ONTARIO ENERGY BOARD

EB-2012-0451
EB-2012-0433
EB-2013-0074

IN THE MATTER OF an application by Enbridge Gas Distribution Inc. for: an order or orders granting leave to construct a natural gas pipeline and ancillary facilities in the Town of Milton, City of Markham, Town of Richmond Hill, City of Brampton, City of Toronto, City of Vaughan and the Region of Halton, the Region of Peel and the Region of York; and an order or orders approving the methodology to establish a rate for transportation services for TransCanada Pipelines Limited;

AND IN THE MATTER OF an application by Union Gas Limited for: an Order or Orders for pre-approval of recovery of the cost consequences of all facilities associated with the development of the proposed Parkway West site; an Order or Orders granting leave to construct natural gas pipelines and ancillary facilities in the Town of Milton; an Order or Orders for pre-approval of recovery of the cost consequences of all facilities associated with the development of the proposed Brantford-Kirkwall/Parkway D Compressor Station project; an Order or Orders for pre-approval of the cost consequences of two long term short haul transportation contracts; and an Order or Orders granting leave to construct natural gas pipelines and ancillary facilities in the City of Cambridge and City of Hamilton.

ENVIRONMENTAL DEFENCE'S CROSS-EXAMINATION DOCUMENT BOOK

Filed September 16, 2013

KLIPPENSTEINS
Barristers and Solicitors
160 John Street, Suite 300
Toronto, Ontario M5V 2E5

Murray Klippenstein, LSUC No. 26950G
Kent Elson, LSUC No. 57091I
Tel.: (416) 598-0288
Fax: (416) 598-9520

Lawyers for Environmental Defence

Index

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[1] http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/std01_079169.pdf

[2] Main report: http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/stdprod_101103.pdf; Technical appendix: http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/stdprod_100824.pdf

19. Interrogatory Response I.A4.EGD.ED.34 (Re: System Standards) [59-60]

20. Marbek Consultants, *Natural Gas Energy Efficiency Potential: Update 2008: Residential, Commercial and Industrial Sectors, Synthesis Report* (I.A4.EGD.ED.14, attachment 1) [61-74]

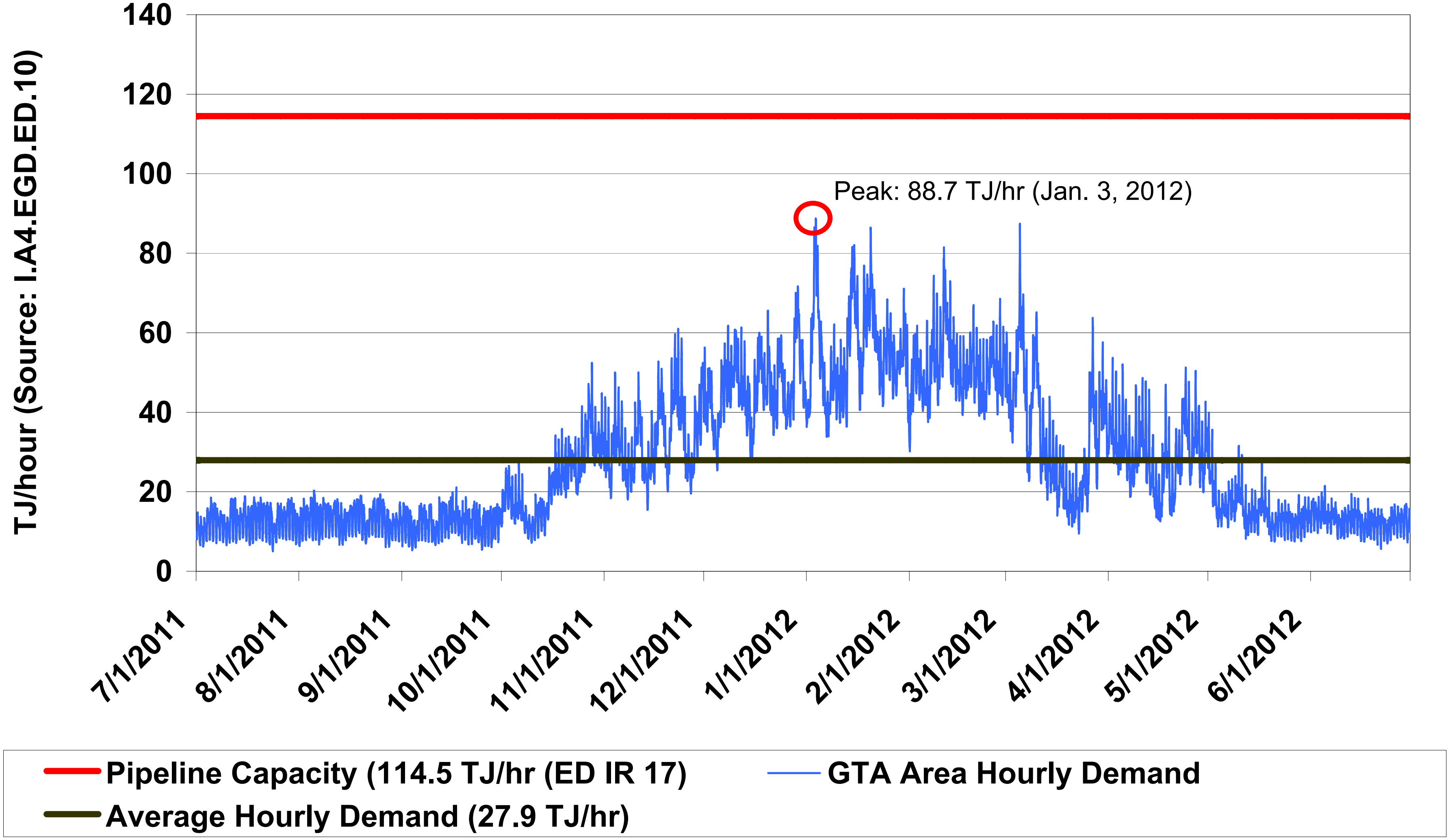
21. Enbridge Response to Environmental Defence Interrogatory No. 6 in EB-2012-0394 (Re: DSM Benefits) [75-81]

22. Enbridge Response to Environmental Defence Interrogatory No. 7 in EB-2012-0394 (Re: DSM Benefits) [82-109]

Note: The above documents have been marked-up by counsel.

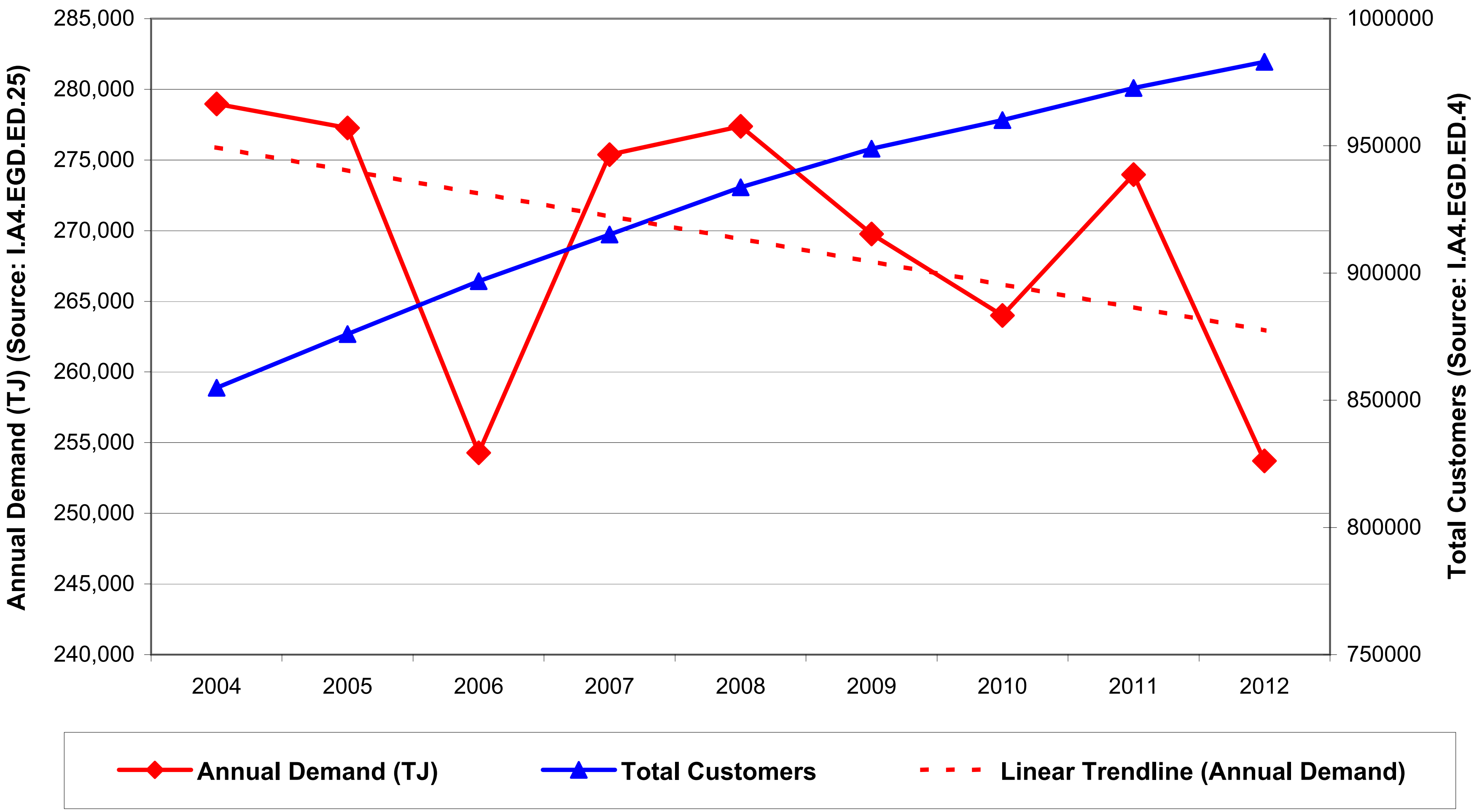
EB-2012-0451, EB-2012-0433, EB-2013-0074
Filed by Environmental Defence on: 2013-09-16
Cross-Examination Document Book

Hourly Gas Demand in the GTA Area
(July 1, 2011 - June 30, 2012)



EB-2012-0451, EB-2012-0433, EB-2013-0074
Filed by Environmental Defence on: 2013-09-16
Cross-Examination Document Book

Enbridge's Annual Demand and Total Customers in the GTA Area 2004 to 2012



EB-2012-0451, EB-2012-0433, EB-2013-0074
Filed by Environmental Defence on: 2013-09-16
Cross-Examination Document Book

Table 1: Summary of Enbridge's Peak Load Forecast Calculations

		Demand from New Customers (Before Reduction Factor)[1]	35% Reduction Factor Amount[2]	Demand from New Customers (After Reduction Factor)[3]	Base (i.e. Demand from Existing Customers)[4]	Forecast Peak Demand[5]
	Year	m³/hr				
Baseline	2011-2012			46,793		2,889,984
Forecast	2012-2013	33,691	11,792	21,899	2,889,984	2,911,883
	2013-2014	32,908	11,518	21,390	2,911,883	2,933,273
	2014-2015	33,565	11,748	21,817	2,933,273	2,955,090
	2015-2016	35,282	12,349	22,933	2,955,090	2,978,023
	2016-2017	35,812	12,534	23,278	2,978,024	3,001,302
	2017-2018	35,223	12,328	22,895	3,001,302	3,024,197
	2018-2019	35,238	12,333	22,905	3,024,197	3,047,102
	2019-2020	35,351	12,373	22,978	3,047,102	3,070,080
	2020-2021	35,594	12,458	23,136	3,070,080	3,093,216
	2021-2022	35,842	12,545	23,297	3,093,216	3,116,513
	2022-2023	35,842	12,545	23,297	3,116,513	3,139,810
	2023-2024	35,842	12,545	23,297	3,139,810	3,163,107
	2024-2025	35,842	12,545	23,297	3,163,106	3,186,403
	Total	456,029		296,419		

Sources and caluclations:

[1] Calculation: Demand from New Customers (After Reduction Factor) divided by 0.65

[2] Calculation: Demand from New Customers (After Reduction Factor) minus Demand from New Customers (Before Reduction Factor)

[3] Source: I.A4.EGD.ED.3 (TOTAL ADD).

[4] Calculation: Forecast Peak Demand minus Demand from New Customers (After Reduction Factor).

[5] Source: I.A4.EGD.ED.3 (TOTAL LOAD).

Table 2: Summary of Enbridge's DSM Evidence

DSM Required to Offset Growth in the GTA Area

	Peak Demand Reduction from Forecast DSM (m^3/hr)[1]	Incremental Peak Demand Reduction needed to Offset Growth (m^3/hr)[2]	Total Peak Demand Reduction needed to Offset Growth (m^3/hr)[3]
2014	12,000	25,000	37,000
2015	12,000	25,000	37,000
2016	12,000	25,000	37,000
2017	12,000	25,000	37,000
2018	12,000	25,000	37,000
2019	12,000	25,000	37,000
2020	12,000	25,000	37,000
2021	12,000	25,000	37,000
2022	12,000	25,000	37,000
2023	12,000	25,000	37,000
2024	12,000	25,000	37,000
2025	12,000	25,000	37,000

Incremental DSM Budget and TRC Benefits From Incremental DSM Needed to Offset Growth

	Forecast DSM Budget for the GTA Area[4]	Incremental DSM Budget Needed to Offset Growth (Yearly)[5]	Incremental net TRC Benefits (Yearly)[6]	Incremental net TRC Benefits (Cumulative)[7]
2014	$ 15,824,016	$ 33,730,415	$ 140,654,152	$ 140,654,152
2015	$ 16,140,496	$ 34,405,024	$ 140,654,152	$ 281,308,304
2016	$ 16,463,306	$ 35,093,124	$ 140,654,152	$ 421,962,456
2017	$ 16,792,572	$ 35,794,987	$ 140,654,152	$ 562,616,608
2018	$ 17,128,424	$ 36,510,886	$ 140,654,152	$ 703,270,760
2019	$ 17,470,992	$ 37,241,104	$ 140,654,152	$ 843,924,912
2020	$ 17,820,412	$ 37,985,926	$ 140,654,152	$ 984,579,064
2021	$ 18,176,820	$ 38,745,645	$ 140,654,152	$ 1,125,233,216
2022	$ 18,540,357	$ 39,520,557	$ 140,654,152	$ 1,265,887,368
2023	$ 18,911,164	$ 40,310,968	$ 140,654,152	$ 1,406,541,520
2024	$ 19,289,387	$ 41,117,188	$ 140,654,152	$ 1,547,195,672
2025	$ 19,675,175	$ 41,939,532	$ 140,654,152	$ 1,687,849,824

Sources and calculations:

1 Source: I.A4.EGD.ED.14 (Note the assumptions and data caveats listed on pg. 2)

2 Source: JT2.36, p. 8

3 Calculation: "Peak Demand Reduction from Forecast DSM" plus "Incremental Peak Demand Reduction needed to Offset Growth"

4 Source: I.A4.EGD.ED.14 (Note the assumptions and data caveats listed on pg. 2)

5 Calculation: "Total GTA Area DSM Budget Needed to Offset Growth (from JT2.20)" minus "Forecast GTA Area DSM Budget (from I.A4.EGD.ED.14)"

6 Source: JT2.20

7 Calculation: Cumulative tally of the yearly totals

ENBRIDGE GAS DISTRIBUTION INC. RESPONSE TO
ENVIRONMENTAL DEFENCE INTERROGATORY #25

INTERROGATORY

Issue A4: "What are the alternatives to the proposed facilities? Are any alternatives to the proposed facilities preferable to the proposed facilities?"

Reference: Ex A, Tab 3, Schedule 4 and 7

Please fill in Tables 1 to 5 appearing below. Please use the same figures as were used to create Enbridge's forecast appearing at Exhibit A, Tab 3, Schedule 4 (e.g. re forecast DSM impacts). For tables 1 to 3, please base the demand/supply balance on the forecast of actual demand, net of the forecast DSM. The tables are entitled as follows:

a) Table 1: GTA Project Influence Area Peak Hour Demand/Supply Balance: 2000 to 2025

b) Table 2: GTA Project Influence Area Peak Day Demand/Supply Balance: 2000 to 2025

c) Table 3: GTA Project Influence Area Annual Demand/Supply Balance: 2000 to 2025

d) Table 4: Impact of Enbridge's Year 2000 to Year 2025 DSM Programs on Demand for Natural Gas in GTA Influence Project Area

e) Table 5: Impact of Enbridge's Year 2000 to Year 2025 DSM Programs on Demand for Natural Gas in Ontario

Witnesses: J. Denomy
F. Oliver-Glasford
T. MacLean
E. Naczynski
J. Ramsay

<u>RESPONSE</u>

a) The response to a) b) and c) will be answered in aggregate.

Table 1 provides actual peak hour, peak day and annual demands for the GTA Project Influence Area. Actual peak hour data are measured at the gate station and are available back to 2008, whereas peak day demand and annual demands are available back to 2000. Since 2013 is not yet complete annual demand is provided to 2012. Peak hour and peak day data for 2013 assume that peak hour or peak day have already occurred. The data presented in Table 1 are not normalized for design conditions.

<u>Table 1</u>

GTA Project Influence Area	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Peak Hour Demand (TJ)									95.7	96.9	93.0	100.5	88.7	102.6
Peak Day Demand (TJ)	1,949.9	1,625.5	1,721.1	2,033.0	2,128.8	2,099.1	1,664.0	2,035.9	1,849.1	1,925.9	1,895.3	1,995.8	1,883.3	2,065.7
Annual Demand (TJ)	270,442.3	252,939.9	269,011.2	273,582.6	278,974.8	277,267.3	254,287.5	275,386.8	277,375.8	269,756.5	264,007.1	273,960.7	253,704.6	

Total system demands for base loads and incremental load growth have been provided in the response to Environmental Defence Interrogatory #3 found at Exhibit I.A4.EGD.ED.3. In effort to assist with the understanding of available system capacity Table 2 provides an analysis that has been completed at Station B, the location that will experience the lowest pressures on the XHP grid.

<u>Table 2</u>

	<u>Capacity Surplus / (Deficit)</u>	<u>Capacity Surplus / (Deficit)</u>
2015 / 2016 Winter Existing System	(15 $10^3 m^3$/hr)	(10 TJ/day)
2015 / 2016 Winter with Proposed Facilities	210 $10^3 m^3$/hr	160 TJ/day
2024 / 2025 Winter with Proposed Facilities	170 $10^3 m^3$/hr	130 TJ/day

Witnesses: J. Denomy
F. Oliver-Glasford
T. MacLean
E. Naczynski
J. Ramsay

b) See the response to a) above.

c) See the response to b) above.

d) Table 4: Impact of Enbridge's Year 2000 to Year 2025 DSM Programs on Annual Demand for Natural Gas in GTA Project Influence Area. Please note that 2013 to 2025 figures are forecasts only.

Please see response to Environmental Defence Interrogatory# 14 found at Exhibit I.A4.ED.14 for peak day and peak hour DSM impacts on natural gas consumption in the GTA Project Influence Area.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Annual Demand (10^3m^3)	34,138	46,167	45,682	45,251	41,128	53,022	51,922	53,314	46,565	40,517	38,063	44,806	35,831	38,856	44,109	44,109	44,109	44,109	44,109	44,109	44,109	44,991	45,891	46,808	47,745	48,699

*2005 Program year includes three month stub period

e) Table 5: Impact of Enbridge's Year 2000 to Year 2025 DSM Programs on Annual Demand for Natural Gas in Ontario. Please note that 2013 to 2025 figures are forecasts only.

Please see response to Environmental Defence Interrogatory #14 found at Exhibit I.A4.EGD.ED.14 for peak day and peak hour DSM impacts on natural gas consumption in the Enbridge's total franchise area.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Annual Demand (10^3m^3)	58,859	79,599	78,761	78,020	70,910	91,418	89,520	91,921	80,285	69,857	65,625	77,252	61,778	66,993	76,049	76,049	76,049	76,049	76,049	76,049	76,049	77,570	79,122	80,704	82,318	83,964

*2005 Program year includes three month stub period

Witnesses: J. Denomy
F. Oliver-Glasford
T. MacLean
E. Naczynski
J. Ramsay

ENBRIDGE GAS DISTRIBUTION INC. RESPONSE TO
ENVIRONMENTAL DEFENCE INTERROGATORY #4

INTERROGATORY

Issue A4: "What are the alternatives to the proposed facilities? Are any alternatives to the proposed facilities preferable to the proposed facilities?"

Reference: Ex. A, Tab 3, Schedule 4, page 4, Table 1

Please provide for each year from 2000 to 2025 inclusive Enbridge's actual/forecast total number of residential, commercial, apartment and industrial customers in the GTA Project Influence Area.

RESPONSE

Total Customers by Sector

	Apartment	Commercial	Industrial	Residential
2004	4,424	68,606	4,773	777,117
2005	4,471	69,885	4,792	796,860
2006	4,497	71,388	4,798	816,062
2007	4,540	73,351	4,805	832,492
2008	4,543	74,848	4,807	849,520
2009	4,564	76,250	4,807	863,284
2010	4,600	77,449	4,812	873,205
2011	4,675	78,626	4,812	884,673
2012	4,701	79,543	4,816	893,936
2013	4,729	80,563	4,823	904,728
2014	4,803	81,718	4,824	916,831
2015	4,872	82,918	4,827	928,500
2016	4,943	84,208	4,830	940,776
2017	5,014	85,535	4,833	953,383
2018	5,083	86,785	4,835	966,418
2019	5,152	88,037	4,837	979,565
2020	5,220	89,288	4,839	992,896
2021	5,287	90,549	4,841	1,006,431

The Company uses multiple data management systems for specific purposes. The Company has not historically tracked information for sub-areas such as the GTA Project Influence Area. To present historical information for the GTA Project Influence Area,

Witnesses: F. Ahmad
M. Suarez

customer numbers have been derived based on one or more data systems to determine the proportion of GTA Project Influence Area customers to the total customers within Areas 10, 20, and 30 in the franchise (within which the GTA Influence Area resides). Forecasts of customer growth for the GTA Influence Area are layered on derived historical numbers and are denoted in the shaded areas.

Witnesses: F. Ahmad
M. Suarez

UNDERTAKING JT2.27

UNDERTAKING

TR 2, page 149

To provide declining average use trends per customer and per sector. Include equation used for regression

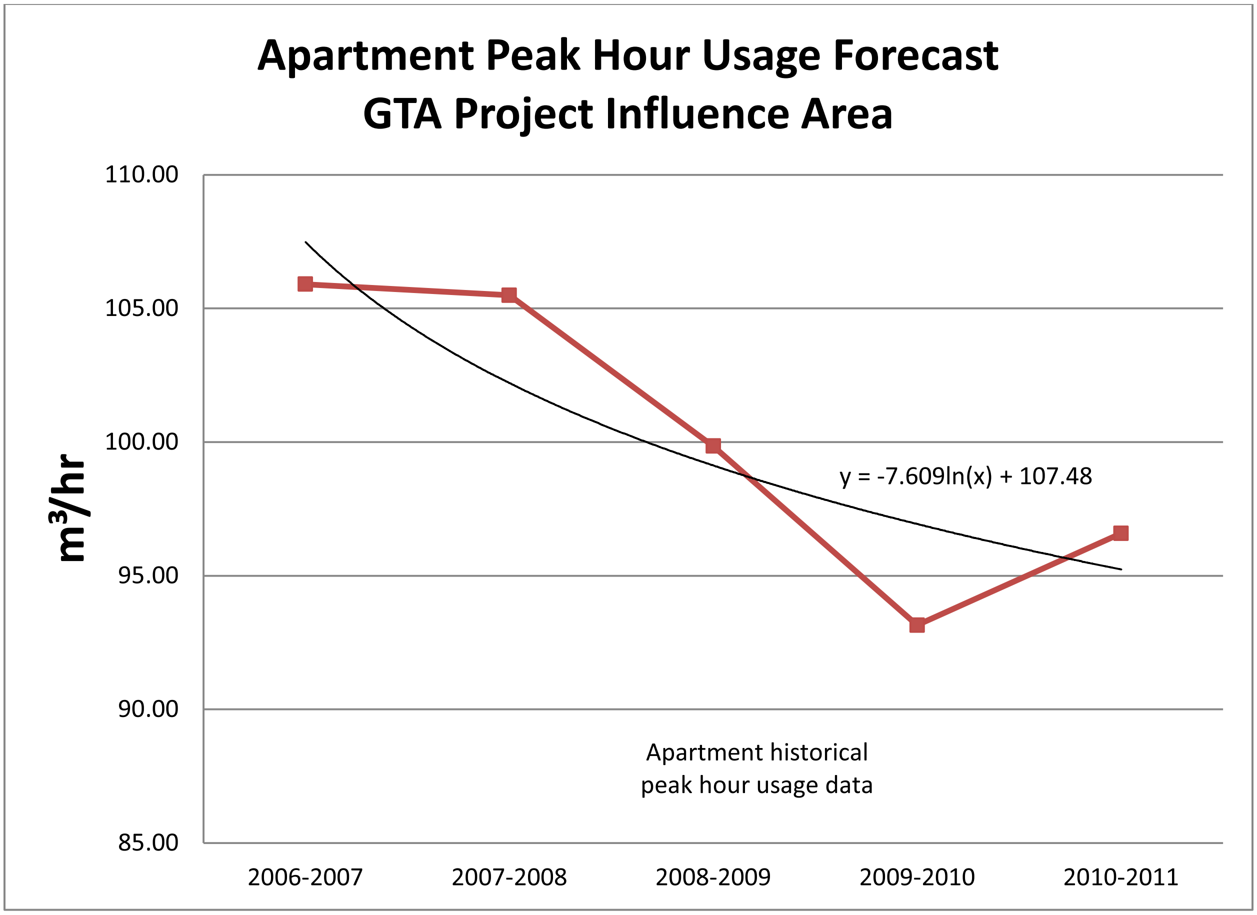
RESPONSE

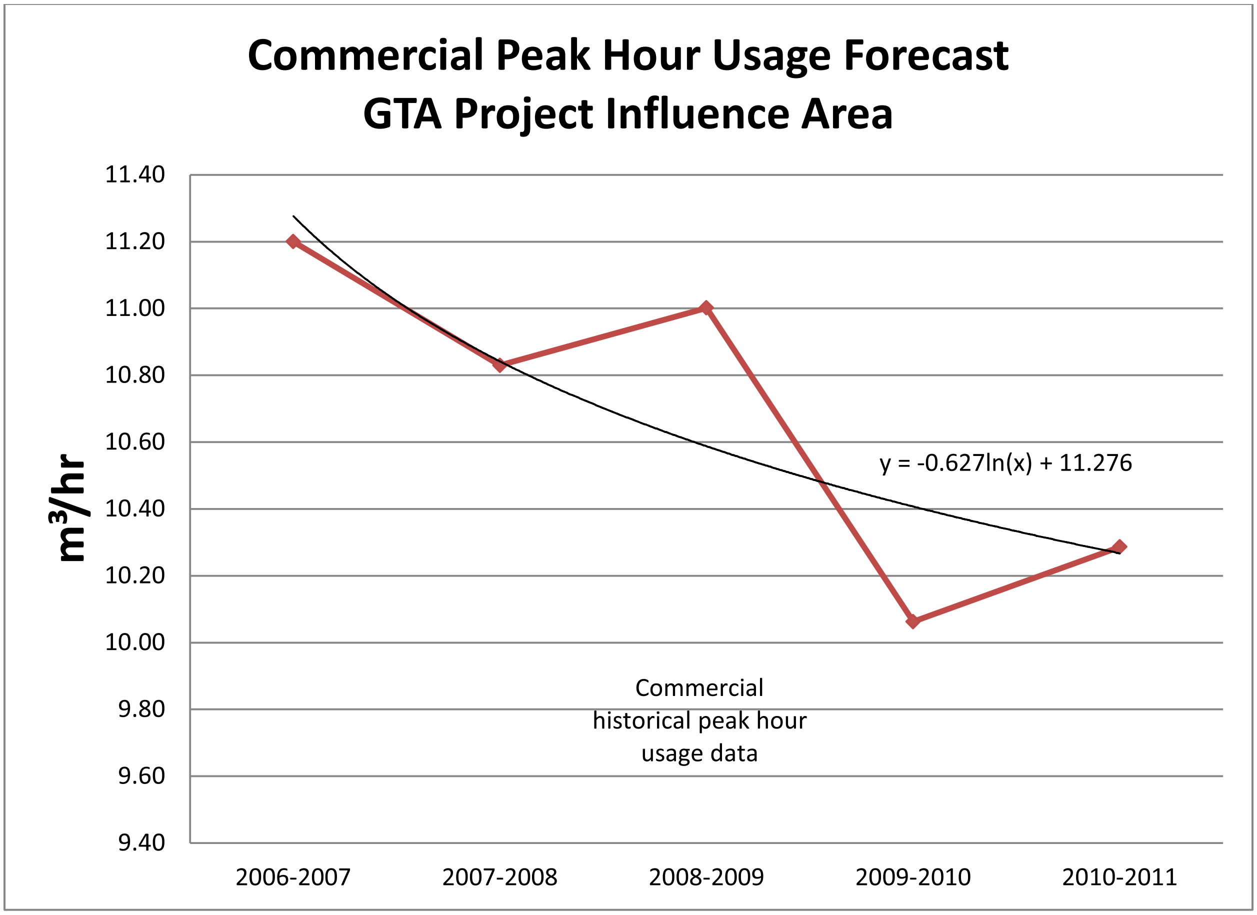
The figures provided on the following pages illustrate the declining peak average usage trends for each sector. The average peak hourly usage forecast was prepared by collecting five years of load gathering data and using lograrithmic trend lines.

