March 13, 2009

Ontario Energy Board
2300 Yonge Street, Suite 2700
Toronto, Ontario
M4P 1E4

Attention: Ms. Kirsten Walli, Board Secretary

RE: Union Gas Comments on Navigant's Report Updating the DSM Technologies (Measures) and Input Assumptions (EB-2008-0346)

Dear Ms. Walli:

The Board issued for comment the draft report titled "Measures and Assumptions for Demand Side Management (DSM) Planning" which was prepared by Navigant Consulting Inc. These are the comments of Union Gas Limited ("Union").

Yours truly,

[Original signed by Joanne Clark for]

Chris Ripley
Manager, Regulatory Applications

cc: Crawford Smith (Torys)
EB-2008-0346 Intervenors

Union Gas Limited
Response to the
Draft Report - Measures and Assumptions
for Demand Side Management (DSM) Planning
Compiled by Navigant Consulting on February 6, 2009

Background

Navigant Consulting was hired by the Ontario Energy Board (the "Board") to prepare a list of measures and related input assumptions for use as the starting point for the natural gas utilities in their 2010 Demand Side Management ("DSM") planning.

Navigant contacted Union Gas ("Union") to obtain existing and new research to aid in their independent analysis of various energy efficiency measures. All information available to Union in their planning along with the Market Potential study was provided to Navigant.

The Ontario Energy Board released Navigant's Draft Report - Measures and Assumptions for Demand Side Management Planning (the "Report") on February 6, 2009 and provided stakeholders with an opportunity for all stakeholders to provide their comments by March 13, 2009. This submission serves as Union's comment on the Report.

The response is in three parts:

1. General Comments & Measure Specific Comments
2. Table of assumptions outlining proposed changes and/or comments ("Appendix A")
3. Substantiation documents for each measure where an alternative value has been suggested ("Appendix B")

Union and Enbridge Gas Distribution ("Enbridge") reviewed the Report and have jointly prepared Appendix A and Appendix B noted above. For most measures, Union and Enbridge share the same opinion. Instances where Union and Enbridge differ have been noted in Appendix A.

EGD and Union provided a detailed response to most every measure. In some cases, the utilities have not had time to propose an alternative value as that would require full-scale evaluation studies. In those instances where alternate values have not been proposed, the utilities have simply registered concerns with the proposed assumptions.

General Comments

Union supports the Board's decision to have a third party develop a "handbook" of measures and related assumptions for use by the natural gas utilities as the basis of 2010 planning. Union believes this is a positive step by the Board in the DSM planning process. Union encourages the Board to make use of the work it has invested to develop the Report and fix the Report's detailed measures and related inputs for calculation of the 2010 SSM as already decided in EB-2006-021.

To best use DSM funds, and mitigate unforeseeable risk for the utilities, fixing inputs at the start of the year continues to be the appropriate approach for DSM. Customers and channel partners also require certainty around utility programs in order to make business and capital investment decisions.

Free Ridership and Spillover

Navigant did not include free ridership or spillover in its Report. Union encourages the Board to include the related free ridership and spillover for the measures in the Final Measures and Assumptions for DSM Planning provided by Navigant. As outlined in Union's submission on the Draft DSM Guidelines free rider and spillover are two sides of the same coin and should both be included to avoid producing biased TRC results[1].

For all applicable measures within Appendix A, free rider rates have been included based on EB 2008-0384, EB 2008-0385 or best available information. In addition, a new column for spillover has been added and where supporting documentation exists, spillover rates have been included.

While Navigant has included market penetration in its Report, Union believes that market penetration is not a straight proxy for free ridership. Market penetration is one consideration within a free rider rate but the two are not synonymous. In addition, where market penetration values are considered to be one of several considerations in a free rider study, that information should come from the Canadian marketplace, preferably from Ontario. In Navigant's study there appears to be frequent use of U.S. data which is not appropriate or relevant for our market.

Adoption of existing free ridership values for current measures provides a common starting point for the utilities to begin planning programs for 2010. To start at a hypothetical level (like the 30% level proposed by GEC in their Draft DSM Guidelines submission) is inappropriate. A hypothetical starting point not based on an evaluation study with market penetration and other relevant factors would lead to increased complexity and debate.

[1] Free Rider and Spillover Effects from Energy Efficiency Programs. Quantec Economic Consulting, July 2002

New and Missing Measures

In some cases Navigant has proposed new measures. For these, the utilities suggest that they bring forward a proposed free ridership value when they present a planned program which includes the measure.

Some measures which were approved by the Board in EGD's and Union's respective 2008 DSM Input Assumption filings (EB-2008-0384 and EB-2008-0385) were omitted without reason, e.g., Energy Star and CFLs. These should be included in the 2010 Board approved assumption list.

In EB-2008-0384 and EB-2008-0385 the Board also approved a table of measure lives for equipment used in custom projects. This table should also be included with the 2010 Board approved assumption list. Please refer to Attachment 1 for an updated version of this table (addition of re-commissioning).

Residential

1. Enhanced Furnace, High Efficiency Furnace – lines 4, 5, 6, 7, 10, 11, 12

Navigant uses a mid efficiency furnace as the base case for the Enhanced Furnace and High Efficiency Furnace measures. Given the new building code mandates 90% efficient units, Union recommends that these measures be reviewed and revised accordingly.

2. Reflector Panels – line 9

Incremental costs for Reflector Panels have been slightly understated by Navigant. Union recommends updating the cost to $238 which is the actual cost of the reflector panels plus shipping.

