23] This is considerably higher than my estimate of 6.5 percent. Even if the maturity premium of Treasury bonds over Treasury bills were only 1 percent, well below the best estimate of 1.5 percent the resulting estimate of the market risk premium over Treasury bills is higher than my estimate of 8.0 percent.

Q10. In addition to the scholarly articles and survey evidence you discussed in Section I of your Direct Testimony, what other evidence do you consider to estimate the MRP?

A10. I also consider the long-run realized equity premia reported in Morningstar's *Ibbotson SBBI Valuation Yearbook 2008*. The data provided cover the period 1926 through 2007. The results are discussed below.

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[22] *Journal of Finance*, 50, September 1995, pp. 1059-1093.

[23] *Ibid*, p. 1082.

Q11. What is the "long-run realized risk premium" in the U.S.?

A11. From 1926 to 2007, the full period reported, Morningstar's data show that the average premium of stocks over Treasury bills is 8.5 percent. I also examine the "post-War" period. The risk premium for 1947-2007 is 8.3 percent.[24] (I exclude 1946 because its economic statistics are heavily influenced by the War years; e.g., the end of price controls yielded an inflation rate of 18 percent. It is not really a "post-War" year, from an economic viewpoint.) These averages often change slightly when another year of data is added to the Ibbotson series. The average premium of stocks over the income returns on long-term Government bonds is 7.1 percent for the 1926 to 2007 period and 7.0 for the 1947 to 2007 period.

Recently there has been a great deal of academic research on the MRP. This research has put practitioners in a dilemma: there is nothing close to a consensus about how the MRP should be estimated, but a general agreement in the academic community seems to be emerging that the old approach of using the average realized return over long periods gives too high an answer.

Q12. What is your conclusion regarding the MRP?

A12. Estimation of the MRP remains controversial. There is no consensus on its value or even how to estimate it. Given a careful review of all of the information, I estimate the risk premium for average risk stocks to be 8.0 percent over Treasury bills and 6.5 percent over long-term Government bonds.

C. RELATIVE RISK

Q13. How do you measure relative risk?

A13. The risk measure I examine is the "beta" of the stocks in question. Beta is a measure of the "systematic" risk of a stock — the extent to which a stock's value fluctuates more or less than average when the market fluctuates. It is the most commonly used measure of risk in capital market theories.

[24] Morningstar, *Ibbotson SBBI Valuation Yearbook 2008*, Appendix A, Table A-3.

Q14. Please explain beta in more detail.

A14. The basic idea behind beta is that risks that cannot be diversified away in large portfolios matter more than those that can be eliminated by diversification. Beta is a measure of the risks that *cannot* be eliminated by diversification.

Diversification is a vital concept in the study of risk and return. (Harry Markowitz won a Nobel Prize for work showing just how important it was.) Over the long run, the rate of return on the stock market has a very high standard deviation, on the order of 15 - 20 percent per year. But many individual stocks have much higher standard deviations than this. The stock market's standard deviation is "only" about 15 - 20 percent because when stocks are combined into portfolios, some of the risk of individual stocks is eliminated by diversification. Some stocks go up when others go down, and the average portfolio return — positive or negative — is usually less extreme than that of individual stocks within it.

In the limiting case, if the returns on individual stocks were completely uncorrelated with one another, the formation of a large portfolio of such stocks would eliminate risk entirely. That is, the market's long-run standard deviation would be not 15-20 percent per year, but virtually zero.

The fact that the market's actual annual standard deviation is so large means that, in practice, the returns on stocks are correlated with one another, and to a material degree. The reason is that many factors that make a particular stock go up or down also affect other stocks. Examples include the state of the economy, the balance of trade, and inflation. Thus some risk is "non-diversifiable". Single-factor equity risk premium models derive conditions in which all of these factors can be considered simultaneously, through their impact on the market portfolio. Other models derive somewhat less restrictive conditions under which several of them might be individually relevant.

Again, the basic idea behind all of these models is that risks that cannot be diversified away in large portfolios matter more than those that can be eliminated by diversification, because there are a large number of large portfolios whose managers actively seek the

best risk-reward tradeoffs available. Of course, undiversified investors would like to get a premium for bearing diversifiable risk, but they cannot.

Q15. Why not?

A15. Well-diversified investors compete away any premium rates of return for diversifiable risk. Suppose a stock were priced especially low because it had especially high diversifiable risk. Then it would seem to be a bargain to well diversified investors. For example, suppose an industry is subject to active competition, so there is a large risk of loss of market share. Investors who held a portfolio of all companies in the industry would be immune to this risk, because the loss on one company's stock would be offset by a gain on another's stock. (Of course, the competition might make the whole industry more vulnerable to the business cycle, but the issue here is the diversifiable risk of shifts in market share among firms.)

If the shares were priced especially low because of the risk of a shift in market shares, investors who could hold shares of the whole industry would snap them up. Their buying would drive up the stocks' prices until the premium rates of return for diversifiable risk were eliminated. Since all investors pay the same price, even those who are not diversified can expect no premium for bearing diversifiable risk.

Of course, substantial non–diversifiable risk remains, as the October Crash of 1987 demonstrates. Even an investor who held a portfolio of all traded stocks could not diversify against that type of risk. Sensitivity to such market–wide movements is what beta measures. That type of sensitivity, whether considered in a single- or multi-factor model, determines the risk premium in the cost of equity.

Q16. What does a particular value of beta signify?

A16. By definition, a stock with a beta equal to 1.0 has average non-diversifiable risk: it goes up or down by 10 percent on average when the market goes up or down by 10 percent. Stocks with betas above 1.0 exaggerate the swings in the market: stocks with betas of 2.0 tend to fall 20 percent when the market falls 10 percent, for example. Stocks with betas

below 1.0 are less volatile than the market. A stock with a beta of 0.5 will tend to rise 5 percent when the market rises 10 percent.

Q17. How is beta measured?

A17. The usual approach to calculating beta is a statistical comparison of the sensitivity of a stock's (or a portfolio's) return to the market's return. Many investment services report betas, including Merrill Lynch's quarterly Security Risk Evaluation, Bloomberg and the *Value Line Investment Survey*. Betas are not always calculated the same way, and therefore must be used with a degree of caution, but the basic point that a high beta indicates a risky stock has long been widely accepted by both financial theorists and investment professionals.

Q18. Are there circumstances when the "usual approach to calculating beta" should not be used?

A18. There are at least two cases where the standard estimate of beta should be viewed skeptically.

First, companies in serious financial distress seem to "decouple" from their normal sensitivity to the stock market. The stock prices of financially distressed companies tend to change based more on individual news about their particular circumstances than upon overall market movements. Thus, a risky stock could have a low estimated beta if the company was in financial distress. Other circumstances that may cause a company's stock to decouple include an industry restructuring or major changes in a company's supply or output markets.

Second, similar circumstances seem to arise for companies "in play" during a merger or acquisition. Once again, the individual information about the progress of the proposed takeover is so much more important for that stock than day-to-day market fluctuations that, in practice, beta estimates for such companies seem to be too low.

Q19. How reliable is beta as a risk measure?

A19. Scholarly studies have long confirmed the importance of beta for a stock's required rate of return. It is widely regarded as the best single risk measure available. The merits of beta seemed to have been challenged by widely publicized work by Professors Eugene F. Fama and Kenneth R. French.[25] However, despite the early press reports of their work as signifying that "beta is dead," it turns out that beta is still a potentially important explanatory factor (albeit one of several) in their work. Thus, beta remains alive and well as the best single measure of relative risk.

D. INTEREST RATE ESTIMATE

Q20. What interest rates do your procedures require?

A20. Modern capital market theories of risk and return use the short-term risk-free rate of return as the starting benchmark. My measures of the MRP incorporate this approach, since they represent the excess of the expected return on the market over the 30-day U.S. Treasury bill rate and over the long-term U.S. Government bond rate. Accordingly, implementation of my procedures requires use of an estimate of the 30-day Treasury bill rate and the long-term Government bond rate. I use the average over the most recent 15 trading days ending on May 7, 2008.

E. COST OF CAPITAL MODELS

Q21. How do you combine the above components into an estimate of the cost of capital?

A21. By far the most widely used approach to estimation of the cost of capital is the "Capital Asset Pricing Model," and I do calculate CAPM estimates. However, the CAPM is only one equity risk premium approach technique, and I also use another.

Q22. Please start with the CAPM, by describing the model.

A22. As noted above, the modern models of capital market equilibrium express the cost of equity as the sum of a risk-free rate and a risk premium. The CAPM is the longest-

standing and most widely used of these theories. The CAPM states that the cost of capital for investment *s* (e.g., a particular common stock) is given by the following equation:

$$k_s = r_f + \beta_s \times MRP \qquad \textbf{(C-1)}$$

where k_s is the cost of capital for investment *s*; r_f is the risk-free rate, β_s is the beta risk measure for the investment *s*; and *MRP* is the market risk premium.

The CAPM relies on the empirical fact that investors price risky securities to offer a higher expected rate of return than safe securities do. It says that the security market line starts at the risk-free interest rate (that is, that the return on a zero-risk security, the y-axis intercept in Figure 1 in the body of my testimony, equals the risk-free interest rate). Further, it says that the risk premium over the risk-free rate equals the product of beta and the risk premium on a value-weighted portfolio of all investments, which by definition has average risk.

Q23. What other equity risk premium approach model do you use?

A23. Empirical research has long shown that the CAPM tends to overstate the actual sensitivity of the cost of capital to beta: low-beta stocks tend to have higher risk premia than predicted by the CAPM and high-beta stocks tend to have lower risk premia than predicted. A number of variations on the original CAPM theory have been proposed to explain this finding. The difference between the CAPM and the type of relationship identified in the empirical studies is depicted in Figure BV-C1.

[25] See for example, "The Capital Asset Pricing Model: Theory and Evidence", Eugene F. Fama and Kenneth R. French, *Journal of Economic Perspectives*, Volume 18, Summer 2004, pp. 25-46.

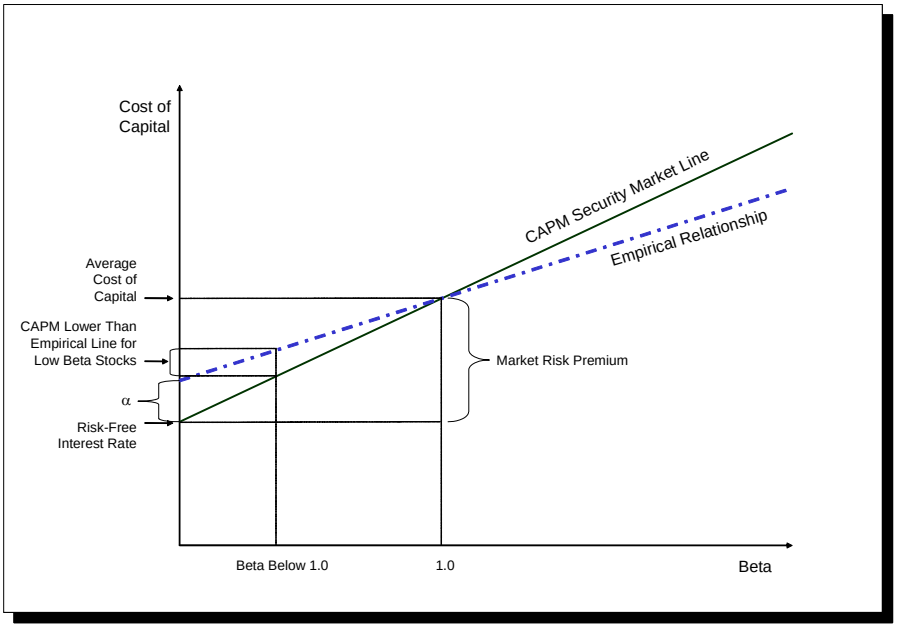

Figure BV-C1: The Empirical Security Market Line

The second model makes use of these empirical findings. It estimates the cost of capital with the equation,

$$k_s = r_f + \alpha + \beta_s \times (MRP - \alpha) \qquad \textbf{(C-2)}$$

where α is the "alpha" of the risk-return line, a constant, and the other symbols are defined as above. I label this model the Empirical Capital Asset Pricing Model, or "ECAPM." For the short-term risk-free rate models, I set alpha equal to 1, 2, and 3 percent which are values somewhat lower than that estimated empirically. For low-beta stocks such as regulated utilities, the use of a lower value for alpha leads to a lower estimate of the cost of capital. For the long-term risk-free rate models, I set alpha equal to both 0.5 percent and 1.5 percent, but I rely more heavily on the 0.5 percent results. The use of a long-term risk-free rate incorporates some of the desired effect of using the ECAPM. That is, the long-term risk-free rate version of the Security Market Line has a higher intercept and a flatter slope than the short-term risk-free version which has been tested. Thus, it is likely that I do not need to make the same degree adjustment when I use the long-term risk-free rate. A summary of the empirical evidence on the magnitude of alpha is provided in Table No. BV-C1 below.

II. EMPIRICAL EQUITY RISK PREMIUM RESULTS

Q24. How is this part of the appendix organized?

A24. This section presents the full details of my equity risk premium approach analyses, which are summarized in the body of my testimony. Details behind the estimates of the short-term and the long-term risk-free interest rates are discussed. Next, the beta estimates, and the estimates of the MRP I use in the models are addressed. Finally, this section reports the CAPM and ECAPM results for the sample's costs of equity, and then describes the results of adjusting for differences between the benchmark sample and New Mexico-American's regulated capital structures.

A. RISK-FREE INTEREST RATE

Q25. How do you obtain estimates of the risk-free interest rates over the period the utility rates set here are to be in effect?

A25. I obtain these rates using data provided by Bloomberg. In particular, I use their reported government debt yields from the "constant maturity series". This information is displayed in Table No. BV-9.

Q26. What values do you use for the short-term and long-term risk-free interest rates?

A26. I use a value of 1.1 percent for the short-term risk-free interest rate and a value of 4.5 percent for the long-term risk-free interest rate as the benchmark interest rates in the equity risk premium analyses. These values represent the average yields on 30-day and long term (20-year) Treasury securities respectively, over the 15-trading day period ending on May 7, 2008.

B. BETAS AND THE MARKET RISK PREMIUM

1. Beta Estimation Procedures

Q27. Which betas do you use in your risk positioning models?

A27. I obtained estimates from the *Value Line Investment Survey* for the sample companies.[26]

Q28. How does *Value Line* estimate the reported betas?

A28. *Value Line* estimates the reported betas using weekly data for a five year period. As a market index, *Value Line* uses the New York Stock Exchange. Also *Value Line* reports so-called adjusted betas, i.e. the betas reported by *Value Line* are calculated as follows:

$$\beta_{Value\ Line} = .67 \times \beta + 0.35 \qquad \textbf{(C-3)}$$

where β is the standard beta estimate. To obtain standard betas, I reverse the adjustment to obtain standard betas, β. *Value Line* and many investment firms adjust the estimated betas using a procedure similar to the one described in equation (C-3). This type of adjustment is intended to compensate for sampling errors in the beta estimation. It adjusts betas below one upwards and betas above one downwards.

Q29. Please summarize the beta estimates you rely on.

A29. After reversing the *Value Line* adjustment procedure, the estimates range from 0.15 to 1.12 for the water sample and from 0.67 to 0.97 for the gas LDC sample, with an average of 0.76 and 0.77 respectively. The beta estimates for individual sample companies are reported in Workpaper #1 to Tables No. BV-10 and BV-20.

Q30. What are the characteristics of recent beta estimates?

A30. Betas for both water and gas utilities have increased in recent years. For example, *Value Line* betas for water utilities averaged approximately .60 in 2002 while they now stand at approximately .86 for an increase of about 45% over the last six years. Similarly, the average beta for the gas LDC sample has increased from approximately 0.65 to

[26] For each sample I used the *Value Line* beta estimates most recently available. For the water sample, estimates are as of April 25, 2008, while for the gas LDC sample estimates are as of March 14, 2008.

approximately .87 for an increase of almost 34% over six years. Thus, at least in *Value Line*'s judgment, the water and gas LDC companies are exposed to more systematic risk today than they were a few years back.

2. Market Risk Premium Estimation

Q31. Given all of the evidence, what MRP do you use in your analysis?

A31. It is clear that market return information is volatile and difficult to interpret, but based on the collective evidence, the MRP I use for the short-term risk-free rate is 8 percent and for the long-term risk-free rate is 6.5 percent.

C. COST OF CAPITAL ESTIMATES

Q32. Based on these data, what are the values you calculate for the overall cost of capital and the corresponding cost of equity for the water utility sample?

A32. Panels A and B of Table No. BV-10 present the cost of equity results using the equity risk positioning methods at the sample companies' market value capital structures. Panel A uses the long-term risk-free rate estimate while Panel B uses the short-term risk-free rate.

Q33. What does the water market data imply about the sample's cost of equity at the proposed 45.1 percent equity ratio for New Mexico-American Water?

A33. The return on equity and the overall cost of capital for the various equity risk positioning methods are reported in Table No. BV-11, Panels A to G. Panels A through C utilize the long-term risk-free rate while Panels D through G use the short-term risk free rate. Panel A reports the cost of capital estimates using the CAPM results for the long-term risk-free rate, while Panels B and C report these estimates for the ECAPM cost of equity results using ECAPM parameters of 0.5 and 1.5 percent, respectively. Panel D reports the CAPM estimates using the short-term risk free rate, while Panels E, F and G report ECAPM results using ECAPM parameters of 1, 2 and 3 respectively. In each panel, column [8] reports the overall cost of capital for each company. The last two rows of each panel report the sample and the subsample averages. The first is for all companies

in the water sample (average [a]), and the second is for the subsample of companies with significant revenue from regulated activities (average [b]).

The sample average ATWACC from each panel of Table No. BV-11 is reproduced in column [1] of Table No. BV-12, which then reports the cost of equity for each of the risk positioning methods that is consistent with the sample information and the capital structure of New Mexico-American. Panel A of Table No. BV-12 reports the results for all sample companies. Panel B of the table summarizes the results for the subsample of companies that have a large percentage of revenues from regulated activities. The sample average ATWACCs and corresponding costs of equity at a 45.1 percent equity ratio are also displayed in Table 3 of my testimony.

Q34. What cost of equity values do you calculate for the gas LDC sample?

A34. The cost of equity estimates for the gas LDC sample are displayed on Panels A and B of Table No. BV-20. As with the water utility sample results, Panel A uses the long-term risk-free rate, and Panel B uses the short-term risk-free rate.

Q35. What does the gas LDC market data imply about the sample's cost of equity at the proposed 45.1 percent equity ratio for New Mexico-American Water?

A35. The sample average ATWACC from each panel of Table No. BV-21 is reproduced in column [1] of Table No. BV-22, which then reports the cost of equity for each of the risk positioning methods that is consistent with the sample information and the capital structure of New Mexico-American. The sample average ATWACCs and corresponding costs of equity at a 45.1 percent equity ratio are also displayed in Table 3 of my testimony.

Q36. What are the implications of the risk positioning results for New Mexico-American's estimated cost of equity?

I discuss the implications of the risk positioning results for the two samples in the main body of my testimony.

Table BV-C1

EMPIRICAL EVIDENCE ON THE ALPHA FACTOR IN ECAPM*

AUTHOR	RANGE OF ALPHA	PERIOD RELIED UPON
Black (1993)[1]	1% for betas 0 to 0.80	1931-1991
Black, Jensen and Scholes (1972)[2]	4.31%	1931-1965
Fama and McBeth (1972)	5.76%	1935-1968
Fama and French (1992)[3]	7.32%	1941-1990
Litzenberger and Ramaswamy (1979)[4]	5.32%	1936-1977
Litzenberger, Ramaswamy and Sosin (1980)	1.63% to 3.91%	1926-1978
Pettengill, Sundaram and Mathur (1995)[5]	4.6%	1936-1990

*The figures reported in this table are for the longest estimation period available and, when applicable, use the authors' recommended estimation technique. Many of the articles cited also estimate alpha for sub-periods and those alphas may vary.

[1]Black estimates alpha in a one step procedure rather than in an un-biased two-step procedure.

[2]Estimate a negative alpha for the subperiod 1931-39 which contain the depression years 1931-33 and 1937-39.

[3]Calculated using Ibbotson's data for the 30-day treasury yield.

[4]Relies on Lizenberger and Ramaswamy's before-tax estimation results. Comparable after-tax alpha estimate is 4.4%.

[5]Pettengill, Sundaram and Mathur rely on total returns for the period 1936 through 1990 and use 90-day treasuries. The 4.6% figure is calculated using auction averages 90-day treasuries back to 1941 as no other series were found this far back.

Sources:

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APPENDIX D

DISCOUNTED CASH FLOW METHODOLOGY:

DETAILED PRINCIPLES AND RESULTS

I. DISCOUNTED CASH FLOW METHODOLOGY PRINCIPLES D-2

A. SIMPLE AND MULTI-STAGE DISCOUNTED CASH FLOW MODELS D-2
B. CONCLUSIONS ABOUT DCF D-9

II. EMPIRICAL DCF RESULTS D-9

A. PRELIMINARY MATTERS D-10
B. GROWTH RATES D-10
C. DIVIDEND AND PRICE INPUTS D-13
D. COMPANY-SPECIFIC DCF COST-OF-CAPITAL ESTIMATES D-14

Q1. What is the purpose of this appendix?

A1. This appendix reviews the principles behind the discounted cash flow or "DCF" methodology and the details of the cost-of-capital estimates obtained from this methodology.

I. DISCOUNTED CASH FLOW METHODOLOGY PRINCIPLES

Q2. How is this section of the appendix organized?

A2. The first part discusses the general principles that underlie the DCF approach. The second portion describes the strengths and weaknesses of the DCF model and why it is generally less reliable for estimating the cost of capital for the sample companies at the present time than the risk positioning method discussed in Appendix C.

A. Simple And Multi-Stage Discounted Cash Flow Models

Q3. Please summarize the DCF model.

A3. The DCF model takes the first approach to cost-of-capital estimation discussed with Figure 1 in Section II-A of my direct testimony. That is, it attempts to measure the cost of equity in one step. The method assumes that the market price of a stock is equal to the present value of the dividends that its owners expect to receive. The method also assumes that this present value can be calculated by the standard formula for the present value of a cash flow stream:

$$P = \frac{D_1}{(1+k)} + \frac{D_2}{(1+k)^2} + \frac{D_3}{(1+k)^3} + \cdots + \frac{D_T}{(1+k)^T} \qquad \textbf{(D-1)}$$

where "P" is the market price of the stock; "D_t" is the dividend cash flow expected at the end of period t; "k" is the cost of capital; and "T" is the last period in which a dividend cash flow is to be received. The formula just says that the stock price is equal to the sum of the expected future dividends, each discounted for the time and risk between now and the time the dividend is expected to be received.

Most DCF applications go even further, and make very strong (*i.e.*, unrealistic) assumptions that yield a simplification of the standard formula, which then can be rearranged to estimate the cost of capital. Specifically, if investors expect a dividend stream that will grow forever at a steady rate, the market price of the stock will be given by a very simple formula,

$$P = \frac{D_1}{(k - g)} \qquad \textbf{(D-2)}$$

where "D_1" is the dividend expected at the end of the first period, "g" is the perpetual growth rate, and "P" and "k" are the market price and the cost of capital, as before. Equation D-2 is a simplified version of Equation D-1 that can be solved to yield the well known "DCF formula" for the cost of capital:

$$\begin{aligned} k &= \frac{D_1}{P} + g \\ &= \frac{D_0 \times (1+g)}{P} + g \end{aligned} \qquad \textbf{(D-3)}$$

where "D_0" is the current dividend, which investors expect to increase at rate g by the end of the next period, and the other symbols are defined as before. Equation D-3 says that if Equation D-2 holds, the cost of capital equals the expected dividend yield plus the (perpetual) expected future growth rate of dividends. I refer to this as the simple DCF model. Of course, the "simple" model is simple because it relies on very strong (*i.e.*, very unrealistic) assumptions.

Q4. Are there other versions of the DCF models besides the "simple" one?

A4. Yes. If Equation D-2 and its underlying assumptions do not hold, sometimes other variations of the general present value formula, Equation D-1, can be used to solve for k in ways that differ from Equation D-3. For example, if there is reason to believe that investors do *not* expect a steady growth rate forever, but rather have different growth rate forecasts in the near term (e.g., over the next five or ten years as compared with subsequent periods), these forecasts can be used to specify the early dividends in Equation D-1. Once the near-term dividends are specified, Equation D-2 can be used to

specify the share price value at the end of the near-term (e.g., at the end of five or ten years), and the resulting cash flow stream can be solved for the cost of capital using Equation D-1.

More formally, the "multistage" DCF approach solves the following equation for *k*:

$$P = \frac{D_1}{(1+k)} + \frac{D_2}{(1+k)^2} + \frac{D_3}{(1+k)^3} + \cdots + \frac{D_T + P_{TERM}}{(1+k)^T} \quad \textbf{(D-4)}$$

The terminal price, P_{TERM} is estimated as

$$P_{TERM} = \frac{D_{T+1}}{(k - g_{LR})} \quad \textbf{(D-5)}$$

where T is the last of the periods in which a near term dividend forecast is made and g_{LR} is the long-run growth rate. Thus, Equation D-4 defers adoption of the very strong perpetual growth assumptions that underlie Equation D-2 — and hence the simple DCF formula, Equation D-3 — for as long as possible, and instead relies on near term knowledge to improve the estimate of k. I examine both simple and multistage DCF results below.

Q5. Please describe the multi-stage DCF model you use.

A5. The multi-stage model I use is presented in Equations D-4 and D-5 above, and assumes that the long-term perpetual growth rate for all companies in the two samples is the forecast long-term growth rate of the GDP. This model allows growth rates to differ across companies during the first ten years before settling down to a single long-term growth rate. The growth rate for the first five years is the long-term growth rate derived from analysts' reports. After year five, the growth rate is assumed to converge linearly to the GDP growth rate. In other words, the growth rate in year 6 is adjusted by $1/6^{th}$ of the difference between each company's 5-year growth rate forecast and the GDP forecast. The growth rates in years 7 to 10 are adjusted by an additional $1/6^{th}$ so that the earning growth rate pattern converges on the long-term GDP growth rate forecast.

Q6. Why do you assume that the long-term growth rate of the sample companies will converge to the long-term growth rate of GDP?

A6. Recall that the DCF model assumes that dividends grow at a constant rate literally forever. If the growth rate of earnings (and therefore, dividends) were greater than (less than) the long-term growth rate of the economy, mathematically it would mean that the company (and the industry) would become an ever increasing (or decreasing) proportion of the economy. Therefore, the most logical assumption is that the company's earnings grow at the same rate as the economy on average over the long run.

Q7. What are the merits of the DCF model?

A7. The DCF approach is conceptually sound only if its assumptions are met. In actual practice one can run into difficulty because those assumptions are so strong, and hence so unlikely to correspond to reality. Two conditions are well-known to be necessary for the DCF approach to yield a reliable estimate of the cost of capital: the variant of the present value formula, Equation D-1, that is used must actually match the variations in investor expectations for the dividend growth path; and the growth rate(s) used in that formula must match current investor expectations. Less frequently noted conditions may also create problems.

The DCF model assumes that investors expect the cost of capital to be the same in all future years. Investors may not expect the cost of capital to be the same, which can bias the DCF estimate of the cost of capital in either direction.

The DCF model only works for companies for which the standard present value formula works. The standard formula does *not* work for companies that operate in industries or markets options (*e.g.*, puts and calls on common stocks), and so it will not work for companies whose stocks behave as options do. Option-pricing effects will be important for companies in financial distress, for example, which implies the DCF model will *understate* their cost of capital, all else equal.

In recent years even the most basic DCF assumption, that the market price of a stock in the absence of growth options is given by the standard present value formula (*i.e.*, by

Equation D-1 above), has been called into question by a literature on market volatility.[1] In any case, it is still too early to throw out the standard formula, if for no other reasons than that the evidence is still controversial and no one has offered a good replacement. But the evidence suggests that it must be viewed with more caution than financial analysts have traditionally applied. Simple models of stock prices may not be consistent with the available evidence on stock market volatility.

Q8. Normally DCF debates center on the right growth rate. What principles underlie that choice?

A8. Finding the right growth rate(s) is indeed the usual "hard part" of a DCF application. The original approach to estimation of g relied on average historical growth rates in observable variables, such as dividends or earnings, or on the "sustainable growth" approach, which estimates g as the average book rate of return times the fraction of earnings retained within the firm. But it is highly unlikely that historical averages over periods with widely varying rates of inflation, interest rates and costs of capital, such as in the relatively recent past, will equal current growth rate expectations.

A better approach is to use the growth rates currently expected by investment analysts, if an adequate sample of such rates is available. Analysts' forecasts are superior to time series forecasts based upon single variable historical data as has been documented and confirmed extensively in academic research.[2] If this approach is feasible and if the

[1] See for example, Robert J. Shiller (1981), "Do Stock Prices Move Too Much to be Justified by Subsequent Changes in Dividends?," *The American Economic Review*, Vol. 71, No. 3, pp. 421-436. John Y. Campbell and Robert J. Shiller (1988), "The Dividend-Price Ratio and Expectations of Future Dividends and Discount Factors," *The Review of Financial Studies*, Vol. 1, No. 3, pp. 195-228. Lucy F. Ackert and Brian F. Smith (1993), "Stock Price Volatility, Ordinary Dividends, and Other Cash Flows to Shareholders," *Journal of Finance*, Vol. 48, No. 1, pp. 1147-1160. Eugene F. Fama and Kenneth R. French (2001), "Disappearing Dividends: Changing Firm Characteristics or Lower Propensity to Pay?," *Journal of Financial Economics*, Vol. 60, pp. 3-43. Borja Larrain and Motohiro Yogo (2005), "Does Firm Value Move Too Much to be Justified by Subsequent Changes in Cash Flow?," Federal Reserve Bank of Boston, *Working Paper*, No. 05-18.

[2] Lawrence D. Brown and Michael S. Rozeff (1978), "The Superiority of Analyst Forecasts as Measures of Expectations: Evidence from Earnings," *Journal of Finance*, Vol. XXXIII, No. 1, pp. 1-16. J. Cragg and B.G. Malkiel (1982), *Expectations and the Structure of Share Prices*, National Bureau of Economic Research, University of Chicago Press. R.S. Harris (1986), "Using Analysts' Growth Forecasts to Estimate Shareholder Required Rates of Return," *Financial Management*, Spring Issue, pp. 58-67. J. H. Vander

person estimating the cost of capital is able to select the appropriate version of the DCF formula, the DCF method should yield a reasonable estimate of the cost of capital for companies not in financial distress and without material option-pricing effects (always subject to recent concerns about the applicability of the basic present value formula to stock prices as well as issues of optimism bias). However, for the DCF approach to work, the basic stable-growth assumption must become reasonable and the underlying stable-growth rate must become determinable *within the period for which forecasts are available*.

Q9. What is the so called "optimism bias" in the earnings growth rate forecasts of security analysts and what is its effect on the DCF analysis?

A9. Optimism bias is related to the observed tendency for analysts to forecast earnings growth rates that are higher than are actually achieved. This tendency to over estimate growth rates is perhaps related to incentives faced by analysts that provide rewards not strictly based upon the accuracy of the forecasts. To the extent optimism bias is present in the analysts' earnings forecasts, the cost-of-capital estimates from the DCF model would be too high.

Q10. Does optimism bias mean that the DCF estimates are completely unreliable?

A10. No. The effect of optimism bias is least likely to affect DCF estimates for large, rate regulated companies in relatively stable segments of an industry. Furthermore, the magnitude of the optimism bias (if any) for regulated companies is not clear. This issue is addressed in a paper by Chan, Karceski, and Lakonishok (2003)[3] who sort companies on the basis of the size of the I/B/E/S forecasts to test the level of optimism bias. Utilities constitute 25 percent of the companies in lowest quintile, and by one measure the level of optimism bias is 4 percent. However, the 4 percent figure does not represent the

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Weide and W. T. Carleton (1988), "Investor Growth Expectations: Analysts vs. History," *Journal of Portfolio Management*, spring, pp. 78-82. T. Lys and S. Sohn (1990), "The Association Between Revisions of Financial Analysts Earnings Forecasts and Security Price Changes," *Journal of Accounting and Economics*, vol 13, pp. 341-363.

[3] L. K.C. Chan, J. Karceski, and J. Lakonishok, 2003, "The Level and Persistence of Growth Rates," *Journal of Finance* 58(2):643-684.

complete characterization of the results in the paper. Table IX of the paper shows that the median I/B/E/S forecast for the first (lowest) quintile averages 6.0 percent. The realized "Income before Extraordinary Items" is 2.0 percent (implying a four percent upward bias in I/B/E/S forecasts), but the "Portfolio Income before Extraordinary Items" is 8.0 percent (implying a two percent downward bias in I/B/E/S forecasts).

The difference between the "Income before Extraordinary Items" and "Portfolio Income before Extraordinary Items" is whether individual firms or a portfolio are used in estimating the realized returns. The first is a simple average of all firms in the quintile while the second is a market value weighted-average. Although both measures of bias have their own drawbacks according to the authors,[4] the Portfolio Income measure gives more weight to the larger firms in the quintile such as regulated utilities. In addition, the paper demonstrates that "analysts' forecasts as well as investors' valuations reflect a wide-spread belief in the investment community that many firms can achieve streaks of high growth in earnings."[5] Therefore, it is not clear how severe the problem of optimism bias may be for regulated utilities or even whether there is a problem at all.

Finally, the two-stage DCF model also adjusts for any over optimistic (or pessimistic) growth rate forecasts by substituting the long-term GDP growth rate for the 5-year growth rate forecasts of the analysts in the years beginning in year 11. I linearly trend the 5-year forecast growth rate to the GDP forecast growth rate in years 6 to 10.

Q11. What about the reforms by the National Associate of Security Dealers (NASD) that were designed to reduce the conflicts of interest and pressures brought against security analysts? Have those reforms been generally successful?

A11. Yes. The conclusion from the Joint Report by NASD and the New York Stock Exchange ("NYSE") on the reforms states

> … the SRO Rules have been effective in helping restore integrity to research by minimizing the influences of investment banking and

[4] Chan, Karceski, and Lakonishok, *op. cit.*, p. 675.

[5] Chan, Karceski, and Lakonishok, *op. cit*., p. 663.

> promoting transparency of other potential conflicts of interest. Evidence also suggests that investors are benefiting from more balanced and accurate research to aid their investment decisions.[6]

The report does note additional reforms are advisable, but the situation is far different today than during the height of the tech bubble when analyst objectivity was clearly suspect.

B. CONCLUSIONS ABOUT DCF

Q12. Please sum up the implications of this part of the appendix.

A12. The unavoidable questions about the DCF model's strong assumptions — whether the basic present value formula works for stocks, whether option pricing effects are important for the company, whether the right variant of the basic formula has been found, and whether the true growth rate expectations have been identified — cause me to view the DCF method as *inherently* less reliable than equity risk premium approach, the other approach I use.

II. EMPIRICAL DCF RESULTS

Q13. How is this part of the appendix organized?

A13. This section presents the details of my DCF analyses for the water and gas LDC samples, which are summarized in my written testimony.

Implementation of the simple DCF models described above requires an estimate of the current price, the dividend, and near-term and long-run growth rate forecasts. The simple DCF model relies only on a single growth rate forecast, while the multistage DCF model employs both near-term individual company forecasts and long-run GDP growth rate forecasts. The remaining parts of this section describe each of these inputs in turn.

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[6] Joint Report by NASD and NYSE on the Operation and Effectiveness of the Research Analyst Conflict of Interest Rules, December 2005, p. 44.

A. PRELIMINARY MATTERS

Q14. In Appendix C you discuss estimating cost of capital and implied cost of equity using the risk positioning methodology. What, if anything, is different when you use the DCF method?

A14. The timing of the market value capital structure calculations is different in the DCF method than in the equity risk premium method. The equity risk premium method relies on the average capital structure over the five-year period *Value Line* uses to estimate beta while the DCF approach uses only current data, so the relevant market value capital structure measure is the most recent that can be calculated. This capital structure for the water sample companies is reported in columns [1]-[3] of Table No. BV-4, and for the gas LDC sample companies in columns [1]-[3] of Table No. BV-15.

B. GROWTH RATES

Q15. What growth rates do you use?

A15. For reasons discussed above, historical growth rates today are not useful as forecasts of current investor expectations for the water utility industry. I therefore use rates forecasted by security analysts.

The ideal in a DCF application would be a detailed forecast of future dividends, year by year well into the future, based on a large sample of investment analysts' expectations. I know of no source of such data. Dividends are ultimately paid from earnings, however, and earnings forecasts are available for a few years. Investors do not expect dividends to grow in lockstep with earnings, but for companies for which the DCF approach can be used reliably (*i.e.*, for relatively stable companies whose prices do not include the option-like values described previously), they do expect dividends to track earnings over the long-run. Thus, use of earnings growth rates as a proxy for expectations of dividend growth rates is a common practice.

Accordingly, the first step in my DCF analysis is to examine a sample of investment analysts' forecasted earnings growth rates. In particular, I utilize Bloomberg's BEst and

Value Line's forecasted earnings growth.[7] The projected earnings growth rates for the water sample companies are in Table No. BV-5, and those for the gas LDC sample companies are in Table No. BV-16. Column [1] reports Bloomberg's BEst analysts' forecasts of the long-term earnings growth for the sample companies. Column [2] reports the number of analysts that provided a forecast. Columns [3] and [4] report *Value Line's* forecasted earnings per share ("EPS") value for each company for 2008 and 2011-2013 respectively. Column [5] provides *Value Line's* implied long-term growth rate forecast, and column [6] provides a weighted average growth rate for each company across the two sources. (I treat the *Value Line* forecasts as though they overlap exactly with the forecasts from Bloomberg.) These growth rates underlie my simple and multistage DCF analyses.

In the simple DCF, I use the five-year average annual growth rate as the perpetual growth rate.[8] In the multistage model, I rely on the company-specific growth rate until the second quarter of 2013 and on the long-term GDP forecast from the third quarter of 2018 onwards. During the intervening five-year period, I assume the growth rate converges linearly towards the long-term GDP forecast.[9]

Q16. Do these growth rates correspond to the ideal you mentioned above?

A16. No. While forecasted growth rates are the quantity required in principle, the forecasts need to go far enough out into the future so that it is reasonable to believe that investors expect a stable growth path afterwards. As can be seen from Table No. BV-5 and Table No. BV-16, the growth rate forecasts vary widely from company to company. For example the BEst growth forecast for Southwest Water is 5 percent while the *Value Line* growth forecast is 15 percent.[10] While the differences between BEst and *Value Line*

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[7] The BEst growth rates were downloaded from Bloomberg on May 7, 2008. *Value Line* estimates are from the most recent report available, dated April 25, 2008 for the water sample utilities, and March 14, 2008 for the gas LDCs.

[8] This growth rate is in column [6] of Table No. BV-5 (Table No. BV-16 for the gas LDC sample).

[9] I use the long-term U.S. GDP growth forecast from *Blue Chip Economic Indicators* (March 10, 2008).

[10] See Table No. BV-5.

forecasts are lower for the gas LDC sample, there is still significant variation.[11] Also, for some companies, the five-year growth rate forecasts are significantly above or below the long-term GDP growth rate forecast, indicating lack of stability in growth rates. Overall, the growth rates indicate that some companies and maybe the industries have yet to reach a stable equilibrium which is required for the correct application of the DCF method.

Q17. How well are the conditions needed for DCF reliability met at present?

A17. The requisite conditions for the sample companies are not fully met at this time. Of particular concern for this proceeding is the uncertainty about what investors truly expect the long-run outlook for the sample companies to be. The longest time period available for growth rate forecasts of which I am aware is five years. The long-run growth rate (*i.e.*, the growth rate after the industry settles into a steady state, which is certainly *beyond* the next five years for water industry) drives the actual results one gets with the DCF model. Unfortunately, this implies that unless the company or industry in question is stable, so there is little doubt as to the growth rate investors expect. DCF results in practice can end up being driven by the subjective judgment of the analyst who performs the work.

This is a problem at present because it is hard to imagine that today's water industry would accurately be described as stable. There is great uncertainty about the costs required to undertake the large investments in infrastructure forecasted for the industry. Indeed, *Value Line* notes the need for investments aimed at replacing the aging infrastructure and complying with increasingly stringent water safety regulations, partially driven by increased fear of bioterrorism. Additionally, American Society of Civil Engineers estimated in 2005 that the drinking water infrastructure requires $11 billion of annual investments, while the wastewater segment requires $390 billion in investments over the following 20 years.[12] The water industry is also going through a series of mergers and acquisitions, which affects the companies' earnings growth rate estimates. This is one reason why companies heavily involved in mergers and acquisitions are normally excluded from the sample. Taken together, these factors mean

[11] See table No. BV-16.

[12] Report Card for America's Infrastructure, The American Society of Civil Engineers, 2005.

that it may be some time before the water industry settles into anything investors will see as a stable equilibrium.

Such circumstances imply that a regulator may often be faced with a wide range of DCF numbers, none of which can be well grounded in objective data on true long-run growth expectations, *because no such objective data now exist*. DCF for firms or industries in flux is *inherently* subjective with regard to a parameter (the long-run growth rate) that drives the answer one gets.

It is clear that much longer detailed growth rate forecasts than currently available from Bloomberg and *Value Line* would be needed to implement the DCF model in a completely reliable way for the water sample at this time; however, the general stability of the 5-year growth rate forecasts for the gas LDC sample indicates a higher degree of reliability than for the water sample at this time.

C. DIVIDEND AND PRICE INPUTS

Q18. What values do you use for dividends and stock prices?

A18. Dividends are the most recent recorded dividend payments as reported by Bloomberg. For most companies this is the second quarter 2008 dividend, but for several it is the 3rd quarter 2008 dividend, and for one company it is the 1st quarter 2008 dividend. The most recent dividend is grown at the estimated growth rate and divided by the price described below to estimate the dividend yield for the simple and multistage DCF models.

Stock prices are the average of the closing stock prices for the 15 trading days ending on the day the BEst forecasts were released (May 7, 2008). Using these dates ensures that the information in growth rates and stock prices are contemporaneous. I use a 15-day average as a compromise. Using a longer period would be inconsistent with the principles that underlie the DCF formula. The DCF approach assumes the stock price is the present value of future expected dividends. Stock prices six months or a year ago reflect expectations at that time, which are different from those that underlie the currently available growth forecasts. At the same time, use of an average over a brief period helps

guard against a company's price on a particular day price being unduly influenced by mistaken information, differences in trading frequency, and the like.

The closing stock price is used because it is at least as good as any other measure of the day's outcome, and may be better for DCF purposes. In particular, if there were any single price during the day that would affect investors' decisions to buy or sell a stock, I would suspect that it would be each day's closing price, not the high or low during the day. The daily price changes reported in the financial pages, for example, are from close to close, not from high to high or from low to low.

D. COMPANY-SPECIFIC DCF COST-OF-CAPITAL ESTIMATES

Q19. What DCF estimates do these data yield?

A19. The cost-of-equity results for the simple and multistage DCF models are shown in Table No. BV-6 for the water utility sample and in Table No. BV-17 for the gas LDC sample. In both tables, Panel A reports the results for the simple DCF method while Panel B reports the results for the multistage DCF method using the long-term GDP growth rate as the perpetual growth rate.

Q20. What overall cost-of-capital estimates result from the DCF cost-of-equity estimates?

A20. The capital structure, DCF cost of equity, and cost of debt estimates are combined to obtain the overall after-tax weighted-average cost of capital for each sample company. These results are presented in Table No. BV-7 for the water sample and in Table No. BV-18 for the gas LDC sample. Again, Panel A relies on the simple DCF cost-of-equity results while Panel B relies on the multistage DCF cost-of-equity results.

Q21. What information do you report in Table No. BV-8 and in Table No. BV-19?

A21. These tables report, for each sample, the return on equity consistent with that sample's estimated overall after-tax weighted-average cost of capital and the proposed equity thickness of 45.1 percent for New Mexico-American Water. For both the simple DCF and multistage DCF methods, the sample's average ATWACC is reported in column [1].

Column [6] reports the return on equity as if the sample companies' average market value capital structure had been that currently proposed for New Mexico-American Water.

Q22. What are the implications of these results?

A22. The implication of these numbers is discussed in my direct testimony, along with the findings of the equity risk premium approach.

APPENDIX E

EFFECT OF DEBT ON THE COST OF EQUITY

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D. COMBINED EFFECTS E-21

Q1. What is the purpose of this Appendix?

A1. In this appendix, I provide details on the effects of debt on the cost of equity. First, I summarize a fairly large body of financial research on capital structure. Second, I provide an extended example to illustrate the effect of debt on the cost of equity.

I. AN OVERVIEW OF THE ECONOMIC LITERATURE

Q2. What is the focus of the economic literature on the effects of debt?

A2. The economic literature focuses on the effects of debt on the value of a firm. The standard way to recognize one of these effects, the impact of the fact that interest expense is tax-deductible, is to discount the all-equity after-tax operating cash flows generated by a firm or an investment project at a weighted average cost of capital, typically known in textbooks as the "WACC." The textbook WACC equals the *market*-value weighted average of the cost of equity and the *after-tax*, *current* cost of debt. However, rate regulation in North America has a legacy of working with another weighted-average cost of capital, the *book*-value weighted average of the cost of equity and the *before-tax*, *embedded* cost of debt. To distinguish the concepts, I refer to the after-tax weighted-average cost of capital as ATWACC.

Q3. How is this section of the appendix organized?

A3. It starts with the tax effects of debt. It then turns to other effects of debt.

A. TAX EFFECTS

Q4. What are the key findings in the literature regarding tax effects?

A4. Three seminal papers are vital for this literature. The first assumes no taxes and risk-free debt. The second adds corporate income taxes. The third adds personal income taxes.

1. Base Case: No Taxes, No Risk to High Debt Ratios

Q5. Please start by explaining the simplest case of the effect of debt on the value of a firm.

A5. The "base case," no taxes and no costs to excessive debt, was worked out in a classic 1958 paper by Franco Modigliani and Merton Miller, two economists who eventually won Nobel Prizes in part for their body of work on the effects of debt.[1] Their 1958 paper made what is in retrospect a very simple point: if there are no taxes and no risk to the use of excessive debt, use of debt will have no effect on a company's operating cash flows (i.e., the cash flows to investors as a group, debt plus equity combined). If the operating cash flows are the same regardless of whether the company finances mostly with debt or mostly with equity, then the value of the firm cannot be affected at all by the debt ratio. In cost-of-capital terms, this means the overall cost of capital is constant regardless of the debt ratio, too.

In the base case, issuing debt merely divides the cash flows into two pools, one for bondholders and one for shareholders. If the divided pools have different priorities in claims on the cash flows, the risks and costs of capital will differ for each pool. But the risk and overall cost of capital of the entire firm, the sum of the two pools, is constant regardless of the debt ratio. Thus,

$$r_1^* = r_{A1} \qquad \text{(E-1a)}$$

where r_1^* is the overall after-tax cost of capital at any particular capital structure and r_{A1} is the all-equity cost of capital for the firm. (The "1" subscripts distinguish the case where there are no taxes from subsequent equations that consider first corporate and then both corporate and personal taxes.) With no taxes and no risk to debt, the overall cost of capital does not change with capital structure.

This implies that the relationship of the overall cost of capital to the component costs of debt and equity is

[1] Franco Modigliani and Merton H. Miller (1958), "The Cost of Capital, Corporation Finance and the Theory of Investment," *American Economic Review*, 48, pp. 261-297.

$$r_{E1} \times \left(\frac{E}{V}\right) + r_{D1} \times \left(\frac{D}{V}\right) = r_1^* \qquad \text{(E-1b)}$$

with the overall cost of capital (r^*) on the *right* side, as the *independent* variable, and the costs of equity (r_E) and debt (r_D) on the left side, as *dependent* variables determined by the overall cost of capital and by the capital structure (i.e., the shares of equity (E) and debt (D) in overall firm value ($V = E + D$) that the firm happens to choose. Note that if equation (E-1a) were correct, the equation that solved it for the cost of equity would be,

$$r_{E1} = r_1^* + (r_1^* - r_D) \times \left(\frac{D}{E}\right) \qquad \text{(E-1c)}$$

Note also that (D / E) gets exponentially higher in this equation as the debt-to-value ratio increases[2] i.e., the cost of equity increases exponentially with leverage.

2. Corporate Tax Deduction for Interest Expense

Q6. What happens when you add corporate taxes to the discussion?

A6. If corporate taxes exist with risk-free debt (and if only taxes at the corporate level matter, not taxes at the level of the investor's personal tax return), the initial conclusion changes. Debt at the corporate level reduces the company's tax liability by an amount equal to the marginal tax rate times the interest expense. All else equal, this will add value to the company because more of the operating cash flows will end up in the hands of investors as a group. That is, if only corporate taxes mattered, interest would add cash to the firm equal to the corporate tax rate times the interest expense. This increase in cash would increase the value of the firm, all else equal. In cost-of-capital terms, it would reduce the overall cost of capital.

How much the value of the firm would rise and *how far* the overall cost of capital would fall would depend in part on how often the company adjusts its capital structure, but this is a second-order effect in practice. (The biggest effect would be if companies could

[2] For example, at 20-80, 50-50, and 80-20 debt-equity ratios, (D / E) equals, respectively, (20/80) = 0.25, (50/50) = 1.0, and (80/20) = 4.0. The extra 30 percent of debt going from 20-80 to 50-50 has much less impact on (D / E) [i.e., by moving it from 0.25 to 1.0] than the extra 30 percent of debt going from 50-50

issue riskless perpetual debt, an assumption Profs. Modigliani and Miller explored in 1963, in the second seminal paper;[3] this assumption could *not* be true for a real company.) Prof. Robert A. Taggart provides a unified treatment of the main papers in this literature and shows how various cases relate to one another.[4] Perhaps the most useful set of benchmark equations for the case where only corporate taxes matter are:

$$r_2^* = r_{A2} - r_D \times t_C \times \left(\frac{D}{V}\right) \quad \text{(E-2a)}$$

$$r_2^* = r_{E2} \times \left(\frac{E}{V}\right) + r_D \times \left(\frac{D}{V}\right) \times (1 - t_C) \quad \text{(E-2b)}$$

which imply for the cost of equity,

$$r_{E2} = r_{A2} + (r_{A2} - r_D) \times \left(\frac{D}{E}\right) \quad \text{(E-2c)}$$

where the variables have the same meaning as before but the "2" subscripts indicate the case that considers corporate but not personal taxes.

Note that Equation (E-2a) implies that when only corporate taxes matter, the overall after-tax cost of capital declines steadily as more debt is added, until it reaches a minimum at 100 percent debt (i.e., when $D/V = 1.0$). Note also that Equation (E-2c) still implies an exponentially increasing cost of equity as more and more debt is added. In fact, except for the subscript, Equation (E-2c) looks just like Equation (E-1c). However, whether any value is added and whether the cost of capital changes at all also depends on the effect of taxes at the personal level.

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to 80-20 [i.e., by moving it from 1.0 to 4.0]. Since the cost of equity equals a constant risk premium times the debt-equity ratio, the cost of equity grows ever more rapidly as you add more and more debt.

[3] Franco Modigliani and Merton H. Miller (1963), "Corporate Income Taxes and the Cost of Capital: A Correction," *American Economic Review*, 53, pp. 433-443.

[4] Robert A. Taggart, Jr. (1991), "Consistent Valuation and Cost of Capital Expressions with Corporate and Personal Taxes," *Financial Management* 20, pp. 8-20.

3. Personal Tax Burden on Interest Expense

Q7. How do personal taxes affect the results?

A7. Ultimately, the purpose of investment is to provide income for consumption, so personal taxes affect investment returns. For example, in the U.S., municipal bonds have lower interest rates than corporate bonds because their income is taxed less heavily at the personal level. In general, capital appreciation on common stocks is taxed less heavily than interest on corporate bonds because (1) taxes on unrealized capital gains are deferred until the gains are realized, and (2) the capital gains tax rate is lower. Dividends are taxed less heavily than interest, also, under current tax law.[5] The effects of personal taxes on the cost of common equity are hard to measure, however, because common equity is so risky.

Professor Miller, in his Presidential Address to the American Finance Association,[6] explored the issue of how personal taxes affect the overall cost of capital. The paper pointed out that personal tax effects could offset the effect of corporate taxes entirely.

Q8. Is it likely that the effect of personal taxes will completely neutralize the effect of corporate taxes?

A8. I do not believe so, although the likelihood of such a result would be increased if the current federal tax reductions on dividends and capital gains became permanent rather than expiring in 2010. However, personal taxes are important even if they do not make the corporate tax advantage on interest vanish entirely. Capital gains and dividend tax advantages definitely convey some personal tax advantage to equity, and even a partial personal advantage to equity reduces the corporate advantage to debt.

The Taggart paper explores the case of a partial offset, also. With personal taxes, the risk-free rate on the security market line is the after-personal-tax rate, which must be

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[5] The current maximum personal tax rate on dividend income was extended to the end of 2010 by the President on May 17, 2006. It is uncertain whether the reduced rates on dividend income will be further extended.

[6] Merton H. Miller (1977), "Debt and Taxes," *The Journal of Finance*, 32: 261-276, the third of the seminal papers mentioned earlier.

equal for risk-free debt and risk-free equity.[7] Therefore, the pre-personal-tax risk-free rate for equity will generally not be equal to the pre-personal-tax risk-free rate for debt. In particular, $r_{fE} = r_{fD} \times [(1-t_D)/(1-t_E)]$, where r_{fE} and r_{fD} are the risk-free costs of equity and debt and t_E and t_D are the personal tax rates for equity and debt, respectively. In terms of the cost of debt, the Taggart paper's results imply that a formal statement of these effects can be written as:[8]

$$r_3^* = r_{A3} - r_D \times t_N \times \left(\frac{D}{V}\right) \quad \text{(E-3a)}$$

$$= r_{E3} \times \left(\frac{E}{V}\right) + r_D \times \left(\frac{D}{V}\right) \times (1-t_C) \quad \text{(E-3b)}$$

which imply

$$r_{E3} = r_{A3} + \left[r_{A3} - r_D \times \left(\frac{1-t_D}{1-t_E}\right)\right] \times \left(\frac{D}{E}\right) \quad \text{(E-3c)}$$

Suppose, for example, that $t_C = 35$ percent, $t_E = 7.7$ percent and $t_D = 40$ percent. Then $[(1-t_D)/(1-t_E)] = 0.65 = (1-t_C)$. That condition corresponds to Miller's 1977 paper, in which the net personal tax advantage of equity fully offsets the net corporate tax advantage of debt. Note also that in that case, $t_N = 0$.[9] Therefore, if the personal tax advantage on equity fully offsets the corporate tax advantage on debt, Equation (E-3a) confirms that the overall after-tax cost of capital is a constant.

However, it is unlikely that the personal tax advantage of equity fully offsets the corporate tax advantage of debt. If taxes were all that mattered (i.e., if there were no

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[7] As Prof. Taggart notes (his footnote 9), it is not necessary that a specific, risk-free equity security exist as long as one can be created synthetically, through a combination of long and short sales of traded assets. Such constructs are a common analytical tool in financial economics.

[8] The net all-tax effect of debt on the overall cost of capital, t_N, equals $\{[t_C+t_E-t_D-(t_C \times t_E)] / (1-t_E)\}$, where t_D is the personal tax rate on debt, as before. This measure of net tax effect is designed for use with the cost of debt in Equation (E-3a), which seems more useful in the present context. The Taggart paper works with a similar measure, but one which is designed for use with the cost of risk-free equity in the equivalent Taggart equation.

[9] In the above example, $t_N = \{[0.35+0.077\underline{0}.\underline{4}(0.35 \square 0.077)] / (1.\underline{0}0.077)\} = 0.0/0.923 = 0$.

other costs to debt), the overall after-corporate-tax cost of capital would still fall as debt was added, just not as fast.

Finally, note that the overall after-tax cost of capital, Equation (E-3b), still uses the corporate tax rate even when personal taxes matter. Equations (E-2b) and (E-3b) both correspond to the usual formula for the ATWACC. Personal taxes affect the way the cost of equity changes with capital structure – Equation (E-3c) – but not the formula for the overall after-tax cost of capital given that cost of equity.

B. NON-TAX EFFECTS

Q9. Please describe the non-tax effects of debt.

A9. If debt is truly valuable, firms should use as much as possible, and competition should drive firms in a particular industry to the same, optimal capital structure for the industry. If debt is harmful on balance, firms should avoid it. Neither picture corresponds to what we actually see. A large economic literature has evolved to try to explain why.

Part of the answer clearly is the costs of excessive debt. Here the results cannot be reduced to equations, but they are no less real for that fact. As companies add too much debt, the costs come to outweigh the benefits. Too much debt reduces or eliminates financial flexibility, which cuts the firm's ability to take advantage of unexpected opportunities or weather unexpected difficulty. Use of debt rather than internal financing may be taken as a negative signal by the market.

Even if the company is generally healthy, more debt increases the risk that the company cannot use all of the interest tax shields in a bad year. As debt continues to grow, this problem grows and others may crop up. Management begins to worry about meeting debt payments instead of making good operating decisions. Suppliers are less willing to extend trade credit, and a liquidity shortage can translate into lower operating profits.

Ultimately, the firm might have to go through the costs of bankruptcy and reorganization. Collectively, such factors are known as the costs of "financial distress."[10]

The net tax advantage to debt, if positive, is affected by costs such as a growing risk that the firm might have to bear the costs of financial distress. First, the expected present value of these costs offsets the value added by the interest tax shield. Second, since the likelihood of financial distress is greater in bad times when other investments also do poorly, the possibility of financial distress will increase the risks investors bear. These effects increase the variability of the value of the firm. Thus, firms that use too much debt can end up with a higher overall cost of capital than those that use none.

Other parts of the answer include the signals companies send to investors by the decision to issue new securities, and by the type of securities they issue. Other threads of the literature explore cases where management acts against shareholder interests, or where management attempts to "time" the market by issuing specific securities under different conditions. For present purposes, the important point is that no theory, whether based on taxes or on some completely different issue, has emerged as "the" explanation for capital structure decisions by firms. Nonetheless, despite the lack of a single "best" theory, there is a great deal of relevant empirical research.

Q10. What does that research show?

A10. The research does not support the view that debt makes a material difference in the value of the firm, at least not once a modest amount of debt is in place. If debt were truly valuable, competitive firms should use as much debt as possible short of producing financial distress, and competitive firms that use less debt ought to be less profitable. The research shows exactly the opposite.

[10] See, for example, Section 18.3 of Brealey, Myers and Allen, 2006, *Principles of Corporate Finance*, 8th Edition, McGraw-Hill/Irwin, 2006.

For example, Kester[11] found that firms in the same industry in both the U.S. and Japan do not band around a single, "optimal" capital structure, and the most profitable firms are the ones that use the *least* debt. This finding comes despite the fact that both countries at the time (unlike the U.S. currently) had fully "classical" tax systems, in which dividends are taxed fully at both the corporate and personal level. Wald[12] confirms that high profitability implies low debt ratios in France, Germany, Japan, the U.K., and the U.S. Booth *et al.* find the same result for a sample of developing nations.[13] Fama and French[14] analyze over 2000 firms for 28 years (1965-1992, inclusive) and conclude, "Our tests thus produce no indication that debt has net tax benefits."[15] A paper by Graham[16] carefully analyzes the factors that might have led a firm not to take advantage of debt. It confirms that a large proportion of firms that ought to benefit substantially from use of additional debt, including large, profitable, liquid firms, appear not to use it "enough."

This research leaves us with only three options: either (1) apparently good, profit-generating managers are making major mistakes or deliberately acting against shareholder interests, (2) the benefits of the tax deduction on debt are less than they appear, or (3) the non-tax costs to use of debt offset the potential tax benefits. Only the first of these possibilities is consistent with the view that the tax deductibility of debt conveys a material cost advantage. Moreover, if the first explanation were interpreted to mean that otherwise good managers are acting against shareholder interests, either deliberately or by mistake, it would require the additional assumption that their competitors (and potential acquirers) let them get away with it.

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[11] Carl Kester (1986), "Capital and Ownership Structure: A Comparison of United States and Japanese Manufacturing Concerns," *Financial Management*, 15:5-16.

[12] John K. Wald (1999), "How Firm Characteristics Affect Capital Structure: An International Comparison," *Journal of Financial Research*, 22:161-167.

[13] Laurence Booth *et al.* (2001), "Capital Structures in Developing Countries," *The Journal of Finance* Vol. LVI, pp. 87-130, finds at p. 105 that "[o]verall, the strongest result is that profitable firms use less total debt. The strength of this result is striking ..."

[14] Eugene F. Fama and Kenneth R. French (1998), "Taxes, Financing Decisions and Firm Value," *The Journal of Finance*, 53:819-843.

[15] *Ibid.*, p. 841.

[16] John R. Graham (2000), "How Big Are the Tax Benefits of Debt," *The Journal of Finance*, 55:1901-1942.

Q11. Are there any explanations in the financial literature for this puzzle other than stupid or self-serving managers at the most profitable firms?

A11. Yes. For example, Stewart C. Myers, a leading expert on capital structure, made it the topic of his Presidential Address to the American Finance Association.[17] The poor performance of tax-based explanations for capital structure led him to propose an entirely different mechanism, the "pecking order" hypothesis. This hypothesis holds that the net tax benefits of debt (i.e., corporate tax advantage over personal tax disadvantage) are at most of a second order of importance relative to other factors that drive actual debt decisions.[18] Similarly, Baker and Wurgler (2002)[19] observe a strong and persistent impact that fluctuations in market value have on capital structure. They argue that this impact is not consistent with other theories. The authors suggest a new capital structure theory based on market timing -- capital structure is the cumulative outcome of attempts to time the equity market.[20] In this theory, there is no optimal capital structure, so market timing financing decisions just accumulate over time into the capital structure outcome. (Of course, this theory only makes sense if investors do not recognize what managers are doing.)

Q12. Do inter-firm differences within an industry explain the wide variations in capital structure across the firms in an industry?