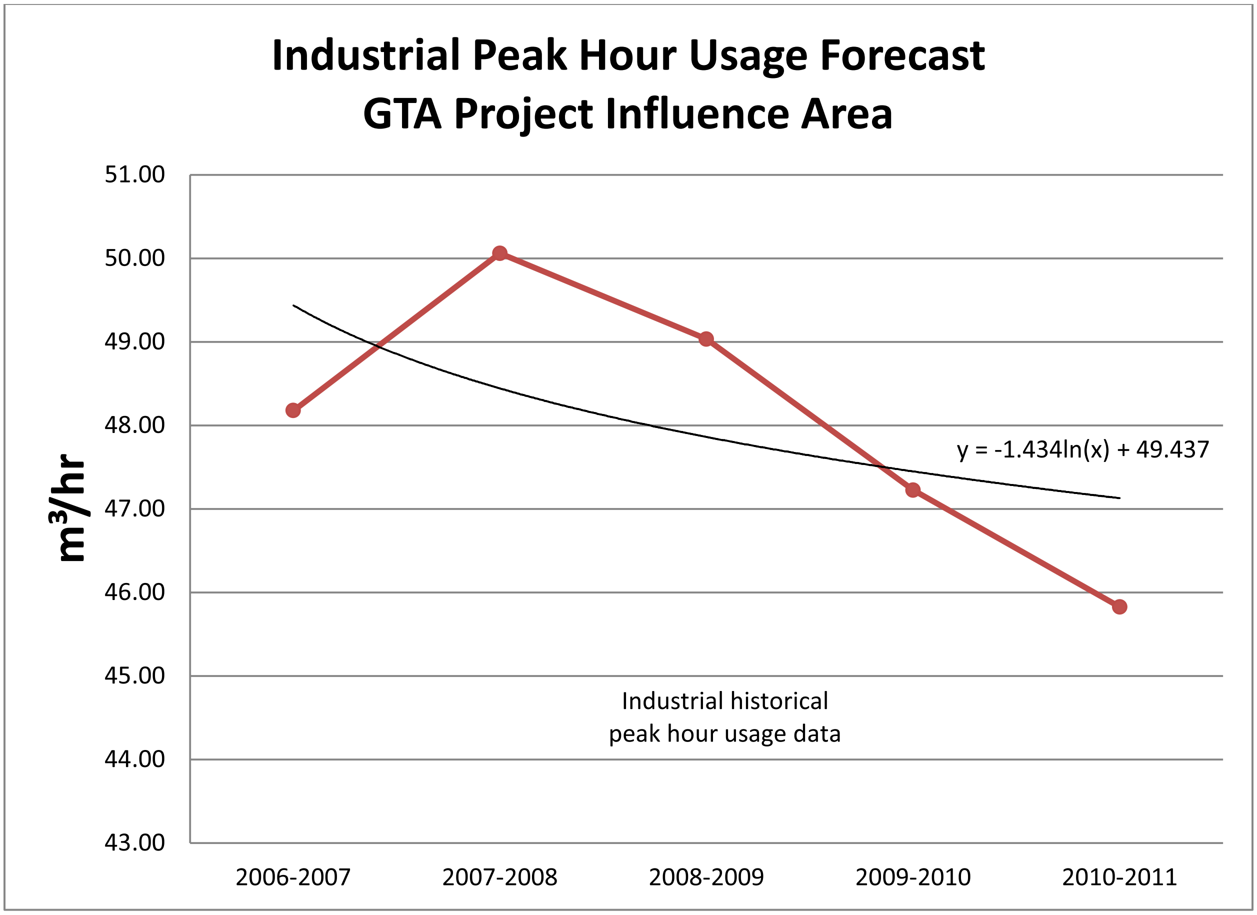
5 years historical data: *2006, 2007, 2008, 2009, 2010*
4 types of customers: *Apartment, Commercial, Industrial, Residential*

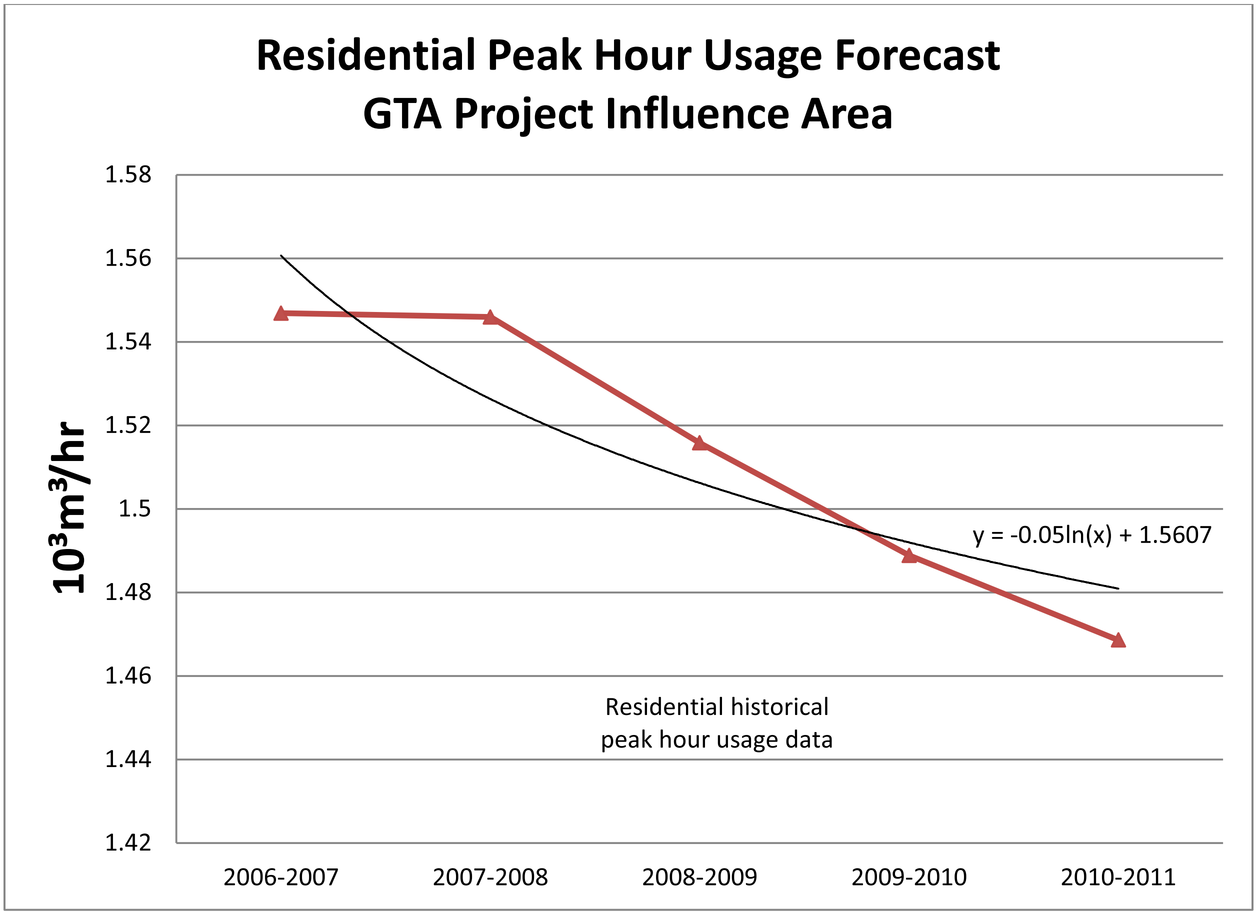
Data has only been provided for 2006 to 2010 as Enbridge implemented a new load gathering system. Prior to 2004, load gathering was completed on a legacy main frame system and the archived data is not readily accessible. From 2004 to 2006 there were numerous changes in customer classifications which make year to year comparisons irrelevant due to changing base data. The load presented excludes unbundled customers. A description of the load gathering process for network planning purposes can be found in the response to Environmental Defence Interrogatory #12 found at Exhibit I.A4.EGD.ED.12.

Witness: E. Naczynski


Apartment Peak Hour Usage Forecast
GTA Project Influence Area
110.00
105.00
100.00
95.00
90.00
85.00
m³/hr
y = -7.609ln(x) + 107.48
Apartment historical
peak hour usage data
2006-2007
2007-2008
2008-2009
2009-2010
2010-2011


Commercial Peak Hour Usage Forecast
GTA Project Influence Area
m³/hr
11.40
11.20
11.00
10.80
10.60
10.40
10.20
10.00
9.80
9.60
9.40
y = -0.627ln(x) + 11.276
Commercial historical peak hour usage data
2006-2007
2007-2008
2008-2009
2009-2010
2010-2011


Industrial Peak Hour Usage Forecast
GTA Project Influence Area
51.00
50.00
49.00
48.00
47.00
46.00
45.00
44.00
43.00
m³/hr
y = -1.434ln(x) + 49.437
Industrial historical
peak hour usage data
2006-2007
2007-2008
2008-2009
2009-2010
2010-2011


Residential Peak Hour Usage Forecast
GTA Project Influence Area
10³m³/hr
1.58
1.56
1.54
1.52
1.5
1.48
1.46
1.44
1.42
y = -0.05ln(x) + 1.5607
Residential historical
peak hour usage data
2006-2007
2007-2008
2008-2009
2009-2010
2010-2011

SUMMARY OF INPUTS

Incremental Customer Additions

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Residential	12,277	12,607	13,034	13,148	13,331	13,535	13,748	13,748	13,748	13,748
Commercial	1,291	1,327	1,250	1,253	1,250	1,261	1,269	1,269	1,269	1,269
Apartment	71	71	69	69	68	67	67	67	67	67
Industrial	3	3	2	2	2	2	2	2	2	2
Total	**13,642**	**14,008**	**14,355**	**14,472**	**14,651**	**14,865**	**15,086**	**15,086**	**15,086**	**15,086**

Average Annual Volume per Customer

($10^3 m^3$)	
Residential	2.568
Commercial	20.230
Apartment	154.877
Industrial	109.481

Total Cumulative Volumes*

($10^3 m^3$)	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Residential	15,764	47,715	80,638	114,255	148,254	182,750	217,782	253,087	288,392	323,696	341,349
Commercial	13,058	39,540	65,606	90,924	116,242	141,640	167,231	192,903	218,575	244,247	257,083
Apartment	5,498	16,494	27,336	38,022	48,631	59,086	69,462	79,839	90,216	100,593	105,781
Industrial	164	493	766	985	1,204	1,423	1,642	1,861	2,080	2,299	2,409
Total	**34,484**	**104,241**	**174,346**	**244,187**	**314,332**	**384,900**	**456,118**	**527,690**	**599,263**	**670,835**	**706,621**

Note* 50% effectivity considered for the first year of customer additions

Savings on Gas Transportation

($s)	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Total Savings	**24,283,396**	**148,930,993**	**154,482,286**	**192,335,965**	**161,419,071**	**156,859,561**	**156,743,050**	**157,109,580**	**157,360,615**	**161,395,219**	**161,094,879**

ENBRIDGE GAS DISTRIBUTION INC. RESPONSE TO
ENVIRONMENTAL DEFENCE INTERROGATORY #5

INTERROGATORY

Issue A4: "What are the alternatives to the proposed facilities? Are any alternatives to the proposed facilities preferable to the proposed facilities?"

Reference: Ex. A, Tab 3, Schedule 4, page 4, Table 1

Please provide for each year from 2000 to 2025 inclusive the actual/forecast *total peak hour* demands (TJ/hour) and average peak hour demands (GJ/hour) of Enbridge's: a) residential; b) commercial; c) apartment; and d) industrial customers in the GTA Project Influence Area. Please also provide the total peak hour demands for all of these customers for each year from 2000 to 2025 inclusive. Please also provide a further breakdown of the commercial customers by subsets such as offices, retail, hospitals, schools, etc.

RESPONSE

Peak load by sector is not measured on an hourly or daily basis. The Company does derive some of this data for network planning purposes as per the response to Environmental Defence Interrogatory #12 found at Exhibit I.A4.EGD.ED.12.
The information provided below is the historical data as used for network planning.

Table 1 (please see attachment) provides a summary of the historical and forecast derived peak load in m^3/hr from 2006 to 2025. This table shows peak load by customer type for all customers in the GTA Project Influence Area.

The Company does not have further breakdowns of the commercial sector for peak demand.

Data has only been provided for 2006 onward as EGD implemented a new load gathering system. Prior to 2004, load gathering was completed on a legacy main frame system and the archived data is not readily accessible. From 2004 to 2006 there were numerous changes in customer classifications which make year to year comparisons irrelevant due to changing base data. The load presented excludes unbundled customers.

The conversion from m^3 to GJ as found in the EGD rate handbook is 37.69 MJ/m^3

Witness: E. Naczynski

Table 1

PEAK LOAD (m3/hr)	Derived Historic						Forecast												
	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023	2023-2024	2024-2025
Apartment	410758	414932	404701	400992	410716	424455	428717	432326	436452	440674	444881	448893	452855	456806	460711	464600	468490	472380	476270
Commercial	896792	900775	916271	905314	902621	1112231	1119742	1126892	1134299	1142224	1150310	1157861	1165411	1172925	1180485	1188071	1195658	1203244	1210830
Industrial	352178	358798	336968	311336	324351	184774	184791	184807	184906	185008	185052	185094	185135	185175	185229	185282	185335	185388	185442
Residential	1203076	1225376	1230241	1220411	1205503	1168523	1178633	1189248	1199433	1210117	1221059	1232348	1243700	1255174	1266791	1278559	1290326	1302094	1313862
TOTAL LOAD	2862804	2899882	2888182	2838054	2843190	2889984	2911883	2933273	2955090	2978023	3001302	3024197	3047102	3070080	3093216	3116513	3139810	3163107	3186403

Filed: 2013-06-03
EB-2012-0451/EB-2012-0433/EB-2013-0074
Exhibit I.A4.EGD.ED.5
Attachment

ENBRIDGE GAS DISTRIBUTION INC. RESPONSE TO
ENVIRONMENTAL DEFENCE INTERROGATORY #9

INTERROGATORY

Issue A4: “What are the alternatives to the proposed facilities? Are any alternatives to the proposed facilities preferable to the proposed facilities?”

Reference: Ex. A, Tab 3, Schedule 4, pages 8 & 9

Enbridge states that the “total forecast peak day demand, shown in Table 3, is the incremental load growth plus the load required by the existing customer base.”

a) Does Enbridge’s forecast assume that the demand from existing buildings will increase, decrease, or remain constant? Please explain why.

b) For each year from 2014 to 2025, please provide the forecast *total peak hour* demands (TJ/hour) and average peak hour demands (GJ/hour) from: a) the above-described incremental load growth from new customers, and b) Enbridge’s existing customer base in the GTA Project Influence Area. Please also break out your results by residential, commercial, apartment and industrial customers.

c) Please also provide the requested data in a table covering only the period from 2015 to 2025. This will assist in comparing the data with Enbridge’s load forecast at Exhibit A, Tab 3, Schedule 4, which covers only the 2015 to 2025 period.

RESPONSE

a) The Company utilizes peak hour demand rather than annual demand for network planning purposes. Forecast peak hourly loads for existing customers are assumed to be constant for network planning. Incremental customers by sector are assumed to have lower peak hourly demands based on the year added as per the load gathering process described in the response to Environmental Defence Interrogatory #12 found at Exhibit I.A4.EGD.ED.12. Efficiency gains for the system as a whole are incorporated in the incremental peak demand through the reduction factor as per the response to Environmental Defence Interrogatory #13 found at Exhibit I.A4.EGD.ED.13.

Witness: E. Naczynski

Enbridge Gas Pipeline Hearing EB-2012-0451

Evidence concerning Demand Side Management Potential in GTA

Ian Jarvis,

Wen Jie Li

Gillian Henderson

Enerlife Consulting

June 28, 2013, Updated September 11, 2013

Executive Summary

This report estimates the Demand Side Management ("DSM") potential for commercial and apartment customers in the GTA area, summarizes the DSM estimates for residential and industrial customers prepared by the consultants retained by the Green Energy Coalition ("GEC"), analyzes the potential DSM against load growth, estimates the present value of the commodity cost savings associated with the efficiency measures, and provides comments on Enbridge's load forecast model. The terms of reference provided to us by Environmental Defence appear at Appendix A to this report.

We conclude that all load growth in the GTA area can be completely offset through commercial and apartment DSM and that overall demand can be significantly *reduced* with the addition of residential and industrial DSM.

Enbridge estimates that its DSM programs will deliver in the order of 12 10^3 m^3 per hour (9 TJ/day) peak demand reduction savings each year. Enbridge also advises that additional peak demand reduction of 25 10^3 m^3/hr (18 TJ/day) is required each year to offset customer load growth. Therefore, a total of approximately 37 10^3 m^3/hr (27 TJ/ day) in peak demand reduction is required.

The forecast annual average peak demand reduction potential through DSM presented in this evidence yields a total of 50 10^3 m^3/hr (37.7 TJ/day) at the top quartile level, which is considered readily attainable in the timeframe involved. The average annual peak hourly reduction presented in the Enerlife model and by the GEC's witnesses is summarized as follows:

Table I. DSM Potential in the GTA Area	
Customer Sector	**DSM Potential (10^3 m^3/hr)**
Commercial (Per Enerlife Model, Top-Quartile Attainment)	31.0
Apartment (Per Enerlife Model, Top-Quartile Attainment)	11.3
Sub Total	**42.3**
Residential (Per Chris Neme)	5.6
Industrial (Per Marbek Report and Chris Neme's Analysis)	2.1
TOTAL	**50.1**

Median-quartile attainment would achieve 18.8 10^3 m^3/hr (14.2TJ/day) for commercial customers and 4.9 10^3 m^3/hr (3.7TJ/day) for apartment customers. The total present value of the avoided commodity costs at 2015 for attainment of the median performance target is $743 million and for the top quartile target is $1,108 million.

The Performance-Based Model presented in this evidence for calculating commercial and apartment DSM potential is derived from Enerlife's substantial and growing database of actual energy performance data for buildings. The approach is consistent with a growing number of provincial and national programs. [1] It takes a different approach from the DSM Potential Study conducted for Enbridge in 2009 by Marbek Resources Consulting Inc.[2] Rather than relying on technologies, assumed penetration levels and engineering calculations, the Performance-Based Model analyzes actual, benchmarked energy use of different building types and establishes the potential savings due to all buildings reaching intensity levels already achieved by one half (median) or one quarter (top-quartile) of the peer group.

Simply bringing high gas use intensity buildings down to meet median base and heating energy levels of existing buildings yields overall percentage savings in the order of 19% for commercial and 12% for apartment buildings. Going further to meet top-quartile performance levels raises the potential to over 32% for commercial buildings and almost 29% for apartments.

It should be noted that attainment of today's top quartile gas use is by no means the greatest savings level that can be planned for and expected within the timelines in question. By definition, one quarter of existing buildings are already performing at or better than this level. Energy efficiency initiatives such as REALpac's 20 by '15 Target and TRCA's Town Hall Challenge and Greening Health Care programs use top quartile gas use to set energy targets.

Measures to improve efficiency in high gas intensity buildings go beyond those included in Marbek's DSM Potential Study and are typically site-specific equipment repairs, upgraded control of buildings systems, and testing, tuning and rebalancing of heating plant and systems. Such projects show generally good Total Resource Cost ("TRC") test values, can be implemented quite quickly, and serve to improve building performance as well as energy efficiency. They require a systematic approach to identify target buildings, engage owners, isolate the inefficiencies, implement the necessary improvements and verify the results.

Enbridge is already starting down the path on this new, data-driven performance-based conservation programming with its Energy Compass and Run It Right programs. The company has also gained experience in this space through its sponsorship of and participation in Toronto & Region Conservation's programs and CivicAction's Race to Reduce. In order to deliver the substantial additional natural gas savings identified herein in an efficient and expedient manner, additional focus and expanded scope should be applied to these new programs. Working with other parties, Enbridge can readily identify and target the largest gas savings potential customers in each sector, and support them in understanding and achieving the considerable energy and cost savings potential in their buildings.

[1] Examples include: Ministry of Education's Utility Consumption Database; REALpac's 20 by '15 Target and Benchmarking; Toronto & Region Conservation's Energy Efficiency Programs of The Living City; Government of Canada's Canadian launch of EPA's Portfolio Manager; CivicAction's Race to Reduce; Ontario Government's Green Energy Act reporting

[2] Exhibit I.A4.EGD.ED.14, Attachment

Target customers	Commercial landlords; major hospitals; universities; major hotels; government	School boards (high schools); municipalities; colleges; large retail; other hospitals, hotels etc	Other retailers; long-term care operators	Banks (branches); school boards (primary schools);

The Apartment sector also has large buildings, large portfolio owners, and collaborative programs in place (including the Federation of Housing Providers of Ontario, and the City of Toronto Tower Renewal Office) so a similar model would apply. A s.

Lower penetration rates are projected in the model for Residential and Industry, but the principles of performance-based conservation may be useful in these sectors as well.

4.2 Finding and Fixing Inefficiencies

Identifying and addressing inefficiencies requires a savings focused approach to DSM. Trained people with similar skill sets to energy analysts, commissioning agents and energy efficiency engineers focused on getting to energy savings as quickly as possible are needed to work with building operation staff. Outcomes-based strategies and incentives prioritize scheduling optimization, ventilation and air flow testing and savings opportunities that use lower cost technology such as zone dampers and variable frequency drives. These typically can be implemented quickly and have short paybacks.

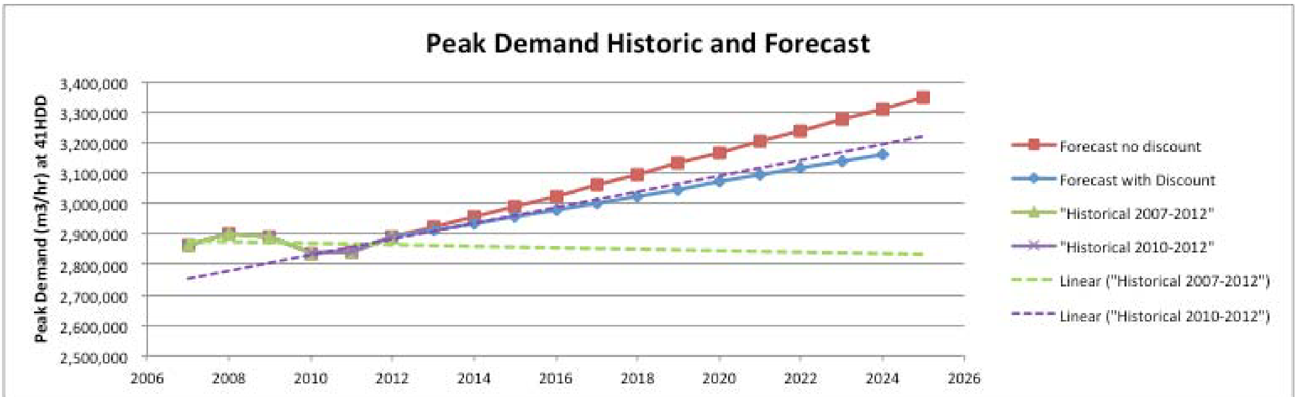
Part Five - Enbridge Peak Demand Forecast Model

5.1 Assessment of Enbridge's Load Growth Forecast Model

Enbridge's argument for a proposed new pipeline to serve the GTA is partially based on the need for additional capacity to meet increased peak hourly demand. To support this, they provided a Peak Load Growth Forecast discounted for gas savings from DSM programs. Due to the short length of review time, we are unable to provide a complete assessment of the load forecast but have the following observations:

a. Insufficient trend information to base projection

Figure 13 Peak Demand Trends



The derived historic peak demand (weather-normalized to 41HDD)[11] from between 2007 and 2012 shows no net growth overall. However, Enbridge's forecast indicates an increase in demand. This is consistent with a shorter data period (2010 to 2012). Given the erratic growth patterns within the Industrial and Commercial sectors during this time, three years would seem insufficient to base a forecast upon. [12]

As illustrated below, the industrial sector demand dropped by 43% between 2011 and 2012 while the commercial sector demand increased by 23% in the same period with no significant increase in the number of customers. Overall there was little total demand growth. This would indicate the difficulty in forecasting future growth based on so little trend data.