3. Programmable thermostat – line 13

Navigant has overstated electricity savings and incremental cost for programmable thermostats. Union recommends that the electricity savings be decreased from 182 kwh to 123 kwh to reflect market penetration of central air conditioning in Ontario of 57%. In addition, the incremental cost should be corrected from $25 to $50 to reflect the full cost of a unit.

4. Faucet Aerator – lines 15, 16

Union recommends adjusting the incremental cost for faucet aerators from $2 to $1 to reflect the actual 2009 utility bulk purchase price.

5. Low Flow Showerhead (1.5 & 1.25 GPM, distributed) – line 17 and 18

Union recommends updating the incremental cost for 1.5 and 1.25 GPM low flow showerheads to $4 to reflect the 2009 actual utility bulk purchase price.

6. Low Flow Showerhead (1.25 GPM, installed) - lines 20, 21

Union recommends updating gas savings for 1.25 GPM low flow showerheads based on Enbridge's load research study (Effects of Low Flow Showerheads on Consumption, SAS Institute (Canada). In addition, Union recommends the incremental cost be updated from $13 to $19 to reflect 2009 utility bulk purchase price.

7. Pipe Insulation for DHW outlet pipe – line 22

Union recommends adjusting incremental cost from $2 to $1 for customer installed pipe wrap as per utility bulk purchase price and $4 for contractor installed pipe wrap.

Low Income

8. Programmable thermostat – line 26

Navigant has overstated electricity savings and incremental cost for programmable thermostats. Union recommends that the electricity savings be decreased from 182 kwh to 123 kwh to reflect market penetration of central air conditioning in Ontario of 57%. In addition, the incremental cost should be corrected from $25 to $69 to reflect the full cost of a unit.

9. Weatherization – line 27

Gas savings and electricity savings for weatherization have been incorrectly entered in the Report at 1134 m^3 and 165 kWh respectively. Gas savings should be corrected to the substantiated value of 1234 m^3, and electricity savings should be 255kWh. In addition, the incremental cost should be corrected to include the cost of the audit resulting in a change from $2284 to a revised cost of $2667. The incremental cost has been increased since the cost of an audit is a prerequisite to identify the appropriate measures for the home.

10. Faucet Aerator – lines 28, 29

Please refer to the comment in #4.

11. Low Flow Showerhead (1.5 & 1.25 GPM, distributed) – lines 30, 34

Please refer to the comment in #5

12. Low Flow Showerhead (1.25 GPM, installed), lines 32, 33

Please refer to the comment in #6.

13. Pipe Insulation for DHW outlet pipe – line 35

Union recommends adjusting incremental cost from $2 to $4 for contractor installed pipe wrap.

Commercial Cooking

14. Energy Star Fryers – line 36

Union recommends adjusting the natural gas savings from 1099 m3 to 916 m3. The savings are based on the Energy Star calculator, by market research specific to the Union franchise area. Union also recommends adjusting measure life from 12 years to 7 years, based on distributor information and incremental cost from $3250 to $1500 based on a survey of contractors in the Union franchise area.

Commercial Space Heating

15. Condensing Boilers – line 40

Union recommends including condensing boilers under "New" Commercial as approved in EB-2008-0385.

16. Demand Control Kitchen Ventilation (DCKV) – lines 41, 42, 43, 43b - 43d (new)

Union recommends updating the measure life for demand control kitchen ventilation to 15 yrs over the previously approved measure life of 20 years based on recent information gained from Melink Canada. Please see the substantiation documents in Appendix B, pages 30 – 33. Union also recommends using previously substantiated and approved savings values and incremental cost as per EB-2008–0385. Navigant's numbers are based on using the top end of savings and incremental costs, whereas Union uses a mid point which is more appropriate. In addition Union recommends using three Cubic Feet per Minute ("CFM") ranges for DCKV units to better classify savings given the large variance in size of the DCKV equipment and function.

Navigant did not reference the correct savings values in line 43 as per EB-2008–0385.

Navigant did not include DCKV for New Commercial buildings, therefore Union recommends including lines 43b - 43d in Appendix A.

17. Destratification fans – line 44

New research for destratification fans, commissioned by Enbridge (Prescriptive Destratification Fan Program, Agviro Inc., February 2009), supports updating natural gas

savings from 6129 m^3 to 7020 m^3, and electricity savings from -511 kwh to -123 kwh. The Enbridge research is based on site monitoring of energy use and temperature stratification before and after fan installation. Please refer to substantiation document in Appendix B page 34 for additional detail.

18. Rooftop Unit – line 59

Navigant gas savings for roof top units were incorrectly calculated based on their own efficiency assumptions. The gas savings should be 300 m^3, not 255 m^3. Please refer to the substantiation document in Appendix B page 37.

19. Programmable Thermostat – 60a - 60b (new)

In its Report, Navigant proposed one value for all commercial thermostats based on a "per building" analysis. Union recommends two categories for the programmable thermostat measure in commercial applications to address the differences between market segments. Further, Union recommends identifying the appropriate square footage for the two market segment categories versus "per building". Clarifying square footage values assists the utilities in tracking and evaluation processes. Given Union's recommendation of two categories for the programmable thermostat measure in existing buildings, all of the values will be different than those proposed by Navigant.

20. Condensing Gas Water Heater – lines 63, 64, 65, 65a (new)

In its Report, Navigant proposes splitting the condensing gas water heater measure into three segments (100, 500 & 1000 gallons of hot water/day). Union does not recommend this approach as it is not able to effectively track and measure as proposed (would require individual metering). Instead, Union consolidated the various segments into one line which has been added to the Appendix A spreadsheet (as line 65a). The new consolidated measure line has incorporated the updated incremental costs according to Navigant's findings. Please see Appendix B pages 42 and 43 for the updated substantiation document.