A12. No. This view is contradicted by the empirical research. As mentioned before, it has long been found that the most profitable firms in an industry, i.e., those in the best position to take advantage of debt, use the least.[21] Graham (2000) carefully examines differences in firm characteristics as possible explanations for why firms use "too little"

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[17] Stewart C. Myers (1984), "The Capital Structure Puzzle," *The Journal of Finance*, 39: 575-592. See also S. C. Myers and N. S. Majluf (1984), "Corporate Financing Decisions When Firms Have Information Investors Do Not Have," *Journal of Financial Economics* 13:187-222.

[18] See also Stewart C. Myers (1989), "Still Searching for Optimal Capital Structure," *Are the Distinctions Between Debt and Equity Disappearing?,* R.W. Kopke and E. S. Rosengren, eds., Federal Reserve Bank of Boston.

[19] Malcolm Baker and Jeffrey Wurgler (2002), "Market Timing and Capital Structure," *The Journal of Finance* 57:1-32.

[20] *Ibid*., p. 29.

[21] For example, Kester, *op. cit.* and Wald, *op. cit.*

debt and concludes that such differences are *not* the explanation: firms that ought to benefit substantially from more debt by all measurable criteria, if the net tax advantage of debt is truly valuable, voluntarily do not use it.[22]

Nor does the research support the view that firms are constantly trying to adjust their capital structures to optimal levels. Additional research on the pecking order hypothesis demonstrates that firms do not tend towards a target capital structure, or at least do not do so with any regularity, and that past studies that seemed to show the contrary actually lacked the power to distinguish whether the hypothesis was true or not.[23] In the words of the Shyam-Sunder - Myers paper p. 242, "If our sample companies did have well-defined optimal debt ratios, it seems that their managers were not much interested in getting there."

II. EXPANDED EXAMPLE

Q13. What topics do you cover in this section?

A13. The discussion in my testimony did not detail the impact of different starting points for the level of debt nor did it address income earned on the investment, interest expense, or taxes. This section covers these topics. First, it discusses how the level of debt affects the cost of equity. Second, it addresses the influence of income and interest on the investment. Third, it explains the impact of taxes on capital structure decisions. The final topic covered in this section is the combined consequence of tax and non-tax effects of debt.

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[22] While not contradicting Graham's finding that differences in firm characteristics do not explain capital structure differences, Nengjiu Ju, Robert Parrino, Allen M. Poteshman, and Michael S. Weisbach, "Horses and Rabbits? Trade-Off Theory and Optimal Capital Structure," *Journal of Financial and Quantitative Analysis*, June 2005, pp. 1-24, looks at the issue in a different manner. Their paper uses a dynamic rather than static model to analyze the tradeoff between the tax benefits of debt and the risk of financial distress. It finds that bankruptcy costs by themselves are enough to explain observed capital structures, once dynamic effects are considered. This means debt is not as valuable as suggested by the traditional static analysis (of the sort used by Graham).

[23] Lakshmi Shyam-Sunder and Stewart C. Myers (1999), "Testing static tradeoff against pecking order models of capital structure," *Journal of Financial Economics* 51:219-244.

A. DETAILS OF DIFFERENT LEVELS OF DEBT

Q14. Please repeat briefly the setup in the example discussed in the direct testimony.

A14. The example considered an investor who purchases $100,000 in real estate. The future value of the real estate is uncertain. Figures 2 and 3 in my direct testimony show how the return on equity to the investor differs if he finances the purchase with 100 percent equity, and if he finances it with 50 percent equity and 50 percent mortgage debt. The lesson from the example is that debt adds risk to equity.

Q15. What happens if the investor finances the real estate purchase with different proportions of debt?

A15. The equity return becomes more variable when the mortgage percentage is a greater proportion of the initial price. Table E-1 below calculates the return on equity when real estate prices increase by 10 percent when mortgages are 0 percent, 30 percent, 50 percent, and 70 percent of the initial price.

Table E-1: The Impact of Leverage on the Return on Equity

	100% Equity	70% Equity	50% Equity	30% Equity
Debt	$0	$30,000	$50,000	$70,000
Original Equity Investment	$100,000	$70,000	$50,000	$30,000
Increase in Market Value of Equity	$10,000	$10,000	$10,000	$10,000
Return on Equity Investment	10%	14.3%	20%	33.3%

Note that going from 70 percent equity down to 50 percent equity increases the return on the equity investment by 5.7 percent while going from 50 percent equity to 30 percent equity increases the return on equity by 13.3 percent. This illustrates a general point; the rate of return on equity increases more quickly at higher levels of debt than at lower levels. Investors demand a higher equity rate of return to bear more risk and debt magnifies equity's risk at an ever increasing rate. Therefore, the required equity rate of

return goes up at an ever increasing rate as debt is added. This is not only basic finance theory, it is the everyday experience of anyone who buys a home. The bigger the mortgage, the more percentage risk the equity faces from changes in housing prices.

B. THE IMPACT OF INCOME AND INTEREST

Q16. How does earning income from the investment and paying interest on debt affect the results?

A16. In the following explanation, I ignore income taxes which I deal with in Section C below. Assume the investor is receiving income, e.g., rent, from the real estate. Specifically, assume the investor receives $500 per month in income after all non-interest expenses ($6,000 per year). Also, assume that the expected appreciation is 5 percent per year, so the expected market value is $105,000 after one year. Then the expected rate of return from the real estate with all equity financing is:

$$\text{Expected Return on Equity @ 0\% debt} = \frac{\text{Expected Net Income + Expected Appreciation}}{\text{Initial Investment}}$$

$$= \frac{\$6{,}000 + (\$105{,}000 - \$100{,}000)}{\$100{,}000}$$

$$= 11\%$$

Now suppose that the mortgage interest rate were 5 percent. Then at a mortgage equal to 50 percent, or $50,000, interest expense would be ($50,000 x 0.05), or $2,500. The expected equity rate of return would be:

$$\text{Expected Return on Equity @ 50\% debt} = \frac{\text{Expected (Net Income + Appreciation) – Int. Expense}}{\text{Initial } \textit{Equity} \text{ Investment}}$$

$$= \frac{\$6{,}000 + \$5{,}000 - \$2{,}500}{\$50{,}000}$$

$$= 17\%$$

Notice that the expected return on equity is higher as is the risk carried by equity.

Q17. Can you provide a more general illustration?

Yes. Figure E-1 uses these assumptions at different mortgage levels to plot both (i) the expected rate of return on the equity in the real estate, and (ii) the realized rate of return on that equity in a year if the real estate value increases by 10 percent more than the expected 5 percent rate (i.e., if the value increases by 15 percent) or by 10 percent less than expected (i.e., if it decreases by 5 percent).[24]

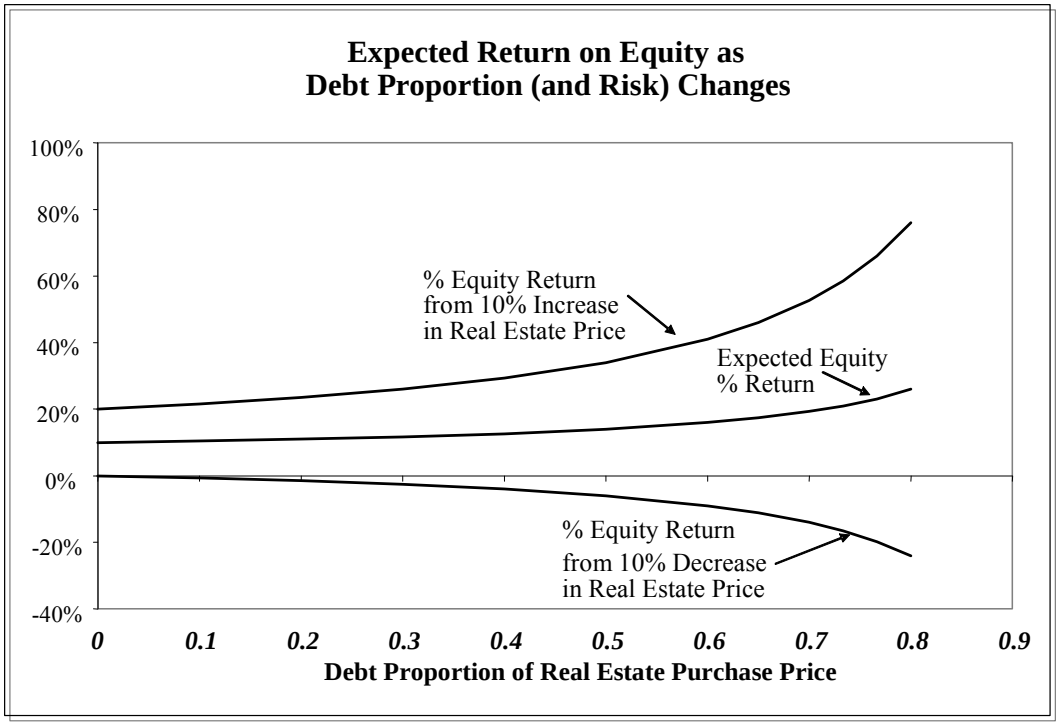

Figure E-1

The expected rate of return on equity increases at an increasing rate as the investor finances more and more of the real estate through loans (e.g., with a mortgage). Since equity bears all the risk of increases or decreases in real estate values (absent financial distress or bankruptcy), the amount of risk the buyer bears grows at an ever increasing rate as the mortgage percentage also increases.

[24] For simplicity, the figure assumes the debt's interest rate is independent of the debt proportion. This might not always be true, and in general would not be true for a corporation that issued debt. However, the general shape of the graphs remains the same.

Q18. What are the implications of this example?

A17. Any time an individual or a company uses debt to finance part an investment, the same risk magnifies. For example, if an investor buys stocks "on margin" -- by borrowing part of the money used to buy the stock -- the expected rate of return will be higher as will the risks the investor carries. As an everyday example, imagine investing your retirement savings in a stock portfolio bought with as much margin as possible. If you were lucky, you could end up living very well in retirement. But you would be taking a lot of risk on the opposite outcome, since your portfolio could decline by more than 100 percent of your initial investment.

The same risk-magnifying effects happen when companies borrow to finance part of their investments.

C. THE EFFECT OF TAXES

Q19. What is the impact of taxes?

A18. Analyzing the net effect of taxes in capital structure decisions by corporations is an important part of the financial research. (Other parts of that research address such issues as the risk of financial distress or bankruptcy, and the signals corporations send investors by the choice of how to finance new investments.) The bottom line is that taxes complicate the picture without changing the basic conclusion.

Q20. Please describe the potential impact of taxes.

A19. Interest expense is tax-deductible for corporations. That increases the pool of cash the corporation gets to keep out of its operating earnings (i.e., its earnings before interest expense). With no debt, 100 percent of operating income is subject to taxes. With debt, only the equity part of the operating income is subject to taxes.

All else equal, the extra money kept from operating income increases the value of the corporation. The standard way to recognize that increase in value is to use an after-tax weighted-average cost of capital as a discount rate when valuing a company's operating cash flows.

Q21. Do personal taxes affect the value of debt, too?

A20. Yes, but in the other direction. One offset to debt's tax benefits at the corporate level is its higher tax burden at the personal level. Investors care about the money they get to keep after all taxes are paid, and while the corporation saves taxes by opting for debt over equity, individuals pay more taxes on interest than on capital gains from equity (and for now, on dividends as well).

Q22. Are there factors other than taxes matter?

A21. Absolutely, "all else" does not remain equal as more debt is added. The more debt, the more the non-tax effects of debt offset the tax benefits. Other costs include such effects as a loss of flexibility, the possibility of sending negative signals to investors, and a host of costs and risks associated with the danger of financial distress.

Q23. Does the tradeoff between the tax and non-tax effects of debt mean that firms have well-defined, optimal capital structures?

A22. No, this sort of "tradeoff" model does not explain actual corporate behavior. A substantial body of economic research confirms that real-world corporations act as if, after a moderate amount of debt is in place, the tax benefits of debt are not worth debt's other costs. In country after country and in industry after industry, the most profitable corporations in an industry tend to use the least debt. The research on this point is quite thorough, and the finding that the most profitable companies tend to use the least debt in a given industry is robust. Yet these are the companies with the most operating income to shield from taxes, who would benefit most if interest tax shields were truly valuable net of debt's other costs. They also presumptively are the best-managed on average (else why are they the most profitable?). This means it is unrealistic to suppose that more debt is always better, or that greater tax savings due to higher interest expense always add value to the firm on balance.

Q24. If the tradeoff model doesn't explain capital structure decisions by firms, is there a model that does?

A23. No single model has (yet) emerged as 'the" explanation of capital structure. However, several alternative models attempt to model the tradeoff (e.g., the "pecking order" hypothesis and "agency cost" explanations).

Q25. What does the absence of an agreed theory of capital structure in the financial literature imply about the overall effect of debt on the value of the firm?

A24. The findings of the financial literature mean that within an industry, there is no well-defined optimal capital structure. The use of some debt does convey some value advantage in most industries, but that advantage is offset by other costs as firms add more debt.[25] The range of capital structures over which the value of the firm in any industry is maximized is wide and should be treated as flat. The location and level of that range, however, does vary from industry to industry, just as the overall cost of capital varies from industry to industry.

Figure E-2 illustrates the picture that emerges from the research. This figure shows the present value of an investment in each of four different industries. For simplicity, the investment is expected to yield $1.00 per year forever. For firms in relatively high-risk industries (Industry 1 in the graph, the lowest line), the $1.00 perpetuity is not worth much and any use of debt decreases firm value. For firms in relatively low-risk industries (Industry 4 in the graph), the perpetuity is worth more and substantial amounts of debt make sense. Industries 2 and 3 are intermediate cases.

The maximum net rate at which taxes can increase value in this figure equals 20 percent of interest expense, representing a balance between the corporate tax advantage to debt

[25] Note that if debt did increase the value of the firm materially, competition would tend to take that value away, since issuing debt is an easy-to-copy competitive strategy. Prices would fall as firms copied the strategy, lowering operating earnings and passing the net tax advantages to debt through to customers (just as happens under rate regulation). Therefore, if also there were a narrow range of optimal capital structures within an industry, competition would drive all firms in the industry to capital structures within that range. This does not happen in practice, which contradicts one or both of the assumptions, i.e., (1) that debt adds material value on balance, and/or (2) that there is a narrow range of optimal capital structures.

and the personal tax disadvantage. The figure plots the maximum possible impact of taxes on value as a separate line, starting at the all-equity value of the lowest-risk industry (Industry 4).

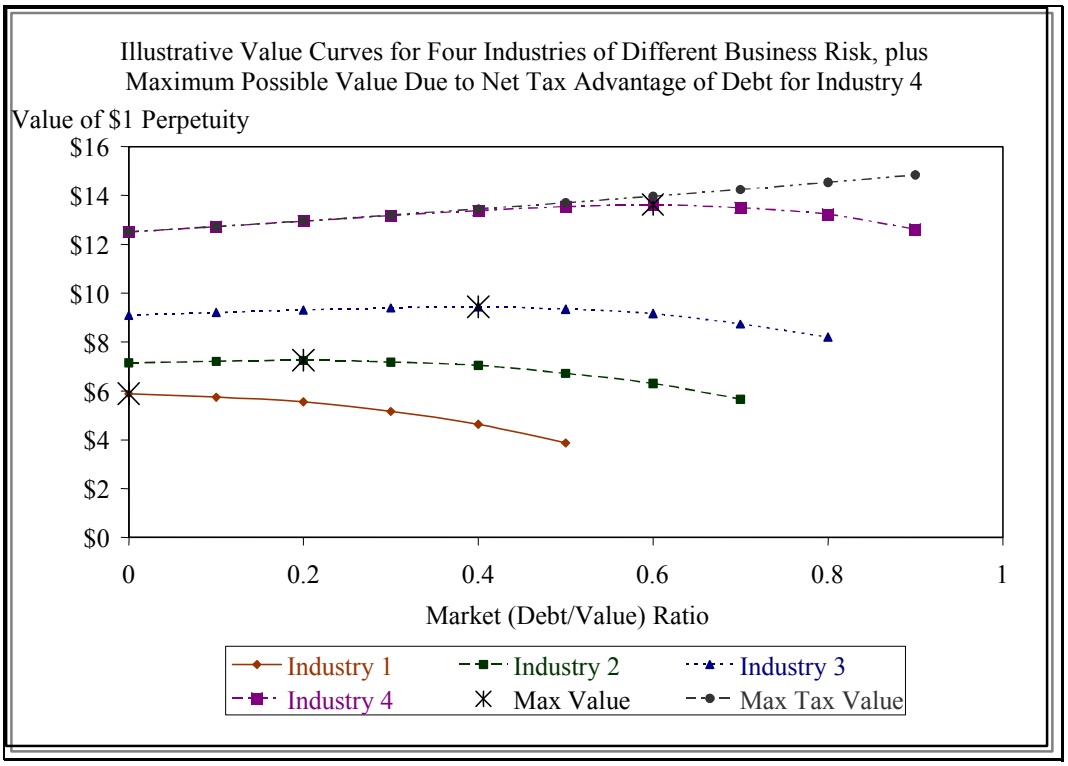

Figure E-2

Figure E-2 identifies a particular point as the maximum value on each of the four curves. However, the research shows that reliable identification of this maximum point, except in the extreme case where no debt should be used, is impossible. In accord with the research, the graph is prepared so that in none of the industries does a change in capital structure make much difference near the top of the curve. Even Industry 4, which increases in value at the maximum rate as quite a lot of debt is added, eventually must reach a broad range where changes in the debt ratio make little difference to firm value, given the research. For Industry 4, debt makes less than a 2 percent difference in the total value of the firm for debt-to-value ratios between 40 and 70 percent. (While these particular values are illustrative, numbers of this order of magnitude are the only ones consistent with the research.)

Q26. What does this imply for the overall cost of capital?

A25. Figure E-3 plots the after-tax weighted-average costs of capital ("ATWACCs") that correspond to the value curves in Figure E-2. This picture just turns Figure E-2 upside down.[26] All the same conclusions remain, except that they are stated in terms of the overall cost of capital instead of the overall firm value. In particular, except for high-risk industries, the overall cost of capital is essentially flat across a broad middle range of capital structures for each industry, which is the only outcome consistent with the research. For Industry 4, for example, the ATWACC changes by less than 15 basis points for debt-to-value ratios between 40 and 70 percent.

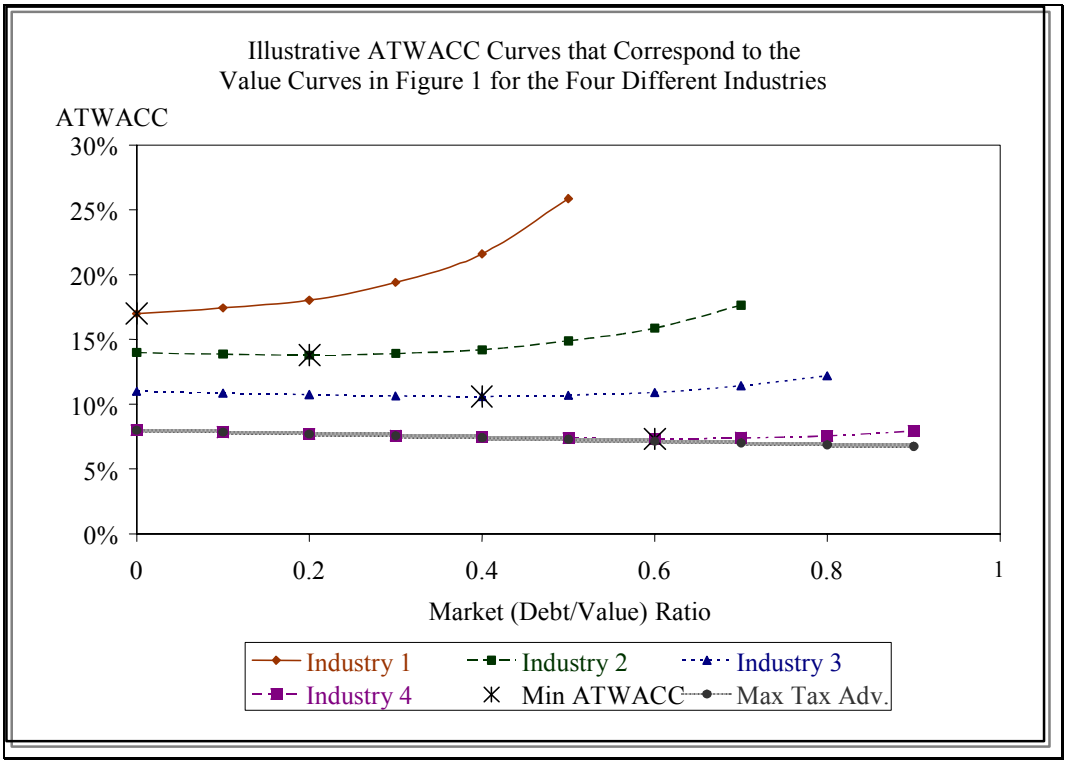

Figure E-3

[26] Note that the actual estimated ATWACC at higher debt ratios will tend to underestimate the ATWACC that corresponds to the value curves in Figure E-2, which are depicted in Figure E-3, and so will tend to overestimate the value of debt to the firm. The reason is that some of the non-tax effects of excessive debt, such as a loss of financial flexibility, may be hard to detect and not show up in cost-of-capital measurement.

Q27. How does this discussion relate to estimation of the right cost of equity for ratemaking purposes?

A26. When an analyst estimates the cost of equity for a sample of companies, s/he does so at the sample's actual market-value capital structure. That is, the sample evidence corresponds to ATWACCs that are already out somewhere in the broad middle range in which changes in the debt ratio have little or no impact on the overall value of the firm or the ATWACC.

An analyst therefore should assume the ATWACCs for the sample companies are literally flat. This assumption always provides the exact tradeoff between the cost of equity and capital structure at the literal minimum of the company's ATWACC curve. The research shows that this minimum is actually a broad, flat region, as depicted above. If the company happens to be somewhat to one side or the other of the literal minimum within this region, the recommended procedure may lead to a small understatement or overstatement of the amount that the cost of equity will change as capital structure changes. The degree of this under- or overstatement, however, is very small compared to the inherent uncertainty in estimating the cost of equity in the first place. Otherwise, the financial research would have found very different results about the existence of a narrowly defined optimal capital structure.

D. COMBINED EFFECTS

Q28. Please summarize the implications for the combined impact of the tax and non-tax effects of debt.

A27. The most profitable firms do not behave as if the precise amount of debt they use makes any material difference to value, and competition does not force them into an alternative decision, as it would if debt were genuinely valuable. The explanation that fits the facts and the research is that within an industry, there is no well-defined optimal capital structure. Use of some debt does convey an advantage in most industries, but that advantage is offset by other costs as firms add more debt. The range of capital structures over which the value of the firm in any industry is maximized is wide and should be

treated as flat. The location and level of that range, however, does vary from industry to industry, just as the overall cost of capital varies from industry to industry. To conclude that more debt does add more value, once the firm is somewhere in the normal range for the industry, is to conclude that corporate management in general is either blind to an easy source of value or otherwise incompetent (and that their competitors let them get away with it).

The finding that there is no narrowly defined optimal capital structure implies that analysts should estimate the ATWACCs for a sample of companies in a given industry and treat the average ATWACC value as independent of capital structure (at least within a broad middle range of capital structures). The right cost of equity for a rate-regulated company in the same industry is the number that yields the same ATWACC at the capital structure used to set the revenue requirement, since that is the cost of equity that (estimation problems aside) the sample companies would have had if their market-value capital structures had been equal to the regulatory capital structure.

BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION

IN THE MATTER OF THE PETITION BY NEW MEXICO-AMERICAN WATER COMPANY, INC. FOR ADJUSTMENT OF WATER RATES FOR ITS CLOVIS DISTRICTS,

Case No. 08-00134-UT

NEW MEXICO-AMERICAN WATER COMPANY, INC.,
Petitioner.

REBUTTAL TESTIMONY
OF
BENTE VILLADSEN
ON BEHALF OF
NEW MEXICO-AMERICAN WATER COMPANY

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EXECUTIVE SUMMARY

Dr. Bente Villadsen, a Principal at *The Brattle Group*, filed direct testimony on the cost of capital for New Mexico-American Water Company's Clovis districts in June 2008 and is now filing rebuttal testimony in response to the testimony submitted by Mr. Thomas C. Patin on behalf of New Mexico Public Regulation Commission Staff and Dr. Larry Blank on behalf of the City of Clovis.

I continue to believe that 11¾ percent return on equity at 45.13 percent equity is an appropriate return on equity for New Mexico-American Water.

Mr. Patin in his testimony relies on a discounted cash flow methodology that the staff of the New Mexico Public Regulation Commission has used in prior cases. I find that the use of more than one method is preferable and I also disagree with Mr. Patin's reliance on the book value capital structure of publicly traded comparables in the assessment of the relative financial risk of New Mexico-American Water. The methodology results in the recommended return on equity of 11.17 percent which is too low.

Given the recent turmoil in financial markets, Dr. Blank's suggested 10.3 percent return on equity is simply too low. Dr. Blank's suggested 10.3 percent is based on a downward adjustment to my midpoint recommendation of 11¾ percent. His adjustment subtracts the change in the 30-year Treasury bond yield since June 2008 from 11¾ percent, but fails to consider the increased volatility in financial markets and increased cost of debt for utilities. Further, the calculated adjustment suffers from methodological issues such as mixing the 20-year and the 30-year Treasury bond yields. The increased market volatility leads investors' risk premium to increase. Further, the increase in utilities cost of debt indicates that the drop in the yield on long-term government bonds is driven by factors other than lower cost of capital for utilities. Hence, the 10.3 percent recommended by Dr. Blank is below what investors currently require to provide equity capital.

I. INTRODUCTION AND SUMMARY

Q1. PLEASE STATE YOUR NAME AND ADDRESS FOR THE RECORD.

A1. My name is Bente Villadsen. My business address is *The Brattle Group*, 44 Brattle Street, Cambridge, MA 02138.

Q2. DID YOU PREVIOUSLY FILE TESTIMONY IN THIS PROCEEDING?

A2. Yes, I filed direct testimony ("Villadsen Direct") on behalf of New Mexico-American Water Company ("New Mexico-American Water" or the "Company") in June 2008 regarding the estimate of the cost of equity for New Mexico-American Water's Clovis districts. The cost of equity is the return that the Commission should provide the Company an opportunity to earn on the portion of its rate base financed by equity.

Q3. WHAT IS THE PURPOSE OF YOUR REBUTTAL TESTIMONY?

A3. New Mexico-American Water has asked me to review and respond to the testimony of Mr. Thomas C. Patin ("Patin Direct"), who filed testimony on behalf of the Utility Division Staff (the "Staff") of the New Mexico Public Regulation Commission ("PRC" or the "Commission"), and to the testimony of Dr. Larry Blank ("Blank Direct"), who filed testimony on behalf of the City of Clovis, NM. Specifically, I will address their recommendations for the cost of equity capital ("CoE") for New Mexico-American Water.

Q4. PLEASE SUMMARIZE THE RECOMMENDATIONS OF THE PATIN DIRECT AND THE BLANK DIRECT.

A4. The Patin Direct recommends a CoE of 11.17 percent. Further, the Patin Direct uses the Company's filed debt cost of 6.43 percent and filed capital structure including 45.13 percent equity.[1] The Patin Direct relies exclusively on a the single stage Discounted Cash Flow ("DCF") method and takes into account that New Mexico-American Water has higher financial risk than the proxy companies. The financial risk adjustment is based on the sample companies' book value capital structure and New Mexico-American Water's regulatory capital structure.

[1] Patin Direct pp. 3-4.

The Blank Direct recommends a CoE of 10.30 percent while also suggesting, without explicit justification, an alternative of 9.715 percent which was the approved CoE in a previous rate case. Dr. Blank suggests that the cost of equity be applied to a capital structure with 44.17 percent equity and that the cost of debt be set at 5.9874 percent.[2] The Blank Direct supports its recommended return on equity by referencing the reduction in the long-term government bond rate since June 2008 when I filed my Direct Testimony and cites the recent turmoil in the financial markets as a possible justification for lower CoE.

Q5. DO YOU AGREE WITH THE RECOMMENDATIONS OF THE PATIN DIRECT AND THE BLANK DIRECT?

A5. I agree with the Patin Direct's recommendation of using the Company's filed capital structure and cost of debt. However, I continue to believe that 11¾ percent return on equity at 45.13 percent equity is an appropriate return on equity for New Mexico American Water. Hence, I find that the Patin Direct and especially the Blank Direct recommended a return on equity that is too low in the current financial environment. The Patin Direct relies on the book value capital structure of the comparable companies in considering the financial risk whereas financial theory suggests that financial risk is determined in financial markets using market values.

More troublesome is the Blank Direct's suggested 10.3 percent return on equity. The recent events in the financial markets and in the economy as a whole suggest that, under current market conditions, equity and debt investors expect higher compensation for their investment now than at the time of the filing of my direct testimony. As I will discuss below, market volatility has been very high in recent months and during periods of higher market volatility, equity investors require a higher premium to invest in equity, so that the cost of equity increases. Further, American Water recently raised debt capital in the form of senior notes. While American Water is a solid investment grade entity,[3] the interest rate was 10 percent.[4] As equity investors carry the residual risk of investments, they are

[2] Blank Direct Exhibit LB-6.

[3] BBB+ by *Standard & Poor's* and Baa2 by *Moody's* (as of January 4, 2009).

[4] American Water Press Release, "American Water Completes Debt Offering," Nov. 26, 2008.

awarded a premium over that of debt holders. Dr. Blank's recommended return on equity does not allow equity investors any premium over the compensation granted to debt holders and therefore is unreasonably low.

Q6. HOW IS THE REMAINDER OF YOUR REBUTTAL TESTIMONY ORGANIZED?

A6. In Section II, I comment on the approach used by Mr. Patin. In Section III, I discuss the methodology and resulting recommendation of Dr. Blank. Section IV provides my concluding remarks. Two supporting figures are attached to this rebuttal testimony.

II. COMMENTS ON STAFF'S (PATIN) DIRECT

Q7. WHY DO YOU DISAGREE WITH THE USE OF THE SAMPLE COMPANIES' BOOK VALUE CAPITAL STRUCTURE FOR FINANCIAL RISK COMPARISONS?

A7. As discussed in the Villadsen Direct pp. 20-21 and Appendix E, standard economic theory relies on market value capital structures when assessing the financial risk of a company. Therefore, although the Patin Direct correctly recognizes the need to adjust the CoE for the relative financial risk of New Mexico-American Water, I disagree with its reliance on the average book value capital structure of the sample companies.[5] Had the Patin Direct relied on the market value capital structure of the comparable companies, the calculated cost of equity would have been on the order of 70 to 75 basis points higher[6] and very similar to that of the Villadsen Direct.

Q8. DO YOU HAVE ANY OTHER COMMENTS ON THE PATIN DIRECT?

A8. I believe that the use of multiple methods to estimate the cost of equity for sample companies is preferable as each method can be used as a check on the results obtained by

[5] See the Patin Direct, Schedule TCP-2.

[6] Using 60 percent market equity for the sample companies in the Patin Direct, Schedule TCP-2 results in a cost of equity of 11.91 percent. Table No. BV-15 in my direct testimony estimated the market value capital structure of the gas LDC sample companies to include approximately 66% equity as of June 2008 and December 2008 data indicate an average of approximately 65% equity, so 60% is a conservative test of the magnitude.

other methods. Further, I prefer the methodologies and implementations relied upon in the Villadsen Direct, but rather than re-iterating the reasons, I shall simply refer to my direct testimony Section III.B.

III. COMMENTS ON CITY'S (BLANK) DIRECT

Q9. WHAT ARE YOUR KEY CONCERNS WITH THE COST OF EQUITY THE BLANK DIRECT RECOMMENDS?

A9. My comments fall into two categories. First, the Blank Direct makes an adjustment to the cost of equity estimated in my June 2008 direct testimony based solely on changes in government interest rates. While government interest rates have declined, the turmoil in financial markets has affected other parameters that impact the cost of equity for a company. Examples of such parameters are the rates at which utilities can borrow (e.g., the yield on utility bonds) as well as investors risk perception and market volatility which impacts the market risk premium. These factors also need to be considered when determining the cost of equity for New Mexico-American Water. Second, I find the implementation of the Blank Direct's adjustment to the cost of equity estimated in June 2008 inconsistent with my June 2008 direct testimony. I will address the implementation of the adjustment first and then turn to the other factors that have impacted the cost of equity.

A. THE COST OF EQUITY ADJUSTMENTS IN THE BLANK DIRECT

Q10. WHY DO YOU DISAGREE WITH DR. BLANK'S ADJUSTMENTS TO YOUR COST OF EQUITY ESTIMATE?

A10. First, if one believes that market conditions have changed to an extent that merits an update in the inputs then it is more appropriate to redo the entire analysis step-by-step using the entire range of most recently available inputs and not merely adjust the long-term interest rates. This approach would have to take into account any impact of the current financial turmoil on the various input parameters. Second, if one nonetheless decides to take this short-cut approach and apply the adjustment to the end-point results, then the calculation should be done in a manner consistent with the Villadsen Direct.

Q11. WHY DO YOU BELIEVE THE ADJUSTMENTS ARE NOT CONSISTENT WITH YOUR DIRECT TESTIMONY?

A11. I have identified several issues that are clearly indicative of such inconsistency. First and foremost, the risk-free rate is only relied upon in the risk positioning methods. Therefore, any adjustment would pertain only to the risk positioning results. As all of the risk positioning results in the Villadsen Direct were higher than my recommended 11¾ percent return on equity,[7] the Blank Direct overstates the reduction in the return on equity (taking his approach for granted). Second, the Blank Direct's implementation of the adjustment is inconsistent with the Villadsen Direct's approach.

Q12. PLEASE EXPLAIN HOW THE BLANK DIRECT IMPLEMENT THE ADJUSTMENT IN A MANNER INCONSISTENT WITH THE VILLADSEN DIRECT.

A12. First, as explained in Appendix C to Villadsen Direct, I rely upon the 20-year Treasury bond yields when calculating the long-term risk-free rates.[8] The Blank Direct uses the 30-year Treasury bond yields instead. In fact, the 30-year yields have dropped by more than the 20-year Treasury bond yields since the filing of the Villadsen Direct. As a result, the Blank Direct's change in the series that is relied upon results in an overstatement of the drop in the risk-free rate by approximately 30 basis points. Second, the Blank Direct is inconsistent with the time span used in the Villadsen Direct when averaging the long-term Treasury bond yields. In particular, I relied on the average across the last 15 trading days, while the Blank Direct uses only data for the month of December. This resulted in only twelve data points being used for his averaging. The shortening of the time period considered resulted in a upward bias in the calculated drop in the risk-free rate by about 10 basis points and hence a downward bias in the estimated cost of equity of about 10 basis points. Third, in Villadsen Direct I round the average yield to the nearest tenth of a percent before using it in the CAPM and ECAPM equation, whereas the Blank Direct relies on two decimals. Table 1 below shows that if the Blank Direct had implemented

[7] Villadsen Direct, Table 3 on p. 40.

[8] See lines 19-21 on p. C-17 of Appendix C to Villadsen Direct.

its calculation in a manner consistent with my direct testimony, the calculated adjustment (cost of equity) would have been 45 basis points lower (higher).

Table 1
Potential Interest Rate Adjustments

Date	Approach Consistent with Villadsen Direct (20-year T. bond yield) [1]	Approach Used in Blank Direct (30-year T. bond yield) [2]
11/25/2008	3.85%	
11/26/2008	3.77%	
11/28/2008	3.71%	
12/1/2008	3.51%	3.22%
12/2/2008	3.47%	3.18%
12/3/2008	3.45%	3.17%
12/4/2008	3.35%	3.06%
12/5/2008	3.41%	3.11%
12/8/2008	3.45%	3.16%
12/9/2008	3.35%	3.06%
12/10/2008	3.39%	3.09%
12/11/2008	3.35%	3.07%
12/12/2008	3.36%	3.07%
12/15/2008	3.29%	2.98%
12/16/2008	3.16%	2.86%
Average in December	3.38%	3.09%
Average in December (Rounded)*	3.40%	3.10%
15-trading Day Average	3.46%	n/a
15-trading Day Average (Rounded)*	3.50%	n/a
Benchmark**	4.50%	4.54%
Change in risk-free rate* **	**1.00%**	**1.45%**

Source: Bloomberg as of December 23, 2008.
[1]: 20-Year US Treasury Bond Yield for the 15 trading days ending on December 16, 2008.
[2]: 30-Year US Treasury Bond Yield from December 1, 2008 through December 16, 2008.
The Difference is calculated as:
[1]: the Benchmark minus the 15-trading Day Average (Rounded).
[2]: the Benchmark minus the Average in December.
* The values are rounded to the nearest tenth of a percent.
** The Benchmark is the average 20-Year US Treasury Bond Yield for the 15 trading days ending on May 7, 2008.
*** The values are rounded to the nearest tenth of a percent in column [1] only.

Q13. DOES TABLE 1 SUGGEST THAT A DOWNWARD ADJUSTMENT IN THE RECOMMNDED COST OF EQUITY BY ONE PERCENT IS WARRANTED?

A13. No, it does not. One should not ignore the fact that while my recommendation of 11¾ percent is based upon primarily on three versions of the risk positioning method, I also consider two versions of the DCF. Clearly, neither the simple nor the multi-stage DCF-based results are affected by the dynamics of the risk-free rate. At the same time, the results based on the risk positioning methods are all well above 11¾ percent.[9] Therefore, if one is willing to make this adjustment to the proposed rates, only the risk-positioning results should be adjusted. As a result any adjustment *to the cost of equity* would be quite a bit lower than the one percent calculated above and which takes Dr. Blank's methodology for granted.

Q14. WHAT WOULD THE FINAL NUMBER LOOK LIKE ONCE THE ADJUSTMENT IS MADE TO THE RISK POSITIONING RESULTS?

A14. The cost of equity results based on the analysis of the gas LDC sample with the risk positioning methods reported in Villadsen Direct would change from 11.9 percent (CAPM) to 12.4 percent (ECAPM with α = 1.5 percent) to 10.9 percent to 11.4 percent, respectively. Since none of the DCF results is affected by Dr. Blank's adjustment and no DCF estimate is below 10.9 percent,[10] it is clear that the resulting cost of equity, everything else equal, is in the range of 10.9 to 11.4 percent for the gas LDC sample. I therefore do not understand how the Blank Direct, based on the figures in my direct testimony, comes up with a cost of equity as low as 10.3 percent. It is noteworthy that the midpoint of the range that results from this calculation is 11.15 percent which is indistinguishable from Mr. Patin's recommendation.

[9] See Table 3 on p. 40 of Villadsen Direct.

[10] *Ibid.*

B. OTHER ISSUES THAT HAVE AFFECTED THE COST OF EQUITY

Q15. ABOVE YOU SAID THAT YOU DID NOT BELIEVE THE DROP IN THE LONG-TERM GOVERNMENT BONDS IS THE ONLY SIGNIFICANT CHANGE IN FINANCIAL MARKETS SINCE YOUR DIRECT TESTIMONY WAS FILED. PLEASE EXPLAIN.

A15. Clearly financial markets have experienced significant turmoil since my direct testimony was filed in June 2008. That is why it is dangerous and incorrect to solely focus on the drop in risk-free rates. The facts that financial markets are in turmoil and stock market volatility has increased dramatically mean that equity investors face increased uncertainty. Increased uncertainty leads them to seek lower risk investments or to demand a higher expected rate of return before they are willing to invest their money. In part, this is an explanation of why market prices have fallen. While the Blank Direct suggests that financial markets distress should make investors content with lower returns,[11] if anything, financial distress means that the current market risk premium ("MRP") is *higher* than it would otherwise be. Dimson, Marsh, and Staunton (2008) appear to agree as they note

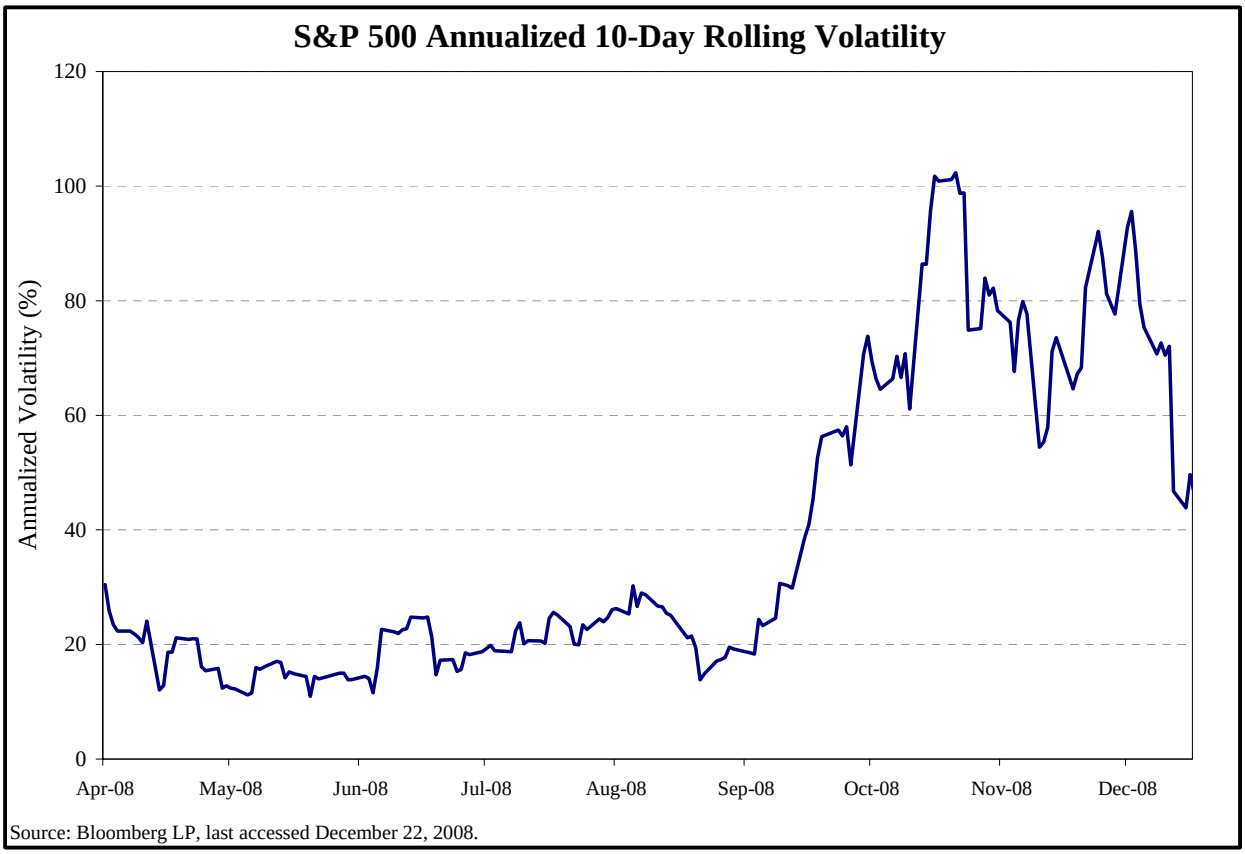
> Although credit spreads widened, credit fundamentals as measured by low default rates remained at historically strong levels. This may indicate higher defaults to come, an increase in risk aversion, a bigger premium for liquidity, or all three.[12]

As shown in Figure 1 below, the volatility in the U.S. stock market spiked to 3 to 4 times the normal level of about 20% in September-October and remains at more than twice its normal level.

[11] See pp. 3-4 in Blank Direct.

[12] Elroy Dimson, Paul Marsh, and Mike Staunton, 2008, *Global Investment Returns Yearbook 2008*, p. 25.

Figure 1



Source: Bloomberg LP, last accessed December 22, 2008.

As investors' risk aversion increases during times of financial distress, the MRP is currently higher than in the recent past. This factor alone is counteracting any adjustment to the CAPM and ECAPM models based on changes in the risk-free rate as contemplated in the Blank Direct.

Q16. ARE THERE ACADEMIC STUDIES THAT PROVIDE INSIGHTS INTO THE MRP IN TIMES OF FINANCIAL RECESSION OR ECONOMIC DOWNTURN?

A16. Yes. The academic literature contains studies of the impact of recessions on investors' attitude towards risk. These studies find that risk aversion, and hence the risk premium required to hold equity rather than debt, increases in economic downturns. Several articles suggest that the market risk premium is higher during times of recession. Constantinides (2008) studies a classical utility model where consumers are risk averse and summarizes some of the empirical literature. Constantinides draws from empirical evidence that shows that consumers become risk averse in times of economic recession or

downturn, and equity investments accentuate this risk.[13] (Increased risk aversion leads to a higher expected return for investors before they will invest.) Specifically, equities are pro-cyclical and decline in value when the probability of a job loss increases; thus, they fail to hedge against income shocks that are more likely to occur during recessions.[14] Consequently, investors require an added risk premium to hold equities during economic downturns:

> In economic recessions, investors are exposed to the double hazard of stock market losses and job loss. Investment in equities not only fails to hedge the risk of job loss but also accentuates its implications. Investors require a hefty equity premium in order to be induced to hold equities. This is the argument that I formalize below and address the predictability of asset returns and their unconditional moments.[15]

And

> The first implication of the theory is an explanation of the counter-cyclical behavior of the equity risk premium: the risk premium is highest in a recession because the stock is a poor hedge against the uninsurable income shocks, such as job loss, that are more likely to arrive during a recession.
>
> The second implication is an explanation of the unconditional equity premium puzzle: even though per capita consumption growth is poorly correlated with stocks returns, investors require a hefty premium to hold stocks over short-term bonds because stocks perform poorly in recessions, when the investor is most likely to be laid off.[16]

Empirically, several authors have found that market volatility and the market risk premium are positively related. For example, Kim, Morley and Nelson (2004)[17] find that

> When the effects of volatility feedback are fully taken into account, the empirical evidence supports a significant positive relationship between stock market volatility and the equity premium.[18]

---

[13] Constantinides, G. M., "Understanding the equity risk premium puzzle". In R. Mehra, ed., *Handbook of the Equity Risk Premium*, 2008, Elsevier, Amsterdam.

[14] Constantinides, G.M., and D. Duffie, 1996, "Asset Pricing with Heterogeneous Consumers", *Journal of Political Economy*.

[15] G.M. Constantinides (2008), *op. cit*.

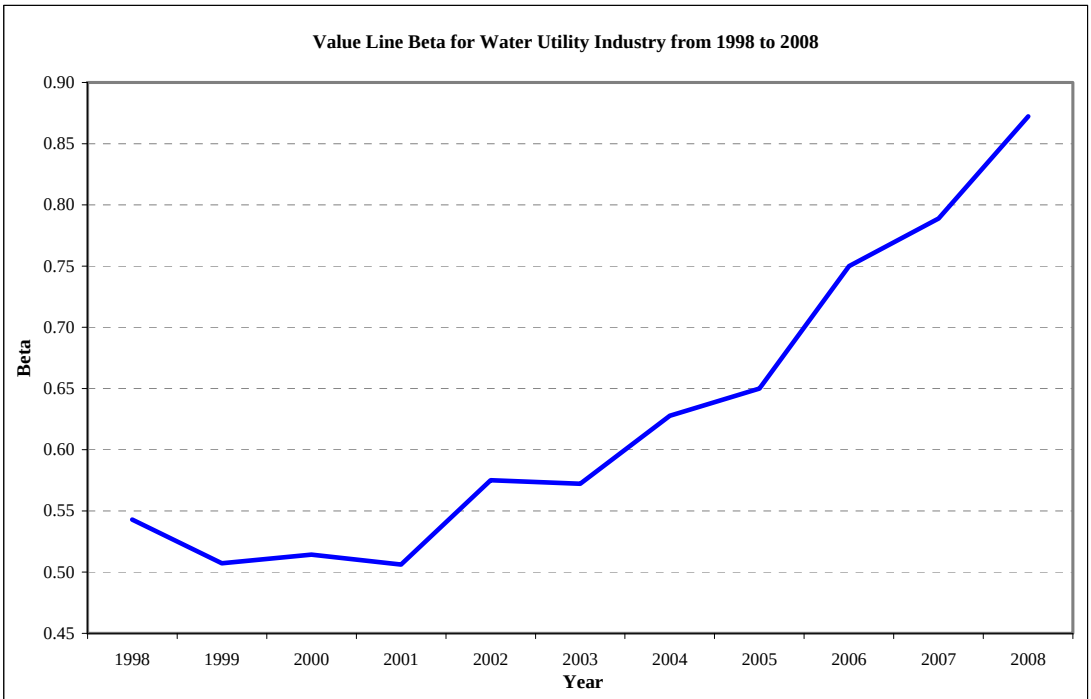
[16] *Ibid*, p. 353.

[17] C-J. Kim, J.C. Morley and C.R Nelson (2004), "Is There a Positive Relationship Between Stock Market Volatility and the Equity Premium," *Journal of Money, Credit and Banking*, Vol. 36.

Q17. WHAT BEARING DOES THIS HAVE ON WATER UTILITIES THAT, ACCORDING TO THE BLANK DIRECT, HAVE LOW RISK AND ARE THEREFORE LIKELY TO BE MORE ATTRACTIVE ALTERNATIVES FOR INVESTORS UNDER CURRENT CONDITIONS?[19]

A17. Although investors traditionally have viewed water utilities as relatively low risk compared to many other industries, the risk of the equity invested (or the systematic risk) in the industry is increasing. *Value Line Investment Survey* (the "*Value Line*") documents this increase in systematic risk as the betas *Value Line* estimates for the utility companies in the water sample have increased over time. Figure 2 below shows the average estimated betas for the water sample. Based upon the end-of-year reports,[20] *Value Line's* estimated betas for the water utility companies have increased from an average of about 0.54 in 1998 to an average of about 0.87 in October 2008.

Figure 2



Source: Value Line Investment Analyzer, as of December 29, 2008.
Value for 2008 is computed using betas published in reports dated October 24, 2008

[18] *Ibid*. p. 357. The authors rely on a statistical (Markov-switching) model of the ARCH type and data for the period 1926 to 2000 for their analysis.

[19] See lines 17-20 on p.10 of the Blank Direct.

[20] The 2008 beta estimates are taken from October 24, 2008 *Value Line Summary & Index*.

Q18. ARE *VALUE LINE* BETAS A RELIABLE MEASURE OF THE WATER INDUSTRY'S SYSTEMATIC RISK?

A18. Yes. While the stocks of publicly traded water companies, as discussed in the Villadsen Direct, trade relatively infrequently, the impact hereof on estimated betas do not change significantly over time, so the trend illustrated in Figure 2 reflects an increase in the water industry's systematic risk. At the same time, there are other indications that the overall risk of the industry is increasing. Moody's Investors Service ("Moody's") and Standard & Poor's ("S&P") both note the need for significant capital expenditures and the costs of complying with environmental and security regulations as sources of risk.[21] Fitch notes that the debt ratios are increasing.[22] At the same time, the regulatory requirements imposed on the water industry are evolving.[23] Hence the water industry is experiencing a transition period which adds to the risk of the industry.

Q19. WHAT EVIDENCE DO YOU HAVE THAT THE WATER INDUSTRY WILL REQUIRE SUBSTANTIAL CAPITAL EXPENDITURES GOING FORWARD?

A19. As noted in the Villadsen Direct pp. 34-35, the water industry is expected to undertake substantial capital investments in coming years. For example, the Environmental Protection Agency ("EPA") has indicated that the water industry needs to invest capital of about $224 billion over the next two decades to meet the nation's need for clean drinking water and for wastewater disposal.[24] Similarly, *Value Line* notes the need for investment totaling "hundreds of millions of dollars in the coming decade" by the water utilities it follows as the EPA enacts more stringent requirements; portions of many current water systems are approaching 100 years in age and require significant maintenance, in some cases complete rebuilding.[25] The requirement for additional capital investment is a substantial hurdle for a group of companies that *Value Line*

---

[21] *Moody's*, Credit Risks Are Increasing for U.S. Investor Owned Water Utilities, Special Comment, January 2004 and *Standard & Poor's*, Key Rating Factors for Water Companies Around the World, July 17, 2006.

[22] *Fitch Ratings*, 2007 Median Ratios for Water and Sewer Revenue Bonds – Retail Systems.

[23] For example, the Ground Water Rule, a set of water quality standards mandated by the EPA, was published in the Federal Register November 8, 2006.

[24] www.epa.gov/waterinfrastructure/infrastructuregap.html

[25] *Value Line Investment Survey*, Water Utility Industry, July 25, 2008, p. 1415.

estimates to have an annual profit of about $450 million in 2009.[26] According to the American Society of Civil Engineers ("ASCE"), New Mexico's drinking water infrastructure "needs $1.04 billion over the next 20 years."[27] The Company also expects to incur substantial capital expenditures over the next several years as it continues to invest in wells.

Q20. PLEASE SUMMARIZE WHAT OFFSETTING EFFECT THE CURRENT STATE OF THE ECONOMY IS LIKELY TO HAVE ON THE COST OF CAPITAL.

A20. In my view, focusing solely on the risk-free rate changes since the time of filing of the Villadsen Direct is inappropriate since the current state of the economy is likely to increase the cost of capital for all companies due to heightened investor uncertainty. Investors are simply unwilling to commit capital to new investment without a much higher expected return relative to the risk of the investment than in the relatively recent past. This coupled with the requirement for substantial infrastructure investment in the water industry in general, and for the Company's continued efforts to maintain Clovis' water supply, makes it imperative that the Commission not underestimate the required return on equity.

Q21. THE BLANK DIRECT CITES ORAL TESTIMONY BY DR. MORIN IN SUPPORT OF ITS SUGGESTED ADJUSTMENT TO THE COST OF EQUITY.[28] HOW DO YOU RESPOND?

A21. As noted in the Blank Direct, Dr. Morin's reduced his recommended cost of equity in a matter before the Maryland Public Service Commission in response to a decline in the long-term treasury bonds. Dr. Morin's testimony clearly took place in a very different financial environment. During the time frame in question, approximately August 2006 to April 2007, the yield on long-term government bonds declined modestly while the yield on utility and corporate bonds changed very little. At the same time, there was no evidence of any substantial change in market volatility. Therefore, the factors discussed above were not present and the circumstances that led Dr. Morin to reduce his

[26] *Ibid*, p. 1415.

[27] *American Society of Civil Engineers*, 2005 Report Card for America's Infrastructure, New Mexico.

[28] Blank Direct pp. 12-13.

recommendation are not comparable to those faced by New Mexico-American Water today.[29]

Q22. DO YOU HAVE ANY FURTHER COMMENTS ON BLANK DIRECT?

A22. Yes. The Blank Direct suggest as an alternative that a cost of equity of 9.715 percent as approved by the Commission in the Company's 2006 rate case can be supported.[30] Not only does Dr. Blank not provide any justification for this figure, but the proposal itself introduces circularity in the rate making process and fail to assess the return on equity that investors *currently* require.

IV. CONCLUDING REMARKS

Q23. HAVE THE TESTIMONIES PROVIDED BY MR. PATIN OR DR. BLANK CAUSED YOU TO CHANGE YOUR COST OF EQUITY RECOMMENDATION?

A23. No. I continue to find that a cost of equity of 11¾ percent is reasonable for New Mexico-American Water.

Q24. DO YOU HAVE ANY OTHER OBSERVATIONS ON THE COST OF EQUITY FOR NEW MEXICO-AMERICAN WATER?

A24. Yes. As noted in my testimony above, the recent turmoil in financial markets has caused the cost of debt and equity to increase. For a utility that needs to undertake investments in infrastructure, it is therefore imperative that the allowed return on equity and overall return are such that it maintains its access to capital.

Q25. DOES THIS CONCLUDE YOUR REBUTTAL TESTIMONY?

A25. Yes.

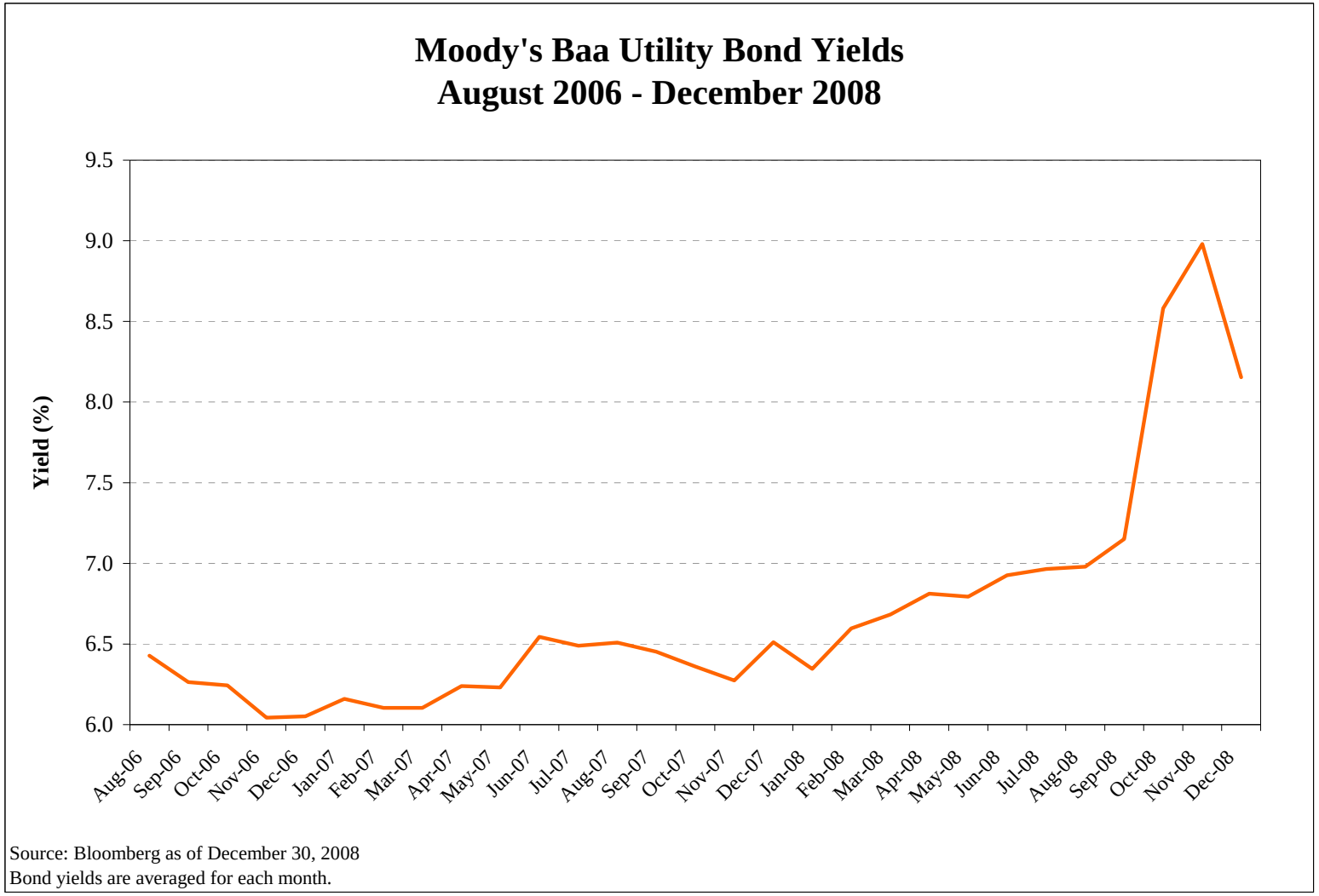
[29] Figure BV-R1 shows Moody's utility bond yield for the period August 2006 to December 2008 and Figure BV-R2 shows the volatility of financial markets for the same period.

[30] See p.13 of Blank Direct.

SUPPORTING FIGURES

Rebuttal Testimony
of Bente Villadsen
NMPRC Case No. 08-00134-UT

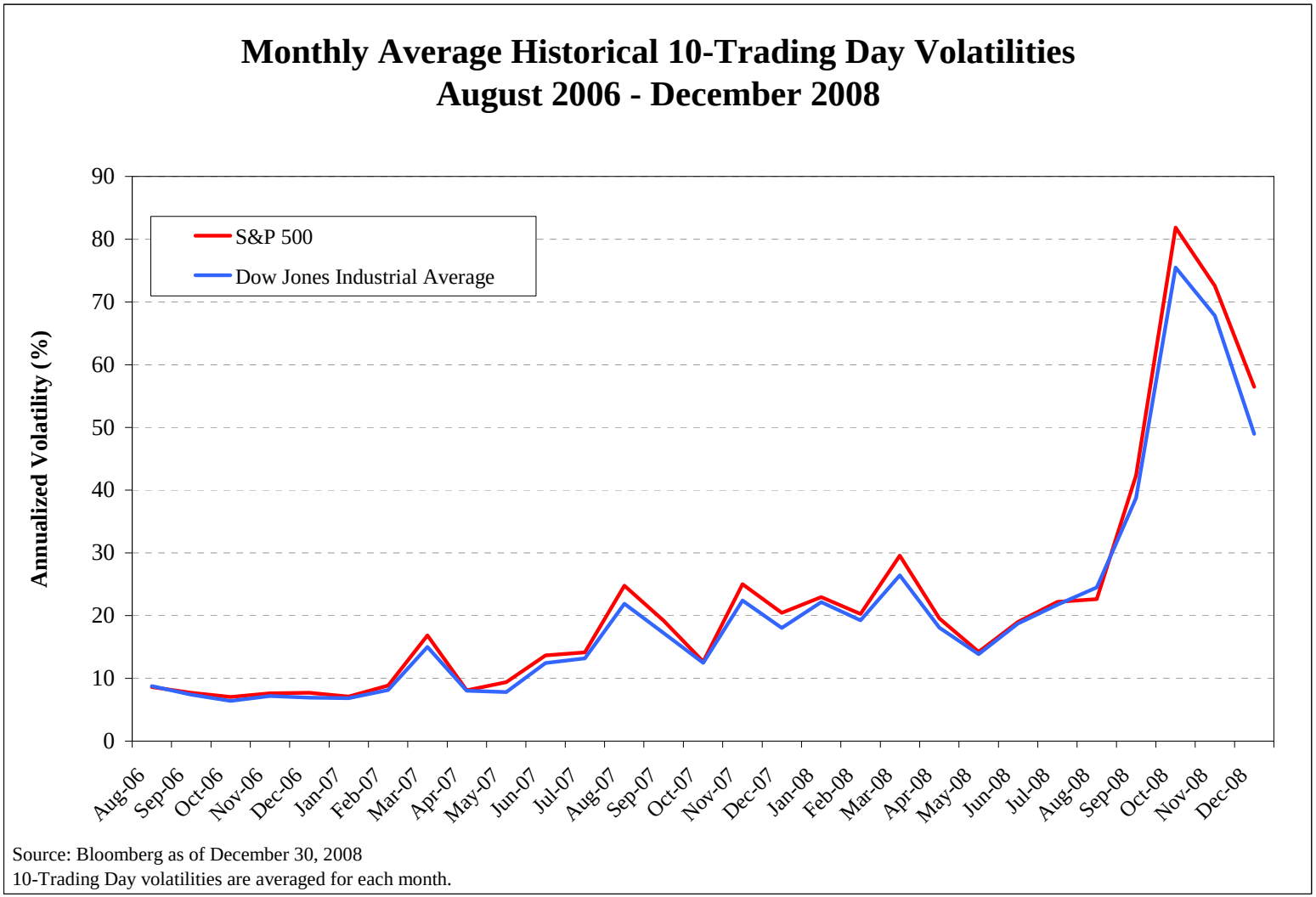
Figure BV-R 1



Source: Bloomberg as of December 30, 2008
Bond yields are averaged for each month.