Table 2 Number of Customers by Sector (historical)

	Apartment	Commercial	Industrial	Residential	Total
	m^3/hr	m^3/hr	m^3/hr	m^3/hr	m^3/hr
2007	410,758	896,792	352,178	1,203,076	2,862,804
2008	414,932	900,775	358,798	1,225,376	2,899,881
2009	404,701	916,271	336,968	1,230,241	2,888,181
2010	400,992	905,314	311,336	1,220,411	2,838,053
2011	410,716	902,621	**324,351**	1,205,503	2,843,191
2012	424,455	**1,112,231**	184,774	1,168,523	2,889,983

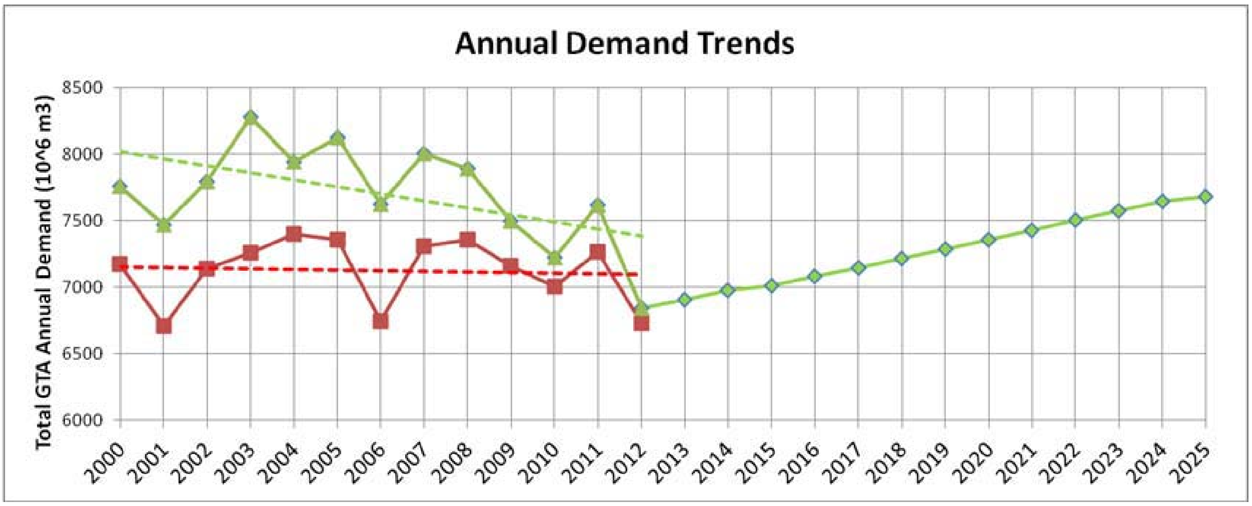
b. Forecast inconsistent with historical peak demand trends

Based on historical annual demand trends, demand has been declining over the past decade but Enbridge has forecast substantial demand growth in the future. As can be seen in the graph below, it

[11] Exhibit I.A4.EGD.ED3
[12] EXHIBIT I.A4.EGD.EGC.ED.3

appears Enbridge provided total GTA annual demand data from two sources. The green line is from actual volumes[13] and the red is measured at the gate station[14]. Neither indicates a growth in demand, while the annual demand is forecast to grow consistently. During the historical period (2004 to 2012) the growth rate of the number of customers is similar to the forecasted customer growth rate, yet there was no peak demand growth. Enbridge uses linear interpolation between annual consumption to derive peak hourly data, which supports the correlation between annual volume and peak hourly demand. Based on this, there is no historical correlation between an increase in number of customers and significant peak demand growth as forecast.

Figure 14 Annual Demand Trends - historic and forecast



c. Inaccurate application of the discount factor

The application of the discount factor in the Enbridge Load Growth Forecast model appears to be misleading. The DSM forecast of 12 10^3m^3/hr reduction each year is 0.4% of the peak hourly load in GTA. The 35% discount factor is applied on the incremental **new** customer growth rate of 1.2% (35 10^3m^3/hr) each year, to account for the DSM load reduction over the entire **existing** building stock. This leads to the misunderstanding that no amount of DSM could offset growth, since even if a 99% discount is applied there will still be a positive growth trend.

It would be more accurate to apply the discount factor directly to the total peak load. The Performance-based DSM model proposed in this report applies it this way, and if DSM reaches 3 times the current level there will be no net growth.

[13] JT2.36 using "actual volumes from Franchise Areas 10, 20, 30 from the billing system to proxy for volumes in the GTA Project Influence Area" for the historical information, and the "2013 Board-approved average use were applied to GTA Project influence area customer growth forecasts to project total annual demands"
[14] Exhibit I.A4.EGD.ED.25, "measured at the gate station"

ENBRIDGE GAS DISTRIBUTION INC. RESPONSE TO
ENVIRONMENTAL DEFENCE INTERROGATORY #14

INTERROGATORY

Issue A4: "What are the alternatives to the proposed facilities? Are any alternatives to the proposed facilities preferable to the proposed facilities?"

Reference: Ex. A, Tab 3, Schedule 4, page 8

a) For each year from 2014 to 2025 inclusive, please state the forecast impact of DSM on peak hourly demand and total annual demand in the GTA Project Influence Area, both yearly and cumulative, based on the "reduction factor" used by Enbridge in its forecast. For each year, please also estimate Enbridge's DSM budget needed to achieve the DSM reductions assumed in the forecast.

b) Please state the amount of DSM, in addition to that assumed in Enbridge's forecast, that would be needed to meet Enbridge's customers' needs in the GTA Project Influence Area in each year from 2014 to 2025 inclusive (i.e. to ensure that minimum system requirements with respect to capacity and pressure are met) without the proposed new Enbridge pipelines.

c) Has Enbridge estimated the potential for incremental DSM in addition to the amount assumed in its forecast? If yes, please state this potential for each year from 2014 to 2025 inclusive. Please also provide all the reports, studies and analyses that support these estimates and state when this research was commenced and was completed.

d) For each of the above, please also provide the requested data in a table or tables covering only the period from 2015 to 2025. This will assist in comparing the data with Enbridge's load forecast at Exhibit A, Tab 3, Schedule 4, which covers only the 2015 to 2025 period

RESPONSE

a) Enbridge reports DSM using annual figures and does not communicate, measure, or interpret DSM reductions on a peak day or peak hour basis. For illustrative

Witnesses: T. Maclean
F. Oliver-Glasford
J. Ramsay

purposes, the Company has converted its annual results into peak hour and peak day reductions using several theoretical assumptions. The assumptions include:

- the use of a linear conversion ratio to derive peak day from annual figures and peak hour from peak day;
    - o In practice the conversion ratio will not be linear and will vary between DSM measures and customer segments
- the use of a factor to apportion the amount of the whole franchise-wide DSM which is attributable to the GTA Project Influence Area; and
- static cost effectiveness as conservation budgets increase (i.e. each incremental m^3 saved is priced at the same as the first m^3).

Because of the theoretical and simplified nature of the assumptions built into the numbers, the charts below should only be used to illustrate the relative magnitude of the data.

Franchise-wide DSM		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Peak Hour Demand Reductions (10^3m^3)	Yearly	24	25	25	25	25	25	25	25	25	25	25	25	25
	Cumulatively	24	49	73	98	122	147	171	196	221	245	270	294	319
Peak Day Demand Reductions (10^3m^3)	Yearly	600	614	614	614	614	614	614	614	614	614	614	614	614
	Cumulatively	600	1,214	1,828	2,442	3,056	3,670	4,284	4,898	5,513	6,127	6,741	7,355	7,969
Annual Demand Reductions (10^3m^3)	Yearly	74,353	76,049	76,049	76,049	76,049	76,049	76,049	76,049	76,049	76,049	76,049	76,049	76,049
	Cumulatively	74,353	150,402	226,451	302,501	378,550	454,599	530,648	606,697	682,747	758,796	834,845	910,894	986,943
Annual Province-wide DSM Budget		$32,380,295	$32,966,700	$33,626,034	$34,298,555	$34,984,526	$35,684,216	$36,397,901	$37,125,859	$37,868,376	$38,625,743	$39,398,258	$40,186,223	$40,989,948

GTA Influence Area DSM		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Peak Hour Demand Reductions (10^3m^3)	Yearly	12	12	12	12	12	12	12	12	12	12	12	12	12
	Cumulatively	12	23	35	47	59	70	82	94	106	118	129	141	153
Peak Day Demand Reductions (10^3m^3)	Yearly	288	295	295	295	295	295	295	295	295	295	295	295	295
	Cumulatively	288	583	877	1,172	1,467	1,762	2,056	2,351	2,646	2,941	3,236	3,530	3,825
Annual Demand Reductions (10^3m^3)	Yearly	35,689	36,504	36,504	36,504	36,504	36,504	36,504	36,504	36,504	36,504	36,504	36,504	36,504
	Cumulatively	35,689	72,193	108,697	145,200	181,704	218,207	254,711	291,215	327,718	364,222	400,726	437,229	473,733
GTA Influence Area DSM Budget		$15,542,541	$15,824,016	$16,140,496	$16,463,306	$16,792,572	$17,128,424	$17,470,992	$17,820,412	$18,176,820	$18,540,357	$18,911,164	$19,289,387	$19,675,175

As shown in the GTA Project Influence Area DSM table above, the impact of the Company's forecasted 2014 DSM reduction on peak hour demand is 12 10^3m^3/hr.

In comparison, the peak load demand reduction as calculated using the reduction factor impact is 13 10^3m^3/hr.

Witnesses: T. Maclean
F. Oliver-Glasford
J. Ramsay

b) In the table below are estimates of the DSM reductions that would be necessary in the GTA Project Influence Area in order to meet the Company's customers' growth needs from 2014 to 2025 inclusive (i.e. to meet a 'growth only' scenario) without the pipelines proposed, holding all other factors constant.

Enbridge asserts that the enormous DSM reductions required to meet customers' needs without the proposed pipeline far exceed any realistic or achievable level.

The data below assumes that the realm of available natural gas savings in the GTA Project Influence Area is unlimited and that cost effectiveness is static. The Company knows this not to be the case. Furthermore, significant portions of the Company's results are achieved through industrial customers of whom there are limited quantities. It is for these reasons among others that conservation was discounted as a non-viable option to offset the GTA Project.

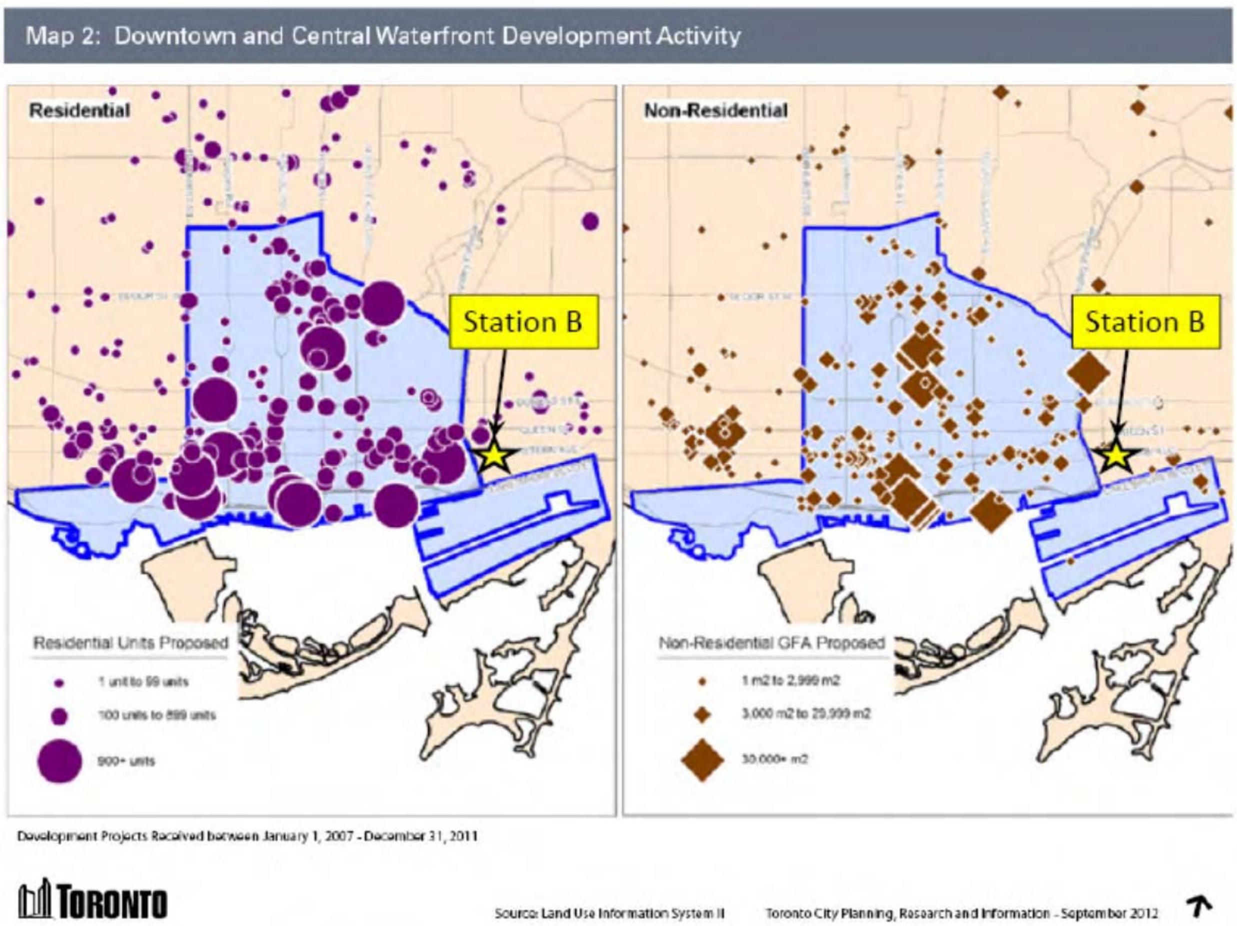
DSM Required to Offset Growth in the GTA Project Influence Area		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Additional Annual DSM Needed in GTA (10^3m^3)		77,811	77,811	77,811	77,811	77,811	77,811	77,811	77,811	77,811	77,811	77,811	77,811
Total Franchise-wide Annual DSM Needed (10^3m^3)		153,860	153,860	153,860	153,860	153,860	153,860	153,860	153,860	153,860	153,860	153,860	153,860
Total DSM Budget Needed	Yearly	**$66,697,115**	**$68,031,057**	**$69,391,679**	**$70,779,512**	**$72,195,102**	**$73,639,004**	**$75,111,785**	**$76,614,020**	**$78,146,301**	**$79,709,227**	**$81,303,411**	**$82,929,479**
	Cumulatively	**$66,697,115**	**$134,728,173**	**$204,119,851**	**$274,899,363**	**$347,094,466**	**$420,733,470**	**$495,845,255**	**$572,459,275**	**$650,605,576**	**$730,314,802**	**$811,618,214**	**$894,547,693**

c) The Company completed a DSM Potential Study in 2009. (The study commenced in 2008.) The Potential Study covered the period 2008 through 2017 using the base year of 2007. The Study Report was filed with the 2012 DSM Plan (EB-2011-0295, Exhibit B, Tab 2, Schedule 7).

d) Please see the table above for 2015 to 2025.

Witnesses: T. Maclean
F. Oliver-Glasford
J. Ramsay

Figure 3[3]: Development projects received by the City of Toronto (2007 to 2011, yet to be built)



Load Growth

9. Pipelines and facilities are sized based on the forecasted total peak hourly consumption, which is calculated from the customer additions forecast and the peak hourly consumption estimate. For each municipality identified in the Influence Area, the peak hourly consumption estimate was calculated for each customer type based

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[3] "Profile Toronto", October 2012 Issue. The location of Station B is overlaid on the figure.

on the five years of historical peak hour consumption. The data was regressed with temperature information to determine peak hourly gas consumption at a 41 DD. A reduction factor was then applied to account for efficiency gains through Demand Side Management ("DSM") and customer losses through building demolition. Large volume customers, such as power plants, are evaluated on an individual basis to determine replacement capacity requirements and therefore excluded from the customer additions forecast. The calculated peak hourly consumption value for each customer sector for each municipality was applied to customer additions forecast.

10. The total forecast peak day demand, shown in Table 3, is the incremental load growth plus the load required by the existing customer base. Gas demand and supply is further described in Exhibit A, Tab 3, Schedule 5.

Filed: 2013-06-18
EB-2012-0451
Exhibit JT2.29
Page 1 of 1

UNDERTAKING JT2.29

UNDERTAKING

TR 2, page 156

To advise how EGD's 0.65 reduction function was calculated with an explanation discussing all the factors it considers including DSM.

RESPONSE

There are a number of factors that influence peak load on the distribution system over time. Some factors, such as GDP growth or a trend to larger buildings which are taller and denser than historical multi-residential construction, would tend to push the peak load higher. Other factors, such as energy efficiency improvements to the existing building stock or installed base of equipment, or changes to Building Codes on new construction and renovations, would be expected to decrease peak load. The Company forecast includes all of the above items.

The Company did a comparison of the load growth forecast (aggregated by sector, by geography, over the project forecast horizon as explained in the response to Environmental Defence Interrogatory #12 found at Exhibit I.A4.EGD.ED.12) to the historical send-out trend on peak day normalized to design conditions. As a result the Company applied a reduction to the forecast of increased peak system loads. The reduction factor captures the impact of all of the factors listed above across the existing and incremental loads.

The table below shows the comparison of the previous period normalized peak day demand for the GTA Project Influence Area and the forecast without and with the reduction factor that was included in the project forecast.

Period	# of Years	Total Growth (GJ/d)	Total Growth (%)
1999-2012 [1]	13	406,923	19.5
2013-2025 forecast (No reduction factor)	13	334,736	13.9
2013-2025 forecast (with reduction factor)	13	217,578	9.0

1 - Normalized peak day demand regression on customer count

Witness: C. Fernandes

Ontario

Go Green

Ontario's Action Plan On Climate Change

August 2007

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GO GREEN:
ONTARIO'S ACTION PLAN ON CLIMATE CHANGE

INTRODUCTION: WHY GO GREEN?

Scientists, and most notably, the United Nations Intergovernmental Panel on Climate Change (IPCC) have shown that the earth's climate is changing dramatically, and human industrial activity and the burning of fossil fuels are largely to blame. Before the Industrial Revolution, the carbon dioxide (CO_2) concentration in the earth's atmosphere was about 280 parts per million.

We are now at about 380 parts per million. At 380 parts per million, coral reefs are dying, glaciers are melting, seas are rising and an estimated 35,000 people died in the 2003 European heat wave. According to the IPCC, without significant action to reduce emissions, CO_2 concentrations may reach 750 parts per million this century.

Partly, this is because molecules of CO_2 remain in the atmosphere for up to 200 years. Which means the CO_2 molecules produced by the first cars, the Wright brothers' plane and the first coal-fired electricity plants may still be airborne.

Climate change is a crisis we caused together, and a responsibility we all share, together. So it's important we act, not only because we can't ignore the science, not only because we bear the responsibility, and not only because we have an obligation to our children.

We must also act, because this environmental crisis is also an economic opportunity. As a province with a strong manufacturing sector, plenty of natural resources, and a smart, educated, skilled workforce, there are opportunities for Ontario.

We don't have to choose between a strong economy and a healthy environment. Faced with the challenge of climate change, the only way to have a strong economy is to go green. And the only way to go green is to have a strong economy.

Go Green: Ontario's Action Plan on Climate Change is Ontario's *greenprint* for creating solutions, here, together. The time for imagining is over. Ontario is going green – now.

ONTARIO'S ACTION PLAN

Go Green: Ontario's Action Plan on Climate Change includes some of the most comprehensive, forward-looking steps on the environment that Ontario has ever contemplated.

We're setting firm targets and goals that we will meet together — not only for the distant future, but for right now, too.

Go Green will improve the way we live and travel in southern and central Ontario, the way we heat and light our homes, and the way we encourage and support businesses and industries that think green.

Through *Go Green*, your government is making green choices. But this plan will also enable everyone to make better, greener choices that will save money and help the economy. It will give Ontario's businesses the tools they need to go green and thrive – and offer opportunities for new, green business to take root and grow in our province.

Go Green is a five-point action plan:

- **Green Targets –** We have set short-, medium- and long-term targets for reducing Ontario's greenhouse gas emissions, starting now and continuing through mid-century. And we're setting out the measures to achieve these targets – new regulations, conservation, a phase-out of coal-fired power plants and much more renewable energy. From phasing out inefficient light bulbs to rebates for energy audits to provincial sales tax breaks for energy efficient products, there are new programs and incentives for Ontario consumers, businesses, and municipalities to get green.

- **MoveOntario 2020 –** We're launching the largest transit investment in Canadian history – a $17.5 billion plan that includes 52 rapid transit projects in the GTA and Hamilton, the country's largest urban area. It calls for 902 kilometres of new or improved rapid transit, creating 175,000 jobs during construction.

- **Creating Jobs by Going Green –** The *Next Generation Jobs Fund*, a new $650-million program, will secure the next generation of high-paying jobs for Ontarians by supporting businesses' commercial development, use and sale of clean and green technologies and businesses right here in Ontario.

- **Green Power –** A $150 million investment will help Ontario homeowners fight climate change, conserve energy and adopt green technologies. In addition to a world leading standard offer for renewable energy, we have set long-term targets to double the amount of electricity from renewable sources by 2025. In the short term we have gone from 10 to nearly 700 windmills, in place or planned. And we now have a standard offer for clean energy to enable power users to improve their efficiency through cogeneration (combined heat and power electricity production). We are removing other barriers that prevent more widespread use of cogeneration.

- **Grow Green –** In addition to the Greenbelt Act, which ensures there will always be nature and open spaces around our most populated areas, 50 million new trees will be planted in southern Ontario by 2020. Under the Places to Grow Act, we are growing more sustainable, energy-efficient, transit-friendly communities and we are setting strong targets to make sure we are achieving our goals. We're also bringing in new programs to promote locally grown Ontario food – the best in the world.

ONTARIO'S GREEN TARGETS

Go Green: Ontario's Action Plan on Climate Change sets ambitious but realistic targets:

Together, we will reduce Ontario's greenhouse gas emissions to 6 per cent below 1990 levels by 2014 – a reduction of 61 megatonnes relative to business-as-usual.

By 2020 Ontario will reduce greenhouse gas emissions to 15 per cent below 1990 levels – a reduction of 99 megatonnes relative to business-as-usual.

By 2050 we will reduce greenhouse gas emissions to 80 per cent below 1990 levels.

These reduction targets won't be easy to achieve, but they are achievable – and they're worth it. These targets put Ontario among the leaders in addressing climate change. No place in Canada is committed to producing more real reductions than Ontario.

If the federal government does its part by introducing an emissions trading system for industry compatible with other markets — an effective regime with real caps on emissions, real reductions over time and with the same 1990 baseline used by most of the international community — Ontario will achieve these targets even sooner.

ENVIRONMENTAL DEFENSE INTERROGATORY #5

INTERROGATORY

Issue 1: "Is the 2014 DSM Budget ($32.2M) reasonable and appropriate? Should the Board determine that the DSM budget for 2014 should be increased, what are the implications and required next steps."

Interrogatory No. 1-ED-5 Greenhouse Gas Emission Reductions

Reference: Ex. B, Tab 1, Schedule 2, page 1-3

Attached is a table containing a breakout of Ontario's energy-related greenhouse gas ("GHG") emissions in 2010 prepared for Environmental Defence and submitted in EB-2012-0337 (Exhibit K 1.5, Tab 4). In that proceeding, Union Gas agreed that the estimates in that table look reasonable.[1]

Also attached for your reference is a report from the Environmental Commissioner of Ontario which lists Ontario's GHG emission reduction targets as follows:

i) 6% below 1990 levels by 2014 (to approximately 165 megatonnes or Mt);
ii) 15% below 1990 levels by 2020 (to approximately 150 Mt); and
iii) 80% below 1990 levels by 2050 (to approximately 35 Mt).[2]

The Environmental Commissioner report states that "[the] government, itself, has projected a 30 Mt gap by 2020."[3]

a) Does Enbridge believe that the estimates in the attached table appear to be reasonable? If not, please provide alternative estimates.

b) According to the attached table, natural gas was responsible for 34.5 percent of Ontario's total energy-related GHG emissions in 2010. When the coal phase-out is complete and the Pickering nuclear station comes to an end of its life, is it more likely than not that the greenhouse gas emissions from natural gas-fired power plants will rise as a proportion of the total (all other things equal)?

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[1] Transcript, EB 2012-0337, Vol. 1, January 31, 2013, p. 92, lns. 1-9.
[2] Environmental Commissioner of Ontario, *A Question of Commitment: Annual Greenhouse Gas Progress Report 2012*, http://www.eco.on.ca/uploads/ Reports-GHG2/20 I 2/Climate-Change-Report-20 I 2.pdf, page 12.
[3] *Ibid.* p. 14.

c) Is it reasonable to assume that a cost-effective strategy to achieve Ontario's 2020 GHG emission target will require a significant increase in the energy efficiency of Ontario's natural gas consumption'?

d) Are GHG emission reductions given a dollar value and factored into the TRC analysis for DSM programs?

<u>RESPONSE</u>

a) While Enbridge has not made any inquiries into the accuracy of the figures, the estimates in the attached table appear reasonable.

b) Yes (all other things being equal) the proposition seems reasonable. Enbridge is however neither qualified nor in a position to comment on the Provincial Governments overall long term plans for operating power generation plants. It therefore cannot comment on whether it is reasonable to assume that 'all other things' will be equal. When the coal phase-out is complete and the Pickering nuclear station comes to an end of its life, greenhouse gas emissions from natural gas-fired power plants will be determined by how often and which of the gas-fired power plants are dispatched in a new supply mix environment.

c) Natural gas energy efficiency contributes towards Ontario's pursuit of its GHG targets. Again, the Company is neither qualified nor in a position to comment on matters of overall Provincial Policy and Strategy as it pertains to Ontario's GHG emission target.

d) No value for CO_2 is included in the TRC equation.

