EB-2011-0327

ONTARIO ENERGY BOARD

IN THE MATTER OF the *Ontario Energy Board Act, 1998*, S.O. 1998, c.15, (Schedule B);

AND IN THE MATTER OF an application by Union Gas Limited seeking approval of its 2012-2014 Demand Side Management plan.

POLLUTION PROBE

CROSS-EXAMINATION REFERENCE BOOK
(Hearing re Large Industrial DSMVA Cap)

February 13, 2012

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

Murray Klippenstein
Kent Elson
Tel: (416) 598-0288
Fax: (416) 598-9520

Lawyers for Pollution Probe

INDEX

<u>Tab</u> **<u>Contents</u> [Page No.]**

Ontario

DEMAND SIDE MANAGEMENT GUIDELINES FOR NATURAL GAS UTILITIES

EB-2008-0346

Date: June 30, 2011

2. Term of the Plan

The initial term of the multi-year plans should be three years (2012, 2013 and 2014). The Board may consider a review of the natural gas DSM framework during the three-year plan term to determine whether to extend its term.

3. Program and Portfolio Design

The design of natural gas DSM programs and the overall portfolio should be guided by the following three objectives:

- Maximization of cost effective natural gas savings;
- Prevention of lost opportunities[4]; and
- Pursuit of deep energy savings.[5]

The natural gas utilities may pursue DSM activities that support fuel-switching away from natural gas where these activities align with the above three DSM objectives and contribute to a net reduction in greenhouse gases.

In addition to the above three objectives, guidance on the design of the natural gas DSM programs and the overall portfolio is provided through the overarching DSM framework (e.g., screening, metrics, incentives, consultation process, etc.). This level of guidance is meant to ensure that adequate flexibility in DSM program and portfolio design is maintained, while recognizing that the natural gas utilities are ultimately responsible and accountable for their actions. This flexibility should ensure that the natural gas utilities can continuously react to and adapt to current and anticipated market developments.

To help ensure that an appropriate balance among the three overarching guiding objectives is maintained and that changes to the DSM plan are consistent with the other elements of the DSM framework, the natural gas utilities should apply to the Board for approval if they decide to re-allocate funds to new programs that are not part of their Board-approved DSM plan. However, the natural gas utilities should inform the Board, as well as their stakeholders, in the event that cumulative fund transfers among Board-approved DSM programs exceed 30% of the approved annual DSM budget for an individual natural gas DSM program.

[4] Lost opportunity markets refer to DSM opportunities that, if not undertaken during the current planning period, will no longer be available or will be substantially more expensive to implement in a subsequent planning period.
[5] Deep energy savings refer to measures that result in long-term savings, such as thermal envelope improvements (e.g., wall and attic insulation).

year DSM plan. Therefore, the amounts in all DSM variance or deferral accounts should be recorded on an annual basis.

The natural gas utilities should use a fully allocated costing methodology for all their DSM activities. Capital assets (property, plant and equipment) associated with the multi-year DSM plan will be included in rate base, and will be treated in the same manner as distribution assets. DSM expenses incurred should be expensed in the normal course of the utility's operations.

Cost allocation in rates should be on the same basis as budgeted DSM spending by customer class. This allocation applies to both direct and indirect DSM program costs.

Any assets purchased with funds from third parties (i.e., not funded through distribution rates) will not be eligible for inclusion in rate base, nor will there be any distribution rate recovery of ongoing operating costs associated with the asset, or income taxes payable in relation to third-party funded activities. Likewise, DSM expenses funded by third parties should not be included in the natural gas utility's distribution accounts. The accounting treatment of DSM spending not funded through distribution rates is further discussed in section 13.6 below.

13.1 Revenue Allocation

Any net revenues generated by a shareholder incentive for distribution rate-funded DSM should be separate from (i.e., not used to offset) the natural gas utilities' distribution revenue requirement.

13.2 Demand-Side Management Variance Account ("DSMVA")

This account should be used to track the variance between actual DSM spending by rate class versus the budgeted amount included in rates by rate class. A natural gas utility may record in the DSMVA in any one year, a variance amount of no more than 15% above its DSM budget for that year. The natural gas utility should apply annually for disposition of the balance in its DSMVA, together with carrying charges, after the completion of the annual third party audit (see section 14).

The actual amount of the variance versus budget targeted to each customer class will be allocated to that customer class for rate recovery purposes. If spending is less than what was built into rates, ratepayers will be reimbursed for the full amount. If more is spent than was built into rates, the natural gas utility may be reimbursed up to a maximum of 15% above its DSM budget for the year. All additional funding beyond the annual DSM budget must be utilized on incremental program expenses only (i.e. cannot be used for additional utility overheads).

The option to spend 15% above the approved annual DSM budget is meant to allow the natural gas utilities to aggressively pursue programs which prove to be very successful.

Accordingly, the natural gas utility will be permitted to recover from ratepayers up to 15% above its annual DSM budget recorded in its DSMVA provided that:

A) It had achieved its weighted scorecard target(s) (i.e., 100%) on a pre-audited basis for the program(s) prior to additional spending being made on those programs; and

B) The DSMVA funds were used to produce results in excess of those targets (i.e., in excess of 100%) on a pre-audited basis.

When applying for disposition of its DSMVA account, the natural gas utility will have to provide evidence demonstrating the prudence and cost effectiveness of the amounts spent in excess of the approved annual DSM budget. In considering the prudence of any spending in excess of an approved annual budget, it is expected that the information available to the natural gas utility at the time the program was implemented will be considered.

13.3 LRAM Variance Account ("LRAMVA")

The LRAMVA should be used to track, at the rate class level, the actual impact of DSM activities undertaken by the natural gas utility from the forecasted impact included in distribution rates. A natural gas utility may only record an LRAM amount in relation to DSM activities undertaken within its franchise area by itself and/or delivered for the natural gas utility by a third party under contract.

The natural gas utilities should calculate the full year impact of DSM programs on a monthly basis, based on the volumetric impact of the measures implemented in that month, multiplied by the distribution rate for each of the rate classes in which the volumetric variance occurred. LRAM amounts are only accruable and thus only recorded in the variance account until such time as the Board sets distribution rates for the utility based on a new load forecast.

The LRAM amount is recovered in rates on the same basis as the variances in distribution revenues were experienced at the rate class level. The LRAM therefore results in a true-up rate class by rate class. The natural gas utilities should apply annually for disposition of the balance in their LRAMVA, together with carrying charges, after the completion of the annual third party audit (see section 14).

13.4 DSM Incentive Deferral Account ("DSMIDA")

The purpose of the DSMIDA is to record the shareholder incentive amount earned by a natural gas utility as a result of its DSM programs. This account will come into effect at the beginning of the term of the multi-year DSM plan, which is expected to be 2012. The natural gas utilities should apply annually for disposition of the balance in their DSMIDA, together with carrying charges, after the completion of the annual third party audit (see section 14).

EB-2011-0327

Union Gas 2012 DSM Programs

Target Yields by Rate Class

Large Industrial T1/R100	Residential/Commercial/Small Industrial Resource Acquisition	Low Income
220.6 cubic metres per dollar[1]	58.9 cubic metres per dollar[2]	6.3 cubic metres per dollar[3]

Relative Cost Effectiveness by Rate Class

Comparison	Calculation	Magnitude Difference
Large Industrial T1/R100 vs. Residential/Commercial/Small Industrial Resource Acquisition	220.6 divided by 58.9	3.7 times more cost effective
Large Industrial T1/R100 vs. Low Income	220.6 divided by 6.3	35 times more cost effective

[1] 1,000,000,000 cubic metres divided by $4,534,000. *Settlement Agreement*, pp. 8 & 24.
[2] 826,000,000 cubic metres divided by $14,022,000. *Settlement Agreement*, pp. 8 & 16.
[3] 43,000,000 cubic metres divided by $6,839,000. *Settlement Agreement*, pp. 8 & 28.

EB-2011-0327

UNION GAS LIMITED

SETTLEMENT AGREEMENT

January 31, 2012

Table 1: 2012 – 2014 DSM Plan Budget

	Year 2012 ($000)		2013 ($000)		2014 ($000)	
Program Budget						
Resource Acquisition						
Residential Incentives/Promotion	$	2,567	$	2,567	$	2,567
Residential Administration	$	576	$	576	$	576
Residential Evaluation	$	20	$	20	$	20
Total Residential Program	$	3,163	$	3,163	$	3,163
Commercial/Industrial Incentives/Promotion	$	8,118	$	8,118	$	8,118
Commercial/Industrial Administration	$	2,682	$	2,682	$	2,682
Commercial/Industrial Evaluation	$	60	$	60	$	60
Total Commercial/Industrial Program	$	10,859	$	10,859	$	10,859
Total Resource Acquisition Programs	$	14,022	$	14,022	$	14,022
Large Industrial T1/R100						
Large Industrial T1/R100 Incentives/Promotion	$	3,587	$	3,587	$	3,587
Large Industrial T1/R100 Administration	$	907	$	907	$	907
Large Industrial T1/R100 Evaluation	$	40	$	40	$	40
Total Large Industrial T1/R100 Program	$	4,534	$	4,534	$	4,534
Low-Income						
Low-Income Incentives/Promotion	$	5,827	$	5,827	$	5,827
Low-Income Administration	$	972	$	972	$	972
Low-Income Evaluation	$	40	$	40	$	40
Low-Income Program	$	6,839	$	6,839	$	6,839
Market Transformation						
New Home Efficiency Incentives/Promotion	$	635	$	1,185	$	1,185
New Home Efficiency Administration	$	194	$	194	$	194
High Efficiency Residential New Build Program	$	829	$	1,379	$	1,379
Programs Sub-total	**$**	**26,223**	**$**	**26,773**	**$**	**26,773**
DWHR Sunset	**$**	**550**	**$**	**-**	**$**	**-**
Portfolio Budget						
Research	$	766	$	766	$	766
Evaluation	$	969	$	969	$	969
Administration	$	1,582	$	1,582	$	1,582
Total DSM Budget Pre-Inflation	**$**	**30,091**	**$**	**30,091**	**$**	**30,091**
Cumulative Inflation @2.87%	$	864	$	1,752	$	2,666
Total DSM Budget Post-Inflation	**$**	**30,954**	**$**	**31,842**	**$**	**32,756**

11

Subject to the Board's findings on Section 3 of this Agreement, the maximum incentive for the Resource Acquisition Scorecard in 2013 and 2014 is 52.4% ($14.022 million /$26.773 million) of the maximum incentive of $10.450 million. This equates to a maximum incentive of $5.473 million for the Resource Acquisition scorecard.