Rebuttal Testimony
of Bente Villadsen
NMPRC Case No. 08-00134-UT

Figure BV-R 2



Source: Bloomberg as of December 30, 2008
10-Trading Day volatilities are averaged for each month.

UNITED STATES OF AMERICA
US DEPARTMENT OF ENERGY
BEFORE THE
BONNEVILLE POWER ADMINISTRATION

2007 SUPPLEMENTAL WHOLESALE POWER RATE ADJUSTMENT PROCEEDING	**BPA Docket WP-07**

DIRECT TESTIMONY ON BEHALF OF THE ASSOCIATION OF PUBLIC AGENCY CUSTOMERS

WITNESSES
DR. BENTE VILLADSEN
LINCOLN WOLVERTON

March 31, 2008

WP-07-E-AP-2

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1

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SUMMARY OF TESTIMONY

First, I find that, given an estimate of the annual damage to Preference Customers during the 2002 to mid-2007 period, the appropriate interest rate to use to bring that amount forward to May 2007 is equivalent to the yield on treasury debt. While it is not a straightforward exercise to pick the debt series that should be used, I recommend the yield on 3-month treasury bills as appropriate as opposed to a rate of pre-judgment interest rate equal to the realized rate of inflation as proposed by BPA.

Second, I find that BPA's proposal for repayment of damages puts the claims of Preference Customers behind other claims on BPA's funds including $210 million of REP benefit to IOUs in Fiscal Year 2009 and an anticipated target of the same amount in later years. As a result, the damages owed BPA's Preference Customers are assigned the role of residual claimants to BPA's funds under the proposal and therefore require an equity-type return. Because the damages due BPA's Preference Customers are last in line for payment and the amount available for payment is uncertain at this point, the carrying charge on the damage amount going forward must reflect the very risky nature of the cash flows. Because many of BPA's operating characteristics are similar to those of an integrated electric utility, I estimate that the lower bound for the carrying charge as similar to the cost of equity for an average integrated electric utility. Using standard cost of capital estimation techniques, I estimate the cost of equity for an average integrated electric utility to be in the range of 11¼ to 11¾ percent. In my opinion, this is a reasonable benchmark for the lower bound on the carrying charge on the amounts that will, per BPA's proposal, be repaid over a number of years going forward. The upper bound on the carrying charge is likely to be much higher but I cannot assess the exact number given the uncertainty about the going-forward interpretation of the Rate Ceiling Test, Average System Cost filings and BPA's rate before consideration of the residential exchange.

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Finally, I find that given the level of uncertainty with respect to the availability of funds to pay the estimated damages suffered by the Preference Customers and given a minimum carrying charge of 11¼ to 11¾ percent, it may well be impossible for the Preference Customers to be fully compensated for the damages incurred under the proposal put forth by BPA. Therefore, in my judgment, BPA's proposal for repayment of the estimated damages due to the Preference Customers is inadequate to ensure that the Preference Customers are compensated fully.

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I INTRODUCTION

Q. Dr. Villadsen, please state your name and qualifications.

A. My name is Bente Villadsen. I am a Principal of *The Brattle Group*, ("Brattle"), an economic, environmental and management consulting firm with offices in Cambridge, Washington, San Francisco, London and Brussels. My qualifications are filed as Exhibit WP-07-Q-AP-2.

Q. Mr. Wolverton, please state your name and qualifications.

A. My name is Lincoln Wolverton. My address and qualifications are filed as Exhibit WP-07-Q-AP-1.

Q. For whom are you offering this testimony?

A. This testimony is being offered on behalf of the Association of Public Agency Customers ("APAC").

Q. Dr. Villadsen, what is the purpose of your testimony in this proceeding?

A. I have been informed by counsel for APAC that the United States Court of Appeals for the Ninth Circuit ("Ninth Circuit") has determined that the Bonneville Power Administration ("BPA") violated the provisions of the Northwest Power Act ("NWPA") regarding the manner in which benefits are calculated under the Residential Exchange Program ("REP"), with the result that BPA's Preference Customers were overcharged. The Ninth Circuit has made a decision for Fiscal Years ("FY") 2002-06 and I have been asked to assume that the implementation led to similar overcharging until mid-2007.[1] BPA's Preference Customers are publicly-owned utilities, cooperative, and federal agencies that are given priority to federal

[1] In the following, I do not distinguish between the 2002-2006 period and the period January 2007 to May 2007 for the purpose of discussing the implementation of the NWPA and the overcharging of BPA's Preference Customers.

power under the Bonneville Project Act.[2] Non-preference customers consist of all others including investor-owned utilities ("IOUs") in the Pacific Northwest. One purpose of this proceeding is to determine how the Preference Customers should be compensated for the damages arising from their overpayments during the 2002 to Mid-2007 period. I have been informed that BPA continued to overcharge Preference Customers until mid-2007, but ceased to distribute the funds collected after the May 2007 opinions by the Ninth Circuit. With respect to the funds collected during fiscal 2007-08, BPA has proposed to return the amount to Preference Customers as payments during 2008 or 2009.[3]

The scope of my testimony does not include the calculation of the amount of the overpayment each year by the Preference Customers. I have been asked by counsel for APAC to opine on the relevant pre-judgment interest rate necessary to restate those overpayments to May 2007 and to estimate the appropriate carrying charge on the unpaid balances during the relevant re-payment period. Finally, I have been asked to discuss whether the Preference Customers can expect to be fully compensated for the damages incurred (as estimated by Mr. Lincoln Wolverton) under the BPA repayment proposal. In parts of this testimony, I rely on testimony presented by Mr. Lincoln Wolverton ("Wolverton") or on information provided to me by Mr. Wolverton. Specifically, I refer to Mr. Wolverton for information regarding the operations of BPA and the specifics of the rate case. I have not made an independent assessment of these facts. For this proceeding I take a position only on the appropriate carrying charge and whether the Preference Customers, given the damage amount and an appropriate carrying charge, can expect to be fully compensated for damages incurred. My testimony makes it clear when I rely on findings or facts provided to me.

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[2] Portland General Electric v. Bonneville Power, No. 01-70041, BPA No. Power Act Opinion, May 3, 2007 ("Portland Opinion") at 4839. This includes the petitioners in matter at hand for the Portland Opinion.

[3] Testimony of Raymond D. Bliven, Charles W. Forman, Jr., and Elizabeth A. Evans, witnesses for Bonneville Power Administration, WP-07-E-BPA-52 p. 24.

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Q. Mr. Wolverton, what is the scope of your participation in this testimony?

A. I have provided Dr. Villadsen with the underlying history and facts of this case and particularly of the BPA proposal in this supplemental case. I have relied on Dr. Villadsen's analysis of the risks and uncertainties of the BPA proposal and have used those in developing my analysis and the conclusions we jointly make on the proposal.

Q. Dr. Villadsen, how is the remainder of your testimony organized?

A. My testimony is organized as follows. First, I discuss the determination of the pre-judgment interest for each year during the period of overpayment by the Preference Customers. Second, I discuss the nature of the cash flows that are expected to be made available to Preference Customers to repay the damages under BPA's proposal. The appropriate carrying charge for those cash flows is a function of the risk of those cash flows. In particular, the higher the risk of the stream of payments to Preference Customers, the higher will be the required carrying charge. Third, I discuss whether the Preference Customers, under BPA's proposal, can expect to be compensated fully for the damages incurred (per the Ninth Circuit's Opinions**)** under BPA's incorrect interpretation of the provisions of the NWPA. In this section, I also discuss the intergenerational issues associated with the likelihood that the re-payment period will be long, perhaps 20 years.[4] Specifically, the longer the re-payment period, the more likely it becomes that the customers who originally overpaid for power will differ from the customers who will be in place to benefit from the payment of damages per BPA's proposal.

[4] See WP-07-E-BPA-52, p. 22.

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II. PRE-JUDGMENT INTEREST TO MAY 3, 2007

Q. Please summarize the issues relevant to the determination of pre-judgment interest.

A. Beginning in 2002, BPA implemented the REP pursuant to settlements entered into with six investor owned utilities ("IOUs") in the Northwest. On May 3, 2007 the Ninth Circuit[5] determined that this implementation of the REP was contrary to the NWPA.

Q. What principles should guide the determination of pre-judgment interest?

A. The pre-judgment interest rate should be consistent with the inherent risk in the underlying cash flows. Prior to the May 3, 2007 opinions of the Ninth Circuit Court of Appeals, the fact that BPA had misinterpreted the NWPA had not been determined. However, the function of the carrying charge is to bring forth to May 2007 the estimated damages using an interest rate that is consistent with the risks in the underlying cash flows. Whatever the dispute may be about the amount of the overcharge, once the amount of annual damages is established the annual cash flows are known and the relevant pre-judgment interest rate should be consistent with the rate on a government-issued security. As noted by professors Ross, Westerfield and Jaffe:

> The discount rate of a project should be the expected return on a financial asset of comparable risk.[6]

Q. How do you suggest that BPA should implement this notion?

A. While no perfect discount rate exists, it is common to substitute the yield on government securities for the discount rate in circumstances where the inherent risk in the cash flows is very low. Once annual damages have been determined, the cash

[5] Portland General Electric v. Bonneville Power, No. 01-70041, BPA No. Power Act Opinion, May 3, 2007.

[6] Stephen A. Ross, Randolph W. Westerfield, and Jeffrey Jaffe, Corporate Finance, 6'th edition, ("Ross, Westerfield & Jaffe 2002") p. 308. See also, Richard A. Brealey, Stewart C. Myers and Franklin Allen, Principles of Corporate Finance, 8'th edition, 2006 ("Brealey, Myers & Allen 2006"), pp. 228-229.

flow amount has little inherent risk, and converting the as-incurred value to a current value requires a low-risk rate of return. A common measure of return on low risk investment is the return on government debt which is considered very low risk.[7,8] I recommend that the appropriate prejudgment interest rate on the estimated damages due the Preference Customers be an interest rate corresponding to the yield on government securities until May 3, 2007 which is the time that a decision was made regarding BPA's unlawful implementation of the NWPA.

Q. Is this low-risk rate of return designed to reflect the opportunity cost to Preference Customers and their retail customers?

A. No. The recommended rate of return reflects the risk inherent in the cash flows. The judgment date of May 2007 reflects the transition point between what is used for the accumulation of damages and what is used after the judgment.

Q. What were the prevailing interest rates on Government securities?

A. The yield-to-maturity (or return) on government securities vary from day to day as well as by time to maturity, but data are available from the Federal Reserve or commercial data providers. Summary data are presented in Table No. BV-13 in Appendix A.[9] For example, over the period from January 2002 to May 2007, the average annual yield to maturity on government securities was 2.5% on 30-day T-bills, 2.6% on 3-month T-bills, 2.9% on 1-year T-bonds, and 3.9% on 5-year T-bonds.[10] However, during the period 2002 to May 2007, rates on short-term government securities fluctuated substantially, and the period was characterized by numerous monetary policy initiatives from the Federal Reserve designed in part to help the U.S. economy recover from the events of September 11, 2001. Therefore, picking a single rate as the "best" rate to use to bring estimated damages forward to

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7 See, for example, Zvi Bodie, Alex Kane, and Alan J. Marcus, *Investments*, Sixth Edition, 2005, ("Bodie, Kane & Marcus 2005") pp. 144-147.

8 The interest rate associated with cash flows that are certain are often referred to as the so-called risk-free rate.

9 All tables labeled BV-number are attached in Appendix A.

10 Monthly yields and annual averages are displayed in Table No. BV-13.

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May 2007 is not straightforward. In my judgment, the best estimate of the pre-judgment interest rate is the yield on 3-month T-bills. The historical yield year-by-year on 3-month T-bills are displayed below in Table 1.

Table 1: Average Annual Yield on 3-Month Government T-Bills

	3-Month Yield
FY 2002	1.78
FY2003	1.14
FY2004	1.12
FY2005	2.75
FY2006	4.57
FY2007	4.86
FY2008 to date	2.78

Source: Bloomberg.

Because BPA has a fiscal year that runs October through September and damages occurred on a month-by-month basis, the average rate during the fiscal year is the best match for the damage incurred during that fiscal year. For damages incurred between May 2007 and September 30, 2007, I also recommend using the yield on the 3-month T-bill. For the period, October 2007 through September 2008, I would recommend the average yield on the 3-month T-bills during that period which can be calculated in early October 2008. The average yield on 3-month T-bills for the period October 2007 to March 2008 was 2.78%. This is a reasonable holding point for the carrying charge until the average yield for fiscal 2008 is known.

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III. CARRYING CHARGE DURING THE RE-PAYMENT PERIOD

Q. What topics do you cover in this section?

A. Having determined the total amount of the re-payment obligation including the appropriate pre-judgment interest, this section determines a lower bound for the carrying charge on the unpaid balance during the re-payment. Section III.A discusses BPA's proposal for repayment of amounts overcharged Preference Customers for the 2002 to mid-2007 period and the implications for the carrying charge. In Section III.B, I estimate the cost of equity for a sample of integrated electric utilities as a benchmark on the lower bound for the carrying charge. Finally, Section III.C draws conclusions regarding the appropriate carrying charge.

A. THE CHARACTERISTICS OF THE PROPOSED PAYMENT STREAM

Q. Please summarize BPA's proposal.

A. BPA has proposed to repay over a number of years the estimated damages owed to Preference Customers resulting from the implementation of the REP Settlement Agreement which was "contrary to NWPA" for the period FY2002-Mid 2007. Specifically, BPA proposes to pay to Preference Customers each year an amount that is the net of the annual Residential Exchange Program ("REP") payments, that would be made to the IOUs as calculated in accordance with the NWPA and a fixed target number ($210 million in FY2009). In other words, the Preference Customers would receive a variable amount of annual compensation after BPA makes its annual interest payments to the Government, covers all of its other costs, and after the IOUs receive the targeted $210 million per year in REP benefits.[11] For amounts collected from Preference Customers during fiscal years 2007-08, BPA proposes to refund the amount as payment in 2008 or 2009.[12]

[11] Testimony of Kenneth J. Marks, Raymond D. Bliven, Rodney A. Boling, Paul A. Brodie, Elizabeth A. Evans, and Charles W. Forman, Jr. on behalf of Bonneville Power Administration; WP-07-E-BPA-62, pp. 18-20.

[12] See WP-07-E-BPA-52, p. 24.

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Q. What is the economic nature of the proposal regarding the repayment of the damages incurred in fiscal 2007-08?

A. Because amounts collected during fiscal 2007-08 under the proposal may be refunded as payments in 2008 or 2009, the inherent risks in the cash flow that is expected to accrue to Preference Customers is low. Further, BPA has already established in contract a carrying charge for those payments.[13] Therefore, I need not make a recommendation for the over-collections made during the second half of FY2007 and FY2008.

Q. What is the economic nature of the proposal regarding the repayment of the damages incurred in 2002-2006?

A. BPA's proposal relegates the repayment amounts due to the Preference Customers for 2002-2006 to the status of a residual claim. Under BPA's proposal, which is a prospective rate-setting, the Preference Customers only receive payment after all of BPA's other costs have been covered (including interest) and after the allocation of a preset amount of REP benefits to the relevant IOUs. Mr. Wolverton has informed me that under BPA's proposal there may be years in which no or very small payments would be made to the Preference Customers to satisfy their claims depending on the outcome of the §7(b)(2) rate test, annual ASC filings in the future and the level of the BPA rate itself.[14] In other words, the Preference Customers would only receive a payment if the amount of REP benefit owing to the IOUs exceeds the target amount annually.[15] Such a residual claimant's position is usually held by equity holders and requires an equity-type return.

[13] See WP-07-E-BPA-62, p. 25.
[14] See the Direct Testimony of Mr. Wolverton.
[15] I base my analysis on the assumption that BPA continues to maintain its target $210 million amount into the future. In fact, the target amount could increase or decrease in future proceedings; it is not set permanently. Mr. Wolverton informs me that a settlement between IOUs and some Preference Customers anticipated continuation of a target between $200 million and $220 million for approximately 20 years. This settlement is referenced in WP-07-E-BPA-63, page 18-19.

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Q. Please explain why the Preference Customers are more like equity holders than debt holders.

A. The proposed payments to Preference Customers are not fixed payments with a specified termination date as is the case with a debt obligation. Under BPA's proposal Preference Customers only receive compensation when all other costs, interest payments to the Government, and a preset target residential exchange amount ($210 million proposed for FY2009) have been allocated to IOUs. As structured in BPA's proposal, the payments are not debt-like and are riskier than BPA's debt obligations. Their characteristics are like equity payments rather than debt payments.[16]

Q. Are there any other important characteristics of the cash flow that is expected to accrue to Preference Customers under BPA's proposal?

A. I have been asked to assume that the size of the payments due the Preference Customers relative to the $210 million due to IOUs annually is such that the money available to repay the Preference Customers could be zero in some years. This represents an extraordinarily risky investment with a correspondingly high cost of capital. In other words, the appropriate carrying charge is high.

Q. What are the implications for the carrying charge during the re-payment period?

A. The appropriate carrying charge must reflect the risk of the payments to the Preference Customers for them to be fully compensated for damages incurred. As noted above, these payments have the characteristics of being residual claims and thus require an equity-type return, but the difficulty here is determining the appropriate equity-like return in this situation. BPA is a U.S. Government agency with no traded equity, so estimating the appropriate equity return will require selecting some benchmarks against which to evaluate the appropriate carrying charge under BPA's proposal. The interest on BPA's debt to the Treasury is not an

[16] See, for example, Bodie, Kane & Marcus 2005, p. 47 for a characterization of equity and pp. 448-453 for a characterization of debt instruments.

appropriate carrying charge, as it does not measure the risk of BPA's payments to the Preference Customers. Instead, it is the carrying charge on a debt-like security.

Q. What benchmark do you use to determine the numerical value of the carrying charge given the risk of the proposed repayment cash flows?

A. To assess the lower bound on the carrying charge I looked to the cost of equity for an average integrated electric utility. BPA, like many integrated electric utilities, operates power plants, transmission lines and associated facilities. However, BPA is a nearly unique entity so there is no perfect sample of companies with publicly traded equity to use to estimate the appropriate carrying charge of equity-like claims. One benchmark, however, for the inherent risk in the cash flow generated by BPA's operations is that of integrated electric utilities. These companies invest in assets of similar risk as those of BPA. I therefore chose a sample of integrated electric utilities and estimated their costs of equity. Although integrated electric utilities are not a perfect match for the risk of the repayment cash flows of BPA, there is no perfect sample. The sample of integrated electric utilities provides a benchmark on the lower bound of the numerical value of the carrying charge.

Q. Why do you say that the estimated return on equity for a sample of integrated electric utilities is a lower bound on the required carrying charge on the amounts overcharged Preference Customers under BPA's proposal?

A. Standard regulatory practice in the U.S. is that the allowed rate of return on the equity financed portion of a utility's rate base becomes part of the revenue requirement for the utility. Under fair regulation the utility will expect to earn its allowed rate of return on average. Sometimes it will earn a bit more and sometime a bit less, but on average it will expect to earn its allowed rate of return. In contrast, the funds available for payment of an REP benefit to IOUs, are the result of a series of tests, the outcome of which are dependent on a myriad of factors, including choices made by BPA and the resolution of certain issues through litigation. In fact, there may be little or no money available for the payment of REP benefits in a particular year. The

result is that the expected cash flows available for repayment of the Preference Customers' damages are riskier than the equity returns for an integrated electric utility. In addition, the estimated equity return for integrated electric utilities implicitly measures the required return on a voluntary transaction. Shareholders do not need to buy stock in integrated electric utilities but elect to do so if the risk and return match their preferences. Under BPA's proposal Preference Customers would involuntarily take a position as residual claimants. It is for this reason that I believe the estimated return for the sample of integrated electric utilities is the lower bound of the applicable carrying charge under BPA's current proposal.

B. THE COST OF EQUITY FOR INTEGRATED ELECTRIC UTILITIES

Q. What is the purpose of this section?

A. I estimate the cost of equity for a sample of integrated electric utilities using several different estimation techniques. I use the cost of equity for a prototypical integrated electric utility as a lower bound benchmark for the appropriate return to residual claimants of cash flows from BPA.

Q. Why do you believe that the cost of equity for integrated electric utilities is an appropriate lower bound benchmark for the carrying charge during the re-payment period?

A. First, as noted above, the Preference Customers have the characteristics of residual claimants (equity holders) under BPA's proposal to repay estimated damages. Hence an equity-like return is appropriate. Second, BPA markets energy from what is called the Federal Base System (principally hydro plants and one nuclear facility) and funds and maintains transmission systems, thus facing many of the same risks as do integrated electric utilities.[17] Obviously, many integrated electric utilities operate

[17] The two main differences between BPA's and integrated electric utilities' operating risks are that BPA unlike most integrated electric utilities does not undertake electric distribution and BPA's role is only to market the power that is produced by hydro facilities owned and operated by the U.S. Corps of Engineers and Bureau of Reclamation and by a single nuclear plant owned by Energy Northwest, while many integrated electric utilities operate a mixture of coal, gas, and other power generating plants.

distribution networks in addition to power plants and many have unregulated power generation and energy marketing operations. However, BPA operates in the same market as do power generators selling power to electric distribution entities and others that have many of the same assets as do integrated electric utilities. Therefore, I believe that there is unlikely to be a sample of companies with more comparable activities and risks than integrated electric utilities. Because the relevant carrying charge is one that is consistent with the inherent risks in the cash flows at risk, the equity returns required by shareholders (residual claimants) of integrated electric utilities constitute a good lower bound benchmark against which to evaluate the carrying charge. Because I evaluate the risks inherent in the cash flows to pay damages to the Preference Customers as higher than those of a generic integrated electric utility, I used the capital structure of generic *Value Line* utility to determine the lower bound. Similarly, I relied on the average bond rating.[18] It is important to note that shareholders elect to invest in electric utilities' stock and thus to become residual claimants in those entities; ***i.e.,*** it is a voluntary activity. Under BPA's proposal, the Preference Customers are involuntarily put in the position of residual claimants.

Q. Please explain your approach to estimating the cost of equity for integrated electric utilities.

A. To select my sample of integrated electric utilities, I start with those companies that are listed as electric utilities in *Value Line Investment Survey*.[19] I eliminate all electric utilities that do not have an investment grade bond rating, utilities with annual revenues below $300 million, and those with recent dividend cuts. Additionally, I require that the companies are categorized as Regulated or Mostly Regulated by

[18] The average electric utility carries a BBB rating according to *Edison Electric Institute*, "Credit Ratings, Q4 2007 Financial Update." BPA carries a better credit rating than most electric utilities but has less equity-like capital than do most electric utilities. See, for example, Fitch Ratings, Energy Northwest (Bonneville Power Administration), March 16, 2007; Moody's Investor Service, Energy Northwest, Bonneville Power Administration, March 9, 2007; Standard & Poor's, Energy Northwest, March 16, 2007.

[19] *Value Line Investment Survey*, Standard Edition, as of March 18, 2008.

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Edison Electric Institute[20] and as Integrated by Standard & Poor's.[21] Finally, I eliminate utilities who have engaged in merger or acquisitions in excess of 30% of their market capitalization within the last five years. This process left me with a sample of 10 electric utilities.

Q. Please explain the methods and procedures you rely on to estimate the cost of capital for the sample of integrated electric utilities.

A. The cost of capital is the expected rate of return in capital markets on alternative investments of equivalent risk. This definition leads me to address three key points in my estimation procedures. First, the cost of capital is an expected rate of return, it cannot be directly observed, but must be inferred from available evidence. Second, the cost of capital is determined in capital markets (such as the New York Stock Exchange). Therefore, capital market data provide the best evidence from which to draw inferences. Third, the cost of capital depends on the return offered by alternative investments of equivalent risk. Consequently, measures of risk that matter in capital markets are part of the evidence that I need to examine. It is a fundamental concept in finance that there is a tradeoff between risk and return so that more risky investments require higher return. This relationship is depicted in Figure 1 below.

[20] Regulated electric utilities have 80% or more of their assets subject to regulation while mostly regulated electric utilities have 50-79% of their assets subject to regulation. See, *Edison Electric Institute*, Stock Performance_Q4_2007_Data from www.eei.org.

[21] See *Standard & Poor's*, U.S. Utilities And Power Companies, Strongest To Weakest, June 22, 2007.

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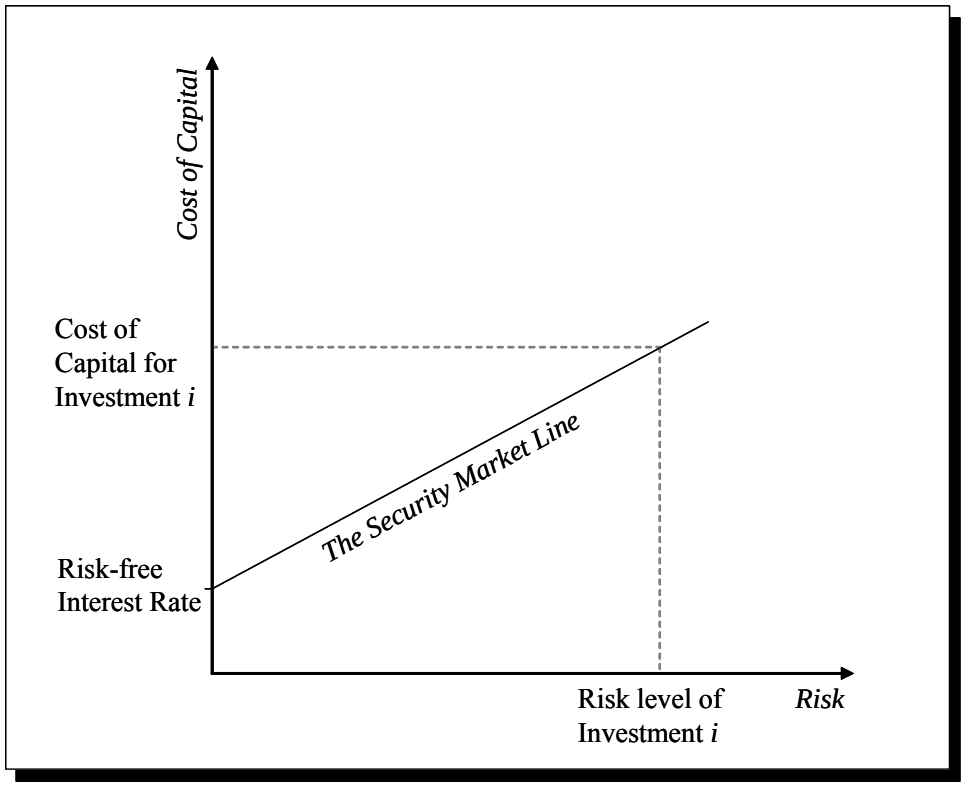
Figure 1: The Security Market Line



Q. How do you determine the cost of equity for integrated electric utilities?

A. I apply standard cost of capital estimation techniques and data to determine the overall cost of capital for each sample company. I then convert this figure into a cost of equity estimate for an average integrated utility with an average capital structure and an average bond rating. The details of these procedures are described in Appendix A.

C. APPROPRIATE CARRYING CHARGE

Q. Based on the discussion above, how do you determine the appropriate carrying charge?

A. Based on the discussion in *Section III.A* above, I find that an appropriate carrying charge must be consistent with the risks inherent in the proposed payments to the Preference Customers. Under BPA's proposal, the estimated damages for fiscal

2007-2008 are to be refunded as payments in 2008 or 2009. Therefore, once the damage amount has been decided, the appropriate carrying charge is similar to the rate on government debt as discussed above. A reasonable interest until the date of payment is the yield on 3-month T-bills. The average rate for 2007 and 2008 year to date was provided above. However, under BPA's proposal for payment of damages for amounts collected during the 2002-Mid 2007 period, the Preference Customers are placed in the position of being residual claimants. Therefore, the appropriate carrying charge should reflect an equity-type return. As discussed in *Sections III.A* and *III.B*, BPA operational activities are quite similar to those of integrated electric utilities. Therefore, I estimated the cost of equity for integrated electric utilities in *Section III.B*. The estimated cost of equity for a sample of integrated electric utilities fell in the range of 11¼ to 11¾ percent. In my opinion, the risk of the cash flows under BPA's proposal requires a carrying charge no less than the required equity return on an average integrated electric utility.

Q. Assume that the BPA proposal for repayment of over-collection from Preference Customers during FY2002-Mid 2007 is changed so that the Preference Customers receive compensation for damages ahead of payments for the residential exchange program. Under those circumstances what happens to the carrying rate?

A. Under those circumstances, the Preference Customers claims are moved up in priority and the risks inherent in the cash flows that is expected to accrue to Preference Customers is reduced. In this scenario, the Preference Customers will receive payment after BPA has paid all its costs and after interest payments on borrowed funds. *I.e.,* the cash flows are behind debt in priority but they are no longer the residual claim after REP payments. Therefore, the carrying charge is clearly higher than the cost of debt but lower than under the BPA proposal.

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Q. Can you provide some guidance on the magnitude of the carrying charge under the circumstances described above?

A. While it is difficult to determine an appropriate carrying charge with a high degree of accuracy, there are benchmarks that can be used. Because the Preference Customers' damage claims are behind debt in priority, the carrying charge has to reflect the higher risk.[22] As a benchmark, the average integrated electric utility currently has an After-Tax Weighted-Average Cost of Capital of 7¼ to 7¾%.[23] This is the weighted cost of debt and equity. The weighted cost of debt and equity is lower than the appropriate carrying charge due to Preference Customers in these revised circumstances because the amount due Preference Customers is treated like priority claims on the residual after all costs (including interest). *I.e.*, the claim still has the status of being an equity-like obligation although its priority has been moved up.

IV. EFFECTIVENESS OF BPA'S REPAYMENT PROPOSAL FOR 2002-MID 2007 DAMAGES

Q. What topic do you cover in this section?

A. This section addresses the issue of how to measure the likely effectiveness of BPA's proposal in compensating the Preference Customers for their overpayments during FY2002-Mid 2007 when payments to the IOUs ceased in response to the ruling by the Ninth Circuit. First, I discuss metrics on how the effectiveness of the proposal can be judged. By effectiveness, I mean whether the Preference Customers can reasonably expect to be compensated fully for their damages in a reasonable period of time. Second, I discuss the expected cash flows resulting from the proposal. The discussion relies on Mr. Wolverton's testimony regarding factors that will ultimately determine the cash flows and the timing hereof. Finally, I discuss whether the Preference Customers can expect to be compensated fully for their estimated damages under BPA's proposal.

[22] Note that BPA expects a borrowing rate of 5.95 to 6.50% for 2008 to 2035 (WP-07-E-BPA-46A p. 86) while the current yield on utility bonds is 6.3 to 6.5% (Workpaper #1 to Table No. BV-11).

[23] See Table No. BV-11.

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A. METRICS BY WHICH TO JUDGE THE EFFECTIVENESS OF THE PROPOSAL

Q. What should be the goal of the repayment proposal?

A. One goal of any proposal to repay the Preference Customers for the amount that they were overcharged should be to restore the entities who bore the burden of the overcharges (*i.e.*, the residential, commercial, agricultural and industrial customers who took service from BPA's Preference Customers) to the position that they would have had absent the payments to the IOUs that were made "contrary to the NWPA,"[24] per the Ninth Circuit's decision. In reality, it is probably impossible to fully match repayments exactly to those entities which bore the burden of overpayments because some of those entities that may have overpaid may no longer be taking service from the Preference Customers. Possibly they moved or closed their businesses and some individuals may have died. However, that is not a reason to abandon this goal. Achieving this goal as closely as possible would require a repayment period as short as possible subject to other important constraints. Everything else being equal, the ideal would be an immediate lump-sum repayment of the full amount of the Preference Customers' overpayment including pre-judgment interest. As discussed above, the Preference Customers are due a rate of prejudgment interest equal to the return or yield on U.S. government securities. Using a prejudgment interest rate equal to the rate of inflation as proposed by BPA in Exhibit WP-07-E-BPA-62, page 9 does not compensate the Preference Customers for the loss of the use of the money that they overpaid.

Q. If immediate repayment is not possible, what are the other characteristics of an effective repayment proposal?

A. If an immediate payment is not practical, there are two other issues that must be addressed. The first is that the carrying charge on the unpaid balance of the damages must reflect the risk of the repayment cash flows, and the second is the length of the repayment period.

[24] Portland Opinion at 4838.

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Q. Please discuss why the carrying charge is important.

A. The Ninth Circuit has determined that the Preference Customers were overcharged and, as a result, are due compensation. Full compensation requires that the carrying charge reflect the time value of money and the risk of the repayment cash flows. If the carrying charge is too low, the present value of the repayments will be less than the present value of the damages. The following simple example illustrates the concept.

Illustrative Example:

Assume that that a company has taken out a 5-year loan of $100. Interest accrues at 11% per year. Principal and interest is paid annually at the end of the year, but only if cash flow is available for payment. Thus, only if cash flow exceeds $20 plus the interest ($11 in year 1 for a total of $31 due in year 1), is the creditor paid in full. Table 2 below provides an illustrative example that shows that at the end of the loan period (year 5) $40 is still outstanding.

Table 2: Example of Contingent Repayment of Loan

	Cash Flow Available for Repayment During Year	Outstanding Loan, end of Year	Interest on Loan During Year	Amount Repaid, end of Year
Year 0		$100		
Year 1	$20	$91	$11	$20
Year 2	$25	$76	$10	$25
Year 3	$28	$56	$8	$28
Year 4	$13	$50	$6	$13
Year 5	$15	$40	$5	$15

Q. If the carrying charge is correctly estimated, why is the timing of the repayment important?

A. As a general rule, the longer the repayment period, the greater will be the mismatch between the customers who overpaid and the customers who receive compensation.

Obviously, a long repayment period means that not all of the customers who were damaged can be restored to the situation as if they had not been overcharged.

Q. BPA's proposal for the repayment of the over-payments made by the Preference Customers during the 2002-mid 2007 period could result in a repayment period of 20 years.[25] Is this a reasonable repayment period in your judgment?

A. No. A repayment period of as much as 20 years will result is a substantial mismatch between the customers who bore the burden of the overcharge and customers ultimately receiving the repayment. Economics does not provide a definitive answer of how long a repayment period is reasonable in a situation like this, but one possible benchmark might be a period no longer than the period of overpayment. Of course, insuring that the customers damaged by the overpayments are fully compensated requires that the carrying charge on the unpaid balances reflect the risk of the cash flows to be received. But, even if the carrying charge is appropriate, the longer the repayment period, the bigger the mismatch between the customers who bore the burden of overpayment and the entities that ultimately benefit from the repayment. In other words, the longer the expected repayment period, the more some of the Preference Customers will not have the opportunity to receive compensation for the overpayment simply because they are no longer part of the pool of entities who take service from Preference Customers. This is of course also dependent on the contractual arrangements between utilities and individual customers.

B. Expected Cash Flows

Q. Does BPA's proposal to repay the overcharges guarantee full repayment of the amount of these damages in all circumstances?

A. No. I understand that BPA's proposal only envisions annual repayments when the REP benefit due to the IOUs exceeds $210 million, and that figure is only a proposal

[25] See, WP-07-E-BPA-52 p. 22.

valid for FY2009. No payment would be made if the REP benefit due to the IOUs were less than $210 million or a future targeted value. [26]

Q. How likely is it that the IOUs' REP payments will not exceed $210 million?

A. The size of the expected payments due the IOUs from the REP program depends upon the interpretation of the various provisions of the NWPA. The interpretation may depend upon future court decisions, but I understand from Mr. Wolverton that three outcomes are possible:

1. The law is interpreted so that there is effectively nothing due the IOUs for the REP program because the Rate Ceiling Test (Section 7(b)(2) of the NWPA) results in no payments being due.

2. There could be a narrowing in the difference between the ASCs and the BPA rate due to rises in the BPA rate or reductions in the ASCs or both. The ASCs are anticipated to be filed annually.

3. There could be future decisions by the BPA Administrator to change the underlying methodologies that underlie the residential exchange and the rate test. The result could be a substantial increase or decrease in the available REP benefits due the IOUs.

As I understand the current status, the 2007 rates have not been approved by FERC and current rate proceedings will only set rates for FY2009. Therefore, going forward, new rate proceedings and potential litigation will decide the exact outcome of the Rate Ceiling Test. In other words, even if a specific proposal is accepted by all parties today, the cash flows available for repayment may be affected by future rate proceedings as well as by planning issues (e.g., the availability of water for hydro generation) and market prices for power. It is because of this uncertainty that I am

[26] See, WP-07-E-BPA-62, pp. 19-20.

unable to determine precisely the likelihood that the Preference Customers would be fully compensated for their damages.

Q. What is the effect of the uncertainty regarding the amount of money due to the IOUs on the expected compensation for the Preference Customers?

A. If the first situation were to arise, the Preference Customers would not expect to be repaid under the BPA's current proposal because there would be no source of money for repayment. Under the second situation, which is essentially a continuation of the current REP interpretation, the Preference Customers may still not be fully compensated because the amount of money available to repay may not be of sufficient size to amortize the unpaid balance. Alternatively, there could be substantially greater amounts due to the IOUs, the Preference Customers may expect to be compensated fully depending on whether the increase in expected REP benefits would be sufficient to amortize the damages after payment of the $210 million to the IOUs. Finally, a future Administrator may propose a change in the rules—that is, a new ASC methodology, a new §7(b)(2) rate test implementation methodology, and a new §7(b)(2) legal interpretation—with totally uncertain outcome.

Q. Why do you say that the Preference Customers would not expect to be fully compensated under the current interpretation of the law?

A. The amount of the damages owing the Preference Customers has not been definitively determined. The damages may be determined to be greater than BPA estimates, and the appropriate carrying charge on the unpaid balances are certainly higher than BPA suggests. Therefore, the amount of money available under the current BPA proposal may not be sufficient to pay the appropriate carrying charge and amortize the unpaid balance. For example, if an amount of about $100 million is owed and the interest rate is 11.5%, then available cash flows need to be well above $10 million per year for the amount to be fully repaid with interest over a 20 year period.

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Q. What are your conclusions from this section?

A. BPA's current proposal for compensating the Preference Customers may be inadequate for several reasons. First, there may not be enough money to repay the damages due the Preference Customers because of the interaction of a number of factors. The proposal is highly risky to the Preference Customers because it assigns them the residual claimants' role so the carrying charge is correspondingly high. Second, the size of the damages may be substantially larger than estimated by BPA and third, the funds available for repayment may be substantially smaller.[27] In the damage awards I have reviewed, the payment of damages was not relegated to the position of a residual claim. Instead, they were generally treated as obligations equivalent to debt. In this regard, BPA's proposal is unusual.

C. Conclusion on the Effectiveness of the Proposed Repayment Plan

Q. **What is your conclusion on the likely effectiveness of BPA's proposal to repay the damages owed the Preference Customers?**

A. In my judgment there is a substantial probability that the Preference Customers would not be fully compensated for their damages under BPA's current proposal. As noted above, there may not be sufficient cash flow available under the proposal to amortize the damages over any reasonable period of time. Moreover, even if there were sufficient cash flows eventually to pay off the obligation, the length of time may be so long that effectively some of the customers who were damaged are denied recovery because they will no longer be customers of BPA for a variety of reasons.

[27] BPA witnesses acknowledge that actual amounts REP amount will differ from those forecast. See, WP-07-E-BPA-62 p. 20.

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APPENDIX A: COST OF CAPITAL ESTIMATION FOR INTEGRATED ELECTRIC UTILITY SAMPLE

Q. What is the purpose of this appendix?

A. The appendix explains the methods and data relied upon to estimate the cost of equity for an average integrated electric utility. Section B.I discusses the estimation methods relied upon to estimate the cost of equity for the sample companies. Section B.II discusses how the individual cost of equity estimates are combined to obtain a cost of capital estimate for a generic integrated electric utility. Section B.III summarizes the cost of capital and cost of equity estimates that I obtain. Finally, Section B.IV contains tables and other supporting materials of more technical nature.

B.I ESTIMATION METHODS

Q. Which methods do you rely on to estimate the cost of equity for integrated electric utilities?

A. To assess the cost of capital for integrated electric utilities, I estimate the market cost of equity for each sample company using two approaches. First, I rely on varieties of the so-called "equity risk premium approach" and second, I use two versions of the Discounted Cash Flow ("DCF") method.

a. The Risk-Positioning Method

Q. Please explain the risk positioning method.

A. The risk positioning method estimates the cost of equity as the sum of a current interest rate and a risk premium. It is therefore sometimes also known as the "risk premium" approach. This approach may sometimes be applied more or less formally. As an example of an informal application, an analyst may estimate the spread between interest rates and what is believed to be a reasonable estimate of the cost of capital at a specific time, and then apply that spread to current interest rates to get a current estimate of the cost of capital. More formal applications of the risk positioning approach take full advantage of the security market line depicted in Figure 1 of the main testimony and use information on a large number of traded

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securities to identify the security market line and derive the cost of capital for the individual security based on that security's relative risk. This reliance on the entire security market line makes the method less vulnerable to the kinds of problems that arise from using one stock at a time (such as the DCF method). The risk positioning approach is widely used and underlies much of the current research published in academic journals on the nature, determinants and magnitude of the cost of capital. The most commonly used version of the formal risk positioning models is the Capital Asset Pricing Model ("CAPM"). The equation for the CAPM is:

$$k_s = r_f + \beta_s \times MRP \qquad \text{(B.1)}$$

Where k is the cost of capital, r_f is the risk-free rate, MRP is the market risk premium, and β is the measure of relative risk.

Q. How do you implement the cost of equity estimation process outlined above?

A. The first step is to specify the current values of the benchmarks that determine the security market line. The second is to determine the security's, or investment's, relative risk. The third is to specify exactly how the benchmarks combine to produce the security market line, so the company's cost of capital can be calculated based on its relative risk.

Q. What benchmarks are used to determine the location of the security market line?

A. The essential benchmarks that determine the security market line are the risk-free interest rate and the premium that a security of average risk commands over the risk-free rate. This premium is commonly referred to as the "market risk premium" ("MRP"), *i.e.*, the excess of the expected return on the average common stock over the risk-free interest rate. In the risk positioning approach, the risk-free interest rate and MRP are common to all securities. A security-specific measure of relative risk

(beta) is estimated separately and combined with the MRP to obtain the company-specific risk premium.

Q. What benchmark do you use for the MRP?

A. I measure the market risk premium as the risk premium of average-risk common stocks over long-term Government bonds. For reasons explained below I do not rely on the market risk premium of average-risk common stock over short-term Treasury bills in this proceeding.

Q. What are the issues in selecting the MRP?

A. There is currently little consensus on "best practice" for estimating the MRP. It is important, however, to understand that this is not the same as saying that all practices are equally good. For example, the latest edition of the leading graduate textbook in corporate finance, after recommending use of the arithmetic average realized excess return on the market for many years (which for a while was noticeably over 9 percent), now reviews the current state of the research and expresses the view that a range between 5 to 8 percent is reasonable for the U.S.[28] There are numerous articles that attempt to estimate the MRP and their conclusions vary widely.[29]

Q. How do you estimate the MRP?

A. Morningstar data from 1926 to 2006, the longest period reported, show an MRP average premium of stocks over Government bonds of 7.1 percent.[30] At the same time, Dimson, Marsh and Staunton 2008 estimates the arithmetic market risk

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[28] Richard A. Brealey, Stewart C. Myers, and Franklin Allen, *Principles of Corporate Finance*, McGraw-Hill, 8th edition, 2006, pp. 151-154.

[29] For examples, see Claus, J. and J. Thomas, (2001), "Equity Risk Premium as Low as Three Percent: Evidence from Analysts' Earnings Forecasts for Domestic and International Stocks," *Journal of Finance* 56:1629-1666; Ibbotson, R. and P. Chen (2003), "Stock Market Returns in the Long Run: Participating in the Real Economy," *Financial Analyst Journal*, 59(1):88-98; Ivo Welch (2000), "Views of Financial Economists on the Equity Premium and on Professional Controversies," *Journal of Business*, 73(4):501-537; Mehra, R., and E.C. Prescott (2003), "The Equity Premium in Retrospect," in *Handbook of the Economics of Finance*, Edited by G.M. Constantinides, M. Harris and R. Stulz, Elsevier B.V; and Morningstar, *Stocks, Bonds, Bills, and Inflation: Valuation Edition 2007 Yearbook* , pp. 96-98.

[30] Morningstar, *Stocks, Bonds, Bills, and Inflation: Valuation Edition 2007 Yearbook*, Appendix A.

premium for the U.S. over the 1900 to 2007 period at 6.5% over bonds.[31] Considering all the evidence, I conclude that S&P stocks of average risk today command a premium of 6.5% over the long-term Government rate.[32]

Q. How do you determine the risk-free rate you use?

A. Ideally, the risk-free rate is the estimated risk-free rate over the period where the discount rate will be in effect. For this proceeding, I use the current yield on long-term Government bonds as an estimate for the long-term risk-free rate. Using an average of 15 trading days ending March 17, 2008, I obtain a long-term risk-free rate of 4.45%.[33] I do not rely on the short-term risk free rate and associated market risk premium in this proceeding because the short-term risk-free rate currently is determined by the policy of the Federal Reserve and its reaction to the turmoil in financial markets rather than by market fundamentals. For example, the Federal Reserve on March 21, 2008 cut the Federal Funds rate by ¾ percent to 2¼ percent.[34] Also, on March 14, 2008 the Federal Reserve joined forces with JPMorgan to bail out the failing Bear Stearns bank.[35] These initiatives have undoubtedly affected credit markets and especially short-term government debt. For example, the 3-month T-bill yields has dropped approximately 200 basis points since early January 2008.[36]

Q. What measure of relative risk do you use?

A. I examine the "beta" of the stocks in question. Beta is a measure of the "systematic" risk of a stock — the extent to which a stock's value fluctuates more or less than average when the market fluctuates. The basic idea behind beta is that risks that cannot be diversified away in large portfolios matter more than those that can be

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[31] Dimson, Marsh and Staunton, Global Investment Returns Yearbook 2008, ABN-Amro, 2008, p. 48.

[32] The Surface Transportation Board ("STB") recently decided to rely on the Capital Asset Pricing Model ("CAPM") when determining the cost of capital for major railroads in the U.S. The STB decided to rely on the long-term market risk premium reported by Morningstar/Ibbotson in its implementation of the CAPM. See, Decision, *STB Ex Parte No. 664*, issued January 17, 2008, p. 8-9.

[33] See Table No. BV-9.

[34] *Federal Reserve*, Press Release, March 21, 2008.

[35] Craig Torres, Bernanke Discards Monetary History with Bear Stearns Bailout, *Bloomberg*, March 15, 2008. See also, *Business Week*, A Sweeter Bear Bid May Sour the Fed, March 24, 2008.

[36] Federal Reserve St. Louis. Available at http://research.stlouisfed.org/fred2/.

eliminated by diversification. Beta is a measure of the risks that cannot be eliminated by diversification.

Q. What does a particular value of beta mean?

A. By definition, a stock with a beta equal to 1.0 has average non-diversifiable risk: it goes up or down by 10 percent on average when the market goes up or down by 10 percent. Stocks with betas above 1.0 exaggerate the swings in the market: stocks with betas of 2.0 tend to fall 20 percent when the market falls 10 percent, for example. Stocks with betas below 1.0 are less volatile than the market. A stock with a beta of 0.5 will tend to rise 5 percent when the market rises 10 percent.

Q. How do you estimate beta?

A. I use beta estimates reported in the *Value Line* for the sample companies. The numerical values are provided in Workpaper 1 to Table No. BV-10.

Q. How do you combine the preceding steps to estimate the cost of equity?

A. The most widely used approach to combine a risk measure with the benchmark market risk premium on common stocks to find a risk premium for a particular firm or industry is the Capital Asset Pricing Model for which a formula was given in equation (1) above. However, the CAPM is only one risk positioning technique. In addition to the CAPM, I rely on an empirical variety of the model. Empirical research has long shown that the CAPM tends to overstate the actual sensitivity of the cost of capital to beta: low-beta stocks tend to have higher risk premia than predicted by the CAPM and high beta stocks tend to have lower risk premia than predicted. A number of variations on the original CAPM theory have been proposed to account for this finding. This finding can be used directly to estimate the cost of capital, using beta to measure relative risk, without simultaneously relying on the CAPM. Here I examine results from both the CAPM and a version of the security market line based on the empirical finding that risk premia are related to beta, but are not as sensitive to beta as the CAPM predicts, to convert the betas into a risk premium. I refer to this

latter model as the "ECAPM," where ECAPM stands for Empirical Capital Asset Pricing Model. The formula for the ECAPM is

$$k_s = r_f + \alpha + \beta_s \times (MRP - \alpha) \qquad \text{(B.2)}$$

where as before k is the cost of capital, r_f is the risk-free interest rate, *MRP* is the market risk premium, β is the measure of relative risk, and α. is the empirical adjustment factor.

Research supports values for α of from one to seven percent when using a short-term interest rate. I use baseline values of α of 0.5 percent for the long-term risk-free rate. I also conduct sensitivity tests for different values of α. For the long-term risk-free rate I use values for α of 0, 0.5 and 1.5 percent. See Table B-1 in Section B.IV for a summary of the empirical evidence on the size of the required adjustment.

Q. Why is it appropriate to use the ECAPM model?

A. Empirical tests of the CAPM have repeatedly shown that an investment's return is related to systematic risk, but that the increase in return for an increase in risk is less than is predicted. The empirical tests have also shown that the theoretical intercept, as measured by the return on Treasury bills, is too low to fit the data. In other words, the empirical tests indicate that the slope of the CAPM is too steep and the intercept is too low. The empirical data support the ECAPM. The ECAPM recognizes the consistent empirical observation that the CAPM underestimates (overestimates) the cost of capital for low (high) beta stocks. The ECAPM corrects the predictions of the CAPM to more closely match the results of the empirical tests. Ignoring the results of CAPM tests would lead to an estimate of the cost of capital that is likely to be less accurate than is possible.

Q. Is the use of the ECAPM equivalent to adjusting the estimated betas for the sample companies?

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A. No. Fundamentally, this is not an adjustment (increase) in beta. This can easily be seen by the fact that the expected return on high beta stocks is lower with the ECAPM than when estimated by the CAPM. The ECAPM model is a recognition that the actual slope of the risk-return tradeoff is flatter than predicted and the intercept higher based upon repeated empirical tests of the model.[37] Even if the beta of the sample companies were estimated accurately, the CAPM would still underestimate the required return for low beta stocks. Even if the ECAPM were used, the costs of equity would be underestimated if the betas were underestimated.

Q. What value of beta do you use in this proceeding?

A. I rely on *Value Line Investment Survey's* estimated beta for the companies in my sample of integrated electric utilities.[38]

Q. How do you use this information to estimate the cost of capital as indicated by the risk positioning method for the sample?

A. First, I estimate each sample company's cost of equity using its Value Line beta, the market risk premium and the current risk-free rate. This figure reflects the cost of equity estimate for the company at its current market value capital structure. Second, I combine this information with market information on the cost of debt and preferred stock to estimate each company's after-tax weighted-average cost of capital as discussed below.

b. Discounted Cash Flow Method

Q. Please describe the discounted cash flow approach.

[37] Many investment firms make an adjustment to the beta. A commonly used adjustment is the Merrill Lynch adjustment, which adjusts betas 1/3 toward one. This type of adjustment is intended to compensate for sampling errors in the beta estimation, not for the empirical fact that CAPM tends to overestimate the sensitivity of the cost of capital to beta.

[38] These values are provided in Workpaper #1 to Table No. BV-10. The estimated betas are as of February 8, February 29, and March 28, 2008 for companies in Western, Eastern, and Central part of the U.S., respectively.

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A. The DCF model takes the first approach to cost of capital estimation, *i.e.*, to attempt to estimate the cost of capital in one step. The method assumes that the market price of a stock is equal to the present value of the dividends that its owners expect to receive. This method also assumes that this present value can be calculated by the standard formula for the present value of a cash flow stream:

$$P = \frac{D_1}{(1+k)} + \frac{D_2}{(1+k)^2} + \frac{D_3}{(1+k)^3} + \cdots + \frac{D_T}{(1+k)^T} \qquad \text{(B.3)}$$

where "P" is the market price of the stock; "D_t" is the dividend cash flow expected at the end of period t (*i.e.*, subscript period 1, 2, 3 or T in the equation); "k" is the cost of capital; and "T" is the last period in which a dividend cash flow is to be received. The formula says that the stock price is equal to the sum of the expected future dividends, each discounted for the time and risk between now and the time the dividend is expected to be received.

Most DCF applications go even further, and make very strong (*i.e.*, unrealistic) assumptions that yield a simplification of the standard formula, which then can be rearranged to estimate the cost of capital. Specifically, if investors expect a dividend stream that will grow forever at a steady state, the market price of the stock will be given by a very simple formula,

$$P = \frac{D_1}{(k-g)} \qquad \text{(B.4)}$$

where "D_1" is the dividend expected at the end of the first period, "g" is the perpetual growth rate, and "P" and "k" are the market price and the cost of capital, as in Equation (B.3). Equation (B.5) is a simplified version of Equation (B.4) that can be solved to yield the well known "DCF formula" for the cost of capital:

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$$k = \frac{D_1}{P} + g \\ = \frac{D_0 \times (1+g)}{P} + g \qquad \text{(B.5)}$$

where "D" is the current dividend, which investors expect to increase at rate g by the end of the next period, and the other symbols are defined as before. Equation (B.5) says that if Equation (B.4) holds, the cost of capital equals the expected dividend yield plus the (perpetual) expected future growth rate of dividends. I refer to this as the simple DCF model. Of course, the "simple" model is simple because it relies on very strong, unrealistic, assumptions.

Q. Are there other versions of the DCF models besides the "simple" one?

A. Yes. There are many variations on the DCF models that may rely on less strong assumptions in that they allow growth rates to vary over time. I consider a variant of the DCF model that uses the companies' individual growth rates during the first five years, converges to a perpetual growth rate in years 6-10 and then uses the GDP growth rate as the perpetual growth rate after year 10 for all companies. This is a variant of the "multi-stage" DCF method. I rely on company-specific growth rates for the first 20 quarters (5 years) and on a linear convergence from company-specific growth rates to the economy-wide growth rate over quarters 21 to 40 (years 6 to 10). Following year 10, I rely on the GDP growth rate.

Q. What are the merits of the DCF approach?

A. The DCF approach is conceptually sound if its assumptions are met, but can run into difficulty in practice because those assumptions are so strong, and hence so unlikely to correspond to reality. Two conditions are well known to be necessary for the DCF approach to yield a reliable estimate of the cost of capital: (1) the variant of the present value formula that is used must actually match the variations in investor expectations for the dividend growth path; and (2) the growth rate(s) used in that formula must match current investor expectations. Less frequently noted conditions such as options may also create problems.

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Q. Do you agree that estimating the right growth rate is the most difficult aspect of implementation of the DCF approach?

A. Yes. Finding the right growth rate(s) is the usual "hard part" of a DCF application. The original approach to estimation of the growth rate, *g*, relied on average historical growth rates in observable variables, such as dividends or earnings, or on the "sustainable growth" approach, which estimates *g* as the average book rate of return times the fraction of earnings retained within the firm. But it is highly unlikely that these historical averages over periods with widely varying rates of inflation and costs of capital will equal current growth rate expectations. Moreover, the constant growth rate DCF model requires that dividends and earnings grow at the same rate for companies that earn their cost of capital on average.[39] It is inconsistent with the theory on which the model is based to have different growth rates in earnings and dividends over the period when growth is assumed to be constant. If the growth in dividends and earnings were expected to vary over some number of years before settling down into a constant growth period, then it would be appropriate to estimate a multistage DCF model. In the multistage model, earnings and dividends can grow at different rates, but must grow at the same rate in the final, constant growth rate period. A difference between forecasted dividend and earnings rates therefore is a signal that the facts do not fit the assumptions of the simple DCF model.

Q. How do you estimate the growth rates you use in your DCF analysis?

A. I use earnings growth rate forecasts from Bloomberg and Value Line. Analysts' forecasts are superior to using single variables in time series forecasts based upon

[39] Why must the two growth rates be equal in a steady-growth DCF model? Think of earnings as divided between reinvestment, which funds future growth, and dividends. If dividends grow faster than earnings, there is less investment and slower growth each year. Sooner or later dividends will equal earnings. At that point, growth is zero because nothing is being reinvested (dividends are constant). If dividends grow slower than earnings, each year a bigger fraction of earnings are reinvested. That makes for ever faster growth. Both scenarios contradict the steady-growth assumption. So if you observe a company with different expectations for dividend and earnings growth, you know the company's stock price and its dividend growth forecast are inconsistent with the assumptions of the steady-growth DCF model.

historical data as has been documented and confirmed extensively in academic research.[40]

Q. How well are the constant-growth rate conditions necessary for the reliable application of the DCF likely to be met for the sample of integrated electric utilities that you used in your analysis today?

A. The requisite conditions for the sample companies are not fully met at this time. Of particular concern for this proceeding is the uncertainty about what investors truly expect the long-run outlook for the sample companies to be. The longest time period available for growth rate forecasts of which I am aware is five years. The long-run growth rate (*i.e.*, the growth rate after the electric industry settles into a steady state, which may be beyond the next five years for this industry) drives the actual results one gets with the DCF model. Unfortunately, this implies that unless the company or industry in question is stable, so there is little doubt as to the growth rate investors expect, DCF results in practice can end up being driven by the subjective judgment of the analyst who performs the work.

Q. What steps do you take in your DCF analyses?

A. Given the above discussion of DCF principles, the steps are to collect the data and then to estimate each sample company's costs of equity at their current capital structure. I combine this information with market information on the cost of debt and preferred stock to estimate each company's after-tax weighted-average cost of capital.

Q. What growth rate information do you use?

[40] See, for example, Lawrence D. Brown and Michael S. Rozeff (1978), "The Superiority of Analyst Forecasts as Measures of Expectations: Evidence from Earnings," *Journal of Finance*, Vol. XXXIII, No. 1, pp. 1-16; R.S. Harris (1986), "Using Analysts' Growth Forecasts to Estimate Shareholder Required Rates of Return," *Financial Management*, Spring Issue, pp. 58-67; J. H. Vander Weide and W. T. Carleton (1988), "Investor Growth Expectations: Analysts vs. History," *Journal of Portfolio Management*, spring, pp. 78-82. T. Lys and S. Sohn (1990), "The Association Between Revisions of Financial Analysts Earnings Forecasts and Security Price Changes," *Journal of Accounting and Economics*, vol 13, pp. 341-363; L. K.C. Chan, J. Karceski, and J. Lakonishok, 2003, "The Level and Persistence of Growth Rates," *Journal of Finance* 58(2):643-684.

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The ideal in a DCF application would be a detailed forecast of future dividends, year by year well into the future until a true steady state (constant) dividend growth rate was reached, based on a large sample of investment analysts' expectations. I know of no source of such data. Dividends are ultimately paid from earnings, however, and earnings forecasts from a number of analysts are available for a few years. Investors do not expect dividends to grow in lockstep with earnings, but for companies for which the DCF approach can be used reliably (*i.e.*, for relatively stable companies whose prices do not include the option-like values), they do expect dividends to track earnings over the long-run. Thus, use of earnings growth rates as a proxy for expectations of dividend growth rates is a common practice.

Accordingly, the first step in my DCF analysis is to examine a sample of investment analysts' forecasted earnings growth rates from Bloomberg and Value Line to the degree such forecasts are available. At present, Value Line data run through either the 2010-2012 or the 2011-2013 horizon, representing an average of about four years from the current earning forecasts available for 2008. Bloomberg also provides a long-term earnings growth rate estimate. The longest-horizon forecasted growth rates from these sources underlie the simple DCF model (*i.e.*, the standard perpetual-growth model associated with the "DCF formula," dividend yield plus growth). Unfortunately, the longest growth forecast data only go out four to five years, which is too short a period to make the DCF model completely reliable.

Q. What values do you use for dividends and stock prices?

A. Dividends are either for the 1st or 2nd quarter of 2008, depending on the most recent dividend information available at the time of estimation for each company.[41] This dividend is grown at the estimated growth rate and divided by the price described below to estimate the dividend yield for the simple DCF model.

[41] The dividend information was obtained from Bloomberg on March 17, 2008.

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Stock prices are an average of closing stock prices for the 15-day trading period ending on the day the BEst[42] forecast was obtained. A 15-day stock price average is used to guard against anomalous price changes in any single day.

Q. How do you use this information to estimate the cost of capital using the DCF models?

A. First, I estimate each sample company's cost of equity using its estimated dividend yield[43] and growth rates from Bloomberg and Value Line. I estimated both the Simple DCF and the Multi-stage DCF cost of equity for each sample company. This figure reflects the cost of equity estimate for the company at its current market value capital structure. Second, I combine this information with market information on the cost of debt and preferred stock to estimate each company's after-tax weighted-average cost of capital as discussed below.

