SCHOOL ENERGY COALITION INTERROGATORIES

SEC-OEBStaff-7

Reference: [Ex.M, p.74-75]

PEG notes that a higher S-factor "merits contemplation" and lists several reasons for why this is the case. What is the specific S-factor that PEG would recommend?

Response to SEC-OEBStaff-7:

PEG's response to this question begins with a glossary of terms that are used in the following sections. We then discuss an alternative approach to Custom IR which features a Comprehensive Price Escalation Factor ("CPEF") applicable to both capital and OM&A revenue. There follow discussions of the advanced capital module ("ACM") and our S factor calculations.

Glossary of Terms

C = C factor

CK = capital cost

CK^{new} = capital cost of new additions

CKD = depreciation expenses

CKR = return on rate base

g = actual billing determinant growth (assumed to equal G for simplicity)

R = total revenue

RK = capital revenue

RK^{+} = supplemental capital revenue

RKR = return on rate base revenue requirement

ROMA = OM&A revenue

VK^{net} = net plant value (aka rate base)

r = rate of return on rate base

VKA = value of proposed gross plant additions ("GPAs")

$VKA^{eligibile}$ = value of proposed gross plant additions eligible for extra revenue

VKA^{funded} = value of gross plant additions funded by both price cap mechanism and any supplemental capital revenue

$VKA^{ineligible}$ = value of proposed gross plant additions ineligible for supplemental revenue

$VKA^{price\ cap}$ = value of gross plant additions funded by the price cap mechanism

M = markdown factor used in the Price Cap IR Threshold Value formula

S = extra stretch factor in the C factor formula, like that approved in EB-2017-0049

Sc_K or S_{cap}= share of capital in total cost

Sc_{OMA} = share of OM&A expenses in total cost

TC = total cost

I = annual price inflation

X = X factor term of the rate or revenue cap index = base productivity trend + stretch factor

Comprehensive CPEF

Theory

The OEB has recently approved Custom IR plans, for Toronto Hydro and Hydro One's transmission and distribution services, in which growth in revenue (or rates) for both capital and OM&A inputs is escalated by an index. Derivation of these indexes begins with the mathematical result that the growth rate of a utility's total cost is a cost-share-weighted average of the growth in its capital and OM&A costs.

$$growth\ TC = Sc_K \cdot growth\ CK + Sc_{OMA} \cdot growth\ COMA. \quad [1]$$

Suppose, then, that growth in allowed revenue is a weighted average of growth in capital revenue ("RK") and OM&A revenue ("ROMA"), where the weights are the shares in a company's projected/proposed cost. Suppose also that we let both of these revenue components grow in accordance with an I-X formula but add a correction for any difference between projected/proposed capital cost growth and annual price inflation ("I"). Then

$$growth\ R = Sc_K \cdot growth\ RK + Sc_{OM\&A} \cdot growth\ ROMA \quad [2]$$

$$= Sc_K \cdot [(I - X) + (growth\ CK - I)] + Sc_{OM\&A} \cdot (I - X) \quad [3]$$

$$= Sc_K \cdot [(growth\ CK - \mathrm{X})] + Sc_{OM\&A} \cdot (I - X) \quad [4]$$

Since the sum of Sc_K and $Sc_{OM\&A}$ equals 1, we know from [3] that

$$growth\ R = I - X + sc_K \cdot [growth\ CK - I].$$

Between years 0 and 1,

$$growth\ R = I - X + \frac{CK_0}{TC_0} \cdot \left[\frac{CK_1 - CK_0}{CK_0} - I\right]$$

$$= I - X + \left[\frac{CK_1 - CK_0}{TC_0} - \frac{CK_0}{TC_0} \cdot I\right]$$

$$= I - X + C \quad [5a]$$

where *C,* the C factor, is defined by the formula

$$C = \left[\frac{CK_1 - CK_0}{TC_0} - \frac{CK_0}{TC_0} \cdot I\right]$$

$$= C_n + S_{cap} * I \quad [5b]$$

and

$$C_n = \left[\frac{CK_1 - CK_0}{TC_0}\right] \quad [5c]$$

$$\left[S_{cap} * I = \frac{CK_0}{TC_0} \cdot I\right] \quad [5d]$$

In in its decision approving the three Custom IR plans noted above, the OEB added an S factor to the C factor formula so that