Parties, except Pollution Probe, agree to the following Resource Acquisition scorecards for each of years 2012, 2013 and 2014.

The scorecard targets contained in this agreement supersede Union's DSM Plan Exhibit A, Table 4.

2012 Resource Acquisition Scorecard				
Metrics	Metric Target Levels			Weight
	Lower Band	Target	Upper Band	
Cumulative Natural Gas Savings (m3)	619,500,000	826,000,000	1,032,500,000	90%
Deep Savings - Residential (homes)	120	160	200	5%
Deep Savings - Commercial/Industrial (% of baseline consumption)	4.00%	5.00%	6.00%	5%

2013 Resource Acquisition Scorecard				
Metrics	Metric Target Levels			Weight
	Lower Band	Target	Upper Band	
Cumulative Natural Gas Savings (m3)	75% of Target	2012 Post-Audit Scorecard Cost Effectivness (m3 per Promotion and Incentive Dollar Spent) times $10.684M times 1.02	125% of Target	90%
Deep Savings - Residential (homes)(1)	2013 Target minus 50 homes	2012 Actual times 1.25	2013 Target plus 50 homes	5%
Deep Savings - Commercial/Industrial (% of baseline consumption)	The higher of: i) 2012 Actual ii) 4.5%	The higher of: i) 2012 Actual + 1% ii) 5.5%	The higher of: i) 2012 Actual + 2% ii) 6.5%	5%

(1) In the event the calculated 2013 Target (2012 Actual times 1.25) is lower than the 2012 Target (160 homes), the 2013 Metric Target Levels will become the 2012 targets (Lower Band: 120, Target:160, Upper Band: 200)

3. The Participating Parties acknowledge that if the Board finds that the increase in the DSM incentive related to the additional Low-income budget should not be approved and, as a result, Union reduces its Low-income budget to align with the lower incentive, the allocation of overheads will change.
4. The Participating Parties rely on Union's Evidence that the amount of $5.095 million proposed to be included in rates for Rate T1 and Rate 100 excludes the allocation of Low-income DSM costs and inflation to Rate T1 and Rate 100.
5. The Participating Parties have agreed that, of the $5.095 million, 70% shall be allocated to Rate T1 ($3.567 million) and 30% shall be allocated to Rate 100 ($1.529 million).
6. The 2012 Large Industrial Rate T1 and Rate 100 scorecard as agreed to by parties is presented below.

   The scorecard targets contained in this agreement supersede Union's DSM Plan Exhibit A, Table 5.

2012 Large Industrial Rate T1/R100 Scorecard			
Metric	Metric Target Levels		
	Lower Band	Target	Upper Band
Cumulative Natural Gas Savings (m3)	750,000,000	1,000,000,000	1,250,000,000

7. The Participating Parties agree that the maximum incentive applicable to Rate T1 and Rate 100 is $1.807 million. This equates to 17.3% of the maximum incentive of $10.450 million. 17.3% represents the Large Industrial Rate T1 and Rate 100 program budget ($4.534 million) as a percent of the Program Budget sub-total ($26.223 million). The maximum incentive of $1.806 million is subject to the Board's findings related to Section 3 of the Agreement.

8. At its sole discretion, Union may transfer a maximum of $0.500 million of the program budget allocated to Rate T1 to Rate 100, or transfer a maximum of $0.500 million of the program budget allocated to Rate 100 to Rate T1 (exclusive of the 15% allowable overspend). Union will not transfer budget dollars from any other part of the overall DSM budget of $30.091 million into Rate T1 and Rate 100.
9. In the event that Union qualifies to access the 15% allowable overspend, Union will only access the overspend for the Large Industrial Rate T1/Rate 100 program up to a maximum of 15% of the budget allocated to the Large Industrial Rate T1/Rate100 program, i.e. $5.095 million. This maximum 15% overspend claim, which on $5.095 million is $0.764 million (not including inflation), may be allocated to programming for Rate T1, Rate 100, or any combination, at Union's discretion. The maximum total budget, including program budget, allocated overheads and 15% allowable overspend, which can be allocated to Rate T1 and Rate 100 is $5.859 million ($5.095 million plus $0.764 million).
10. As a result of the above restrictions, the maximum budget, including program budget, allocated overheads and 15% allowable overspend, for Rate T1 in 2012 will be $4.831 million ($3.567 plus $0.500 plus $0.764). The maximum allocation of the DSM Incentive for Rate T1 is 82.4% ($4.831 million divided by $5.859 million) which equates to $1.489 million (82.4% multiplied by $1.807 million). The maximum budget for Rate 100 will be $2.793 million ($1.529 plus $0.500 plus $0.764). The maximum allocation of the DSM Incentive for Rate 100 is 47.7% ($2.793 million divided by $5.859 million) which equates to $0.861 million (47.7% multiplied by $1.807 million). The maximum total budget, including program budget, allocated overheads and 15% allowable overspend,

PROPOSED DSM PROGRAMS

PROGRAMS OF

UNION LIMITED

TABLE OF CONTENTS

1.0.8 Residential Cost Effectiveness

Table 3 – Residential Program Cost Effectiveness

Measure	Participants	Total TRC Benefits	Total TRC Costs	Total Net TRC Before Program Costs	TRC Ratio
NHC - Faucet Aerator - Bath - 1.0gpm	280	$ 10,658	$ 111	$ 10,547	96.3
NHC - Faucet Aerator - Kitchen - 1.5gpm	280	$ 19,541	$ 242	$ 19,299	80.7
NHC - Showerhead - 1.25gpm	280	$ 59,398	$ 955	$ 58,443	62.2
Install - Faucet Aerator - Bath - 1.0gpm [1]	1,705	$ 27,328	$ 674	$ 26,654	40.5
Install - Faucet Aerator - Bath - 1.0gpm replacing existing 1.5gpm [1]	255	$ 1,807	$ 101	$ 1,706	17.9
Install - Faucet Aerator - Kitchen - 1.5gpm [1]	1,960	$ 85,837	$ 1,694	$ 84,143	50.7
Install - Pipe Insulation - 2m [1]	1,960	$ 57,369	$ 1,844	$ 55,525	31.1
Install - Showerhead - 1.25gpm [1]	1,705	$ 289,489	$ 5,816	$ 283,672	49.8
Install - Showerhead - 1.25gpm replacing existing 2.0 gpm [1]	255	$ 37,523	$ 869	$ 36,654	43.2
Pull - Faucet Aerator - Bath - 1.0gpm [1]	29,232	$ 564,105	$ 11,555	$ 552,549	48.8
Pull - Faucet Aerator - Bath - 1.0gpm replacing existing 1.5gpm [1]	4,368	$ 37,294	$ 1,727	$ 35,568	21.6
Pull - Faucet Aerator - Kitchen - 1.5gpm [1]	33,600	$ 1,662,189	$ 29,040	$ 1,633,148	57.2
Pull - Pipe Insulation - 2m [1]	33,600	$ 538,951	$ 31,611	$ 507,340	17.0
Pull - Showerhead - 1.25gpm [1]	29,232	$ 3,623,332	$ 99,710	$ 3,523,621	36.3
Pull - Showerhead - 1.25gpm replacing existing 2.0 gpm [1]	4,368	$ 469,656	$ 14,899	$ 454,757	31.5
Push - Faucet Aerator - Bath - 1.0gpm [1]	17,539	$ 252,977	$ 6,933	$ 246,044	36.5
Push - Faucet Aerator - Bath - 1.0gpm replacing existing 1.5gpm [1]	2,621	$ 16,725	$ 1,036	$ 15,689	16.1
Push - Faucet Aerator - Kitchen - 1.5gpm [1]	20,160	$ 794,601	$ 17,424	$ 777,177	45.6
Push - Pipe Insulation - 2m [1]	20,160	$ 310,214	$ 18,967	$ 291,247	16.4
Push - Showerhead - 1.25gpm [1]	17,539	$ 1,525,632	$ 59,826	$ 1,465,806	25.5
Push - Showerhead - 1.25gpm replacing existing 2.0 gpm [1]	2,621	$ 197,752	$ 8,940	$ 188,813	22.1
Thermostat - Programmable	6,000	$ 674,882	$ 85,500	$ 589,382	7.9
Attic Insulation	88	$ 27,163	$ 34,197	-$ 7,034	0.8
Basement Wall Insulation	87	$ 66,479	$ 96,412	-$ 29,932	0.7
Draft Proofing Kit [2]	56,000	$ 822,729	$ 504,000	$ 318,729	1.6
Total		**$ 12,173,630**	**$ 1,034,083**	**$ 11,139,546**	
		Promotion Costs	$ 2,048,417		
		Administration	$ 365,851		
		EM&V Costs	$ 20,000		
		Program Total		**$ 8,705,278**	
		Program TRC Ratio			**3.5**

1. TRC benefits adjusted based on 2010 verification study results. The adjustments reflect installation rates, persistance rates, percentage of showering under showerhead (for showerhead measures), and percentage of homes without gas water heaters.
2. Draft proofing kit includes: 1 Foam Can, 1 Caulking Tube, 3 Rolls of Foam Tape, 4 Energy Saver Gaskets with 2 Child Safety Inserts

1.0.9 Residential Program Targets

Table 4 – Residential Program Targets

2012 Residential Program Targets			
Metric	Metric Target Levels		
	50%	100%	150%
Cumulative Natural Gas Savings (m3)	12,409,000	24,819,000	31,023,000
Deep Measures	88	175	219