Schedule A to Interrogatory No. 1-ED-5

Table of Ontario's Natural Gas-Related & Other Greenhouse Gas ("GHG") Emissions in 2010

Percent of Ontario's Total 2010 Energy-Related GHG Emissions from Certain Sources		
#	GHG Emission Source	Percent
1	Natural Gas Power Plants	8%
2	All Natural Gas Consumption	34.5%
3	Coal-Fired Power Plants	9%
4	Transportation	45.6%

Sources and Calculations

1. Ontario's total natural gas consumption in 2010 was 24,264.58 million cubic metres.[1]

2. Emission Factors for Natural Gas[2]:

   a) Carbon Dioxide: 1879 g/cubic metre
   b) Methane: 0.037 g/cubic metre
   c) Nitrous Oxide: 0.033 g/cubic metre

3. Natural Gas Consumption Emissions (m3 of gas multiplied by emission factors)

   a) Carbon Dioxide: 45,593,145.82 tonnes
   b) Methane: 897.79 tonnes
   c) Nitrous Oxide: 800.73 tonnes

4. IPCC Global Warming Potentials – 100 – Year Time Horizon (Second Assessment Report)[3]

   a) Carbon Dioxide: 1
   b) Methane: 21
   c) Nitrous Oxide: 310

5. Natural Gas Consumption GHG Emissions (Carbon Dioxide Equivalent)

   a) Carbon Dioxide: 45,593,145.82 tonnes
   b) Methane: 18,853.59 tonnes

[1] Statistics Canada, Catalogue 57-601, *Energy Statistics Handbook*, Tables 6.6 & 6.7, http://www.statcan.gc.ca/pub/57-601-x/2012001/tablelist-listetableaux6-eng.htm.
[2] Environment Canada, *GHG Emissions Quantification Guidance: Fuel Combustion*, http://www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=AC2B7641-1.
[3] Environment Canada, *Global Warming Potentials*, http://www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=CAD07259-1.

c) Nitrous Oxide: 248,226.3 tonnes
d) Total 45,860,225.71 tonnes

6. Ontario's Natural Gas Consumption GHG Emissions (45,860,225.71 tonnes) as a percent of Ontario's Total Energy-Related GHG Emissions (133,000,000 tonnes):

   34.5%[4]

7. Ontario's transportation-related GHG emissions as a percent of Ontario's Total Energy-Related GHG Emissions in 2010:

   45.6%[5]

8. Ontario's coal-fired electricity-related GHG emissions as a percent of Ontario's Total Energy-Related GHG emissions in 2010:

   9%[6]

9. Ontario's natural gas-fired electricity-related GHG emissions as a percent of Ontario's Total Energy-Related GHG emissions in 2010:

   8%[7]

   These emissions are a sub-component of Ontario's total Natural Gas Consumption GHG emissions.

---

[4] Calculated as 45,860,225.71 divided by 133,000,000. Ontario's total energy-related GHG emissions in 2010 were 133,000,000 tonnes. Environment Canada, *National Inventory Report 1990-2010 Part 3*, Table A14-12.
[5] Environment Canada, National Inventory Report 1990-2010 Part 3, Table A14-12.
[6] Environment Canada, National Inventory Report 1990-2010 Part 3, Table A14-12; and Environmental Commissioner of Ontario, *A Question of Commitment: Annual Greenhouse Gas Progress Report 2012*, (December 2012), page 21.
[7] Environment Canada, National Inventory Report 1990-2010 Part 3, Table A14-12; and Environmental Commissioner of Ontario, *A Question of Commitment: Annual Greenhouse Gas Progress Report 2012*, (December 2012), page 21.

Related GHG Figures

Ontario's GHG Emission Reduction Targets[8]

1. 6% below 1990 levels by 2014 (to approximately 165 megatonnes or Mt);
2. 15% below 1990 levels by 2020 (to approximately 150 Mt); and
3. 80% below 1990 levels by 2050 (to approximately 35 Mt).

GHG Emissions Gap

According to the Government of Ontario, in the absence of additional policy action, Ontario's GHG emissions in 2020 will be 30 Mt greater than its target.[9]

[8] Environmental Commissioner of Ontario, *A Question of Commitment: Annual Greenhouse Gas Progress Report 2012*, page 12.
[9] Environmental Commissioner of Ontario, *A Question of Commitment: Annual Greenhouse Gas Progress Report 2012*, page 14.

Climate Vision | Climate Change Progress Report

Ontario

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Technical Appendix A

Introduction

This technical appendix provides details on the province's greenhouse gas (GHG) emissions and changes in emission levels since 1990.[1] In addition, it also provides an update on the province's forecasted emission levels out to 2020, including the impact of policies on progress toward the province's emission targets.

How Ontario Measures its GHG Emissions

Ontario's definition of GHG emissions aligns with the definitions used to prepare Environment Canada's National Inventory Report 1990–2010: Greenhouse Gas Sources and Sinks in Canada (NIR), published in April, 2012. Each year, Environment Canada submits its updated NIR to the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat. Historical GHG emissions in this progress report are taken from the latest NIR, which covers the period from 1990 to 2010. The data cover most activities in Ontario's economy that influence GHGs but do not include impacts relating to land use and forestry at this time. The NIR is organized into numerous categories that are defined by UNFCCC reporting protocols and therefore do not match categorizations by other sources of economic, industrial, energy and emissions data. For this appendix, the categories are rolled up into six key economic sectors (see Table 1).

TABLE 1
ONTARIO EMISSION SECTOR DESCRIPTIONS

ECONOMIC SECTOR	DESCRIPTION
Transportation	Emissions from the consumption of fossil fuels such as diesel, gasoline and propane consumed by passenger and commercial vehicles including road, rail, marine and air travel
Industry	Emissions from industrial processes and the use of fossil fuels such as coke, natural gas and coal are produced from a range of industries including mining, oil and gas extraction, manufacturing, mineral and chemical production, construction and paper and wood products production
Buildings	Emissions from the use of fossil fuels such as natural gas in residential, commercial and institutional buildings for heating and water
Electricity	Emissions from electricity and heat generation produced from the combustion of fossil fuels such as coal and natural gas
Agriculture	Emissions generated by enteric fermentation, manure management and fertilizer application
Waste	Emissions generated by solid waste disposal on land, wastewater handling and waste incineration

NB: Emissions from the pipeline transportation of petroleum products are included in the Industry sector.

1 All figures in this appendix are rounded, which may therefore not produce the exact results indicated for totals, ratios, etc.

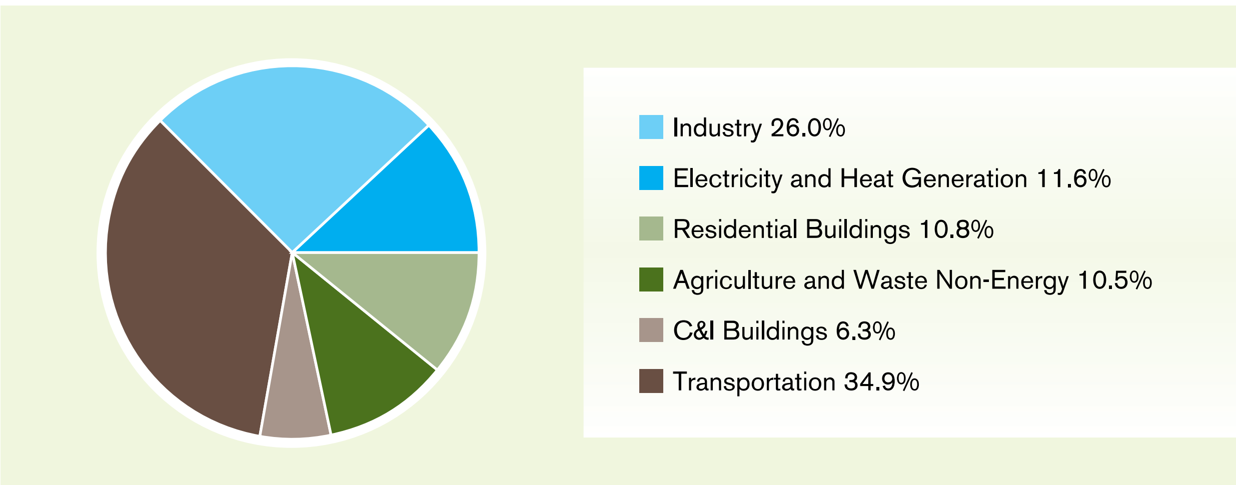
Changes in NIR

Environment Canada is continually working to refine the data and methods used to estimate national and provincial emissions. These refinements often lead to re-calculation of GHG emission estimates for the whole time period of the NIR, dating back to 1990. This means that our 1990 base year emissions and historical trends can change from year to year, influencing our emission forecasts and the assessment of our progress to targets. These changes are well documented in the NIR and are typically minor but in recent years, some changes in the industrial sector methods have had a pronounced impact on Ontario emission estimates.

Sources of Ontario's GHG Emissions

GHG emissions result from virtually all aspects of Ontario's society and economy but primarily from how we produce and consume energy. Ontario's 2010 emissions are estimated to have been 171 megatonnes (Mt) of carbon dioxide equivalent (CO_2 eq), with sectoral shares shown in Figure 1.

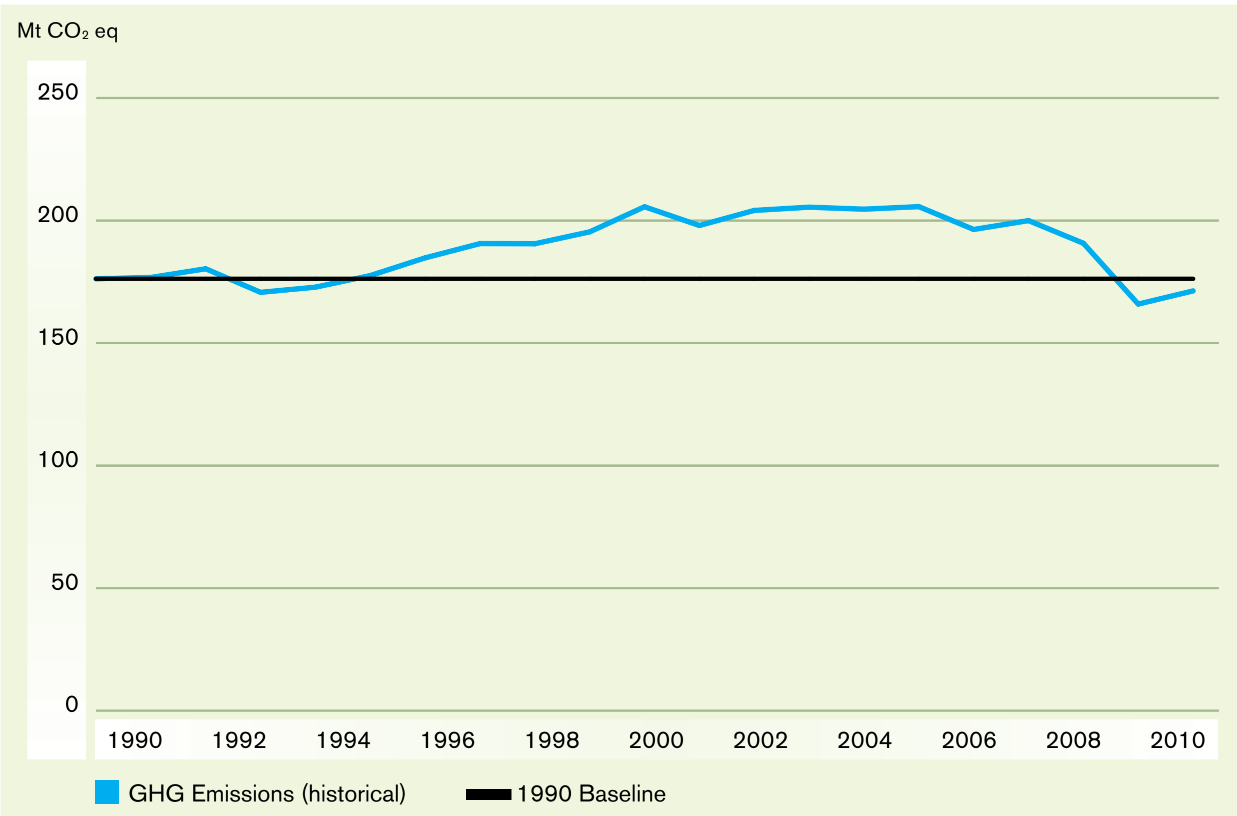
FIGURE 1
2010 GHG EMISSIONS BY SECTOR



Long-Term Trends in Ontario's Emissions (1990–2010)

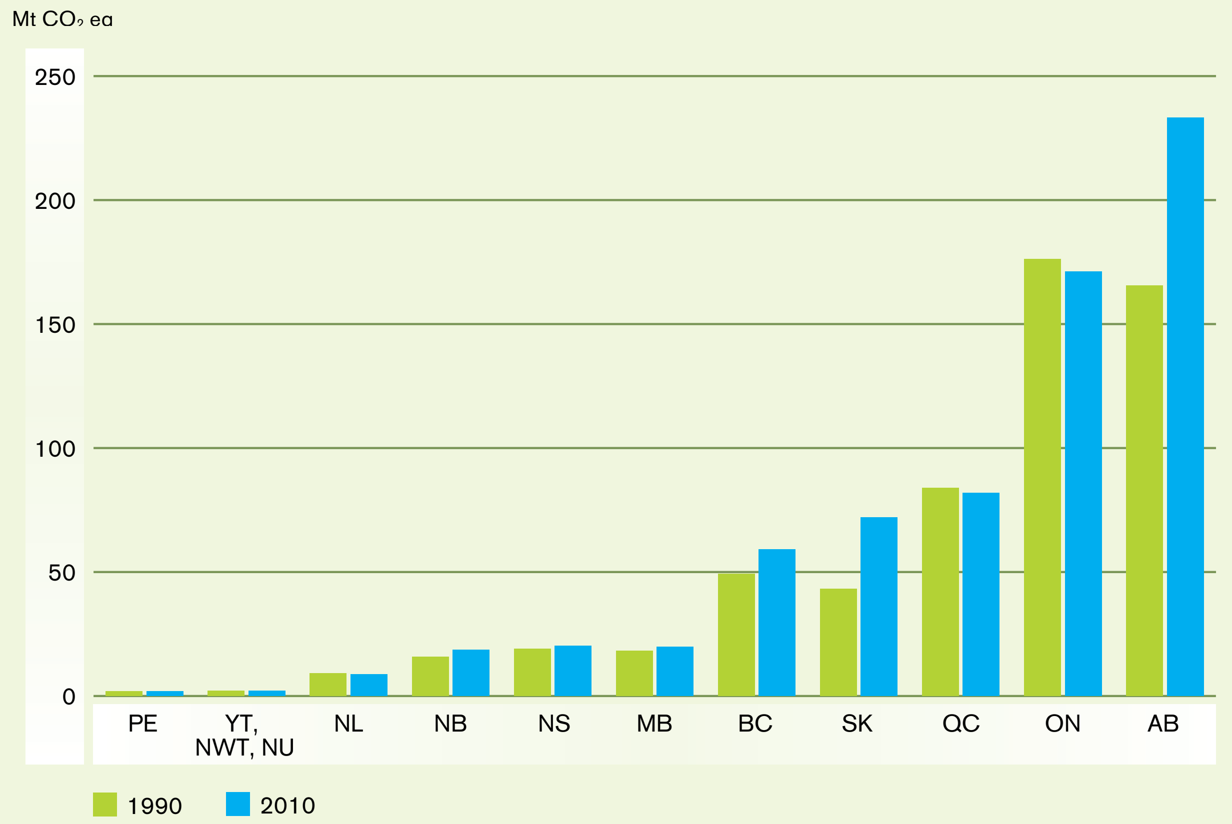
Between 1990 and 2010, Ontario's total annual emissions dropped by three per cent, from 176 Mt of CO_2 eq to 171 Mt of CO_2 eq. Figure 2 shows that, while total emissions increased fairly steadily in the first half of this period, more recent annual emission levels have fluctuated in response to changes in the economy, weather, energy demand and technologies used by industry, electricity generation, transportation, and consumer products.

FIGURE 2
ONTARIO'S GHG EMISSIONS, 1990–2010



In contrast to Ontario's stable to declining emissions, the national trend is increasing emissions. In 2010, Canada's GHG emissions totalled[2] 695 Mt CO_2 eq, which represents an increase of 18 per cent since 1990. However, increases since 1990 have varied significantly across Canada. Similar to Ontario, Quebec's emissions decreased by two per cent while Saskatchewan realized the highest increase in emissions (67 per cent) (see Figure 3). In absolute emissions since 1990, the most growth has occurred in Alberta (68 Mt) while the greatest decrease has occurred in Ontario (5 Mt).

FIGURE 3
TERRITORIAL AND PROVINCIAL GHG EMISSIONS, 1990 AND 2010



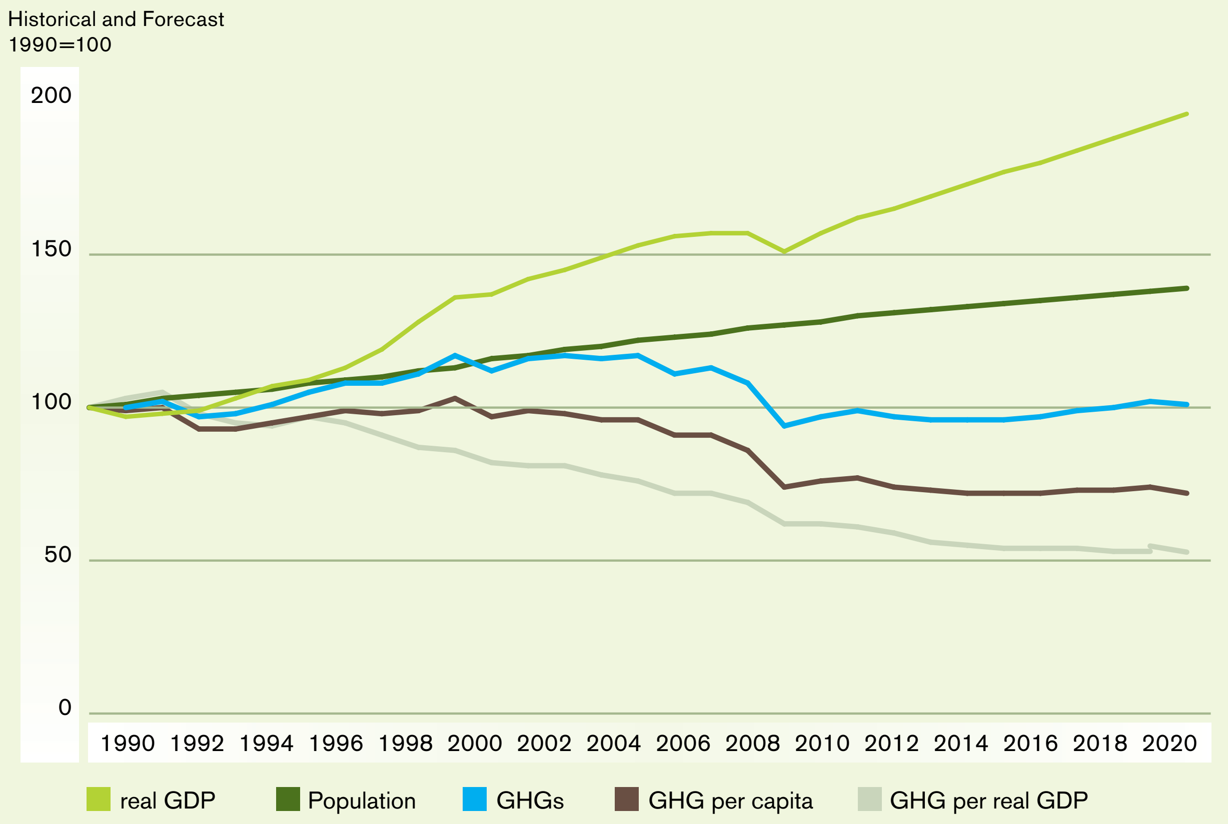
2 In June 2012, British Columbia released their Greenhouse Gas Inventory Report 2010, in which they identified a significant discrepancy in the "Fossil Fuel Production and Refining" line item of the 1990-2010 NIR. As the discrepancy was due to a data automation issue that was not identified before the NIR was published, this appendix uses a revised estimate for B.C. (and therefore total Canadian) emissions: an increase of 3037.5 kiltotonnes CO2 eq in 2010.

TABLE 2
EMISSION CHANGES BY SECTOR (ONTARIO)

ECONOMIC SECTOR	DESCRIPTION
Transportation 1990: 45.5 Mt 2010: 59.8 Mt Change: +31%	Road transportation was responsible for the greatest increase in Ontario's emissions between 1990 and 2010. This long-term increase can be attributed to 30 per cent growth in the on-road vehicle population and the increased consumer preference for SUVs, vans and pick-ups (which more than doubled over this period) over smaller passenger vehicles. Higher emissions also reflect the national trend toward just-in-time delivery, requiring more transportation per product.
Industry 1990: 63.2 Mt 2010: 44.5 Mt Change: -30%	Significant improvements in energy efficiency since 1990 have resulted in greenhouse gas reductions as industries responded to increased energy costs and global competitiveness.
Buildings 1990: 26.3 Mt 2010: 29.2 Mt Change: +11%	Long-term increases in this sector are due to economic changes and population growth. Emissions from commercial and institutional buildings have increased 18 per cent due to a shift in the provincial economy from a manufacturing base to a diversified service industry including finance, insurance and real estate. Residential emissions increased by seven per cent while the population increased by 28 per cent.
Electricity 1990: 25.1 Mt 2010: 19.8 Mt Change: -21%	Emissions in Ontario's electricity and heat generation sector grew between 1990 and 2000 (an increase of approximately 70 per cent). Significant decreases after 2007 (40 per cent by 2010) have been achieved primarily through the phasing out of coal-fired generation, increasing of renewables and conservation initiatives in the industrial, residential and commercial sectors.
Agriculture 1990: 10.0 Mt 2010: 10.3 Mt Change: +4%	Emissions from agriculture have remained relatively constant with slight fluctuations resulting from a combination of changing tilling and nutrient management techniques and livestock levels.
Waste 1990: 6.2 Mt 2010: 7.6 Mt Change: +24%	Waste emissions increased primarily due to increases in landfill gas which is generated from waste disposed in landfill sites both recently and in past decades.

It is important to note that, while Ontario's total emissions decreased by three per cent between 1990 and 2010, both emissions per capita and emissions for each dollar of real Gross Domestic Production (GDP) have declined by a much greater amount (24 percent and 38 per cent respectively; see Figure 4). This indicates an ongoing trend towards a lower-carbon economy and society, which our modelling suggests will continue.

FIGURE 4
EMISSION INTENSITIES INDICES



Ontario's intensities are significantly lower than most provinces. Table 3 shows 2010 emissions per capita and per dollar of real GDP across Canada.

TABLE 3
PROVINCIAL/TERRITORIAL GHG INTENSITIES

PROVINCE/ TERRITORY	GHG INTENSITY (Mt/$B GDP)	RANK (GHG INTENSITY)	GHG PER CAPITA (t/CAPITA)	RANK (GHG PER CAPITA)
YT, NWT, NU	0.18	1	18.99	7
QC	0.34	2	10.37	1
ON	**0.37**	**3**	**12.95**	**2**
BC	0.41	4	13.04	3
MB	0.53	5	16.05	5
PE	0.57	6	13.67	4
NL	0.59	7	17.33	6
NS	0.79	8	21.54	8
NB	0.88	9	24.68	9
AB	1.55	10	62.70	10
SK	2.12	11	69.05	11

NB: GDP is measured in 1997 dollars.

Short-Term Trends in Ontario's Emissions (2007–2010)

Between 2007 (when the Climate Change Action Plan was first released) and 2010, Ontario's emissions decreased by 14 per cent – a decline of 29 Mt. Table 4 shows emissions decreased across all major sectors. The electricity sector saw a 40 per cent reduction in emissions, the largest decrease. The second largest decrease was in the industrial sector where emissions fell by 23 per cent. These reductions are largely attributable to reduced coal-fired electricity generation and a decline in both output and emission intensity in energy-intensive industries. Both residential and commercial buildings also reduced their emissions from heating, despite increases in total floor space. This is due to ongoing successful natural gas demand management programs, and the residential retrofit program; however, economic activity likely affected these emissions as well.

TABLE 4 CHANGES IN ONTARIO'S EMISSIONS (2007–2010) (MT CO_2 EQ)			
SECTOR	2007	2010	VARIATION (2007–2010)
Transportation	58.0	59.8	3%
Industrial	58.0	44.5	-23%
Buildings	33.0	29.2	-12%
Electricity	33.0	19.8	-40%
Agriculture	10.0	10.3	4%
Waste	7.9	7.6	-4%
Total	**200.0**	**171.3**	**-14%**

Emission Modelling Overview

Reporting on the progress of Climate Change Action Plan initiatives and projecting future GHG emissions are essential to understanding Ontario's progress towards meeting its action plan targets. It should be noted, that emission forecasts are only one measure of progress on climate change actions. Decarbonization is achieved through steady, ongoing reductions in the key drivers of energy use (particularly fossil fuels) and non-energy emissions. Incremental progress in these areas is best assessed by looking at a variety of indicators – quantitative ones like emission forecasts, but also changes in emission intensities, building densities, vehicle kilometres travelled, etc. – along with qualitative assessments of the nature and resilience of socioeconomic changes. Finally, most of the important initiatives (public transit infrastructure, building energy efficiency, vehicle efficiency improvements, and land use) take decades until their peak impacts are felt.

Ontario's approach to modelling GHG emissions is updated periodically to incorporate the latest data available and refinements based on best practices. In addition, the projections of emission reductions are adjusted as required to incorporate changes to programs or policies. This modelling uses the most recent NIR data (April 2012) from Environment Canada and economic and demographic forecasts from February 2012 by Informetrica.

This information was used to create:

1. A Business-as-Usual (BAU) projection – a projection that assumes underlying historical emission trends continue (excluding the anticipated future impact of emission reduction initiatives, both planned and already underway), while taking account of the current economic outlook for Ontario;

2. A Climate Change Action Plan projection – a projection that includes the anticipated future impact of emission reduction initiatives (both those that are underway and those that are committed to and sufficiently developed to reasonably estimate their impacts).

Third-Party Validation

To provide confidence in the province's long-term forecasts, Ontario has had its emissions forecasting methodology and assumptions validated by an independent third party. In 2009, Ontario was the first jurisdiction to undertake a validation of its forward-looking emission reduction forecasts. The process of completing a validation is intended to ensure that the methodologies, data sources and assumptions used to develop the projected GHG emissions under the action plan are reasonable and align with best practices where available. For this report, Ontario retained Navius Research Inc., who concluded that Ontario's estimates are a fair representation of those expected using current best practices in GHG emissions forecasting and evaluation of GHG mitigation programs (see Appendix C for assurance statement).

Updated Emissions Projection

Since the release of the last climate change progress report, the province's emission forecasting model has been updated to reflect the best available information.

The government is now projecting that the suite of initiatives will achieve approximately 90 per cent of the reductions needed to meet the 2014 target. The forecasts show a slight improvement over those in the last report (see Table 5). Changes in forecasted emissions reflect revisions to modelling[3], changes to the BAU scenario (see below) and new data on program participation and effectiveness.