$$growth\ R = I - X + sc_K \cdot [growth\ CK - (I + S)]$$

$$= I - X + \frac{CK_0}{TC_0} \cdot \left[\frac{CK_1 - CK_0}{CK_0} - (I + S)\right]$$

$$= I - X + \left[\frac{CK_1 - CK_0}{TC_0} - \frac{CK_0}{TC_0} \cdot (I + S)\right]$$

$$= I - X + C \quad [6a]$$

where

$$C = \left[\frac{CK_1 - CK_0}{TC_0} - \frac{CK_0}{TC_0} \cdot (I + S)\right]$$

$$= \quad C_n + S_{cap} * (I + S) \qquad [6b]$$

Hydro Ottawa has proposed a CPEF with the formula

growth CPEF = I – X + G. [7]

Suppose, then, that we apply this formula to capital as well as OM&A revenue and add a C factor and an S factor to the formula. Then

$$growth\ R = Sc_K \cdot growth\ RK + Sc_{OM\&A} \cdot growth\ ROM \qquad [8a]$$

$$= Sc_K \cdot [(I - X + G) + (growth\ CK - (I + G) - S)] + Sc_{OMA} \cdot (I - X + G) \qquad [8b]$$

$$= Sc_K \cdot [growth\ CK - (X + S)] + Sc_{OMA} \cdot (I - X + G). \qquad [8c]$$

and

$$growth\ R = I - X + G + sc_K \cdot [growth\ CK - (I + \mathrm{G} + S)]$$
$$= I - X + G + \frac{CK_0}{TC_0} \cdot \left[\frac{CK_1 - CK_0}{CK_0} - (I + \mathrm{G} + S)\right]$$
$$= I - X + G + \left[\frac{CK_1 - CK_0}{TC_0} - \frac{CK_0}{TC_0} \cdot (I + \mathrm{G} + S)\right]$$
$$= I - X + G + C \qquad [9a]$$

where

$$C = \left[\frac{CK_1 - CK_0}{TC_0} - \frac{CK_0}{TC_0} \cdot (I + G + S)\right]$$

$$= \ C_n + S_{cap} * (I + G + S) \qquad [9b]$$

Application to Hydro Ottawa

To apply this formula to Hydro Ottawa we need a more appropriate inflation measure. The cost-share weights on the two inflation measures should be those commensurate with total cost, not

those commensurate with OM&A expenses. Suitable weight calculations can be found in Table 1. The weight on the labor price index should now be the share of net (i.e., non-capitalized) OM&A labor expenses in the total revenue requirement. While this share is not readily available for Hydro Ottawa, we can impute OM&A labor expenses by multiplying net OM&A expenses by the available data on the share of labor in *gross* OM&A expenses. The resultant share of labor in total cost is 27.02%. Table 2 combines these weights with recent Conference Board inflation forecasts. We forecast the inflation measure to average 2.01% annual growth during the four indexing years.

Table 3 shows how a C factor consistent with this more appropriate inflation measure might be calculated for Hydro Ottawa. It is constructed with updated revenue requirement data that the Company provided for the Custom IR term on page 25 of Exhibit 1/Tab 8/Schedule 1. We assume a 0.40% G factor and the 0.30% stretch factor that is indicated by the benchmarking work of Clearspring and PEG. We consider formulas with and without S factors.

In the absence of any S factor, Table 3 shows that the C factor for Hydro Ottawa varies considerably over the indexing years. For example, it is much higher in 2022 than in 2025 in order to fund the 2022 surge in the Company's capital cost. The C factor averages about 2.39% over the four-year 2022-25 period. That is, the C factor would accelerate allowed revenue growth by an average of about 2.39% annually.