1.1.8 Cost Effectiveness

Table 8 – Commercial/Industrial Program Cost Effectiveness

	Measure	Participants	Total TRC Benefits	Total TRC Costs	Total Net TRC Before Program Costs	TRC Ratio
Retrofit	Air Curtains - Double Door	5	$ 24,748	$ 11,875	$ 12,873	2.1
Retrofit	Air Curtains - Single Door	5	$ 9,620	$ 7,838	$ 1,783	1.2
Retrofit	Building Optimization [55]	30	N/A	N/A	N/A	
New Build/Retrofit	CEE Tier 2 Front-Loading Clothes Washer (Multi Family)	1,000	$ 1,300,674	$ 540,000	$ 760,674	2.4
New Build/Retrofit	Commercial Custom [56]	100	$ 15,375,615	$ 3,564,214	$ 11,811,400	4.3
New Build	Condensing Boiler - Space Heating 300 to 999 MBtu/h [1]	35	$ 684,688	$ 213,088	$ 471,600	3.2
Retrofit	Condensing Boiler - Space Heating 300 to 999 MBtu/h [2]	120	$ 2,413,101	$ 751,003	$ 1,662,098	3.2
New Build	Condensing Boiler - Space Heating over 1,000 Mbtu/h [3]	35	$ 2,042,778	$ 635,752	$ 1,407,027	3.2
Retrofit	Condensing Boiler - Space Heating over 1,000 Mbtu/h [4]	55	$ 2,964,985	$ 922,760	$ 2,042,225	3.2
New Build	Condensing Boiler - Space Heating up to 299 MBtu/h [5]	65	$ 489,562	$ 149,065	$ 340,497	3.3
Retrofit	Condensing Boiler - Space Heating up to 299 MBtu/h [6]	140	$ 987,308	$ 396,872	$ 590,436	2.5
New Build/Retrofit	Condensing Gas Water Heater (1,000gal/day) - Purchase	15	$ 55,773	$ 31,778	$ 23,996	1.8
New Build/Retrofit	Condensing Gas Water Heater (100gal/day)	15	$ 11,939	$ 31,778	-$ 19,839	0.4
New Build/Retrofit	Condensing Gas Water Heater (500gal/day)	15	$ 31,393	$ 31,778	-$ 385	1.0
New Build	Condensing Rooftop Units (MUA) All other Commercial Efficiency + 2 speed > 6000 cfm [7]	1	$ 31,001	$ 9,120	$ 21,881	3.4
New Build	Condensing Rooftop Units (MUA) All other Commercial Efficiency + 2 speed 1700 - 5999 cfm [8]	1	$ 13,199	$ 4,357	$ 8,841	3.0
New Build	Condensing Rooftop Units (MUA) All other Commercial Efficiency + VFDs > 6000 cfm [9]	1	$ 51,235	$ 9,206	$ 42,030	5.6
New Build	Condensing Rooftop Units (MUA) All other Commercial Efficiency + VFDs 1700 - 5999 cfm [10]	1	$ 22,040	$ 4,431	$ 17,609	5.0
New Build	Condensing Rooftop Units (MUA) Multifamily & Healthcare Efficiency + 2 speed > 6000 cfm [11]	1	$ 48,756	$ 9,136	$ 39,621	5.3
New Build	Condensing Rooftop Units (MUA) Multifamily & Healthcare Efficiency + 2 speed 1700 - 5999 cfm [12]	1	$ 21,186	$ 4,437	$ 16,749	4.8
New Build	Condensing Rooftop Units (MUA) Multifamily & Healthcare Efficiency + VFDs 1700 - 5999 cfm [13]	1	$ 34,079	$ 4,477	$ 29,602	7.6
New Build	Condensing Rooftop Units (MUA) Multifamily & Healthcare Efficiency + VFDs> 6000 cfm[14]	1	$ 78,381	$ 9,222	$ 69,159	8.5
New Build	Condensing Rooftop Units (MUA) Multifamily & Healthcare Improved efficiency > 6000 cfm [15]	1	$ 19,443	$ 6,275	$ 13,168	3.1
New Build	Condensing Rooftop Units (MUA) Multifamily & Healthcare Improved efficiency 1700 - 2999 cfm [16]	1	$ 5,061	$ 2,245	$ 2,816	2.3
New Build	Condensing Rooftop Units (MUA) Multifamily & Healthcare Improved efficiency 3000 - 5999 cfm [17]	1	$ 10,388	$ 3,738	$ 6,650	2.8
New Build/Retrofit	Condensing Unit Heater [18]	5	$ 16,362	$ 11,804	$ 4,559	1.4
New Build/Retrofit	DCKV Dinner House (10000 - 15000 cfm)	1	$ 92,507	$ 19,000	$ 73,507	4.9
New Build/Retrofit	DCKV Fast Casual (< 5000 cfm)	2	$ 48,762	$ 19,000	$ 29,762	2.6
New Build/Retrofit	DCKV Full Menu (5000 - 9999 cfm)	12	$ 685,068	$ 171,000	$ 514,068	4.0
New Build	Destratification Fan [19]	10	$ 164,776	$ 63,189	$ 101,587	2.6
Retrofit	Destratification Fan [20]	20	$ 673,580	$ 126,378	$ 547,202	5.3
New Build	DWHR - Ent - Arena [21]	1	$ 16,485	$ 8,846	$ 7,638	1.9
Retrofit	DWHR - Ent - Arena [22]	1	$ 16,485	$ 13,783	$ 2,702	1.2
New Build	DWHR - Hospital - Dishwashing [23]	1	$ 6,234	$ 1,682	$ 4,552	3.7
Retrofit	DWHR - Hospital - Dishwashing [24]	1	$ 16,105	$ 2,575	$ 13,530	6.3
New Build	DWHR - Hospital - Laundry [25]	1	$ 153,255	$ 35,388	$ 117,868	4.3
New Build	DWHR - Laundromat	1	$ 173,408	$ 35,350	$ 138,057	4.9
Retrofit	DWHR - Laundromat	1	$ 173,408	$ 38,770	$ 134,637	4.5
New Build	DWHR - Nursing Home - Dishwashing [26]	1	$ 4,477	$ 1,681	$ 2,796	2.7
New Build	DWHR - University/College Cafeterias - Dishwashing [27]	1	$ 8,324	$ 1,681	$ 6,643	5.0
Retrofit	DWHR - University/College Cafeterias - Dishwashing [28]	1	$ 20,991	$ 3,086	$ 17,904	6.8
New Build/Retrofit	Energy Star Convection Ovens - Full Size	10	$ 16,184	$ 7,000	$ 9,184	2.3
New Build/Retrofit	Energy Star Dishwasher - Rack Conveyor - Multi Tank - High Temperature - Purchase	5	$ 148,860	$ 1,051	$ 147,809	141.6
New Build/Retrofit	Energy Star Dishwasher - Rack Conveyor - Multi Tank - High Temperature - Rental	5	$ 77,489	$ 4,463	$ 73,026	17.4
New Build/Retrofit	Energy Star Dishwasher - Rack Conveyor - Single Tank - High Temperature - Purchase	30	$ 540,266	$ 52,013	$ 488,253	10.4
New Build/Retrofit	Energy Star Dishwasher - Rack Conveyor - Single Tank - High Temperature - Rental	5	$ 46,872	$ 4,463	$ 42,410	10.5
New Build/Retrofit	Energy Star Dishwasher - Stationary Rack - High Temperature - Purchase	5	$ 26,297	-$ 1,400	$ 27,697	NA [58]
New Build/Retrofit	Energy Star Dishwasher - Stationary Rack - High Temperature - Rental	5	$ 12,491	$ 3,987	$ 8,504	3.1
New Build/Retrofit	Energy Star Dishwasher - Stationary Rack - Low Temperature - Purchase	30	$ 128,324	-$ 8,400	$ 136,724	NA [58]
New Build/Retrofit	Energy Star Dishwasher - Stationary Rack - Low Temperature -Rental	5	$ 10,159	$ 3,806	$ 6,353	2.7
New Build/Retrofit	Energy Star Dishwasher - Undercounter - Low Temperature - Purchase	50	$ 51,629	-$ 390	$ 52,019	NA [58]
New Build/Retrofit	Energy Star Fryer	200	$ 415,830	$ 164,480	$ 251,350	2.5
New Build	Energy Star Steam Cookers	10	$ 59,729	$ 16,000	$ 43,729	3.7