21. Pre-Rinse Spray Nozzle – 67, 67a – 67f (new)

Union has developed a new substantiation document for pre-rinse spray nozzles based on two recent studies (Free Ridership and Spillover for Low Flow Pre Rise Spray Nozzles and Pre rinse Spray nozzle deemed savings study). Based on the research findings, Union recommends splitting the measure into three segments which more accurately reflects savings realized within each of these segments. Please refer to Appendix B pages 44 to 47 for additional detail.

22. Tankless Water Heaters - lines 68, 69, 70, 70a (new)

Navigant proposes splitting the tankless water heater measure into three segments (100, 500 & 1000 gallons of hot water/day), which is similar to their suggestion for condensing

water heaters. Union does not recommend this approach as it is not able to effectively track and measure as proposed (would require individual metering). Instead, Union has added a single measure for tankless water heaters to the Appendix A spreadsheet (as line 70a). Please refer to Appendix B pages 48 - 51 for the updated substantiation documents.

Multi Family Water Heating

23. CEE Qualified Clothes Washer – line 71

Union recommends the savings values for Energy Star clothes washers be adjusted to reflect actual savings based on equipment in the Enbridge Energy Star clothes washers DSM program. The energy savings calculation from Navigant was used to calculate these savings. Please refer to the substantiation document in Appendix B, page 52.

24. Faucet Aerator (Kitchen and Bathroom) – line 72a and 73a (new)

New faucet aerator lines have been added for Kitchen (72a) and Bathroom (73a) in Appendix A to account for a 1.0 GPM model.

25. Low Flow Showerheads – lines 74, lines 75, 76, 77, 77a – 77g (new), 78

The gas and water savings for low flow showerheads are understated in the Report and should be updated to reflect findings in the Summit Blue study (Resource Savings Values in Selected Residential DSM Prescriptive Program, June 2008). The findings support that savings should be adjusted to account for the percentage of showers taken with an efficient showerhead in a multi residential setting (92%) compared to the 76% in low rise residential (which was used Navigant). In addition, Union recommends the incremental cost be updated to reflect current utility bulk purchase price plus the installation cost.

26. Dropped/New Measures

Measures that were approved by the Board in EB-2008-0084 and EB-2008-0085 were not included in Navigant's Report. There were no reasons provided for these measures to be omitted. Union believes these measures should be included and they have been add to Appendix A. Substantiation documents for these measures in addition to new measures recommended for inclusion are in Appendix B pages 60 to 68.

27. Custom Measures

Custom Measures have been added in Appendix A in order to capture the recommended free rider and spillover rates.

Custom Resource Acquisition Technologies

Measure Life Assumptions
March, 2009

	Commercial	Industrial	Multi-residential
Boiler Related			
Boilers – DHW	25[1]	n/a	25[1]
Boilers - Industrial Process	n/a	20	n/a
Boilers – Space Heating	25[1]	25[1]	25[1]
Combustion Tune-up	5	5	n/a
Controls	15	15	15
Steam pipe/tank insulation	n/a	15	n/a
Steam trap	13[3]	13[3]	n/a
Building Related			
Building envelope	25	25	25
Windows	25	25	25
Greenhouse curtains	na	10	na
Double Poly greenhouse	n/a	5	n/a
HVAC Related			
Dessicant cooling	15	n/a	n/a
Heat Recovery	15	15	n/a
Infra-red heaters	10	10	n/a
Make-up Air	15	15	15
Novitherm panels	15	n/a	15
Furnaces (gas-fired)	18[2]	n/a	18[2]
Re-Commissioning	**5**[4]	n/a	**5**[4]
Process Related			
Furnaces (gas-fired)	n/a	18[2]	n/a

Source: RP-2002-0133 Settlement Proposal, Ex N1, Tab 1, Schedule 1, page 70.
Also applied to EB-2005-0001.
[1]updated in RP-2006-0001 – Source: ASHRAE
[2]new item - Source: ASHRAE updated in EB-2006-0021
[3]Source: Measure Life of Steam Traps Research Study, Enbridge Gas Distribution, November, 2007.
[4]Source: Measure Life For Retro-Commissioning And Continuous Commissioning Projects, Finn Projects, December, 2008.

Appendix A

Union Gas and Enbridge Gas Distribution: Review and Proposed Changes to Navigant's Report (Draft Report: Measures and Assumptions for Demand Side Management (DSM) Planning, Presented to the Ontario Energy Board, February 6, 2009)

Appendix A

Union Gas and Enbridge Gas Distribution: Review and Proposed Changes to Navigant's Report "Appendix B"
Draft Report: Measures and Assumptions for Demand Side Management (DSM) Planning,
Ontario Energy Board, February 6, 2009

Legend: - cells with proposed changes are highlighted
- values from Navigant's Appendix B are shown in brackets next to the proposed change
- shaded rows show values as approved in EB 2008 0384 and 0385