Table 1

Inflation Factor Weights for a Comprehensive CPEF

	2016	2017	2018	2019	2020	Averages
OM&A Revenue Requirement [A]	83,106	84,693	86,311	87,648	89,007	
Base Revenue Requirement [B]	163,573	170,733	179,157	185,264	188,931	
Labour as a Share of Gross OM&A Expenses [C]	56.77%	55.69%	55.88%	55.22%	54.32%	**55.54%**
OM&A Labor Cost in Total Cost (estimated) [D=A*C]	47,179	47,166	48,231	48,399	48,349	
Share of OM&A Labor in Total Cost (estimated) E=D/B]	28.84%	27.63%	26.92%	26.12%	25.59%	**27.02%**
Share of Other Costs in Total Cost (estimated) [1-E]						**72.98%**

Sources:

Revenue Requirement data: Exhibit 6, Tab 1, Schedule 1, p. 2 filed May 5, 2020
HOL labor share of Gross OM&A: Exhibit 1, Tab 10, Schedule 1, page 14

Table 2

Inflation Factor for a Comprehensive CPEF

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Average
GDP-IPI Final Domestic Demand	1.068	1.083	1.102	1.124	1.138	1.162	1.188	1.210	1.232	1.254	
Growth Rates [A]		1.41%	1.72%	1.98%	1.24%	2.07%	2.20%	1.83%	1.80%	1.80%	**1.78%**
Ontario Average Weekly Earnings	$923.40	$931.05	$963.33	$1,003.45	$1,052.99	$1,066.12	$1,089.38	$1,115.11	$1,141.35	$1,168.21	
Growth Rates [B]		0.83%	3.41%	4.08%	4.82%	1.24%	2.16%	2.33%	2.33%	2.33%	**2.61%**
OM&A Labor Cost Share [C]											**27.02%**
Non-Labor Cost Share [D]											**72.98%**
Inflation Forecast (CPEF-style) [A*D+B*C]											**2.01%**

Source for Inflation forecasts: Conference Board of Canada data as presented in PEG's working papers

Table 3

C Factor Computations for Hydro Ottawa

Variables		2021	2022	2023	2024	2025	Totals	AAGRs
Return on Rate Base		68,158	74,253	78,242	80,677	85,470		5.66%
Amortization		52,333	56,699	59,015	60,585	63,900		4.99%
Payments in Lieu of Taxes		2,224	3,881	8,604	11,533	7,590		
Total Capital Cost (CK)	[S]	122,715	134,833	145,861	152,795	156,960	713,164	6.15%
CK Growth Rate			9.87%	8.18%	4.75%	2.73%		6.38%
Base Revenue Requirement (TC)		205,624	220,142	232,891	241,817	248,217		4.71%
								Averages
$C_n = (CK_t - CK_{t-1})/TC_{t-1}$	[A]		0.0589	0.0501	0.0298	0.0172		3.90%
I	[B]		0.0201	0.0201	0.0201	0.0201		2.01%
X	[C]		0.0030	0.0030	0.0030	0.0030		0.30%
S	[D]		0.0018	0.0018	0.0018	0.0018		0.18%
G	[E]		0.0040	0.0040	0.0040	0.0040		0.40%
S_{CAP}	[F]		0.6125	0.6263	0.6319	0.6323		62.6%
(I+G) x S_{CAP}	[G = (B+E)xF]		0.0148	0.0151	0.0152	0.0152		0.0151
(I+G+S) x S_{CAP}	[H = (B+D+E)xF]		0.0159	0.0162	0.0164	0.0164		0.0162
C factor	[I=A-G]		0.0442	0.0350	0.0145	0.0020		2.39%
C factor with S	[J=A-H]		0.0431	0.0339	0.0134	0.0008		2.28%
CPEF	[K=B-C+E+I]		0.0653	0.0561	0.0356	0.0231		4.5%
CPEF with S	[L=B-C+E+J]		0.0642	0.0550	0.0345	0.0219		4.4%
Total Revenue	[M]	205,624	219,045	231,334	239,580	245,111		
Total Revenue with S	[N]	205,624	218,817	230,843	238,807	244,045		
Capital Revenue (RK)	[O]	122,715	134,465	145,059	151,520	155,196		5.87%
Capital Revenue w/S (RK*)	[P]	122,715	134,242	144,575	150,751	154,134		5.70%
CK Markdown	[Q=S-O]	-	368	802	1,275	1,764	4,209	
CK Markdown w/S	[R=S-P]	-	591	1,286	2,044	2,826	6,747	
CK % Markdown	[T=(Q/S)]		0.27%	0.55%	0.83%	1.12%	0.59%	
CK % Markdown w/S	[T=(R/S)]		0.44%	0.88%	1.34%	1.80%	0.95%	

ACM Materiality Threshold

The ACM is a provision of the OEB's Price Cap incentive rate setting ("IR") system which can furnish supplemental capital revenue. Extra revenue is available only for gross plant additions ("GPAs") in the years when rates are escalated by the price cap index. In these years, only those GPAs that

exceed a materiality threshold are eligible for extra revenue. This threshold has a dead band, so there is a markdown on eligible GPAs.[1] In this section we first consider the rationale for the materiality threshold and then estimate the markdown that might result were Hydro Ottawa to operate under Price Cap IR.