B.II. Combining the Estimated Cost of Equity to Obtain a Cost of Capital

Q. How do you use the estimated cost of equity for the sample companies to determine the cost of capital for integrated electric utilities?

A. Because cost of capital depends on both the business risk and the financial risk of the entity, it is important to consider both types of risk when estimating the cost of capital. Business risk is the risk of a company from its line of business if it used no debt financing. When a firm uses debt to finance its assets, the business risk of the assets is shared between the debt holders and the equity holders, but the equity holders bear more of the risk because debt holders have a priority claim on the company's cash flows. As noted above, equity holders are residual claimants, which mean that they get paid last. In other words, the use of debt imposes financial risk on the equity holders. The sample companies were selected to reflect the business risks of electric generation and transmission, but their capital structure was not considered

[42] Bloomberg refers to consensus estimates by financial analysts as BEst estimates.
[43] The dividend yield is the estimated dividends divided by the estimated stock price.

in the selection process. Therefore, to estimate the sample's cost of capital, I need to consider the capital structure underlying the estimated cost of equity for each company.

Q. Please explain why it is necessary to report the cost of equity adjusted for capital structure.

A. Briefly, rate regulation in North America tends to focus on the components of the overall cost of capital, and in particular, on what the "right" cost of equity and capital structure should be. Frequently, there is no consideration of whether the financial risks of the sample companies differ among themselves or differ from the regulated company. The cost of equity estimated using the standard models (e.g., the DCF model or the risk positioning model) reflects both the business and financial risk of the sample companies. However, the overall cost of capital depends primarily on the business the firm is in, *i.e.*, business risk, while the costs of the debt and equity components depend not only on this business risk alone but also on the distribution of revenues between debt and equity, *i.e.* financial risk. The overall cost of capital is thus the more basic concept.

Q. Please explain the implications of the relationship between capital structure and the cost of equity in your testimony.

A. The risk equity holders carry, and therefore the cost of equity, depends on the capital structure. As leverage increases, financial risk increases, and hence the required return on equity increases. An approach that estimates the cost of equity for each of the sample firms without explicit consideration of the market value capital structure (*i.e.*, the financial risk) underlying those costs risks material errors. The costs of equity of the sample companies at their actual market-value capital structures do not necessarily reflect the same degree of financial risk as faced by residual claimants to BPA's cash flow, and thus could lead to an unfair rate of return if the sample's cost of equity estimate were simply and mechanically applied to the regulated company's capital structure. I avoid this problem by calculating each sample company's After-

Tax Weighted-Average Cost of Capital ("ATWACC") using its market value capital structure. Using the sample's average overall cost of capital (*i.e.*, the average of the sample companies' ATWACCs) as an estimate of cost of capital, I then determine the corresponding return on equity as the cost of equity that correspond to the capital structure for an average electric utility followed by Value Line. According to the most recent information in Value Line the average electric utility had approximately 52.6% debt in its capital structure as of year-end 2006 which is the most recent year for which Value Line has that information.[44]

Q. To assess the magnitude of financial risk for a rate regulated company, should you use the market-value or the book-value capital structure?

A. The market-value capital structure is the relevant quantity for analyzing the cost of equity evidence, which is based on market information.

Q. Has the need to use market-value capital structures to estimate the cost of equity been widely recognized in the academic community?

A. Yes. The need to use market-value capital structures to analyze the effect of debt on the cost of equity has been recognized in the financial literature for a long time. For example, the initial reconciliation of the Modigliani-Miller theories of capital structure with the Capital Asset Pricing Model[45] works with market-value capital structures. Book values may be relevant for some issues, e.g., for covenants on individual bond issues, but as explained in the text, market values are the determinants of the impact of debt on the cost of equity.

[44] Value Line Investment Survey as of March 28, 2008. Electric utilities followed by Value Line had approximately 52.6% debt as of year-end 2006 - - the most recent year for which Value Line carry this information.

[45] Robert S. Hamada, Portfolio Analysis, Market Equilibrium and Corporate Finance, *The Journal of Finance* 24: 13-31, March 1969. For a more recent presentation, see Brealey, Myers & Allen 2006 pp. 503-506.

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Q. Please summarize your conclusions as set forth in this section.

A. The market risk, and therefore the cost of equity, depends directly on the market-value capital structure of the company or asset in question. It therefore is impossible to compare validly the measured costs of equity of different companies without taking capital structure into account. Capital structure and the cost of equity are unbreakably linked, and any effort to treat the two as separate and distinct questions violates both everyday experience and basic financial principles.

Q. How should a cost of capital analyst implement this principle?

A. There has been a great deal of financial research on the effects of capital structure on the value of a firm. One of the key conclusions that results from the research is that no narrowly defined optimal capital structure exists within industries, although the typical range of capital structures does vary among industries.[46] Instead, there is a relatively wide range of capital structures within any industry in which fine-tuning the debt ratio makes little or no difference to the value of the firm, and hence to its overall after-tax cost of capital.

Accordingly, analysts should treat the market-value weighted average of the cost of equity and the after-tax current cost of corporate debt, or the "ATWACC" for short,[47] as constant within a broad middle range of capital structures for the industry. Sample evidence should be analyzed to determine the sample's average ATWACC, which can be compared across different firms or industries. The economically appropriate cost of equity for a regulated firm is the quantity that, when applied to the regulatory capital structure, produces the same ATWACC. That value is the cost of equity that

[46] An exception is that very high-risk industries should avoid debt entirely, which makes their optimal capital structure zero percent debt.

[47] This quantity typically is called the "weighted-average cost of capital" or "WACC" in finance textbooks. The textbook WACC equals the *market*-value weighted average of the cost of equity and the *after-tax*, *current* cost of debt. However, rate regulation in North America has a legacy of working with another, and very different, weighted-average cost of capital, the *book*-value weighted average of the cost of equity and the *before-tax*, *embedded* cost of debt. Accordingly, in regulatory settings it's useful to refer to the textbook WACC as the "ATWACC," or "after-tax weighted-average cost of capital." I follow that practice here.

the sample would have had, estimation problems aside, if the sample's market-value capital structure had been equal to the regulatory capital structure in question.

Q. Can you provide an example of the calculation of the cost of equity consistent with the market-determined estimate of the sample's average overall cost of capital?

A. Yes. Consider the following equation to calculate the ATWACC:[48]

$$ATWACC = r_D \times (1 - T_C) \times D + r_E \times E \qquad \text{(B.6)}$$

where r_D = market cost of debt,
r_E = market cost of equity,
T_C = corporate marginal income tax rate,
D = percentage of debt in the capital structure, and
E = percentage of equity in capital structure.

The cost of equity consistent with overall cost of capital estimate (ATWACC), the market cost of debt and equity, the marginal corporate income tax rate and the amount of debt and equity in the capital structure can be determined by solving equation (B.6) for r_E.

Q. What capital structure information do you require?

A. For reasons discussed below, an explicit evaluation of the market-value capital structures of the sample companies is vital for a correct interpretation of the market evidence on the return on equity. This requires estimates of the market values of common equity, preferred equity and debt, and the current market costs of preferred equity and debt.

Q. Please describe how you calculate the market values of common equity, preferred equity and debt.

[48] Note that this equation assumes that only debt and equity are in the capital structure, but one can add preferred equity to the equation if appropriate.

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A. I estimate the capital structure for each sample company by estimating the market values of common equity, preferred equity and debt from the most recent publicly available data.

Briefly, the market value of common equity is the price per share times the number of shares outstanding. For the risk positioning approach, I use the last 15 trading days of each year to calculate the market value of equity for the year. I then calculate the average capital structure over the corresponding five-year period used to estimate the "beta" risk measures for the sample companies. This procedure matches the estimated beta to the degree of financial risk present during its estimation period. In the DCF analyses, I use the average stock price over 15 trading days ending on the release date of the BEst growth rate forecasts utilized.[49]

The market value of debt is estimated at its book value adjusted by the difference between the "estimated fair (market) value" and the "carrying cost" of long-term debt reported in each company's 10-K.[50] The market value of preferred stock for the samples is set equal to its book value.[51]

Q. How do you estimate the current market cost of debt?

A. The fifteen-day average market cost of debt for each company is set equal to the yield on an index of public utility bonds that have the same credit rating, and the yield is reported by Bloomberg for an index of public utility company bonds with the same S&P rating. The DCF analyses use the current credit rating whereas the risk positioning analyses use the current yield of a utility bond that corresponds to the five-year average debt rating of each company so as to match consistently the horizon of information used by Value Line to estimate each company's beta. Bond rating

[49] BEst is Bloomberg's name for its earnings growth rate information. BEst growth rate forecasts are as of March 17, 2008.

[50] The book value of debt from Bloomberg includes all interest-bearing financial obligations that are not current and includes capitalized leases and mandatory redeemable preferred and trust preferred securities in accordance with FASB 150 effective June 2003. See Bloomberg definition of long-term debt for additional detail.

[51] This is unlikely to affect the results as the average percentage of preferred is less than ¼ percent for both the water and gas sample.

information was obtained from Bloomberg which reports Standard & Poor's bond ratings. Calculation of the after-tax cost of debt uses the average corporate tax rate in the U.S. of about 40%[52] and a BBB bond rating.[53]

Q. How do you estimate the market cost of preferred equity?

A. For all sample companies, the preferred rating was assumed equal to the company's bond rating. The cost of a company's preferred equity was set equal to the yield on an index of preferred utility stock with the same rating. The data were obtained from the Mergent Bond Record.[54]

B.III. COST OF CAPITAL ESTIMATES

Q. What are the cost of equity estimates derived from the risk positioning approach?

A. Using the long-term interest rate in the two risk positioning models (CAPM and ECAPM), with two values of the ECAPM parameter (0.5% and 1.5%), I obtain three estimates of each sample company's cost of equity (Table No. BV-12). The cost of equity estimates are combined with the estimates of the company's cost of debt and preferred to calculate the company's ATWACC (Table No. BV-11). Table No. BV-12 combines the sample average ATWACC with the average electric utility's capital structure, cost of debt, and tax rate to obtain a carrying charge that reflects the cost of equity for an integrated electric utility with average capital structure. The cost of equity results are summarized below in Table B-1 below.

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[52] KPMG 2007 Corporate and Indirect Tax Rate Survey.

[53] The average electric utility currently has a BBB rating. See Credit Ratings, Q4 2007 Financial Update, *Edison Electric Institute*.

[54] Published monthly, Mergent's Bond Record offers a comprehensive review of over 68,000 bond issues including coverage of corporate, government, municipal, industrial development/environmental control revenue and international bonds, plus structured finance and equipment trust issues, medium-term notes, convertible issues, preferred stocks and commercial paper issues.

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Table B-1. Cost of Equity Estimates

Integrated Electric Sample*	CAPM	α = 0.5%	α = 1.5%	Simple	Multi
Cost of Equity	11.3%	11.4%	11.6%	14.7%	12.8%
Average ATWACC	7.4%	7.5%	7.6%	9.0%	8.1%

Sources: Tables BV-8 and BV-12.

Q. What are the DCF estimates for the samples?

A. Combining the growth rates from Value Line and Bloomberg along with the individual sample companies' dividend yield, I obtain cost of equity estimates for each sample company using the two versions of the DCF method. I combine these estimates with the sample companies' market value capital structure and market cost of debt to estimate the sample companies ATWACC. Table BV-8 applies the estimated ATWACC to the average electric utility capital structure with 52.6% debt and obtains the cost of equity for an average integrated electric utility using the DCF method. These figures are also shown in Table B-1 above.

Q. Based on the analysis described above, what conclusion do you draw about the cost of equity for an average integrated electric utility?

A. The risk positioning model indicate an after-tax weighted-average cost of capital for an average integrated electric utility at 7¼ to 7¾ percent with a corresponding cost of equity of about 11¼ to 11¾ percent. The estimated ATWACC using the DCF model is somewhat higher at 8¼ to 9 percent for a cost of equity at 12¾ to 14¾ percent. Looking at Table No. BV-5, the growth rates vary widely from 1.3% to 21.4% and thus indicate that the industry has not settled into a stable growth.[55] Specifically, Empire District shows a very large growth rate from just one BEst analyst while the Value Line growth is much more in line with that of other companies. For this reason and because a number of restructuring and re-restructuring activities are ongoing in the electric industry, I do not

[55] The electric industry continues to undergo restructuring and reversals of restructuring activities in many jurisdictions so that the industry has yet to settle into a stable equilibrium which would be needed to satisfy the DCF model's assumptions.

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believe that the DCF model provides fully reliable cost of capital estimates for the integrated electric industry at this time.[56] While I do not view the DCF model as fully reliable for the integrated electric industry at this time, it indicates, if anything, that the cost of equity for the integrated electric utility sample at 52.6% debt is a little higher than the range indicated by the risk positioning methods. Therefore, the best estimate of the cost of equity for an average integrated electric utility at this point in time is between 11¼ and 11¾ percent for a midpoint of about 11½ percent.

[56] If Empire District were removed from the sample of integrated electric utilities, the Simple DCF and the Multi-stage DCF would result in a cost of equity of about 12½% and 11½%, respectively.

Year	Month / day	Title	Filed with	Proceeding or Report	On behalf of	Available as / at
2016	30-Nov	Report on Aspects of the WACC	Queensland Competition Authority	2016 Access Undertaking	Aurizon Network (Australian railroad)	http://www.aurizon.com.au/what-we-deliver/network/network-
2016	23-Nov	Common Equity Ratio for OPG's Regulated Generation	Ontario Energy Board	EB-2016-0152, M3	OEB Staff	n/a
2016	16-Nov	Pre-filed Direct Testimony	The Regulatory Commission of Alaska	TA 158-126	Anchorage Water and Wastewater Utility	http://rca.alaska.gov/RCAWeb/home.aspx
2016	July	Direct Testimony on Capital Structure, Embedded Cost of Debt, and Incom	Michigan Public Service Commission	UE-18131	Detroit Thermal	http://efile.mpsc.state.mi.us/efile/docs/18131/0001.pdf
2016	June	Direct Testimony on return on equity	Arizona Corporation Commission	E-01345A-16-0036	Arizona Public Service Company	M3-3.1-SEC-1_Attachment 1
2016	February	Written Evidence on cost of equity and capital structure	Alberta Utilities Commission	Proceeding No. 20622	AltaGas Utilities, ENMAX Power Corporation, FortisAlberta, The ATCO Utilities	Attached to M3 - 3.1-VECC-1
	May, 2016	Rebuttal Evidence on cost of quity and capital structure	Alberta Utilities Commission	Proceeding No. 20623	AltaGas Utilities, ENMAX Power Corporation, FortisAlberta, The ATCO Utilities	M3-3.1-SEC-1_Attachment 2
2015	February	Direct Testimony on Cost of Capital	Oregon Public Utility Commission	Docket No. UE 294	Portland General Electric	http://apps.puc.state.or.us/edockets/srchlist.asp?Prefix=UE++&D
2014	December	2014 Draft Access Undertaking: Comments on Aspects of the WACC	Queensland Competition Authority	2014 Access Undertaking	Aurizon Network (Australian railroad)	M3-3.1-SEC-1_Attachment 3
2014	September	Verified Statement	Surface Transportation Board	EP 664 (Sub-No. 2)	American Association of Railroads	M3-3.1-SEC-1_Attachment 3
	November, 2014	Verified Reply Statement	Surface Transportation Board	EP 664 (Sub-No. 2)	American Association of Railroads	M3-3.1-SEC-1_Attachment 5
2014	September	Supplemental Direct Testimony on cost of capital	The Regulatory Commission of Alaska	U-13-202	Anchorage Water and Wastewater Utility	http://rca.alaska.gov/RCAWeb/home.aspx
	March, 2015	Reply testimony on cost of capital	The Regulatory Commission of Alaska	U-13-202	Anchorage Water and Wastewater Utility	http://rca.alaska.gov/RCAWeb/home.aspx
2014	July	Rebuttal Testimony on cost of capital	Oregon Public Utility Commission	Docket No. UE 283	Portland General Electric	http://apps.puc.state.or.us/edockets/srchlist.asp?Prefix=UE++&D
2013	February	Estimating the cost of Equity for Regulated Companies	Australian Energy Regulator, Economic Regulation Authority	Consultation	Australian Pipeline Industry Association	M3-3.1-SEC-1_Attachment 6
2012	November	Calculating the Equity Risk Premium and the Risk Free Rate	NMa and Opta (Dutch Regulator)	Consultation	NMa and Opta (Dutch Regulator)	http://www.brattle.com/system/publications/pdfs/000/004/825,
2012	May	Survey of cost of capital practices in Canada	British Columbia Utilities Commission	Consultation	British Columbia Utilities Commission	http://www.bcuc.com/Documents/Proceedings/2016/DOC_4543
2011	02-May	Direct Testimony on cost of capital	California Public Utilities Commission	Application No. 11-05	California-American Water Company	https://www.scribd.com/document/119935544/MPRWA-Attachı
	September, 2011	Rebuttal Testimony on cost of capital	California Public Utilities Commission	Application No. 11-06	California-American Water Company	Not publicly available
2011	May	Direct testimony on cost of capital	New Mexico Public Regulation Commission	Case No. 11-00196-UT	New Mexico-American Water	M3-3.1-SEC-1_Attachment 7
	November, 2011	Rebuttal Testimony on cost of capital	New Mexico Public Regulation Commission	Case No. 11-00196-UT	New Mexico-American Water	Not publicly available
2010	November	Direct testimony on cost of capital	Arizona Corporation Commission	Docket No. W-01303A-10-0448	Arizona-American Water Company	http://edocket.azcc.gov/Search/DocketDetailSearch
	July, 2011	Rebuttal testimony on cost of capital	Arizona Corporation Commission	Docket No. W-01303A-10-0448	Arizona-American Water Company	http://edocket.azcc.gov/Search/DocketDetailSearch
2010	September	Review of Regulatory Cost of Capital Methodologies	Canadian Transportation Agency	Consultation	Canadian Transportation Agency	Available from the CTA upon request; please contac t Dale McKea
2009	August	Direct Testimony on cost of capital	New Mexico Public Regulation Commission	Docket No. 09-00156-UT	New Mexico-American Water	M3-3.1-SEC-1_Attachment 8
2009	July	Direct Testimony on cost of capital	Arizona Corporation Commission	Docket No. W-01303A-09-0343	Arizona-American Water	http://edocket.azcc.gov/Search/DocketDetailSearch
	March, 2010	Rebuttal Testimony on cost of capital	Arizona Corporation Commission	Docket No. W-01303A-09-0343	Arizona-American Water	http://edocket.azcc.gov/Search/DocketDetailSearch
2008	June	Direct Testimony on cost of capital	New Mexico Public Regulation Commission	Docket No. 08-00134-UT	New Mexico-American Water	M3-3.1-SEC-1_Attachment 9
	January, 2009	Rebuttal Testimony on cost of capital	New Mexico Public Regulation Commission	Docket No. 08-00134-UT	New Mexico-American Water	M3-3.1-SEC-1_Attachment 10
2008	April	Direct Testimony on cost of capital and carrying charge	Bonneville Power Administration	BPA Docket No. WP-07	Preference Customers of BPA (consumers)	M3-3.1-SEC-1_Attachment 11
2008	April	Direct Testimony on cost of capital	Arizona Corporation Commission	Docket No. W-0130A-08-0227	Arizona-American Water	http://edocket.azcc.gov/Search/DocketDetailSearch
	February, 2009	Rebuttal Testimony on cost of capital	Arizona Corporation Commission	Docket No. W-0130A-08-0227	Arizona-American Water	http://edocket.azcc.gov/Search/DocketDetailSearch
2006	July	Direct Testimony on cost of capital - Mohave District	Arizona Corporation Commission	Docket No. W-01303A-06-0491	Arizona-American Water	http://edocket.azcc.gov/Search/DocketDetailSearch
	July, 2007	Rebuttal Testimony on cost of capital	Arizona Corporation Commission	Docket No. W-01303A-06-0491	Arizona-American Water	http://edocket.azcc.gov/Search/DocketDetailSearch
2006	June	Direct Testimony on cost of capital - Anthem / Aqua Fria District	Arizona Corporation Commission	Docket No. W-01303A-06-0403	Arizona-American Water	http://edocket.azcc.gov/Search/DocketDetailSearch
	April, 2007	Rebuttal Testimony on cost of capital	Arizona Corporation Commission	Docket No. W-01303A-06-0403	Arizona-American Water	http://edocket.azcc.gov/Search/DocketDetailSearch
2006	January	Direct Testimony on cost of capital - Sun City District	Arizona Corporation Commission	Docket No. W-01303A-06-0014	Arizona-American Water	http://edocket.azcc.gov/Search/DocketDetailSearch
	October, 2006	Rebuttal Testimony on cost of capital	Arizona Corporation Commission	Docket No. W-01303A-06-0014	Arizona-American Water	http://edocket.azcc.gov/Search/DocketDetailSearch

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/original/Calculating_the_Equity_Risk_Premium_and_the_Risk-free_rate_Harris_Villadsen_Lo_Passo_Nov_26_2012.pdf?1378772132
4_A2-3_BrattleGroup_Cost-of-Capital-Practices.pdf

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SEC Interrogatory #2

Issue Number: 3.1
Issue: Are OPG's proposed capital structure and rate of return on equity appropriate?

Interrogatory:

Reference: Exhibit M3

[p.5] Please describe the ways, if any, that the Board's decision to allow 45% equity thickness in EB-2013-0321 influenced the expert's conclusion that the equity thickness going forward should be 48%. Please include any independent assessment by the expert as to whether the 45% equity thickness was appropriate under the circumstances that existed when the Board so ordered.

Response:

The following response was provided by The Brattle Group:

Dr. Villadsen did not undertake an independent study of the appropriate equity thickness as of the time of the EB-2013-0321 proceeding, but takes the equity thickness for granted at the time of the decision. Dr. Villadsen further notes that the EB-2013-0321 decision resulted in, for example, DBRS confirming OPG's credit rating noting that:

> The confirmation reflects the recent Ontario Energy Board (OEB) decision which is expected to improve the stability of earnings as the Company has seen below-average returns recently. OPG's ratings also assume that the Company will continue to receive financial support provided by the owner, the Province of Ontario (the Province; rated AA (low) by DBRS).
>
> [Source: OPG Ex. A2-3-1, Attachment 2, Page 1]

Looking to today, Dr. Villadsen noted in M3, p. 21

> Relative to the time of EB-2013-0321, the key change to OPG's risk is the large construction program and to a lesser extent the expected switch to incentive regulation for OPG's prescribed hydroelectric facilities.

Thus, in Dr. Villadsen's view the risk of OPG had increased since the time of EB-2013-0321 and consequently, the focus was on assessing the increase in risk.

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SEC Interrogatory #3

Issue Number: 3.1
Issue: Are OPG's proposed capital structure and rate of return on equity appropriate?

Interrogatory:

Reference: Exhibit M3

[p.7 and elsewhere] SEC is seeking to understand better how performance based regulation (IRM) increases or decreases the risk that a utility will be able to recover its prudently incurred costs, relative to forward test period cost of service regulation.

a) Please explain how decoupling costs from rates makes revenues more variable, and/or makes income more variable, and how that translates into a greater or lesser risk of non-recovery of costs.
b) Please explain how longer periods of rate and revenue certainty affect costs and cost management, and how that translates into a greater or lesser risk of non-recovery of costs.
c) Please provide any empirical data in the expert's possession showing the increased cost of equity or equity thickness required when a generation utility is regulated under IRM.

Response:

The following response was provided by The Brattle Group:

a) Under incentive ratemaking (IRM), base revenues are the result of formulaic adjustments that do not take into account changes in recorded costs. The effect of increased regulatory lag under IRM is that revenues and costs can diverge: the level of revenues is independent of whether or not efforts to control costs are successful, and this provides strengthened financial incentives to control costs under IRM. Since base rates are independent of changes in costs during the plan term, it is possible that achieved returns could be below the authorized level by a non-trivial amount. Unless there are mechanisms for rebasing in the intervening years, prolonged periods of returns above or below authorized level can affect the utility's income.

b) Under traditional cost-of-service approaches, recorded costs influence rates and revenues that will be charged in the year (or years) that is the subject of the

proceeding. Typically a cost-of-service proceeding with a forward test year will examine a forecast of test-year costs as well as recorded costs for the most recent year available. As a result, the level of revenues that is approved for the test year can take into account changes in recorded costs up to that most recent year available. However, once rates are set, subsequent changes in recorded costs cannot influence rates (except via trackers, true-ups or similar mechanisms).

i. Under the traditional cost-of-service approach, rate cases generally take place periodically and could, in theory, be updated every year albeit that rarely occurs. Under IRM, the gap between rate cases is longer (5-years) and fixed. Under the traditional cost-of-service approach, changes in recorded costs influenced rates with a lag that depends on the time between rate cases, whereas under IRM the lag is now greater.

c) Dr. Villadsen does not have such data in her possession, but please see also the response to M3-3.1-VECC-4.

SEC Interrogatory #4

Issue Number: 3.1
Issue: Are OPG's proposed capital structure and rate of return on equity appropriate?

Interrogatory:

Reference: Exhibit M3

[p.12] Please confirm that legacy coal generation businesses face substantial risks related to future government actions and environmental controls. Please provide any information available to the expert on the appropriate equity thickness and return on equity for a generation utility that is solely or primarily generating electricity from existing coal facilities. Please provide any information available to the expert that compares the required equity thickness and return on equity for coal generation with the thickness and return for a nuclear generation business, or with the thickness and return for a hydroelectric generation business.

Response:

The following response was provided by The Brattle Group:

Neither confirmed nor denied. The risks associated with future government actions and environmental controls depend on the jurisdiction in which the regulated entity resides and in the U.S. on the policies that the incoming administration will pursue. However, Dr. Villadsen is aware that many coal generators have been shut down, while others are scheduled to be shut down or to have environmental controls installed. Among Concentric's sample companies, First Energy is planning to retire more than 800 MW of coal generating capacity (Energy Velocity Suite, November 2016) and ALLETE is planning environmental spending of about US $1 billion on environmental efforts (ALLETE Investor Presentation, November 2016).
Dr. Villadsen is not aware of public data on the equity thickness of a utility that generates electricity solely from coal facilities, but please see the table at M3-3.1-SEC-4_Attachment 1 for data on the equity thickness for entities with coal and nuclear generation.

Refined Comparables Generation Break Down

		% Coal Generation	% Nuclear Generation	Book Value Equity Capitalization
Ameren Corporation	[a]	67.1%	23.3%	47.4%
DTE Energy Company	[b]	67.0%	17.0%	47.4%
El Paso Electric Company	[c]	6.0%	47.0%	44.6%
Entergy Arkansas, Inc.	[d]	14.0%	54.0%	41.7%
Entergy Louisiana, LLC	[e]	2.0%	27.0%	48.6%
PG&E Corporation	[f]	0.0%	22.6%	49.4%
Pinnacle West Capital Corporation	[g]	31.0%	26.8%	55.3%
Tennessee Valley Authority	[h]	29.0%	33%[1]	22.1%
BC Hydro and Power Authority	[i]	0.0%	0.0%	19.6%
Bonneville Power Administration	[j]	0.0%	9.9%	15.5%
IDACORP, Inc.	[k]	28.4%	0.0%	54.1%
Ontario Power Generation, Inc.	[l]	0.0%	57.0%	63.9%

Notes:

1: In Exhibit M3, Figure 6, we mistakenly referred to the numbers as for the fiscal year ending September 30, 2016, however they were figures for the fiscal year ending September 30, 2015. These are the correct percentages for the fiscal year ending September 30, 2016. They are each 1 percent lower than the 2015 figures.

The percentages for coal and nuclear represent percent of total generation (MWh) reported for 2015, except for Tennessee Valley Authority (TVA) and BC Hydro and Power Authority (BC Hydro). TVA's data reflects their fiscal year ending September 30, 2016 and BC Hydro's reflects data for 2014/2015 year. Total generation includes purchased power.

The data for OPG did not include purchased power. It is unclear whether or not OPG purchases any power.

Sources:

Percentages for coal and nuclear generation data in rows [a], [c]-[h], and [k] from the most recently available company 10-Ks.

Percentages for coal and nuclear generation in row [b] from ValueLine, Inc

Percentages for coal and nuclear generation in row [i] comes BC Hydro and Power Authority 2016/17-2018/19 Service Plan; accessed at:
https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/corporate/regulatory-planning-documents/service-plans/bchydro-service-pla

Percentages for coal and nuclear generation in row [j] from BPA Fuel Mix Percent Summary. CY 2015 Data; accessed at:
https://www.bpa.gov/power/BPA_Fuel_Mix/docs/BPA_Official_Fuel_Mix_2015.pdf

Percentages for coal and nuclear generation in row [l] from OPG 2015 Sustainability Report, p. 22; accessed at:
http://www.opg.com/news-and-media/Reports/Sustainability_Report_2015.pdf

Book Value Equity Capitalization calculated from data from SNL Financial

n-2016-17-2018-19.pdf

SEC Interrogatory #5

Issue Number: 3.1
Issue: Are OPG's proposed capital structure and rate of return on equity appropriate?

Interrogatory:

Reference: Exhibit M3

[p.14][Please describe the extent, if any, to which the operating risk of OPG is reduced by:

a) The mechanisms in place to allow flow through of cost components; and/or
b) The implicit government guarantee of recovery of costs due to the dominant position of OPG in the Ontario generation sector.

To the extent, if any, that these reductions can be quantified empirically, please provide the quantified risk reductions.

Response:

The following response was provided by The Brattle Group:

a) Mechanisms that allow flow through of cost components will, everything else equal, reduce the variability in income for OPG and are credit metric positive.
b) Dr. Villadsen is not quite sure what is meant by this question, but please see also M3 p. 32 for a discussion of the impact of OPG's regulatory status and generation volume on its competitive business risks.

Dr. Villadsen has not quantified these effects empirically.

SEC Interrogatory #6

Issue Number: 3.1
Issue: Are OPG's proposed capital structure and rate of return on equity appropriate?

Interrogatory:

Reference: Exhibit M3

[p.17 and 34] With respect to the comparator group selection:

a) Please explain why Bonneville, TVA and BC Hydro, which have higher concentrations of hydroelectric generation, more comparable to OPG, and are all AA or AAA rated and have equity less than 25%, are not better comparators for OPG than US investor-owned utilities with broadly different risk profiles.
b) Please provide further details as to why these three utilities were excluded from the expert's sample.
c) Please recalculate the average and median from the expert's sample if these three utilities were included in the sample.

Response:

The following response was provided by The Brattle Group:

a) Bonneville and BC Hydro's asset mixes are dominated by hydroelectric generation at 69% and 98% capacity concentrations (MW) respectively (see Ex. BV-2 of Exh. M3). Bonneville's total generation capacity consists of only about 1.1 GW of nuclear, which makes up less than 4% of its total capacity. BC Hydro does not own any nuclear generation. Furthermore, Bonneville also has coal generation and natural gas fired capacity, each making up about 6% of Bonneville total asset mix. OPG's asset mix contrasts with that of these two companies strikingly - consisting of hydroelectric and nuclear generation in almost equal proportions (hydroelectric – 43%, nuclear at 39%). As Dr. Villadsen detailed in M3, the most relevant risks for OPG over the next 5-year period are Operating Risks, Construction and Execution Risk, and Regulatory Risks. Elevated Operating and Execution Risks emanate directly from the nuclear refurbishment program of Darlington that OPG will be undertaking, and therefore, makes a comparison of comparable companies with large

nuclear concentrations more pertinent (note: OPG is not expected to face such elevated risks from its hydroelectric assets).
TVA, similar to Bonneville, has a more mixed generation capacity (including 29% coal) than OPG, and therefore is not a good comparable either.
Finally, TVA and Bonneville are US federal agencies whose credit metrics and equity capitalization averages are not necessarily maintained on a stand-alone-basis. See M3-3.1-SEC-6_Attachment 1, which illustrates S&P's LT Unsecured / Issuer credit rating for the Refined Sample.
Importantly, neither Bonneville Power nor TVA are regulated under a rate of return scheme; TVA uses a debt-service methodology [TVA 2016 Form 10-K, p. 12].

b) See explanations in part a. above.

c) Inclusion of these three utilities – hypothetically, would result in a median equity capitalization of 46% and average equity capitalization of 39%.

S&P Rating on Senior Unsecured Debt for Refined Sample

			S&P Senior Unsecured
1	Ameren Corporation	[a]	BBB
2	DTE Energy Company	[b]	BBB
3	El Paso Electric Company	[c]	BBB
4	Entergy Arkansas, Inc.	[d]	BBB+
5	Entergy Louisiana, LLC	[e]	BBB+
6	PG&E Corporation	[f]	BBB
7	Pinnacle West Capital Corporation	[g]	A-
8	Tennessee Valley Authority	[h]	AA+
9	BC Hydro and Power Authority	[i]	AAA
10	Bonneville Power Administration	[j]	AA-
11	IDACORP, Inc.	[k]	BBB

Notes:
Ratings in rows [d],[g], and [k] are LT issuer ratings, since these companies do not have seni
Sources:
Ratings in rows [a]-[g] and [k] from SNL Financial
Rating in row [h] from Tennessee Valley Authority; accessed here:
http://www.snl.com/IRW/CustomPage/4063363/Index?KeyGenPage=206578
Rating in row [i] from Standard and Poor's Financial Services LLC
Rating in row [j] from S&P Rating Report; accessed here:
https://www.bpa.gov/Finance/FinancialInformation/Debt/RatingAgencyReportsArticles/S%

ior unsecured credit ratings

%20and%20P%20Rating%20Report%20March%202016.pdf

SEC Interrogatory #7

Issue Number: 3.1
Issue: Are OPG's proposed capital structure and rate of return on equity appropriate?

Interrogatory:

Reference: Exhibit M3

[p.18] Please provide the source of the "understanding" in fn. 36. Please advise whether the term "generation capacity" includes all capacity, whether or not available, or only capacity available to produce electricity at any given time.

Response:

The following response was provided by The Brattle Group:

Dr. Villadsen reviewed IESO's Supply Outlook presentation dated August 16, 2016 (M3-3.1-SEC-7_Attachment 1; see slide 8). Note that the ***installed*** nuclear capacity shown (including refurbished capacity as they become operational) remains constant between 2016 and 2019 at 12.1 GW, decreasing slightly to 11.3 GW in 2020, and then decreasing further to 10.4 GW in 2021, but then after, holding steady until Pickering is scheduled for retirement in 2023.

MODULE 4: Supply Outlook

August 2016

ieso
Connecting Today.
Powering Tomorrow.

This module is divided into five sections

1. Available supply over the planning outlook
2. Uncertainties and Risks in the Supply Outlook
3. Supply-Demand Balance
4. Outlook for Low-Carbon Supply Technologies
5. Distributed Energy Resources

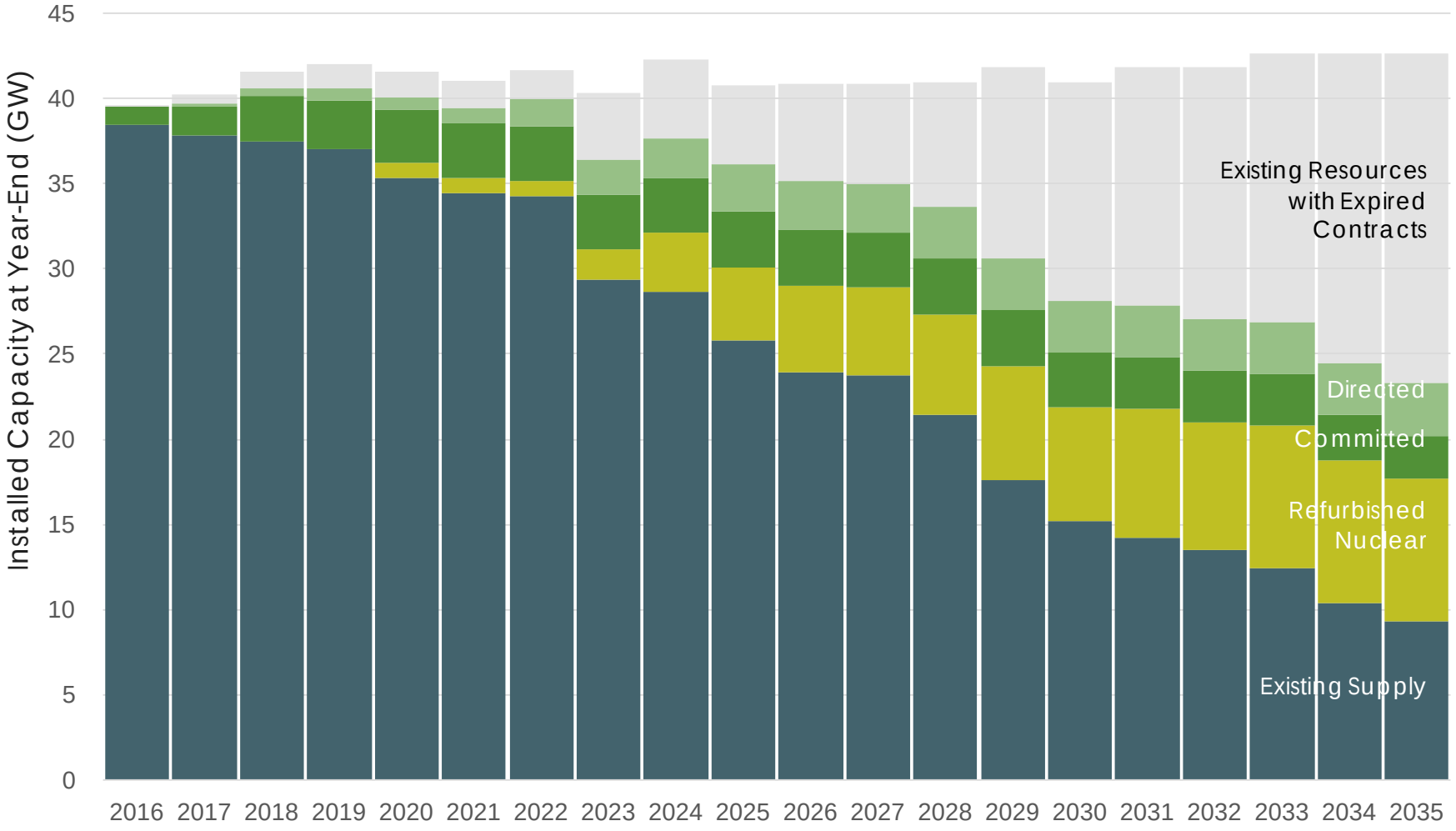
1. Available Supply over the Planning Outlook

Terminology

- *Installed capacity:* the maximum continuous electrical output that a resource is capable of injecting onto the grid in a given year
- *Existing capacity*: a resource that is currently in commercial operation, producing electricity, and receiving payments for electricity production
- *Committed capacity*: a resource that has been acquired, either through a contract or auction, but is not yet in service (e.g., under construction)
- *Directed capacity*: resources that are part of a procurement program or government directive, but have not been acquired yet (e.g., LRP II)
- *Expired contracts*: capacity that was once under an IESO or OEFC contract, but the contract has reached commercial term
- *Summer peak:* months of June, July, and August
- *Winter peak*: months of December, January, and February*
- *Capacity contribution, or effective capacity:* median output of resources during seasonal peak demand hours

* "Winter 2017" would mean Dec 2016, Jan 2017, Feb 2017

Ontario installed capacity, projected, 2016-2035

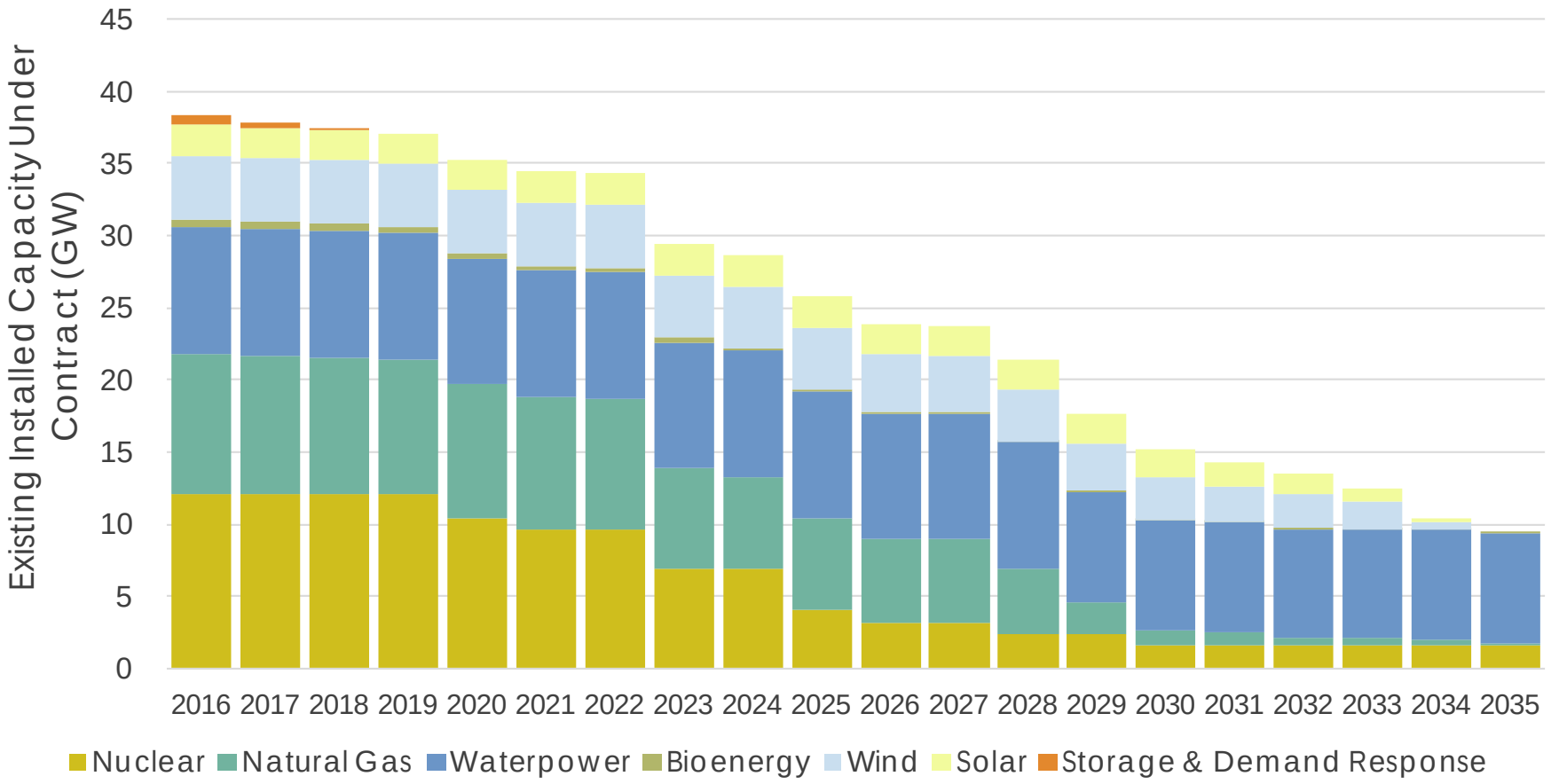


Ontario installed capacity, projected in MW, 2016-2035

Installed Capacity, MW	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Existing Supply	38,417	37,868	37,510	37,056	35,307	34,425	34,288	29,405	28,620	25,756
Committed, Not Yet Online	1,078	1,678	2,655	2,811	3,194	3,194	3,230	3,229	3,244	3,244
Directed Procurements	0	125	433	683	683	963	1,563	2,047	2,287	2,767
Expired Contracts	32	581	939	1,492	1,548	1,548	1,684	3,875	4,661	4,689
Refurbished Nuclear	0	0	0	0	881	881	881	1,762	3,465	4,346
TOTAL	*39,527*	*40,251*	*41,536*	*42,043*	*41,613*	*41,010*	*41,646*	*40,319*	*42,277*	*40,800*

Installed Capacity, MW	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Existing Supply	23,903	23,789	21,440	17,599	15,155	14,254	13,471	12,443	10,401	9,345
Committed, Not Yet Online	3,244	3,244	3,244	3,239	3,238	3,021	3,021	2,991	2,696	2,517
Directed Procurements	2,855	2,855	3,033	3,033	3,033	3,033	3,033	3,033	3,033	3,033
Expired Contracts	5,719	5,832	7,376	11,221	12,843	13,961	14,744	15,803	18,140	19,375
Refurbished Nuclear	5,127	5,127	5,900	6,722	6,722	7,544	7,544	8,366	8,366	8,366
TOTAL	*40,848*	*40,846*	*40,991*	*41,813*	*40,991*	*41,813*	*41,813*	*42,635*	*42,635*	*42,635*

Existing installed capacity by fuel type, 2016-2035



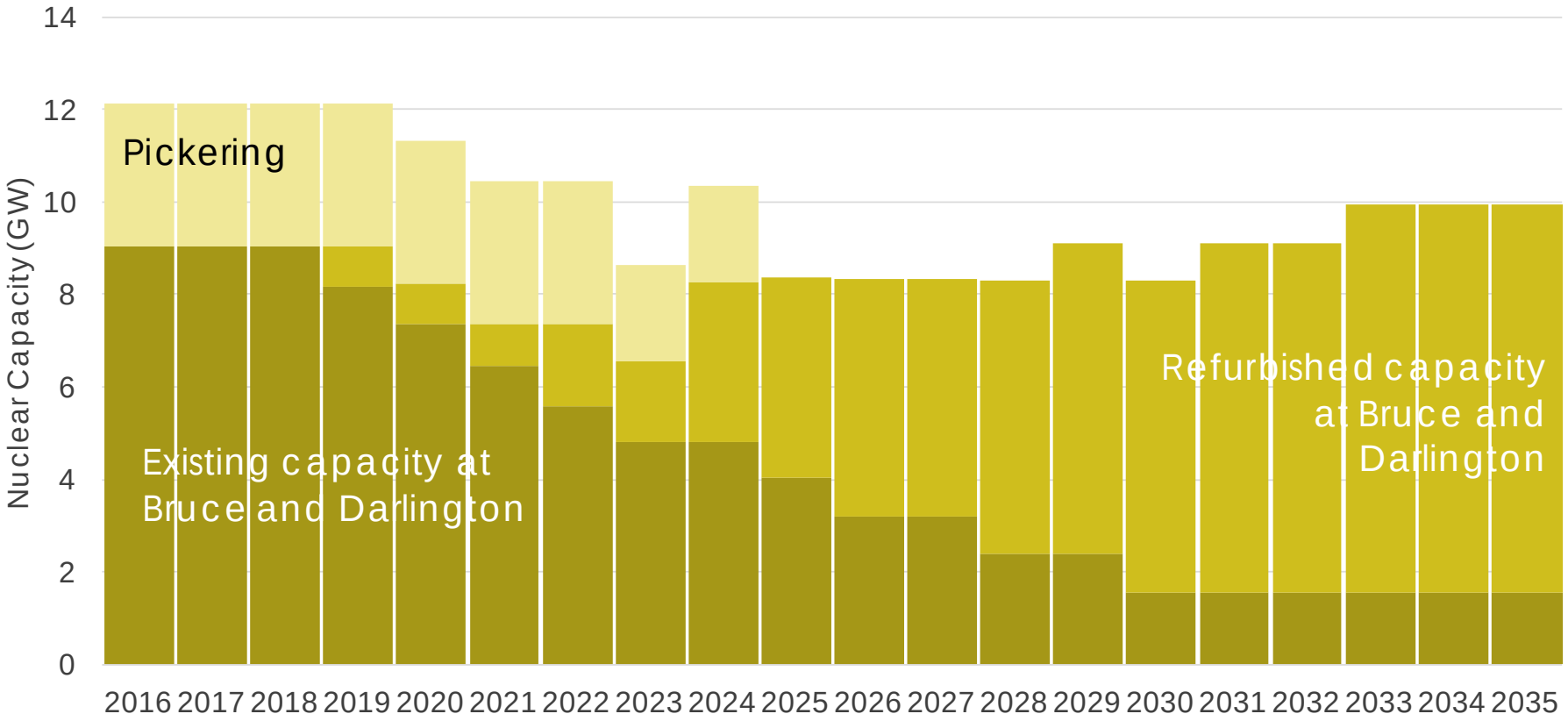
Note: Capacity shown is at year-end, assuming resources become unavailable after reaching contract term.

Existing installed capacity by fuel type, 2016-2035

Installed Capacity, Existing, MW	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Nuclear	12,133	12,133	12,133	12,133	10,430	9,549	9,549	6,857	6,857	4,020
Natural Gas	9,687	9,547	9,426	9,248	9,248	9,248	9,117	6,974	6,394	6,382
Waterpower	8,768	8,768	8,766	8,766	8,758	8,758	8,757	8,757	8,757	8,744
Bioenergy	574	569	569	416	378	378	373	325	120	118
Wind	4,374	4,374	4,374	4,374	4,374	4,373	4,373	4,373	4,373	4,373
Solar PV	2,119	2,119	2,119	2,119	2,119	2,119	2,119	2,119	2,119	2,119
Storage & Demand Response	761	357	122	0	0	0	0	0	0	0
TOTAL	*38,417*	*37,868*	*37,510*	*37,056*	*35,307*	*34,425*	*34,288*	*29,405*	*28,620*	*25,756*

Installed Capacity, Existing, MW	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Nuclear	3,198	3,198	2,376	2,376	1,554	1,554	1,554	1,554	1,554	1,554
Natural Gas	5,749	5,749	4,565	2,143	1,044	940	502	500	417	201
Waterpower	8,744	8,738	8,709	7,717	7,618	7,612	7,593	7,585	7,583	7,578
Bioenergy	116	92	88	88	68	53	44	36	14	13
Wind	3,978	3,893	3,593	3,186	2,947	2,405	2,321	1,872	591	0
Solar PV	2,119	2,119	2,109	2,089	1,924	1,690	1,457	897	243	0
Storage & Demand Response	0	0	0	0	0	0	0	0	0	0
TOTAL	*23,903*	*23,789*	*21,440*	*17,599*	*15,155*	*14,254*	*13,471*	*12,443*	*10,401*	*9,345*

Nuclear fleet installed capacity, 2016-2035

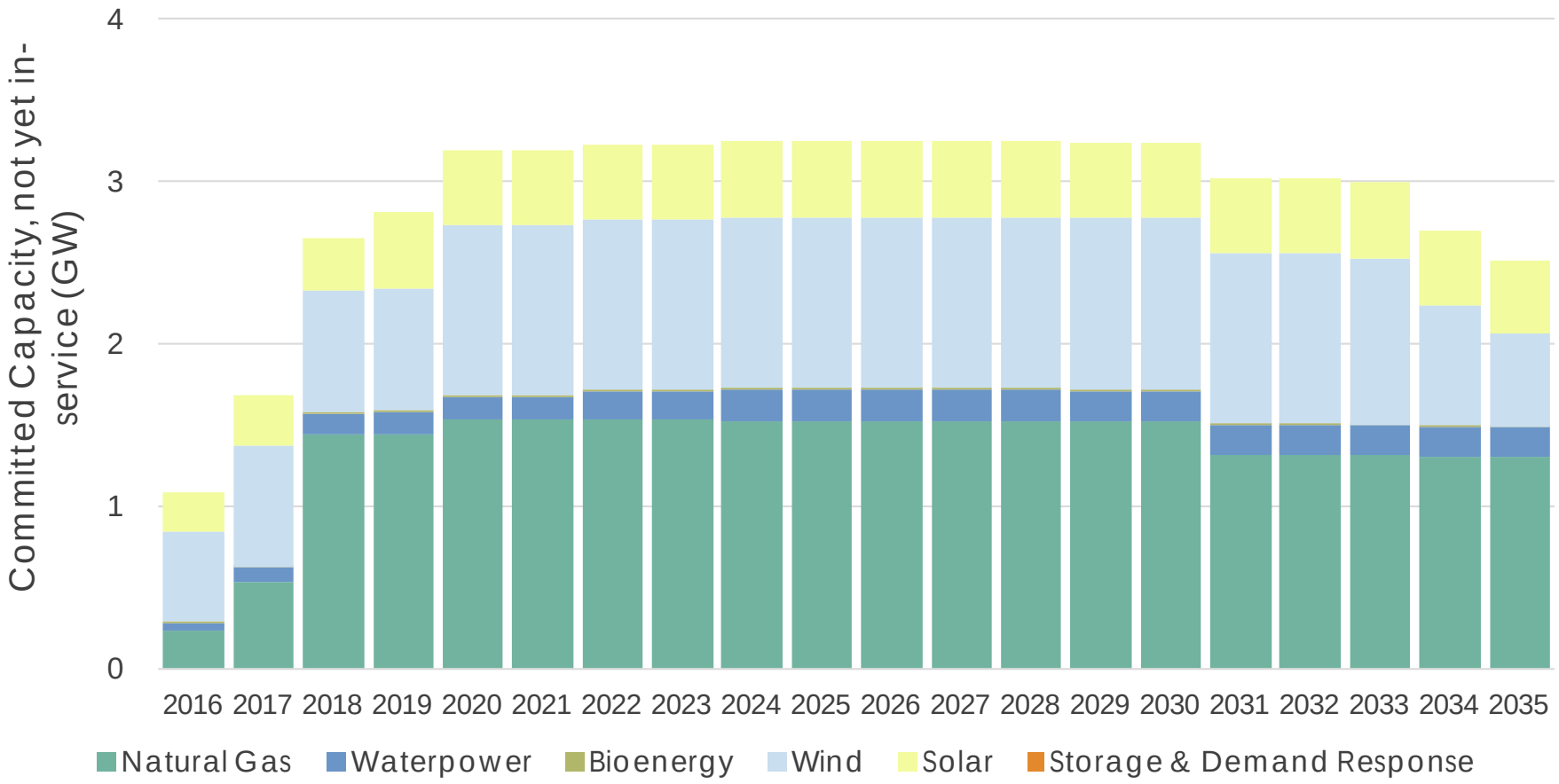


Note: Capacity shown is at year-end

Nuclear fleet installed capacity, 2016-2035

Installed Capacity, Nuclear, MW	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Existing Capacity at Bruce and Darlington	9,039	9,039	9,039	8,158	7,336	6,455	5,574	4,793	4,793	4,020
Refurbished Capacity at Bruce and Darlington	0	0	0	881	881	881	1,762	1,762	3,465	4,346
Existing Capacity at Pickering	3,094	3,094	3,094	3,094	3,094	3,094	3,094	2,064	2,064	0
TOTAL	*12,133*	*12,133*	*12,133*	*12,133*	*11,311*	*10,430*	*10,430*	*8,619*	*10,322*	*8,366*
Installed Capacity, Nuclear, MW	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
Existing Capacity at Bruce and Darlington	3,198	3,198	2,376	2,376	1,554	1,554	1,554	1,554	1,554	1,554
Refurbished Capacity at Bruce and Darlington	5,127	5,127	5,900	6,722	6,722	7,544	7,544	8,366	8,366	8,366
Existing Capacity at Pickering	0	0	0	0	0	0	0	0	0	0
TOTAL	*8,325*	*8,325*	*8,276*	*9,098*	*8,276*	*9,098*	*9,098*	*9,920*	*9,920*	*9,920*

Committed installed capacity by fuel type, 2016-2035



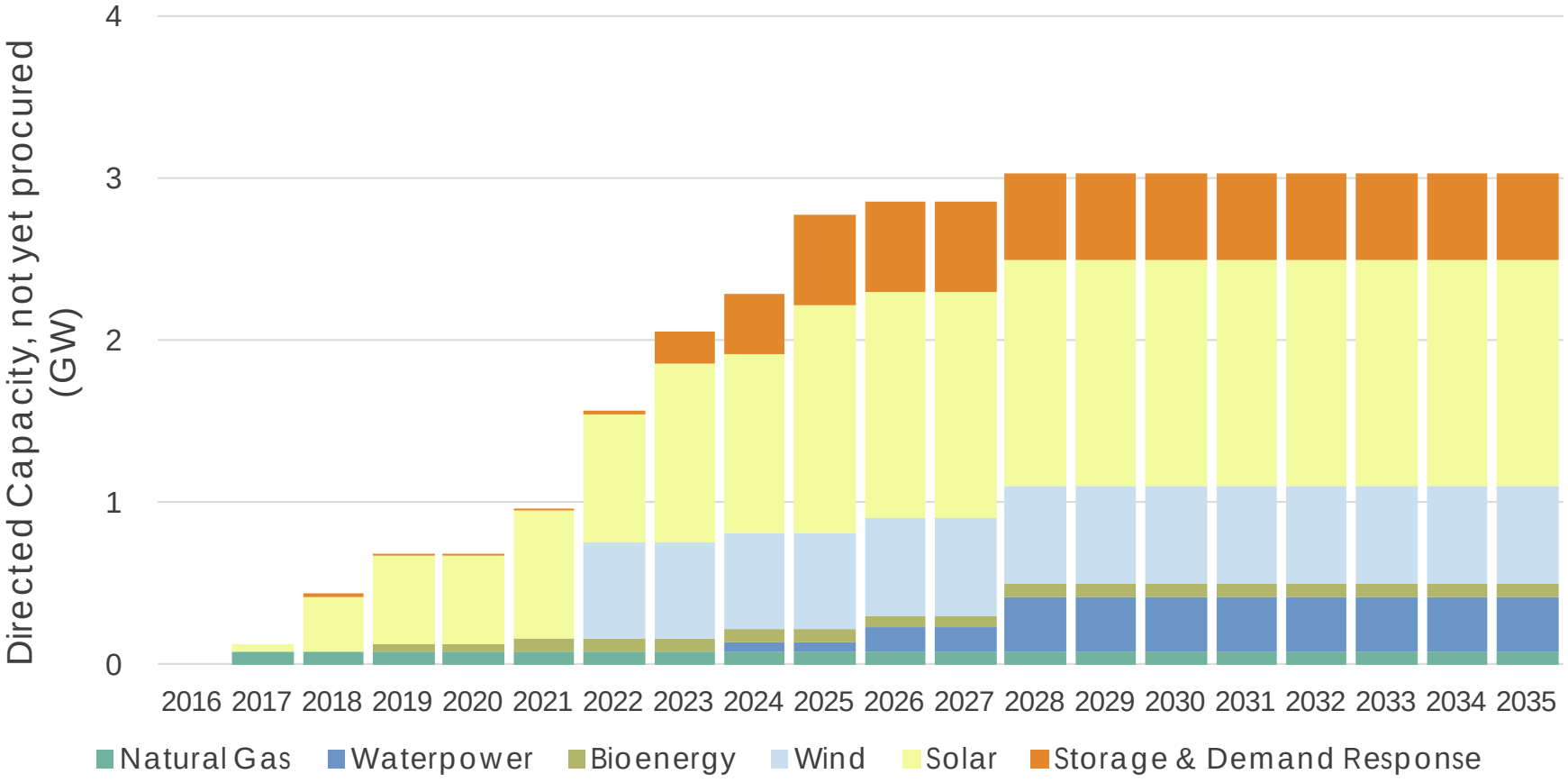
Note: Capacity shown is at year-end

Committed installed capacity by fuel type, 2016-2035

Installed Capacity, Committed, MW	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Natural Gas	234	526	1,436	1,446	1,528	1,528	1,528	1,527	1,527	1,527
Waterpower	42	91	131	138	139	139	174	174	189	189
Bioenergy	7	10	11	11	11	11	11	11	11	11
Wind	554	749	749	749	1,049	1,049	1,049	1,049	1,049	1,049
Solar PV	241	301	328	468	468	468	468	468	468	468
Storage & Demand Response	0	0	0	0	0	0	0	0	0	0
TOTAL	*1,078*	*1,678*	*2,655*	*2,811*	*3,194*	*3,194*	*3,230*	*3,229*	*3,244*	*3,244*

Installed Capacity, Committed, MW	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Natural Gas	1,527	1,527	1,527	1,527	1,527	1,312	1,312	1,312	1,308	1,308
Waterpower	189	189	189	184	184	182	182	182	182	175
Bioenergy	11	11	11	11	11	11	11	6	6	6
Wind	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,024	744	574
Solar PV	468	468	468	468	468	468	468	467	456	455
Storage & Demand Response	0	0	0	0	0	0	0	0	0	0
TOTAL	*3,244*	*3,244*	*3,244*	*3,239*	*3,238*	*3,021*	*3,021*	*2,991*	*2,696*	*2,517*

Directed installed capacity by fuel type, 2016-2035

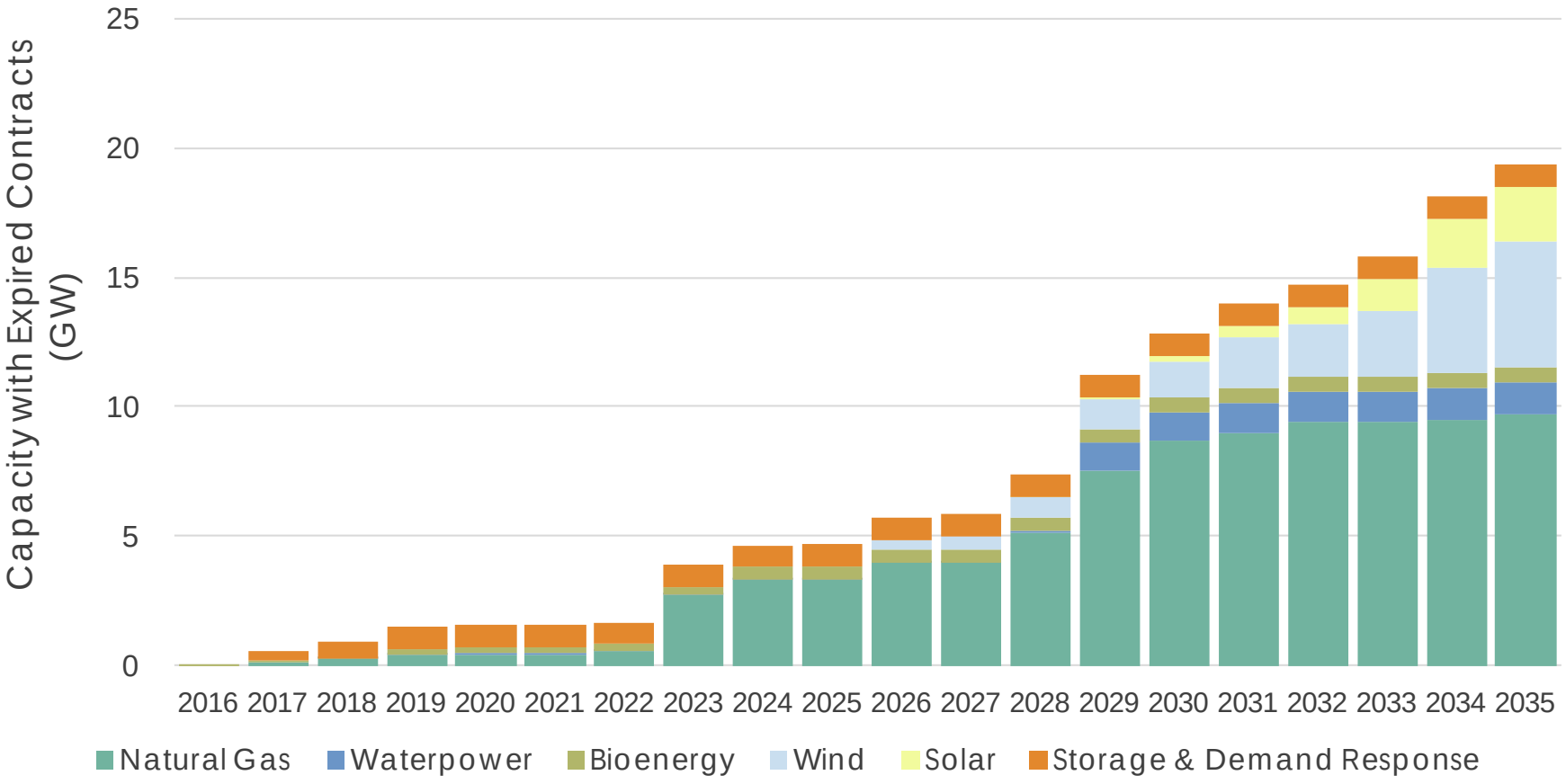


Note: Capacity shown is at year-end

Directed installed capacity by fuel type, 2016-2035

Installed Capacity, Directed, MW	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Natural Gas	0	75	75	75	75	75	75	75	75	75
Waterpower	0	0	0	0	0	0	0	0	60	60
Bioenergy	0	0	0	50	50	80	80	80	80	80
Wind	0	0	0	0	0	0	600	600	600	600
Solar PV	0	50	341	541	541	791	791	1,096	1,096	1,396
Storage & Demand Response	0	0	16	16	16	16	16	196	376	555
TOTAL	*0*	*125*	*433*	*683*	*683*	*963*	*1,563*	*2,047*	*2,287*	*2,767*
Installed Capacity, Directed, MW	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
Natural Gas	75	75	75	75	75	75	75	75	75	75
Waterpower	149	149	342	342	342	342	342	342	342	342
Bioenergy	80	80	80	80	80	80	80	80	80	80
Wind	600	600	600	600	600	600	600	600	600	600
Solar PV	1,396	1,396	1,396	1,396	1,396	1,396	1,396	1,396	1,396	1,396
Storage & Demand Response	555	555	539	539	539	539	539	539	539	539
TOTAL	*2,855*	*2,855*	*3,033*	*3,033*	*3,033*	*3,033*	*3,033*	*3,033*	*3,033*	*3,033*

Expiring contracts, installed capacity by fuel type, 2016-2035



Note: Capacity shown is at year-end

Expiring contracts, installed capacity by fuel type, 2016-2035

Installed Capacity, Expiring Contracts, MW	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Natural Gas	0	140	261	439	449	449	580	2,723	3,303	3,315
Waterpower	0	0	3	3	10	10	11	11	11	24
Bioenergy	32	37	37	190	228	228	233	281	486	489
Wind	0	0	0	0	0	0	0	0	0	0
Solar PV	0	0	0	0	0	0	0	0	0	0
Storage & Demand Response	0	404	639	861	861	861	861	861	861	861
TOTAL	*32*	*581*	*939*	*1,492*	*1,548*	*1,548*	*1,684*	*3,875*	*4,661*	*4,689*

Installed Capacity, Expiring Contracts, MW	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Natural Gas	3,949	3,949	5,133	7,555	8,653	8,972	9,410	9,413	9,500	9,716
Waterpower	24	31	59	1,056	1,156	1,163	1,182	1,191	1,192	1,205
Bioenergy	490	514	518	518	538	553	562	576	598	599
Wind	395	478	778	1,185	1,424	1,967	2,050	2,524	4,085	4,847
Solar PV	0	0	10	29	195	429	662	1,222	1,887	2,132
Storage & Demand Response	861	861	877	877	877	877	877	877	877	877
TOTAL	*5,719*	*5,832*	*7,376*	*11,221*	*12,843*	*13,961*	*14,744*	*15,803*	*18,140*	*19,375*

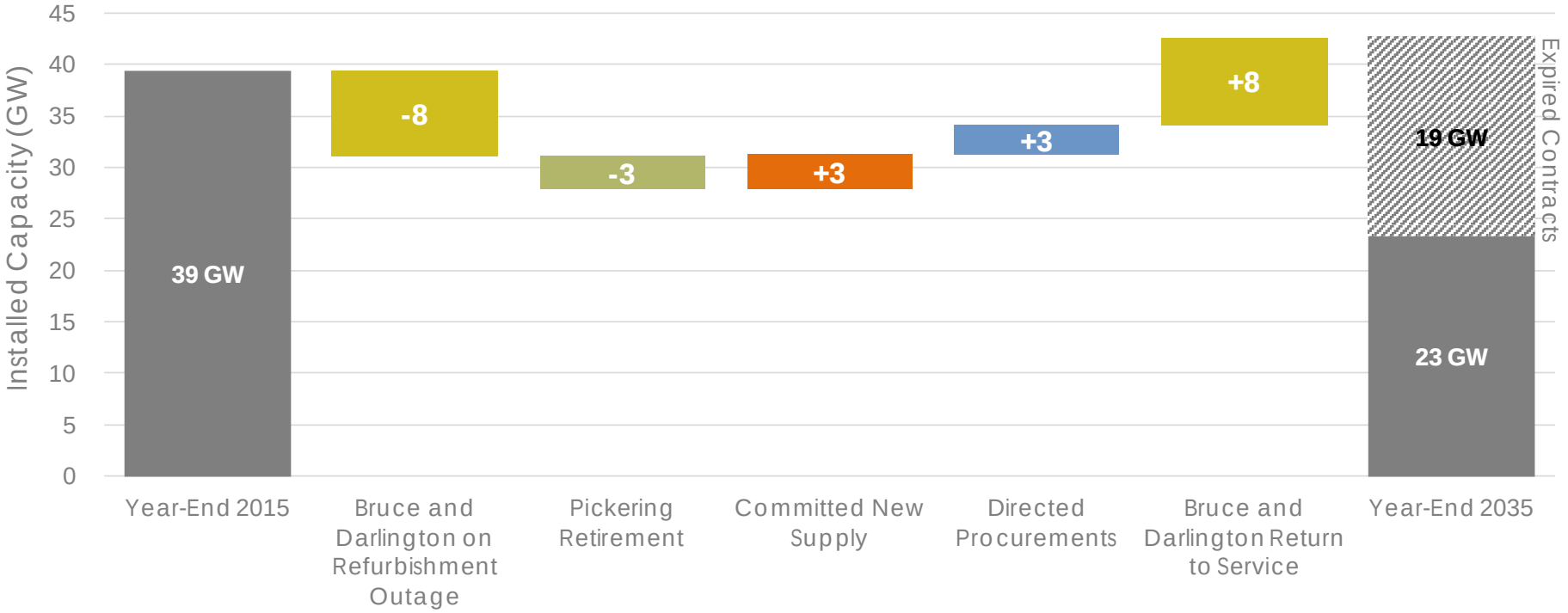
2. Uncertainties and Risks in the Supply Projection

Resource availability risks

- Ontario's electricity supply system will continue to evolve as existing generators are retired or refurbished, new supply sources are commissioned and age-related effects on generator performance become more pronounced. Additional changes may ensue as contracted supply resources reach end of commercial term over the coming decades.
- These transitions will introduce implementation, performance and availability risks that will require attention. These risks are with respect to:
  - Resource turnover
  - Aging generators
  - Expiring generator contracts

Resource turnover

- Substantial resource turnover anticipated in coming years, driven by nuclear retirements, nuclear refurbishments and by the commissioning of sizeable amounts of committed and directed resources.
- The scale of the resource turnover over the planning period may well exceed the turnover experienced during Ontario's recent coal replacement program.