	Target Market		Equipment Details				Annual Resource Savings			Other						NOTES
	Sector	New / Existing	Efficient Equipment	Details of efficient equipment	Base Equipment	Details of base equipment	Natural Gas (m^3)	Electricity kWh	Water (L)	EUL	Inc. Cost ($)	Payback (Yrs)*	Market Share/Pen.+	Free Ridership	Spillover	
	Residential Space Heating															
1	Residential	Existing	Air Sealing	Air infiltration reduction (6 ACH50)	Existing infiltration controls	(8 ACH50)	231	101	0	15	$1,000	8.3	Med			
2	Residential	Existing	Basement Wall	R-1 Insulation	R-12 Insulation		237	87	0	25	$2 / ft^2	13.4	High			
3	Residential	Existing	Ceiling	R-40 Insulation	R-10 Insulation		348	214	0	20	$0.7 / ft^2	3.2	Med			
4	Residential	Existing	Enhanced Furnace	ECM (continuous)	Mid-efficiency furnace	PSC motor	-183	1,387	0	15	$960	22*	Low			Recommendation: Base case used is mid efficiency unit, however new building code mandates 90% efficiency. This should be revised.
5	Residential	Existing	Enhanced Furnace	ECM (non continuous)	Mid-efficiency furnace	PSC motor	-26	324	0	15	$960	51*	Low			Recommendation: Base case used is mid efficiency unit, however new building code mandates 90% efficiency. This should be revised.
5a	Residential	Existing	Enhanced Furnace	ECM Only	Mid-efficiency furnace	PSC motor	-65	730	0	18	$550					
6	Residential	New	Enhanced Furnace	Furnace only (continuous)	Mid-efficiency furnace		-166	1,403	0	15	$960	18*	Low			Recommendation: Base case used is mid efficiency unit, however new building code mandates 90% efficiency. This should be revised.
7	Residential	New	Enhanced Furnace	Furnace only (non continuous)	Mid-efficiency furnace		-26	207	0	15	$960	137*	Low			Recommendation: Base case used is mid efficiency unit, however new building code mandates 90% efficiency. This should be revised.
8	Residential	Existing	Energy Star Windows	Low E, argon filled (R-3.8)	Standard windows	Double pane, standard glazing (R-2.0)	121	206	0	20	$150 / unit	28	High			
9	Residential	Existing	Reflector Panels		No reflector panels		143	0	0	18	($213) 238	3.1	Low	0%		Adjustments: Updated incremental cost based on cost of panels plus shipping ($238); FR of 0% as per EB 2008-0384 and 0385
9a	Residential	Existing	Reflector Panels		No reflector panels		143	0	0	18	$213					
10	Residential	Existing	High Efficiency Furnace	AFUE 90	Mid-efficiency furnace	AFUE 80	268	0	0	18	$667	4.8	Med			Recommendation: Base case used is mid efficiency unit, however new building code mandates 90% efficiency. This should be revised.
11	Residential	Existing	High Efficiency Furnace	AFUE 92	Mid-efficiency furnace	AFUE 80	317	0	0	18	$1,067	6.5	Med			Recommendation: Base case used is mid efficiency unit, however new building code mandates 90% efficiency. This should be revised.
12	Residential	Existing	High Efficiency Furnace	AFUE 96	Mid-efficiency furnace	AFUE 80	407	0	0	18	$2,433	11.5	Med			Recommendation: Base case used is mid efficiency unit, however new building code mandates 90% efficiency. This should be revised.
12a	Residential	Existing	High Efficiency Furnace		Mid-efficiency furnace		385	0	0	18	$650					
13	Residential	Existing	Programmable Thermostat		Standard Thermostat		146	(182) 123	0	15	($25) 50	0.3	65%	43%	14%	Adjustments: Electricity savings adjusted to reflect market penetration of central air conditioning in Ontario (57% as per Summit Blue, Resource Savings Values in Selected Residential DSM Prescriptive Programs, June 2008); incremental cost increased to reflect full cost of unit; FR as per EB 2008-0384 and 0385, Spillover as per SB FR & Spillover Study - June 4, 2008
13a	Residential	Existing	Programmable Thermostat		Standard manual thermostat		152	26	0	15	$50					
14	Residential	Existing	Wall Insulation	R-8 Insulation	R-19 Insulation		405	194	0	30	$2.5 / ft^2	11.2	High			