New Build	ERV 1 - up to 1000CFM - Multi Family, Health Care, Nursing [29]	20	$ 200,196	$ 41,146	$ 159,050	4.9
Retrofit	ERV 1 - up to 1000CFM - Multi Family, Health Care, Nursing [30]	20	$ 164,322	$ 31,841	$ 132,481	5.2
New Build	ERV 2 - over 1000CFM - Multi Family, Health Care, Nursing [31]	10	$ 351,887	$ 72,323	$ 279,564	4.9
Retrofit	ERV 2 - over 1000CFM - Multi Family, Health Care, Nursing [32]	15	$ 647,544	$ 125,477	$ 522,066	5.2
New Build	ERV 3 - up to 2000CFM - Hotel, Restaurant, Retail [33]	15	$ 112,846	$ 41,690	$ 71,157	2.7
Retrofit	ERV 3 - up to 2000CFM - Hotel, Restaurant, Retail [34]	15	$ 113,160	$ 39,469	$ 73,690	2.9
New Build	ERV 4 - over 2000CFM - Hotel, Restaurant, Retail [35]	15	$ 419,494	$ 154,977	$ 264,517	2.7
Retrofit	ERV 4 - over 2000CFM - Hotel, Restaurant, Retail [36]	10	$ 218,697	$ 76,280	$ 142,417	2.9
New Build	ERV 5 - up to 2000CFM - Office, Warehouse, School [37]	20	$ 130,556	$ 75,525	$ 55,031	1.7
Retrofit	ERV 5 - up to 2000CFM - Office, Warehouse, School [38]	20	$ 94,970	$ 51,901	$ 43,069	1.8
New Build	ERV 6 - over 2000CFM - Office, Warehouse, School [39]	20	$ 360,126	$ 208,328	$ 151,798	1.7
Retrofit	ERV 6 - over 2000CFM - Office, Warehouse, School [40]	20	$ 433,722	$ 237,028	$ 196,694	1.8
New Build	High Efficiency Under-Fired Broilers	4	$ 12,812	$ 4,064	$ 8,748	3.2
New Build	HRV >2,000cfm-Hotel, Restaurant, Retail, Rec [41]	10	$ 121,319	$ 68,624	$ 52,694	1.8
Retrofit	HRV >2,000cfm-Hotel, Restaurant, Retail, Rec [42]	10	$ 133,043	$ 68,624	$ 64,418	1.9
Retrofit	HRV ≥2,000cfm-School,Office, Warehouse, Man [43]	10	$ 85,127	$ 68,624	$ 16,503	1.2
New Build	HRV 500 to 2,000cfm-Hotel, Restaurant, Retail, Rec [44]	20	$ 121,258	$ 68,590	$ 52,668	1.8
Retrofit	HRV 500 to 2,000cfm-Hotel, Restaurant, Retail, Rec [45]	10	$ 51,661	$ 26,647	$ 25,014	1.9
New Build	HRV Multi Family, Health Care, Nursing [46]	10	$ 78,720	$ 24,761	$ 53,959	3.2
Retrofit	HRV Multi Family, Health Care, Nursing [47]	10	$ 71,000	$ 20,337	$ 50,663	3.5
Retrofit	HWC - Faucet Aerator - Bath - 1.0gpm (Multi Family) [59]	2,300	$ 29,859	$ 1,221	$ 28,638	24.4
Retrofit	HWC - Faucet Aerator - Kitchen 1.5gpm (Multi Family) [59]	1,000	$ 40,676	$ 1,161	$ 39,515	35.0
Retrofit	HWC - Showerhead - 1.25gpm (Multi Family) [59]	4,300	$ 553,389	$ 14,667	$ 538,722	37.7
Retrofit	HWC - Showerhead - 1.25gpm replacing existing 2.0gpm (Multi Family) [59]	1,333	$ 137,620	$ 4,547	$ 133,073	30.3
New Build/Retrofit	Industrial Custom [57]	90	$ 59,544,225	$ 10,878,227	$ 48,665,998	5.5
New Build	Infrared Heating - 101 to 300 MBtu/hr [48]	225	$ 1,311,949	$ 288,011	$ 1,023,938	4.6
Retrofit	Infrared Heating - 101 to 300 MBtu/hr [49]	100	$ 583,817	$ 128,173	$ 455,644	4.6
New Build	Infrared Heating - 20 to 100 MBtu/hr [50]	150	$ 509,871	$ 107,701	$ 402,170	4.7
Retrofit	Infrared Heating - 20 to 100 MBtu/hr [51]	150	$ 460,286	$ 96,240	$ 364,046	4.8
New Build/Retrofit	Laundry Washing Equipment with Ozone - <= 120 lbs & >= 200,000 lbs/yr [52]	20	$ 482,157	$ 201,848	$ 280,309	2.4
New Build/Retrofit	Laundry Washing Equipment with Ozone - > 120 lbs & 1,000,000 lbs/yr [53]	1	$ 120,539	$ 27,848	$ 92,691	4.3
New Build/Retrofit	Laundry Washing Equipment with Ozone - > 120 lbs & 260,000 - 1,000,000 lbs/yr [54]	5	$ 379,698	$ 139,242	$ 240,456	2.7
New Build/Retrofit	New Measure 2012 [60]	220	N/A	N/A	N/A	N/A
Retrofit	Prescriptive Schools - Elementary (hydronic boilers with 83%+)	2	$ 58,622	$ 12,623	$ 45,999	4.6
Retrofit	Prescriptive Schools - Secondary (hydronic boilers with 83%+)	2	$ 237,407	$ 21,126	$ 216,281	11.2
	Total		**$ 98,903,882**	**$ 21,583,622**	**$ 77,320,260**	
			Promotion Costs	$ 974,220		
			Administration	$ 2,582,842		
			EM&V Costs	$ 60,000		
			Program Total Net		**$ 73,703,198**	
			Program TRC Ratio			**3.9**

1.3.8 **Cost Effectiveness**

Table 21 – Low Income Cost Effectiveness

Measure	Participants	Total TRC Benefits	Total TRC Costs	Total Net TRC Before Program Costs	TRC Ratio
Attic Insulation (Weatherization) [3]	550	$ 349,994	$ 412,676	-$ 62,682	0.8
Basement Insulation (Weatherization) [3]	550	$ 1,302,870	$ 959,783	$ 343,087	1.4
Building Optimization [5]	70	N/A	N/A	N/A	N/A
CEE Tier 2 Front-loading Clothes Washer (Multi Family)	88	$ 114,459	$ 47,520	$ 66,939	2.4
Condensing Boiler - up to 299 Mbtu/h [1]	5	$ 35,261	$ 14,174	$ 21,087	2.5
Condensing Gas Water Heater (1000gal/day) - Purchase	15	$ 55,773	$ 31,778	$ 23,996	1.8
Early Furnace Replacement - 60% AFUE	28	$ 16,540	$ 14,504	$ 2,036	1.1
Early Furnace Replacement - 70% AFUE	82	$ 28,902	$ 42,476	-$ 13,574	0.7
Early Hot Water Heater Replacement (0.575 to 0.62 EF)	28	$ 1,660	$ 4,704	-$ 3,044	0.4
HHC - Faucet Aerator - Bath - 1.0gpm [4]	10,000	$ 587,411	$ 5,841	$ 581,570	100.6
HHC - Faucet Aerator - Kitchen - 1.5gpm [4]	10,000	$ 1,398,217	$ 12,771	$ 1,385,446	109.5
HHC - Pipe Insulation - 2m [4]	10,000	$ 350,291	$ 9,702	$ 340,589	36.1
HHC - Showerhead - 1.25gpm exist 2.0-2.5 [4]	3,000	$ 743,888	$ 11,256	$ 732,632	66.1
HHC - Showerhead - 1.25gpm exist 2.6+ [4]	7,000	$ 2,926,815	$ 26,265	$ 2,900,550	111.4
HHC - Thermostat - Programmable	6,000	$ 1,172,163	$ 160,083	$ 1,012,080	7.3
HWC - Faucet Aerator - Bath - 1.0gpm (Multi Family) [4]	5,000	$ 64,911	$ 2,655	$ 62,256	24.4
HWC - Faucet Aerator - Kitchen - 1.5gpm (Multi Family) [4]	5,000	$ 203,380	$ 5,805	$ 197,575	35.0
HWC - Showerhead - 1.25gpm (Multi Family) [4]	5,000	$ 643,475	$ 17,055	$ 626,420	37.7
HWC - Showerhead - 1.25gpm replacing existing 2.0gpm (Multi Family) [4]	5,000	$ 516,203	$ 17,055	$ 499,148	30.3
Sealing Measures (Weatherization) [3]	550	$ 375,901	$ 148,126	$ 227,775	2.5
Social and Assisted Housing Multi-Family Offering (Custom) [2]	12	$ 232,473	$ 332,500	-$ 100,027	0.7
Wall Insulation (Weatherization) [3]	550	$ 562,081	$ 437,481	$ 124,600	1.3
Total		**$ 11,682,669**	**$ 2,714,210**	**$ 8,968,459**	
		Promotion Costs	$ 1,315,648		
		Administration	$ 971,549		
		EM&V Costs	$ 40,000		
		Program Total Net TRC		**$ 6,641,262**	
		Program TRC Ratio			**2.3**

1. Condensing Boiler measure is quasi-prescriptive. Savings are based on an average capacity of 185,394 Btu/hr from 2010 year results
2. Social and Assisted Housing Multi-Family Offering (Custom). Input assumptions based on driving a TRC ratio of 0.7 by funding 50% of the full cost, up to the budgeted
3. Weatherization (Attic Insulation, Basement Insulation, Sealing Measures, Wall Insulation). 1220 m3 saved per home is the expected average derived from 150 work plans created for Union Gas by EnviroCentre in 2010 & 2011 (the m3 saved by each measure were totaled to comprise of the 1220 m3 average). 180 kWh saved per home derived from the 150 work plans. Average retrofit cost of $3483.10 based on the sum of average cost/m3 saved in each measure in 150 work plans. 20 year measure life for
4. TRC benefits adjusted based on 2010 verification study results. The adjustments reflect installation rates, persistance rates, percentage of showering under showerhead (for showerhead measures), and percentage of homes without gas water heaters.
5. Building Optimization savings and total resource costs will not be realized until 2013, from all participants in the 2012 year.

1.2.7 Program Budget

- Union has not included inflation in the table below. Union proposes to use the Q2 GDP-IPI inflation factor, released at the end of August, to align with Union's annual rate setting process.

Table 14 – Rate T1 / Rate 100 Customer Program Budget

2012 T1/R100 Customer Program Budget ($000)			
Program Cost	**2012**	**2013**	**2014**
Promotion Costs	$ 360	$ 360	$ 360
Incentive Costs	$ 1,840	$ 1,840	$ 1,840
EM&V & Monitoring Costs	$ 40	$ 40	$ 40
Administrative Costs	$ 907	$ 907	$ 907
Total	**$3,147**	**$3,147**	**$3,147**

1.2.8

Cost Effectiveness

Table 15 – Large Industrial Rate T1/Rate 100 Program Cost Effectiveness

Measure	Participants	Total TRC Benefits	Total TRC Costs	Total Net TRC Before Program Costs	TRC Ratio
T1/R100 Offering (Custom) [1]	30	$ 41,085,780	$ 1,170,257	39,915,523.00	35.1
Total		**$ 41,085,780**	**$ 1,170,257**	**$ 39,915,523**	
		Promotion	$ 360,000		
		Administration	$ 906,511		
		EM&V Costs	$ 40,000		
		Program Total Net TRC		**$ 38,609,012**	
		Program TRC Ratio			**16.6**

1. T1/R100 Offering (Custom). TRC Benefits and TRC Costs based on 3 year historical average of T1/R100 custom results

Rate 100 and Rate T1: Forecast Union Gas Delivery Volumes, Rates and Total Costs in 2012

Rate	2012 Forecast Delivery Volumes[1] (Thousand Cubic Meters)	2012 Union Gas Average Delivery Charges (cents/m^3)	Total Delivery Costs
Rate 100	2,219,052	0.6802	$15,093,992
Rate T1	4,794,769	0.9437	$45,248,235