Materiality Threshold Rationale

When a utility is operating under Price Cap IR, the revenue for costs addressed by the price cap index in the first indexing year (R_1) is determined by the following formula:

$$R_1 = ROM_1 + RK_1 = R_0 \cdot (1 + I - X) \cdot (1 + g) + RK_1^+. \quad [10]$$

It can be seen that revenue in year 1 depends on the growth rate of billing determinants ("g") and of the approved price cap index, which has an I-X formula. There may also be some supplemental capital revenue ("RK_1^+"). The total capital revenue requirement is the sum of the revenue required for depreciation, the return on rate base, and taxes. However, the rationale for the ACM/ICM materiality threshold is based only on the return on rate base component of capital cost ("*CKR*"), so we consider only this and the corresponding revenue ("*RKR*") in the continuing discussion. To simplify the analysis, we assume that rate base equals net plant value.

Consider now the difference between *CKR* and *RKR* in the first year of a plan. The former is the company's proforma return on net plant value. The latter is the return on net plant value revenue provided by the price cap mechanism and any supplemental capital revenue. The formulas are

$$CKR_1 = r \cdot VK_1^{net} = r \cdot (VK_0^{net} + VKA_1 - CKD_1) \quad [11]$$

and, in the absence of supplemental revenue,

$$RKR_1 = r \cdot VK_0^{net} \cdot (1 + I - X) \cdot (1 + g). \quad [12]$$

[1] In all save the last year of the plan, revenue is boosted in the year of an eligible gross plant addition by the full annual cost of the addition, whereas a half year rule is employed in traditional cost accounting. However, plant additions in the first year of an IR plan are ineligible for extra revenue even if they cause a sizable second-year cost bump that will be underfunded.

Here $VK_1^{net} = VK_0^{net} + VKA_1 - CKD_0$ because net plant value in year 0 equals the prior year's net plant value plus the value of additions made in the current year minus annual depreciation.

In the absence of RK^+, all VKA_1 above the threshold value would be underfunded and cost would exceed revenue, i.e.,

$$CKR_1 > RKR_1. \quad [13]$$

Substituting [11] and [12] into [13] yields the following relation:

$$r \cdot (VK_0^{net} + VKA_1 - CKD_1) > r \cdot \left(VK_0^{net} \cdot (1 + I - X) \cdot (1 + g)\right). \quad [14]$$

Rearranging, distributing, and collecting terms then gives

$$VKA_1 > CKD_1 + VK_0^{net} \cdot \left(g + (I - X)\right) \cdot (1 + g). \quad [15]$$

Inspecting the results, it can be seen that part of the funding for plant additions comes from the depreciation of older plant.

The "Threshold Value" formula in the ACM/ICM materiality threshold for the first indexing year is obtained by dividing both sides of [15] by depreciation and appending a "markdown factor", $M > 0$, to the right-hand-side.

Threshold Value Formula

$$\frac{VKA_1}{CKD_0} > 1 + \frac{VK_0^{net}}{CKD_0} \cdot \{[g + (I - X)] \cdot (1 + g)\} + M \quad [16]$$

This formula was adopted by the OEB in EB-2014-0219. Note that depreciation is in the base year (CKD_0) in the OEB's approved formula. The markdown factor allows the OEB to set the minimum amount by which GPAs must exceed the funded amount before any additions become eligible for extra capital revenue. The OEB initially set *M* at 20% and later lowered it to 10%. Using a CPEF like that proposed by Hydro Ottawa, the analogous threshold value formula would be formula would be

$$\frac{VKA_1}{CKD_0} > 1 + \frac{VK_0^{net}}{CKD_0} \cdot (\mathrm{I} - \mathrm{X} + \mathrm{G}) + M \quad [17]$$