TABLE 5
PROGRESS TO TARGETS

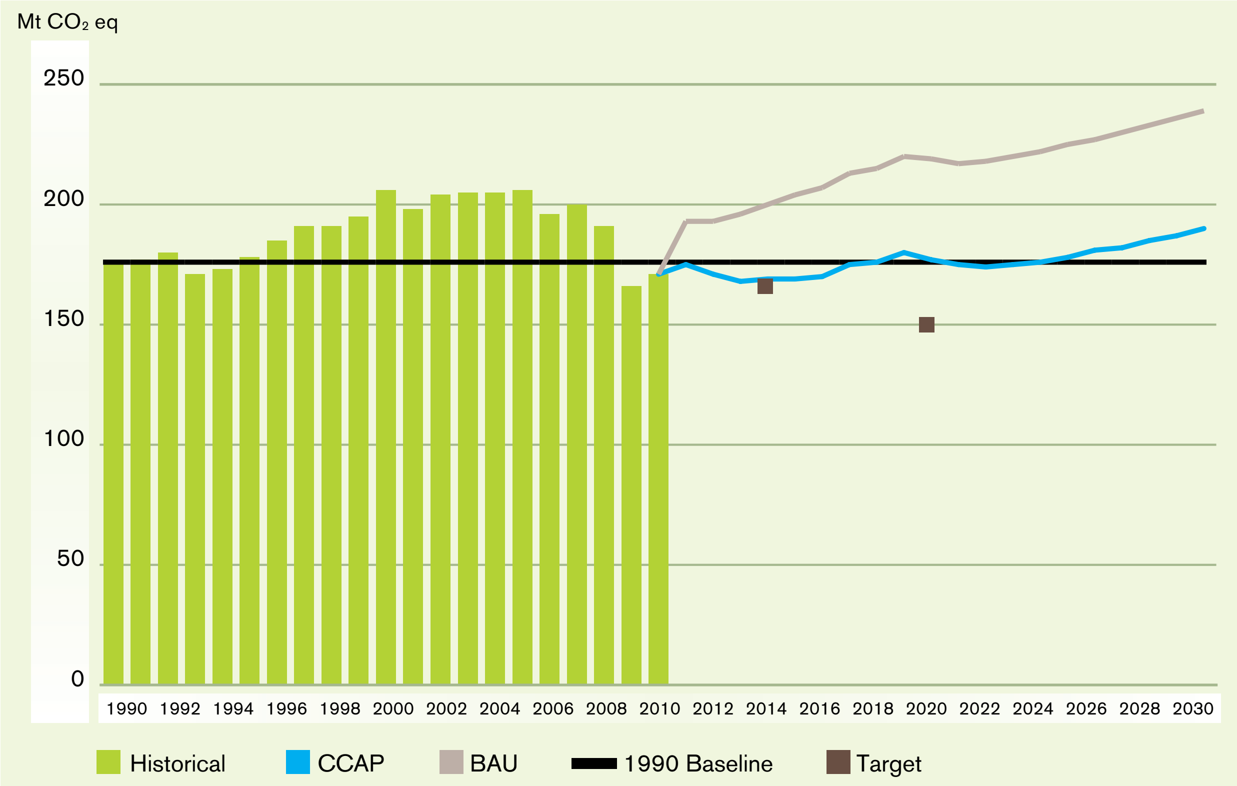
2012 REPORT	2014	2020
Projected Reductions (Mt)	31	42
Progress to Target	91%	60%
Gap (Mt)	3	28
2011 REPORT	**2014**	**2020**
Projected Reductions (Mt)	27	39
Progress to Target	88%	57%
Gap (Mt)	4	30

Updating the BAU

The province's BAU scenario has been updated to reflect more recent emission and energy use data, revisions to historical data from Environment Canada and Natural Resources Canada, revised economic and demographic forecasts and refinements to the underlying model.

3 The most significant methodological change was in how ethanol in blended gasoline is both reported and forecast. In the last report, the NIR data used did not account for ethanol in motor gasoline and the model did not forecast emission reductions from higher ethanol blending due to Ontario's ethanol regulation (although in place at the time). A change to using an average of historical emission factors of coal in generating electricity also significantly increased the BAU emissions from electricity, as recommended by the validator.

FIGURE 5
FORECASTED GHG EMISSIONS



Initiative Impacts

The province's suite of initiatives represent a combination of distinct GHG reduction efforts, such as provincial regulation requiring methane from landfills to be captured, and clusters of related efforts aimed at achieving a common goal, such as the phase-out of coal-fired electricity generation and related renewable generation and conservation activities. The initiatives cross all of the emission sources and economic sectors and represent a blend of short-, medium- and long-term emission reductions. The initiatives include activities that are both within and outside the direct control of the Ontario government and include federal policies that are closely interrelated with provincial initiatives.

TABLE 6
EMISSION REDUCTIONS BY INITIATIVE (SECTOR TOTALS)

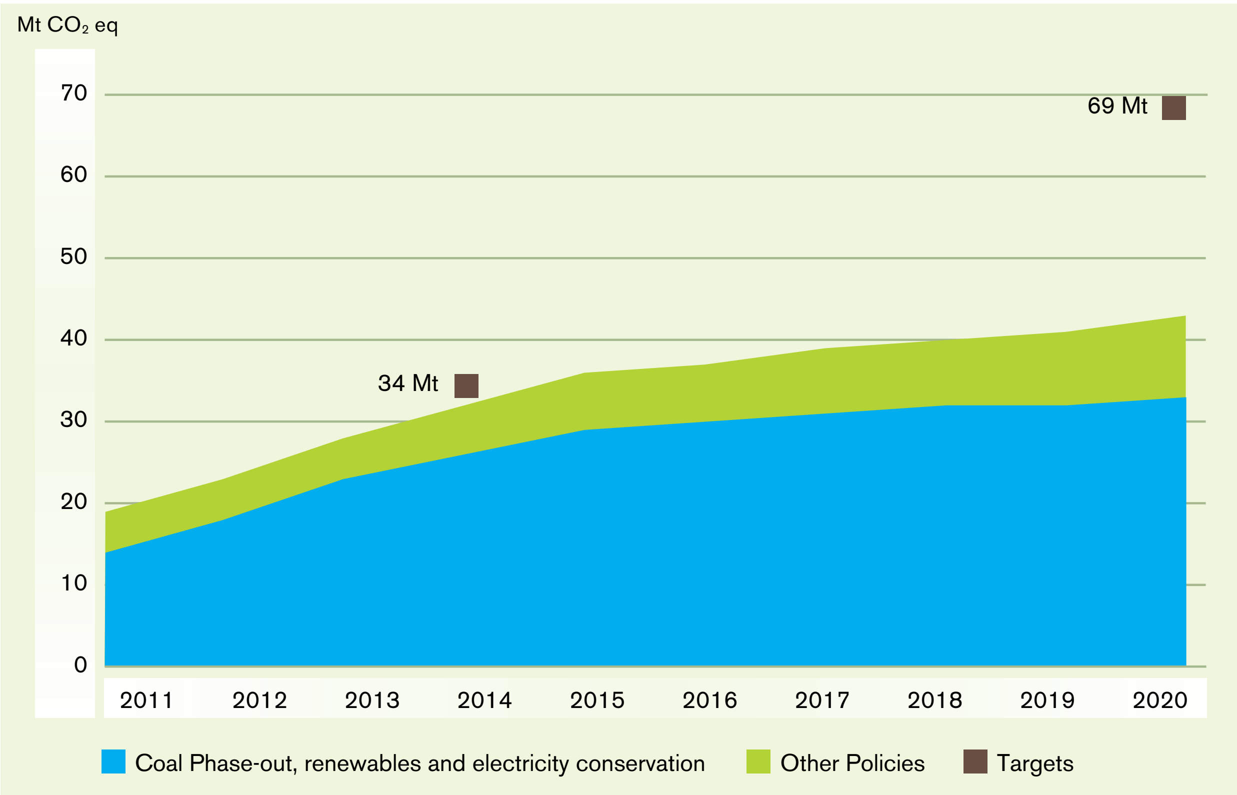
SECTOR	INITIATIVE	PROJECTED REDUCTIONS (MT)	
		2014	2020
Transportation	• The Big Move regional transportation plan and Growth Plan for the Greater Golden Horseshoe[4] • Passenger vehicle efficiency regulations • Freight truck speed limiter regulation • Municipal hybrid bus purchase and Green Commercial Vehicle Programs • Ontario ethanol regulation	1.9	3.9
Industry	• Natural gas demand side management programs	0.6	1.0
Buildings	• The Growth Plan for the Greater Golden Horseshoe • Natural gas demand side management programs • Building Code changes	1.6	2.9
Electricity	• Long-Term Energy Plan: Coal phase-out; the Feed-In Tariff; residential, commercial and industrial conservation programs; and related electricity policies	24.8	31.6
Agriculture and Waste	• Biogas Financial Assistance Program • Landfill gas capture regulation	1.8	2.0
	All initiatives	30.6	41.3

NB Emission reductions for all initiatives together may differ from the sum of individual initiative reductions due to interaction between them.

Phasing out coal-fired electricity generation and replacing it with renewable power, natural gas, refurbished nuclear and energy conservation has by far the largest impact in the near future (see Figure 7). After 2020, however, impacts from initiatives in the transportation and building sectors will increase relative to those from the electricity sector because of the time required for construction (transit projects) and turnover (vehicle fleets, housing stock).

4 The regional transportation plan is an official long-term plan, produced by Metrolinx. However, capital projects are approved and funded individually as the plan is implemented over 25 years and may be subject to change. Therefore, modelling for this initiative is inherently more uncertain than for other initiatives.

FIGURE 7
REDUCTIONS BY SOURCE



Uncertainty

The reductions presented in this report, linked to the government's GHG emission reduction measures, are based on a single set of economic, demographic, energy, and policy assumptions. As with any modelling of this kind, there are significant uncertainties inherent in this projection.

As a rough example, if in 2020 both real GDP and population were one per cent higher than forecasted, the projected non-electricity emissions would be approximately 1.5 Mt greater (almost one per cent of non-electricity emissions). This change is a generalized effect. The increase could be significantly higher or lower depending, for example, on whether energy-intensive manufacturing output is higher than the service sector. Electricity emissions are sensitive to weather – more frequent hot summer afternoons (especially combined with higher GDP) would increase emissions much further.

PURPOSE, NEED, AND TIMING

Introduction

1. The intent of this section is to provide a summary of the purpose of the GTA Project and the needs met through the construction of the proposed facilities. In Exhibit A, Tab 3, Schedule 8, the justification for bringing forth the GTA Project Application for Leave to Construct to the Ontario Energy Board (the "Board") at this time will be discussed.

2. Segments A and B are described in detail at Exhibit A, Tab 3, Schedule 6. The existing Extra High Pressure ("XHP") infrastructure is further described in Exhibit A, Tab 3, Schedule 2. The GTA Project Influence Area is later described in Exhibit A, Tab 3, Schedule 4. An overview map of the XHP distribution system with the proposed GTA Project facilities is provided in Figure 1. Major pipelines discussed in this Application are also noted on the map, which includes the NPS 36 "Parkway North", NPS 36 Mississauga Southern Link ("MSL"), NPS 30 "Don Valley", and the NPS 26 lines.

Purpose and Need

3. The GTA Project has multiple purposes intended to address multiple needs. At the highest level, the purpose of the GTA Project is to reinforce the XHP system to manage operational risks and meet growth needs, in a prudent manner. The specific elements are detailed below.

4. The GTA Project will:

    a. Meet customer growth requirements over the period from 2015 to 2025 by reinforcing the XHP distribution network;

b. Reduce operational risks and enhance safety and reliability by:
   i. Improving diversity and flexibility of the distribution system through additional looping of single feed XHP lines and providing additional supply sources for the major XHP lines in the GTA Project Influence Area; and
   ii. Providing the ability to lower pressures on key supply lines;

c. Provide entry point diversity by reducing the dependence upon Parkway Gate Station which currently provides more than 50% of the supply to the GTA Project Influence Area and does not have alternate means of supply; and

d. Improve supply chain diversity, reduce upstream supply risks and reduce gas supply costs over the period 2015 to 2025.

5. The following evidence will discuss each of the above elements. Table 1 on the following page provides a summary of the nature of the benefits associated with each element of the GTA Project.

ENBRIDGE GAS DISTRIBUTION INC. RESPONSE TO
ENVIRONMENTAL DEFENCE INTERROGATORY #34

INTERROGATORY

Interrogatory No. A.1-ED-34 Reference: Ex. A, Tab 3, Schedule 1, Page 5 & 6

The second purpose for the project is described at pages 5 and 6 of Exhibit A, Tab 3, Schedule 1, and is summarized as follows at page 2:

> "4. The GTA Project will: …
>
> b. Reduce operational risks and enhance safety and reliability by:
>
> i. Improving diversity and flexibility of the distribution system through additional looping of single feed XHP lines and providing additional supply sources for the major XHP lines in the GTA Project Influence Area; and
>
> ii. Providing the ability to lower pressures on key supply lines;"

a) Please identify and describe all minimum system standards relating to operational risks, safety, and reliability that Enbridge will fail to meet if this project is not built.

b) If customer growth requirements could be completely met through DSM alternatives, would the project be necessary to meet minimum system standards relating to operational risks, safety, and reliability? Please explain your answer and identify and describe any such minimum system standards.

c) If customer growth requirements could be completely met through DSM alternatives, could certain portions of the project be avoided or deferred while still meeting minimum system standards relating to operational risks, safety, and reliability? Please explain and justify your answer.

RESPONSE

(a) Enbridge operates all of its pipelines facilities to meet or exceed minimum codes, regulations, and standards. There are no minimum standards relating to operational risk, safety and reliability that will not be met if this project does not proceed.

Witnesses: C. Fernandes
N. Thalassinos

(b) The Company does not believe that load growth can be met through efficiency gains, please refer to Environmental Defense Interrogatory #20 at Exhibit I.A4.EGD.ED.20. The project is not justified based on meeting minimum safety standards. The project addresses many needs as identified in Exhibit A, Tab 3, Schedule 1, Paragraph 4 of the pre-filed evidence. With regards to operational risk and safety specifically, the TSSA recently released the Oil and Gas Pipeline Systems Code Adoption Document Amendment FS-196-12 which directs companies such as Enbridge to implement risk reduction activities for higher risk assets. This project is consistent with the directives of the Code Adoption Document.

(c) The Company does not believe that load growth can be met through efficiency gains, please refer to Environmental Defense Interrogatory #20 at Exhibit I.A4.EGD.ED.20. In order to meet all of project objectives, there are no sections of this project that could be deferred. The justification for the project is multi-faceted as explained in Exhibit A, Tab 3, Schedule 1, Paragraph 4 of the pre-filed evidence. The project in it’s entirely is required to achieve these objectives.

Witnesses: C. Fernandes
N. Thalassinos

MARBEK
Resource Consultants Ltd.

Natural Gas
Energy Efficiency Potential: Update 2008

Residential, Commercial and Industrial Sectors
Synthesis Report

Submitted to:

Enbridge Gas Distribution

Submitted by:

Marbek Resource Consultants Ltd.

September 2009

Marbek Resource Consultants Ltd.
300-222 Somerset Street West, Ottawa, ON K2P 2G3
Tel: 613.523.0784 • Fax: 613.523.0717 • www.marbek.ca

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Note: Report analysis substantially completed in December 2008.

1. INTRODUCTION

1.1 BACKGROUND AND OBJECTIVES

Enbridge Gas Distribution (Enbridge) is the largest natural gas utility in Canada with 1.9 million residential, commercial and industrial customers. Enbridge is a regulated utility with a Service Area in central and eastern Ontario that includes the cities of Toronto and Ottawa and the Niagara Region. Enbridge distributes approximately 13 billion m^3 of natural gas to its customers annually.

Since 1995, Enbridge has been delivering demand side management (DSM) programs to its customers following a decision of the provincial regulator, the Ontario Energy Board (OEB). Enbridge offers DSM programs to all customer rate classes and across all sectors.

Enbridge has been participating in a market of increasing DSM program maturity. This market is continually evolving in its engagement with energy efficiency through growing voluntary initiatives and more stringent codes and standards. In addition, changes in the economy have started to have negative impact on the commercial and industrial marketplace in Enbridge's Service Area.

In the DSM Generic Proceeding held in 2006, Enbridge committed to creating an updated Market Potential Study for input into the next DSM plan. When completed, the results of this Natural Gas Energy Efficiency Potential Study will provide a foundation that Enbridge can use to guide the development of its longer-term DSM strategy, including new programs. More specifically, this includes support for Enbridge's filing to the OEB regulatory application for the next multi-year DSM plan by:

- Estimating the achievable and economic potential for DSM measures across all applicable technologies, markets and sectors in Enbridge's Service Area
- Giving shape to, and refining ongoing energy-efficiency work by Enbridge in order to develop its next multi-year DSM plan, and
- Provide information that is actionable and can be easily converted to plan and program development.

1.2 STUDY SCOPE

This current study (Update 2008) is an update of the earlier Natural Gas Efficiency Potential Study that was completed for Enbridge in 2006. Consequently, to the extent possible, this study employs the same methodology, sector definitions, facility archetypes and geographical coverage as in the previous study. Additional details are provided below:

- **Sector Coverage:** The study addresses three sectors: Residential, Commercial[1] and Industrial.

[1] Throughout this report the term "Commercial" also includes institutional sectors, such as schools, hospitals, etc., unless otherwise noted.

- **Geographical Coverage**: The study results are presented for the total Enbridge Service Area and for two service regions: Central and Eastern. The study results are presented at the level of individual service region due to differences in building stock and weather conditions (heating degree days) that exist in the two regions.

  The Central service region is dominated by the Greater Toronto Area, but also includes customers in the Niagara region. Major municipalities in the Central service region include: Metropolitan Toronto (01), Mississauga (21), Richmond Hill (35), Whitby (45), and Niagara (76). The Eastern region is dominated by the City of Ottawa. Major municipalities in the Eastern service region include: Peterborough (47), Barrie (53), and Ottawa (65).

- **Study Period**: This study covers a 10-year period. The Base Year is the calendar year 2007, with milestone periods at five-year increments: 2012 and 2017. The Base Year of 2007 was selected, as this was the most recent calendar year for which complete customer data were available.

- **Technologies:** The study addresses the full range of natural gas energy efficiency measures together with selected renewable energy technologies that are currently commercially available, or are expected to be available within the first 5 years of this study period.

  The study also provides a high-level treatment of selected emerging technologies. Although it is not expected that these emerging technologies will significantly affect results in this study period, they provide insight into possible future directions that may influence the market for higher efficiency products.

1.2.1 Caveats

Readers are reminded of the following caveats when reviewing the results presented in this report:

- Energy Efficiency Potential studies, such as this one, provide a "big picture" assessment of the scope of energy efficiency opportunities within a specific service area. They are particularly valuable in identifying the level of aggregate savings, the key measures involved, their costs and the relative priority of individual sub markets and technologies. Because these studies must assess literally hundreds of combinations of technologies and sub markets, the assessment is necessarily high level. As such, these study results are intended to provide a foundation for detailed program design, but it must be emphasized that detailed program design requires substantial additional analysis.

- During the completion of this study, the world economy entered a period of unprecedented uncertainty that may have significant impact on the results of this study, particularly in the short term. For example, key factors underlying Enbridge's load forecast and the study's Reference Case such as gross domestic product (GDP), energy prices, new construction etc. may change. The net effect of these changes would be lower levels of future natural gas consumption. Similarly, the participation rates estimated during the Achievable Potential workshops do not explicitly take into account changes in consumer outlook as a result of the economic downturn. Although neither the extent nor the duration of the economic downturn is known at this time, the expected impact would be lower consumer spending and, hence, lower program participation rates than those presented in this report. The precise magnitude of the reduced program participation is unknown at this time.

- The analysis was conducted based on the current and expected future participation of other industry partners such as the federal government, led by Natural Resources Canada, the Ontario government, and the Ontario Power Authority (OPA). At the time of this writing, the future energy efficiency strategies and complementary programs to be pursued by these agencies is not certain. Over the duration of this forecast, impacts due to the changing roles of industry partners should be assessed from time to time and, in particular, should be included within Enbridge's following multi-year plan.

- The inclusion of natural conservation in the study's Reference Case does address some, but not necessarily all, free rider and spillover impacts. A more detailed assessment of free rider impacts is practical only as part of a detailed program design, which is beyond the scope of this study.

- As in any study of this type, the results presented in this report are based on a large number of important assumptions. Assumptions such as those related to the current and forecast costs of natural gas, the current penetration of energy efficient technologies, the rate of future economic growth and customer willingness to implement new energy efficiency measures are particularly influential. Wherever possible, the assumptions used in this study are consistent with those used by Enbridge and are based on best available information, which in many cases includes the professional judgement of the consultant team, client personnel and/or local experts. The reader should use the results presented in this report as best available estimates; major assumptions, information sources and caveats are noted throughout the report.

1.3 DEFINITIONS

This study employs numerous terms that are unique to analyses such as this one and consequently it is important to ensure that all readers have a clear understanding of what each term means when applied to this study. Below is a brief description of some of the most important terms.

Base Year Natural Gas Use The Base Year is the starting point for the analysis. It provides a detailed description of "where" and "how" natural gas is currently used in each sector. The bottom up profile of energy use patterns and market shares of energy using technologies was calibrated to actual Enbridge customer sales data.

Reference Case Forecast The Reference Case is a projection of natural gas consumption to 2017, in the absence of any new Enbridge DSM market interventions after 2008. It is the baseline against which the scenarios of energy savings are calculated. The Reference case forecast incorporates an estimation of "natural conservation", namely, changes in end use efficiency over the study period that are projected to occur in the absence of new market interventions by Enbridge.

Measure Total Resource Cost The Measure TRC calculates the net benefits that result from an investment in an efficiency technology or measure. The measure TRC is equal to its full or incremental capital cost (depending on application) plus any change (positive or negative) in the combined annual energy, water and equipment O&M costs. This calculation includes, among others, the following inputs: the avoided natural gas, electricity and water supply costs, the life of the technology, and the selected discount rate, which in this analysis has been set at 9.14%.

The Measure Total Resource Cost (TRC) test is the primary determinant of whether a measure is included in the economic potential.

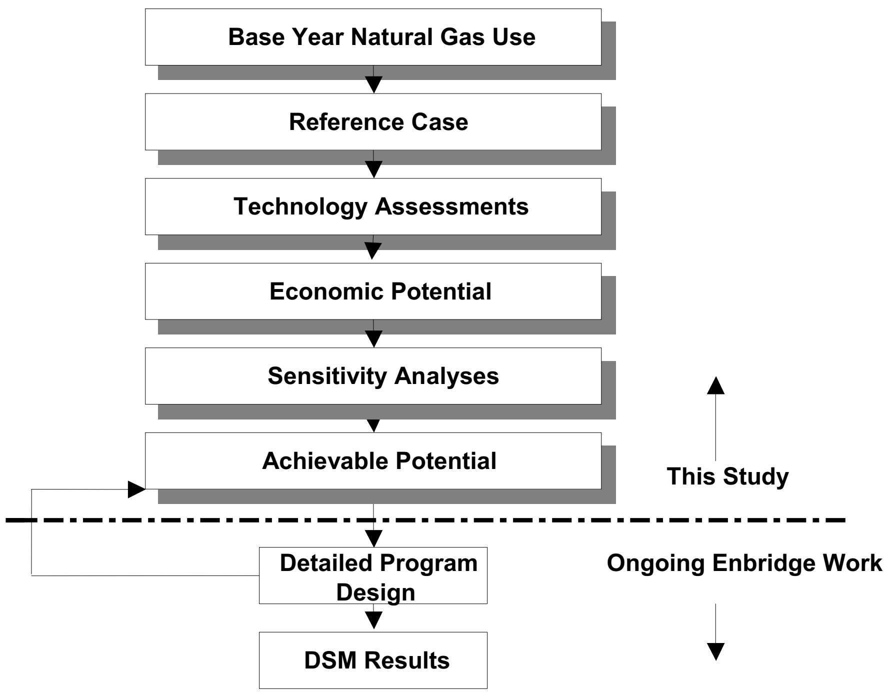
Economic Potential Forecast The Economic Potential Forecast is the level of natural consumption that would occur if all equipment and building envelopes were upgraded to the level that is cost-effective from Enbridge's perspective. All the energy efficiency technologies and measures that have a positive measure TRC are incorporated into the Economic Potential Forecast. These technologies and measures are applied at either natural stock turnover rates or at designated years for immediate application.

Achievable Potential The Achievable Potential is the proportion of the natural gas savings identified in the Economic Potential Forecast that could realistically be achieved within the study period. Achievable Potential recognizes that it is practically difficult to induce customers to purchase and install all the efficiency technologies that meet the criteria defined by the Economic Potential Forecast.

1.4 APPROACH

To meet the objectives outlined above, the study was conducted through an iterative process that involved a number of well-defined steps. At the completion of each step, the client reviewed the results and, as applicable, revisions were identified and incorporated into the interim results. The study then progressed to the next step. A summary of the steps is presented in Exhibit 1.1 and briefly discussed below.

Exhibit 1.1: Major Study Steps



Step 1: Develop Base Year Calibration Using Actual Enbridge Sales Data

The Base Year (2007) is the starting point for the analysis. It provides a detailed description of "where" and "how" natural gas is currently used, based on actual natural gas sales.

The consultants compiled the best available data and used sector-specific macro models to estimate natural gas use; they then compared the results to the Enbridge's actual billing data to verify their accuracy.

Step 2: Develop Reference Case

The Reference Case uses the same sector-specific macro models to estimate the expected level of natural gas consumption that would occur over the study period with no new (post-2007) Enbridge DSM initiatives. The Reference Case includes projected increases in natural gas consumption based on expected rates of population and economic growth, using the growth rates included in the Enbridge 2007 load forecast. The Reference Case also makes an estimate for some "natural" conservation, that is, conservation that occurs without Enbridge DSM programs. The Reference Case provides the point of comparison for the calculation of Technical, Economic and Achievable natural gas saving potentials.

Step 3: Assess DSM Technologies

The consultants researched a wide range of commercially available DSM technologies and measures that can enable the Enbridge customers to use natural gas more efficiently. For each DSM technology or measure, the consultants calculated a value for the net benefits per year per cubic meter (m^3) of saved natural gas, referred to as the measure Total Resource Cost (TRC).

This approach allowed the consultants to compare the measure TRC benefits with other natural gas efficiency technologies and measures, and to determine whether or not to include the DSM measure in the Economic Potential Forecast. Only technologies and measures with positive TRC benefits were included in the Economic Potential Forecast.

Step 4: Estimate Economic Natural Gas Savings Potential

The Economic Potential Forecast incorporates all "cost-effective" DSM measures reviewed in Step 3. To forecast the potential natural gas savings that are defined as economic, the consultants used the sector-specific macro models to calculate the level of natural gas consumption that would occur if Enbridge's customers installed all "cost-effective" technologies. "Cost effective" for the purposes of this study means that the measure has a positive measure TRC.