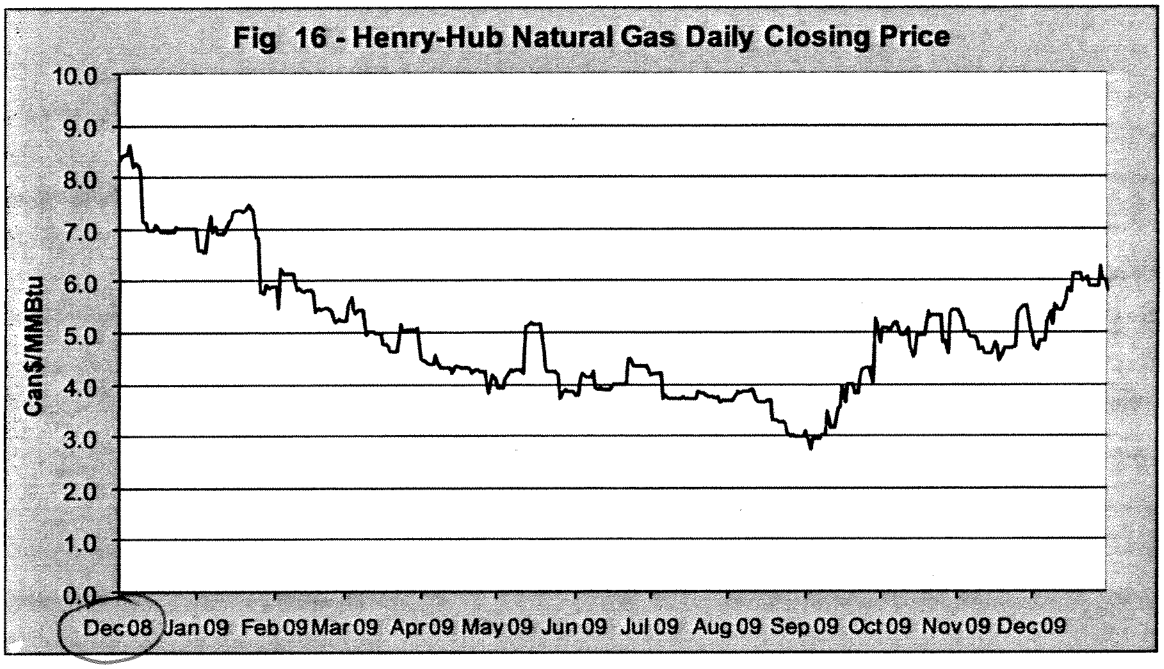
Rate 100 and Rate T1: Gas Commodity Costs

Forecast Volumes in 2012 (Thousand Cubic Meters)	Dawn Spot Price February 6, 2012[2]	Total Annual Gas Costs Assuming February 6, 2012 Spot Price
7,013,821	$2.7986 ($C/GJ)	$724,431,729[3]

[1] EB-2011-0327, Settlement Agreement, Appendix A, page 9.
[2] http://www.ngx.com/marketdata/UDSPOT.html; Retrieved February 7, 2012.
[3] $2.7986 per GJ = $103.27 per thousand cubic metres (Settlement Agreement, Appendix A, page 9).
$724,431,729 = 7,013,821 thousand cubic metres x $103.27 per thousand cubic metres.

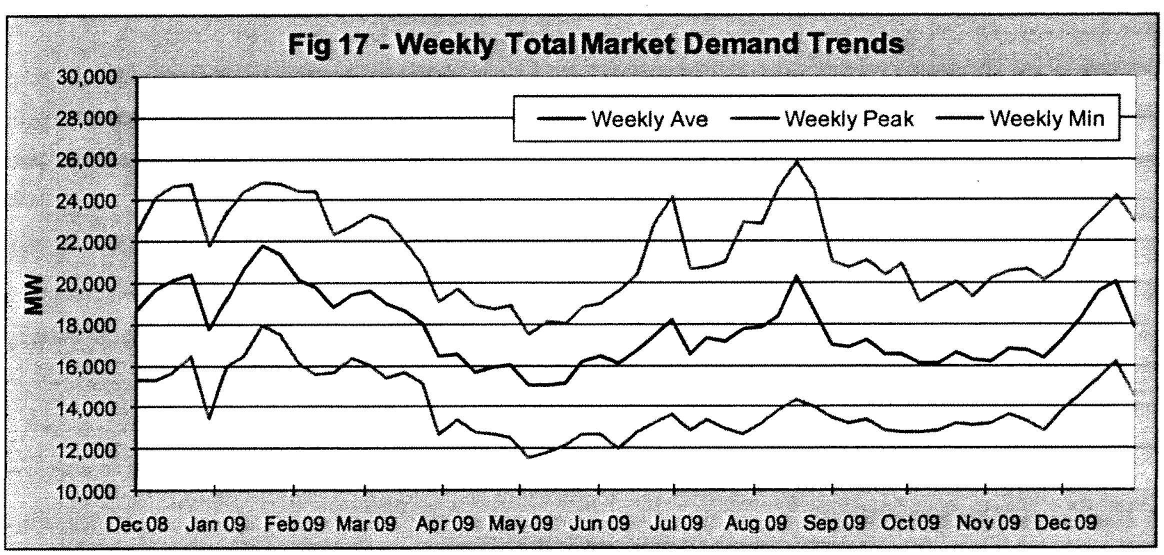
6.6 Henry-Hub Natural Gas Closing Price

Natural gas is a fuel for some Ontario-based generation, and when dispatched, is often the marginal source of electricity in Ontario. In addition, gas prices influence import offers into Ontario and export bids out of the province.



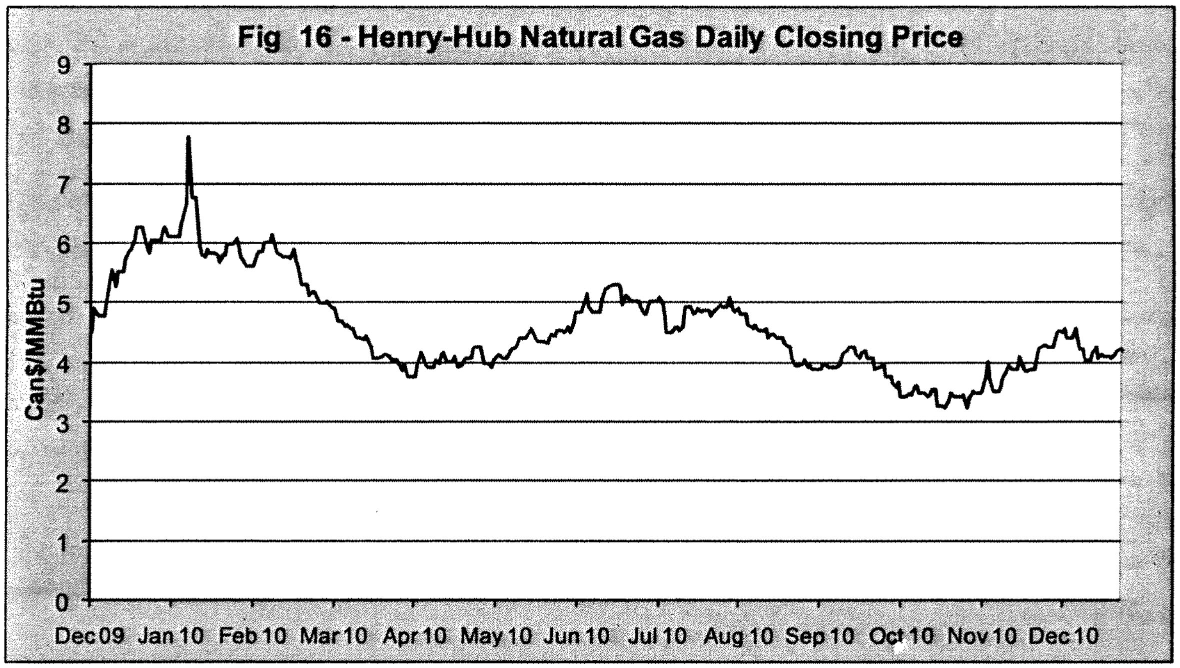
11

6.7 Weekly Market Demand Trends

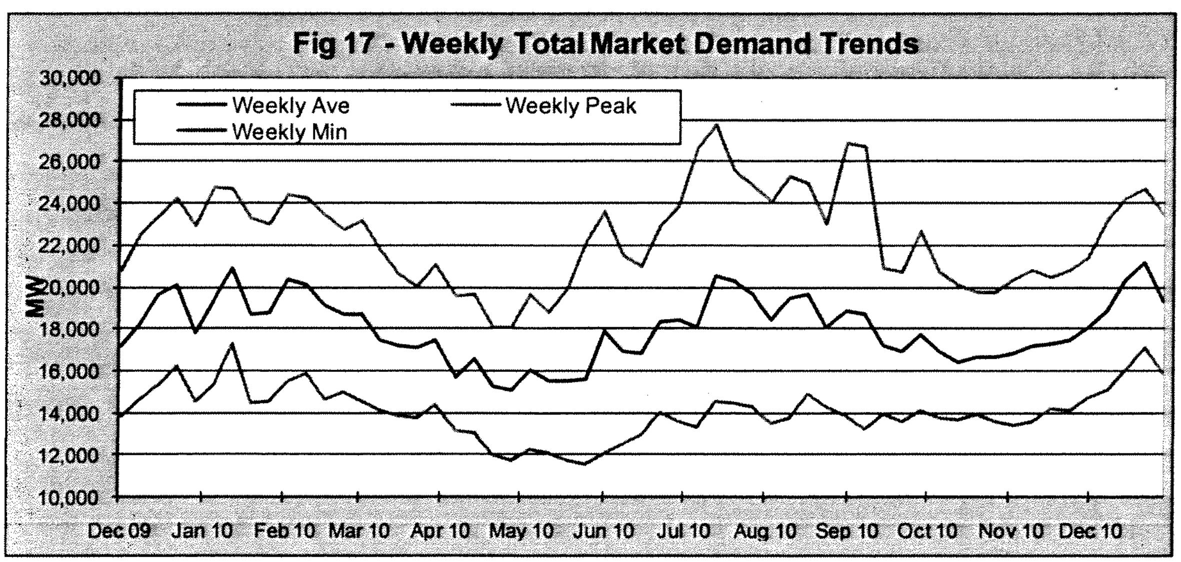


6.6 Henry-Hub Natural Gas Closing Price

Natural gas is a fuel for some Ontario-based generation, and when dispatched, is often the marginal source of electricity in Ontario. In addition, gas prices influence import offers into Ontario and export bids out of the province.