Appendix A

	Target Market		Equipment Details				Annual Resource Savings			Other						NOTES
	Sector	New / Existing	Efficient Equipment	Details of efficient equipment	Base Equipment	Details of base equipment	Natural Gas (m^3)	Electricity kWh	Water (L)	EUL	Inc. Cost ($)	Payback (Yrs)*	Market Share/Pen.+	Free Ridership	Spillover	
	Residential Water Heating															
15	Residential	Existing	Faucet Aerator	Kitchen, 1.5 GPM	Average existing stock	2.5 GPM	38	0	7,797	10	($2) 1	0.1	90%	UG 33%; EGD 31%	ESK 17% TAPS 7%	Adjustments: Incremental cost as per 2009 utility bulk purchase price; FR as per EB 2008-0384 and 0385; Spillover as per SB FR & Spillover study June 4, 2008
15a	Residential	Existing	Faucet Aerator	Kitchen, 1.5 GPM	Average existing stock	2.5 GPM	22	0	7,800	10	$2					
16	Residential	Existing	Faucet Aerator	Bathroom, 1.5 GPM	Average existing stock	2.2 GPM	10	0	2,004	10	($2) 1	0.4	90%	UG 33%; EGD 31%	ESK 17% TAPS 7%	Adjustments: Incremental cost as per 2009 utility bulk purchase price; FR as per EB 2008-0384 and 0385; Spillover as per SB FR & Spillover study June 4, 2008
16a	Residential	Existing	Faucet Aerator	Bathroom, 1.5 GPM	Average existing stock	2.2 GPM	6	0	2,000	10	$2					
17	Residential	Existing	Low-flow showerhead	1.5 GPM (distributed, e.g., ESK)	Average existing stock	2.2 GPM	33	0	6,334	10	($6) 4	0.4	65%	10%	19% (distributed)	Adjustments: Incremental cost as per 2009 utility bulk purchase price; FR as per EB 2008-0384 and 0385; Spillover as per SB FR & Spillover study June 4, 2008
17a	Residential	Existing	Low-flow showerhead	1.5 GPM, (Union ESK program)	Average existing stock	2.2 GPM (implicitly)	22	0	6,400	10	$4					
18	Residential	Existing	Low-flow showerhead	1.25 GPM (distributed, e.g., ESK)	Average existing stock	2.2 GPM	60	0	10,570	10	($13) $4	0.4	65%	10%	19% (distributed)	Adjustments: Incremental cost as per 2009 utility bulk purchase price; FR as per EB 2008-0384 and 0385. Spillover as per SB FR & Spillover study June 4, 2008
18a	Residential	Existing	Low-flow showerhead	1.25 GPM, distributed as part of Union ESK program	Average existing stock	2.2 GPM (implicitly)	40	0	10,700	10	$4					
19	~~Residential~~	~~Existing~~	~~Low-flow showerhead~~	~~1.25 GPM (installed)~~	~~Average existing stock~~	~~2.0 GPM~~	~~49~~	~~0~~	~~8,817~~	~~10~~	~~$13~~	0.5	65%			See below, line 20 and line 21
19a	Residential	Existing	Low-flow showerhead	1.25 GPM (TAPS program)	Average existing stock	2.0 GPM	33	0	8,900	10	$15					
20	Residential	Existing	Low-flow showerhead	1.25 GPM (installed)	Average existing stock in one of two ranges.	2.25 GPM (2.0 to 2.5 GPM)	(62) 66	0	10,886	10	($13) $19	0.4	65%	10%	8% (installed)	Adjustments: Gas savings updated from EGD load research study, Effects of Low Flow Showerheads on Consumption, SAS Institute (Canada) and Enbridge Gas Distribution, March 2009. Incremental cost as per 2009 utility bulk purchase price; FR as per EB 2008-0384 and 0385.
20a	Residential	Existing	Low-flow showerhead	1.25 GPM (TAPS program)	Average existing stock	2.25 GPM	47	0	12,400	10	$15					
21	Residential	Existing	Low-flow showerhead	1.25 GPM (installed)	Average existing stock in one of two ranges.	3.0 GPM - 2.6 GPM and higher	(102) 116	0	17,168	10	($13) $19	0.3	65%	10%	8% (installed)	Adjustments: Gas savings updated from EGD load research study, Effects of Low Flow Showerheads on Consumption, SAS Institute (Canada) and Enbridge Gas Distribution, March 2009. Incremental cost as per 2009 utility bulk purchase price; FR as per EB 2008-0384 and 0385.
21a	Residential	Existing	Low-flow showerhead	1.25 GPM (TAPS program)	Average existing stock	3.0 GPM	68	0	17,500	10	$15					
22	Residential	Existing	Pipe insulation for DHW outlet pipe	R-4 insulation	Uninsulated DHW outlet pipes	R-1	25	0	0	10	($2) $1 / $4	0.2	47%	4%		Adjustments: Measure life as per EB2008-0384 and 0385. Incremental cost as per utility bulk purchase price, customer and contractor installed. Free ridership as per EB 2008-0384 and 0385
22a	Residential	Existing	Pipe insulation for DHW outlet pipe	1/2" polyethylene foam insulation	Uninsulated DHW outlet pipes		17	0	0	15	$1					
23	Residential	New/Existing	Solar Pool Heater	Solar Heating System	Conventional Gas-fired Heating System	50% seasonal efficiency	493	-57	0	20	$1,450	5.7	Med			
24	Residential	Existing	Tankless Water Heater	EF = 0.82	Storage Tank Water Heater	EF=0.575	137	0	0	18	$750	10.5	Low			
24a	Residential	Existing	Tankless Water Heater	EF = 0.82	Storage Tank Water Heater	EF=0.58	237	0	0	20	$694					
25	Residential	New	Tankless Water Heater	EF = 0.82	Storage Tank Water Heater	EF=0.575	137	0	0	18	$750	10.5	Low			
25a	Residential	New	Tankless Water Heater	EF = 0.82	Storage Tank Water Heater	EF=0.58	237	0	0	20	$694					
	Low Income Space Heating															
26	Low Income	Existing	Programmable Thermostat		Standard manual thermostat		146	(182) 123	0	15	($25) $69	0.3	65%	1%		Adjustments: Electricity savings adjusted to reflect market penetration of central air conditioning in Ontario (57% as per Summit Blue study, June 2008); incremental cost increased to reflect full cost of unit and installation; FR as per EB 2008-0384 and 0385
26a	Low Income	Existing	Programmable Thermostat		Standard manual thermostat		152	26	0	15	$50					