Step 5: Conduct Sensitivity Analysis

The results presented in the Economic Potential Forecast are sensitive to the assumptions employed. Consequently, in consultation with Enbridge personnel, the Economic Potential results were subjected to a sensitivity analysis around two assumptions:

- **Technology Costs:** The Economic Potential Forecast was re-run using the most energy efficient technologies and measures assessed in Step 3, regardless of their current capital and installation costs (i.e., the most efficient technologies were included, even if they had a negative measure TRC value).[2] However, to ensure a measure of practical reality and basis for comparison with the preceding economic potential results, the technology adoption rates employed in this analysis are the same as those defined in the preceding economic potential forecast.

[2] In Enbridge's previous (2004) DSM Potential study, this analysis was reported as a separate Section entitled Technical Potential. The method and assumptions applied to current sensitivity analysis are the same as in the previous (2004) Technical Potential analysis.

- **Value of GHG Emissions**: The natural gas avoided cost values that were used to determine the measure TRC results presented in Step 4 do not include a value for greenhouse gas (GHG) emissions. However, the Government of Ontario has committed to aggressive GHG reduction targets. In this future context, it is not unreasonable to expect that future measure TRC calculations may incorporate a greenhouse gas (GHG) adder that accounts for carbon dioxide emissions resulting from natural gas consumption. Consequently, the measure TRC calculations were re-run using an avoided supply cost value that incorporates a GHG adder.

  The value of the GHG adder was set at \$15/tonne CO_2e (per tonne of CO_2 equivalent emissions) for the period 2007 to 2012 and \$20 /tonne CO_2e for the period 2013-2017. An emissions coefficient of 0.001903 tonnes CO_2e/m^3 (1903 g CO_2e/m^3) is used to account for carbon dioxide emissions resulting from natural gas consumption, while an emissions coefficient of 0.000220 tonnes CO_2e/kWh (220 g CO_2e/kWh) represents the average carbon dioxide emissions from electricity production in Ontario.[3, 4]

Step 6: Estimate Achievable Natural Gas Savings Potential

The Achievable Potential is the proportion of the savings identified in the Economic Potential Forecast that could realistically be achieved within the study period. The study assessed achievable natural gas savings potential from two perspectives:

- ***Potential Savings in Future Natural Gas Consumption:*** For this perspective, the study calculated the change in natural gas consumption levels that could occur in a given milestone year due to the aggregate impact of **all** measures implemented over the period from the Base Year (2007) to the Milestone Year (2012 or 2017). This perspective provides Enbridge Gas with an estimate of future natural gas consumption under different levels of DSM investment.

  This portion of the analysis calculated savings relative to the Reference Case (i.e., no new DSM), which is consistent with the approach used to estimate savings under the Economic Potential forecast and the sensitivity analyses described above in Steps 4 and 5.

- ***Potential DSM Program TRC Benefits***: For this perspective, the study calculated the potential natural gas savings in accordance with the provisions defined by the Ontario Energy Board (OEB) and employed by Enbridge when submitting its DSM plan to the OEB. This perspective emphasizes the estimation of net TRC benefits and the annual natural gas savings presented are due to those measures installed in (only) a given milestone year (i.e., 2012 or 2017).

[3] Based on emission factors and Global Warming Potentials (GWPs) presented in Environment Canada, National Inventory Report (1990-2005): Greenhouse Gas Sources and Sinks in Canada", pgs. 23 and 583, April 2007.

[4] Based on Ontario emission factors presented in Environment Canada, National Inventory Report (1990-2005): Greenhouse Gas Sources and Sinks in Canada", pg. 521, April 2007.

Within each of the above perspectives, the analysis of Achievable Potential was assessed under four different Marketing scenarios:

- One Financially Unconstrained scenario
- Three Financially Constrained scenarios, each limited by a different annual program budget, which for this study were set at $20 million, $40 million and $60 million.

Data on the costs and savings for each measure were combined with participation rates identified in the achievable workshops to generate measure-by-measure estimates of potential savings. These results were then compiled into a table and ranked according to TRC benefits per program dollar from least cost to most costly. From this table it was then possible to identify the most cost effective portfolio of measures at the $20 million, $40 million, $60 million and Financially Unconstrained budget levels together with the annual natural gas savings and net TRC benefits associated with each program budget level.[5]

The potential savings in future natural gas consumption were then calculated by selecting only those measures contained in the above table that passed at each budget level and milestone year. That package of measures was then applied in each of the sector models and the results were compared with those in the Reference Case and Economic Potential forecasts.

Further information on each of the Marketing scenarios is provided in each of the sector specific sections of this report.

1.5 STUDY ORGANIZATION AND REPORTS

The study was organized and conducted by sector using a common methodology, as outlined above. Following this introductory section, the remainder of this Synthesis Report is organized as follows:

- Section 2 presents the combined natural gas savings for the three sectors.
- Section 3 presents a summary of the natural gas savings for the Residential sector.
- Section 4 presents a summary of the natural gas savings for the Commercial sector.
- Section 5 presents a summary of the natural gas savings for the Industrial sector.

[5] There are numerous possible approaches to the selection of program measures; this approach was selected for simplicity and clarity.

2. SUMMARY OF STUDY FINDINGS

The study findings confirm the existence of significant remaining cost-effective natural gas DSM opportunities in the Residential, Commercial and Industrial sectors within Enbridge's service area.

2.1 TOTAL NATURAL GAS SAVING POTENTIAL

As presented previously in Section 1, the study estimated natural gas savings potential from two perspectives.

- **Potential Savings in Future Natural Gas Consumption** – This perspective estimates the reductions in future natural gas consumption based on the aggregate impact of DSM measures implemented over the study's 10-year time period.
- **Potential DSM Program TRC Benefits –** This perspective estimates the total lifetime savings due to those measures installed in (only) a given milestone year (i.e., 2012 or 2017). This is the method employed in the calculation of net TRC benefits and is part of the DSM program portfolio design process.

The savings associated with each perspective are summarized below.

2.1.1 Potential Savings in Future Natural Gas Consumption

Exhibits 2.1 and 2.2 provide a summary of the total annual natural gas consumption levels contained in each of the forecasts addressed by the study.[6]

Exhibits 2.3 and 2.4 provide a summary of the potential natural gas savings under each of the potential scenarios; in each case savings are presented in both volumetric (m^3) and percentage terms. In each case the savings shown are annual and are based on the aggregate impact of measures installed in prior years within the period when compared to the Reference Case consumption levels.

As illustrated in Exhibits 2.1 to 2.4, inclusive, Achievable Potential savings increase only marginally beyond the $40M scenario. Based on the Achievable Potential workshop results, few additional savings were identified in the $60M scenario and Financially Unconstrained scenarios, while maintaining a positive TRC.

[6] Note: Actual results may not be linear as shown in Exhibits 2.1 and 2.2.

Exhibit 2.1: Graphic of Forecast Results for the Total Enbridge Service Area – Annual Natural Gas Consumption

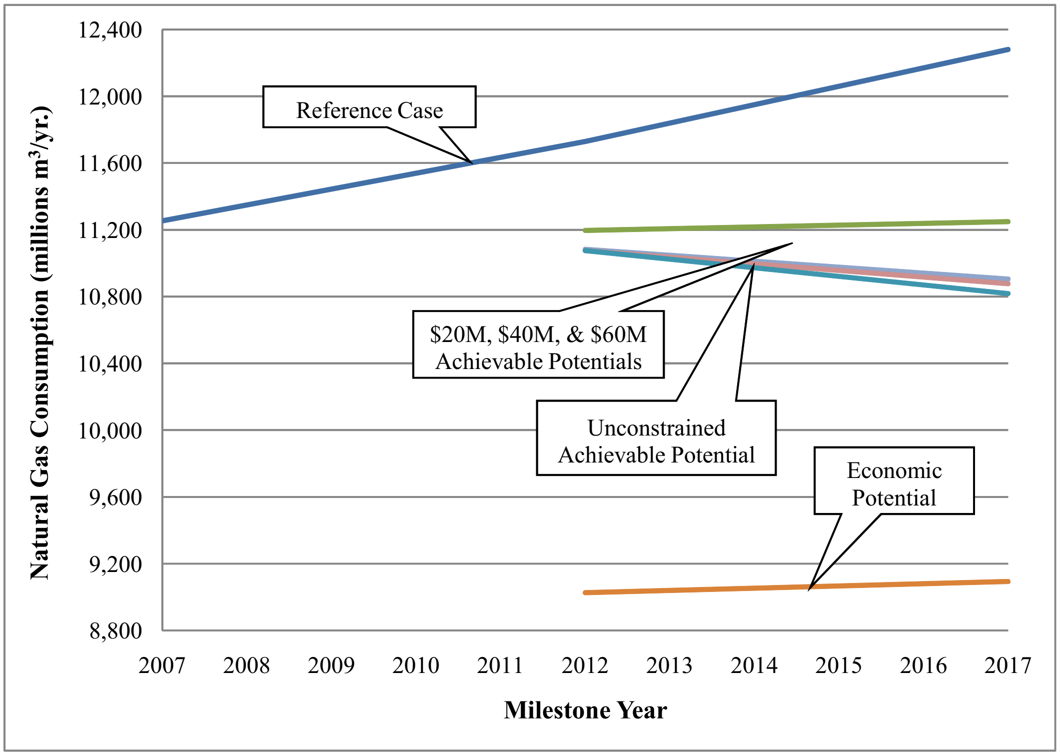


Exhibit 2.2: Total Annual Natural Gas Consumption, by Milestone Year and Forecast Scenario, 3 Sectors

Milestone Year	Total Annual Natural Gas Consumption, All Sectors (million m^3/yr.)					
	Reference Case	Economic Potential	Achievable Potential			
			$20M Scenario	$40M Scenario	$60M Scenario	Financially Unconstrained
2007	11,254					
2012	11,728	9,026	11,197	11,083	11,076	11,076
2017	12,280	9,093	11,249	10,905	10,877	10,818

Exhibit 2.3: Total Natural Gas Savings, in the Milestone Years and Forecast Scenario Relative to Reference Case and Economic Potential Forecasts, 3 Sectors

Milestone Year	Natural Gas Savings, All Sectors (million m^3/yr. vs. Ref Case, % vs. Ref. Case and Econ. Potential)				
	Economic Potential	Achievable Potential Scenarios			
		$20M Scenario	$40M Scenario	$60M Scenario	Financially Unconstrained
2012	2,703	532	645	652	652
2017	3,188	1,032	1,375	1,404	1,463
Savings as % of Reference Case Consumption					
2012	23%	5%	6%	6%	6%
2017	26%	8%	11%	11%	12%
Savings as % of Economic Potential Savings					
2012		20%	24%	24%	24%
2017		32%	43%	44%	46%

Note**:** Natural gas savings in the milestone years represent the potential reduction in gas use in that year as a result of DSM measures implemented in the period. Achievable Potential savings increase only marginally beyond the $40M scenario. Based on the Achievable Potential workshop results, few additional savings were identified in the $60M scenario and Financially Unconstrained scenarios, while maintaining a positive TRC.

Exhibit 2.4: Distribution of Natural Gas Savings, by Sector and Scenario in 2017, 3 Sectors

Sector	Natural Gas Savings, 2017 (million m^3/yr. vs. Ref Case, % of Econ. Potential Savings)				
	Economic Potential	Achievable Potential Scenarios			
		$20M Scenario	$40M Scenario	$60M Scenario	Financially Unconstrained
Residential	842	237	268	296	355
Commercial	1,427	440	715	715	715
Industrial	919	355	392	392	392
Total	3,188	1,032	1,375	1,404	1,463
Achievable Savings as % of Economic Potential Savings					
Residential		28%	32%	35%	42%
Commercial		31%	50%	50%	50%
Industrial		39%	43%	43%	43%
Total		32%	43%	44%	46%

Note**:** Natural gas savings in the milestone years represent the potential reduction in gas use in that year as a result of DSM measures implemented in the period. Achievable Potential savings increase only marginally beyond the $40M scenario. Based on the Achievable Potential workshop results, few additional savings were identified in the $60M scenario and Financially Unconstrained scenarios, while maintaining a positive TRC.

2.1.2 Potential DSM Program TRC Benefits

Exhibit 2.5 presents a summary of the forecast TRC benefits, annual program costs and natural gas savings in 2017 for each of the achievable scenarios, by scenario and sector. As noted previously, the natural gas savings shown in Exhibit 2.5 are calculated in accordance with OEB requirements for the filing of DSM plans. Therefore, the savings shown are only for the measures installed in 2017; they do not include the savings in 2017 that occur as a result of measures installed in prior years within the period.

Exhibit 2.5: Forecast Annual Achievable Program Costs[7], Savings[8] and TRC Benefits, by Scenario For Installations Completed in (only) 2017, 3 Sectors

Scenario	Forecast Achievable Program Costs and Savings, 2017				
	Annual Program Cost (millions $)	Gas Savings (million m^3/yr.)	TRC Benefits (million $)	Program Cost per Unit ($/$m^3$)	Program Cost per Unit ($/TRC$)
Residential (50% of Funding)					
$20M Annually	10.0	21.1	46.4	0.47	0.22
$40M Annually	20.0	27.0	47.2	0.74	0.42
$60M Annually	30.0	32.4	47.9	0.92	0.63
Financially Unconstrained	36.2	35.0	48.0	1.03	0.75
Commercial (30% of Funding)					
$20M Annually	6.0	48.9	168.1	0.12	0.04
$40M Annually	10.9	66.8	202.5	0.16	0.05
$60M Annually	10.9	66.8	202.5	*	*
Financially Unconstrained	10.9	66.8	202.5	*	*
Industrial (20% of Funding)					
$20M Annually	4.0	44.3	44.0	0.09	0.09
$40M Annually	4.4	48.0	44.3	0.09	0.10
$60M Annually	4.4	48.0	44.3	*	*
Financially Unconstrained	4.4	48.0	44.3	*	*
Total (3 Sectors)					
$20M Annually	20.0	114.3	258.5	0.18	0.08
$40M Annually	35.3	141.8	294.0	0.25	0.12
$60M Annually	45.3	147.3	294.7	**	**
Financially Unconstrained	51.5	149.8	294.8	**	**

** Based on the participation rates identified during the Achievable workshop results, all eligible measures are implemented at the program spending level shown.*
*** Values are not calculated as they are skewed by the Commercial and Industrial sector limits.*

2.2 OBSERVATIONS AND IMPLICATIONS

As illustrated in the preceding exhibits, despite a decade of successful DSM program implementation, there remains significant cost-effective DSM potential within Enbridge's service area. This remaining opportunity reflects, in part, continued technology cost and performance improvements over the period. Key study observations are highlighted below.

❑ Economic Potential

The study estimated economic potential savings to be approximately 3,188 million m^3 by 2017, which is approximately 26% relative to the Reference Case. This value is significantly larger than the value estimated in Enbridge's 2004 study; the change reflects a significant

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[7] Program costs do not include salary and overhead costs.

[8] The savings shown in Exhibit 2.5 are only for the measures installed in 2017; they do not include the savings in 2017 that occur as a result of measures installed in prior years within the period.

ENVIRONMENTAL DEFENSE INTERROGATORY #6

INTERROGATORY

Issue 1: "Is the 2014 DSM Budget ($32.2M) reasonable and appropriate? Should the Board determine that the DSM budget for 2014 should be increased, what are the implications and required next steps."

Interrogatory No. 1-ED-6 DSM Benefits: Protection from Energy Price Fluctuations, etc.

Reference: Ex. B, Tab 1, Schedule 2, page 3

A report by the Canadian Council of Chief Executives concluded as follows:

> Fundamentally, however, Canada needs to begin with a renewed commitment to energy conservation. We must use existing and future energy supplies as efficiently as possible, embracing the maxim that the cheapest form of energy is the unit that is not used. Better conservation practices will help to insulate Canadians from volatile energy prices, reduce costs for public institutions such as hospitals, and improve the international competitiveness of Canadian companies.

...

> The bottom line is that governments must resist the temptation to shield Canadians from higher energy prices. By any reasonable measure, energy remains a comparative bargain for Canadians.[1]

The relevant excerpts are attached for your reference.

a) Does Enbridge agree with the Council of Chief Executives that "[b]etter conservation practices will help to insulate Canadians from volatile energy prices, reduce costs for public institutions such as hospitals, and improve the international competitiveness of Canadian companies"? If no, why not?

b) Please explain how better conservation practices will help to insulate Canadians from volatile energy prices.

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[1] Canadian Council of Chief Executives, *Energy- Wise Canada, Building a Culture of Energy Conservation*, December 2011, http://www.ceocouncil.ca/wp-content/uploads/2011/12/Energy-Conservation-Paper-FINAL-December-20111.pdf, pp. 2 & 4.

c) Please explain how better conservation practices will improve the international competitiveness of Canadian companies.

d) Is the protection from volatile energy prices resulting from conservation given a dollar value and factored into the TRC analysis for DSM programs?

RESPONSE

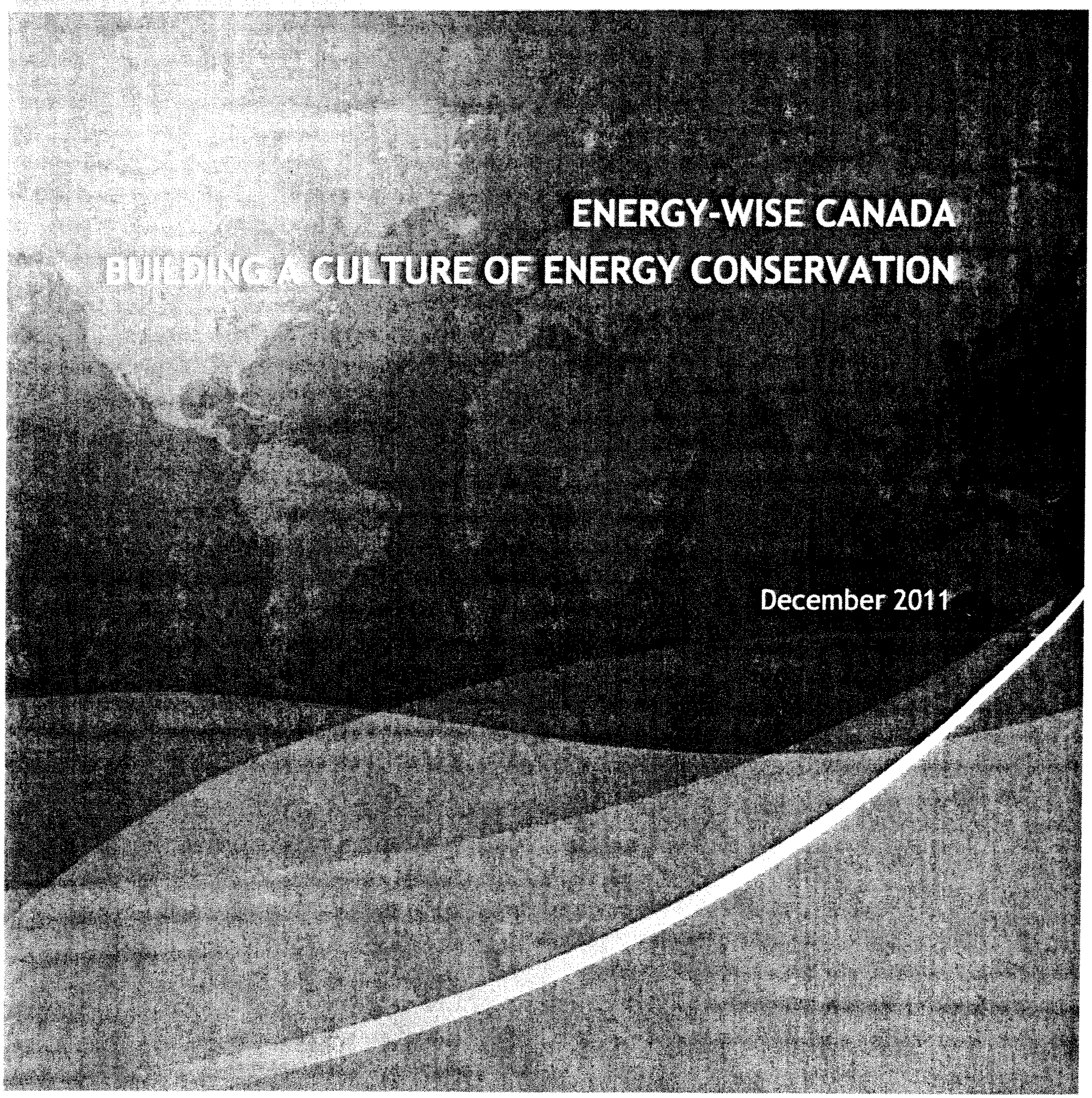
a), b), c) & d)

Enbridge generally accepts that a sustained focus on energy efficiency assists with the long-term environmental sustainability and economic competitiveness of the Province. While energy efficiency helps customers lower their overall energy usage which in turn reduces one input cost for businesses, it does not directly address energy price volatility. Price volatility is outside the scope of conservation programming. Customers wishing to insulate themselves from price volatility could do so through fixed price commodity contracts.

Schedule A to Interrogatory No. 1-ED-6

CANADIAN COUNCIL of CHIEF EXECUTIVES

CONSEIL CANADIEN des CHEFS D'ENTREPRIS



ENERGY-WISE CANADA

BUILDING A CULTURE OF ENERGY CONSERVATION

December 2011

ENERGY-WISE CANADA
BUILDING A CULTURE OF ENERGY CONSERVATION
Canadian Council of Chief Executives
December, 2011

Executive Summary

A key driver of Canada's future prosperity, and a source of comparative advantage for the country, is our diverse array of energy resources. By combining smart government policy with private sector commitment and innovation, Canada can demonstrate to the world that it can be a reliable and environmentally responsible energy supplier and partner.

In previous papers, the Canadian Council of Chief Executives has advocated a multi-pronged strategy, aimed at bringing on a larger and varied supply of energy to meet growing domestic and international demand. This includes investing in advanced energy technologies that can create new business and employment opportunities and position Canada to compete successfully in a world of rising energy prices.

Fundamentally, however, Canada needs to begin with a renewed commitment to energy conservation. We must use existing and future energy supplies as efficiently as possible, embracing the maxim that the cheapest form of energy is the unit that is not used. Better conservation practices will help to insulate Canadians from volatile energy prices, reduce costs for public institutions such as schools and hospitals, and improve the international competitiveness of Canadian companies.

Cutting our energy use would bring other benefits to society as well. Reduced use of carbon-based fuels would make urban air more breathable. Smart transportation choices would diminish traffic congestion and improve workplace productivity. And better urban design would make cities more livable and help Canadians achieve a better work-life balance.

Few of us deliberately waste energy. Yet the choices we make cause energy waste that cascades through the system. For instance, because of inefficiencies and losses at nearly every stage in production, transmission and end use, the amount of energy actually delivered to a light bulb in our home or to a fuel tank in our car is usually at least 50 percent, and sometimes as much as 90 percent, less than the energy content at source.

There are some signs of progress in our quest for energy efficiency. The overall energy intensity of our economy – the amount of energy consumed per unit of GDP – improved 22 percent between 1990 and 2008. The manufacturing sector overall used 8 percent less energy and produced 25 percent more output in 2008 compared to 1995. In the agriculture sector, energy intensity has declined steadily over the past 20 years. Some

municipal governments are ahead of the curve and are embracing sustainability in urban design and transportation planning. And programs such as LEED (Leadership in Energy and Environmental Design) are re-defining how new commercial and public buildings are designed for overall energy and environmental coherence.

In too many instances, however, such gains are outweighed by trends toward greater energy consumption. New building codes and better construction materials are helping to make Canadian homes more energy-efficient, yet the number of houses continues to grow with immigration and shifting demographics. Moreover, the average size of a house is larger and the percentage of homes with air conditioning has doubled since 1990, to 45 percent. Today's televisions and computers are more efficient than those manufactured as recently as five years ago, but many homes now have more than one of each, operating for many more hours. Vehicle fuel efficiency is set to increase significantly with the new North American standards recently announced, but overall passenger-kilometres travelled continues to increase. As well, there has been a significant shift to trucks as the mode of choice for freight transportation and to airlines for passenger travel.

This paper analyzes energy consumption trends and conservation initiatives in each of the major segments of Canadian society: industry, residential, commercial and institutional, transportation, municipalities and agriculture. Needless to say, there is scope for significant improvement in all of these areas.

A review of these trends leads us to two main conclusions. First, governments, industry and public-spirited groups should work together to improve Canadians' energy literacy. We do not underestimate the challenge of changing consumers' behaviour. After all, governments have been preaching the merits of energy conservation and efficiency since the first oil-price shocks of the mid-1970s, with limited success. Nevertheless, Canadians need to understand the energy choices that the country faces so that they can make informed decisions based on realistic assessments of their respective costs and benefits.

A second, closely related, conclusion is that the most effective means of promoting energy conservation is to allow energy prices to rise. It seems clear that higher prices will influence Canadians' behaviour in a way that public exhortation and appeals to the greater good have not. That is why the CCCE has previously stated its support for a broad-based carbon pricing scheme in Canada. Canadians – as business owners, farmers, building managers and individual consumers – need to see the everyday cost of inefficient use of energy and be motivated to change their energy consumption patterns and investment decisions. To be sure, carbon pricing would have to be introduced gradually, both to allow businesses and consumers time to adjust and to avoid any disproportionate impact on Canada's competitive position. (For Canadians on fixed incomes, the impact could be offset through other social or fiscal policies.)

The bottom line is that governments must resist the temptation to shield Canadians from higher energy prices. By any reasonable measure, energy remains a comparative bargain for Canadians. Electricity in particular is cheaper today on an inflation-adjusted basis than it was 20 years ago. In most provinces the regulated electricity rates paid by households and some industries do not even cover the cost of producing and delivering it, but ultimately these costs will have to be recouped through the broader tax base.

Canada's vast array of natural resources, our growing population, our climate and geography push us towards above-average energy consumption. But the present trend is unsustainable. It is time for Canadians to get serious about energy conservation, for the health of our economy as well as the environment.

ENVIRONMENTAL DEFENSE INTERROGATORY #7

INTERROGATORY

Issue 1: "Is the 2014 DSM Budget ($32.2M) reasonable and appropriate? Should the Board determine that the DSM budget for 2014 should be increased, what are the implications and required next steps."

Interrogatory No. 1-ED-7 DSM Benefits: Increased Productivity, GDP, etc.