Resource turnover

	Installed Capacity, GW
Existing Supply at Year-End 2015	39.4
Bruce and Darlington on Refurbishment Outage	-8.4
Pickering Retirement	-3.1
Committed New Supply	3.2
Directed Procurements	3.0
Bruce and Darlington Return to Service	8.4
Existing, Committed, Refurbished Nuclear, and Directed Supply at Year-End 2035	23.3
Expired Contracts at Year-End 2035	19.4

Total may not add up due to rounding

Risks inherent in any large and rapid resource turnover, as illustrated in the previous slide, include implementation delay and implementation failure. Resource availability risks can be evaluated from a number of perspectives. Potential impacts of such risks are greatest where the capacity at stake is high and where advance warning is less likely.

Risk Perspective	Description
Capacity at Stake	The amount of capacity (in MW) subject to risk in a given resource category
In-Service Delay	The risk from resources not coming into service as scheduled in the deterministic supply projection
Failure to Materialize	Risk from a given category of supply not being built/implemented/available as assumed in the deterministic supply projection
Lead-Time/Advance Warning	The degree to which delays/failures can be anticipated and permit a wider range of mitigation options. Surprises can be more difficult to mitigate.

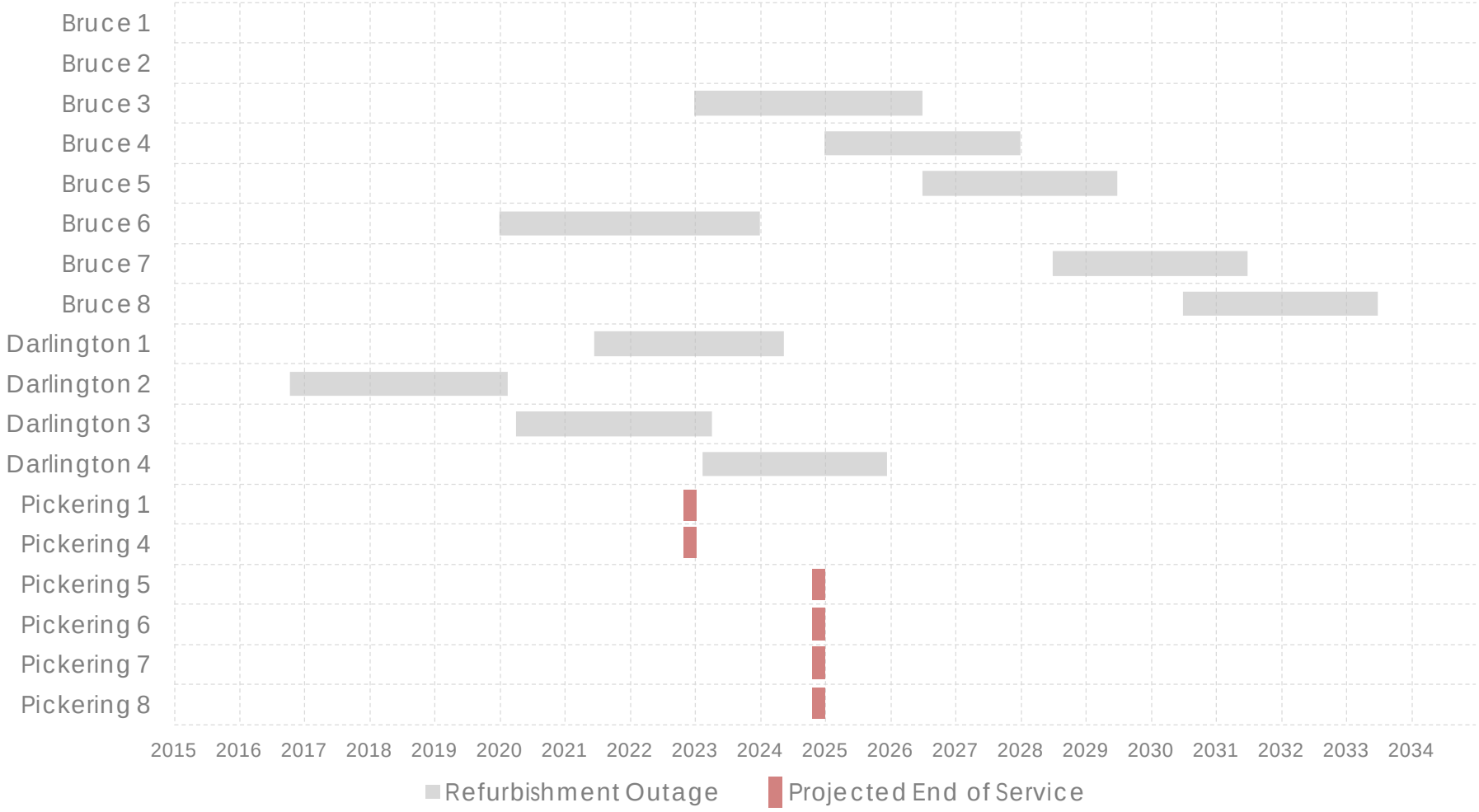
Of the resource turnover risks identified, availability of the nuclear fleet will require most of our attention

- Refurbishment schedule
  - Lessons learned from past refurbishments and longer budgeted times increases confidence in the achievability of the planned refurbishment schedule. However, should delays occur, the impact would be greatest between 2024 and 2026 due to the number of units expected to be on refurbishment outage.

- Pickering continued operations to 2022/2024
  - If a regulatory decision is made in 2017-2018 to not proceed with the continued operations of Pickering to 2022/2024, there will be approximately two to three years to put in place replacement resources to the extent they are required.

- Nuclear off-ramps
  - If costs exceed budgets or the planning context evolves such that refurbishments are no longer economic, an off-ramp may be exercised. Decision would consider demand/supply outlook at the time and account for the investment and lead time required to implement alternative supply resources. Should off-ramps be exercised, there would be a lead time of 4 to 5 years between when the off-ramp decision is made and when the impact of that off-ramp would occur.

Nuclear schedule



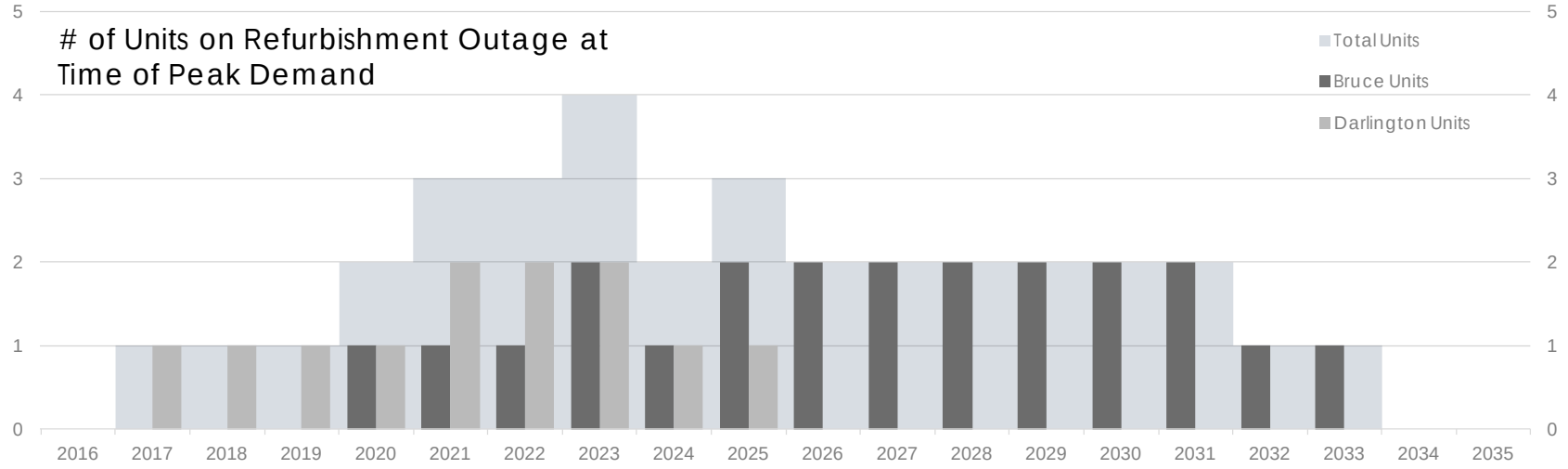
As of January 2016.

Nuclear schedule

Unit	Refurbishment Outage Start	Refurbishment Outage End	Projected End-of-Service
Bruce 3	January 2023	June 2026	
Bruce 4	January 2025	December 2027	
Bruce 5	July 2026	June 2029	
Bruce 6	January 2020	December 2023	
Bruce 7	July 2028	June 2031	
Bruce 8	July 2030	June 2033	
Darlington 1	June 2021	May 2024	
Darlington 2	October 2016	February 2020	
Darlington 3	February 2020	February 2023	
Darlington 4	February 2023	December 2025	
Pickering 1			December 2022
Pickering 4			December 2022
Pickering 5			December 2024
Pickering 6			December 2024
Pickering 7			December 2024
Pickering 8			December 2024

As of January 2016.

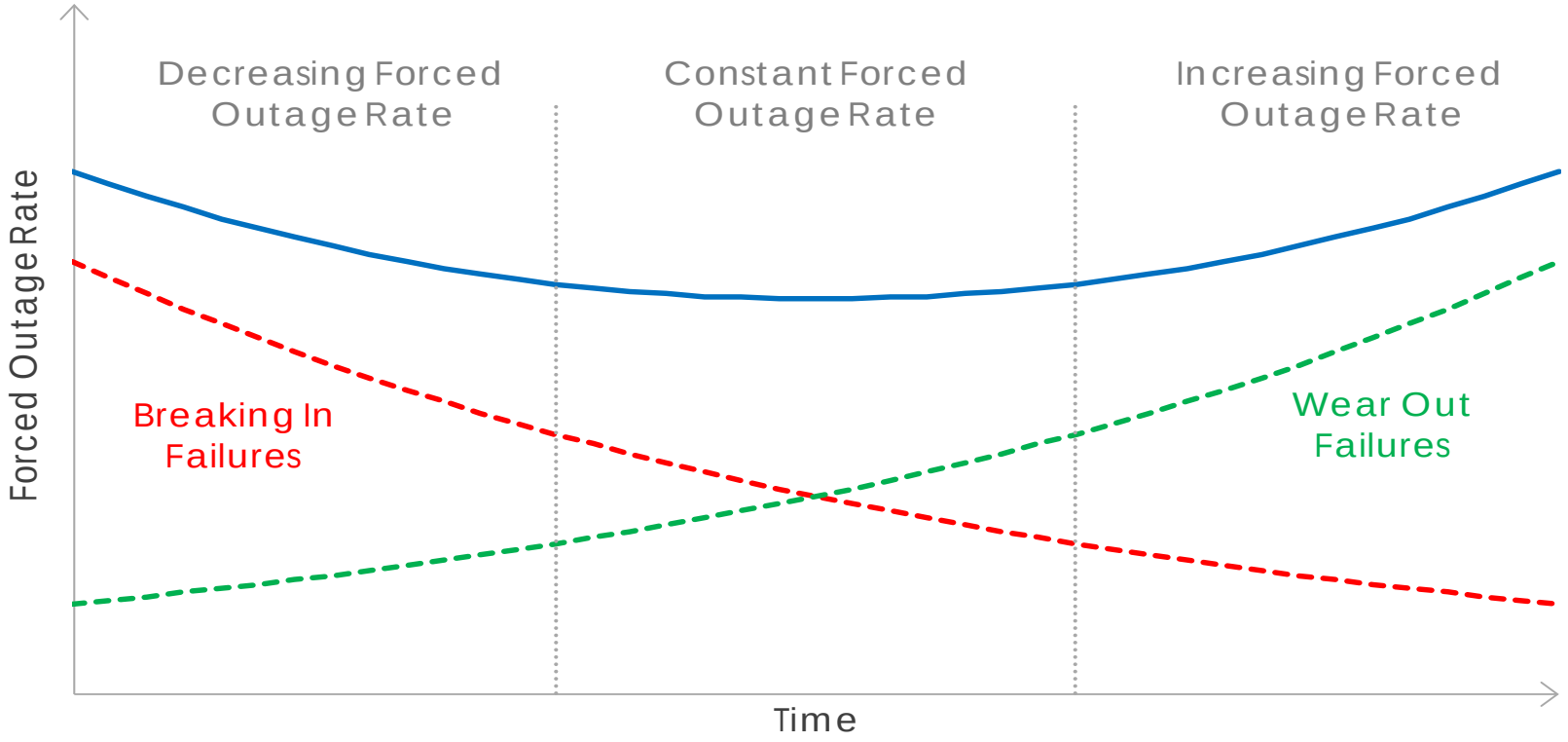
Nuclear refurbishment outages



Nuclear refurbishment outages

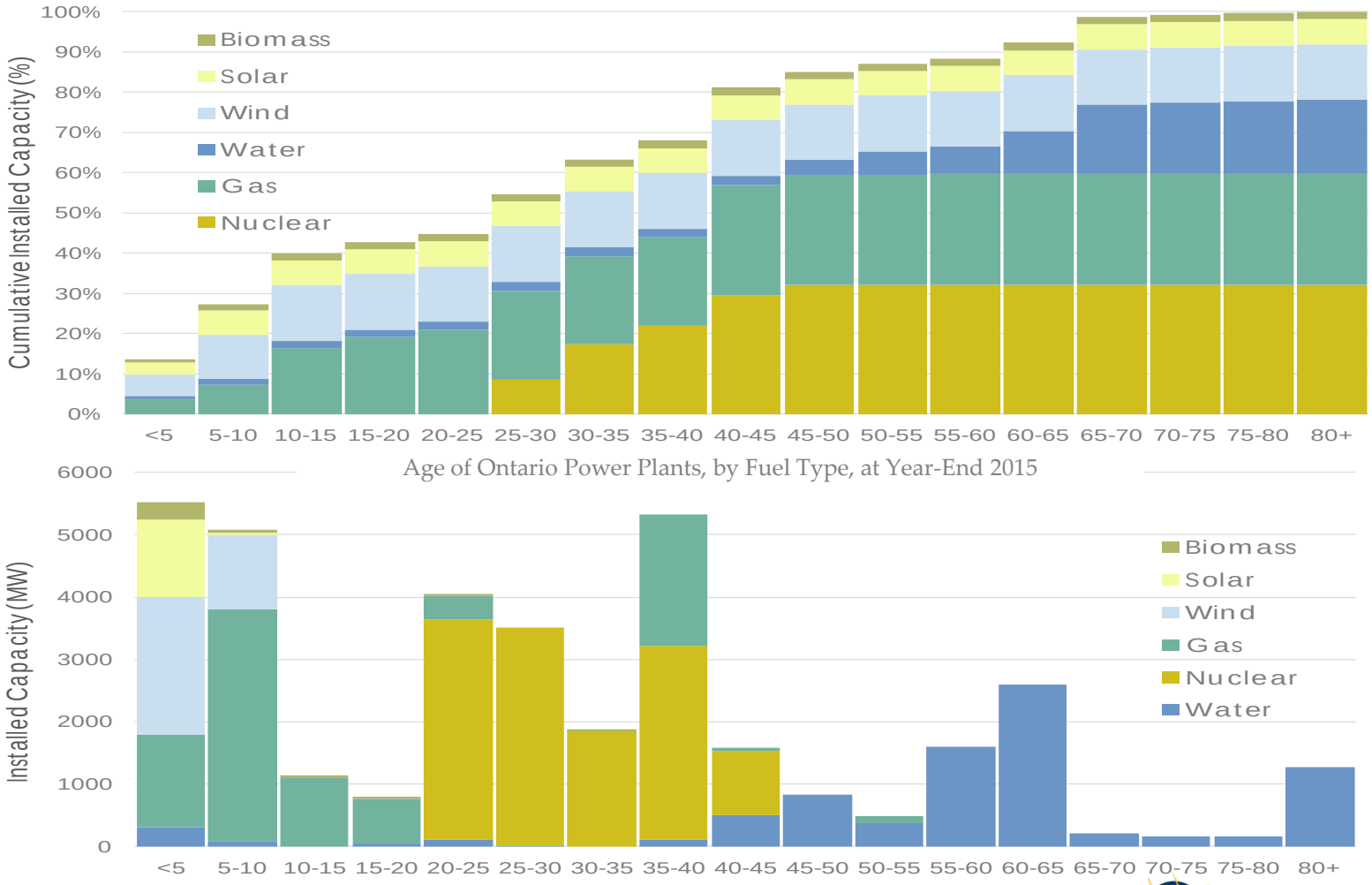
# of Units on Refurbishment Outage at Time of Peak Demand	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Darlington	0	1	1	1	1	2	2	2	1	1
Bruce	0	0	0	0	1	1	1	2	1	2
Total	*0*	*1*	*1*	*1*	*2*	*3*	*3*	*4*	*2*	*3*
# of Units on Refurbishment Outage at Time of Peak Demand	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
Darlington	0	0	0	0	0	0	0	0	0	0
Bruce	2	2	2	2	2	2	1	1	0	0
Total	*2*	*2*	*2*	*2*	*2*	*2*	*1*	*1*	*0*	*0*

The effect of ageing on generator reliability is another issue to watch. As illustrated in the figure below, generator reliability can change over time. "Breaking in" failures are of particular concern during a unit's infancy, "wearing out" failures are of particular concern during a unit's twighlight years.



This type of figure is sometimes referred to as a "bathtub curve"

The issue of aging is relevant in light of the "demographic" distribution of Ontario's generator fleet: about 40% of Ontario's total capacity is less than 15 years old, about 45% of Ontario's capacity is greater than 30 years old



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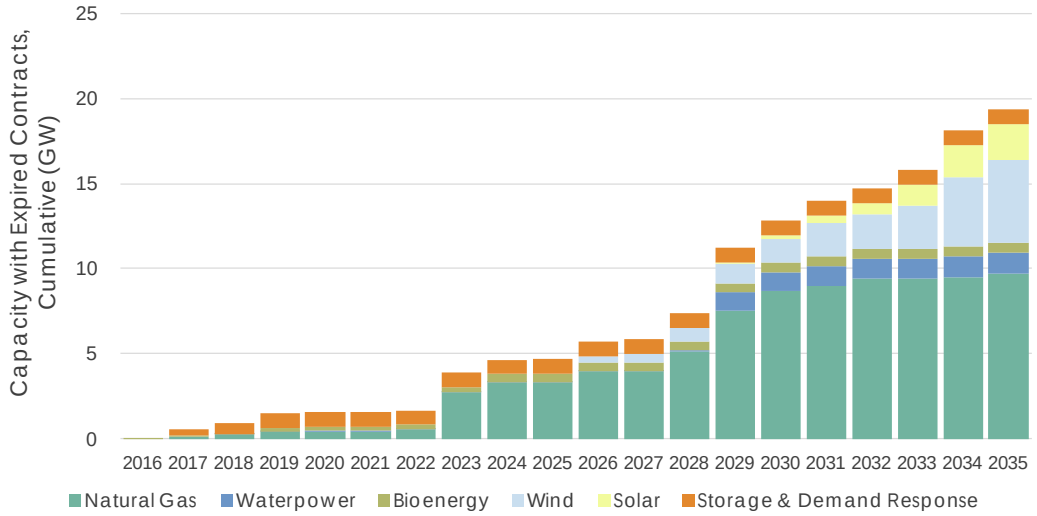
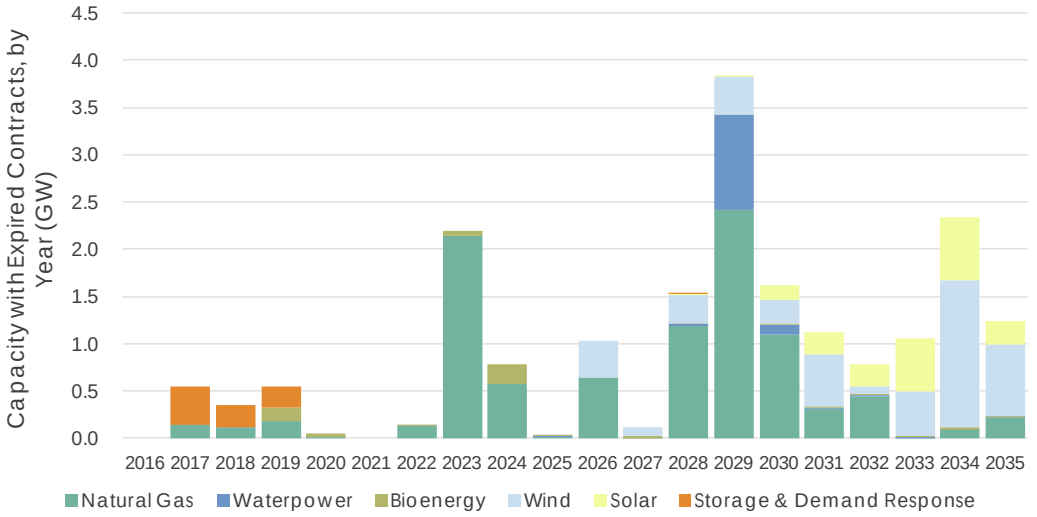
Age of Ontario's Generation Fleet, by Fuel Type, at Year-End 2015

Cumulative Installed Capacity, %	< 5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70-75	75-80	80+
Bioenergy	1%	1%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Gas	4%	7%	17%	19%	21%	22%	22%	22%	27%	27%	27%	28%	28%	28%	28%	28%	28%
Wind	5%	11%	14%	14%	14%	14%	14%	14%	14%	14%	14%	14%	14%	14%	14%	14%	14%
Solar PV	3%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%
Nuclear	0%	0%	0%	0%	0%	9%	17%	22%	30%	32%	32%	32%	32%	32%	32%	32%	32%
Waterpower	1%	2%	2%	2%	2%	2%	2%	2%	2%	4%	6%	7%	11%	17%	18%	18%	18%
Installed Capacity by Age, MW	**< 5**	**5-10**	**10-15**	**15-20**	**20-25**	**25-30**	**30-35**	**35-40**	**40-45**	**45-50**	**50-55**	**55-60**	**60-65**	**65-70**	**70-75**	**75-80**	**80+**
Bioenergy	289	51	38	37	30	0	0	0	0	0	0	0	0	0	0	0	0
Gas	1,488	3,723	1,108	715	390	0	12	2,112	46	0	122	0	0	0	0	0	0
Wind	2,211	1,187	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Solar PV	1,232	39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nuclear	0	0	0	0	3,524	3,498	1,854	3,108	1,030	0	0	0	0	0	0	0	0
Waterpower	310	85	0	52	112	20	0	106	511	838	369	1,596	2,603	203	162	154	1,275

There is potential for further change as approximately 18 GW of installed capacity currently under IESO contract will reach end of term before 2035.

- About half of this amount, mostly comprised of natural gas-fired resources, will reach term in the mid-to-late 2020's. The other half will reach end of term in the early 2030s and consists mostly of wind and solar PV resources.
- These assets offer Ontario significant scope for reinvestment or divestment and we generally have time to decide.





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Installed Capacity with Expiring Contracts, 2016-2035

Installed Capacity with Expired Contracts, Cumulative, MW	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Natural Gas	0	140	261	439	449	449	580	2,723	3,303	3,315
Waterpower	0	0	3	3	10	10	11	11	11	24
Bioenergy	32	37	37	190	228	228	233	281	486	489
Wind	0	0	0	0	0	0	0	0	0	0
Solar PV	0	0	0	0	0	0	0	0	0	0
Storage & Demand Response	0	404	639	861	861	861	861	861	861	861
TOTAL	*32*	*581*	*939*	*1,492*	*1,548*	*1,548*	*1,684*	*3,875*	*4,661*	*4,689*

	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Natural Gas	3,949	3,949	5,133	7,555	8,653	8,972	9,410	9,413	9,500	9,716
Waterpower	24	31	59	1,056	1,156	1,163	1,182	1,191	1,192	1,205
Bioenergy	490	514	518	518	538	553	562	576	598	599
Wind	395	478	778	1,185	1,424	1,967	2,050	2,524	4,085	4,847
Solar PV	0	0	10	29	195	429	662	1,222	1,887	2,132
Storage & Demand Response	861	861	877	877	877	877	877	877	877	877
TOTAL	*5,719*	*5,832*	*7,376*	*11,221*	*12,843*	*13,961*	*14,744*	*15,803*	*18,140*	*19,375*

Installed Capacity with Expired Contracts, by Year, MW	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Natural Gas	0	140	121	178	9	0	131	2,143	581	12
Waterpower	0	0	3	0	8	0	1	0	0	14
Bioenergy	0	5	0	153	38	0	5	48	205	3
Wind	0	0	0	0	0	0	0	0	0	0
Solar PV	0	0	0	0	0	0	0	0	0	0
Storage & Demand Response	0	404	235	222	0	0	0	0	0	0
TOTAL	*0*	*549*	*358*	*553*	*55*	*0*	*137*	*2,191*	*786*	*28*

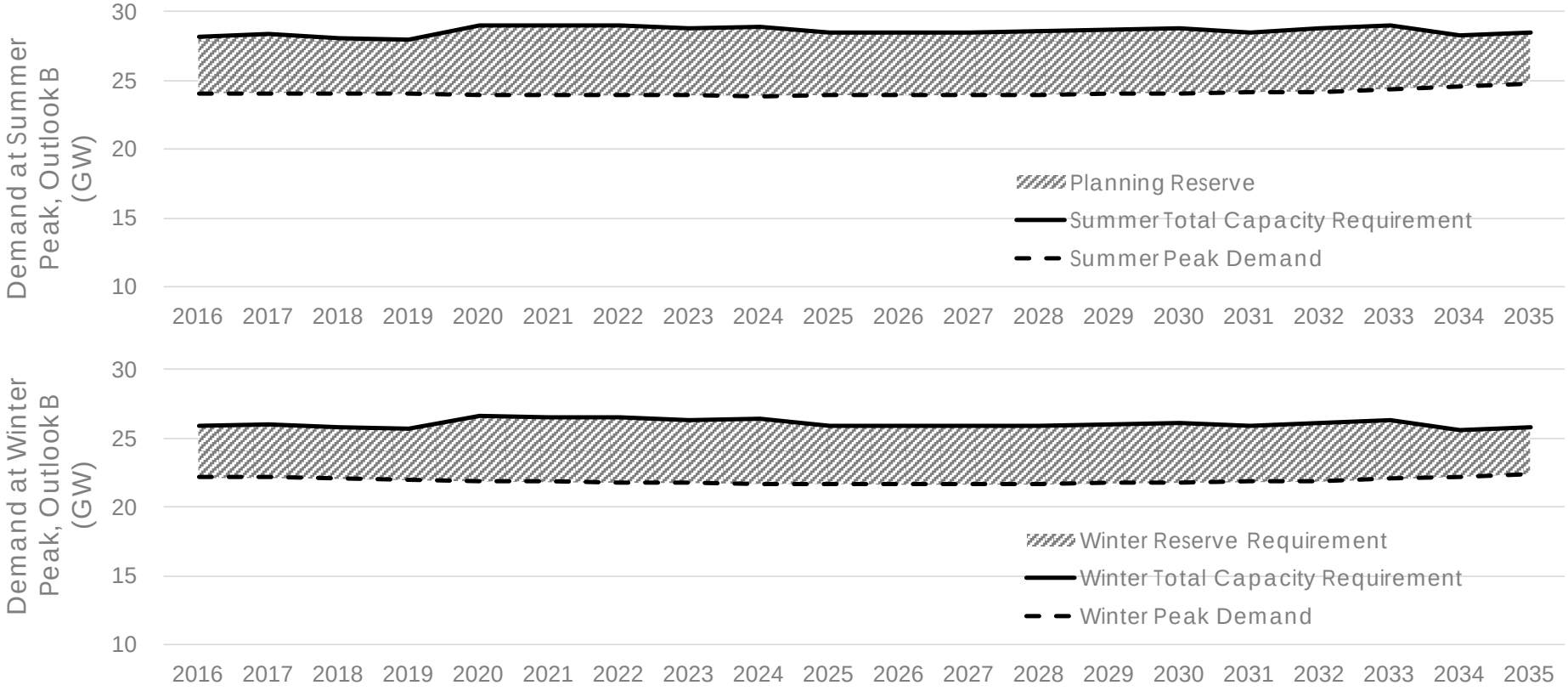
	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Natural Gas	634	0	1,184	2,422	1,099	319	438	3	87	216
Waterpower	0	6	29	996	100	8	19	9	2	12
Bioenergy	2	24	4	0	20	15	9	13	23	1
Wind	395	83	300	407	239	542	84	474	1,561	762
Solar PV	0	0	10	19	165	234	233	560	665	245
Storage & Demand Response	0	0	16	0	0	0	0	0	0	0
TOTAL	*1,030*	*113*	*1,544*	*3,845*	*1,623*	*1,118*	*783*	*1,059*	*2,337*	*1,235*

The IESO has accounted for resource availability uncertainty in its calculation of the planning reserve margin, detailed in Section 3

- The government's Long Term Energy Plan, 2013, outlined principles for nuclear refurbishment. Principle #2 stated "mitigate reliability risks by developing contingency plans that include alternative supply options if contract and other objectives are at risk of non-fulfillment."
- The IESO has a mandate ensure supply adequacy through setting a reserve margin, as part of its obligations to the North American Electricity Reliability Corporation (NERC)
- A planning reserve margin is calculated to account for uncertainties such as generator performance and availability. The IESO has included the uncertainty borne by nuclear refurbishment delays and impacts of generator aging in its calculation of the planning reserve margin

3. Supply-Demand Balance

Ontario's resource requirement is the amount of available capacity required to meet the NPCC reliability criterion of an annual loss of load expectation of 0.1 days per year. To meet the NPCC target, the resource requirement includes some capacity that is in excess of Ontario's demand. The fraction of the resource requirement that is in excess of Ontario's demand is referred to as the "reserve margin" or "planning reserve". Ontario's planning reserve reflects the expected internal supply mix and their availability risks, forecast demand levels and their uncertainties, major transmission limits, and both scheduled and unscheduled resource outages.



Note: Outlook B is shown here for illustration. Tables for all four outlooks are provided on the slides that follow.

Ontario's total capacity requirement, Outlook A

Reflects peak demand plus a planning reserve margin

OUTLOOK A (MW)	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Summer Peak Demand	23,971	23,900	23,705	23,465	23,216	23,029	22,879	22,777	22,628	22,568
Planning Reserve	4,099	4,230	4,006	3,919	4,970	4,915	4,889	4,758	4,847	4,340
Summer Total Capacity Requirement	28,070	28,130	27,711	27,383	28,186	27,944	27,769	27,535	27,475	26,908
Winter Peak Demand	22,093	22,020	21,825	21,574	21,338	21,143	20,976	20,864	20,694	20,602
Winter Reserve Requirement	3,778	3,897	3,688	3,603	4,649	4,594	4,566	4,443	4,518	4,049
Winter Total Capacity Requirement	25,870	25,917	25,514	25,176	25,987	25,737	25,542	25,306	25,212	24,651

OUTLOOK A (MW)	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Summer Peak Demand	22,453	22,372	22,295	22,292	22,258	22,231	22,198	22,317	22,436	22,586
Planning Reserve	4,368	4,356	4,344	4,344	4,383	4,112	4,330	4,348	3,365	3,388
Summer Total Capacity Requirement	26,821	26,728	26,639	26,636	26,641	26,343	26,527	26,664	25,802	25,973
Winter Peak Demand	20,483	20,394	20,315	20,316	20,295	20,282	20,260	20,375	20,488	20,622
Winter Reserve Requirement	4,072	4,059	4,047	4,047	4,085	3,840	4,039	4,056	3,073	3,093
Winter Total Capacity Requirement	24,555	24,453	24,363	24,364	24,380	24,122	24,299	24,431	23,561	23,715

Ontario's total capacity requirement, Outlook B

Reflects peak demand plus a planning reserve margin

OUTLOOK B (MW)	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Summer Peak Demand	24,046	24,083	24,041	23,993	23,916	23,889	23,881	23,890	23,868	23,918
Planning Reserve	4,112	4,263	4,063	4,007	5,090	5,061	5,060	4,942	5,058	4,540
Summer Total Capacity Requirement	28,157	28,345	28,104	28,000	29,006	28,950	28,941	28,832	28,925	28,457
Winter Peak Demand	22,140	22,143	22,072	21,985	21,898	21,841	21,799	21,778	21,718	21,718
Winter Reserve Requirement	3,786	3,919	3,730	3,672	4,745	4,713	4,706	4,593	4,692	4,214
Winter Total Capacity Requirement	25,926	26,063	25,802	25,657	26,643	26,554	26,505	26,371	26,411	25,932
OUTLOOK B (MW)	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
Summer Peak Demand	23,882	23,918	23,940	24,030	24,082	24,133	24,171	24,369	24,568	24,792
Planning Reserve	4,582	4,588	4,591	4,605	4,660	4,379	4,626	4,655	3,685	3,719
Summer Total Capacity Requirement	28,465	28,505	28,531	28,635	28,742	28,512	28,796	29,024	28,253	28,510
Winter Peak Demand	21,659	21,668	21,672	21,746	21,794	21,844	21,875	22,052	22,229	22,422
Winter Reserve Requirement	4,249	4,250	4,251	4,262	4,313	4,058	4,281	4,308	3,334	3,363
Winter Total Capacity Requirement	25,908	25,919	25,922	26,008	26,106	25,902	26,156	26,359	25,563	25,785

Ontario's total capacity requirement, Outlook C

Reflects peak demand plus a planning reserve margin

OUTLOOK C (MW)	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Summer Peak Demand	24,048	24,088	24,108	24,124	24,112	24,152	24,216	24,298	24,353	24,486
Planning Reserve	4,088	4,095	4,098	4,101	5,099	5,106	5,117	5,131	5,140	5,163
Summer Total Capacity Requirement	28,137	28,183	28,207	28,225	29,212	29,258	29,332	29,429	29,493	29,648
Winter Peak Demand	22,190	22,251	22,315	22,395	22,501	22,661	22,863	23,105	23,326	23,626
Winter Reserve Requirement	3,772	3,783	3,793	3,807	4,825	4,852	4,887	4,928	4,966	5,016
Winter Total Capacity Requirement	25,962	26,033	26,108	26,202	27,326	27,514	27,749	28,033	28,292	28,643

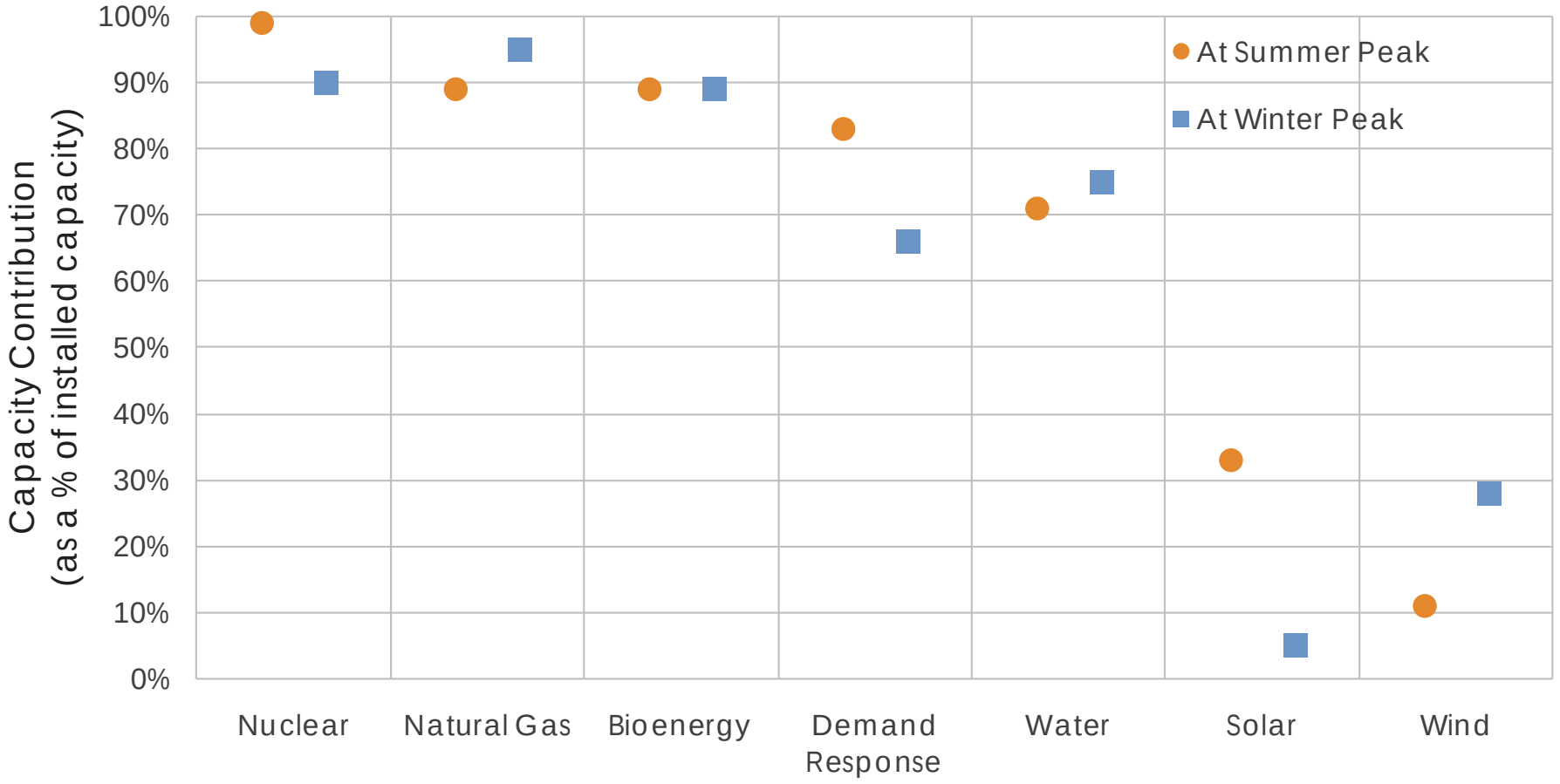
OUTLOOK C (MW)	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Summer Peak Demand	24,549	24,680	24,804	25,049	25,550	26,022	26,199	26,551	26,902	27,276
Planning Reserve	5,173	5,196	5,217	5,258	5,344	5,424	5,454	5,514	4,573	4,637
Summer Total Capacity Requirement	29,723	29,876	30,021	30,307	30,894	31,445	31,653	32,065	31,476	31,912
Winter Peak Demand	23,911	24,265	24,633	24,513	25,085	25,695	26,330	27,185	28,144	29,167
Winter Reserve Requirement	5,065	5,125	5,188	5,167	5,264	5,368	5,476	5,621	4,784	4,958
Winter Total Capacity Requirement	28,976	29,390	29,820	29,680	30,349	31,063	31,806	32,806	32,928	34,125

Ontario's total capacity requirement, Outlook D

Reflects peak demand plus a planning reserve margin

OUTLOOK D (MW)	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Summer Peak Demand	24,048	24,088	24,166	24,242	24,291	24,393	24,520	24,667	24,788	24,987
Planning Reserve	4,088	4,095	4,108	4,121	5,130	5,147	5,168	5,193	5,214	5,248
Summer Total Capacity Requirement	28,137	28,183	28,275	28,363	29,421	29,540	29,689	29,861	30,002	30,235
Winter Peak Demand	22,190	22,251	22,385	22,560	22,783	23,083	23,442	23,862	24,273	24,779
Winter Reserve Requirement	3,772	3,783	3,806	3,835	4,873	4,924	4,985	5,056	5,126	5,212
Winter Total Capacity Requirement	25,962	26,033	26,191	26,395	27,656	28,007	28,428	28,918	29,399	29,992
OUTLOOK D (MW)	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
Summer Peak Demand	25,446	25,921	26,124	26,410	26,667	26,937	27,197	27,633	28,071	28,532
Planning Reserve	5,326	5,407	5,441	5,490	5,533	5,579	5,624	5,698	4,772	4,850
Summer Total Capacity Requirement	30,772	31,327	31,566	31,900	32,200	32,517	32,821	33,331	32,843	33,383
Winter Peak Demand	24,742	25,492	26,277	27,226	28,296	29,451	30,683	32,158	33,716	35,379
Winter Reserve Requirement	5,206	5,334	5,467	5,628	5,810	6,007	6,216	6,467	5,732	6,014
Winter Total Capacity Requirement	29,948	30,826	31,745	32,854	34,106	35,457	36,899	38,625	39,448	41,393

Contribution of resources towards meeting peak demand requirements varies with season

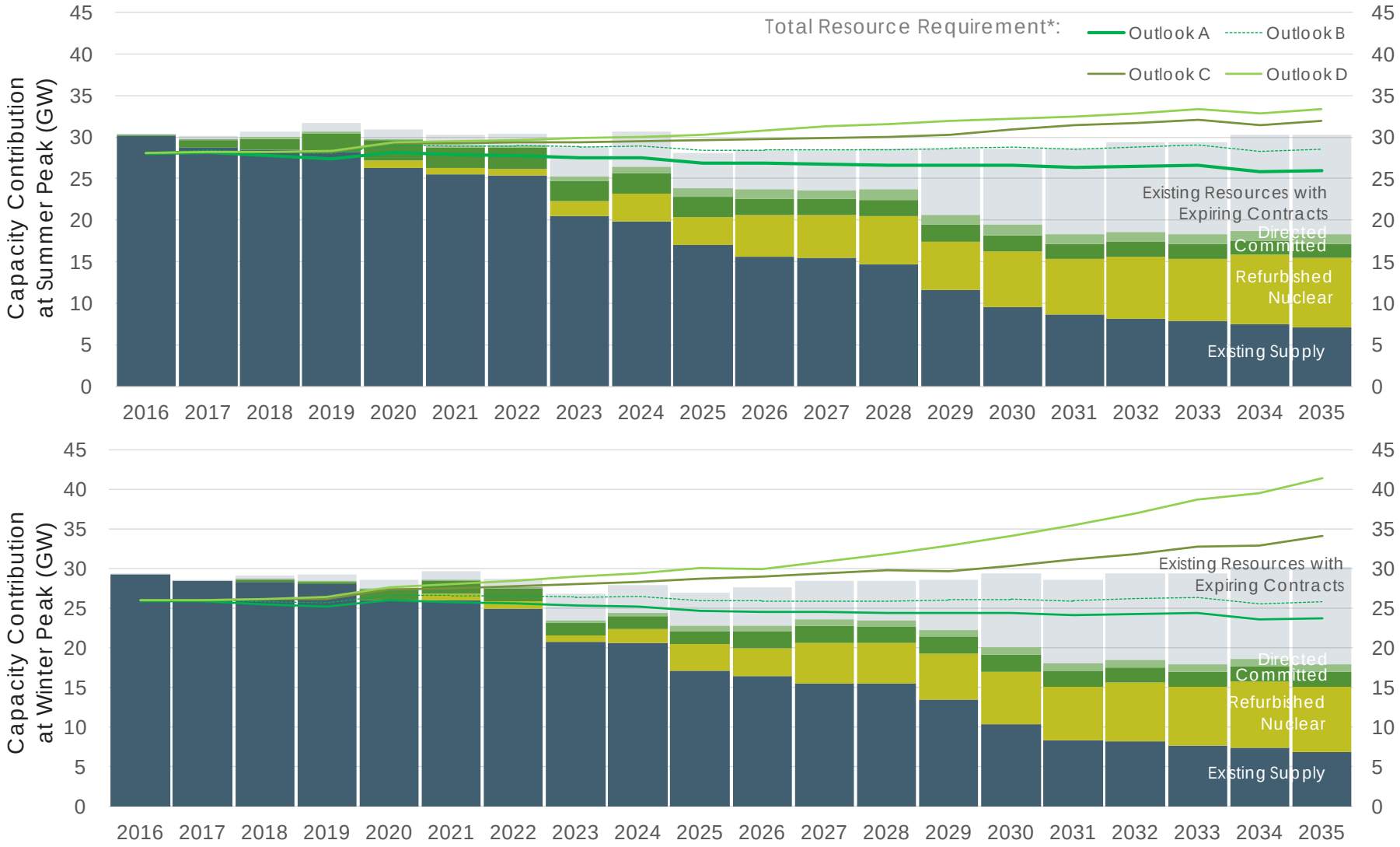


Note: capacity contribution may also referred to as "effective capacity"

Contribution of resources towards meeting peak demand requirements varies with season

	Capacity Contribution (% of Installed Capacity Available at Time of Peak Demand)	
	At Summer Peak	At Winter Peak
Nuclear	99%	90%
Natural Gas	89%	95%
Waterpower	71%	75%
Bioenergy	89%	89%
Wind	11%	28%
Solar PV	33%	5%
Demand Response	83%	66%

Resource adequacy outlook across demand outlooks



Total Resource Requirement*: The amount of supply needed to meet peak demand plus planning reserve requirements (to account for generator unavailability and variability in demand due to weather).

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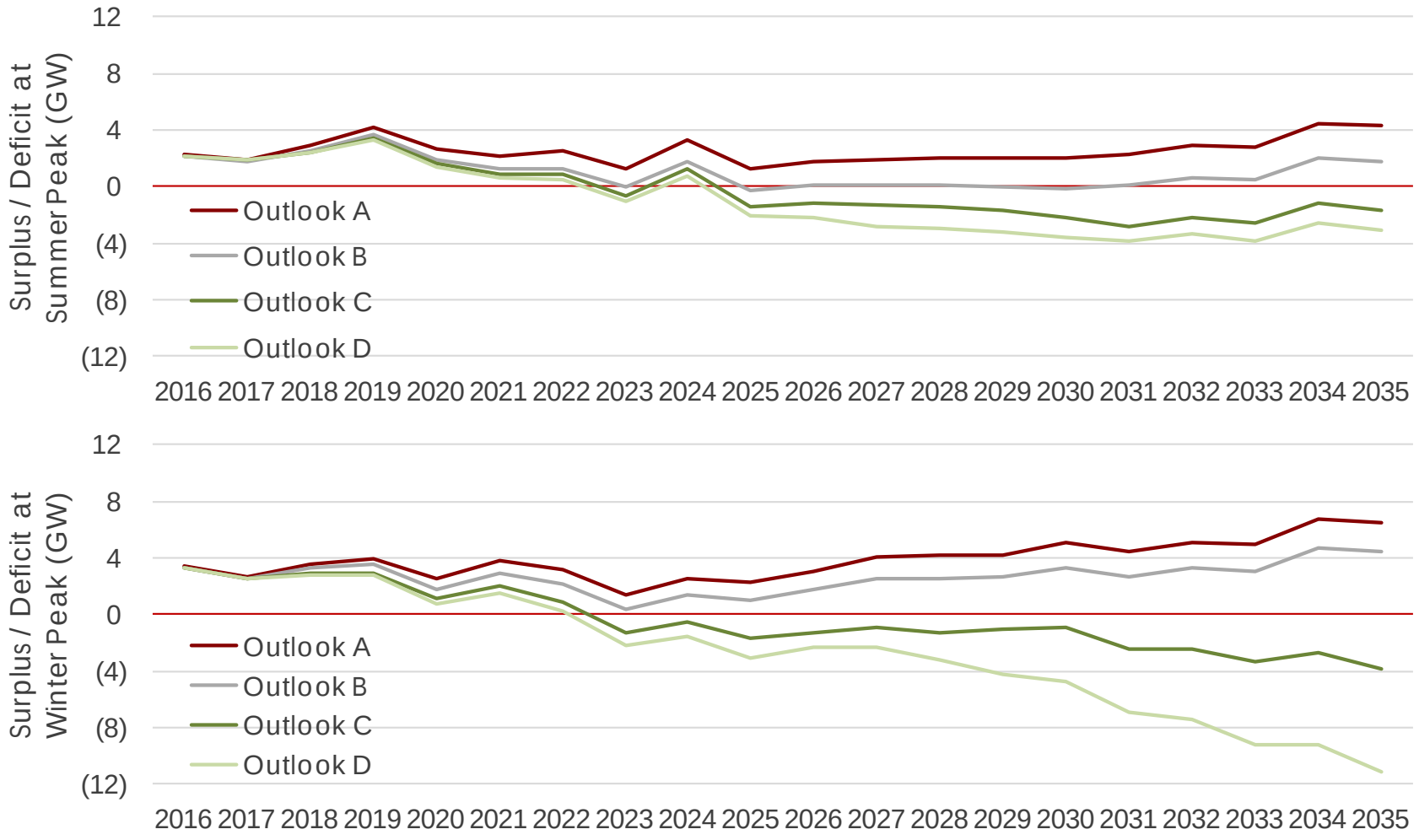
Summer capacity contribution of Ontario supply, 2016-2035

Summer Capacity Contribution (MW)	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Existing Supply	30,122	28,724	28,477	28,198	26,336	25,456	25,337	20,497	19,793	16,951
Refurbished Nuclear	0	0	0	0	878	878	878	1,756	3,453	3,453
Committed, Not Yet Online	183	899	1,305	2,147	2,360	2,427	2,451	2,451	2,452	2,452
Directed Procurements	0	17	199	318	136	255	315	559	752	993
Expired Contracts	31	477	725	1,087	1,252	1,263	1,381	3,560	4,265	4,276
TOTAL	*30,337*	*30,118*	*30,705*	*31,750*	*30,962*	*30,278*	*30,364*	*28,824*	*30,715*	*28,125*
Summer Capacity Contribution (MW)	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
Existing Supply	15,558	15,510	14,666	11,601	9,596	8,682	8,128	7,904	7,503	7,145
Refurbished Nuclear	5,084	5,084	5,851	5,851	6,670	6,670	7,488	7,488	8,307	8,307
Committed, Not Yet Online	1,952	1,952	1,952	1,950	1,949	1,823	1,752	1,746	1,726	1,701
Directed Procurements	1,056	1,056	1,176	1,176	1,176	1,176	1,176	1,176	1,176	1,176
Expired Contracts	4,850	4,898	4,940	8,009	9,195	10,235	10,861	11,091	11,511	11,894
TOTAL	*28,501*	*28,501*	*28,587*	*28,587*	*28,587*	*28,587*	*29,404*	*29,404*	*30,223*	*30,223*

Winter capacity contribution of Ontario supply, 2016-2035

Winter Capacity Contribution (MW)	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Existing Supply	29,268	28,448	28,239	27,981	26,020	25,980	24,983	20,696	20,649	17,057
Refurbished Nuclear	0	0	0	0	0	878	878	878	1,756	3,453
Committed, Not Yet Online	0	0	314	349	1,279	1,587	1,587	1,614	1,613	1,617
Directed Procurements	0	0	2	99	157	8	49	200	367	573
Expired Contracts	31	151	512	769	1,100	1,149	1,267	3,408	3,456	4,216
TOTAL	*29,299*	*28,599*	*29,067*	*29,200*	*28,557*	*29,602*	*28,765*	*26,795*	*27,840*	*26,917*
Winter Capacity Contribution (MW)	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
Existing Supply	16,459	15,525	15,471	13,385	10,337	8,366	8,128	7,633	7,384	6,814
Refurbished Nuclear	3,453	5,084	5,084	5,851	6,670	6,670	7,488	7,488	8,307	8,307
Committed, Not Yet Online	2,117	2,117	2,117	2,114	2,113	2,113	1,906	1,902	1,895	1,790
Directed Procurements	741	807	791	936	936	936	936	936	936	936
Expired Contracts	4,815	4,929	5,000	6,271	9,320	10,472	10,917	11,416	11,672	12,347
TOTAL	*27,584*	*28,463*	*28,463*	*28,557*	*29,375*	*28,557*	*29,375*	*29,375*	*30,193*	*30,193*

Capacity surplus/deficit across demand outlooks



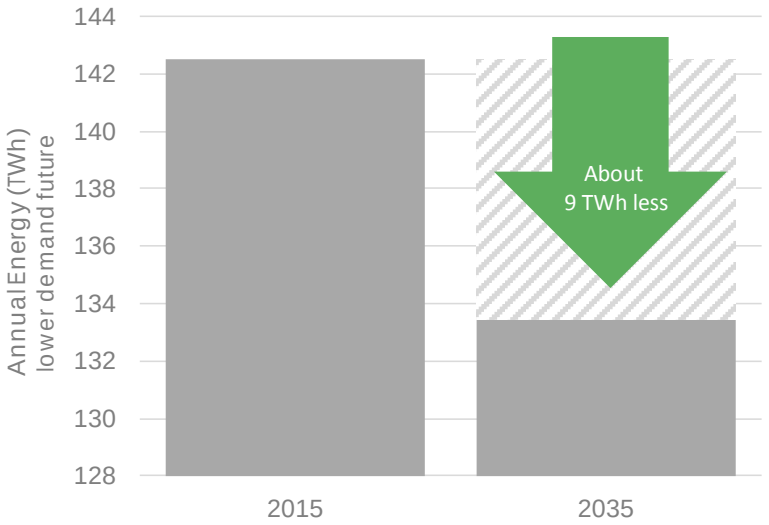
Capacity surplus/deficit across demand outlooks

Surplus/Deficit at Summer Peak (MW)	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Outlook A	2,267	1,987	2,994	4,366	2,776	2,335	2,595	1,288	3,240	1,217
Outlook B	2,179	1,773	2,601	3,750	1,956	1,329	1,422	(8)	1,789	(332)
Outlook C	2,200	1,934	2,499	3,524	1,750	1,020	1,031	(605)	1,221	(1,523)
Outlook D	2,200	1,934	2,431	3,386	1,541	738	675	(1,037)	713	(2,110)
Surplus/Deficit at Summer Peak (MW)	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
Outlook A	1,680	1,773	1,948	1,951	1,945	2,244	2,877	2,740	4,421	4,250
Outlook B	36	(5)	56	(48)	(156)	75	608	381	1,970	1,713
Outlook C	(1,222)	(1,375)	(1,434)	(1,721)	(2,307)	(2,859)	(2,249)	(2,660)	(1,253)	(1,689)
Outlook D	(2,271)	(2,827)	(2,979)	(3,313)	(3,613)	(3,930)	(3,416)	(3,927)	(2,620)	(3,159)

Surplus/Deficit at Winter Peak (MW)	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Outlook A	3,429	2,682	3,554	4,023	2,570	3,865	3,223	1,488	2,628	2,265
Outlook B	3,374	2,537	3,265	3,543	1,914	3,048	2,260	424	1,430	985
Outlook C	3,337	2,566	2,959	2,997	1,231	2,088	1,015	(1,239)	(452)	(1,726)
Outlook D	3,337	2,566	2,876	2,805	901	1,595	337	(2,123)	(1,559)	(3,075)
Surplus/Deficit at Winter Peak (MW)	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
Outlook A	3,029	4,010	4,100	4,193	4,995	4,435	5,076	4,944	6,632	6,478
Outlook B	1,676	2,544	2,540	2,549	3,269	2,655	3,218	3,015	4,630	4,408
Outlook C	(1,392)	(928)	(1,357)	(1,124)	(974)	(2,506)	(2,431)	(3,432)	(2,735)	(3,932)
Outlook D	(2,364)	(2,363)	(3,282)	(4,298)	(4,731)	(6,900)	(7,525)	(9,251)	(9,255)	(11,200)

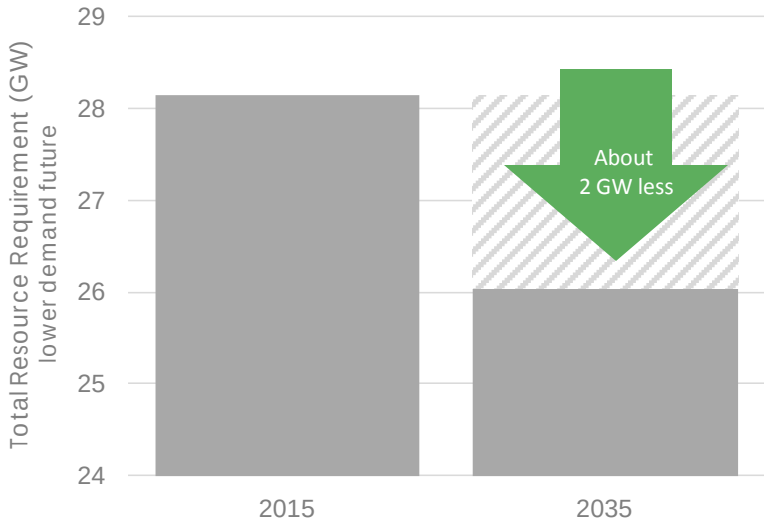
Outlook A: A lower demand would reduce the need for supply resources

- Reductions in supply would likely have to be a combination of different resources, and would depend on the nature of the demand profile as well as take into account ratepayer and system impacts.