Appendix A

	Target Market		Equipment Details				Annual Resource Savings			Other						NOTES
	Sector	New / Existing	Efficient Equipment	Details of efficient equipment	Base Equipment	Details of base equipment	Natural Gas (m^3)	Electricity kWh	Water (L)	EUL	Inc. Cost ($)	Payback (Yrs)*	Market Share/Pen.+	Free Ridership	Spillover	
27	Low Income	Existing	Weatherization	full weatherization	No Weatherization		(1134) 1234	(165) 255	0	23	($2284) $2667	3.9	Med	0%		Adjustments: Gas savings and incremental costs adjusted to reflect results from first two years of program operation. FR as per EB 2008-0384 and 0385
27a	Low Income	Existing	Weatherization		Existing home sample		1,143	165		23	$2,600					
	Low Income Water Heating															
28	Low Income	Existing	Faucet Aerator	Kitchen, 1.5 GPM (distributed)	Average existing stock	2.5 GPM	38	0	7,797	10	($2) $1	0.1	90%	1%		Adjustments: Incremental cost as per utility bulk purchase price; FR as per EB 2008-0384 and 0385
28a	Low Income	Existing	Faucet Aerator	Kitchen, 1.5 GPM	Average existing stock	2.5 GPM	22	0	7,800	10	$2					
29	Low Income	Existing	Faucet Aerator	Bathroom, 1.5 GPM (distributed)	Average existing stock	2.2 GPM	10	0	2,004	10	($2) $1	0.4	90%	1%		Adjustments: Incremental cost as per utility bulk purchase price; FR as per EB 2008-0384 and 0385
29a	Low Income	Existing	Faucet Aerator	Bathroom, 1.5 GPM	Average existing stock	2.2 GPM	6	0	2,000	10	$2					
30	Low Income	Existing	Low-flow showerhead	1.5 GPM (distributed, e.g.,ESK)	Average existing stock	2.2 GPM	33	0	6,334	10	($6) $4	0.4	65%	Union 1%, EGD 5%		Adjustments: Incremental cost as per utility bulk purchase price. FR as per EB 2008-0384 and 0385
30a	Low Income	Existing	Low-flow showerhead	1.5 GPM, (Union ESK program)	Average existing stock	2.2 GPM (implicitly)	22	0	6,400	10	$4					
31	~~Low Income~~	~~Existing~~	~~Low-flow showerhead~~	~~1.25 GPM (installed)~~	~~Average existing stock~~	~~2.0 GPM~~	~~49~~	~~0~~	~~8,817~~	~~10~~	~~$13~~	0.5	65%			See below, line 32 and 33
31a	Low Income	Existing	Low-flow showerhead	1.25 GPM (TAPS program)	Average existing stock in 1 of 3 ranges.	2.0 GPM	33	0	8,900	10	$15					
32	Low Income	Existing	Low-flow showerhead	1.25 GPM (installed)	Average existing stock in 1 of 2 ranges.	2.25 GPM (2.0 to 2.5 GPM)	(62) 66	0	10,886	10	($13) $19	0.4	65%	Union - 1%; EGD - 5%		Adjustments: Gas savings updated from EGD load research study, Effects of Low Flow Showerheads on Consumption, SAS Institute (Canada) and Enbridge Gas Distribution, March 2009. Incremental cost as per utility bulk purchase price; FR as per EB 2008-0384 and 0385.
32a	Low Income	Existing	Low-flow showerhead	1.25 GPM (TAPS program)	Average existing stock in 1 of 3 ranges.	2.25 GPM	47	0	12,400	10	$15					
33	Low Income	Existing	Low-flow showerhead	1.25 GPM (installed)	Average existing stock in 1 of 2 ranges.	3.0 GPM (2.6 GPM and above)	(102) 116	0	17,168	10	($13) $19	0.3	65%	Union - 1%; EGD - 5%		Adjustments: Gas savings updated from EGD load research study, Effects of Low Flow Showerheads on Consumption, SAS Institute (Canada) and Enbridge Gas Distribution, March 2009. Incremental cost as per utility bulk purchase price; FR as per EB 2008-0384 and 0385.
33a	Low Income	Existing	Low-flow showerhead	1.25 GPM (TAPS program)	Average existing stock in 1 of 3 ranges.	3.0 GPM	68	0	17,500	10	$15					
34	Low Income	Existing	Low-flow showerhead	1.25 GPM (distributed)	Average existing stock	2.2 GPM	60	0	10,570	10	($13) $4	0.4	65%	Union 1%, EGD 5%		Adjustments: Incremental cost as per 2009 utility bulk purchase price. FR as per EB 2008-0384 and 0385
34a	Low Income	Existing	Low-flow showerhead	1.25 GPM, distributed as part of Union ESK program	Average existing stock	2.2 GPM (implicitly)	40	0	10,700	10	$4					
35	Low Income	Existing	Pipe insulation for DHW outlet pipe	R-4 insulation	Uninsulated DHW outlet pipes (R-1)		25	0	0	10	($2) $4	0.2	47%	1%		Adjustments: Incremental cost as per utility bulk purchase price plus installation. Free ridership as per EB 2008-0384 and 0385
35a	Low Income	Existing	Pipe insulation for DHW outlet pipe	1/2" polyethylene foam insulation	Uninsulated DHW outlet pipes		17	0	0	15	$1					
	Commercial Cooking															
36	Commercial	New/Existing	Energy Star Fryer	50% cooking efficiency	Standard fryer	35% cooking efficiency	(1099) 916	-546	0	(12) 7	($3250) $1500	5.9	Med			Adjustments: Updatedsavings values, measure life and incremental cost based on best available information.
37	Commercial	New/Existing	High Efficiency Griddle	40% cooking efficiency	Standard griddle	32% cooking efficiency	503	0	0	12	$1,570	6.2	Med			
	Commercial Space Heating															
38	Commercial	Existing	Air Curtains	Single door	Non-air curtain doors		2,191	172	0	15	$1,650	1.5	Med	5%		Adjustments: FR as per EB 2008-0384 and 0385
38a	Commercial	Existing	Air Curtains	Single door			2,118	172	0	15	$1,650					
39	Commercial	Existing	Air Curtains	Double door	Non-air curtain doors		4,661	1,023	0	15	$2,500	1.1	Med	5%		Adjustments: FR as per EB 2008-0384 and 0385
39b	Commercial	Existing	Air Curtains	Double door			4,508	1,023	0	15	$2,500					
40	Commercial	New / Existing	Condensing Boilers	(88%) 90% estimated seasonal efficiency	Non-condensing boiler	76% estimated seasonal efficiency	(0.0104) .0119 / Btu/hr	0	0	25	$12 / kBtu/hr	2.3	High	5%		Adjustments: Details of Efficient Equipment and savings values updated. FR as per 2008-0384 and 0385