Reference: Ex. B, Tab 1, Schedule 2, page 3

In 2011, the former Governor of the Bank of Canada, Mark Carney, gave a speech to the Empire and Canadian Clubs and stated that:

> In a world where deleveraging holds back demand in our traditional foreign markets, the imperative is for Canadian companies to invest in improving their productivity and to access fast-growing emerging markets.
>
> This would be good for Canadian companies and good for Canada. Indeed, it is the only sustainable option available. A virtuous circle of increased investment and increased productivity would increase the debt-carrying capacity of all, through higher wages, greater profits and higher government revenues. This should be our common focus.[1]

The relevant excerpts are attached for your reference.

A report by Dr. Ernie Stokes of the Centre for Spatial Economics, which quantifies the economic benefits of energy efficiency investments which reduce Ontario's natural gas consumption, found that a 16.1% reduction in Ontario's natural gas consumption in 2021 would increase Ontario's GDP by $5.5 billion, increase employment by 33,800 jobs, raise corporate profits by $446 million and reduce the provincial deficit by $479 million.[2] The relevant excerpts are attached for your reference.

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[1] Mark Carney, *Growth in the Age of Deleveraging, speech to Empire Club of Canada & Canadian Club of Toronto*, December 12, 2011, http://www.bankofcanada.ca/wp-content/uploads/2011/12/speech-121211.pdf, p. 11.
[2] Centre for Spatial Economics, *The Economic Impacts of Reducing Natural Gas Use in Ontario*, April 2011, http://www.cleanairalliance.org/files/cse.pdf, p. 7.

a) Does Enbridge agree with Mark Carney that Ontario would benefit if its industries increased their investment and productivity? Does Enbridge agree that this could lead to higher wages, profits, and government revenues?

b) When a business participates in one of Enbridge's resource acquisition DSM programs, is that an investment that increases productivity? Please explain.

c) Generally speaking, will Enbridge's DSM programs increase productivity and GDP? If not, why not?

d) Are the economy-wide benefits of conservation spending, such those resulting from increased productivity, given a dollar value and factored into the TRC analysis for DSM programs?

RESPONSE

a), b), c) & d)

Mark Carney's remarks that increased investment results in increased productivity appear reasonable. It is the understanding of the Company that pervasive economic theory does suggest that higher productivity may lead to higher wages, profits and government revenues. Enbridge believes that when a business participates in DSM programs and invests in energy efficiency upgrades, all other things being equal, it may see increases in productivity. While Enbridge cannot specifically predict the future impacts of DSM on overall productivity and GDP, it believes that DSM initiatives can be a factor in elevated productivity and thus, GDP. These productivity gains – which may be difficult if not impossible to predict with any certainty – are not factored into the TRC analysis for DSM programs.

Schedule A to Interrogatory No. 1-ED-7

BANK OF CANADA
BANQUE DU CANADA

Remarks by Mark Carney
Governor of the Bank of Canada
Empire Club of Canada / Canadian Club of Toronto
12 December 2011
Toronto, Ontario

Growth in the Age of Deleveraging

Introduction

These are trying times.

In our largest trading partner, households are undergoing a long process of balance-sheet repair. Partly as a consequence, American demand for Canadian exports is $30 billion lower than normal.

In Europe, a renewed crisis is underway. An increasing number of countries are being forced to pay unsustainable rates on their borrowings. With a vicious deleveraging process taking hold in its banking sector, the euro area is sinking into recession. Given ties of trade, finance and confidence, the rest of the world is beginning to feel the effects.

Most fundamentally, current events mark a rupture. Advanced economies have steadily increased leverage for decades. That era is now decisively over. The direction may be clear, but the magnitude and abruptness of the process are not. It could be long and orderly or it could be sharp and chaotic. How we manage it will do much to determine our relative prosperity.

This is my subject today: how Canada can grow in this environment of global deleveraging.

How We Got Here: The Debt Super Cycle

First, it is important to get a sense of the scale of the challenge.

Accumulating the mountain of debt now weighing on advanced economies has been the work of a generation. Across G-7 countries, total non-financial debt has doubled since 1980 to 300 per cent of GDP. Global public debt to global GDP is almost at 80 per cent, equivalent to levels that have historically been associated with widespread sovereign defaults.[1]

The debt super cycle has manifested itself in different ways in different countries. In Japan and Italy, for example, increases in government borrowing have led the way. In the United States and United Kingdom, increases in household debt have been more significant, at least until recently. For the most part, increases in non-financial corporate debt have been modest to negative over the past thirty years.

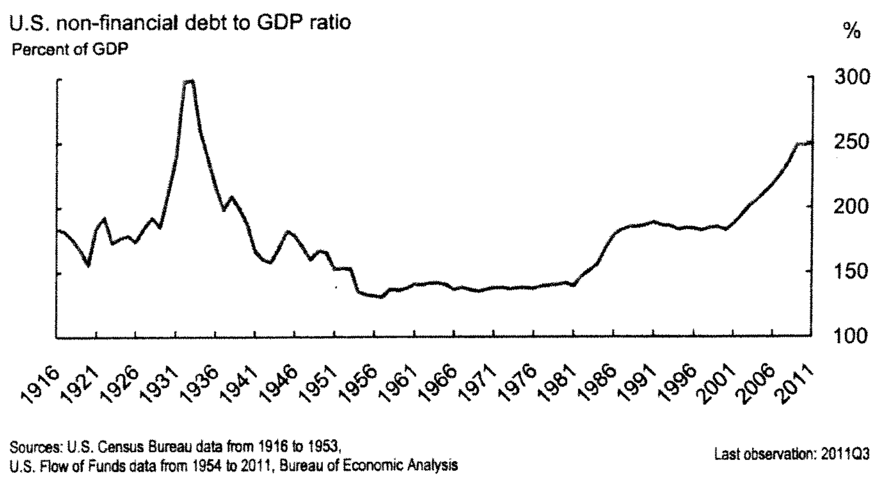
In general, the more that households and governments drive leverage, the less the productive capacity of the economy expands, and, the less sustainable the overall debt burden ultimately is.

Another general lesson is that excessive private debts usually end up in the public sector one way or another. Private defaults often mean public rescues of banking sectors; recessions fed by deleveraging usually prompt expansionary fiscal policies. This means that the public debt of most advanced economies can be expected to rise above the 90 per cent threshold historically associated with slower economic growth.[2]

The cases of Europe and the United States are instructive.

Today, American aggregate non-financial debt is at levels similar to those last seen in the midst of the Great Depression. At 250 per cent of GDP, that debt burden is equivalent to almost US$120,000 for every American (**Chart 1**).[3]

Chart 1: U.S. non-financial debt near levels of the Great Depression



Several factors drove a massive increase in American household leverage. Demographics have played a role, with the shape of the debt cycle tracking the progression of baby boomers through the workforce.

The stagnation of middle-class real wages (itself the product of technology and globalisation) meant households had to borrow if they wanted to maintain consumption growth.[4]

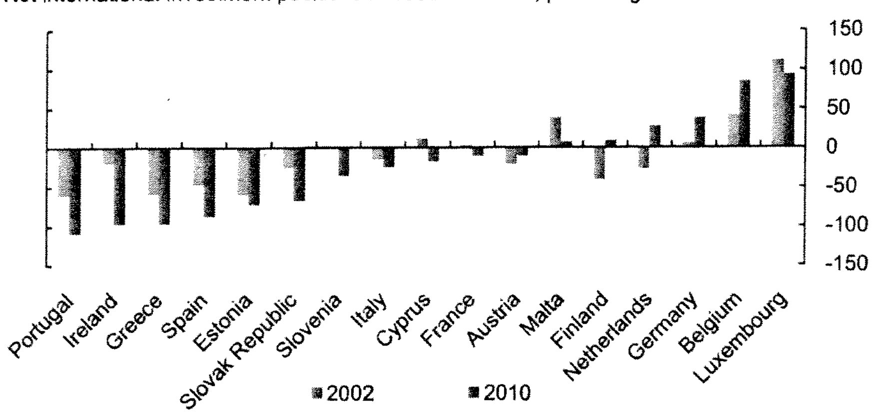
Financial innovation made it easier to do so. And the ready supply of foreign capital from the global savings glut made it cheaper.

Most importantly, complacency among individuals and institutions, fed by a long period of macroeconomic stability and rising asset prices, made this remorseless borrowing seem sensible.

From an aggregate perspective, the euro area's debt metrics do not look as daunting. Its aggregate public debt burden is lower than that of the United States and Japan. The euro area's current account with the rest of the world is roughly balanced, as it has been for some time. But these aggregate measures mask large internal imbalances. As so often with debt, distribution matters (**Chart 2**).

Chart 2: Euro-area imbalances have widened

Net international investment positions in 2002 and 2010, percentages of GDP



Sources: International Monetary Fund International Financial Statistics, International Monetary Fund World Economic Outlook

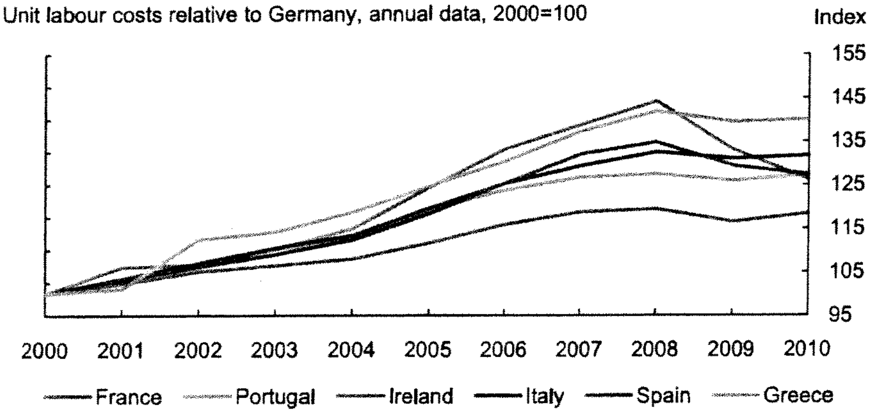
Last observation: 2010

Europe's problems are partly a product of the initial success of the single currency. After its launch, cross-border lending exploded. Easy money fed booms, which flattered government fiscal positions and supported bank balance sheets.

Over time, competitiveness eroded. Euro-wide price stability masked large differences in national inflation rates. Unit labour costs in peripheral countries shot up relative to the core economies, particularly Germany. The resulting deterioration in competitiveness has made the continuation of past trends unsustainable (**Chart 3**). Growth models across Europe must radically change.

Chart 3: Unit labour costs in peripheral countries up, relative to core

Unit labour costs relative to Germany, annual data, 2000=100



Sources: Deutsche Bundesbank, national statistics agencies

Last observation: 2010

It's the Balance of Payments, Stupid!

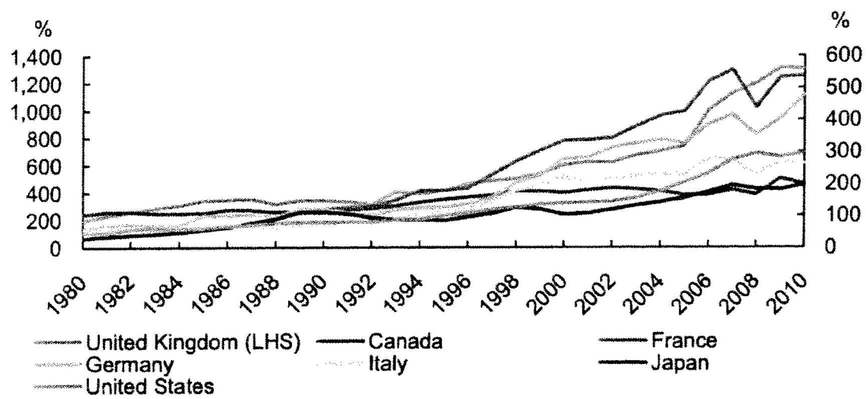
For years, central bankers have talked of surplus and deficit countries, of creditors and debtors. We were usually ignored. Indeed, during a boom, the debtor economy usually feels more vibrant and robust than its creditors. In an era of freely flowing capital, some even thought current account deficits did not matter, particularly if they were the product of private choices rather than public profligacy.

When the leverage cycle turns, the meaning and implications of these labels become tangible. Creditors examine more closely how their loans were spent. Foreign financing constraints suddenly bind. And to repay, debtors must quickly restore competitiveness.[5]

Financial globalisation has provided even greater scope for external imbalances to build (**Chart 4**). And its continuation could permit larger debt burdens to persist for longer than historically was the case. However, experience teaches that sustained large cross-border flows usually presage liquidity crunches.[6]

Chart 4: Capital flows have expanded rapidly

Gross foreign assets and liabilities as percentages of GDP, annual data



Source: International Monetary Fund International Financial Statistics, International Monetary Fund World Economic Outlook

Last observation: 2010

The Global Minsky Moment Has Arrived

Debt tolerance has decisively turned. The initially well-founded optimism that launched the decades-long credit boom has given way to a belated pessimism that seeks to reverse it.

Excesses of leverage are dangerous, in part because debt is a particularly inflexible form of financing. Unlike equity, it is unforgiving of miscalculations or shocks. It must be repaid on time and in full.

While debt can fuel asset bubbles, it endures long after they have popped. It has to be rolled over, although markets are not always there. It can be spun into webs within the financial sector, to be unravelled during panics by their thinnest threads. In short, the central relationship between debt and financial stability means that too much of the former can result abruptly in too little of the latter.

Hard experience has made it clear that financial markets are inherently subject to cycles of boom and bust and cannot always be relied upon to get debt levels right.[7] This is part of the rationale for micro- and macroprudential regulation.

It follows that backsliding on financial reform is not a solution to current problems. The challenge for the crisis economies is the paucity of credit demand rather than the scarcity of its supply. Relaxing prudential regulations would run the risk of maintaining dangerously high leverage—the situation that got us into this mess in the first place.

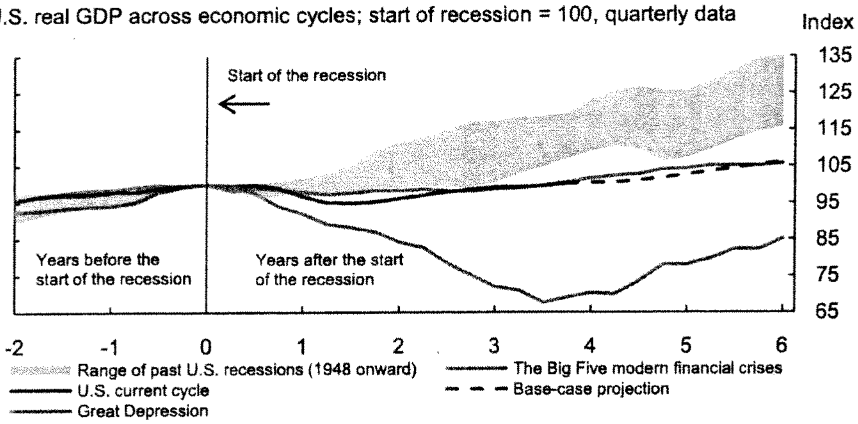
The Implications of Deleveraging

As a result of deleveraging, the global economy risks entering a prolonged period of deficient demand. If mishandled, it could lead to debt deflation and disorderly defaults, potentially triggering large transfers of wealth and social unrest.

History suggests that recessions involving financial crises tend to be deeper and have recoveries that take twice as long.[8] The current U.S. recovery is proving no exception (**Chart 5**). Indeed, it is only with justified comparisons to the Great Depression that the success of the U.S. policy response is apparent.

Chart 5: Weakest U.S. recovery since Great Depression

U.S. real GDP across economic cycles; start of recession = 100, quarterly data



Note: The Big Five modern financial crises include Spain (1977), Norway (1987), Finland (1991), Sweden (1991) and Japan (1992).
Sources: U.S. Bureau of Economic Analysis and Organisation for Economic Co-Operation and Development

Such counterfactuals—it could have been worse—are of cold comfort to American households. Their net worth has fallen from 6 ½ times income pre-crisis to about 5 at present (**Chart 6**). These losses can only be recovered through a combination of increased savings and, eventually, rising prices for houses and financial assets. Each will clearly take time.

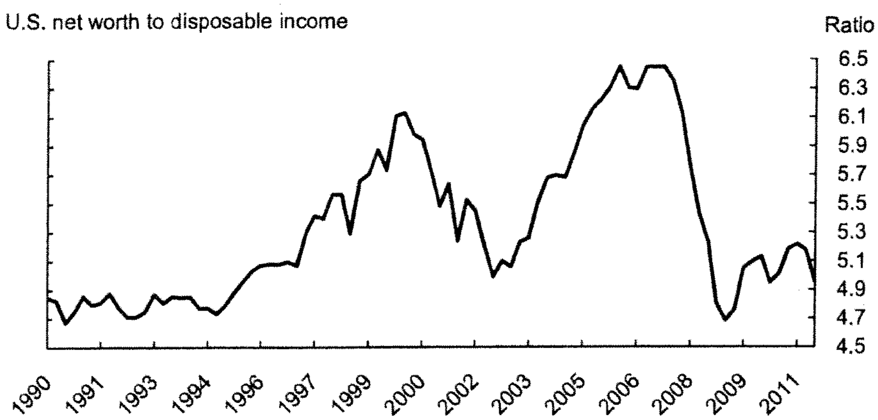
In Europe, a tough combination of necessary fiscal austerity and structural adjustment will mean falling wages, high unemployment and tight credit conditions for firms. Europe is unlikely to return to its pre-crisis level of GDP until a full five years after the start of its *last* recession (**Chart 7**).

Managing the Deleveraging Process

Austerity is a necessary condition for rebalancing, but it is seldom sufficient. There are really only three options to reduce debt: restructuring, inflation and growth.

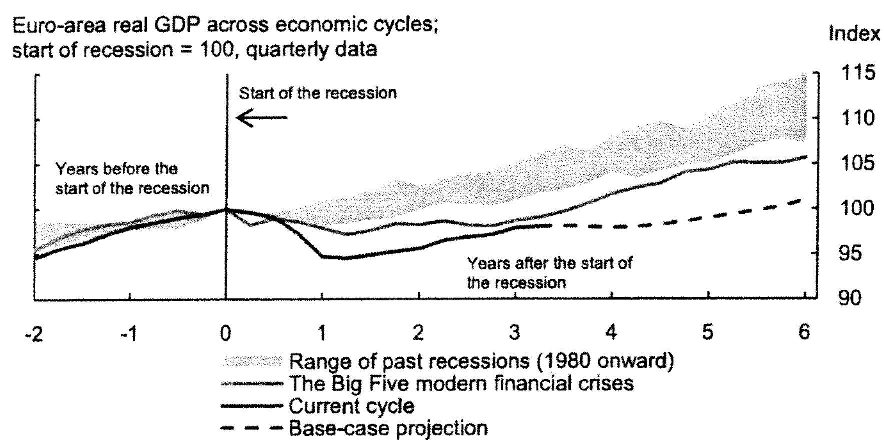
Whether we like it or not, debt restructuring may happen. If it is to be done, it is best done quickly. Policy-makers need to be careful about delaying the inevitable and merely funding the private exit. Historically, as an alternative to restructuring,

Chart 6: Large drop in U.S. household wealth



Sources: U.S. Federal Reserve, Bureau of Economic Analysis, and Bank of Canada calculations
Last observation: 2011Q3

Chart 7: Euro-area recovery was weak, is over



Note: The Big Five modern financial crises include Spain (1977), Norway (1987), Finland (1991), Sweden (1991) and Japan (1992)
Sources: Eurostat and Organisation for Economic Co-Operation and Development

financial repression has been used to achieve negative real interest rates and gradual sovereign deleveraging.

Some have suggested that higher inflation may be a way out from the burden of excessive debt.[9]

This is a siren call. Moving opportunistically to a higher inflation target would risk unmooring inflation expectations and destroying the hard-won gains of price stability. Similarly, strategies such as nominal GDP level targeting would fail unless they are well understood by the public and the central bank is highly credible.[10, 11]

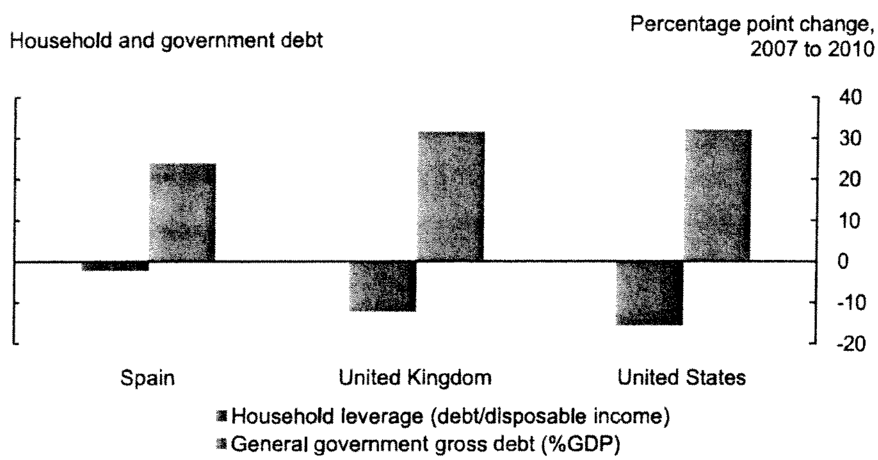
With no easy way out, the basic challenge for central banks is to maintain price stability in order to help sustain nominal aggregate demand during the period of real adjustment. In the Bank's view, that is best accomplished through a flexible inflation-targeting framework, applied symmetrically, to guard against both higher inflation and the possibility of deflation.

The most palatable strategy to reduce debt is to increase growth. In today's reality, the hurdles are significant.

Once leverage is high in one sector or region, it is very hard to reduce it without at least temporarily increasing it elsewhere.

In recent years, large fiscal expansions in the crisis economies have helped to sustain aggregate demand in the face of private deleveraging (**Chart 8**). However, the window for such Augustinian policy is rapidly closing. Few except the United States, by dint of its reserve currency status, can maintain it for much longer.

Chart 8: Private deleveraging, public leveraging



Sources: Bank for International Settlements, IMF World Economic Outlook September 2011

In most of Europe today, further stimulus is no longer an option, with the bond markets demanding the contrary.

There are no effective mechanisms that can produce the needed adjustment in the short term. Devaluation is impossible within the single-currency area; fiscal transfers and labour mobility are currently insufficient; and structural reforms will take time.

Actions by central banks, the International Monetary Fund and the European Financial Stability Facility can only create time for adjustment. They are not substitutes for it.

To repay the creditors in the core, the debtors of the periphery must regain competitiveness. This will not be easy. Most members of the euro area cannot depreciate against their major trading partners since they are also part of the euro.

Large shifts in relative inflation rates between debtor and creditor countries could result in real exchange rate depreciations between euro-area countries. However, it is not clear that ongoing deflation in the periphery and higher inflation in the core would prove any more tolerable than it did between the United

Kingdom and the United States under the postwar gold standard of the 1920s and 1930s.

The route to restoring competitiveness is through fiscal and structural reforms. These real adjustments are the responsibility of citizens, firms and governments within the affected countries, not central banks. A sustained process of relative wage adjustment will be necessary, implying large declines in living standards for a period in up to one-third of the euro area.

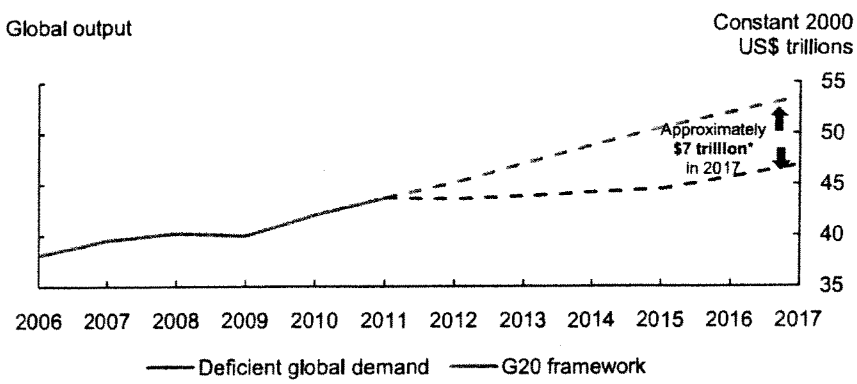
We welcome the measures announced last week by European authorities, which go some way to addressing these issues.

With deleveraging economies under pressure, global growth will require global rebalancing. Creditor nations, mainly emerging markets that have benefited from the debt-fuelled demand boom in advanced economies, must now pick up the baton.

This will be hard to accomplish without co-operation. Major advanced economies with deficient demand cannot consolidate their fiscal positions and boost household savings without support from increased foreign demand. Meanwhile, emerging markets, seeing their growth decelerate because of sagging demand in advanced countries, are reluctant to abandon a strategy that has served them so well in the past, and are refusing to let their exchange rates materially adjust.

Both sides are doubling down on losing strategies. As the Bank has outlined before, relative to a co-operative solution embodied in the G-20's Action Plan, the foregone output could be enormous: lower world GDP by more than US$7 trillion within five years (**Chart 9**). Canada has a big stake in avoiding this outcome.

Chart 9: The $7-trillion question



*This estimate is a rough approximation. Depending on the assumptions, it could range from $6 trillion to $9 trillion.
Sources: Bank of Canada, World Bank

To Summarize Thus Far

The market cannot be solely relied upon to discipline leverage.

It is not just the stock of debt that matters, but rather, who holds it. Heavy reliance on cross-border flows, particularly when they fund consumption, usually proves unsustainable.

As a consequence of these errors, advanced economies are entering a prolonged period of deleveraging.

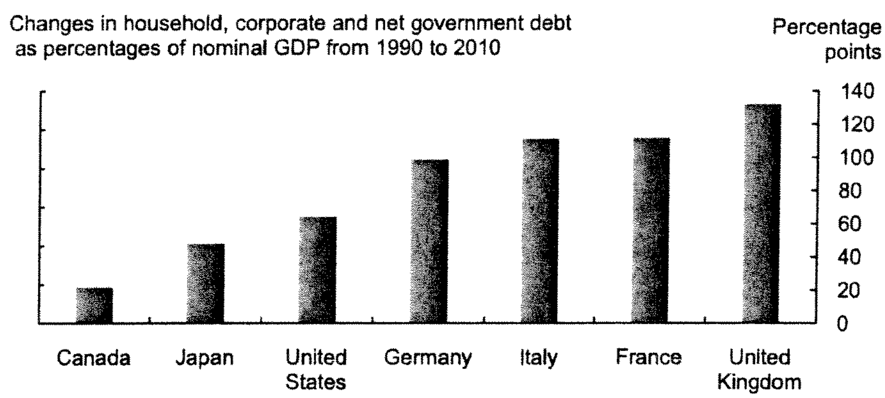
Central bank policy should be guided by a symmetric commitment to the inflation target. Central banks can only bridge real adjustments; they can't make the adjustments themselves.

Rebalancing global growth is the best option to smooth deleveraging, but its prospects seem distant.

What It Means for Canada

Canada has distinguished itself through the debt super cycle (**Chart 10**), though there are some recent trends that bear watching. Over the past twenty years, our non-financial debt increased less than any other G-7 country. In particular, government indebtedness fell sharply, and corporate leverage is currently at a record low (**Chart 11**).