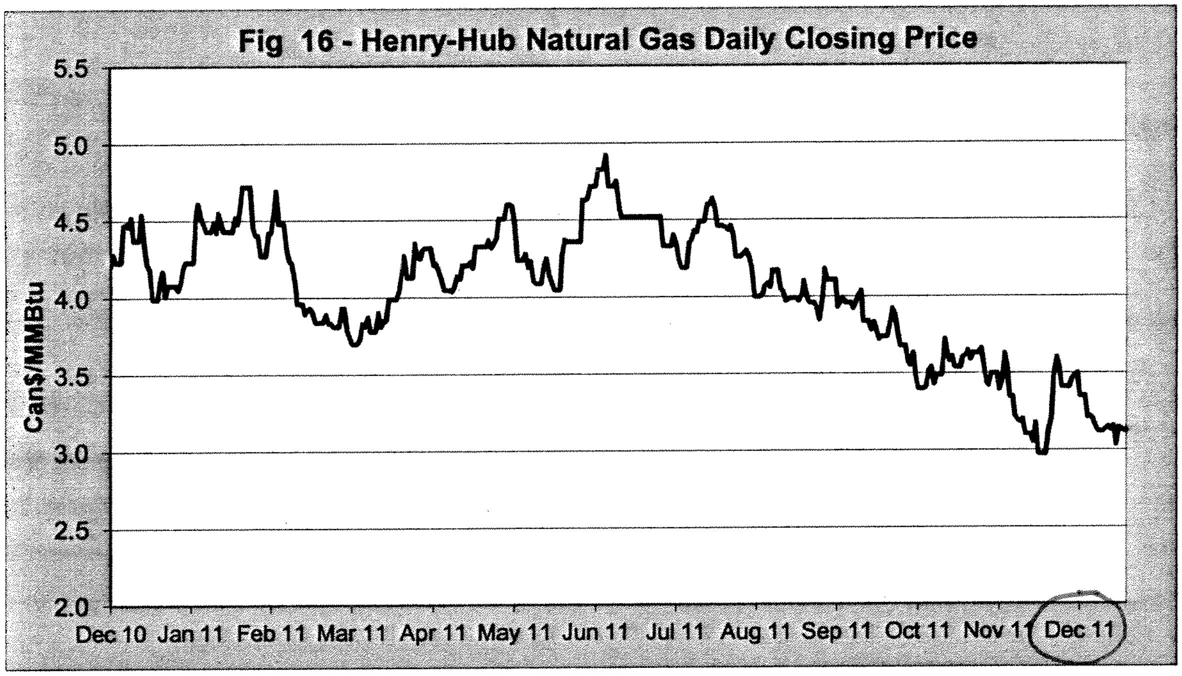


6.7 Weekly Market Demand Trends



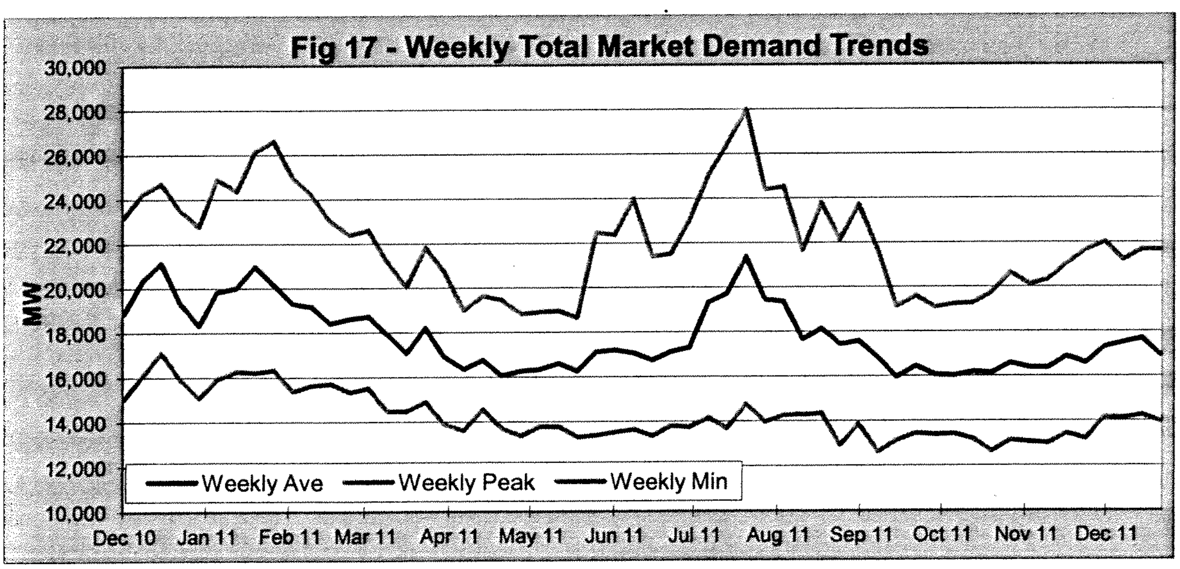
5.6 Henry-Hub Natural Gas Closing Price

Natural gas is a fuel for some Ontario-based generation, and when dispatched, is often the marginal source of electricity in Ontario. In addition, gas prices influence import offers into Ontario and export bids out of the province.



||

5.7 Weekly Market Demand Trends



Filed: January 27, 2011
EB-2010-0332
Exhibit I-9-5
Attachment 1
Page 1 of 130

CME
Ontario

Advancing Opportunities in Energy Management in Ontario Industrial and Manufacturing Sector

Final Report

Submitted by:
Canadian Manufacturers & Exporters

In Association with:
Stantec Consulting, Marbek, and ODYNA

March 17, 2010

Revision 1

Canadian Manufacturers and Exporters
6725 Airport Road; Suite 200
Mississauga ON L4V 1V2; CanadaK2P 2G3
Tel: +1 (905) 672-3466
Fax: +1 (905) 672-1764
www.cme-mec.ca

Stantec

Marbek ODYNA

Executive Summary

Background

Energy management (EM) is increasingly being recognized as an important core strategy to help sustain the productive sectors of our economy and reduce industry's negative impact on climate change. Canadian Manufacturers & Exporters (CME) is a long time and strong proponent of EM and retained Stantec Consulting and Marbek to conduct a study:

Advancing Opportunities in Energy Management in Ontario Industrial and Manufacturing Sector

The outcomes from this study fill critical knowledge gaps pertaining to EM potential in Ontario industry and provide the basis for public policy and program initiatives targeted to help Ontario industry increase its competitiveness and reduce greenhouse gas (GHG) and criteria air contaminant (CAC) emissions associated with energy use.

The primary objectives of the study are to: determine the ***current energy management performance*** of the industrial sector; estimate the ***economic potential*** for energy management, together with the associated greenhouse gas (GHG) and criteria air contaminants (CACs) emission reduction; benchmark the ***GHG and CAC emissions*** associated with energy use in Ontario's industrial sector; and develop a ***framework*** to accelerate the implementation of best practices and increase industry's EM performance.

This study focuses on the Ontario industrial and manufacturing sector and defines the sector by eleven sub-sectors. The comprehensive methodology employed in this study is unique in that it integrates two critical areas of EM analysis, which are more commonly addressed separately:

i) Energy management ***performance benchmarking***; and
ii) Energy management ***potentials analysis***.

EM performance benchmarking seeks to understand the relationship between the EM practices and the implementation of technical best practices. The EM potential scenario estimates the reduced amount of energy use compared to a Reference Case projection of energy use in Ontario industry from 2007 to 2030.

A total of 148 plants participated in the energy performance benchmarking portion of the study and data was obtained through remote surveys, on-site assessments and telephone interviews. In terms of participation, six sub-sectors are very well represented, while three sub-sectors have moderate representation and two sub-sectors have limited or no representation. To ensure representative data was used in the EM potential analysis, data from secondary sources were used to supplement sub-sectors with low or no representation.

Energy Use Profile

In 2007 Ontario's industrial sector used an estimated total 732 PJ[1] of energy; 640 PJ if biomass is excluded. Natural gas and electricity accounted for 38 percent and 22 percent of total energy use, respectively, while biomass accounted for an estimated 13 percent of total energy use. The ten largest sub-sectors, by total energy use, accounted for close to 85 percent of Ontario industrial energy use. Close to 65 percent of the energy was used by industry for process heating, while motive power and air compressors accounted for close to 15 percent.

The Reference Case total energy use is estimated to increase by about 16 percent from 2007 to 2030. In absolute terms the increase is close to 104 PJ. The largest increases in energy use are associated with four of the five largest sub-sectors, by energy use: Primary Metal; Chemical; Non-metallic Mineral Products; and Petroleum and Coal Products manufacturing. The Other Industry manufacturing sub-sector shows the largest decrease in energy use.

Implementation of Best Practices

The energy performance benchmarking results illustrate a relatively low implementation of ***technical best practices*** (TBPs) in the Ontario industrial sector. The 75th percentile of TBP implementation by sub-sector ranges from 31 to 42 percent. This means most of the plants have implemented less than 42 percent of applicable TBPs, and the opportunity exists for most companies to implement more than 58 percent of the TBPs. The end uses with the lowest levels of implemented TBPs are motive power, lighting, and cooling and refrigeration. Compressed air systems have the highest implementation of TBPs.

The implementation of TBP by plant size indicates large plants have implemented, on average, close to 10 percent more TBPs than small and medium sized enterprises (SME). The most significant differences in TBP implementation were observed for lighting, process specific, and indirect process heating (e.g. boilers and steam system) end uses.

Overall, 75 percent of plants have implemented less than 48 percent of the energy ***management best practices*** (MBPs). Among the sub-sectors, relatively low implementation of MBPs was observed in: Primary Metal manufacturing; Other manufacturing; and Fabricated Metal manufacturing. Higher implementation rates of MBPs were observed in: Chemical manufacturing; Non-metallic Mineral manufacturing; Transportation and Machinery manufacturing; and Food and Beverage manufacturing. These results indicate that, in general, plants manage and finance energy projects on an ad-hoc basis, while best practices associated with continuous improvement are not widely implemented. This is reflected by the categories with lowest implementation of MBPs: Policy and Planning; Organization and Accountability; Monitoring, Reporting and Communication; and Training and Capacity building.

The implementation of MBPs by plant size indicates that large plants have implemented, on average, close to 30 percent more MBPs than SMEs. The most significant differences in MBP implementation are observed in the Financing, Policy and Planning, and Monitoring categories.

The energy performance benchmarking results indicate that plants that have implemented more than 75 percent of the MBPs, on average have implemented 42 percent of the applicable

---

[1] 1 Peta-Joule (PJ) = 2.8×10^5 MWh

TBPs. Only five percent of all the plants fall into this top MBP quartile category. On the other hand, plants that have implemented less than 25 percent of the MBPs, on average, have implemented 25 percent of the applicable TBPs. Almost 50 percent of all the plants fall into this bottom quartile of the MBP category. These results illustrate the relationship of the degree of MBP implementation to that of TBP implementation, indicating that the implementation of the former encourages the implementation of the later, thus providing opportunities for energy savings.