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	Target Market		Equipment Details				Annual Resource Savings			Other						NOTES
	Sector	New / Existing	Efficient Equipment	Details of efficient equipment	Base Equipment	Details of base equipment	Natural Gas (m^3)	Electricity kWh	Water (L)	EUL	Inc. Cost ($)	Payback (Yrs)*	Market Share/Pen.+	Free Ridership	Spillover	
40a	Commercial	Existing	Condensing Boilers	88% seasonal efficiency (est.)	Non-condensing Boiler	76% estimated seasonal efficiency	0.0119/Btu/hr	0	0	25	15.4 / kBtu/hr					
41	Commercial	Existing	Demand Control Kitchen Ventilation	(5,000 CFM) 0 - 4,999 CFM	Kitchen ventilation without DCKV		(4801) 3972	(13521) 7231	0	(10) 15	($10000) $5000	4.2	Low	5%		Adjustments: Updated savings values, measure life and incremental cost. FR as per EB 2008-0384 and 0385
41a	Commercial	Existing	Demand Control Kitchen Ventilation	0 - 4,999 CFM	Ventilation without DCKV		3,660	7229 (7319 UG)	0	20	$5,000					
42	Commercial	Existing	Demand Control Kitchen Ventilation	(10,000 CFM) 5,000 - 9,999 CFM	Kitchen ventilation without DCKV		(11486) 10,347	(30901) 23,051	0	(10) 15	($15000) $10000	2.6	Low	5%		Adjustments: Updated savings values, measure life and incremental cost. FR as per EB 2008-0384 and 0385
42a	Commercial	Existing	Demand Control Kitchen Ventilation	5,000 - 9,999 CFM	Ventilation without DCKV		5960 (9535 UG)	12855 (23180 UG	0	20	$10,000					
43	Commercial	Existing	Demand Control Kitchen Ventilation	(15,000 CFM) 10,000 - 15,000 CFM	Kitchen ventilation without DCKV		(18924) 18,941	(49102) 40,692	0	(10) 15	($20000) $15000	2.1	Low	5%		Adjustments: Updated savings values, measure life and incremental cost. FR as per EB 2008-0384 and 0385
43a	Commercial	Existing	Demand Control Kitchen Ventilation	10,000 - 15,000 CFM	Ventilation without DCKV		10910 (17,455 UG)	40334 (40929 UG	0	20	$15,000					