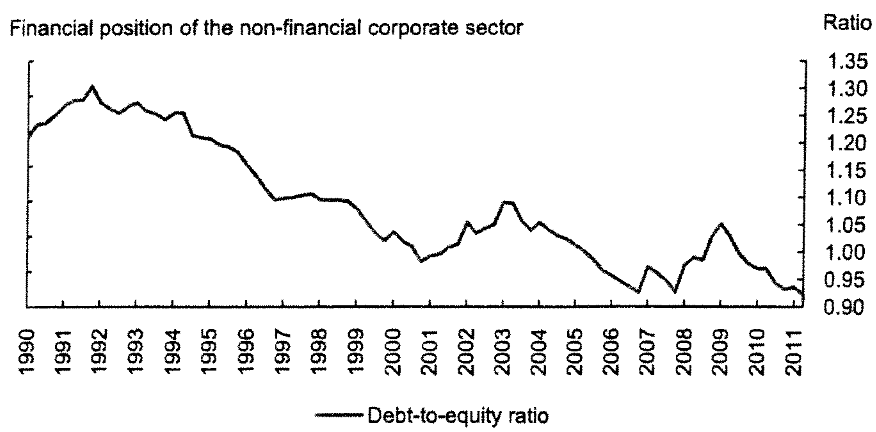
Chart 10: Canadian debt has risen less than its G-7 peers



Note: German data prior to 1991 reflects West Germany.
Sources: Cecchetti, Mohanty and Zampolli 2011, Organisation for Economic Co-operation and Development, and Bank of Canada calculations

Last observation: 2010

Chart 11: Corporate leverage at a record low



Source: Statistics Canada, Quarterly Financial Statistics for Enterprises

Last observation: 2011Q3

In the run-up to the crisis, Canada's historically large reliance on foreign financing was also reduced to such an extent that our net external indebtedness was virtually eliminated.

Over the same period, Canadian households increased their borrowing significantly. Canadians have now collectively run a net financial deficit for more than a decade, in effect, demanding funds from the rest of the economy, rather than providing them, as had been the case since the Leafs last won the Cup.

Developments since 2008 have reduced our margin of manoeuvre. In an environment of low interest rates and a well functioning financial system, household debt has risen by another 13 percentage points, relative to income. Canadians are now more indebted than the Americans or the British. Our current account has also returned to deficit, meaning that foreign debt has begun to creep back up.

The funding for these current account deficits has been coming largely from foreign purchases of Canadian portfolio securities, particularly bonds. Moreover, much of the proceeds of these capital inflows seem to be largely, on net, going to fund Canadian household expenditures, rather than to build productive capacity in the real economy. If we can take one lesson from the crisis, it is the reminder that channelling cheap and easy capital into unsustainable increases in consumption is at best unwise.

Canada's relative virtue throughout the debt super cycle affords us a privileged position now that the cycle has turned. Unlike many others, we still have a risk-free rate and a well-functioning financial system to support our economy. It is imperative that we maintain these advantages. Fortunately, this means largely doing what we have been doing—individuals and institutions acting responsibly and policy-makers executing against sound fiscal, monetary and regulatory frameworks.

It cannot entirely be business as usual. Our strong position gives us a window of opportunity to make the adjustments needed to continue to prosper in a deleveraging world. But opportunities are only valuable if seized.

First and foremost, that means reducing our economy's reliance on debt-fuelled household expenditures. To this end, since 2008, the federal government has taken a series of prudent and timely measures to tighten mortgage insurance requirements in order to support the long-term stability of the Canadian housing market. Banks are also raising capital to comply with new regulations. Canadian authorities are co-operating closely and will continue to monitor the financial situation of the household sector.

To eliminate the household sector's net financial deficit would leave a noticeable gap in the economy. Canadian households would need to reduce their net financing needs by about $37 billion per year, in aggregate. To compensate for such a reduction over two years could require an additional 3 percentage points of export growth, 4 percentage points of government spending growth or 7 percentage points of business investment growth.

Any of these, in isolation, would be a tall order. Export markets will remain challenging. Government cannot be expected to fill the gap on a sustained basis.

But Canadian companies, with their balance sheets in historically rude health, have the means to act—and the incentives. Canadian firms should recognize four realities: they are not as productive as they could be; they are under-exposed to fast-growing emerging markets; those in the commodity sector can expect relatively elevated prices for some time; and they can all benefit from one of the most resilient financial systems in the world. In a world where deleveraging holds back demand in our traditional foreign markets, the imperative is for Canadian companies to invest in improving their productivity and to access fast-growing emerging markets.

This would be good for Canadian companies and good for Canada. Indeed, it is the only sustainable option available. A virtuous circle of increased investment and increased productivity would increase the debt-carrying capacity of all, through higher wages, greater profits and higher government revenues. This should be our common focus.

The Bank of Canada is doing its part by fulfilling its mandate to keep inflation low, stable and predictable so that Canadian households and firms can invest and plan for the future with confidence. It is also assisting the federal government in ensuring that Canada's world-leading financial system will be there for Canadians in bad times as well as good and in pushing the G-20 Action Plan because it is in Canada's interests.

Conclusion

It makes sense to step back and consider current challenges through the longer arc of financial history. Today's venue is an appropriate place to do so. A century ago, when the Empire Club and the Canadian Club of Toronto would meet, the first great leveraging of the Canadian economy was well under way. During the three decades before the First World War, Canada ran current account deficits averaging 7 per cent of GDP. These deficits were largely for investment and were principally financed by long-term debt and foreign direct investment.

On the eve of the Great War, our net foreign liabilities reached 140 per cent of GDP, but our productive capacity built over the decades helped to pay them off over time. Our obligations would again swell in the Great Depression. But in the ensuing boom, we were again able to shrink our net liabilities.

When we found ourselves in fiscal trouble in the 1990s, Canadians made tough decisions, so that on the eve of Lehman's demise, Canada was in the best fiscal shape in the G-7.

We must be careful, however, not to take too much comfort from these experiences. Past is not always prologue. In the past, demographics and productivity trends were more favourable than they are today. In the past, we deleveraged during times of strong global growth. In the past, our exchange rate acted as a valuable shock absorber, helping to smooth the rebuilding of competitiveness that can only sustainably be attained through productivity growth.

Today, our demographics have turned, our productivity growth has slowed and the world is undergoing a competitive deleveraging.

We might appear to prosper for a while by consuming beyond our means. Markets may let us do so for longer than we should. But if we yield to this temptation, eventually we, too, will face painful adjustments.

It is better to rebalance now from a position of strength; to build the competitiveness and prosperity worthy of our nation.

Endnotes

[1] C. M. Reinhart and K. S. Rogoff, "A Decade of Debt," National Bureau of Economic Research Working Paper No. 16827, Cambridge, 2011.

[2] C. M. Reinhart and K. S. Rogoff, "Growth in a Time of Debt," *American Economic Review* 100, no. 2 (May 2010): 573–78.

[3] These figures, daunting as they are, actually understate the extent of the problem. They do not include the liabilities stemming from the pension and health care promises made by governments but not yet funded, which some estimate to be even larger than the current explicit stock of debt.

[4] R. G. Rajan, *Fault Lines: How Hidden Fractures Still Threaten the World Economy* (Princeton: Princeton University Press, 2010).

[5] Japan illustrates the importance of whether one's creditors are domestic or foreign. The public and total non-financial debt burdens in Japan have risen well beyond levels that have proved unsustainable in other countries, owing largely to the fact that the preponderance of that debt is owed domestically. From an external perspective, Japan is the largest net creditor in the world.

[6] See M. Carney, "Global Liquidity," a speech delivered to the Canada-United Kingdom Chamber of Commerce in London, United Kingdom, 8 November 2011.

[7] See A. Turner, "Debt and Deleveraging: Long Term and Short Term Challenges," a speech delivered to the Centre for Financial Studies, Frankfurt, Germany, 21 November 2011. Turner argues, in fact, that the current situation is the result of "decades of cumulative, massive policy errors," particularly the over reliance on free markets, (p.6).

[8] See C. M. Reinhart and V. R. Reinhart, "After the Fall," *Macroeconomic Challenges: The Decade Ahead,* Federal Reserve Bank of Kansas City 2010 Economic Policy Symposium. Available at: <http://www.kansascityfed.org/publicat/sympos/2010/reinhart-paper.pdf>.

[9] K. Rogoff, "Inflation Is Now the Lesser Evil," *Project Syndicate*, December 2008.

[10] See J. Hatzius, Z. Pandl, A. Phillips, and S. J. Stehn, A. Tilton, S. Wu, and M. Acosta-Cruz, "The Case for a Nominal GDP Level Target," *US Economics Analyst*, No: 11/41; Goldman Sachs Global ECS Research, 2011; and C. Romer, "Dear Ben: It's Time for Your Volcker Moment," *New York Times*, 29 October 2011.

[11] Indeed, if inflation is both higher and more uncertain, a higher inflation risk premium might result, prompting an increase in real interest rates that would exacerbate unfavourable debt dynamics.

Schedule B to Interrogatory No. 1-ED-7

THE CENTRE FOR SPATIAL ECONOMICS

The Economic Impacts of Reducing Natural Gas Use in Ontario

Prepared for
Ontario Clean Air Alliance
and
Ontario Clean Air Alliance Research Inc.

The Ontario Clean Air Alliance and Ontario Clean Air Alliance Research Inc.
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The EJLB Foundation, The Toronto Atmospheric Fund and
The Taylor Irwin Family Fund at the Toronto Community Foundation

TORONTO Atmospheric Fund   TORONTO COMMUNITY FOUNDATION

April 2011

INTRODUCTION

The Ontario Clean Air Alliance and the Ontario Clean Air Alliance Research Inc. requested the Centre for Spatial Economics (C_4SE) to undertake a study that looks at the economic impacts of reducing the use of natural gas in Ontario. The possibility of achieving a significant reduction in the use of natural gas has been shown in a study undertaken for Enbridge Gas Distribution that estimated possible reductions in natural gas use on the part of its customers. The current study examines the economic impacts of reducing natural gas in the province by creating a projection for the future economic performance of the Ontario economy that contains a reduction in the use of natural gas that is similar in nature to that shown in the Enbridge Gas Distribution analysis and compares the results of this scenario against a projection that does not contain this reduction.

The next section provides a description of the approach adopted to estimate the impacts of reducing the use of natural gas and the assumptions behind the approach. The third section discusses the expected impacts of reducing the use of natural gas on the economy from a qualitative point of view. The fourth section then presents the quantitative estimates of the impacts found using the assumptions for the reduction in natural gas considered.

STUDY APPROACH AND ASSUMPTIONS

Enbridge Gas Distribution commissioned a study regarding the possibility of reducing the use of natural gas by its customers in Ontario using a Demand Side Management (DSM) approach (Marbek Resource Consultants Ltd. "Natural Gas Energy Efficiency Potential: Update 2008, Residential, Commercial and Industrial Sectors Synthesis Report," September 2009). The results of the study suggest estimates of possible reductions in natural gas use for industrial, commercial, and residential customers under different assumptions regarding DSM costs. Under its Economic Potential Forecast, for example, reductions in residential, commercial, and industrial, natural gas usage over a 10-year period are estimated at 18, 29, and 34 percent, respectively. These reductions are to be realized (Marbek, op. cit. page 4):

> ".. if all equipment and building envelopes were upgraded to the level that is cost-effective from Enbridge's perspective. All the energy efficiency technologies and measures that have a positive measure TRC.. (net benefits that result from an investment in an efficiency technology or measure).. are incorporated into the Economic Potential Forecast. These technologies and measures are applied at either natural stock turnover rates or at designated years for immediate application."

The Ontario Clean Air Alliance is interested in estimating the impact on the Ontario economy if a reduction in natural gas use could be achieved in the province as a whole. The assumptions adopted for the reduction in natural gas use found in the Enbridge study serve as a starting point for those used in this study. The reduction is assumed to take place over the 10-year time period 2012 to 2021.

The approach adopted to estimate the economic impacts on Ontario of reducing the use of natural gas employs the C_4SE macroeconomic model of the Ontario economy. This model is used to prepare two economic projections for the future performance of the economy. The first projection shows the performance of the economy without the reduction in the use of natural gas. The second one shows the performance when the usage of natural gas is reduced. The impacts on the economy are then estimated by comparing the results of the two projections for key economic and fiscal variables such real Gross Domestic Product (GDP), the Consumer Price Index (CPI), employment, population, and government budget balances.

The C_4SE macroeconomic model is a multi-sector (industry) model that assumes the existence of a gross output (total value of production) KLEM production technology for the different sectors – KLEM stands for the production inputs of capital, labour, energy, and materials. It incorporates variable input-output coefficients that respond to changes in relative prices for production inputs. For example, increases in the price of natural gas will lead to a reduction in natural gas's share of total inputs to gross output and an increase in the share for the other inputs. The model also incorporates a Green House Gas emissions component that estimates CO_2 equivalent emissions by industry.

The projection that does not contain the reductions in natural gas is called the base case projection. It is created by making assumptions about the key drivers for the Ontario economy such as economic growth and inflation in Ontario's major trading partners, oil prices, natural gas prices, fiscal policy, and so on. The projection with the reductions in natural gas is created using the base case assumptions and then reducing the input shares of natural gas for the various industries along with the consumer expenditure share of natural gas for households. The input shares are variables in the macroeconomic model.

The Enbridge study does not cover all of Ontario's economy. The current study wishes to expand the coverage to the province as whole. The reductions in natural gas use employed are 25 percent for the industrial sector, 20 percent for the commercial sector, and 15 percent for the residential sector. These reductions are lower and, therefore, more conservative than those found in the Enbridge Economic Potential Forecast.

It is assumed that an increase in the share of capital in gross output will occur with the reduction in natural gas use in gross output as firms purchase new energy efficient technologies. As a result, there will be an increase in the share of value-added (net output or GDP) in gross output in the economy. In the case of households, the reduction in the share of natural gas in consumer expenditures is replaced by an increase in the share of the other consumer expenditure categories.

While the Enbridge study provides estimates of reductions in natural gas use, it does not contain estimates of the amount of capital expenditures that would be required to achieve these reductions. The C_4SE model suggests that the "incremental" increase in the stock of capital over the projection period required to achieve the non-residential natural gas reductions measured in $2010 would be about $4 billion. For the residential sector it is assumed that a $3 billion increase in the value of residential structures would be required – which is about $500 per household (occupied housing unit). This assumption is a "rough" estimate, but is similar to the ratio of the increases in non-residential capital stock to natural gas reductions produced by the model. Lower amounts of residential expenditures would reduce the economic impact on the economy and higher ones would increase the impact.

It is also assumed that the prices for capital goods purchased to reduce natural gas usage will not rise from those found in the base case projection other than through possible increases in wholesale and retail trade margins for local firms as demand pressures rise. The prices for imported capital goods remain unchanged from base case values.

While the reductions in natural gas use are assumed to take place over the 10-year period 2012 to 2021, the projection period is extended for another 5 years to 2026. The longer time period is adopted to allow the economy to fully adjust to both the direct and indirect impacts of the reductions in the use of natural gas on the economy.

A final set of assumptions includes the absence of a response of fiscal and monetary policy on the part of governments. The Bank of Canada will not respond to changes in inflation associated with the reduction in natural gas use. Governments will not change policies in the face of changes in their budget balances. Any improvements or deterioration in budget balances will lead to changes in government debt.

EXPECTED IMPACTS

Before presenting the quantitative estimates of the impact of the reduction in natural gas use it is worthwhile to review the nature of impacts expected from a qualitative point of view – that is, directions of change rather than the estimated size of change.

The reduction in the use of natural gas is to be accomplished by replacing natural gas with more energy efficient capital equipment. This replacement is expected to allow firms to produce the same amount of goods and services they did when using natural gas because the more productive capital replaces the contribution of natural gas use in gross output. It should be noted that the reductions in natural gas use implemented through the model's input shares will not likely reduce natural gas use in the same proportion. This difference is a result of changes in economic performance caused by the changes in technology. While the share of natural gas in the economy is reduced, the actual size of the economy will increase, which in turn, will lead to additional use of natural gas. Nevertheless, the latter increase will be small in relation to the decline that results from introducing more efficient capital equipment.

Significant increases in investment expenditures in the economy are expected to be observed over the period relative to the base case projection when firms substitute capital for natural gas. Over the long run when the more efficient capital begins to wear out, additional replacement expenditures are expected with the higher valued capital in contrast to the relatively lower replacement values for the old capital.

The purchase of new equipment and the construction of structures needed to achieve lower gas use will increase production and employment in industries throughout the economy. The increased employment and disposable income will lead to increases in consumer and housing expenditures. These increases, in turn, will lead to additional production and employment, and so on.

Because Ontario does not produce natural gas the reduction in its use will not have a major negative impact on the economy. Nevertheless, firms in the natural gas distribution system are likely to see a reduction in their sales, which will offset somewhat the increases in GDP resulting from the more productive capital.

The fall in natural gas use will be observed through a reduction in provincial imports, which will lead to an improvement in the trade balance (exports minus imports) over the long run. During the period in which the capital is being replaced, nevertheless, the reduction in natural gas imports will be offset by imports of machinery and equipment. The import share of the machinery that will be purchased to reduce natural gas use is high for the province.

The higher GDP associated with the increase in capital to replace natural gas will lead to increases in labour productivity, which, in turn, will result in increases in wages and personal income. The latter will cause an increase in consumer expenditures, in addition to that observed as a result of the increased investment activity mentioned above.

The increased economic activity resulting from the reduction in gas use will also result in an improvement in the budget balances of the federal and provincial governments. This improvement comes from increases in revenues from both income taxes – personal and corporate – and indirect taxes such as the HST. Expenditures also rise as the increase in employment results in additional persons moving into the province, but this increase will be lower than the increase in revenues.

The reduction in the use of natural gas will lead to a reduction in CO_2 emissions. This reduction will be somewhat offset by increases in emissions resulting from a higher level of economic activity associated with replacing the natural gas with more energy efficient capital.

ESTIMATED IMPACTS

Estimates of the impacts of reducing natural gas use in the province for key economic indicators are shown in **Table 1**. The impacts for many indicators refer to the percentage differences and level differences from the base case projection values. The level differences for expenditure or income variables are measured in millions of 2010 dollars.

The results for real GDP show a 0.6 percentage point increase from the base case in 2026. This increase represents $5.1 billion measured in 2010 dollars. It should be noted that part of the

TABLE 1: IMPACT ON KEY ECONOMIC INDICATORS (Level or Percentage Difference from Base Case)

	2016	2021	2026
Real GDP $2010 Millions			
% Difference	0.2	0.7	0.6
Difference	1706	5497	5144
GDP Deflator % Difference	0	0.1	0
Consumer Expenditures $2010 Millions			
% Difference	0.2	0.6	0.5
Difference	787	2694	2630
Residential Investment $2010 Millions			
% Difference	1.4	3	0.6
Difference	686	1651	394
Non-Residential Investment $2010 Millions			
% Difference	0.5	1.3	0.7
Difference	346	891	559
Exports $2010 Millions			
% Difference	0	-0.1	0
Difference	-49	-284	142
Imports $2010 Millions			
% Difference	0.1	0	-0.1
Difference	204	126	-628
CPI % Difference	0	0.1	0
Hourly Wage Rate $ % Difference	0.2	0.5	0.2
Employment 000s			
% Difference	0.2	0.4	0.4
Difference	12.2	33.8	28.5
Productivity (GDP/Hour) % Difference	0	0.2	0.2
Personal Income $2010 Millions			
% Difference	0.3	0.7	0.5
Difference	1215	3738	2612
Corporate Profits Before Tax $2010 Millions			
% Difference	0.1	0.7	0.6
Difference	73	446	451
Federal Net Lending $2010 Millions Difference	231	496	148
Provincial Net Lending $2010 Millions Difference	159	479	443
Natural Gas Final Demand (BCF)			
Difference	-69	-196	-192
% Difference	-6.9	-16.1	-15.4
Total Provincial CO2 Equivalent Emissions (KT)			
Difference	-4107	-13742	-13061
% Difference	-2.1	-6.1	-5.5

increase in GDP and some of its components is a result of an increase in population caused by higher employment leading to additional migration to the province.

Consumer expenditures account for the largest amount of the increase in GDP in 2026 where the percentage difference in expenditures is 0.5. The increase in consumer expenditures is the result of an increase in personal income, which rises 0.5 percent.

The increase in personal income results from increases in employment and wages. The wage rate rises 0.2 percent above base case values while there is a 0.4 percent increase in employment. The increase in employment in level terms is 29 thousand in 2026. Part of the increase in wages is due to the higher productivity that results from the increase in capital with the reduction in the use of natural gas. The fact that the Consumer Price Index (CPI) does not change over the period adds to the purchasing power of the wage increase.

As expected non-residential investment expenditures show a noticeable increase reaching 0.7 percent above base case values in 2026. The latter increase is less than the 1.3 percent observed for 2021 when the use of natural gas is being reduced through investments in energy saving capital.

There is also a 3.0 increase in residential investment to 2021, which falls to 0.6 percent in 2026 as the additional residential capital needed to reduce natural gas consumption is put in place. Some of the higher residential investment is accounted for by an increase in population associated with the higher employment attracting more people to the province.

Imports rise to 2021 in the projection where natural gas use is reduced, which is a result of both higher investment and consumer expenditures. Nevertheless, they fall later as the higher level of investment and associated activity is reduced. The increase in productivity that is caused by the reduction in the use of natural gas reduces business costs enough to cause exports to rise slightly by 2026. This latter increase leads to an improvement in the trade balance of almost $800 million that year. The reduced costs are also responsible for the increase in corporate profits before taxes over the projection period.

The federal and provincial governments see an improvement in their budget balances with the increased economic activity. The federal budget balance by 2026 is nearly $150 million higher while that for the provincial government is about $445 million higher. The sum of these differences over the period suggests about a $3.8 and $4.4 billion decline in federal and provincial government debt, respectively.

The percentage reduction in natural gas use for total final demand – which excludes natural gas used to produce electricity – is 15.4 percent in 2026. The reduction in physical units is 192 billion cubic feet of natural gas (BCF). This reduction divided into the increase in GDP in 2026 shows a $26 million dollar increase in GDP for each 1 BCF of natural gas reduction.

The reduction in the use of natural gas has a noticeable impact on total provincial CO_2 emissions over the projection period. By 2026 the level of CO_2 equivalent emissions is reduced 5.5 percent or 13.1 megatonnes with the replacement of natural gas by the more energy efficient capital.

The estimated percentage impacts on the industries in the economy that are covered in the C_4SE model are shown in **Table 2**. The impacts on the various industries reflect their relative intensities of natural gas use as well as their involvement in producing and installing capital goods. The construction industry, for example, will see a larger increase in activity as it builds and installs new capital. Industries with high shares of their production represented by natural gas such as primary metals will tend to have larger responses to the reduction in gas use.

The mining and manufacturing industries see relatively large increases in GDP because they use relatively large amounts of natural gas. Within the manufacturing industry the two automobile related industries show the smallest increase while primary metals and other manufacturing, which includes the pulp and paper industry, show relatively large increases in GDP.

As expected the construction industry registers a large increase to 2021 with a 2.0 percent difference between the base case projection and the reduced natural gas projection. This impact declines to 0.7 percent once the conversion to more efficient capital is completed.

The impacts on the service industries reflect in part the higher population associated with the employment increase as well as a reduction in natural gas use. The retail and wholesale trade, finance, insurance, and real estate, and accommodation and food services show the largest increases among private services.

TABLE 2: IMPACT ON INDUSTRY GDP (%)
(Percentage Difference from Base Case)

	2016	2021	2026
Total	0.2	0.7	0.6
Agriculture	0.1	0.2	0.2
Forestry	0.2	0.4	0.4
Mining	0.4	1.3	1.3
Manufacturing	0.4	1.3	1.1
Plastics	0.2	0.6	0.5
Motor Vehicle Assembly	0.1	0.4	0.3
Motor Vehicle Parts	0.1	0.4	0.4
Machinery	0.3	0.7	0.7
Fabricated Metals	0.3	0.8	0.6
Primary Metals	0.7	2.1	1.9
Other Manufacturing	0.6	1.8	1.6
Construction	0.8	2	0.7
Utilities	0.1	0.5	0.4
Transportation & Warehousing	0.1	0.3	0.3
Trade	0.2	0.6	0.5
Finance, Insurance & Real Estate	0.2	0.7	0.6
Professional, Scientific & Management Services	0.1	0.3	0.2
Accommodation & Food	0.2	0.6	0.5
Health Services	0.1	0.4	0.4
Other Services	0.2	0.6	0.5
Education Services	0.2	0.7	0.6
Government Services	0.1	0.4	0.5

APPENDIX: THE CENTRE FOR SPATIAL ECONOMICS

The Centre for Spatial Economics (C_4SE) monitors and forecasts economic and demographic change throughout Canada at virtually all levels of geography. The C_4SE also prepares customized studies on the economic, industrial and community impacts of various fiscal and other policy changes, and develops customized impact and projection models for in-house client use. Our clients include government departments, crown corporations, manufacturers, retailers and real estate developers.

The C_4SE was formed in July 2000 through an initiative of two consulting firms: Strategic Projections Inc. and Stokes Economic Consulting Incorporated. These two firms specialize in demographic and economic research. A key part of this research has been the geographical distribution of demographic and economic activity. The C_4SE was established as a partnership of SPI and SEC to improve the quality of information and research conducted in Canada and to make the information and research available to organizations requiring such information, and to the public as the opportunity arises. The C_4SE draws from a list of academics and research consultants on an as needed basis to minimize overhead costs and to obtain the best researchers for the topic at hand.

The staff of the C_4SE is currently as follows:
Ernie Stokes - Managing Partner
Tom McCormack - Partner
Robert Fairholm - Partner
Robin Somerville - Partner
Aaron Stokes - Staff Economist
Tara Schill - Staff Economist
Adam Papp – Staff Economist
Robert Daniells - Consultant
Sam Patayanikorn – Consultant

Ernie Stokes, the author of this report, is the Managing Partner of the C_4SE, as well as the President of Stokes Economic Consulting. He has more than 30 years experience as an economic advisor in both the private and public sectors. Ernie has worked both in North America and developing countries. He has a Ph. D. in economics from Queen's University (1979). Prior to establishing Stokes Economic Consulting in 1995 he served as Managing Director, the WEFA Group, Canada (1989 to 1994), as senior economist with the Alberta Energy Company (1987 to 1989), as a senior official with the Canada Department of Finance (1985 to 1987) and as Director of the National Forecasting Group with the Conference Board (1978 to 1984).

Stokes is currently a member of the B.C. Minister of Finance Forecast Council and the Ontario Minister of Finance Forecast Council as well as an expert on the Ontario Minister of Infrastructure Strategy Panel.

For more information on the C_4SE see our website: www.c4se.com