9 TWh of energy is roughly equivalent to any of the following:

- 1.2 GW nuclear
- 2 GW waterpower
- 3.5 GW wind
- 7 GW solar PV

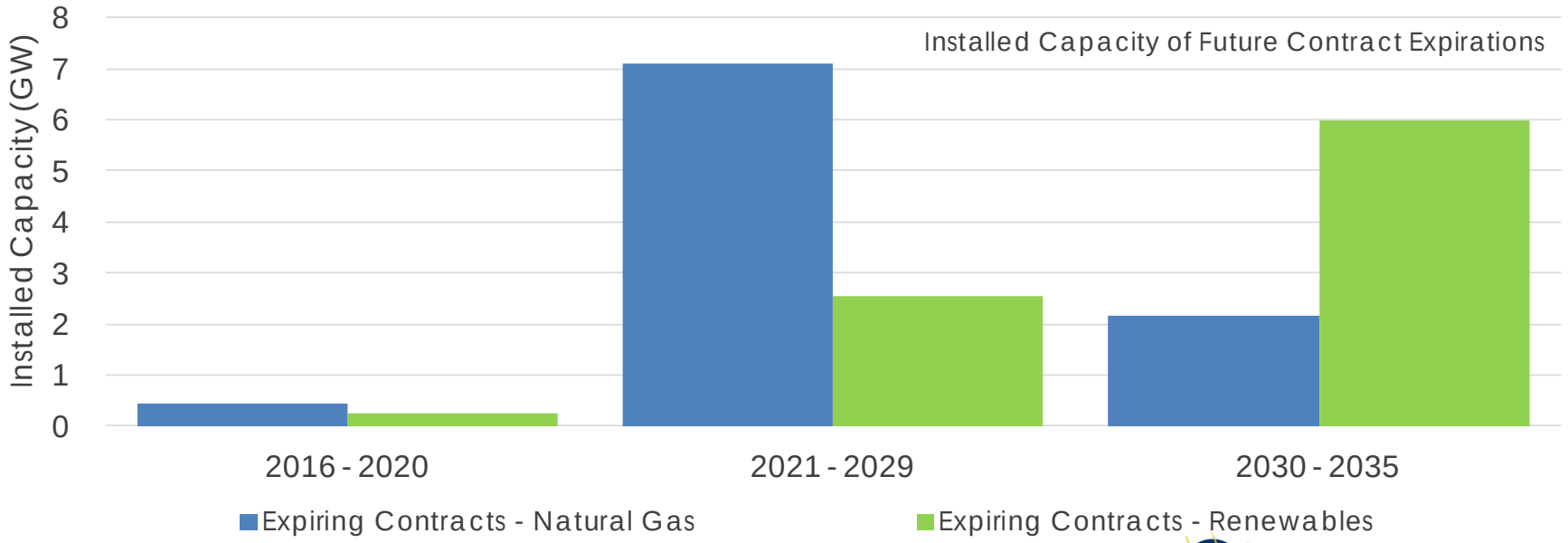


2 GW of summer effective capacity is roughly equivalent to any of the following:

- 2.2 GW nuclear
- 2.8 GW waterpower
- 17 GW wind
- 6 GW solar PV
- 2.2 GW natural gas

Supply outlook under lower demand

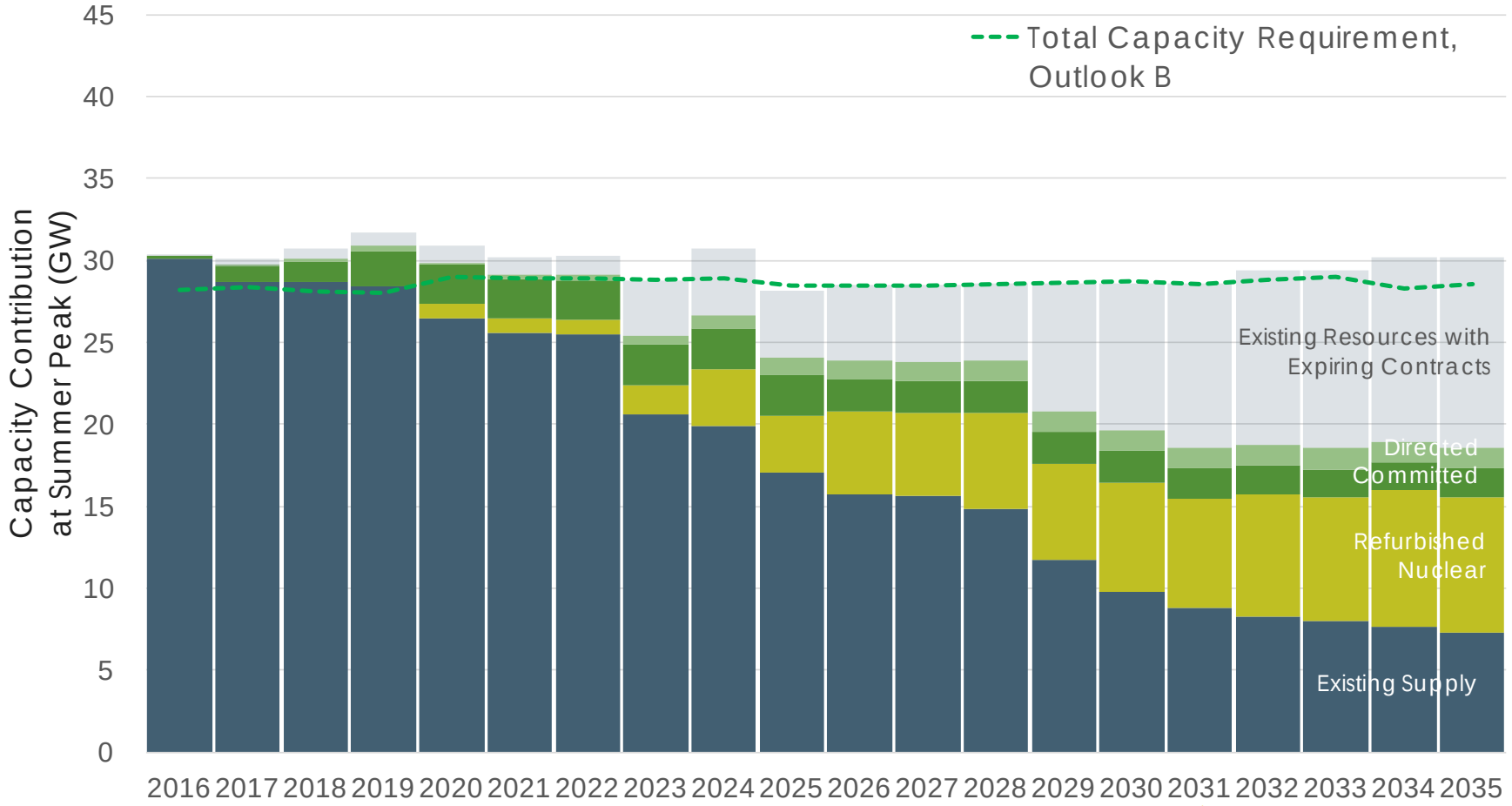
- Ontario could adapt to lower demand outlooks by not recontracting with generation facilities when contracts expire
- Ontario also has the option of exercising nuclear refurbishment off-ramps where changes in supply or demand for electricity have resulted in there no longer being a need to refurbish the remaining units or where there are more economic electricity supply alternatives
- These provide the ability to align future investments with the province's evolving needs, opportunities and priorities. They also provide opportunities to diversify resource commitments including through the use of mechanisms such as capacity auctions
  - New mechanisms for acquiring capacity would provide a balance of short-term, medium-term and longer-term commitments giving Ontario additional flexibility to adapt to changing circumstances and harness evolving opportunities



Installed capacity of expiring contracts

Installed Capacity, Expiring Contracts, MW	2016 - 2020	2021 - 2029	2030 - 2035
Expiring Contracts - Natural Gas	449	7,106	2,161
Expiring Contracts - Renewables	238	2,550	5,993
TOTAL	*2,449*	*15,438*	*8,976*

Outlook B: Provided existing resources continue to operate and planned resources enter service, Ontario would have sufficient supply to meet a flat demand outlook. There is scope for choice, however, as Ontario can choose to replace resources as contracts expire with different types of supply



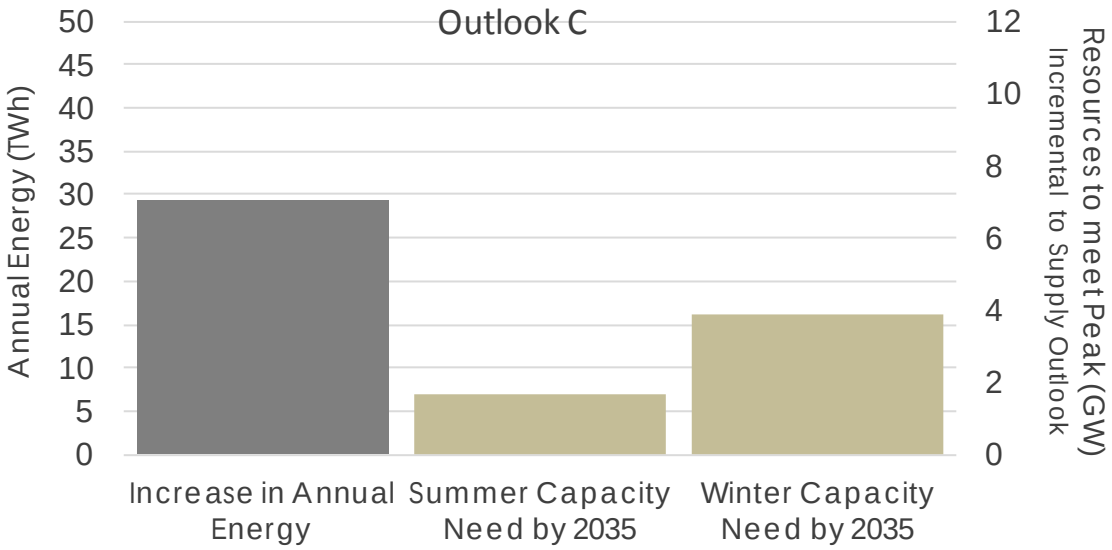
Summer capacity contribution of Ontario resources provided existing resources continue to operate and planned resources enter service and total capacity requirement for Outlook B

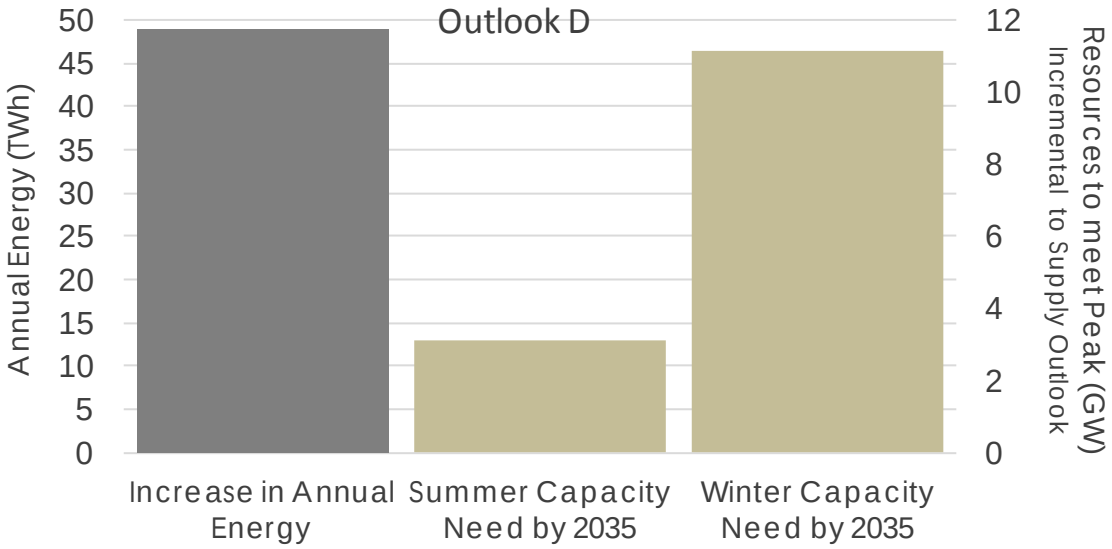
Summer Capacity Contribution (MW)	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Existing Supply	30,122	28,724	28,477	28,198	26,336	25,456	25,337	20,497	19,793	16,951
Refurbished Nuclear	0	0	0	0	878.005	878.005	878.005	1756.01	3452.73	3,453
Committed, Not Yet Online	183	899	1305	2147	2360	2427	2451	2451	2452	2,452
Directed Procurements	0	17.3795	198.753	318.146	136.115	255.165	315.483	559.16	751.725	993
Expired Contracts	31	477	725	1,087	1,252	1,263	1,381	3,560	4,265	4,276
Total Available Capacity	*30,337*	*30,118*	*30,705*	*31,750*	*30,962*	*30,278*	*30,364*	*28,824*	*30,715*	*28,125*
Total Capacity Requirement for Outlook B	28,157	28,345	28,104	28,000	29,006	28,950	28,941	28,832	28,925	28,457
Summer Capacity Contribution (MW)	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
Existing Supply	15,558	15,510	14,666	11,601	9,596	8,682	8,128	7,904	7,503	7,145
Refurbished Nuclear	5,084	5,084	5,851	5,851	6,670	6,670	7,488	7,488	8,307	8,307
Committed, Not Yet Online	1,952	1,952	1,952	1,950	1,949	1,823	1,752	1,746	1,726	1,701
Directed Procurements	1,056	1,056	1,176	1,176	1,176	1,176	1,176	1,176	1,176	1,176
Expired Contracts	4,850	4,898	4,940	8,009	9,195	10,235	10,861	11,091	11,511	11,894
Total Available Capacity	*28,501*	*28,501*	*28,587*	*28,587*	*28,587*	*28,587*	*29,404*	*29,404*	*30,223*	*30,223*
Total Capacity Requirement for Outlook B	28,465	28,505	28,531	28,635	28,742	28,512	28,796	29,024	28,253	28,510

Outlook C and D: Resource requirements to meet net demand by 2035

- By 2035, energy consumption increases by 30-50 TWh in demand outlooks C and D. Resource requirements to meet peak demand increase by 3,900 MW-11,200 MW in the winter and 1,600 MW–3,100 MW in the summer.

- To meet higher demand such as those in outlooks C and D, investment in new resources may be required. These could take many forms:
  - Building new low-carbon capacity (see section 4 of this module)
  - Distributed energy resources (see section 5 of this module)
  - Additional conservation (see module 3)





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Outlook C and D: Increase in resource requirements by 2035

Outlook C	
Increase in Annual Energy (TWh)	29.3
Summer Capacity Need by 2035 (MW)	1,689
Winter Capacity Need by 2035 (MW)	3,932

Outlook D	
Increase in Annual Energy (TWh)	48.9
Summer Capacity Need by 2035 (MW)	3,159
Winter Capacity Need by 2035 (MW)	11,200

4. Outlook for Low-Carbon Supply Technologies

Ontario also faces sizeable and increasing opportunities related to the further deployment of low carbon technologies and distributed energy resources to meet higher demand outlooks

- A number of these opportunities are described in the following slides
- Being driven by technological advancements, evolutions in policy and market design and increasing customer engagement
- No single resource option can meet all customer needs at all times
- Maintaining a diverse resource mix can provide the different services necessary to support reliable and efficient operations

Solar Photovoltaic (PV)

	Utility-Scale Solar PV	Consumer-Based Solar PV
Annual Capacity Factor	15%	15%
Typical Scale (MW)	0.5 - 100	0.005 - 0.5
LUEC (2016$/MWh)	140 - 180[1]	210 - 290[2]
Lead Time	1 to 3 years	1 year
Potential (MW)	Abundant	Abundant
Operating Reserve	No	No
Load Following	Limited	Limited
Frequency Regulation	No	No
Contribution to Winter Peak	3% - 5%	3% - 5%
Contribution to Summer Peak	20% - 35%	20% - 35%

- Solar PV costs are expected to continue to decrease, with industry projections suggesting an average annual price decline rate of 3%
- By 2035, the LUEC for utility-scale solar in Ontario is expected to be $90-$130/MWh. Smaller facilities may reach $150-$230/MWh.[3]
- The cost of solar depends, among other things, on the quality of local solar PV resources. Levelized costs for solar PV are lower in high-irradiance areas such as the Southwest USA
- Solar PV energy is more valuable to systems with higher demand in the summer
- Hour-to-hour and minute-to-minute variability of solar PV output is difficult to predict

[1] LRP I Results: http://www.ieso.ca/Pages/Participate/Generation-Procurement/Large-Renewable-Procurement/default.aspx
[2] FIT/microFIT Rates: http://fit.powerauthority.on.ca/sites/default/files/version4/FIT-Price-Schedule-2016-01-01.pdf
[3] IESO planning estimates based on industry-average projections for cost of solar PV, adapted to the Ontario context

Wind Power

	Onshore Wind	Offshore Wind
Annual Capacity Factor	30%	35% - 40%
Typical Scale (MW)	10 - 200	40 - 400
LUEC (2016$/MWh)	65 - 107[1]	130 - 210[2]
Lead Time	3 years	5.5 years
Potential (MW)	Abundant	35,000[3]
Operating Reserve	No	No
Load Following	Limited	Limited
Frequency Regulation	No	No
Contribution to Winter Peak	20% - 30%	20% - 30%
Contribution to Summer Peak	11%	11%

- Given the maturity of the technology, the rate of cost decline is expected to be slower than in the past
- Production is generally higher in the winter and lower in the summer, but hour-to-hour and minute-to-minute variability is difficult to predict
- Compared to other forms of generation, onshore wind uses more land in terms of total project site, but most of this land can still be used for agricultural purposes including crops and grazing of livestock.

[1] LRP I Results: http://www.ieso.ca/Pages/Participate/Generation-Procurement/Large-Renewable-Procurement/default.aspx
[2] IESO estimate for Great Lakes, based on NREL analysis http://www.nrel.gov/docs/fy15osti/64283.pdf
[3] Helimax Study for OPA: http://www.powerauthority.on.ca/sites/default/files/page/6446_D-5-2_Att_1_Helimax_Analysis_FINAL.pdf

Bioenergy

	Bioenergy
Annual Capacity Factor	40% - 80%
Typical Scale (MW)	0.25 - 200
LUEC (2016$/MWh)	160 - 260[1]
Lead Time	up to 3 years
Potential (MW)	480 - 2,450[2]
Operating Reserve	Yes
Load Following	Limited
Frequency Regulation	No
Contribution to Winter Peak	85% - 90%
Contribution to Summer Peak	85% - 90%

- There are many different forms of bioenergy with diverse fuel sources. Some technologies are well-established while other technologies are still in the research phase
- Potential is limited because most feedstocks are waste products and there are competing uses for biomass in other industries
- LUEC is for new bioenergy in Ontario. Larger-scale bioenergy projects can sometimes achieve a lower LUEC than shown here.

[1] FIT/microFIT Rates: http://fit.powerauthority.on.ca/sites/default/files/version4/FIT-Price-Schedule-2016-01-01.pdf
[2] Ontario's 2006 IPSP: http://www.powerauthority.on.ca/integrated-power-system-plan/d-conservation-and-supply-resources

Combined Heat and Power (CHP)

	CHP
Annual Capacity Factor	up to 65%
Typical Scale (MW)	0.1 - 20
LUEC (2016$/MWh)	85 - 210[1]
Lead Time	1 to 2.5 years
Potential (MW)	6,400[2]
Operating Reserve	No
Load Following	No
Frequency Regulation	No
Contribution to Winter Peak	up to 95%
Contribution to Summer Peak	up to 89%

- A combined heat and power (also known as cogeneration) system generates both electricity and useful heat (thermal energy) outputs from a single fuel source
- CHP systems can potentially increase overall fuel efficiency by up to 75% over standard gas-fired generation facilities
- CHP systems are sized to meet thermal load
- Suitable when heat is required year-round (e.g. industrial activity)
- Usually not operated to provide electrical grid services such as frequency regulation
- One application of CHP is for district heating systems, which supply hot water or steam to a network of buildings

[1] LTEP 2013: http://www.powerauthority.on.ca/sites/default/files/planning/LTEP_2013_Consolidated_Figures_and_Data_Tables.pdf
[2] 2016 Conservation BMG Potential Study, CHP Technical Potential: http://www.ieso.ca/Documents/consult/APS/APS-Behind-the-Meter-Generation-Potential-2016.pdf

Waterpower

	Waterpower
Annual Capacity Factor	30% - 70%
Typical Scale (MW)	0.5 - 200
LUEC (2016$/MWh)	120 – 240[1]
Lead Time	8 to 10 years
Potential (MW)	7,000[2]
Operating Reserve	Yes
Load Following	Yes
Frequency Regulation	Yes
Contribution to Winter Peak	67%-75%
Contribution to Summer Peak	63%-71%

- Most of Ontario's waterpower potential exists Northern Ontario. The most economic of these tend to be small sites. The larger sites are more expensive to develop.
- Assessment of waterpower's costs need to take into account not only capacity and energy but also the long lifetime of the asset (50 to 100 years), the relatively low fuel cost, and applicable operability benefits
- Waterpower projects have relatively longer lead times to develop
- Due to their remote locations, waterpower sites in Northern Ontario can face transmission connection challenges and are generally not located near load

[1] IESO estimate for Northern Ontario, using: 1) FIT/microFIT rates: http://fit.powerauthority.on.ca/sites/default/files/version4/FIT-Price-Schedule-2016-01-01.pdf, 2) EIA: https://www.eia.gov/forecasts/aeo/electricity_generation.cfm, and 3) Northern Hydro Assessment Waterpower Potential in the Far North of Ontario: http://www.owa.ca/assets/files/NorthernHydroFinal-Executive-Summary.pdf

[2] "Probable and comitted" or "practical" potential. Northern Hydro Assessment Waterpower Potential in the Far North of Ontario

Interjurisdictional Trade

- In addition to opportunities within the province, opportunities also exist for greater electricity trade between Ontario and its neighbours.
  - Additional information on opportunities that exist for electricity trade can be found in the Review of Ontario Interties: http://www.ieso.ca/Documents/IntertieReport-20141014.pdf
- Energy and firm capacity can be exchanged over interties with Ontario's neighbours
- Ontario has recently signed a capacity swap agreement with Quebec for 500 MW of firm capacity in the summer should it be needed
- Expansion of imports to meet Ontario's capacity needs, and its cost, would require consideration of:
  - Whether or not the level of import required calls for new generation to be built by the other jurisdiction
  - Nature of capacity agreement
  - Cost of enabling transmission ($20-$100/MWh), and lead times associated with building new lines
  - Emissions associated with imported electricity
  - Seasonal availability of capacity in other jurisdictions
- Ontario could also take greater advantage of up to 1,000 MW of "interconnection assistance", or non-contracted import supply, to meet some of its resource requirements for reliability purposes
- Depending on the nature of the agreement, imports can to varying degrees provide services such as load following and operating reserve

Nuclear

	Traditional Large Nuclear	Small Modular Reactors[1]
Annual Capacity Factor	85% - 95%	70% - 95%
Typical Scale (MW)	400 - 1200	20 - 300
LUEC (2016$/MWh)	120 - 200[2]	130 - 290[3]
Lead Time	10 years	4 to 7 years
Potential (MW)	Abundant	Abundant
Operating Reserve	No	No
Load Following	Limited	Limited
Frequency Regulation	No	No
Contribution to Winter Peak	90% - 95%	90% - 95%
Contribution to Summer Peak	95% - 99%	95% - 99%

- Nuclear refurbishment is estimated to cost $80/MWh, which is lower than new build
- Nuclear power plants are baseload resources. They produce electricity on a continuous basis with limited but increasing capability to vary output as demand varies (i.e. load follow). Opportunities for baseload resources, including nuclear, will be limited by the extent to which there is growth in baseload demand.
- Lead time may be shortened by up to 3 years if environmental assessment and other permitting is completed ahead of time
- If developed successfully, Small Modular Reactors (SMRs) promise a number of potential benefits over existing reactor designs, including a smaller footprint, more passive safety features, potential for economy of scale through mass production, and reduced project/overbuild risk . Applications also include serving off-grid, remote loads.

[1] Technology and generator characteristics are currently untested; first commercial operation is expected in the mid-2020s.
[2] WEC and BNEF, World Energy Perspectives: https://www.worldenergy.org/wp-content/uploads/2013/09/WEC_J1143_CostofTECHNOLOGIES_021013_WEB_Final.pdf
[3] IESO estimate, using: 1) NuScale: http://analysis.nuclearenergyinsider.com/small-modular-reactors/nuscale-targets-smr-cost-below-90mwh-wider-deployment, and 2) Hatch, Feasibility of the Potential Deployment of Small Modular Reactors (SMRs) in Ontario: http://ontarioenergyreport.ca/pdfs/MOE%20-%20Feasibility%20Study_SMRs%20-%20June%202016.pdf

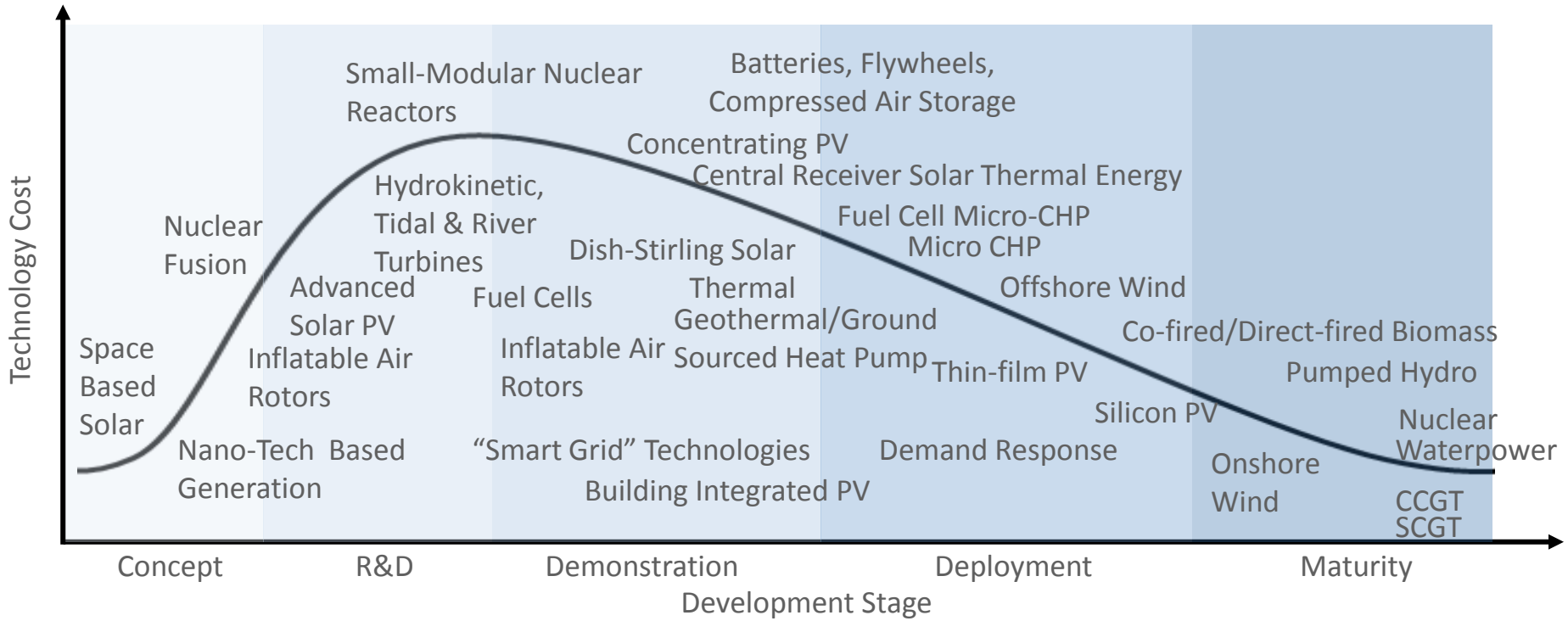
Electricity Storage

	Modular Storage[1]
Annual Capacity Factor	n/a
Typical Scale (MW)	0.005 - 50
LUEC (2016$/MWh)	n/a
Lead Time	1 to 3 years
Potential (MW)	Abundant
Operating Reserve	Yes
Load Following	Yes
Frequency Regulation	Yes
Contribution to Winter Peak	Technology-dependent
Contribution to Summer Peak	Technology-dependent

- Storage complements variable generators well – it can smooth production profiles and offer ancillary services to the grid
- Costs for storage have decreased greatly in the past decade, and this trend is expected to continue
- The cost of residential-scale lithium-ion batteries is projected to decline from $640/kWh today to $300/kWh by 2032[2]
- Pilot programs are underway to better understand the capacity and operability value of storage
- Further deployment of storage technologies will depend on the economics of storage in Ontario's power market. This includes the rate structure for charging/discharging and how the value of the energy, capacity, and ancillary services is captured.

[1] Includes technologies such as batteries, flywheels, and compressed air energy storage. Pumped hydro storage is not included, as it has different characteristics and applications.
[2] Rocky Mountain Institute, The Economics of Grid Defection: http://www.rmi.org/electricity_grid_defection#economics_of_grid_defection

Different forms of electricity generation technology are at different stages of development. New supply options may emerge in the future as technologies are proven and costs decline



5. Distributed Energy Resources

Distributed energy resources (DERs) refers to small-scale electricity generation and storage that is located closer to the customer. This differs from traditional electricity supply, which is characterized by large central generating stations and transmission lines that deliver power over long distances to customers.

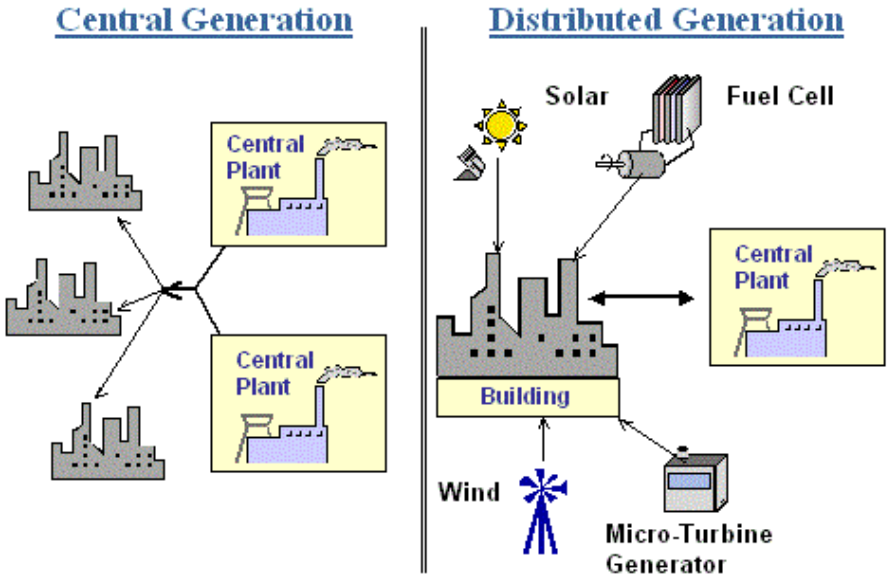
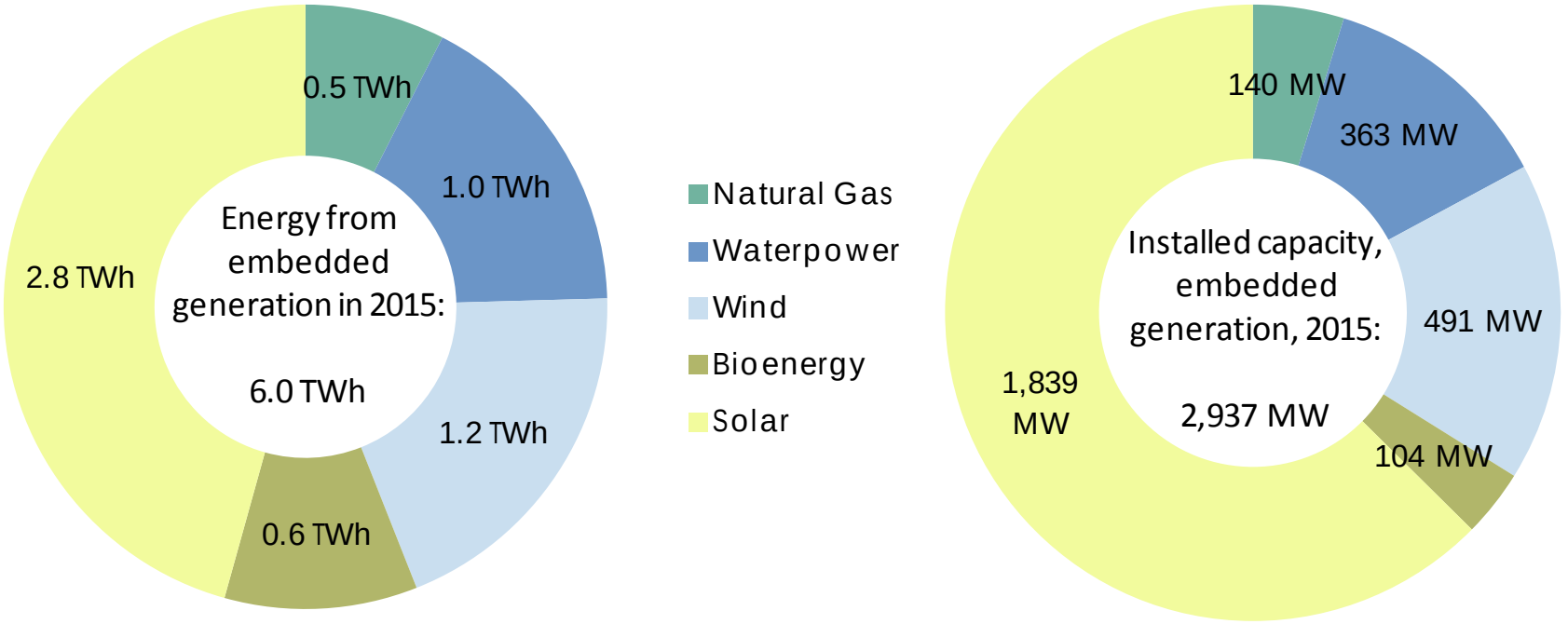


Image credit: National Fuel Cell Research Centre, University of California.

- DERs typically derive their energy from renewable sources such as waterpower, bioenergy, solar PV and wind, or from Combined Heat and Power (CHP) facilities.
- Recent improvements in the economics and performance of smaller scale electricity supply and storage technologies, coupled with policy enablers, have facilitated growing customer interest in self-sufficiency and in having a lower carbon footprint.
- Distributed energy resources are connected to the low voltage distribution system either directly or through a host facility (such as a home or business).

In Ontario today, most DER supply is from embedded generation facilities, in other words facilities that do not participate in the real-time electricity market*. As of the end of 2015, embedded generation facilities represent about 3,300 MW and produce 6 TWh/year of energy. Once committed and planned projects enter service, embedded generation capacity will be 4,800 MW and produce 10 TWh/year. Growth of embedded generation beyond these levels will depend on a number of factors, such as consumer behaviour and government policy.



* Capacity-backed demand response is a notable exception

A number of drivers have contributed to the increase of DERs in Ontario, which are facilitating a more distributed electricity system

1. Evolutions in Technology
   - Aggressive research and development and manufacturing improvements have instigated a trend towards smaller, lower-cost, and customer-centric options

2. Incentives
   - Distributed generation developed to date in Ontario has been primarily in response to procurement programs aligned with government policy for energy, the economy, or the environment.
   - The incentives offered have evolved with each iteration of procurement programs, reflecting technology cost declines

3. Increased Customer Engagement
   - Electricity consumers are increasingly looking at on-site generation as a way to meet all or a portion of their electricity needs or as a way to generate revenue through the sale of power.
   - A growing number of communities are developing Community Energy Plans (CEPs). The trend of increasing CEP activities is being driven by factors such as greenhouse gas emission targets, interest in distributed energy resources, ambitions for achieving a greater degree of energy self-sufficiency, and availability of funding and technical support from government programs to develop energy plans.

DER in the context of lower demand outlooks (Outlook A)

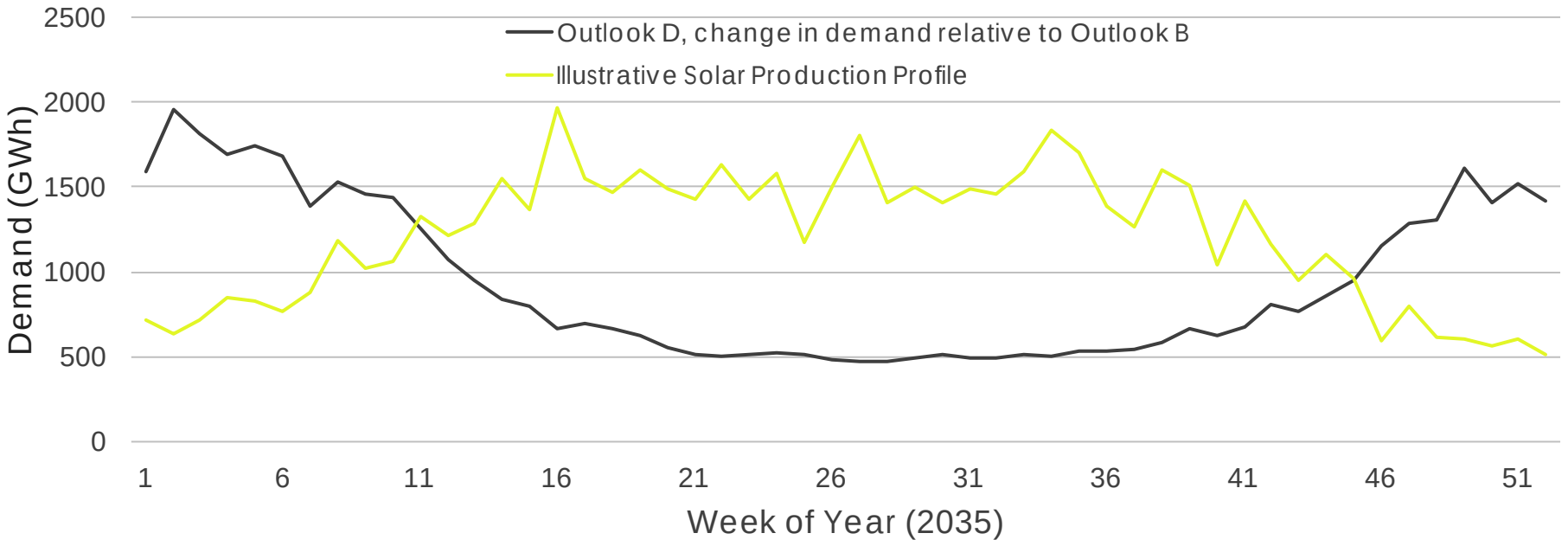
- In lower demand outlooks (Outlook A), Ontario would have excess supply. Increasing amounts of distributed energy resources could lead to the underutilization of existing assets.
- Alternatively, increased levels of distributed energy resources could replace the need to reacquire capacity as contracts expire.
- DER also may play a role in regional planning to meet local resource requirements

DER in the context of flat demand outlooks (Outlook B)

- Additional DER could replace the need to continue to invest in and operate existing and planned resources after their contracts expire.
- Opportunities exist for DER to compete with existing and planned resources to meet electricity requirements
- Flexibility exists within the current resource outlook to adapt to increasing levels of DER or pursue additional DER where cost-effective to do so
  - Sources of flexibility include not reacquiring existing resources at the end of contract term.
  - These sources of flexibility can reduce the risk of asset underutilization or stranding amidst increasing levels of distributed energy resources.

DER in the context of higher demand outlooks (Outlook C and D)

- Risk of underutilizing assets becomes less of an issue in higher demand futures. DERs can be part of the solution in addressing higher demands.
- It is important to consider the coincidence of electricity production from DER relative to the profile of the increased resource requirements. In outlooks C and D, the increase in demand is mostly in the winter, when, for example, solar PV produces limited energy.



DER technical integration considerations

- DER has the effect of reducing IESO grid demand – i.e. the demand the IESO sees and operates the system to in the control room. These resources will continue to introduce demand forecast uncertainty which in turn will affect the operability of the bulk power system.
- DERs affect load shape. This results in new minimum loads and changes the time when peak demand occurs. Most DERs are variable in nature (e.g. cloud-cover could radically change the output of a solar PV system in real-time).
- The IESO continuously works on improving its forecast accuracy and has introduced tools in recent years to improve forecasting and visibility of variable generation resources. However, the IESO has limited visibility into distribution systems and it is becoming more difficult to predict how these embedded distributed energy resources will be operated.
- A number of facilities, tools and measures will be needed to ensure that the power system can continue to be reliably operated amid increasing amounts of distributed energy resources. In some cases, distributed energy resources technologies themselves can help address some of these requirements.
- Technical issues become more significant when the level of DER being connected is greater than local load. A number of factors such as short circuit contribution or power quality currently limit the amount of distributed energy resources connection capacity in local transmission and distribution systems.
- Greater coordination between transmission and distribution system resources is an active area of study, with many jurisdictions currently investigating innovative ways to facilitate coordination between the bulk electricity system and embedded resources.
- The IESO has engaged with LDCs to evaluate and test various DER. These pilot projects can provide experience and build capability within the electricity sector.

DER in the context of regional planning and customer choices

- Customers today have a wider range of choices in how they obtain their electricity supply.
- A number of communities are developing Community Energy Plans (CEPs). Coordination between CEPs and regional planning activities provides an opportunity to build a shared understanding of local electricity supply issues and to leverage local solutions that have the support of the community.
- One of the key objectives of regional planning is to achieve greater alignment between electricity planning and community objectives and growth plans. Regional planning and the recommendations contained in the August 2013 Planning and Siting Report are helping to guide this coordination.
- Current challenges to deploying non-wires solutions for addressing local electricity needs include:
  - **Lower Near-Term Value to Provincial Electricity System:** In the near-term, with adequate provincial supply, resources developed to address regional needs are expected to have low value to the provincial system (e.g., due to lower system avoided costs). One of the considerations in developing local resources is the benefits they can provide to the community, particularly from the value of deferring or avoiding wires solutions. Among the challenges going forward will be how to quantify local benefits so that DER can be effectively evaluated and compared against wires solutions, within the context of the broader provincial supply mix.
  - **Cost Allocation for Regional Solutions:** Cost recovery for wires-based solutions, such as transmission and distribution facilities, is set out in the OEB's Transmission System Code and Distribution System Code. No equivalent rule exists as a guide for "non-wires" alternatives such as DER. This represents both a challenge and an opportunity in developing policy and regulatory mechanisms for determining how the costs are allocated amongst ratepayer groups.
  - **Acquisition and Dispatch Mechanisms for Targeting Regional Needs:** A mechanism would be required to acquire and/or dispatch DER to address regional infrastructure needs. Procurement programs to date have been designed and deployed from a provincial perspective.

DER considerations

- The point in time at which the cost of implementing a given DER technology becomes equivalent to the cost of grid electricity supply is often referred to as "grid parity". Factors influencing grid parity include:
  - **DER Technology Costs:** Including capital, borrowing costs, and ongoing operations and maintenance costs.
  - **DER Technology Performance:** Operating characteristics of technology and fuel limitations.
  - **Cost of Grid Supply:** Not all cost components of the electricity bill can be avoided by DER so long as a customer remains grid connected.
  - **Level of Incentives:** Government support can accelerate the timing of grid parity.
  - **Connection Configuration:** DER can be installed in a variety of configurations (such as separately metered, behind the meter, net metered, or off-grid) which have differences in the benefit and cost streams considered. Procurement programs can also influence how customers configure their installations.
  - **Consumer Load Profile:** Alignment of DER electricity output with customer electricity load profile.
  - **Evaluation Perspective:** What may be economic from one type of customer's perspective (e.g. utility, developer, residential consumer, industrial consumer, etc) may not be economic for another, or for the electricity system as a whole.
  - **Customer Reliability Expectations:** A DER resource may be installed as the primary source of power or as a back-up power source. A higher degree of electricity supply reliability requires greater level of investment. This is of particular importance for off-grid systems.

DER considerations (continued…)

- DERs have the effect of reducing the amount of energy required from the provincial grid to supply the customer's electricity needs
- The cost of electricity includes fixed costs (cost which do not vary with energy consumption) associated with the capital and maintenance cost of existing bulk system assets and payments made to electricity generators for the power they produce, which includes incentives paid for DER. The majority of costs to operate the electricity system are non-variable, so as electricity consumption declines, those costs are recovered across smaller volumes. In principle this reduces the likelihood of existing assets being stranded, but it also can lead to a circle of increasing bulk costs encouraging more grid defection.
- Recovery of tariff payments and reduced utility revenues lead to higher average electricity costs for non-participating customers who do not change their electricity consumption. Average rates increase as the cost numerator rises while the grid sales denominator declines.

SEC Interrogatory #8

Issue Number: 3.1
Issue: Are OPG's proposed capital structure and rate of return on equity appropriate?

Interrogatory:

Reference: Exhibit M3

[p.22] Please confirm that the expert assumes OPG has 100% of its generation under regulation for the purposes of its equity thickness, and thus has zero market exposure. Please explain how this expert has adjusted the peer group risk to reflect the higher market exposure for the peer group compared to OPG.

Response:

The following response was provided by The Brattle Group:

Confirmed as to the generation relevant for OEB regulation. At the same time, the refined sample of comparable companies was selected to ensure that they too have minimal exposure to market price risk. As discussed in Ex. M3 (see the discussion on Market Risk on Pg. 18-21), the average market price exposure for Dr. Villadsen's refined sample was also very small at about 2%. Therefore, Dr. Villadsen found OPG's regulated generation and the refined sample are highly comparable with respect to the exposure to market price risk, having, respectively, none and trivial proportions of their generation capacity exposed to market price risk.

SEC Interrogatory #9

Issue Number: 3.1
Issue: Are OPG's proposed capital structure and rate of return on equity appropriate?

Interrogatory:

Reference: Exhibit M3

[p.23] Please confirm the expert's opinion that the equity thickness for OPG should be greater because of the risk that OPG will incur imprudent costs associated with the Darlington Refurbishment Program.

Response:

The following response was provided by The Brattle Group:

Not confirmed. If M3-3.1-SEC-9 intends to ask about imprudent costs, Dr. Villadsen assumes the OEB will review costs associated with the Darlington Refurbishment Program and make a regulatory decision regarding imprudent costs, should they occur. Further, Dr. Villadsen notes that while there is a risk of non-recovery, the recommended increase in equity thickness is impacted by the fact that cash flow and therefore credit metrics will decline during the construction phase.

SEC Interrogatory #10

Issue Number: 3.1
Issue: Are OPG's proposed capital structure and rate of return on equity appropriate?

Interrogatory:

Reference: Exhibit M3

[p.27] Please provide the details behind Figure 4, including the timing and capacity value of each unit of each nuclear station during this period. By way of example, if the Figure assumes that Darlington Unit #3 will be part of installed capacity for certain years, but not others, please advise how much capacity for that unit is included in the capacity figure for each year.

Response:

The following response was provided by The Brattle Group:

Detailed capacity values, including timing of changes projected in capacity levels due to refurbishment/retirement are published by IESO in its August 2016 Supply Outlook presentation, which is attached as M3-3.1-SEC-7_Attachment 1. Please see the details in slides 6 through 9.

SEC Interrogatory #11

Issue Number: 3.1
Issue: Are OPG's proposed capital structure and rate of return on equity appropriate?

Interrogatory:

Reference: Exhibit M3

[p.30] SEC is seeking to understand whether, if at all, demand destruction due to increasing nuclear costs and prices will have a future impact on OPG's ability to recover all costs for all of its potential production. Please advise whether the expert has reviewed this possibility, and if so what conclusions the expert has reached, if any, with respect to this risk.

Response:

The following response was provided by The Brattle Group:

Dr. Villadsen has reviewed the Ontario LTEP as to its inclusion of the Darlington Refurbishment Program and nuclear generation. Dr. Villadsen is also aware that OPG's nuclear generation is subject to regulation. Finally, demand destruction can occur for many reasons including, but not limited to, cost increases, reliance on renewable resources, energy efficiency, etc. Thus, Dr. Villadsen considers that there is a risk associated with demand destruction, but notes that the risk is mitigated (albeit not necessarily completely) by the province's LTEP and the regulatory nature of OPG's nuclear assets.

SEC Interrogatory #12

Issue Number: 3.1
Issue: Are OPG's proposed capital structure and rate of return on equity appropriate?

Interrogatory:

Reference: Exhibit M3

[p.32] Please advise the median and average hydroelectric generation in the refined proxy group, and compare that to OPG for each of the next five years. Please advise the median and average nuclear generation in the refined proxy group, and compare that to OPG for each of the next five years.

Response:

The following response was provided by The Brattle Group:

Dr. Villadsen does not have data on the forecasted hydroelectric generation capacities of the refined sample. For OPG, Dr. Villadsen reviewed OPG's forecast of hydroelectric rate base information in the analysis, but did not research nor utilize forecast of MW capacity information.

SEC Interrogatory #13

Issue Number: 3.1
Issue: Are OPG's proposed capital structure and rate of return on equity appropriate?

Interrogatory:

Reference: Exhibit M3

[p.34] Please restate Figure 6 showing, for each of the companies on the list, the percentage of generation from each type of fuel or technology, adding up to 100% in each case. Please add OPG to the list for comparison purposes, and show the percentages by fuel or technology forecast for OPG for each of 2017 through 2021.

Response:

The following response was provided by The Brattle Group:

See attachment M3-3.1-SEC-13_Attachment 1. Dr. Villadsen does not include OPG's percentage of generation for each fuel type for years 2017 through 2021 because she does not possess the data necessary to make such a forecast. For related information, please review IESO's Supply Outlook presentation provided as an attachment to Dr. Villadsen's response to **M3-3.1-SEC-7.**

Refined Comparables Complete Generation Break Down

		Coal	Nuclear	Hydroelectric	Natural Gas/Oil	Other	Purchased Power	Total
Ameren Corporation	[a]	67.1%	23.3%	3.6%	0.3%	0.2%	5.5%	100.0%
DTE Energy Company	[b]	67.0%	17.0%	0.0%	1.0%	0.0%	15.0%	100.0%
El Paso Electric Company	[c]	6.0%	47.0%	0.0%	34.0%	0.0%	13.0%	100.0%
Entergy Arkansas, Inc.	[d]	14.0%	54.0%	0.0%	18.0%	0.0%	14.0%	100.0%
Entergy Louisiana, LLC	[e]	2.0%	27.0%	0.0%	46.0%	0.0%	25.0%	100.0%
PG&E Corporation	[f]	0.0%	22.6%	5.3%	8.9%	0.4%	62.8%	100.0%
Pinnacle West Capital Corporation	[g]	31.0%	26.8%	0.0%	18.5%	1.5%	22.2%	100.0%
Tennessee Valley Authority	[h]	29.0%	33%[2]	8%[2]	16.0%	0.0%	14.0%	100.0%
BC Hydro and Power Authority	[i]	0.0%	0.0%	75.0%	0.0%	0.6%	24.4%	100.0%
Bonneville Power Administration	[j]	0.0%	9.9%	84.5%[1]	0.1%	1.0%	4.5%	100.0%
IDACORP, Inc.	[k]	28.4%	0.0%	35.9%	12.6%	0.0%	23.0%	100.0%
OPG	[l]	0.0%	57.0%	42.0%	0.0%	1.0%	0.0%	100.0%

Notes:
Other Includes solar, biomass, wind, and uncategorized renewables
1: This percentage includes both small and large and small hydroelectric generation, whereas the percentage in Exhibit M3, Figure 6 just included large hydroelectric generation.

2: In Exhibit M3, Figure 6, we mistakenly referred to the numbers as for the fiscal year ending September 30, 2016, however they were figures for the fiscal year ending September 30, 2015. The percentages as of fiscal year ending September 30, 2016 are presented above. Note that, they are each 1 percent lower than the 2015 figures.
The percentages represent percent of total generation (MWh) reported for 2015, except for Tennessee Valley Authority (TVA) and BC Hydro and Power Authority (BC Hydro). TVA's data reflects their fiscal year ending September 30, 2016 and BC Hydro's reflects data for 2014/2015 year. Total Generation reported includes purchased power.

The data for OPG did not include purchased power. It is unclear whether or not OPG purchases any power.
Sources:
Composition data in rows [a], [c]-[h], and [k] from the most recently available company 10-Ks.
Composition data in row [b] from ValueLine, Inc
Composition data in row [i] comes BC Hydro and Power Authority 2016/17-2018/19 Service Plan; accessed at:
https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/corporate/regulatory-planning-documents/service-plans/bchydro-service-plan-2016-17-2018-
Composition data in row [j] from BPA Fuel Mix Percent Summary. CY 2015 Data; accessed at:
https://www.bpa.gov/power/BPA_Fuel_Mix/docs/BPA_Official_Fuel_Mix_2015.pdf
Composition data in row [l] from OPG 2015 Sustainability Report, p. 22; accessed at:
http://www.opg.com/news-and-media/Reports/Sustainability_Report_2015.pdf

19.pdf

SEC Interrogatory #14

Issue Number: 3.1
Issue: Are OPG's proposed capital structure and rate of return on equity appropriate?

Interrogatory:

Reference: Exhibit M3

[p.36] Please confirm that all of the credit metrics identified are measures of cash flow, calculated various ways, relative to debt or debt service requirements. Please confirm that the only two ways to improve these metrics are a) increase cash revenues from increased production or increased prices, or b) decrease the principal or interest on debt. Please explain how an external guarantee of debt or debt service affects the importance of any of the identified credit metrics.

Response:

The following response was provided by The Brattle Group:

Confirmed that EBITDA, FFO, CFO, and EBIT are measures of cash flow. The metrics listed measure leverage, debt or interest coverage.

Not confirmed that the only two ways to improve these metrics are a) increase cash revenues from increased production or increased prices, or b) decrease the principal or interest on debt. Certainly, an increase in cash flow from revenue or a decrease in principal / interest will improve the metrics, but given the adjustments credit rating agencies make to the ratios, there may be other factors that impact the ratios, too. For example, S&P adjusts for leases and certain liabilities.

From a credit rating agency's perspective an external guarantee of debt or debt service will, everything else equal, lead to an improved credit rating. See also, OPG Ex. A2-3-1, Attachment 2, page 2 and OPG Ex. A2-3-1, Attachment 5, p. 2.

SEC Interrogatory #15

Issue Number: 3.1
Issue: Are OPG's proposed capital structure and rate of return on equity appropriate?

Interrogatory:

Reference: Exhibit M3

[p.39] Please estimate the portion of the proposed 3% increase in equity thickness that is caused by risks associated with the Darlington Refurbishment Program.

Response:

The following response was provided by The Brattle Group:

Focusing on the proposed increase in equity thickness, Exhibit M3 pp. 44-45 recommend an increase in OPG's equity ratio based on "the large exposure to construction risk and declining credit metrics, which to a degree are offset by the assurances that come from Ontario's LTEP and being a fully regulated entity." Further, as noted on p. 43 of Exhibit M3, the "transitioning to incentive regulation increases OPG's exposure to income volatility (at least temporarily)." Thus, the increase in OPG business risk relative to the EB-2013-0321 decision is dominated by the DRP, but Dr. Villadsen has not assigned a specific percentage to that risk.

SEC Interrogatory #16

Issue Number: 3.1
Issue: Are OPG's proposed capital structure and rate of return on equity appropriate?

Interrogatory:

Reference: Exhibit M3

[p.43] Please provide details on which risks associated with the forecast construction program that are NOT "offset by the protections provided by the province".

Response:

The following response was provided by The Brattle Group:

The forecast construction program leads to a change in the credit metrics of OPG as detailed in Ex. M3, Section IV.A and Exhibit BV-4a and BV-4b regardless of the protections of the province. Further, as noted on p. 23 of Ex. M3, large construction programs are challenging because even with full recovery, the cash flow are delayed and because over the construction period, it is possible that the provincial or regulatory policy changes.

SEC Interrogatory #17

Issue Number: 3.1
Issue: Are OPG's proposed capital structure and rate of return on equity appropriate?

Interrogatory:

Reference: Exhibit M3

[p.44] SEC is seeking to understand the interaction, if any, between OPG's history of failing to achieve its allowed rate of return in past years and the analysis done by the expert. Please provide the expert's view on any interaction between this history of under-earning and:

a) OPG's existing and forecast credit metrics and credit rating, and
b) The appropriate level of ROE and equity thickness for OPG going forward.

Response:

The following response was provided by The Brattle Group:

a) Dr. Villadsen independently calculated credit metrics for OPG going forward. In doing so, Dr. Villadsen assumed OPG would be able to earn its allowed return on equity. Hence, Dr. Villadsen's recommendation does not assume an inability to earn the allowed return on equity going forward.
b) Please see the response to a) above.

VECC Interrogatory #1

Issue Number: 3.1
Issue: Are OPG's proposed capital structure and rate of return on equity appropriate?

Interrogatory:

Reference: Exhibit M3 Credit Metrics

a) Please find attached Dr. Villadsen's evidence offered on behalf of Altagas Utilities Inc. et al. in the AUC's Generic Cost of Capital Proceeding No. 20622. On page 65 of that evidence Dr. Villadsen indicated:

In the 2013 GCOC Decision, the Commission confirmed its prior method of using credit metrics to assess the capital structure of Utilities. The Commission also affirmed that it intended for the credit metrics to be such that the utilities could achieve an A rating. The Commission looked to three credit metrics and used a minimum benchmark for each. The Commission's metrics and minimum benchmarks are summarized below:

- *Earnings before Interest and Taxes (EBIT) Coverage of at least 2.0 times.*
- *Funds from Operations (FFO) to Debt of 11.1% to 14.3%.*
- *Funds from Operations (FFO) Interest Coverage of at least 3.0 times.*

Please confirm that the AUC uses the minimum of the benchmarks, since in practice Canadian utilities get higher credit ratings than similar US utilities with the same financial ratios due to their greater regulatory protection. If Dr. Villadsen cannot agree please indicate why the AUC has adopted this policy and provide the Moody's document referred to in footnote 96.

b) Can Dr. Villadsen confirm the following excerpt from the AUC decision was issued in the Proceeding 20622 (page 133):

"As a result of this analysis, the Commission has determined, subject to company specific adjustments, that a deemed equity ratio of 37 per cent for both distribution and transmission utilities, including those which pay tax and those which currently do not pay tax, satisfies the fair return standard required when combined with an 8.3 per cent allowed ROE for 2016, and an 8.5 per cent allowed ROE for 2017, and will enable the affected utilities to maintain a credit rating in the A category."

c) Can Dr. Villadsen confirm the following regulated common equity ratios for Alberta utilities.