Energy Management Potential and Associated Emission Reduction Potential

If all the remaining economically feasible best practices were implemented, total Ontario industrial energy use would be estimated to decrease from 2007 levels by 110 PJ in 2030. These savings would represent a 29 percent reduction in yearly energy use in 2030, as compared to the Reference Case energy use, which is the projected energy use without any new EM market interventions after 2007. The absolute energy savings would be larger for sub-sectors that account for the largest share of energy use, such as Primary Metal manufacturing and Chemical manufacturing, while lower absolute energy savings would be associated with sub-sectors that account for a smaller share of the total energy use, such as Fabricated Metal Products manufacturing and Plastics manufacturing.

Natural gas use is estimated to decrease by 106 PJ, over the Reference Case scenario natural gas use, in 2030. This is 50 percent of the total 2030 industry savings. The significant savings potential estimated for the direct (which includes ovens, dryers, kilns and furnaces) and indirect (which includes boilers and steam systems) process heating end uses are the main reason for the large natural gas savings potential. The system end use, which includes TBPs that apply to the total plant, is estimated to contribute over 35 percent of all the Economic Potential savings by 2030.

The 2007 Base Year greenhouse gas (GHG) emissions associated with energy use are 39.5 million tonnes CO_2eq and the associated criteria air contaminants (CAC) emissions are 92.9 tonnes. Due to the projected increase in energy use in the Reference Case it is estimated that the GHG emissions will increase by 16 percent and CAC emissions by 17 percent by 2030. If all the economically feasible energy efficiency best practices are implemented, as per the Economic Potential scenario, the reduction in GHG emissions is estimated to be 12.6 million tonnes CO_2eq (or 27 percent) less compared to the Reference Case in 2030. The Economic Potential scenario CAC emission reduction is estimated to be 27.5 tonnes (or 25 percent) compared to the Reference Case in 2030.

26

CANADIAN COUNCIL
of **CHIEF EXECUTIVES**

CONSEIL CANADIEN
des **CHEFS D'ENTREPRISE**

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.

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.

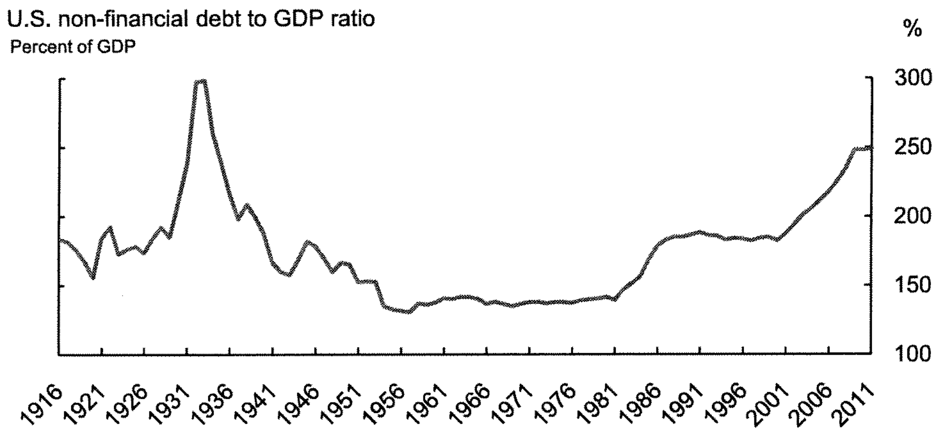
In general, the more that households and governments drive leverage, the less the productive capacity of the economy expands, and, the less sustainable the overall debt burden ultimately is.

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



Sources: U.S. Census Bureau data from 1916 to 1953,
U.S. Flow of Funds data from 1954 to 2011, Bureau of Economic Analysis

Last observation: 2011Q3

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]

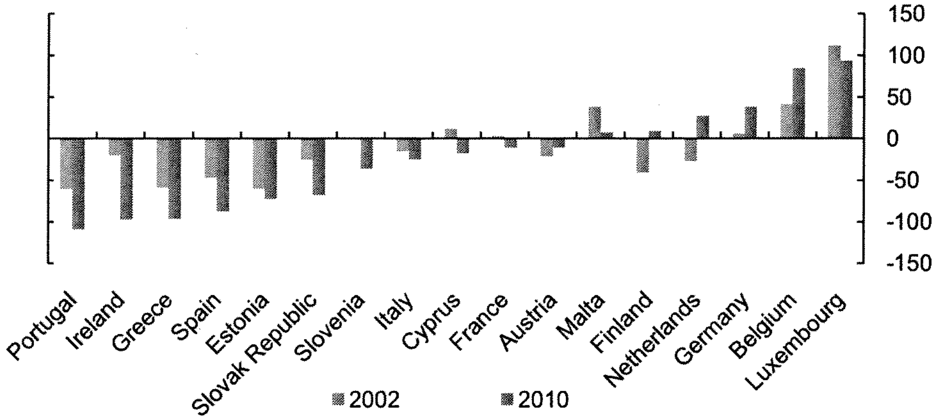
Financial innovation made it easier to do so. And the ready supply of foreign capital from the global savings glut made it cheaper.

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

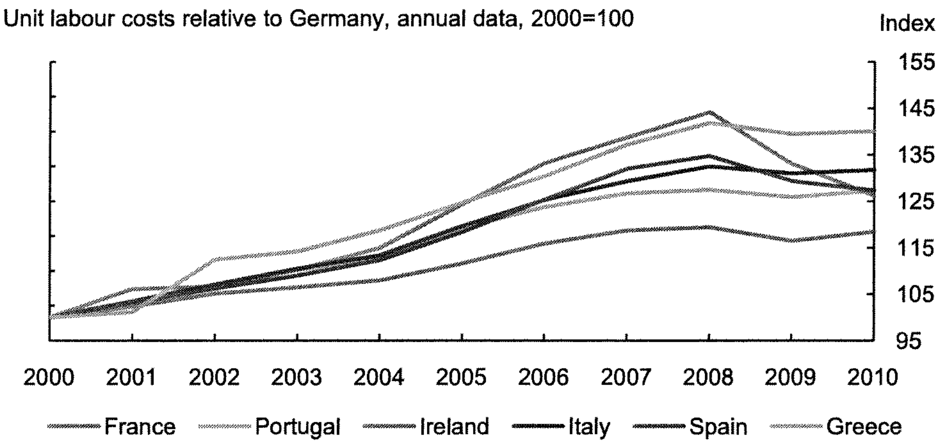
Last observation: 2010

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!

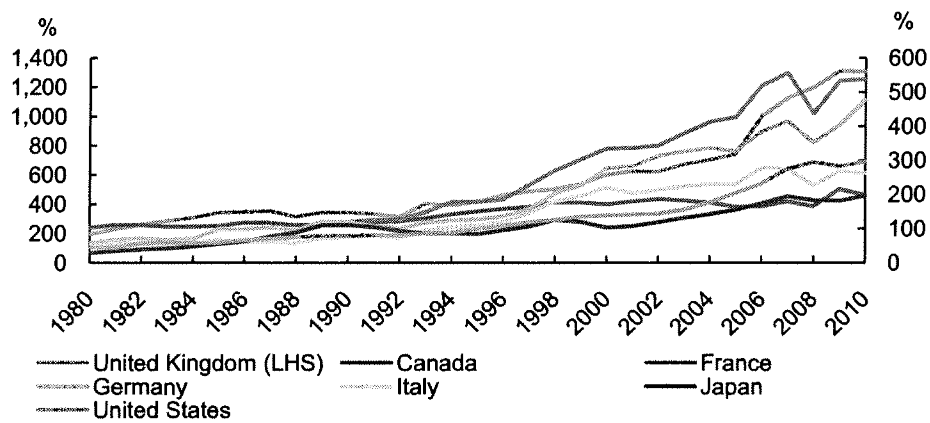
For years, central bankers have talked of surplus and deficit countries, of creditors and debtors. We were usually ignored. Indeed, during a boom, the debtor economy usually feels more vibrant and robust than its creditors. In an era of freely flowing capital, some even thought current account deficits 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.

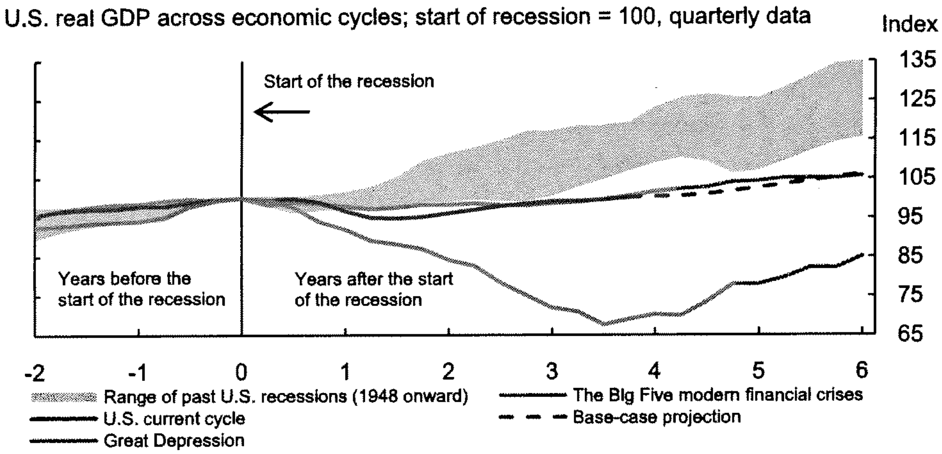
It follows that backsliding on financial reform is not a solution to current problems. The challenge for the crisis economies is the paucity of credit demand rather than the scarcity of its supply. Relaxing prudential regulations would run the risk of maintaining dangerously high leverage—the situation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



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.