The value of additions that are ineligible for supplemental revenue are then given by the following formula.

$$VKA_1^{ineligible} = CKD_0 + VK_0^{net} \cdot (I - X + G) + M \cdot CKD_0 \,. \quad [18]$$

Since $VKA = VKA^{eligible} + VKA^{ineligible}$, it follows that

$$VKA^{eligible} = VKA - VKA^{ineligible} \,. \quad [19]$$

Plugging [18] into [19], the portion of gross plant additions eligible for supplemental capital revenue is then

$$\begin{aligned} VKA_1^{eligible} &= VKA_1 - [CKD_0 + VK_0^{net} \cdot (I - X + G) + CKD_0 \cdot \mathrm{M}] \\ &= VKA_1 - [(1 + M) \cdot CKD_0 + VK_0^{net} \cdot (I - X + G)]. \end{aligned} \quad [20]$$

Note here that the markdown factor *M* only applies to base year depreciation and not to the other source of funding as a result of the OEB's chosen Threshold Value formula. *M* could reasonably be applied to the second source of funding as well. If it were, markdowns on eligible capex would be larger.

The full funding for gross plant additions in indexing year *1* is then the sum of gross plant additions provided by the price cap and those eligible for supplemental revenue.

$$VKA_1^{funded} = CKD_0 + VK_0^{net} \cdot [(1 + I - X) - 1] + VKA_1^{eligible} \,. \quad [21]$$

By substituting from [20] into [21] and carrying out simple algebra, it can be shown that

$$VKA_1^{funded} = VKA_1 - M \cdot CKD_0. \quad [22]$$

The share of VKA_1 that is *not* funded under Price Cap IR in the first year after rebasing is then

$$\begin{aligned} \frac{VKA_1 - VKA_1^{funded}}{VKA_1} &= \frac{VKA_1 - (VKA_1 - \mathrm{M} \cdot \mathrm{CKD}_0)}{VKA_1} \\ &= \frac{M \cdot CKD_0}{VKA_1}. \end{aligned} \quad [23]$$

As can be seen from [23], the percentage of GPAs that would not be funded in the first year of an ACM is the ratio of *M* times base year depreciation to GPAs in year 1. The percentage markdown will be less to the extent that *VKA* exceeds the materiality threshold. It can be shown with more algebra that the markdown formula in any indexing year t is the same as for the first year but with VKA_t instead of VKA_1.

Estimating the Markdown for Hydro Ottawa

We estimate in Table 4 the markdown that would occur were Hydro Ottawa's projected/proposed gross plant additions addressed by an ACM rather than the Custom IR plan that the Company proposed. We estimate that the average share of GPAs in the four indexing years that would be marked down is **5.35%.**

The value of this hypothetical markdown is estimated in Table 5. We assume that the share of the *revenue requirement* for new capex that would be marked down is equal to the share of eligible *GPAs* that would be marked down. Hydro Ottawa provided us with an estimate of the revenue requirement for its proposed GPAs from 2021 to 2025 in its response to interrogatory OEB-32 (a). It can be seen that, even though GPAs are highest in 2021, the revenue requirement in that year is quite small due to tax offsets. The cost bump produced by the 2021 GPAs occurs chiefly in 2022. This pattern most likely repeats itself with the other years of additions.

The concept of an ACM-equivalent S factor is open to interpretation. One interpretation is the S factor that would produce a markdown on the capital revenue requirement for the GPAs in the four indexing years (2022-2025) of Hydro Ottawa's proposed plan. This component of the revenue requirement is reasonably approximated by the total revenue requirement reported by Hydro Ottawa for these years less four times the revenue requirement reported in 2022. This amounts to $67,647,857. 5.35% of this would be a markdown of $3,619,160.