Table 26. Commission-approved deemed equity ratios

	2016-2017 approved	Last approved	Change in approved common equity ratio
	(%)		
Electricity and natural gas transmission			
AltaLink	37	36	+1
ATCO Electric Transmission*	37	36	+1
ATCO Pipelines	37	37	0
ENMAX Transmission*	37	36	+1
EPCOR Transmission	37	36	+1
Lethbridge	37	36	+1
Red Deer	37	36	+1
TransAlta	37	36	+1
Electric and gas distribution			
AltaGas	41	42	-1
ATCO Electric Distribution	37	38	-1
ATCO Gas	37	38	-1
ENMAX Distribution*	37	40	-3
EPCOR Distribution	37	40	-3
FortisAlberta	37	40	-3
* approved on a placeholder basis			

d) Can Dr. Villadsen confirm that for 2016 Ontario utilities operating on a formula ROE are allowed an ROE of 9.19% (OEB letter October 15, 2015) which exceeds that allowed by the AUC by 0.89% which all else constant means better credit metrics than assumed by the AUC.

e) Can Dr. Villadsen confirm that the AUC "average risk" common equity ratio was 3% lower than that recommended by her?

f) Can Dr. Villadsen indicate any Canadian regulator that has allowed a common equity ratio that was recommended by her and provide the Decision.

Response:

The following response was provided by The Brattle Group:

a) Not confirmed. However, Dr. Villadsen can confirm that the AUC has relied on the benchmarks listed in a) above.

Dr. Villadsen cannot speculate as to whether "Canadian utilities get higher credit ratings than similar US utilities with the same financial ratios due to their greater regulatory protection." Nor can Dr. Villadsen speculate as to "why the AUC has adopted this policy." The requested Moody's document is attached as M3-3.1-VECC_Attachment 1.

b) Confirmed.

c) Not confirmed. As noted in the table, VECC copied from Decision 20622-D01-2016, the equity ratios for ATCO Electric Transmission, ENMAX Electric Transmission and ENMAX Electric Distribution were "on a placeholder basis" with ENMAX Transmission, and ENMAX Distribution requested to undertake a compliance filing, while ATCO Transmission's GTA was ongoing at the time of decision.

d) Not confirmed. Dr. Villadsen can confirm that the OEB letter dated October 15, 2015 allowed an ROE of 9.19% (OEB Letter 27 October 2016 allowed an ROE of 8.78% for 2017) and that Decision 20622-D01-2016 allowed an ROE of 8.3% for 2016 and 8.5% for 2017 (Decision 20622-D01-2016, p. 73). Dr. Villadsen observes that credit metrics depend on many factors.

e) Dr. Villadsen is not certain what is meant by "AUC average risk," but Dr. Villadsen can confirm that she recommended that the "benchmark deemed equity ratio be moved to 40%" for the Alberta Utilities. Dr. Villadsen can confirm that the AUC has found "that a deemed equity ratio of 37 per cent for both distribution and transmission utilities, including those which pay tax and those which currently do not pay tax, satisfies the fair return standard …" (Decision 20622-D01-2016 p. 133)

f) Dr. Villadsen has not provided capital structure evidence in Canadian proceedings other than AUC 20622 and this proceeding.

MOODY'S
INVESTORS SERVICE

RATING METHODOLOGY

Regulated Electric and Gas Networks

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Summary

This rating methodology explains Moody's approach to assessing credit risk for regulated electric and gas networks globally. This document provides general guidance that helps companies, investors, and other interested market participants understand how qualitative and quantitative risk characteristics are likely to affect rating outcomes for companies in the regulated electric and gas networks industry. This document does not include an exhaustive treatment of all factors that are reflected in Moody's ratings but should enable the reader to understand the qualitative considerations and financial information and ratios that are usually most important for ratings in this sector.

This rating methodology replaces[1] the Regulated Electric and Gas Networks Industry Methodology published in August 2009. While reflecting many of the same core principles as the 2009 methodology, this updated document provides a more transparent presentation of the rating considerations that are usually most important for companies in this sector and incorporates refinements in our analysis that better reflect credit fundamentals of the industry. No rating changes will result from publication of this rating methodology.

This report includes a detailed rating grid and illustrative examples that compare the mapping of various companies against the factors in the grid. The grid is a reference tool that can be used to approximate credit profiles within the regulated electric and gas networks sector in most cases. The grid provides summarized guidance for the factors that are generally most important in assigning ratings to companies in the regulated electric and gas networks industry. However, the grid is a summary that does not include every rating consideration. The weights shown for each factor in the grid represent an approximation of their importance for rating decisions but actual importance may vary substantially. In addition, the illustrative mapping examples in this document use historical results while ratings are based on our forward-looking expectations. As a result, the grid-indicated rating is not expected to match the actual rating of each company.

[1] This update may not be effective in some jurisdictions until certain requirements are met.

The grid contains five factors that are important in our assessment for ratings in the regulated electric and gas networks sector:

1. Regulatory Environment and Asset Ownership Model
2. Scale and Complexity of Capital Program
3. Financial Policy
4. Leverage and Coverage

The scoring for factors 1-4 results in a preliminary grid-indicated outcome. In addition, we apply the following factor 5, which can result in upward notching for issuers that benefit from structural enhancements, incorporated in their corporate structure, their regulatory licence or their financing arrangements.

5. Structural Considerations and Sources of Rating Uplift From Creditor Protection

Some of these factors also encompass a number of sub-factors. Since an issuer's scoring on a particular grid factor or sub-factor often will not match its overall rating, in Appendix C we include a discussion of some of the grid "outliers" – companies whose grid-indicated rating for a specific sub-factor differs significantly from the actual rating – in order to provide additional insights.

This rating methodology is not intended to be an exhaustive discussion of all factors that our analysts consider in assigning ratings in this sector. We note that our analysis for ratings in this sector covers factors that are common across all industries such as ownership, management, liquidity, corporate legal structure, governance and country related risks, which are not explained in detail in this document, as well as factors that can be meaningful on a company-specific basis. Our ratings consider these and other qualitative considerations that do not lend themselves to a transparent presentation in a grid format. The grid used for this methodology reflects a decision to favor a relatively simple and transparent presentation rather than a more complex grid that would map grid-indicated ratings more closely to actual ratings.

Highlights of this report include:

» An overview of the rated universe

» A summary of the rating methodology

» A description of factors that drive rating quality

» Comments on the rating methodology assumptions and limitations, including a discussion of rating considerations that are not included in the grid

The Appendices show the full grid (Appendix A), tables that illustrate the application of the grid to a representative sample of the covered issuers, with explanatory comments on some of the more significant differences between the grid-implied rating for each sub-factor and our actual rating (Appendices B and C)[2], an explanation of how we calculate adjusted interest coverage ratio (Appendix D), a brief discussion of our approach to networks within a corporate family (Appendix E) and a brief summary of industry issues over the medium term (Appendix F).

This publication does not announce a credit rating action. For any credit ratings referenced in this publication, please see the ratings tab on the issuer/entity page on www.moodys.com for the most updated credit rating action information and rating history.

[2] In most cases, the reference utilized for comparison to the grid-indicated rating is the senior unsecured rating. The Baseline Credit Assessment (BCA) is used for government-related issuers, and we refer to the senior unsecured rating for those issuers that incorporate structural enhancement.

This methodology describes the analytical framework used in determining credit ratings. In some instances our analysis is also guided by additional publications which describe our approach for analytical considerations that are not specific to any single sector. Examples of such considerations include but are not limited to: the assignment of short-term ratings, the relative ranking of different classes of debt and hybrid securities, how sovereign credit quality affects non-sovereign issuers, and the assessment of credit support from other entities. Documents that describe our approach to such cross-sector methodological considerations can be found here.

What Has Changed?

While incorporating many of the core principles of the 2009 publication, this methodology refines the description of three factors in the grid, revises and/or merges certain sub-factors and modifies some sub-factor weighting. More specifically, this methodology reduces the weighting for Asset Ownership Model to 5% from 10% and simultaneously increases the weighting for Cost and Investment Recovery to 15% from 10%. We have amended our approach to assessing efficiency and execution risk, considered in Factor 2 previously. Cost efficiency is now considered as part of Factor 1 while Factor 2 considers solely the scale and complexity of a company's capital program, with an increased weighting of 10%. This change reflects a larger rated portfolio than in 2009, which makes global comparisons of efficiency more difficult, particularly if independent and verifiable information is not readily available. We have also refined our approach to assessing the Financial Policy of companies, considered in Factor 3. Previously, our approach to assessing creditor protection from debt structural features was considered both within this Factor 3 but also as a separate consideration outside of the main grid. In this methodology our approach has been simplified with this consideration assessed as a stand-alone notching adjustment within the grid (Factor 5). The revised Factor 3 instead focuses on the financial policy of the company and how it is expected to balance financial risk against shareholders returns.

A further change in this update is at the low end of the scale in the grid, which has been extended to include Caa in order to better capture our views of more challenging regulatory environments and weaker business models. We have also made changes to our leverage and coverage ranges, particularly at the lower end of the scale to incorporate the extension of the grid criteria to Caa. Finally, while this methodology retains four financial ratios, the retained cash flow (RCF) / capital expenditure (capex) ratio has been replaced by a RCF / net debt ratio in this update. The relative weightings on these ratios have also been changed to reflect the importance of different ratios across regulatory jurisdictions.

About the Rated Universe

The Regulated Electric and Gas Networks methodology is applicable to companies that are primarily engaged in the transmission and/or distribution of electricity and/or natural gas, that provide their services primarily to non-retail customers, and that operate as monopolies within their service territory with tariffs regulated at the national/sovereign level. This methodology also applies to oil pipelines that are national monopoly businesses and subject to tariff regulation.

Transmission companies are engaged in the high-voltage/high-pressure transportation of electricity and gas while distribution companies are responsible for low-voltage/low-pressure transportation services. Issuers rated pursuant to this methodology predominantly own infrastructure assets with no significant ownership of upstream or downstream activities, e.g. electricity generation/gas production. While they may physically transmit electricity or gas to end-users on behalf of retail energy suppliers, regulated networks are generally not responsible for providing utility services to the final consumer. Instead, the customers of regulated networks are other energy companies, including retail energy suppliers, who procure electricity and gas on behalf of the end consumer and are themselves responsible for providing

utility services, including billing and metering. As natural monopolies, the charges that networks can levy are determined by a regulatory authority at the national/sovereign level, with tariffs typically reviewed periodically.

While the majority of issuers rated pursuant to this methodology are financed on a corporate basis, this methodology also applies to some project-financed entities that are predominantly engaged in the ownership and operation of network infrastructure as many factors - including regulatory environment and the mechanisms for recovery of costs and investment are common across these corporate-financed and project-financed regulated networks.

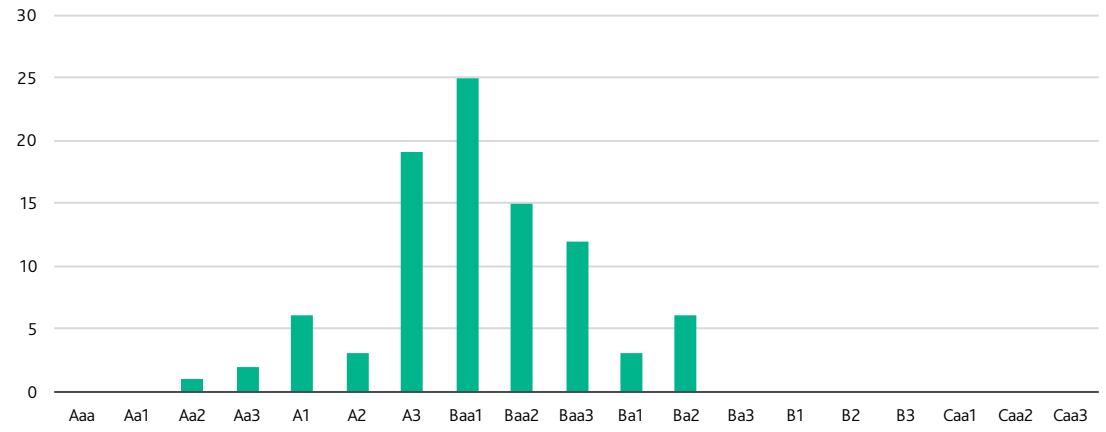
This methodology excludes the following types of issuers, which are covered by separate rating methodologies: Regulated Electric and Gas Utilities (companies that are engaged in the transmission and/or distribution of electricity and/or natural gas but that also provide regulated utility services to a retail customer base, that in many cases also own regulated electricity generation assets, and that typically have a different type of regulatory framework), Unregulated Utilities and Power Companies, US Public Power Utilities (including US municipal utilities), US Electric Cooperatives, and Natural Gas Pipelines (companies that usually do not hold a monopoly franchise, could be subject to some competition, and whose revenues are determined primarily by commercial contracts, albeit with some regulatory oversight).

This rating methodology currently covers about 90 issuers globally, whose rated long-term debt totals approximately $115 billion.

The rating distribution in this sector ranges from Aa to Ba. The rating distribution of both holding companies and operating companies is summarized in Exhibit 1:

EXHIBIT 1

Regulated Electric and Gas Networks' Senior Unsecured Ratings Distribution



Source: Moody's Investors Service, ratings as of November 2014

About this Rating Methodology

This report explains the rating methodology for electric and gas networks in several sections, which are summarized as follows:

1. Identification and Discussion of the Grid Factors

The grid in this rating methodology focuses on five rating factors. The first four grid factors are comprised of sub-factors that provide further detail. The fifth factor is used to make notching adjustments for structural enhancements where they are incorporated either in the company's regulatory licence, its corporate structure or through its financial arrangements.

EXHIBIT 2
Regulated Electric and Gas Networks

Broad Grid Factors	Factor Weighting	Sub-Factors	Sub-Factor Weighting
Regulatory Environment and Asset Ownership Model	40%	Stability and Predictability of Regulatory Regime	15%
		Asset Ownership Model	5%
		Cost and Investment Recovery (Ability and Timeliness)	15%
		Revenue Risk	5%
Scale and Complexity of Capital Program	10%	Scale and Complexity of Capital Program	10%
Financial Policy	10%	Financial Policy	10%
Leverage and Coverage	40%	(FFO + Interest Expense - Non-Cash Accretion - Capital Charges) / (Interest Expense - Non-Cash Accretion) OR (FFO + Interest Expense) / Interest Expense	10%
		Net Debt / RAB OR Net Debt / Fixed Assets	12.5%
		FFO / Net Debt	12.5%
		RCF / Net Debt	5%
Total	**100%**		**100%**

Factor 5 – Structural Considerations and Sources of Rating Uplift From Creditor Protection – is a notching adjustment to the preliminary grid-indicated rating that results from Factors 1-4.

2. Measurement or Estimation of Factors in the Grid

We explain our general approach for scoring each grid factor and show the weights used in the grid. We also provide a rationale for why each of these grid components is meaningful as a credit indicator. The information used in assessing the sub-factors is generally found in or calculated from information in company financial statements, derived from other observations or estimated by Moody's analysts.

Our ratings are forward-looking and reflect our expectations for future financial and operating performance. However, historical results are helpful in understanding patterns and trends of a company's performance as well as for peer comparisons. We utilize historical data (in most cases, an average of the last three years of reported results) in this document to illustrate the application of the rating grid. All of the quantitative credit metrics incorporate Moody's standard adjustments to income statement, cash flow statement and balance sheet amounts for restructuring, impairment, off-balance sheet accounts, receivable securitization programs, under-funded pension obligations, and recurring operating leases.

For definitions of Moody's most common ratio terms please see Moody's Basic Definitions for Credit Statistics, User's Guide (June 2011). For a description of Moody's standard adjustments, please see Moody's Approach to Global Standard Adjustments in the Analysis of Financial Statements for Non-Financial Corporations December 2010). These documents can be found at www.moodys.com under the Research and Ratings directory.

In most cases, the illustrative examples in this document use historic financial data from a recent three year period. However, the factors in the grid can be assessed using various time periods. For example, rating committees may find it analytically useful to examine both historic and expected future performance for periods of several years or more.

3. Mapping Grid Factors to the Rating Categories

After estimating or calculating each sub-factor, the outcomes for each of the sub-factors are mapped to a broad Moody's rating category (Aaa, Aa, A, Baa, Ba, B or Caa).

4. Mapping Issuers to the Grid and Discussion of Grid Outliers

In Appendix C, we provide a table showing how various companies map to grid-indicated ratings for each rating sub-factor and factor. We highlight companies whose grid-indicated performance on a specific sub-factor is two or more broad rating categories higher or lower than its actual rating and discuss some general reasons for such positive and negative outliers for a particular sub-factor.

5. Assumptions, Limitations and Rating Considerations Not Included in the Grid

This section discusses limitations in the use of the grid to map against actual ratings, some of the additional factors that are not included in the grid but can be important in determining ratings, and limitations and assumptions that pertain to the overall rating methodology.

6. Determining the Overall Grid-Indicated Rating

To determine the overall grid-indicated rating before notching considerations, we convert each of the sub-factor scores into a numerical value based upon the scale below.

EXHIBIT 3
Sub-factor score to numeric value

Aaa	Aa	A	Baa	Ba	B	Caa
1	3	6	9	12	15	18

The sub-factor weightings are modified by applying a further weighting by rating category as shown in the table below.

EXHIBIT 4
Over-weighting of certain sub-factor scores

Aaa	Aa	A	Baa	Ba	B	Caa
1	1	1	1.15	2	3	5

We weight lower rating scores more heavily than higher scores in the grid because a serious weakness in one area often cannot be completely offset by strength in another. For example, the lack of flexibility normally associated with a high degree of leverage can increase risk more than would be reflected without the additional weighting for a low grade score on this measure.

The actual weighting applied to each sub-factor is the product of that sub-factor's standard weighting and its over-weighting, divided by the sum of these products for all the sub-factors (an adjustment that brings the sum of all the sub-factor weightings back to 100%).

The numerical score for each sub-factor is multiplied by the adjusted weight for that sub-factor with the results then summed to produce a composite weighted-factor score. The composite weighted-factor score is then mapped back to an alphanumeric rating based on the ranges in the table below.

EXHIBIT 5
Grid-Indicated rating

Grid-Indicated Rating	Aggregate Weighted Total Factor Score
Aaa	x < 1.5
Aa1	1.5 ≤ x < 2.5
Aa2	2.5 ≤ x < 3.5
Aa3	3.5 ≤ x < 4.5
A1	4.5 ≤ x < 5.5
A2	5.5 ≤ x < 6.5
A3	6.5 ≤ x < 7.5
Baa1	7.5 ≤ x < 8.5
Baa2	8.5 ≤ x < 9.5
Baa3	9.5 ≤ x < 10.5
Ba1	10.5 ≤ x < 11.5
Ba2	11.5 ≤ x < 12.5
Ba3	12.5 ≤ x < 13.5
B1	13.5 ≤ x < 14.5
B2	14.5 ≤ x < 15.5
B3	15.5 ≤ x < 16.5
Caa1	16.5 ≤ x < 17.5
Caa2	17.5 ≤ x < 18.5
Caa3	18.5 ≤ x < 19.5

For example, an issuer with a composite weighted factor score of 11.7 would have a Ba2 preliminary grid-indicated rating.

We apply a fifth factor called "Structural Considerations and Sources of Rating Uplift From Creditor Protection" to the preliminary grid-indicated rating score that results from factors 1-4, in order to arrive at a final grid-indicated rating. Factor 5 can result in upward adjustment of the grid-indicated rating due to structural enhancements that are incorporated in the company's regulatory licence, its corporate structure, or through its financial arrangements. How we assess the effectiveness of any such enhancements to determine the appropriate uplift is described in the section "Structural Considerations and Sources of Rating Uplift From Creditor Protection".

We used a similar approach to derive the grid-indicated ratings shown in the illustrative examples in Appendix C.

7. Appendices

The Appendices provide illustrative examples of grid-indicated ratings based on historical financial information and also provide additional commentary and insights on our view of credit risks in this industry.

Discussion of the Grid Factors

The grid for regulated electric and gas networks focuses on four broad factors:

1. Regulatory Environment and Asset Ownership Model
2. Size and Complexity of Capital Program
3. Financial Policy
4. Leverage and Coverage

There is also a fifth factor: "Structural Considerations and Sources of Rating Uplift From Creditor Protection", which is scored as a notching adjustment to the preliminary grid-indicated rating score that results from the combination of the four factors above. The illustrative mapping examples in this report generally use historical financial information with Moody's standard adjustments.

Factor 1: Regulatory Environment and Asset Ownership Model (40% Weight)

Why It Matters

As monopoly providers of essential transmission and distribution services, electric and gas networks rated pursuant to this methodology are regulated, i.e. their revenues (or tariffs) are subject to price control limits that are typically reset periodically. Price-setting mechanisms are generally structured to limit volatility and tend to be highly predictable. In addition to price-setting, there are a number of ways that regulatory decisions can affect a network's business position, including a regulator's ability to agree on a capital expenditure program or to set efficiency targets to reduce operating costs. Finally, the ability to recover prudently-incurred costs in a timely manner is one of the most important credit considerations for regulated electric and gas networks, as a delay in cost recovery may cause financial stress. Therefore, the predictability and supportiveness of the regulatory framework in which a network operates – as well as the legal and political framework that underpins it - is a key credit consideration and the one that differentiates this sector from most other corporate sectors.

The asset ownership model of one network can be significantly different from other networks serving similar regions (in terms of size or population) elsewhere in the world. Indeed, the nature of the ownership and/or exploitation rights of the network can vary from full ownership and control of all key assets, through some form of concession arrangement, to a short-term lease or licence arrangement that is capable of being terminated relatively easily by the regulator or the licensing authority, hence giving only a short period of time to enjoy the revenue earning capacity of the network. This risk may be further elevated in jurisdictions where there is an increased likelihood of expropriation or where the laws detailing property rights are weaker or less established. The ability of a company to sell, if necessary, its network without constraint is also a key consideration and allows substantial operational and capital flexibility. This is most easily achieved where assets are owned outright in jurisdictions with strong property rights. Therefore, the type of asset ownership arrangement will drive the business flexibility of an issuer.

To assess this factor, we examine the following four sub-factors:

» Stability and Predictability of Regulatory Regime

» Asset Ownership Model

» Cost and Investment Recovery (Ability and Timeliness)

» Revenue Risk

How We Assess Stability and Predictability of Regulatory Regime for the Grid

We consider the characteristics of the regulatory environment in which a network operates. These include how developed and transparent the regulatory framework is; the strength of the political and legal underpinnings of the regulatory framework; the regulator's track record for predictability and stability in terms of decision making; its independence from political interference; and our forward looking view on whether these conditions will continue to persist. In addition, this sub-factor also considers the effectiveness of the independent body or legal system that can arbitrate disputes between a regulator and a regulated company in a timely fashion.

A network operating in a stable, reliable and highly predictable regulatory environment will be scored high; those networks operating in a less developed regulatory framework or one that is characterized by a high degree of political intervention in the regulatory process will receive much lower scores for this factor. Nevertheless, changes to the regulatory framework or to existing utility law do occur, although the way that this is achieved can vary significantly. Where regulatory or legislative changes do occur, networks can still be scored high on this sub-factor if the changes are sufficiently consulted upon, supportive of networks' credit quality and have involved the affected companies within the process. In contrast, networks will be scored low on this factor if changes to the regulatory framework have been implemented without consultation, are unclear, or are detrimental to credit quality.

How We Assess Asset Ownership Model for the Grid

In those cases where network assets are not owned outright by the rated entity, we consider the risk that a licence or concession may be terminated. We also consider whether the right to exploit the network assets may effectively be short-to-medium term and therefore transitory in nature. It is common practice throughout the world that the ownership of what are in many cases assets of national importance is subject to a licence, and this would be considered the usual arrangement. It is less common to see private sector companies own assets outright in perpetuity, although this ownership model may be seen in certain countries or in cases where alternative transportation systems exist (e.g. transit pipeline, interconnector, etc).

A company that owns all key network assets outright in perpetuity and has control over them would score high under this factor, and a company that held its key assets under a short-term operating lease or licence type arrangement would score low. Issuers with concession agreements or more permanent licences would score somewhere in the middle of the grid depending on (i) the nature of events that could cause a loss of concession or licence, (ii) the timeframe thereof, and (iii) the entitlement to compensation upon termination.

We also consider the general rule of law and the value and enforcement of asset property rights. In order to score 'A' and above, unless there are mitigating factors such as government ownership, networks are expected to operate in jurisdictions where there is no perceived risk of expropriation and where the laws pertaining to property rights are well established – reducing the risk for creditors. For example, if there is a heightened risk of expropriation of assets in this sector with limited potential for compensation - we would score a company lower even if it currently owns its assets outright.

How We Assess Cost and Investment Recovery for the Grid

This sub-factor focuses on the supportiveness of the regulatory framework, i.e. the extent to which the regulatory formula is supportive of cost recovery, including the mechanism by which one-off costs or over-spends are recovered, if at all. In other words, it focuses on the risk allocation between the network operator and its customers. Prevalent regulatory models for unbundled networks across the world are "ex-ante", "ex-post" or "cost-plus". While in theory ex-ante regulation provides the greatest certainty for the recovery of capital investment, each type of regulatory model may have greater or lesser predictability in cost recovery depending on the details of the framework and the manner in which it is applied by regulators. We assess whether the regulator seeks to insulate consumers from the volatility and the uncertainty associated with operating and financial costs, whether there is risk-sharing between the network and its consumers, and whether the network is easily able to pass through its incurred costs, including financial costs. A network that has complete flexibility to set tariffs so that it can meet current and future operating and capital costs without impediment will likely score high under this sub-factor. A network that benefits from fair and timely cost and investment recovery but is subject to efficiency targets or high regulatory scrutiny would likely score in the middle of the grid. Where there is a significant deferral of allowed revenue, e.g. for a greenfield development where the current number of customers is very low but expected to grow, or where a company has been significantly over-spending on its investments, a low score on this sub-factor would likely apply.

How We Assess Revenue Risk for the Grid

In this sub-factor we consider the ability of a network to generate the revenue allowed to it by the regulator. In general, the revenues achieved by networks can vary from this pre-determined level due to differences in consumed volumes from that forecast when charges were initially set. However, the extent to which networks are affected by volume risk depends on the structure of the regulatory charge, which can include both a fixed and a variable element. The greater the proportion of the end-user charge that is fixed, the lower the potential revenue variability. As a general rule, we believe that gas and electricity transmission tends to be less volatile than distribution due to its wider geographic outreach (e.g. volumes are arguably more stable and predictable where exposed to a country's entire economy vs. a subset thereof). From a commodity perspective, gas is likely to be more exposed to weather conditions than electricity, given its role as a heating fuel source in many jurisdictions. However, there may be ultimately no direct link between volumes volatility and revenue generation as some regulators may de-couple the two, given that volumes are outside of a network company's control. Furthermore, regulators do not typically wish to incentivize networks to distribute more energy, which would run contrary to the principles of energy efficiency. If so, the regulator may choose to eliminate volume risk entirely (by setting a fully fixed charge for transmission and distribution activities) or may allow a true-up mechanism that allows networks to reset their charges in a timely fashion to recover any lost revenue. Issuers will likely score high on this sub-factor if their revenues are entirely de-linked from volumes transported. Networks will likely score in the middle of the grid if they have some exposure to volume risk but benefit from a regulatory formula that allows for the recovery of any lost revenue. In contrast, networks that have high exposure to volumes or where volumes are expected to be particularly volatile would likely score low on this sub-factor. We will also take into account a network's reliance on revenues associated with new connections. Whilst the costs incurred in connecting new customers are normally a pass-through under most developed regulatory frameworks, such activity may generate significant cash flows if the network is allowed to make a margin, thereby raising the overall volatility of the business.

M3-3.1-VECC-1
Attachment 1

Factor 1: Regulatory Environment and Asset Ownership Model (40% Weight)

Sub-factor	Sub-factor weight	Aaa	Aa	A	Baa	Ba	B	Caa
Stability and Predictability of Regulatory Regime	15%	Regulation is independent, well established (> 15 years of being predictable and stable) and transparent (well-established regulatory principles clearly define risk allocation between companies and customers and are consistently applied, with public or shared financial models). These conditions are expected to continue.	Regulation is independent, well established (> 10 years of being predictable and stable) and transparent (well-established regulatory principles clearly define risk allocation between companies and customers and are generally consistently applied). These conditions are expected to continue.	Regulation is generally independent and developed (regulatory principles define risk allocation between companies and customers and are based on established precedents in the same jurisdiction). These conditions are expected to continue.	Regulatory framework is relatively new and untested, although regulatory principles are based on established precedents. Jurisdiction has a history of independent and transparent regulation for other utility services. These conditions are expected to continue.	Regulatory framework is defined but not consistently applied; tariff setting is subject to negotiation and political interference; some precedents in the country of predictable regulation for other utility services. These conditions are expected to continue.	Regulatory framework is unclear, untested or undergoing significant change, with a history of political interference. These conditions are expected to continue.	Regulatory framework is not defined, is unpredictable or politically driven with significant adverse consequences for the utility. These conditions are expected to continue.
Asset Ownership Model	5%	All key T&D assets held outright in perpetuity AND no risk that a change in ownership would negatively affect creditor rights.	All key T&D assets held outright under licence which can be terminated for underperformance, failure to meet certain financial parameters or insolvency OR held under long term concession with clearly defined right to timely recovery of residual asset value at termination/end of concession underpinned by highly rated entity AND no risk that a change in ownership would negatively affect creditor rights.	All key T&D assets held under long-term concession with clearly defined right to recover value of residual assets at termination/end of concession underpinned by highly rated entity but with undefined timeframe OR held under medium/long-term operating leases or management contracts with very substantial portfolio diversification, very established market position and very high renewal rate (>95%) AND no risk that a change in ownership would negatively affect creditor rights.	All key T&D assets held under long-term concession with some entitlement to recover value of residual assets at termination/end of concession but procedures untested/undefined OR held under medium-term operating leases or management contracts with substantial portfolio diversification, established market position and high renewal rate (>90%) AND/OR jurisdiction has reasonably strong property rights although there is some, albeit low risk that a change in ownership would negatively affect creditor rights.	All key T&D assets held under concession with recovery of residual asset value at termination/end of concession subject to negotiation OR held under short-term operating leases or management contracts with good degree of portfolio diversification and renewal rate (>80%) AND/OR jurisdiction may have some laws detailing property rights although these may be untested. A change of ownership would likely result in a loss for creditors.	Key T&D assets held under short-term operating leases or management contracts (limited portfolio diversification) with limited clarity on renewal and/or compensation AND/OR probability of termination/ expropriation is elevated. Compensation likely to be minimal and could be subject to significant delays in payment.	Company is in default of its licence, concession or lease/contract and is likely to lead to termination AND/OR expropriation very likely, no prospect of compensation.

Factor 1: Regulatory Environment and Asset Ownership Model (40% Weight)

Sub-factor	Sub-factor weight	Aaa	Aa	A	Baa	Ba	B	Caa
Cost and Investment Recovery (Ability and Timeliness)	15%	No regulatory or contractual impediment to adjust tariffs (no approval or reviews required).	Tariff formula is expected to allow for timely recovery of operating expenditure including depreciation, electricity losses and balancing costs/shrinkage gas and a fair return on all investment. All capital expenditure is included in asset base as incurred. Unanticipated expenditure quickly reflected in allowed revenue with low, if any, efficiency assessment.	Tariff formula is expected to allow for recovery of operating expenditure including depreciation based on allowances set at frequent price reviews (5-yearly intervals or shorter) and a fair return on all efficient investment. Capital expenditure is included in asset base as incurred. Opex and capex subject to efficiency tests; electricity losses and balancing costs/shrinkage gas subject to efficiency test on volumes only (price is a pass through). Unanticipated expenditure generally quickly reflected in allowed revenue although this may not be until the following regulatory period and may be subject to a degree of regulatory scrutiny or sharing factor with customers. Performance is likely to be in line with regulatory expectations.	Tariff formula is expected to allow for recovery of operating expenditure including depreciation and return on investment but subject to retrospective regulatory approval or infrequent price reviews (> 5-yearly intervals); recovery of electricity losses and balancing costs/shrinkage gas is somewhat exposed to price. Some instances of revenue backloading expected (e.g. depreciation allowance set below asset consumption or operating expenditure is capitalized). Unanticipated expenditure slow to be reflected in allowed revenue or may be subject to a stringent efficiency assessment/low sharing factor. Performance may be below regulatory expectations.	Tariff formula is not expected to take into account all cost components and depreciation is set below asset consumption; recovery of electricity losses and balancing costs/shrinkage gas has large exposure to price. Revenues expected to cover most operating expenditure but investment is not clearly or fairly remunerated. Overspend either not recognized in allowed revenue or there is high uncertainty about its future recognition. Operational underperformance likely to be significantly impacting the returns achieved by the business.	Tariff formula is not expected to take into account all cost components and depreciation is set below asset consumption; recovery of electricity losses and balancing costs/shrinkage gas is fully exposed to price. Revenues expected to cover cash operating expenditure.	Revenues expected to only partially cover cash operating costs.
Revenue Risk	5%	No exposure to volume risk. Collected revenues based on capacity charges.	Very low exposure to volume risk. Collected revenues based on volume charges with stable volumes expected. Revenue cap mechanism with timely recovery in place.	Limited exposure to volume risk. Collected revenues based on volume charges with some volatility in volumes expected. Revenue cap mechanism in place; OR Hybrid price/revenue cap with low volatility in volumes.	Moderate exposure to volume risk. Hybrid price/revenue cap with moderate volatility in volumes; OR Some reliance on connection revenues.	Material exposure to volume risk: price cap with significant volatility in volumes; OR Material reliance on connection revenues.	High exposure to volume risk: price cap with substantial volatility in volumes; OR Very high reliance on connection revenues.	Very high exposure to volume risk: price cap with high concentration of volumes to one particular customer or sector; OR Revenues mainly driven by connections.

Factor 2: Scale and Complexity of Capital Program (10% Weight)

Why It Matters

Factor 2 considers a network's investment plan and the associated execution risk. Given the global trend of population growth, renewable generation deployment and decarbonisation requirements, the emergence of new energy technologies (such as smart grids and electric cars), many networks have large and ongoing capital investment programs.

Many companies also have substantial needs for replacement of grids that are ageing, or for improvement of their reliability. For most networks, a sizeable capital expenditure program is thus a constant feature of their business model. While networks are generally experienced in large construction programs, they nonetheless introduce execution risk to the enterprise. The program may take longer than envisaged or could cost more. Furthermore, such cost overruns may not be recoverable from future revenues or may be subject to an efficiency review by the regulator. In addition to the direct financial impact, a large or complex capital program may prove a distraction for the management of a network, which could lead to an under-performance in other areas of the business.

How We Assess Scale and Complexity of Capital Program for the Grid

Moody's makes an assessment of a regulated network's capital expenditure program by considering (i) its size and scope, (ii) the complexity of this capex program, i.e. the type of assets to be built and associated technical issues as well as the relative concentration of challenging projects within the issuer's total capex program, (iii) management's ability to deliver the plan without material cost over-runs, and (iv) whether the program will introduce financing challenges.

To some extent, the size of a network's capital expenditure plans can be correlated to the complexity of the program, particularly for material capacity increases or technically challenging projects. Thus, we consider the size of the total annual capex plan as percentage of its Regulatory Asset Base or its total fixed assets. However, this percentage may not directly correlate to risk in all scenarios. For example, replacement programs that are large in scope may nevertheless present only limited execution risk, for example the laying of polyethylene gas pipe. Here the technology is simple and well-established. A large capital expenditure program could also reflect a significant number of individual projects where overall execution risk is reduced through diversification.

As a result, a network undertaking a relatively small investment program but one which is specific and/or complex will likely be scored lower than a network involved in a number of small and simple projects. For this sub-factor we consider total capital expenditure, including those outside of the core regulated activity. Although such activities would generally not directly prejudice the network operations, material investments outside of the core regulated business may impair debt service or cause a significant drain on management's time and resources.

Issuers with large, modern asset bases requiring a limited amount of simple maintenance (with capital expenditure representing a low percentage of fixed assets) will likely have very high scores for this sub-factor. In contrast, networks that need to modernize their systems and must engage in complex, concentrated programs that are challenging to finance (and where annual capex represents a high percentage of fixed assets) will likely have very low scores for this factor.

M3-3.1-VECC-1
Attachment 1

Factor 2: Scale and Complexity of Capital Program (10% Weight)

Sub-factor	Sub-factor weight	Aaa	Aa	A	Baa	Ba	B	Caa
Scale and Complexity of Capital Program	10%	Capex program is extremely limited in scale, reflecting a modern, highly developed asset base that requires only simple maintenance expenditure (e.g. total annual capex is < 4% of total fixed assets or regulated asset base).	Capex program is limited in scale, reflecting a well developed asset base that requires only maintenance expenditure (e.g. total annual capex is 4-6% of total fixed assets or regulated asset base).	Capex program is modest in size, reflecting a well developed asset base. Expenditure primarily relates to maintenance although some projects may be larger (e.g. total annual capex is 6-8% of total fixed assets or regulated asset base) or more complicated.	Capex program is manageable in size (e.g. total annual capex is 8-12% of total fixed assets or regulated asset base) or is generally straightforward (expenditure consists of a combination of replacement plus a number of development projects albeit with limited execution risk).	Capex program is large in size (e.g. total annual capex is 12-20% of total fixed assets or regulated asset base) or is challenging in scope (small number of large and complex development projects account for the majority of capital expenditure and carry a degree of execution risk). Obligation to invest poses a financing challenge.	Capex program is very large in size (e.g. total annual capex is 20-30% of total fixed assets or regulated asset base) or highly complex in scope (one large or complex project accounts for majority of expenditure and carries a high execution risk). Capex obligation likely to pose a significant financing challenge.	Capex program is extremely large in size (e.g. total annual capex is ≥ 30% total fixed assets or regulated asset base) or is highly technically complex (one or more large projects account for the majority of expenditure and together carry a very high execution risk). Capex obligation likely to undermine the ongoing financial stability of the company.

Factor 3: Financial Policy (10% Weight)

Why It Matters

Management and board tolerance for financial risk is an important rating factor as it directly affects debt levels, credit quality and risk in the capital structure (e.g., refinancing risk, counterparty risk or exposure to interest rates or foreign exchange movements).

The generally stable and predictable cash flows of a regulated network create significant capacity to incur debt financing and potentially to invest in related businesses. While debt financing may be considered essential to the efficient capital structure of a network, a desire to enhance shareholder returns may lead to the pursuit of higher leverage, which increases credit risk. The way in which a network owner uses its debt capacity, therefore, is a key rating consideration.

In this factor we assess the likelihood that financial policy decisions, in their totality, could add uncertainty to future cash flow levels and divert resources away from creditors. In this regard, management's track record and their public commitment to maintaining the issuer's credit quality are key considerations.

How We Assess Financial Policy for the Grid

In this factor, we consider the company's approach to financing its activities, in particular the balance it strikes in apportioning risk between shareholders and creditors. We assess both the company's historical track record and its stated objectives with respect to leverage and financing decisions, as well as the investment return requirements of its owners. The behavior of owners can be a key differentiating credit consideration – where owners' objectives are short-term, opaque or where there is a lack of track record, the regulated network will likely be scored lower than if its shareholders have more long-term return requirements and may be willing to forego near-term distributions to maintain flexibility.

Issuers are likely to have a high score on this factor if they have an extended track record of low levels of leverage plus a public commitment to maintaining high levels of credit quality. A network that employs an average level of leverage for the industry (e.g. to a level implied within the regulator's allowed rate return) and that has a solid of commitment to maintaining its targeted financial metrics is likely to be scored in the middle of the range. However, scores of "Baa" and above would generally only apply where there are no (or only very limited) concerns regarding owners' behavior – e.g. listed companies, government majority owned companies or those owned by industrial shareholders. Issuers with consistently higher levels of leverage or those with a less transparent financial policy would likely score "Ba" or lower on this factor.

This factor is scored separately from a notching factor for specific structural enhancements that provide additional creditor protection (Factor 5). However, where they exist, such enhancements will be considered to the extent they define or clarify the issuer's overall financial policy.

Factor 3: Financial Policy (10% Weight)

Sub-factor	Sub-factor weight	Aaa	Aa	A	Baa	Ba	B	Caa
Financial Policy	10%	Long track record and expected maintenance of extremely conservative financial policy; very stable metrics; low debt levels for the industry; AND Public commitment to the highest credit quality over the long-term.	Long track record and expected maintenance of a conservative financial policy; stable metrics; lower than average debt levels for the industry; AND Public commitment to a very high credit quality over the long-term.	Extended track record and expected maintenance of a conservative financial policy; moderate debt leverage and a balance between shareholders and creditors; Not likely to increase shareholder distributions and/or make acquisitions which could lead to a weaker credit profile; Solid commitment to high credit quality.	Track record and expected maintenance of a conservative financial policy; an average level of debt for the industry and a balance between shareholders and creditors; Some risk that shareholder distributions and/or acquisitions could lead to a weaker credit profile; Solid commitment to targeted metrics.	Track record or expectation of maintenance of a financial policy that is likely to favour shareholders over creditors; higher than average, but not excessive, level of leverage; Owners are likely to focus on extracting distributions and acquisitions but not at the expense of financial stability.	Track record of aggressive financial policies or expected to have a financial policy that favours shareholders through high levels of leverage with only a modest cushion for creditors; OR High financial risk resulting from shareholder distributions or acquisitions.	Expected to have a financial policy unfavourable to creditors with a track record of or expected policy of maintaining excessively high debt leverage; OR Elevated risk of debt restructuring.

Factor 4: Leverage and Coverage (40% Weight)

Why It Matters

The first three rating factors aim to capture the credit strengths and weaknesses afforded by the network's fundamental business and its financial policies. However, a company's ultimate credit profile must also incorporate its financial metrics, as a network that is substantially weaker than its peers in terms of cash flow generated or debt relative to the value of its asset base will generally have a higher probability of default.

When examining leverage and coverage, there is no single measure that can predict the likelihood of default. We utilize metrics that measure both the absolute capacity of the issuer to service its debt and the size of its debt burden relative to those of its peers. Leverage ratios aim to capture different measures of how easily an issuer can repay its debt; coverage ratios focus more on the ability to service the debt prior to repayment but also need to take into account the peculiarities of different regulatory frameworks.

To score this factor in the grid, we examine four financial metrics:

» Adjusted Interest Coverage Ratio ("Adjusted ICR") or FFO Interest Coverage

» Net Debt / Regulatory Asset Base ("RAB") or Net Debt / Fixed Assets

» FFO / Net Debt

» RCF / Net Debt

How We Assess Interest Coverage for the Grid

Interest coverage is used as an indicator of a regulated network's ability to cover the cost of its debt. Depending on the regulation type and the level of publicly available information, we will calculate the interest coverage ratio (ICR) in one of two ways.

The adjusted ICR is our preferred metric for networks where allowed revenues/tariffs are determined using a 'building block approach' and where the components of allowed revenues/tariffs are routinely published and can be verified by an independent source, which in most cases is the regulatory authority itself. Components of the revenue building block analysis include: the total amount of operating and capital expenditure, the portion of the RAB/asset base that provides for a return of capital (known as regulatory depreciation) and any other adjustments that can change the timing of cost recovery. This information is necessary as the adjusted ICR seeks to normalize for different regulatory approaches to the capitalization and depreciation of networks' expenditure, which affects the timing of their cash flow. The adjusted ICR therefore adjusts funds from operations (FFO) by an amount of money (Capital Charges) that the regulator provides as current revenues at the expense or benefit of future revenues. Capital Charges include elements such as regulatory depreciation, the timing of cost recovery (the so called 'speed of money') or a profiling of the company's revenues over a regulatory period resulting in a potential volatility that we seek to adjust. Further information can be found in Appendix D.

The formula for the Adjusted ICR is as follows:

$$\frac{\text{FFO + Interest Expense – Non-Cash Accretion – Capital Charges}}{\text{Interest Expense – Non-Cash Accretion}}$$

For regulated networks that utilize unconventional debt funding, such as zero-coupon, capital accretion, index-linked bonds or swap arrangements, we seek to make the appropriate adjustments to the ratio calculations to improve consistency and comparability to the peer portfolio.

In jurisdictions where regulatory revenues/tariffs are not determined with a 'building block approach' or where the regulatory information needed to calculate Capital Charges may not be consistently available, publicly or otherwise, the ICR is calculated as (FFO + Interest Expense) / Interest Expense.

How We Assess Net Debt / RAB or Net Debt / Fixed Assets for the Grid

Typically, the Net Debt / RAB ratio is preferred for regulated networks, especially where the RAB serves as a proxy for the long-term average enterprise value of a regulated business. The RAB is analogous to the Rate Base in the US albeit with some differences. In this methodology we use the term RAB throughout.

Under some regulatory regimes, however, RAB may not accurately represent the invested capital on which the network will earn a return over time (e.g. because of ex-post rate-setting), or it may not be publicly available. In these circumstances we typically utilize Net Debt / Fixed Assets. For example, a network may be allowed to earn a return on construction-work-in-progress, but it will not be part of RAB until the asset is completed. Alternatively, a regulator may designate certain assets (for example receivables, deferred charges or regulatory assets) to be outside of RAB but permit the network to earn a regulated return on them.

For this ratio and those that follow, net debt is calculated as total debt less unrestricted cash.

How We Assess FFO / Net Debt for the Grid

This ratio is one of Moody's most commonly used dynamic leverage measures to measure cash flow in comparison to its indebtedness. This ratio may be more useful in comparing the ability of a company (or a peer group of networks operating under similar regulatory financial models) to generate sufficient cash flow to cover future debt repayments than in comparing networks operating under very different regulatory financial models (see Appendix D). More specifically, a higher level of FFO / net debt may not be a sign of financial strength when it is driven by a higher level of regulatory depreciation. Nevertheless, in comparing two companies that maintain a similar net debt / RAB ratio over a period of time, a higher level of FFO / net debt is usually indicative of greater financial strength.

The numerator in this ratio is FFO, and the denominator is net debt.

How We Assess RCF / Net Debt for the Grid

This ratio is an indicator for financial leverage as well as an indicator of the strength of a network's cash flow after dividend payments are made. Dividend obligations of networks are often substantial, quasi-permanent outflows that can affect the ability of a network to cover its debt obligations, and this ratio can also provide insight into its financial policies. The higher the level of retained cash flow relative to a network's debt, the more cash it has to support its capital expenditure program. The numerator of this ratio is FFO minus dividends, and the denominator is net debt.

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Factor 4: Leverage and Coverage (40% Weight)

Sub-factor	Sub-factor weight	Aaa	Aa	A	Baa	Ba	B	Caa
Adjusted Interest Coverage Ratio:[3]	10%	≥ 5.5x	3.5 - 5.5x	2 - 3.5x	1.4 - 2x	1.1 - 1.4x	0.9 - 1.1x	< 0.9x
(FFO + Interest Expense - Non-Cash Accretion[4] - Capital Charges) / (Interest Expense - Non-Cash Accretion)								
OR		OR	OR	OR	OR	OR	OR	OR
FFO Interest Coverage:								
(FFO + Interest Expense) / Interest Expense		≥ 7.5x	5.5 - 7.5x	4 - 5.5x	2.8 - 4x	1.8 - 2.8x	1.1 - 1.8x	< 1.1x
Net Debt / RAB OR Net Debt / Fixed Assets[5]	12.5%	< 30%	30 - 45%	45 - 60%	60 - 75%	75 - 90%	90 - 100%	≥ 100%
FFO / Net Debt[6]	12.5%	≥ 35%	26 - 35%	18 - 26%	11 - 18%	5 - 11%	0 - 5%	< 0%
RCF / Net Debt[6]	5%	≥ 30%	21 - 30%	14 - 21%	7 - 14%	1 - 7%	(4) - 1%	< (4)%

[3] The adjusted ICR is our preferred metric for networks where allowed revenues/tariffs are determined using a 'building block approach' and where the components of allowed revenues/tariffs are routinely published and can be verified by an independent source, which in most cases is the regulatory authority itself. Required components of the revenue building block include: the total amount of allowed operating and capital expenditure, the portion of the RAB/asset base that provides for a return of capital (known as regulatory depreciation) and any other adjustments that can change the timing of cost recovery. For regulated networks that utilize unconventional debt funding, such as zero-coupon, capital accretion, index-linked bonds or swap arrangements, we seek to make the appropriate adjustments to the ratio calculations to improve consistency and comparability to the peer portfolio. Please see Appendix D for a discussion of Capital Charges and some illustrative example of this ratio.

For other regulated networks, the FFO Interest Coverage Ratio is used.

[4] For clarity, Non-Cash Accretion is deducted in the numerator only to the extent it has been added to FFO, and it is deducted from the denominator only to the extent that it has been included in Interest Expense.

[5] Net Debt / Regulatory Asset Base (RAB) is the preferred ratio where RAB is publicly available and when it represents the invested capital on which the network earns a return. Net Debt / Fixed assets is used in all other cases. Net Debt is total debt minus unrestricted cash. When Net Debt is negative, the score for this sub-factor is Aaa.

[6] For FFO / Net Debt and RCF / Net Debt, when Net Debt is negative and the numerator is a positive number (thus, a negative ratio), the score is Aaa. When Net Debt is negative and the numerator is a negative number (thus, a positive ratio), the score is B.

Factor 5: Structural Considerations and Sources of Rating Uplift From Creditor Protection

Why It Matters

Electric and gas networks may be financed using a range of different techniques. The simplest form is arguably a lowly leveraged, unsecured debt structure with few, if any, restrictive covenants. In contrast, some networks are very highly leveraged but operate within the confines of a tightly covenanted financial structure that significantly restricts their flexibility in a manner that is generally beneficial to debt holders. Indeed, in the recent past, many electric and gas networks have increased their leverage following changes in their ownership with large, vertically integrated utilities reducing their ownership in favor of specialist investment funds. These funds can also vary significantly in their complexity, ranging from traditional private equity owners with a relatively short-term return requirement to an open-ended and long-duration infrastructure fund backed by pension funds.

In response to the emergence of new owners, higher leverage and a somewhat shorter track record of financial policy, debt investors have increasingly sought additional credit protection mechanisms more akin to those in project financing.

We believe that structural enhancements may provide valuable protection to financial creditors in the regulated electric and gas network sector, and this can result in rating uplift. Such enhancements may be incorporated into the terms and conditions of financing agreements pertaining to essentially all of a network's securities holders, or they may be a feature within the networks' regulatory licence, and include requirements such as maintaining a certain credit rating and demonstrating sufficient operating and financial resources (as is the case in the United Kingdom).

How We Assess It for the Grid

Our determination of the degree of ratings uplift that debt structural features and/or regulatory ring-fence provisions provide a regulated network is based primarily on an assessment of the following:

A. Factors that reduce the likelihood that an issuer will default on its debt, and

B. Factors that give creditors either the right, or ability to influence the taking of corrective action - to stop or reverse credit deterioration.

In order for structural features to provide ratings uplift they typically must benefit all debt creditors, although individual creditors may be subject to different payment priorities.

A. Factors that reduce the likelihood that an issuer will default on its debt

These comprise:

1. **Restriction on business activities.** Prohibiting an issuer from engaging in new activities or making acquisitions is seen as credit positive because it eliminates the business risk associated with corporate activity and ensures that all critical functionality is subject to the debt structural features.

2. **Restriction on raising additional debt.** Restricting additional indebtedness reduces the risk that additional obligations can cause a payment default.

3. **Distribution lock-up tests.** Prohibiting distributions to shareholders in a distressed scenario preserves cash within the business, thus reducing the risk of default.

4. **Limits on debt structure.** Requiring the issuer to remove or mitigate certain financial risks, such as interest rate, currency or refinancing risk. The latter can range from restrictions on debt maturity concentration to the implementation of a fully amortizing debt structure, which in itself can achieve a full notch of ratings uplift. Covenants can also restrict the issuer's use of derivative products, thus reducing the likelihood of additional and/or sizeable claims on the business.
5. **Reserves to cover large future or unforeseen costs.** Dedicated timing reserves for large-cost items, e.g., one-off capital expenditure.

B. Factors that give creditors either the right, or ability, to influence the taking of corrective action – to stop or reverse credit deterioration

An important element of leveraged infrastructure debt structures has been the ability of debt creditors to force owners to reduce debt ahead of the point where equity value is lost and debt is impaired, and to take action to repay debt through the enforcement of security if this is not achieved. The debt event of default tests and the consequences of these are key elements of this protection. To provide effective protection to creditors, these features need to work within the context of the business being financed, in most cases to allow the operating businesses to continue as a going concern and to allow debt service to be paid though available liquidity facilities while action is being taken.

The elements of debt structural features that provide control rights are assessed in the following areas:

1. **Effectiveness of control rights.** The degree to which the exercise of control rights may be impeded (e.g., local jurisdiction laws or certain regulatory restrictions). We assess the proposed terms and conditions in conjunction with legal guidance to ascertain whether the proposed control rights are likely to operate as intended.
2. **Length of the control period.** The length of time debt creditors have to exercise control rights before the issuer loses the right to generate cash flow from the assets (e.g., before an insolvency process or before a concession/regulatory licence is terminated).
3. **Dedicated liquidity support.** Dedicated liquidity support facilities to cover ongoing debt service while control rights are exercised. To be considered valuable, such dedicated liquidity would need to be available for use in circumstances where control rights are exercised.

In almost all cases, to be effective and/or to assure the structure has integrity, debt structural features need to include the following elements:

1. The entity subject to the financing and the restrictions would be separated from the wider ownership group and any wider business group. The separation is achieved through legal means related to the creation of the issuer and/or restrictions in the financial structure.
2. All debt creditors must be subject to common terms that ensure that individual creditors or creditors cannot take unilateral action to destabilize the financing.
3. Creditor step-in rights should be specifically permitted under the concession, regulatory licence or legal framework, as well as the finance documents. Note that we give value to security arrangements only as one element, albeit usually a critical element, of a wider package of features designed to improve creditors' ability to detect early potential problems and rectify them if possible (in the first instance by retaining cash surpluses within the company). Further, if remedial action is not possible or fails, the security arrangements are used to maximize recovery prospects.

Structural features that provide a meaningful level of creditor protection would provide a notching uplift to the composite score generated from the grid factors, a final step to arrive at the grid-indicated rating.

When assessing rating uplift we consider the package as a whole (i.e. elements of both A. and B. above) in order to gauge the overall effectiveness. For example, independent validation of compliance with financial ratio covenants may be an important consideration in assessing the ongoing effectiveness of such covenants.

Security is sometimes not allowed or is not enforceable on certain assets, the title of which may be retained by the state or other granting authority, or where the company is restricted from giving security over its assets by a pre-existing statute.

Structural enhancements that we view as very comprehensive and effective can deliver an uplift of up to three notches within the grid. However, across the rated universe, the current typical uplift is in the range of zero to two notches. Due to the broad spectrum of possible financing structures (which can contain a variety of elements in an array of potential combinations), these enhancements are scored in increments of half-a-notch. While debt structural features could in theory be stronger than those we have encountered, more restrictive terms and conditions would constrain management abilities to pursue strategies and policies and may not be suited to certain types of businesses, so they have typically fallen within a moderately narrow range.

Ratings fully incorporate our view of the actual structural or contractual features in a particular transaction. In rare cases contractual features may provide greater uplift to the issuer's credit quality that what is reflected in the scorecard.

Rating Methodology Assumptions and Limitations, and Rating Considerations That Are Not Covered in the Grid

The grid in this rating methodology represents a decision to favor simplicity that enhances transparency and to avoid greater complexity that would enable the grid to map more closely to actual ratings. Accordingly, the five rating factors in the grid do not constitute an exhaustive treatment of all of the considerations that are important for ratings of companies in this regulated networks sector. In addition, our ratings incorporate expectations for future performance, while the financial information that is used to illustrate the mapping in the grid in this document is mainly historical. In some cases, our expectations for future performance may be informed by confidential information that we cannot disclose. In other cases, we estimate future results based upon past performance, industry trends, competitor actions or other factors. In either case, predicting the future is subject to the risk of substantial inaccuracy.

Assumptions that may cause our forward-looking expectations to be incorrect include unanticipated changes in any of the following factors: the macroeconomic environment and general financial market conditions, industry competition, disruptive technology, regulatory and legal actions.

Key rating assumptions that apply in this sector include our view that sovereign credit risk is strongly correlated with that of other domestic issuers, that legal priority of claim affects average recovery on different classes of debt, sufficiently to generally warrant differences in ratings for different debt classes of the same issuer, and the assumption that access to liquidity is a strong driver of credit risk.

In choosing metrics for this rating methodology grid, we did not explicitly include certain important factors that are common to all companies in any industry such as the quality and experience of management, assessments of corporate governance and the quality of financial reporting and information disclosure. Therefore ranking these factors by rating category in a grid would in some cases suggest too much precision in the relative ranking of particular issuers against all other issuers that are rated in various industry sectors.

Ratings may include additional factors that are difficult to quantify or that have a meaningful effect in differentiating credit quality only in some cases, but not all. Such factors include financial controls, exposure to uncertain licensing regimes and possible government interference in some countries. Regulatory, litigation, liquidity, technology and reputational risk as well as changes to consumer and business spending patterns, competitor strategies and macroeconomic trends also affect ratings. While these are important considerations, it is not possible to precisely express these in the rating methodology grid without making the grid excessively complex and significantly less transparent. Ratings may also reflect circumstances in which the weighting of a particular factor will be substantially different from the weighting suggested by the grid.

This variation in weighting rating considerations can also apply to factors that we choose not to represent in the grid. For example, liquidity is a consideration frequently critical to ratings and which may not, in other circumstances, have a substantial impact in discriminating between two issuers with a similar credit profile. As an example of the limitations, ratings can be heavily affected by extremely weak liquidity that magnifies default risk. However, two identical companies might be rated the same if their only differentiating feature is that one has a good liquidity position while the other has an extremely good liquidity position.

Other Rating Considerations

Ratings consider a number of additional considerations. These include but are not limited to: the impact of non-core businesses, our assessment of the quality of management, corporate governance, financial controls, liquidity management and event risk.

Impact of Non-Core Businesses

This methodology grid is applied to the assessment of issuers, who primary activity is the ownership and operation of regulated electric and gas networks. Where the company has or will seek to diversify its operations towards other business types, we will determine the impact of such entities on credit quality. In particular, the ownership of material businesses with higher credit risk than electric and gas networks would likely result in an actual rating that is lower than the grid-indicated rating.

Liquidity and Access to Capital Markets

Liquidity analysis is a key element in the financial analysis of electric and gas networks, and it encompasses a company's ability to generate cash from internal sources as well as the availability of external sources of financing to supplement these internal sources. Liquidity and access to financing are of particular importance in this sector. Network assets can often have a very long useful life - 30, 40 or even 60 years is not uncommon, as well as high price tags. Furthermore, the sector has historically experienced prolonged periods of negative free cash flow, such that a portion of capital expenditure must be debt financed. Dividends also represent a quasi-permanent outlay, as networks will only rarely cut their dividend. Liquidity is also important to meet maturing obligations, which often occur in large chunks, and to meet collateral calls under any hedging agreements.

Our assessment of liquidity for regulated networks involves an analysis of total sources and uses of cash over the next 12 months or more. Using our financial projections and our analysis of its available sources of liquidity (including an assessment of the quality and reliability of alternate liquidity such as committed credit facilities), we evaluate how its projected sources of cash (cash from operations, cash on hand and existing committed multi-year credit facilities) compare to its projected uses (including all or most capital expenditures, dividends, maturities of short and long-term debt, our projection of potential liquidity calls on financial hedges, and important issuer-specific items such as special tax payments). We assume no access to capital markets or additional liquidity sources, no renewal of existing credit facilities, and no cut to dividends. We examine a company's liquidity profile under this

scenario, its ability to make adjustments to improve its liquidity position, and any dependence on liquidity sources with lower quality and reliability.

Management Quality

The quality of management is an important factor supporting a company's credit strength. Assessing the execution of business plans over time can be helpful in assessing management's business strategies, policies, and philosophies and evaluates management performance relative to performance of competitors and our projections. A record of consistency provides Moody's with insight into management's likely future performance in stressed situations and can be an indicator of management's tendency to depart significantly from its stated plans and guidelines.

Size

The size and scale of a regulated networks has generally not been a major determinant of its credit strength in the same way that it has been for most other industrial sectors. However, size can still be a very important factor in our assessment of certain risks that impact ratings, including event risk, construction risk and access to external funding. While the grid attempts to incorporate some of the execution risk around large or complex projects into Factor 2, for some issuers these considerations may be sufficiently important that the rating reflects a greater weight for these risks.

Interaction of Ratings with Government Policies and Sovereign Ratings

Compared to most industrial sectors, regulated networks are more likely to be impacted by government actions. Credit impacts can occur directly through regulation, and indirectly through energy, environmental and tax policies. While Factor 1 of the grid attempts to capture many of these risks, for some issuers a greater weighting may be appropriate in assessing the rating.

Corporate Governance

Among the areas of focus in corporate governance are audit committee financial expertise, the incentives created by executive compensation packages, related party transactions, interactions with outside auditors, and ownership structure.

Financial Controls

We rely on the accuracy of audited financial statements to assign and monitor ratings in this sector. The quality of financial statements may be influenced by internal controls, including centralized operations and the proper tone at the top and consistency in accounting policies and procedures. Auditors comments in financial reports and unusual financial statement restatements or delays in regulatory filings may indicate weaknesses in internal controls.

Event Risk

We also recognize the possibility that an unexpected event could cause a sudden and sharp decline in an issuer's fundamental creditworthiness. Typical special events include mergers and acquisitions, asset sales, spin-offs, capital restructuring programs, litigation and shareholder distributions.