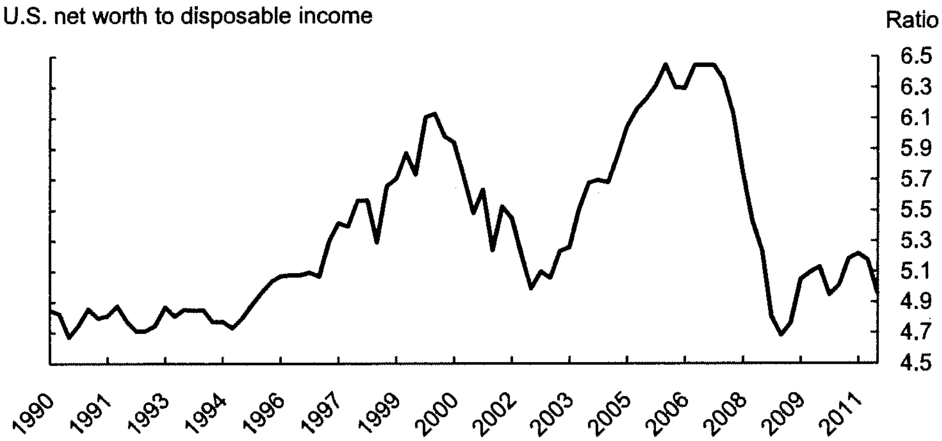
In Europe, a tough combination of necessary fiscal austerity and structural adjustment will mean falling wages, high unemployment and tight credit conditions for firms. Europe is unlikely to return to its pre-crisis level of GDP until a full five years after the start of its *last* recession (**Chart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

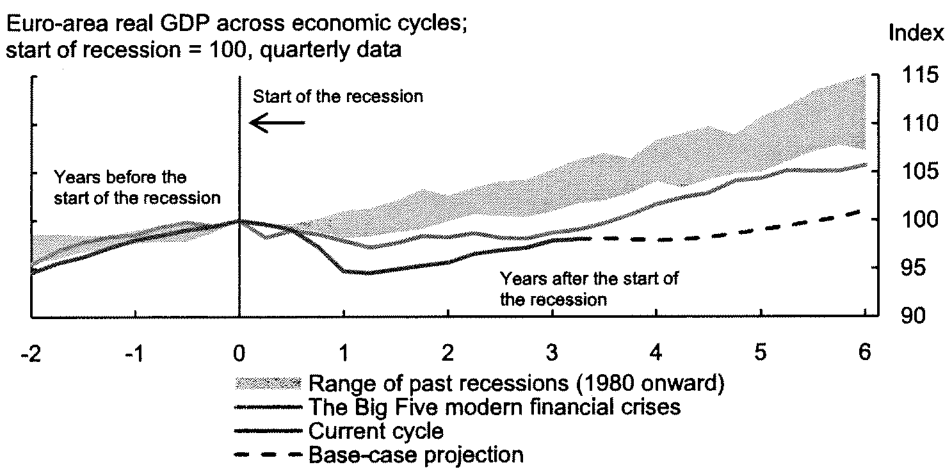
Chart 6: Large drop in U.S. household wealth



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]

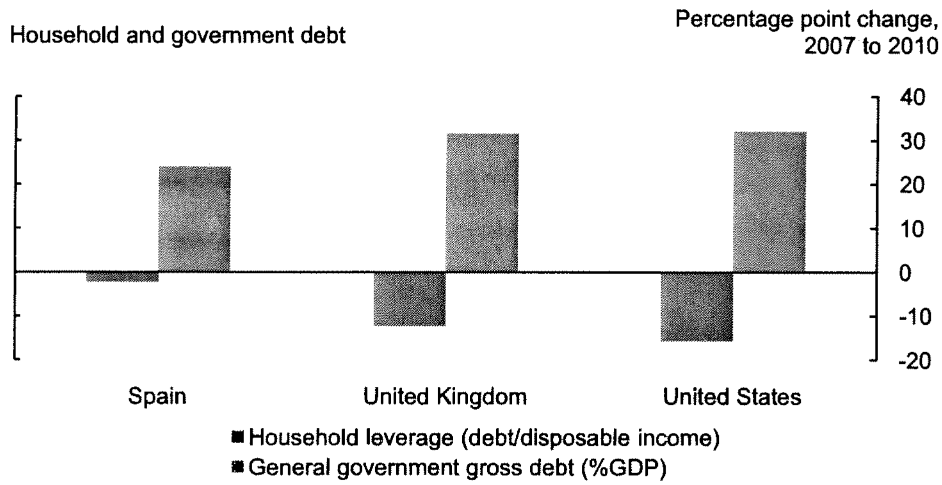
With no easy way out, the basic challenge for central banks is to maintain price stability in order to help sustain nominal aggregate demand during the period of real adjustment. In the Bank's view, that is best accomplished through a flexible inflation-targeting framework, applied symmetrically, to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

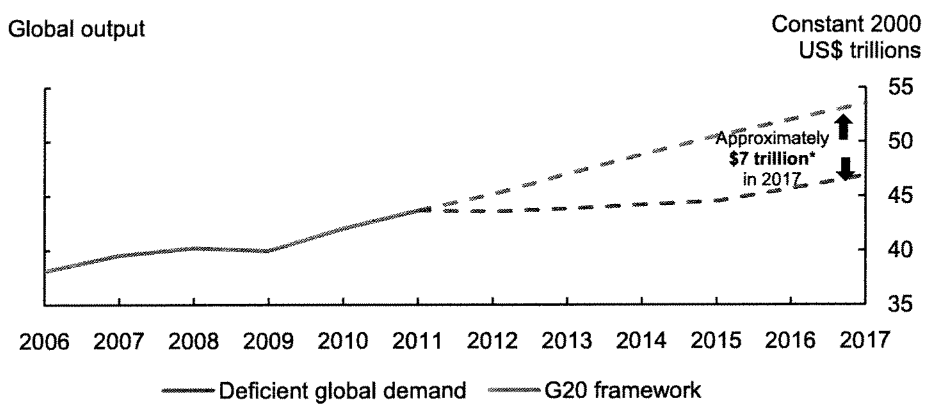
We welcome the measures announced last week by European authorities, which go some way to addressing these issues.

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.

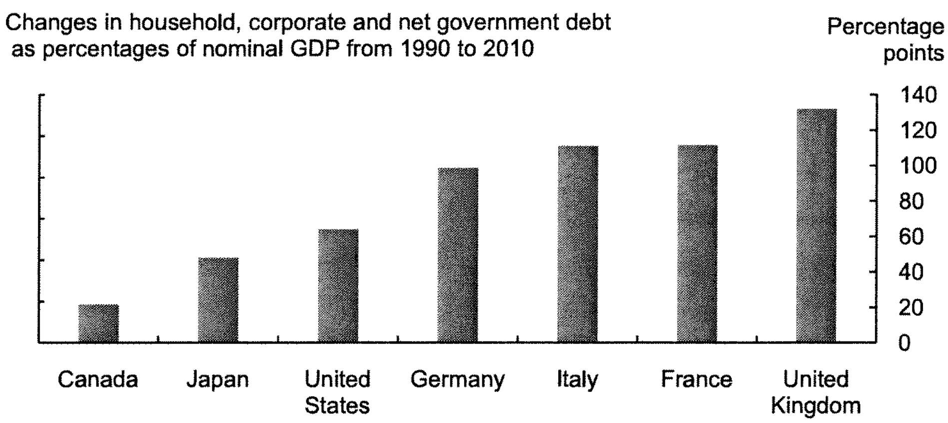
Central bank policy should be guided by a symmetric commitment to the inflation target. Central banks can only bridge real adjustments; they can't make the adjustments themselves.

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**).

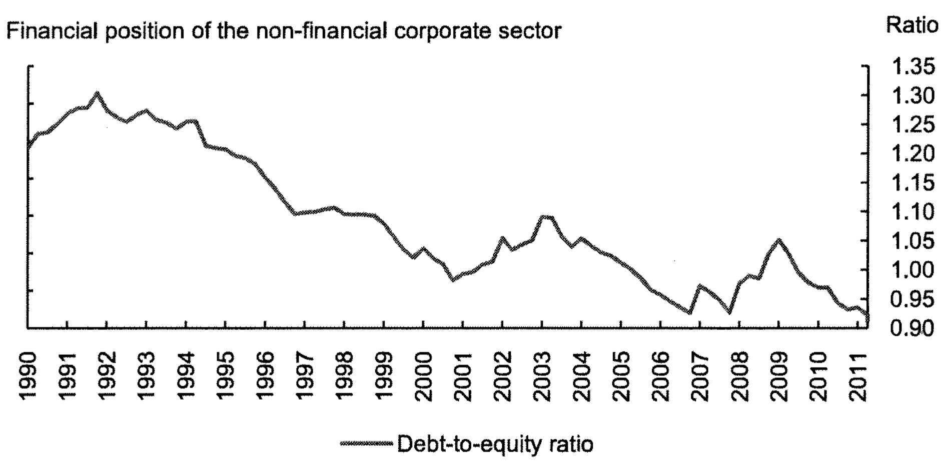
Chart 10: Canadian debt has risen less than its G-7 peers



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.

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. thank the following for their financial support:
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

EB-2011-0327

Union Gas 2012 DSM Plan

Potential Impact of Large Industrial DSMVA Cap

Size of Large Industrial DSMVA Cap

A	Total Proposed DSM Budget (A)[1]	$30,954,000.00
B	Maximum Available DSMVA Funds (15% of Budget, A multiplied by .15)	$4,643,100.00
C	Cap on DSMVA Funds Available for Large Industrial Programs[2]	$764,000.00
D	DSMVA Funds not Available for Large Industrial Programs (B minus C)	**$3,879,100.00**

Potential Impact of Cap on Cost Savings for Large Industrial Customers

E	Cost Effectiveness of Large Industrial Programs (i.e. TRC, or savings per $)[3]	16.6
F	Estimated Potential Savings if $3.8 Million in DSMVA Funds is Spent on Large Industrial (E multiplied by D)	**$64,393,060.00**

Potential Impact of Cap on Rate Predictability

G	Rate 100 & T1 Forecast Gas Commodity Costs[4]	$724,431,729.00
H	Rate 100 Forecast Total Delivery Costs[5]	$15,093,992.00
I	Rate T1 Forecast Total Delivery Costs[6]	$45,248,235.00
J	Total Forecast Costs for Large Industrial Customers (G + H + I)	$784,773,956.00
K	DSMVA Funds not Available for Large Industrial Programs (D)	$3,879,100.00
L	Additional DSMVA Funds ($3.8 million) as a Percentage of Total Forecast Costs (D divided by J)	**0.49%**

---

[1] *Settlement Agreement, p. 8.*
[2] *Settlement Agreement, p. 25.*
[3] Exhibit A, Tab 1, Appendix A, p. 51 (Filed: 2011-09-23, EB-2011-0327, Union Gas, *Proposed DSM Programs*)
[4] Union Response to Information Request, (Provided: 2012-02-09, EB-2011-0327), Poll. Probe Ref. Book Tab 4
[5] *Ibid.*
[6] *Ibid.*