Table 4

Hydro Ottawa Gross Plant Additions 2016-2025

Year	Gross Plant Additions	Amortization Expenses	ACM Markdown Share
2016	81,598,034		
2017	97,685,684		
2018	101,250,833		
2019	215,015,699		
2020	84,600,540		
2021	146,378,560	$ 52,333,000	
2022	124,685,374		4.20%
2023	78,653,701		6.65%
2024	83,348,385		6.28%
2025	122,558,762		4.27%
Averages			
2022-2025	102,311,556		**5.35%**

Sources:
Total Plant Additions as Reported in Exhibit 2-2-1 on May 5, 2020
Amortization Expenses: Exhibit 1-1-8, p. 25 updated May 5, 2020

Table 5

Capital-Related Revenue Requirement of Hydro Ottawa's Proposed Plant Additions

		Test Year	CPEF Adjustment Year				Totals (2022-25)	Imputed Revenue Requirement for 2022-25 Capex	ACM Markdown Share	ACM-Equivalent Markdown	
		2021	2022	2023	2024	2025				2022-25 GPAs	2021-25 GPAs
			$								
			[A]				[B]	[C=B-4*A]	[D]	[E=C*D]	[F=BxD]
Rate Base											
VKA	Gross Plant Additions (Annual)	146,378,560	124,685,374	78,653,701	83,348,385	122,558,762					
	Gross Plant Additions (Cumulative)	146,378,560	271,063,934	349,717,635	433,066,020	555,624,782					
	Accumulated Depreciation	2,503,237	11,554,553	25,069,228	41,933,312	63,858,681					
	New Additions Rate Base	71,937,662	201,692,352	292,078,894	357,890,558	441,449,405					
	Change in New Rate Base		129,754,691	90,386,542	65,811,664	83,558,847					
Capital-Related Annual Revenue Requirement (New)											
	Interest Expense [G]	1,428,682	4,016,905	5,882,469	7,288,083	9,607,705					
	Return on Equity [H]	2,555,226	7,365,805	10,877,018	13,471,001	16,704,445					
	Depreciation Expense [I]	2,503,237	9,051,316	13,514,675	16,864,084	21,925,369					
	PILs/Taxes [K]	-6,382,958	-5,817,503	-2,032,732	746,502	-3,351,193					
CK	Total [L = G + H + I + K]	**104,187**	**14,616,523**	**28,241,430**	**38,369,670**	**44,886,326**	**126,113,949**	**67,647,857**	**0.0535**	**3,619,160**	**6,747,096**
Capital-Related Annual Revenue Requirement (Total Proposed) [M]		125,847,062	138,043,112	149,152,864	156,168,702	160,419,141	**603,783,819**				
	Share of Capital-Related Revenue Requirement (New) in Total [L/M]	0.08%	10.59%	18.93%	24.57%	27.98%	20.89%				

Comments

Black font indicates numbers provided by Hydro Ottawa. Purple font indicates PEG calculations.

An alternative approach is encouraged by the fact that the S factor adjusts the eligible growth in capital revenue in all four index years. The growth of capital cost in 2022 is strongly influenced by the GPAs in 2021. Were Hydro Ottawa not subject to Custom IR, it would likely have postponed its biggest plant additions to one of the middle years of the plan. The total 2022-25 revenue requirement for GPAs is roughly $126 million. 5.35% of this is about $6.75 million.

ACM-Equivalent S Factor

Since the S factor(s) would apply over a four year period, PEG has elected in this proceeding to eschew the *analytical* approach to determining ACM-equivalent X factors that it used in other recent IR proceedings because the formula becomes quite complicated as years are added. PEG instead has used a *numerical* approach to the S factor calculations. These calculations are provided in Table 5. It can be seen that the S factor that marks down revenue by about $6.75 million has a value of about **0.18%.**

Higher S Factors

Higher S factors may reasonably be contemplated, for several reasons. One is that materiality thresholds are chiefly rationalized on the grounds of reducing regulatory cost by discouraging applications that involve immaterial extra funding. PEG shows in Section 6.1 of their testimony that dead bands can also address two other problems with Custom IR: overcompensation and weak capex containment incentives.

Another concern arises from the fact that the M factor in the Threshold Value formula only applies to one of the two sources of GPA funding. It can reasonable be applied to both sources, and this would markedly increase the markdown.

Still another concern arises from the fact that the S factors that PEG has calculated to date are sensitive to the stretch factors. If the stretch factor is unusually high due to a bad cost benchmarking score, the S factor is lower. This weakens the incentive impact of the stretch factor. It can be argued that an ACM-equivalent S factor should focus on discouraging immaterial funding requests and be calculated separately from the stretch factor.