Structural Subordination

A utility company can finance itself in many different ways but it may involve a regulated network operating company (OpCo) and a holding company (HoldCo) structure with debt located at different levels. Given that creditors of the HoldCo usually have a secondary claim on the group's cash flows and assets after OpCo creditors, this leads to structural subordination. Our ratings of HoldCo debt are usually notched downwards from our assessment of group credit quality (which ignores priority of claim) but takes into account a number of other factors including, *inter alia*, the following:

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- Regulatory or other barriers to cash movement from OpCos to HoldCos
- Specific ring-fencing provisions or financial covenants at the OpCo level
- HoldCo exposure to subsidiaries with high business risk or volatile cash flows
- Strained liquidity at the HoldCo level

Conclusion: Summary of the Grid-Indicated Rating Outcomes

The illustrative mapping of 25 representative issuers results in the following comparison of grid-indicated outcomes to ratings (see Appendix C for details):

- 28% or 7 companies map to their rating (or BCA where relevant)
- 44% or 11 companies have a grid-indicated rating that is one alpha-numeric notch from their rating (or BCA where relevant)
- 28% or 7 companies have grid-indicated ratings that are two alpha-numeric notches from their rating (or BCA where relevant)

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Appendix A: Regulated Electric and Gas Networks Methodology Factor Grid

	Sub-factor weight	Aaa	Aa	A	Baa	Ba	B	Caa
Factor 1: Regulatory Environment and Asset Ownership Model (40%)								
Stability and Predictability of Regulatory Regime	15%	Regulation is independent, well established (> 15 years of being predictable and stable) and transparent (well-established regulatory principles clearly define risk allocation between companies and customers and are consistently applied, with public or shared financial models). These conditions are expected to continue.	Regulation is independent, well established (> 10 years of being predictable and stable) and transparent (well-established regulatory principles clearly define risk allocation between companies and customers and are generally consistently applied). These conditions are expected to continue.	Regulation is generally independent and developed (regulatory principles define risk allocation between companies and customers and are based on established precedents in the same jurisdiction). These conditions are expected to continue.	Regulatory framework is relatively new and untested, although regulatory principles are based on established precedents. Jurisdiction has a history of independent and transparent regulation for other utility services. These conditions are expected to continue.	Regulatory framework is defined but not consistently applied; tariff setting is subject to negotiation and political interference; some precedents in the country of predictable regulation for other utility services. These conditions are expected to continue.	Regulatory framework is unclear, untested or undergoing significant change, with a history of political interference. These conditions are expected to continue.	Regulatory framework is not defined, is unpredictable or politically driven with significant adverse consequences for the utility. These conditions are expected to continue.
Asset Ownership Model	5%	All key T&D assets held outright in perpetuity AND no risk that a change in ownership would negatively affect creditor rights.	All key T&D assets held outright under licence which can be terminated for underperformance, failure to meet certain financial parameters or insolvency OR held under long term concession with clearly defined right to timely recovery of residual asset value at termination/end of concession underpinned by highly rated entity AND no risk that a change in ownership would negatively affect creditor rights.	All key T&D assets held under long-term concession with clearly defined right to recover value of residual assets at termination/end of concession underpinned by highly rated entity but with undefined timeframe OR held under medium/long-term operating leases or management contracts with very substantial portfolio diversification, very established market position and very high renewal rate (>95%) AND no risk that a change in ownership would negatively affect creditor rights.	All key T&D assets held under long-term concession with some entitlement to recover value of residual assets at termination/end of concession but procedures untested/undefined OR held under medium-term operating leases or management contracts with substantial portfolio diversification, established market position and high renewal rate (>90%) AND/OR jurisdiction has reasonably strong property rights although there is some, albeit low risk that a change in ownership would negatively affect creditor rights.	All key T&D assets held under concession with recovery of residual asset value at termination/end of concession subject to negotiation OR held under short-term operating leases or management contracts with good degree of portfolio diversification and renewal rate (>80%) AND/OR jurisdiction may have some laws detailing property rights although these may be untested. A change of ownership would likely result in a loss for creditors.	Key T&D assets held under short-term operating leases or management contracts (limited portfolio diversification) with limited clarity on renewal and/or compensation AND/OR probability of termination/ expropriation is elevated. Compensation likely to be minimal and could be subject to significant delays in payment.	Company is in default of its licence, concession or lease/contract and is likely to lead to termination AND/OR expropriation very likely, no prospect of compensation.

	Sub-factor weight	Aaa	Aa	A	Baa	Ba	B	Caa
Cost and Investment Recovery (Ability and Timeliness)	15%	No regulatory or contractual impediment to adjust tariffs (no approval or reviews required).	Tariff formula is expected to allow for timely recovery of operating expenditure including depreciation, electricity losses and balancing costs/shrinkage gas and a fair return on all investment. All capital expenditure is included in asset base as incurred. Unanticipated expenditure quickly reflected in allowed revenue with low, if any, efficiency assessment.	Tariff formula is expected to allow for recovery of operating expenditure including depreciation based on allowances set at frequent price reviews (5-yearly intervals or shorter) and a fair return on all efficient investment. Capital expenditure is included in asset base as incurred. Opex and capex subject to efficiency tests; electricity losses and balancing costs/shrinkage gas subject to efficiency test on volumes only (price is a pass through). Unanticipated expenditure generally quickly reflected in allowed revenue although this may not be until the following regulatory period and may be subject to a degree of regulatory scrutiny or sharing factor with customers. Performance is likely to be in line with regulatory expectations.	Tariff formula is expected to allow for recovery of operating expenditure including depreciation and return on investment but subject to retrospective regulatory approval or infrequent price reviews (> 5-yearly intervals); recovery of electricity losses and balancing costs/shrinkage gas is somewhat exposed to price. Some instances of revenue backloading expected (e.g. depreciation allowance set below asset consumption or operating expenditure is capitalized). Unanticipated expenditure slow to be reflected in allowed revenue or may be subject to a stringent efficiency assessment/ low sharing factor. Performance may be below regulatory expectations.	Tariff formula is not expected to take into account all cost components and depreciation is set below asset consumption; recovery of electricity losses and balancing costs/shrinkage gas has large exposure to price. Revenues expected to cover most operating expenditure but investment is not clearly or fairly remunerated. Overspend either not recognized in allowed revenue or there is high uncertainty about its future recognition. Operational underperformance likely to be significantly impacting the returns achieved by the business.	Tariff formula is not expected to take into account all cost components and depreciation is set below asset consumption; recovery of electricity losses and balancing costs/shrinkage gas is fully exposed to price. Revenues expected to cover cash operating expenditure.	Revenues expected to only partially cover cash operating costs.
Revenue Risk	5%	No exposure to volume risk. Collected revenues based on capacity charges.	Very low exposure to volume risk. Collected revenues based on volume charges with stable volumes expected. Revenue cap mechanism with timely recovery in place.	Limited exposure to volume risk. Collected revenues based on volume charges with some volatility in volumes expected. Revenue cap mechanism in place; OR Hybrid price/revenue cap with low volatility in volumes.	Moderate exposure to volume risk. Hybrid price/revenue cap with moderate volatility in volumes; OR Some reliance on connection revenues.	Material exposure to volume risk: price cap with significant volatility in volumes; OR Material reliance on connection revenues.	High exposure to volume risk: price cap with substantial volatility in volumes; OR Very high reliance on connection revenues.	Very high exposure to volume risk: price cap with high concentration of volumes to one particular customer or sector; OR Revenues mainly driven by connections.

	Sub-factor weight	Aaa	Aa	A	Baa	Ba	B	Caa
Factor 2: Scale and Complexity of Capital Program (10%)								
Scale and Complexity of Capital Program	10%	Capex program is extremely limited in scale, reflecting a modern, highly developed asset base that requires only simple maintenance expenditure (e.g. total annual capex is < 4% of total fixed assets or regulated asset base).	Capex program is limited in scale, reflecting a well developed asset base that requires only maintenance expenditure (e.g. total annual capex is 4-6% of total fixed assets or regulated asset base).	Capex program is modest in size, reflecting a well developed asset base. Expenditure primarily relates to maintenance although some projects may be larger (e.g. total annual capex is 6-8% of total fixed assets or regulated asset base) or more complicated.	Capex program is manageable in size (e.g. total annual capex is 8-12% of total fixed assets or regulated asset base) or is generally straightforward (expenditure consists of a combination of replacement plus a number of development projects albeit with limited execution risk).	Capex program is large in size (e.g. total annual capex is 12- 20% of total fixed assets or regulated asset base) or is challenging in scope (small number of large and complex development projects account for the majority of capital expenditure and carry a degree of execution risk). Obligation to invest poses a financing challenge.	Capex program is very large in size (e.g. total annual capex is 20-30% of total fixed assets or regulated asset base) or highly complex in scope (one large or complex project accounts for majority of expenditure and carries a high execution risk). Capex obligation likely to pose a significant financing challenge.	Capex program is extremely large in size (e.g. total annual capex is ≥ 30% total fixed assets or regulated asset base) or is highly technically complex (one or more large projects account for the majority of expenditure and together carry a very high execution risk). Capex obligation likely to undermine the ongoing financial stability of the company.
Factor 3: Financial Policy (10%)								
Financial Policy	10%	Long track record and expected maintenance of extremely conservative financial policy; very stable metrics; low debt levels for the industry; AND Public commitment to the highest credit quality over the long-term.	Long track record and expected maintenance of a conservative financial policy; stable metrics; lower than average debt levels for the industry; AND Public commitment to a very high credit quality over the long-term.	Extended track record and expected maintenance of a conservative financial policy; moderate debt leverage and a balance between shareholders and creditors; Not likely to increase shareholder distributions and/or make acquisitions which could lead to a weaker credit profile; Solid commitment to high credit quality.	Track record and expected maintenance of a conservative financial policy; an average level of debt for the industry and a balance between shareholders and creditors; Some risk that shareholder distributions and/or acquisitions could lead to a weaker credit profile; Solid commitment to targeted metrics.	Track record or expectation of maintenance of a financial policy that is likely to favour shareholders over creditors; higher than average, but not excessive, level of leverage; Owners are likely to focus on extracting distributions and acquisitions but not at the expense of financial stability.	Track record of aggressive financial policies or expected to have a financial policy that favours shareholders through high levels of leverage with only a modest cushion for creditors; OR High financial risk resulting from shareholder distributions or acquisitions.	Expected to have a financial policy unfavourable to creditors with a track record of or expected policy of maintaining excessively high debt leverage; OR Elevated risk of debt restructuring.

	Sub-factor weight	Aaa	Aa	A	Baa	Ba	B	Caa
Factor 4: Leverage and Coverage (40%)								
Adjusted Interest Coverage Ratio: [7] (FFO + Interest Expense - Non-Cash Accretion[8] - Capital Charges) / (Interest Expense - Non-Cash Accretion)	10%	≥ 5.5x	3.5 - 5.5x	2 - 3.5x	1.4 - 2x	1.1 - 1.4x	0.9 - 1.1x	< 0.9x
OR FFO Interest Coverage: (FFO + Interest Expense) / Interest Expense		OR ≥ 7.5x	OR 5.5 - 7.5x	OR 4 - 5.5x	OR 2.8 - 4x	OR 1.8 - 2.8x	OR 1.1 - 1.8x	OR < 1.1x
Net Debt / RAB OR Net Debt / Fixed Assets[9]	12.5%	< 30%	30 - 45%	45 - 60%	60 - 75%	75 - 90%	90% - 100%	≥ 100%
FFO / Net Debt[10]	12.5%	≥ 35%	26 - 35%	18 - 26%	11 - 18%	5 - 11%	0 - 5%	< 0%
RCF / Net Debt[10]	5%	≥ 30%	21 - 30%	14 - 21%	7 - 14%	1 - 7%	(4) - 1%	< (4)%
Factor 5: Structural Considerations and Sources of Rating Uplift From Creditor Protection								
Number of Notches Provided by Debt Structural Features (0-3 notches)								

[7] The adjusted ICR is our preferred metric for networks where allowed revenues/tariffs are determined using a 'building block approach' and where the components of allowed revenues/tariffs are routinely published and can be verified by an independent source, which in most cases is the regulatory authority itself. Required components of the revenue building block include: the total amount of allowed operating and capital expenditure, the portion of the RAB/asset base that provides for a return of capital (known as regulatory depreciation) and any other adjustments that can change the timing of cost recovery. It is calculated as: (FFO + Interest Expense – Non-Cash Accretion – Capital Charges) / (Interest Expense – Non-Cash Accretion). For regulated networks that utilize unconventional debt funding, such as zero-coupon, capital accretion, index-linked bonds or swap arrangements, we seek to make the appropriate adjustments to the ratio calculations to improve consistency and comparability to the peer portfolio. Please see Appendix D for a discussion of Capital Charges and some illustrative example of this ratio.

For other regulated networks, the ratio is calculated as (FFO + Interest Expense) / Interest Expense.

[8] For clarity, Non-Cash Accretion is deducted in the numerator only to the extent it has been added to FFO, and it is deducted from the denominator only to the extent that it has been included in Interest Expense.

[9] Net Debt / Regulatory Asset Base (RAB) is the preferred ratio where RAB is publicly available and when it represents the invested capital on which the network earns a return. Net Debt / Fixed assets is used in all other cases. Net Debt is total debt minus unrestricted cash. When Net Debt is negative, the score for this sub-factor is Aaa.

[10] For FFO / Net Debt and RCF / Net Debt, when Net Debt is negative and the numerator is a positive number (thus, a negative ratio), the score is Aaa. When Net Debt is negative and the numerator is a negative number (thus, a positive ratio), the score is B.

Appendix B: Regulated Electric and Gas Networks - Ratings Compared to Grid-Indicated Ratings for an Illustrative Cross-Section of Issuers

	Issuer	Outlook	Actual rating	BCA/Standalone credit strength	Grid-Indicated Rating	Country
1	American Transmission Company LLC	Stable	A1	-	A1	United States
2	Amprion GmbH	Stable	A3	-	A2	Germany
3	AusNet Services	Stable	A3	-	Baa1	Australia
4	EATE - Emp. Amazonense Trans. Energ. S.A.	Stable	Baa2	-	Baa1	Brazil
5	Electricity Supply Board (ESB)	Stable	Baa1	baa1	A2	Ireland
6	IDGC of Center and Volga Region, JSC	Stable	Ba2	ba3	Ba1	Russia
7	ITC Holdings Corp.	Stable	Baa2	-	Baa2	United States
8	Lenenergo, JSC	Stable	Ba2	ba3	Ba1	Russia
9	N.V. Nederlandse Gasunie	Stable	A2	baa1	Baa1	Netherlands
10	National Grid Gas Plc	Stable	A3	-	A3	United Kingdom
11	Northern Powergrid (Northeast) Limited	Stable	A3	-	A1	United Kingdom
12	Phoenix Natural Gas Finance PLC	Stable	Baa2	-	Ba1	United Kingdom
13	Powercor Australia LLC	Negative	Baa1	-	Baa2	Australia
14	Red Electrica de Espana, S.A.U.	Positive	Baa2	baa2	Baa1	Spain
15	ROSSETI, JSC	Negative	Ba1	ba3	Ba1	Russia
16	SNAM S.p.A.	Stable	Baa1	-	A3	Italy
17	Solveig Gas Norway A.S.	Stable	Baa2	-	Baa2	Norway
18	South Eastern Power Networks PLC	Stable	Baa1	-	A3	United Kingdom
19	SP PowerAssets Ltd	Stable	Aa2	A2	A2	Singapore
20	TenneT Holding B.V.	Stable	A3	baa2	Baa1	Netherlands
21	Terna - Rete Elettrica Nazionale S.p.A.	Stable	Baa1	baa1	A3	Italy
22	Transelec S.A.	Stable	Baa1	-	Baa2	Chile
23	Transmisssora Alianca de Energia Eletrica	Stable	Baa3	-	Ba2	Brazil
24	VECTOR Limited	Stable	Baa1	-	Baa1	New Zealand
25	Western Power Distrib (East Midlands) Plc	Stable	Baa1	-	A3	United Kingdom

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Attachment 1

Appendix C: Regulated Electric and Gas Networks Grid Outcomes and Outlier Discussion

In the table below positive or negative "outliers" for a given sub-factor are defined as issuers whose grid sub-factor score is at least two broad rating categories higher or lower than a company's rating (e.g. a B-rated company whose rating on a specific sub-factor is in the Baa-rating category is flagged as a positive outlier for that sub-factor).

Green is used to denote a positive outlier, whose grid-indicated performance for a sub-factor is two or more broad rating categories higher than Moody's rating.

Red is used to denote a negative outlier, whose grid-indicated performance for a sub-factor is two or more broad rating categories lower than Moody's rating.

	Factor			Regulatory Environment and Asset Ownership Model				Scale and Complexity of Capital Program	Financial Policy	Leverage and Coverage				Uplift for Structural Considerations
	Sub-factor			Stability and Predictability of Regulatory Regime	Asset Ownership Model	Cost and Investment Recovery (Ability and Timeliness)	Revenue Risk	Scale and Complexity of Capital Program	Financial Policy	Adjusted Interest Coverage Ratio OR FFO Interest Coverage	Net Debt / Regulated Asset Base or Fixed Assets	FFO / Net Debt	RCF / Net Debt	Number of notches
	Issuer	Moody's Rating/ BCA[1]	Grid-Indicated Rating[2]	15%	5%	15%	5%	10%	10%	10%	12.5%	12.5%	5%	Uplift
1	American Transmission Company LLC	A1	A1	Aaa	Aaa	Aa	Aaa	Baa	Baa	A	A	A	Baa	0
2	Amprion GmbH	A3	A2	A	Aa	A	A	B	A	Aaa	Aaa	Aaa	Aaa	0
3	AusNet Services	A3	Baa1	Aaa	Aa	A	Baa	A	Baa	Ba	Baa	Baa	Baa	0
4	EATE - Emp. Amazonense Trans. Energ. S.A.	Baa2	Baa1	Ba	Ba	A	Aa	Baa	Ba	A	Aa	Aaa	Baa	0
5	Electricity Supply Board (ESB)[3]	baa1	A2	Aa	Aa	A	Aa	Baa	Baa	A	A	Baa	A	0
6	IDGC of Center and Volga Region, JSC[3]	ba3	Ba1	B	Baa	Ba	Ba	B	Ba	A	Aa	Aaa	Aaa	0
7	ITC Holdings Corp.	Baa2	Baa2	Aaa	Aaa	Aa	Aaa	Ba	Ba	Baa	Ba	Ba	Baa	0
8	Lenenergo, JSC[3]	ba3	Ba1	B	Baa	Ba	Ba	B	Ba	A	Aa	Aa	Aa	0
9	N.V. Nederlandse Gasunie[3]	baa1	Baa1	Baa	Aa	A	A	Baa	Baa	A	Baa	Baa	Baa	0
10	National Grid Gas Plc	A3	A3	Aaa	Aa	A	Aa	Ba	Baa	A	Baa	Baa	Ba	0.5
11	Northern Powergrid (Northeast) Limited	A3	A1	Aaa	Aa	A	Aa	Ba	A	A	A	Aa	Aa	0.5
12	Phoenix Natural Gas Finance PLC	Baa2	Ba1	Aa	Aa	Baa	Baa	Aaa	Ba	B	Baa	B	Caa	0.5
13	Powercor Australia LLC	Baa1	Baa2	Aaa	Aa	A	Baa	Baa	Baa	Ba	Ba	Ba	Baa	0
14	Red Electrica de Espana, S.A.U.[3]	baa2	Baa1	Ba	Aaa	Baa	Aa	A	Baa	Aa	A	A	A	0
15	ROSSETI, JSC[3]	ba3	Ba1	B	Baa	Ba	Ba	B	Ba	Aa	Aa	Aa	Aaa	0
16	SNAM S.p.A.	Baa1	A3	Aa	Aa	A	Aa	Baa	Baa	A	Baa	Baa	Ba	0
17	Solveig Gas Norway A.S.	Baa2	Baa2	Ba	A	A	A	Baa	Baa	Baa	A	Baa	A	0
18	South Eastern Power Networks PLC	Baa1	A3	Aaa	Aa	A	Aa	Ba	Ba	A	Baa	Baa	Baa	0.5
19	SP PowerAssets Ltd	A2	A2	Aaa	Aa	A	Aa	Baa	A	A	A	Baa	Baa	0
20	TenneT Holding B.V.[3]	baa2	Baa1	A	Aa	A	A	B	Baa	A	A	A	A	0
21	Terna - Rete Elettrica Nazionale S.p.A.[3]	baa1	A3	Aa	A	A	Aa	Baa	Baa	A	Baa	Baa	Ba	0

	Factor			Regulatory Environment and Asset Ownership Model				Scale and Complexity of Capital Program	Financial Policy	Leverage and Coverage				Uplift for Structural Considerations
	Sub-factor			Stability and Predictability of Regulatory Regime	Asset Ownership Model	Cost and Investment Recovery (Ability and Timeliness)	Revenue Risk	Scale and Complexity of Capital Program	Financial Policy	Adjusted Interest Coverage Ratio OR FFO Interest Coverage	Net Debt / Regulated Asset Base or Fixed Assets	FFO / Net Debt	RCF / Net Debt	Number of notches
	Issuer	Moody's Rating/ BCA[1]	Grid-Indicated Rating[2]	15%	5%	15%	5%	10%	10%	10%	12.5%	12.5%	5%	Uplift
22	Transelec S.A.	Baa1	Baa2	A	Aa	A	Baa	Baa	Baa	A	Ba	Baa	Ba	0
23	Transmisssora Alianca de Energia Eletrica	Baa3	Ba2	Ba	Baa	A	Aa	Aa	Ba	Baa	Baa	B	Caa	0
24	VECTOR Limited	Baa1	Baa1	Baa	Aa	Baa	Baa	Baa	A	Baa	Baa	Baa	Baa	0
25	Western Power Distribution (East Midlands) Plc	Baa1	A3	Aaa	Aa	A	Aa	Baa	Ba	A	Baa	A	B	0.5

1 Baseline Credit Assessments (BCAs) are opinions of issuers' standalone credit strength, absent any extraordinary support from an affiliate or a government

2 Based on the scorecard grid, including notching (if any), but excluding any support from an affiliate or a government

3 GRI

Outlier Discussion

Factor 1: Regulatory Environment and Asset Ownership Model

In the sample of issuers shown above, many networks are shown as outliers for Factor 1 principally reflecting the high quality regulatory regimes where they operate, which reduces overall business risk. Such regulatory frameworks tend to be well established, provide timely cost recovery and have de-coupling mechanisms that limit volume risk. This means that scores for these sub-factors can often be "Aaa" or "Aa" while issuers themselves are rated in the "A" or "Baa" range. This applies particularly to networks in developed countries with strong regulation, e.g. AusNet Services and Powercor Australia LLC (regulated in Australia by the AER); South Eastern Power Networks plc, Northern Powergrid (Northeast) Ltd. and National Grid Gas plc (regulated in the UK by Ofgem); and American Transmission Company LLC and ITC Holdings LLC (regulated in the US by the FERC). The strength of this factor is frequently balanced against significant capital expenditure programs and cash flow metrics that are sufficient, but not robust. These same issuers also tend to be outliers for the Asset Ownership Model sub-factor as networks assets tend to be owned outright or under licence. Conversely, issuers in emerging markets such as ROSSETI, JSC or Transmissora Aliance de Energia Eletrica tend not to be outliers, as the regulatory regimes within which they operate drive the ratings to large extent, even if there are stronger scores in some of the other sub-factors. Given the lack of track record of such regimes often accompanied by a lack of transparency, scores for these sub-factors have tended to be in the "Ba" and "B" range, in-line with the assigned rating. For the Cost and Investment Recovery sub-factor, ITC Holdings LLC is a positive outlier as its regulatory framework allows for rapid cost recovery. For the Revenue Risk sub-factor UK and US networks are positive outliers as the regulation allows for any under-recovery of revenue to be compensated for in future tariffs.

Factor 2: Scale and Complexity of Capital Program

Amprion, National Grid Gas, Northern Powergrid (Northeast) and TenneT Holding are negative outliers for this Factor reflecting the execution risk entailed in very large capital programs relative to the size of their asset bases, but which is balanced against supportive regulatory regimes that generally provide reasonably contemporaneous returns for construction spending. Conversely, Phoenix Natural Gas is a positive outlier whose modern asset base requires only a very small capital, simple program, which is balanced against financial metrics that have been consistently weaker than its UK network peers.

Factor 3: Financial Policy

There are no outliers on this factor. Scores for all 25 issuers in this sample are closely aligned with assigned ratings.

Factor 4: Leverage and Coverage

The majority of the issuers in the sample have financial metrics which are scored either "Baa" or "Ba" which doesn't make them outliers relative to their assigned ratings which are generally around "A" or "Baa". Nevertheless emerging market issuers such as IDGC of Center and Volga Region, JSC tend to have little debt compared with issuers in more developed markets. Hence, the financial metrics of these groups tend to be strong and thus positive outliers, which is balanced against regulatory frameworks that are evolving, including the potential for significant required investments to modernize their assets.

Appendix D: Calculating the Adjusted Interest Coverage Ratio for the Regulated Electric and Gas Networks Grid

As discussed in the section explaining Factor 4: Leverage and Coverage, a regulator has significant ability to alter the timing of a networks' cost recovery by changing specific parts of the regulatory formula, for example through:

1. **Regulatory asset lives/regulatory depreciation:** a regulator can change the rate at which capital is returned to a network by changing the rate of depreciation of the RAB. Reducing asset lives to increase the rate of depreciation increases a networks' regulatory revenue and thus its FFO in the short-term but decreases the RAB in relative terms in the long term (thus reducing future cash returns).
2. **Speed of money:** under ex-ante regulatory frameworks, a regulator can change the rate at which allowed total expenditure (operating + capital) is capitalized into the RAB. In the UK, the regulatory allowances for operating expenditure are known as 'fast money' whereas the allowances for capital expenditure are known as 'slow money'. If the regulator's rate of capitalization into the RAB is lower than is implied in a company's financial accounts, 'fast money' will be higher than statutory operating expenditure, which increases a networks' regulatory revenue and thus FFO.
3. **Revenue profiling:** a regulator may choose to smooth the impact of revenue changes on the end customer by profiling the trajectory of tariffs over a control period. Volatility in revenue potentially results from a regulated network's investment program which could be lumpy. This may lead to a trajectory of costs that rises and falls within a short-term frame. This may be undesirable from a regulator's perspective which may choose to manage this by profiling allowed revenue such that all costs are recovered but the impact on the consumer is reduced.

The adjusted ICR attempts to normalize for these 'regulatory levers' by adjusting FFO by an amount of money ("Capital Charges") that can be influenced by regulatory decision making in the allowed revenue calculation. The Capital Charges typically consist of some or all of the following:

» Regulatory depreciation (for many regulated networks, this is the only Capital Charge)

» The excess of 'fast money' over operating expenditure

» The excess of 'profiled revenue' over 'un-profiled revenue'

In eliminating the effects of regulatory timing differences, the adjusted ICR instead tries to capture the credit effects of true cost outperformance and provide better comparability between networks that may be allowed greater current cash returns (either because revenue is being pushed forward or because the RAB is effectively being depleted faster) with those that are likely to have more stable returns over the longer term.

To illustrate these points, we consider four hypothetical regulated networks – company A, B, C and D, which have the same RAB. For all four companies, the regulator calculates allowed revenue using a 'building block' approach, i.e. money to cover operating expenditure (i.e. fast money), an allowed return to cover debt and equity costs plus regulatory depreciation, i.e. the portion of the RAB that has been allowed by the regulator to reward historic investment. Please see the table on the following page, which contains the specific numbers and ratios for each example.

Company A has a revenue of 200, of which 40 reflects regulatory depreciation, while company B has revenue of 240 and regulatory depreciation of 80. This reflects the regulator adopting a policy of 'accelerated depreciation' for company B, effectively bringing forward cash flow into the near-term to

the detriment of the longer-term. This change results in an increase of revenue and FFO of 40 for company B, which significantly boosts its FFO-based financial ratios. In this example, FFO / net debt increases to 18% from 12% and FFO interest coverage increases to 4.7x from 3.3x. In contrast, however, the adjusted ICR remains stable at 2.0x as the higher amount of regulatory depreciation is deducted from FFO for the purpose of the interest coverage ratio calculation. Our point in time example does not illustrate the effect of accelerated depreciation on net debt / RAB, which for Company B would be expected to increase over time unless debt were commensurately reduced or capex were commensurately higher.

Company C has a revenue of 220, which is 20 higher than for company A. The difference reflects the regulator allowing the company a higher amount of 'fast money' than their statutory amount of operating expenditure. In contrast, the amount of 'slow money' capitalized into the RAB (not illustrated) will be 20 lower than the statutory level of capital expenditure, lead to either less growth or a depletion of the RAB. Moody's considers this regulatory lever to be equivalent to the way revenue is influenced by changes to regulatory depreciation. Moody's therefore treats the 20 delta to be a further capital charge which is then deducted from FFO for the purpose of calculating the adjusted ICR. While FFO-based financial ratios are improved by increasing the speed of money, the adjusted ICR remains the same at 2.0x.

Company D has a revenue of 210, which is 10 higher than for company A. The difference reflects the regulator profiling the allowed revenue over the period of a price control in a different way than is implied by the company's expected evolution of costs (which may be volatile) but is preferred by the regulator because of the experience from the end consumer's perspective. If the profiling is calculated correctly, the Net Present Value of allowed revenue should be the same irrespective of the profiling method employed. In this example Moody's would treat the 10 amount of revenue benefit as a capital charge and would be deducted from FFO for the purpose of calculating the adjusted ICR. In contrast, in other periods within the price control, the profiling adjustment will be a negative amount but Moody's would adjust for it in a similar way (that negative amount would increase FFO net of Capital Charges).

		Company A	Company B	Company C	Company D
		(Conventional approach)	(Accelerated regulatory depreciation)	(Fast speed of money)	(Revenue profile adjusted)
Regulatory Asset Base (RAB)	[a]	1000	1000	1000	1000
Regulatory depreciation as a % of RAB	[b]	4%	8%	4%	4%
Net debt	[c]	600	600	600	600
Total debt	[d]	600	600	600	600
Allowed rate of return	[e]	6%	6%	6%	6%
Actual cost of debt	[f]	5%	5%	5%	5%
Actual interest expense	[g] = [d] x [f]	30	30	30	30
Regulatory capitalization rate (slow money as a % of total expenditure)	[h]	75%	75%	70%	75%
Statutory capitalization rate (capital expenditure as a % of total expenditure)	[i]	75%	75%	75%	75%
Total expenditure	[j]	400	400	400	400
Statutory operating expenditure	[k] = [1 – [i]] x [j]	100	100	100	100
Speed of money adjustment	[l] = [[i] – [h]] * [j]	0	0	20	0
Revenue Building Block					
Fast money	[m] = [k] + [l]	100	100	120	100
Regulatory depreciation	[n] = [a] x [b]	40	80	40	40
Allowed return	[o] = [a] x [e]	60	60	60	60
Revenue profiling adjustment	[p]	0	0	0	10
Revenue allowance	[q] = [m] + [n] + [o] + [p]	200	240	220	210
FFO	[r] = [[q] – [k] – [g]]	70	110	90	80
Capital charges					
-regulatory depreciation	[n]	40	80	40	40

		Company A	Company B	Company C	Company D
		(Conventional approach)	(Accelerated regulatory depreciation)	(Fast speed of money)	(Revenue profile adjusted)
-excess fast money over opex	[s] = [m] – [k]	0	0	20	0
-profiled revenue over unprofiled revenue	[p]	0	0	0	10
Total capital charges	[t] = [n] + [s] + [p]	40	80	60	50
FFO net of Capital Charges	[y] = [r] – [t]	30	30	30	30
Ratios					
- Net Debt / RAB	[u] = [c] / [a]	60%	60%	60%	60%
- FFO / Net debt	[v] = [r] / [c]	12%	18%	15%	13%
- (FFO + Interest Expense) / Interest Expense	[w] = [[r] + [g]] / [g]	3.3x	4.7x	4.0x	3.7x
- Adjusted Interest Coverage Ratio	**[x] = [[y] + [g]] / [g]**	**2.0x**	**2.0x**	**2.0x**	**2.0x**

Appendix E: Considerations for Ratings Within a Corporate Family

Our approach to the ratings of network entities within a corporate family includes an assessment of the degree to which the credit quality of each legal entity is interlinked with the rest of the family or the degree to which the family members are insulated from each other. We assess the total landscape in determining whether probability of default is similar for each family entity, differentiated but tightly banded around an overall family credit quality, or differentiated with a wider banding. There can be a broad range in the combinations of credit insulating elements that are present in each family and also in their effectiveness. Major considerations include:

Regulatory framework

» Requirement that a network maintain a minimum financial profile (e.g., to comply with its regulatory licence)

» Requirement that a network maintain a particular capital structure in order to earn its allowed revenues/tariffs (versus a network whose tariffs are set based on an assumed capital structure)

» Prohibition on pooling cash with a parent or certain affiliates or making loan advances to those entities (versus an ability of the parent company to pool the cash of all family entities)

» Pre-approval by the regulator for debt issuance and liquidity arrangements (versus the ability of a network's management to freely make financing decisions)

» Ability and willingness of the regulator to limit/prohibit the network from making dividend distributions to its parent

Financing structure

» Strength or weakness of financial covenants and other structural features

» The relative amounts of debt at each network and at holding companies (networks may have leverage at intermediate holding companies and at the parent company)

» For a holding company, the extent to which it is dependent on the distributions of a particular network in order to meet its own obligations

» Ability of each entity to meet its own liquidity needs (e.g., its dependence on external sources of support)

Corporate structure

» A network subsidiary may have independent board members whose votes are necessary for major corporate actions, including voluntary bankruptcy (versus a corporate family where the board members of each subsidiary are all parent company board members or managers)

» Network subsidiaries may have minority (and/or blocking) shareholders that must be consulted for major corporate actions

In many circumstances, the rating of a regulated network subsidiary is constrained by the overall credit quality of the group to which it belongs, because the regulatory treatment of its activities provides little credit insulation between entities and there is little restriction in the movement of cash between entities in the corporate or financing documents. The absence of such barriers tends to align the credit quality of a network with its family and parent. In these circumstances our rating analysis places a much heavier weight on an assessment of the consolidated group's credit quality, and the ratings of the

family members are likely to be the same or very closely aligned. In these circumstances, a certain amount of credit deterioration at a weaker subsidiary within a utility family would more than likely be counterbalanced by stronger subsidiary(ies) and an expectation that the parent would find a way to direct support to the weak entity. However, if the deterioration at a network subsidiary was severe (e.g., due to material regulatory challenges) and parent support was not assured, ratings within the group could be more differentiated, since the distressed regulated network could be rated well below the parent. There are aspects of the UK regulatory framework that have led to a partial de-linkage of ratings for group members. Typically, UK networks must: (1) maintain an investment grade credit rating; (2) not participate in sizeable unregulated business activities; (3) maintain at least 12 months of operating and financial resources; and (4) not pledge any of the network assets as collateral. Nevertheless, our approach to these groups typically starts with an assessment of consolidated credit quality and incorporates our view of the parent's activities, because until one of these triggers is breached, networks are mostly unimpeded from making distributions or maintaining a capital structure that is different than the one regulators assume when revenues/tariffs are set. However, were a trigger point to occur, e.g. if the credit quality of the wider parent fell below a certain level, the ratings of regulated networks with sufficiently protective arrangements may vary much more from the consolidated credit profile. Even in a situation of distress at the parent, regulated networks that are subject to these provisions may likely maintain a relatively high credit rating and could thus pierce the consolidated credit quality of the group by a substantial number of notches. In addition, notching within the family may be wider in the presence of debt structural features – these have been more widely used in the UK than other markets.

Even when meaningful regulatory barriers exist such that ratings of individual networks vary more widely from the consolidated credit profile, the credit quality of the parent still has an impact in most circumstances. Therefore, while credit analysis of the individual regulated network may have greater weight in our ratings, parent credit quality also plays a role. Nevertheless, in some jurisdictions there may be significant barriers to cash movement. For instance, in the United States, some state regulators engage in pervasive oversight of the financing arrangements of utility companies. Examples of state level oversight can include: (1) pre-approval by the regulator to increase indebtedness; (2) explicit leverage restrictions on the regulated entity and potentially on its immediate parent; (3) an expectation that the utility will maintain the capital structure utilized for rate-setting; (4) limitations on the exposure of a regulated network to its affiliates, for example via a regulated moneypool arrangement; and (5) higher regulatory pressure that restricts dividends. Nevertheless, the benefit to creditors of these arrangements can vary significantly between different states and leads to a range in the barriers to cash movement between regulated companies and related entities. US networks rated pursuant to this methodology are regulated primarily by the Federal Energy Regulatory Commission (FERC), which has tended to exercise less pervasive oversight than most state regulators with respect to financing arrangements. A change in approach by regulators may change our approach to assessing the ratings of networks in any family that we consider to be affected.

Appendix F: A Summary of Industry Issues over the Intermediate Term

Political and regulatory issues

The credit quality of a regulated electric and gas network is particularly sensitive to its regulatory and political environment. Issuers that are highly rated tend to be domiciled in jurisdictions where there is a sizeable track record of consistent and predictable decision making by the regulator and an absence of political interference. The following global snapshot suggests that the overall regulatory environment for rated networks is either stable or has improved over time. A reversal of this trend would have a significant impact on ratings of the affected issuers.

In the United Kingdom, the gas distribution networks (GDNs) and the electricity and gas transmission system operators (TSOs) obtained their regulatory settlements in December 2012 and as such have revenue and cash flow visibility through 2021. This provides a stable regulatory environment for UK issuers. Similarly to the UK, the regulatory framework in Australia has generally been consistently applied and is supportive of credit quality. However, a new approach to calculating the allowed rate of return which was announced in late 2012 will apply for regulatory periods commencing after July 2014. Whilst the Australian Energy Regulator (AER) has stated its intention to apply this new framework consistently in future revenue decisions, the re-establishment of a regulatory track record over the near term is likely to be more important in our assessment of the regulatory framework.

In Germany, changes to the incentive-based regulatory regime since its introduction in January 2009 have resulted in greater certainty of earning a timely return on new expansion investments for network operators. However, networks in Germany are exposed to wider developments in national energy policy, particularly with respect to renewable energy generation. The increasing costs to the end consumer because of renewables could attract political interference into the sector and with it a heightened risk environment. In Italy, the deterioration of the country's macroeconomic and public finance conditions since 2011-12 have affected the credit quality of the Italian energy networks, with additional tax levies and more difficult access to financing. However, the stabilization of the Italian sovereign outlook in February 2014 as well as a visible improvement in liquidity conditions is credit positive for regulated networks. Aside from this, the regulatory framework remains supportive and has been consistently applied during and between tariff cycles even throughout the sovereign debt crisis.

In Russia, whilst the progression towards a RAB-based model, introduced for a major part of the domestic grid sector in 2011, is credit positive as it improves tariff-setting transparency, this model has not been consistently applied in regulatory settlements. Continuous revisions of the regulatory framework, driven by the government's efforts to cap tariff increases for end users and support economic growth, have culminated in tariff freezes for 2014 and inflation-linked tariff growth caps from 2015 onwards. Given the domestic economy's dependence on the cyclical oil industry, and exposure to volatile geo-political and macroeconomic factors, the risk of political uncertainty and resultant changes in the regulatory framework remains an ongoing credit consideration. If such risks remain, the creditor benefits of the progression to a RAB-based model (and the associated refinements to the regulatory framework) may be limited. Whilst these risks are systemic for the industry, for some companies these risks are reduced due to their ownership by the sovereign. However, the level of ownership varies significantly through this shareholder structure in Russia.

In North America, regulation by the FERC continues to be both stable and supportive of credit quality. However, the recent Section 206 complaint filings have increased uncertainty and may result in a cut to the allowed return on equity (ROE) that transmission network operators may be able to earn. However, we do not currently expect that the outcome of these various complaints will result in

adverse changes that would have a material negative effect on the financial performance of transmission companies or change our view of the credit supportiveness of FERC's regulatory framework. In South America, the regulatory environments for networks are somewhat more complex than in other regions but are mostly supportive. Most countries adopted a long-term (e.g. 20+ year) formulaic tariff plan (often indexed to inflation) with no review for assets brought into service after a certain date, while older assets continue to be subject to periodic tariff reviews. We continue to view Chile, Colombia and Peru as credit supportive with reasonably predictable review outcomes; however, in Brazil the passing of a law in January 2013 which will accelerate the renewal of certain generation and transmission concessions increases uncertainty.

High investment requirements

Regulated networks face ongoing high capital expenditure programs to maintain, upgrade and grow their asset base. Across many jurisdictions, the age of network infrastructure is relatively old and often results in high inefficiencies in the system through losses and equipment failure. Networks are often therefore obliged to invest significant amounts to replace and upgrade these ageing assets in order to improve the reliability of electricity and gas supplies. In addition, networks are often required to expand their asset base in response to macroeconomic drivers such as population growth and increases in wealth and consumption. Networks often need to invest ahead of expected higher loads and changing demand patterns. Significant additional capital expenditure also reflects the changing structure of the electricity and gas industry, particularly in Europe but also in the United States. In these regions, the old model of large power stations producing power away from demand centers is changing with distributed generation sources (e.g., solar photovoltaic and onshore wind) increasingly dominant in power supplies. The abundance of such non-conventional generation sources requires networks to invest in new connections but also to facilitate the two-way flow of electricity across the grid.

In a supportive regulatory environment, which allows for cost recovery and a reasonably contemporaneous return on investments, high levels of capital expenditure need not be a major credit concern. Should upward pressure on utility rates to consumers caused by major new grid investments diminish the regulatory support for regulated networks, there could be a negative impact on their ratings. In addition, a significant capital program that is either: (1) high relative to the size of the existing asset base; and/or (2) complex and involves new forms of technology (and thus greater likelihood of substantial cost over-runs) - could introduce meaningful execution risk that could negatively affect a networks' credit profile and its rating. In addition, an out-sized capital program will also likely present a financing challenge for a network, potentially negatively impacting its liquidity profile.

Economic and financial market conditions

Compared with other corporate issuers, networks tend to be more insulated from macroeconomic and financial market conditions as their revenues are determined by a regulatory authority and are set for a fixed period of time. Networks also tend to be relatively immune from a reduction in demand partly reflecting the generally lower elasticity of electricity and gas consumption but also the presence of 'revenue caps', also called 'de-coupling'. Revenue caps allow networks to adjust their tariffs as required in order to recover their full revenue entitlement even as demand profiles change – revenues are de-coupled from volumes.

In general, regulated networks tend to be more highly leveraged than similarly rated corporate issuers on account of their typically lower business risk profile. Since the 2008-09 global financial crisis, regulated networks have therefore benefitted from a significant decline in market interest rates

M3-3.1-VECC-1
Attachment 1

reflecting in part the monetary policies of global central banks. However, a secondary consequence of a reduction in interest rates is that the allowed financial return (as determined by regulators) has also fallen. In general, networks were positively affected as their overall cost of debt has declined at a quicker rate than regulatory returns. However, some networks may be exposed, particularly if their average debt tenor is substantially longer than the time period considered by regulators when making this assessment. In such a scenario, regulatory returns will fall at a quicker rather than a company's cost of debt, leading to a weakening of key credit metrics. A further uncertainty is the response of regulators to rising interest rates, if and when this occurs, as both debt and equity investors will require a higher overall rate of return, but regulators may be unwilling to increase regulated tariffs by the same amount.

Moody's Related Research

Rating Methodologies:

» Government-Related Issuers, October 2014 (173845)

» How Sovereign Credit Quality May Affect Other Ratings, February 2012 (139495)

To access any of these reports, click on the entry above. Note that these references are current as of the date of publication of this report and that more recent reports may be available. All research may not be available to all clients.

The credit ratings assigned in this sector are primarily determined by this credit rating methodology. Certain broad methodological considerations (described in one or more secondary or cross-sector credit rating methodologies) may also be relevant to the determination of credit ratings of issuers and instruments in this sector. Potentially related secondary and cross-sector credit rating methodologies can be found here.

For data summarizing the historical robustness and predictive power of credit ratings assigned using this credit rating methodology, see link.

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VECC Interrogatory #2

Issue Number: 3.1
Issue: Are OPG's proposed capital structure and rate of return on equity appropriate?

Interrogatory:

Reference: Exhibit M3 Reliance on comparables

a) Is Dr. Villadsen aware that in the 2012 Union Gas (EB-2011-0210, page 49) Decision the Board criticized Union Gas evidence since it was based on "comparables" and stated
"Union's second argument focuses on the first part of the comparable investment standard – that the return on invested capital must be comparable. However, Union's argument fails to address the second part of the comparable investment standard, that being the issue of "enterprises of like risk". Union would have the Board increase (and potentially reduce) its deemed common equity ratio in lock-step with the decisions of other regulators, without an analysis of whether the utilities to which it is compared are enterprises of like risk."

b) Can Dr. Villadsen confirm that that her 48% common equity ratio is "largely" derived from an average and median of a sample of firms that she regards as comparable to OPG as indicated in her Figure 6?

c) Can Dr. Villadsen confirm that all of the firms in her Figure 6 that resulted in the average common equity ratio of 48% are US regulated utilities and not one is Canadian?

d) In Dr. Villadsen's AUC evidence (page 63) she provided the following graphic. Please confirm the following:
   a. The average US natural gas utility has an allowed ROE of 9.60% on 49.94% common equity versus 9.31% on 40.23% in Canada,
   b. The average US electric has 9.59% ROE on 48.78% common equity versus 8.80% ROE on 40.27% in Canada
   c. The average US utility (all) has a 9.59% ROE on 49.24% common versus 9.09% on 40.25%

Figure 21: Allowed ROEs and Capital Structures in Canada and the U.S.

Service	2014 Allowed ROE (%)	2014 Common Equity Ratio (%)	2015 Allowed ROE (%)	2015 Common Equity Ratio (%)
U.S.				
Natural Gas	9.78	51.06	9.60	49.94
Electric	9.75	50.21	9.59	48.78
Electric T&D	9.50	49.26	9.23	47.18
All	9.77	50.60	9.59	49.24
All - Settled	9.65	49.50	9.86	49.70
All - Fully Litigated	10.02	51.27	9.56	48.89
Canada				
Natural Gas	9.32	40.40	9.31	40.23
Electric	8.81	40.40	8.80	40.27
All	9.12	40.40	9.09	40.25
All (excluding Alberta)	9.41	40.64	9.41	40.46

Sources:
For U.S. data: SNL Financial
For Canadian data: Concentric Energy Advisors Authorized Return on Equity for Canadian and U.S. Gas and Electric Utilities, Volume III.

g) Please confirm that in the previous graphic and ignoring the higher allowed ROEs in the US the average common equity is 9.71% higher for a natural gas utility; 8.51% higher for an electric utility and 8.99% higher for "all" utilities.

h) Please confirm that in practice US utilities have consistently higher allowed ROEs and common equity ratios than do "comparable" Canadian utilities and to obtain Canadian regulated common equity ratios at a first blush we need to reduce ratios from a sample of US utilities by at least 8.0%. If not please explain in detail why not?

i) Please explain why in her judgement Canadian utilities can on average finance with investment grade bond ratings when they have both lower allowed ROEs and common equity ratios.

j) Please indicate any instances Dr. Villadsen is aware of that indicate that there are financial access problems for a Canadian utility; in particular is she aware of either Union Gas or EGDI both operating on 36% common equity ratios having any problems accessing markets.

Response:

The following response was provided by The Brattle Group:

a)Yes, Dr. Villadsen is aware of the Board's findings in the Union Gas Limited EB-2011-0210 decision. Note that, in this decision, the Board did not reject the validity of a comparable-based assessment of equity thickness or fair rate of return on investments. Rather, the Board's rejection of Union's comparability argument was driven by Union's failure to demonstrate that its enterprise risks were comparable to "Other Canadian Utilities" that had higher deemed equity capitalization levels. Stated differently, the OEB found that Union had not demonstrate that the "Other Canadian Utilities" it referred to were an appropriate sample of comparable companies on an enterprise risk basis.

b) Confirmed, but Dr. Villadsen points out that she undertook an independent determination of OPG's forecasted credit metrics (M3, Section IV.A, Exhibits BV-4a and BV-4b) and a business risk analysis (M3, Section III) to confirm the appropriateness of the recommended equity thickness. See Exhibits BV-4a and BV-4b attached to Exh. M3.

c) Confirmed.

d) a. Confirmed for 2015.
b. Confirmed for 2015. Dr. Villadsen notes that the summary data did not include Virginia-based integrated electric utilities (Virginia provides an incentive ROE for generation, which was not applicable to T&D entities in Alberta).
c. Confirmed for 2015. See also the response to b. above.

e) [Sub-question does not appear in request]

f) [Sub-question does not appear in request]

g) Dr. Villadsen can confirm that the difference between the average allowed common equity ratio for US and Canada utilities in 2015 was 9.71% (49.94% minus 40.23%) for natural gas utilities, 8.51% (48.78% minus 40.27%) for electric utilities (excluding Virginia-based integrated electric utilities), and 8.99% (49.24% minus 40.25) for all utilities.

h) Not confirmed. Dr. Villadsen can confirm that the average allowed ROE / equity thickness in the U.S. is higher than the average allowed ROE / equity thickness in Canada, but Dr. Villadsen has not undertaken an analysis of the comparability of the companies in the table nor of their comparability to OPG.

i) Dr. Villadsen has not undertaken a study of Canadian utilities ability to raise capital relative to that of U.S. based companies, but observes that there may be

many reasons for that. Among such reasons, (i) many Canadian utilities (e.g., crown or municipal-owned entities) have implicit support from a governmental agency, (ii) there may be a clientele effect in the Canadian market (including tax effects), (iii) Canadian utilities, unlike most U.S. utilities, issue hybrid securities (e.g., preferred equity), and (iv) investor perceptions of the political or regulatory climate.

j) Dr. Villadsen cannot speak to Union Gas or EDGI's ability to access capital markets and does not personally have knowledge of the ability to issue paper in the Canadian market. However, she notes that Mr. Lomore of AltaLink testified at the hearing in the proceeding that the company had experienced difficulties raising debt capital (AUC Proceeding No. 20622, Transcript Vol. 2, June 1, 2016, p. 254 ff).

VECC Interrogatory #3

Issue Number: 3.1
Issue: Are OPG's proposed capital structure and rate of return on equity appropriate?

Interrogatory:

Reference: Exhibit M3 Regulated generation

a) Dr. Villadsen places significant weight (page 4, final paragraph) on the fact that OPG's generation is almost 100% regulated and for this reason uses a refined comparable sample of US utilities as compared to Mr. Coyne's sample which includes non-regulated generation. Can she confirm that her recommendation of a 48% common equity ratio, which is 2% less than Mr. Coyne's, largely comes from the use of this different sample . If not, please provide all the areas of disagreement and what they are worth in terms of OPG's common equity ratio.

b) In Mr. Coyne's 2013 evidence on behalf of Quebec Hydro (both Transmission and Distribution), Mr. Coyne stated on page 9 of the summary

> *"the only important difference is that a percentage of electric companies in the US Proxy group (and in Canada) own some regulated generation, which suggests that these companies have somewhat more business risk than HQD and HQT."*

And further on page 53

> *"as discussed in the following section of this testimony the incremental ROE required to offset the increased operating risk of regulated generation is approximately 41 basis points."*

Would Dr. Villadsen agree that an extra 0.41% is needed to offset the added risk of regulated generation as compared to a traditional Canadian Transmission and distribution utility? If she does not agree with that estimate what extra ROE is needed for a regulated utility with generation as compared to one without?

c) If the adjustment is not made to the ROE but instead to the common equity ratio, what incremental common equity ratio is needed to offset the added risk of regulated generation as compared to a pure T&D company?

Response:

The following response was provided by The Brattle Group:

a) Not confirmed. OPG Exhibit C1-1-1, Attachment 1 p. 5 recommends "an equity ratio of no less than 49%" and OPG Exhibit C1-1-1, p. 1 requests an equity ratio of 49%. Dr. Villadsen can confirm that she relied on a different sample than Mr. Coyne. However, Dr. Villadsen's recommended equity ratio of 48% was further supported by an independent credit metric analysis (Exhibit M3, Exhibits BV 4a and 4b). She further examined the increases / decreases in OPG risk relative to the EP-2013-0321 decision.

b) Dr. Villadsen has not examined the specific risks of HQD and HQT and does not know (i) what specific companies Mr. Coyne relied upon, (ii) the data of Mr. Coyne's analysis, or (iii) the exact analysis undertaken by Mr. Coyne. Therefore, she cannot agree or disagree with the estimate cited above.

c) Dr. Villadsen agrees that an adjustment for risk characteristics can be made to either the ROE or the equity thickness. However, Dr. Villadsen cannot provide a number of basis points that is required for regulated generation relative to regulated T&D. Because there are differences between T&D companies, between T&D companies and generation companies as well as between generation companies in addition to changing economic and regulatory conditions, Dr. Villadsen cannot assign a specific number of basis points to such difference.

VECC Interrogatory #4

Issue Number: 3.1
Issue: Are OPG's proposed capital structure and rate of return on equity appropriate?

Interrogatory:

Reference: Exhibit M3 Incentive Regulation

a) Ms. Villadsen bases her 48% common equity ratio in part on the increased risk that incentive regulation imposes on shareholders. Can she indicate any studies or analysis that she has performed on the impact of incentive regulation in Canada?

b) Is Dr. Villadsen aware of any Canadian regulator that has increased the allowed ROE or common equity when putting a utility on incentive regulation?

Response:

The following response was provided by The Brattle Group:

a) Dr. Villadsen has not performed studies reviewing the impact of incentive regulation in Canada.

b) If incentive regulation is applied to mean standard PBR, Dr. Villadsen is not aware of a Canadian regulator that stated it would increase the allowed ROE or common equity. However, the NEB's "restructuring" decision in RH-3-11 for the TransCanada Mainline can be viewed as a form of incentive regulation as it committed the Mainline to fixed tolls for a five year period. The decision provided the Mainline a substantial ROE premium, in part on the grounds that the scheme implemented was riskier than cost of service regulation. [NEB Decision RH-3-11 p. 164 and 191]

VECC Interrogatory #5

Issue Number: 3.1
Issue: Are OPG's proposed capital structure and rate of return on equity appropriate?

Interrogatory:

Reference: Exhibit M3 Compensating Shareholders

a) Is Dr. Villadsen aware that OPG is included in the Ontario Provincial budget as income from government business enterprises and that in the 2016 budget http://www.fin.gov.on.ca/en/budget/ontariobudgets/2016/bk9.html, the Province of Ontario stated:

> **Powering Up for the Future**
>
> The Province remains committed to building a cleaner and more sustainable energy system for all Ontarians while reducing electricity system cost pressures. Since 2003, more than $34 billion has been invested in cleaner energy generation in Ontario, with Hydro One investing about $15 billion in modern transmission and distribution infrastructure. Other initiatives include:
>
> - Pursuing the continued operation of the Pickering Nuclear Generating Station beyond 2020 up to 2024. By doing this, Ontario Power Generation (OPG) would protect 4,500 jobs across the Durham region, avoid eight million tonnes of GHG emissions, and save Ontario electricity consumers up to $600 million.
> - Moving forward with OPG's refurbishment of the four units at the Darlington Nuclear Generating Station. The Independent Electricity System Operator has updated its contract with Bruce Power to refurbish six nuclear units, in addition to two already refurbished units at the Bruce nuclear site. Together, this secures over 9,800 megawatts (MW) of affordable, reliable and emission-free power.

a) Please confirm that in the Ontario Government's infrastructure programme it includes the costs of the Darlington refurbishment programme as provincial government expenditures.

b) Please indicate whether any of the utilities in Dr. Villadsen's proxy sample are instructed by their owners to follow provincial or state-wide non-financial objectives, such as preserving 4,500 jobs, and if their owners have ever put out a release with titles similar to that of Ontario's "Jobs for today and tomorrow". In Dr.

Villadsen's judgement is such an attitude by the shareholder consistent with the stand alone principle?

c) Can Dr. Villadsen cite any literature in finance or economics that indicates that where a shareholder imposes a more risky strategic direction on a company they own, this necessitates a higher common equity ratio or allowed ROE due to this self-imposed risk? Or put another way, isn't the higher required rate of return or common equity ratio a decision that reflects an external risk that cannot otherwise be controlled rather than a willingly undertaken strategy which must by definition offer them a positive NPV?

d) Is Dr. Villadsen aware that previously when the forerunner of OPG embarked on a significant nuclear programme all electricity consumers were saddled with a "stranded debt charge" that has only just been removed for some consumers? How did Dr. Villadsen take the ability of the Province to levy extra charges on all electricity uses (as well as tax payers) into account in reducing the risk of the DRP to OPG and itself?

e) In Dr. Villadsen's judgment is OPG as a 100% owned OBCA company riskier than when it was a part of a provincial crown company and would her recommendation change if it reverted to crown status?

f) Why did Dr. Villadsen not compare OPG to the only other North American operator of a Candu nuclear reactor?

Response:

The following response was provided by The Brattle Group:

a) Dr. Villadsen has examined the link provided, but did not find the exact cites provided above nor did she find a line item for the Darlington Refurbishment Program in the document at
http://www.fin.gov.on.ca/en/budget/ontariobudgets/2016/papers_all.pdf

Dr. Villadsen agrees that the Ontario budget includes a discussion of the Darlington Refurbishment Program, the Pickering extension as well as maintaining 4,500 jobs and "9,800 MW of affordable, reliable and emission-free power."

b) Certainly, there are examples of companies that follow non-financial objectives. Looking at the companies in the refined sample, DTE Energy has a foundation that awards grants and a group that works with companies that may relocate to Michigan

(https://newlook.dteenergy.com/wps/wcm/connect/dte-web/dte-pages/ccr/home/community) as does El Paso Electric (https://www.epelectric.com/community/community-partner-program). Entergy in turn was recognized as one of the best corporate citizens in 2016 (http://www.entergynewsroom.com/latest-news/entergy-corporation-ranked-number-18-100-best-corporate-citizens-list/). While Dr. Villadsen does not know of a company in the refined sample that has committed to preserving a large number of jobs, it is not uncommon to have such provisions in connection with mergers or acquisitions. For example, Fortis Inc. (included in Concentric's sample) committed to maintain staffing levels in Arizona when acquiring UNS (Condition 27; Arizona Corporation Commission Decision 74689).c) No.

d) Dr. Villadsen is examining OPG's equity thickness on a stand-alone basis.

e) Please see the response to d) above.

f) It is Dr. Villadsen's understanding that CANDU nuclear reactors in North America are operated by OPG, Bruce Power in Ontario (not OEB rate-regulated) and Energie NB Power in New Brunswick (regulated by the New Brunswick Energy & Utilities Board) (see M3-3.1-VECC-5_Attachment 1 for a list of CANDU units operating in North America). Dr. Villadsen's approach to sample selection focused on asset composition, including a review of fuel mix, to evaluate whether companies had similar asset level risk to that of OPG. Her analysis did not look to technological differences within an asset class to develop her sample of comparable companies. In addition, Dr. Villadsen observes that Bruce Power is not rate-regulated by the OEB, but sells the majority of its power to the IESO under long-term contracts and that NB Power's 10-year plan calls for it to improve its equity ratio through, among other, earning a return on equity of 16 – 26% between 2017 and 2020.
See p. 2 of https://www.nbpower.com/media/169786/2017-26-ten-year-plan-en.pdf

Corporate Info
Organization
Programs
Members
Partnerships

COG Members

Nuclear Power Generating Companies

Name of Company	Name of Sation	Number of Units	Status
Bruce Power	Bruce A	4	Operational
	Bruce B	4	Operational
Énergie NB Power Nucléaire Nuclear	Point Lepreau	1	Operational
ONTARIO POWER GENERATION	Pickering A	2	Operational
		2	Non-Operational - Laid-Up
	Pickering B	4	Operational
	Darlington	4	Operational
NUCLEOELECTRICA ARGENTINA S.A.	Embalse	1	Operational
NUCLEARELECTRICA	Cernavoda	2	Operational
中国核电 CNNP 中核核电运行管理有限公司 CNNC Nuclear Power Operations Management Co.,Ltd.	Qinshan	2	Operational
Nuclear Power Corporation of India Limited	Rajasthan	5	Operational
		2	Under Construction
		1	Non-Operational
	Madras	2	Operational

		2	Operational
	Kakrapar	2	Under Construction
	Kaiga	4	Operational
	Narora	2	Operational
	Tarapur	2	Operational
KHNP KOREA HYDRO & NUCLEAR POWER CO., LTD	Wolsong A	2	Operational
	Wolsong B	2	Operational
Pakistan Atomic Energy Commission	KANUPP	1	Operational
NUCLEARELECTRICA	Cernavoda	2	Operational

Total	**Operational**	47
	Under Construction	4
	Non-Operational - Laid-Up	2
	Non-Operational - Other	1

CANDU Reactor Manufacturer and Service Provider

Atomic Energy of Canada Ltd.	1 Research Reactor (NRU)

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VECC Interrogatory #6

Issue Number: 3.1
Issue: Are OPG's proposed capital structure and rate of return on equity appropriate?

Interrogatory:

Reference: Exhibit M3 Equity Ratios

Please review the Concentric document published by the Canadian Gas Association May 27, 2016 titled Authorized Return on Equity for Canadian and U.S. Gas and Electric Utilities, a copy of which is attached. The following conclusion appears on the first page:

> **EQUITY RATIOS**
> The median authorized common equity ratio has declined slightly over the past few years in both Canada and the U.S. The gas distribution ratio is now 39.25% in Canada, vs. 50% in the U.S. The median electric distribution equity ratio is now 40% in Canada, and 50% in the U.S.1 Electric transmission equity ratios remain at 36% in Canada.
> The differences between allowed equity ratios in Canada and the U.S. seem attributable to a few factors. Regulators in both countries rely on peer group analysis, which reinforces prevailing levels of allowed equity ratios. Regulators also look for material differences in risk or financial metrics before changing the allowed equity ratio, so they tend to remain relatively stable. While credit rating agencies notice the greater leverage of Canadian companies, and rank some of these utility companies as "Aggressive" in terms of financial risk, most companies have been able to maintain A or A- level credit ratings, so the regulatory response has been muted.

b) Would Dr. Villadsen agree or disagree with Concentric's assessment?

Response:

The following response was provided by The Brattle Group:

a) [Sub-question does not appear in request]

b) Dr. Villadsen is not certain which part of the statement she is asked to agree or disagree with. However, she agrees with the factual statement on allowed **median** equity ratios and that most companies are in the A to A- range. As for the reasons that equity ratios differ, she agrees that regulators tend to maintain relatively stable equity

ratios and use peer analysis so that changes tend to occur slowly. Certainly, some regulators view the ability to maintain an A to A- credit rating as important, but Dr. Villadsen has not studied all jurisdictions and cannot speak to the reasons why regulators in jurisdictions she is not familiar with have maintained the equity ratios they have. Dr. Villadsen further notes that while many Canadian regulators deem an equity ratio, many U.S. regulators use the regulated entity's actual book capital structure.