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	Target Market		Equipment Details				Annual Resource Savings			Other						NOTES
	Sector	New / Existing	Efficient Equipment	Details of efficient equipment	Base Equipment	Details of base equipment	Natural Gas (m^3)	Electricity kWh	Water (L)	EUL	Inc. Cost ($)	Payback (Yrs)*	Market Share/Pen.+	Free Ridership	Spillover	
43b	Commercial	New	Demand Control Kitchen Ventilation	0 - 4,999 CFM	Ventilation without DCKV		3,972	7,190	0	15	$5,000			5%		Adjustments: included item from EB2008-0384 and 0385. FR as per 2008-0384 and 0385.
43c	Commercial	New	Demand Control Kitchen Ventilation	5,000 - 9,999 CFM	Ventilation without DCKV		6,467	22,791	0	15	$10,000			5%		Adjustments: included item from EB2008-0384 and 0385. FR as per 2008-0384 and 0385.
43d	Commercial	New	Demand Control Kitchen Ventilation	10,000 - 15,000 CFM	Ventilation without DCKV		11,838	40,217	0	15	$15,000			5%		Adjustments: included item from EB2008-0384 and 0385. FR as per 2008-0384 and 0385.
44	Commercial	New / Existing	Destratification Fans		No destratification fans		(6129) 7,020	(-511) -123	0	15	$7,021	2.3	Low	10%		Adjustments: Updated savings based on Enbridge research, Prescriptive Destratification Fan Program, Agviro Inc., February, 2009 . Free ridership as per EB-2008-0384 & 0385.
44a	Commercial	New / Existing	Destratification Fans		No destratification fans		6,205	-511	0	15	$7,021					
45	Commercial	Existing	Energy Recovery Ventilator		Ventilation without ERV		3.95 / CFM	0	0	20	$3 / cfm	1.5	Low	5%		Adjustments: Free ridership based on EB-2008-0384 and 0385.
45a	Commercial	Existing	Energy Recovery Ventilator		Ventilation without ERV		3.14 / CFM	0	0	15	$2.5 / CFM					
46	Commercial	New	Energy Recovery Ventilator		Ventilation without ERV		3.75 / CFM	0	0	20	$3 / cfm	1.6	Low	5%		Adjustments: Free ridership based on EB-2008-0384 and 0385.
46a	Commercial	New	Energy Recovery Ventilator		Ventilation without ERV		3.14 / CFM	0	0	15	$2.5 / CFM					
47	Commercial	Existing	Enhanced Furnace	ECM (continuous)	Standard PSC Motor		(-)2.7 kBtu/hr	20.5/kBtu/hr	0	15	$960	14*	Low			
48	Commercial	Existing	Enhanced Furnace	ECM (non-continuous)	Standard PSC Motor		(-)0.4 / kBtu/hr	4.8 / kBtu/hr	0	15	$960	31*	Low			
48a	Commercial	Existing	Enhanced Furnace	Up to 299 MBtu/h, ECM only	Mid-efficiency furnace		(-)0.87 / kBtu/hr	9.7 / kBtu/hr	0	18	$550					
49	Commercial	New	Enhanced Furnace	ECM (continuous)	Standard PSC Motor		(-)2.5 kBtu/hr	20.8/kBtu/hr	0	15	$960	11*	Low			
50	Commercial	New	Enhanced Furnace	ECM (non-continuous)	Standard PSC Motor		(-)0.3 / kBtu/hr	3.1 / kBtu/hr	0	15	$960	55*	Low			
51	Commercial	Existing	Heat Recovery Ventilation	Ventilation with HRV	Ventilation without HRV		3.77 / CFM	0	0	20	$3.40	1.8	Low	5%		Adjustments: FR as per EB 2008-0384 and 0385
51a	Commercial	Existing	Heat Recovery Ventilation		Ventilation without HRV		2.92 / CFM	0	0	15	$3.40					
52	Commercial	New	Heat Recovery Ventilation	Ventilation with HRV	Ventilation without HRV		3.49 / CFM	0	0	20	$3.40	2.0	Low	5%		Adjustments: FR as per EB 2008-0384 and 0385
52a	Commercial	New	Heat Recovery Ventilation		Ventilation without HRV		2.92 / CFM	0	0	15	$3.40					
53	Commercial	Existing	High Efficiency Furnace	AFUE 90			3.6 / kBtu/hr	0	0	18	$6.7 / kBTu/h	3.7	Med			
54	Commercial	Existing	High Efficiency Furnace	AFUE 92			4.2 / kBtu/hr	0	0	18	$11 / kBTu/h	5.2	Med			
55	Commercial	Existing	High Efficiency Furnace	AFUE 96			5.4 / kBtu/hr	0	0	18	$22 / kBTu/h	8.1	Med			
55a	Commercial	Existing	High Efficiency Furnace		Mid-efficiency furnace		5.1 / kBtu/hr	0	0	18	$650					

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	Target Market		Equipment Details				Annual Resource Savings			Other						NOTES
	Sector	New / Existing	Efficient Equipment	Details of efficient equipment	Base Equipment	Details of base equipment	Natural Gas (m^3)	Electricity kWh	Water (L)	EUL	Inc. Cost ($)	Payback (Yrs)*	Market Share/Pen.+	Free Ridership	Spillover	
56	Commercial	New / Existing	Infrared Heaters	0 - (75,000) 49,000 BTUH	Regular Unit Heater		(0.015) 0.0102/ Btu/hr	(245) 236	0	20	($0.0122 / Bth/hr) $0.009/$10^3$ Btu/hr	1.6	Med	33%		Adjustments: Updated savings values and incremental costs. Free ridership based on EB-2008-0384 and 2008-0385.
56a	Commercial	New / Existing	Infrared Heaters	0 - 49,999 BTUH	Unit heater		0.0102 Btu/hr	312	0	20	$15.4 kBTu/h					
57	Commercial	New / Existing	Infrared Heaters	(76,000 - 150,000 BTUH) 49,000 - 164,999 BTUH	Regular Unit Heater		(0.015) 0.0102/ Btu/hr	(559) 534	0	20	($0.0122 / Bth/hr) $0.009/$10^3$ Btu/hr	1.6	Med	33%		Adjustments: Updated savings values and incremental costs. Free ridership based on EB-2008-0384 and 2008-0385.
57a	Commercial	New / Existing	Infrared Heaters	49,999 - 164, 999 BTUH	Unit heater		0.0102 m^3/Btu/hr	624	0	20	$15.4 kBTu/h					
58	Commercial	New / Existing	Infrared Heaters	(151,000 - 300,000 BTUH) >165,000 BTUH	Regular Unit Heater		(0.015) 0.0102/ Btu/hr	(870) 833	0	20	($0.0122 / Bth/hr) $0.009/$10^3$ Btu/hr	1.6	Med	33%		Adjustments: Updated savings values and incremental costs. Free ridership based on EB-2008-0384 and 2008-0385.
58a	Commercial	New / Existing	Infrared Heaters	165,000 BTUH	Unit heater		0.0102 /Btu/hr	936	0	20	$15.4 kBTu/h					
59	Commercial	New / Existing	Rooftop Unit	Two-stage rooftop unit - up to and including 5 tons of cooling	Single stage rooftop unit	Single stage rooftop unit - 80% efficient	(255) 300	0	0	15	$375	2.9	Med	5%		Adjustments: Navigant gas savings were incorrectly calculated based on their own efficiency assumptions. The new substantiation document reflects this correction. FR as per EB 2008-0384 and 0385
59a	Commercial	New	Rooftop Unit	Two-stage rooftop unit	Rooftop unit	Single stage rooftop unit	1,275	0	0	20	$1,250					
60	~~Commercial~~	~~Existing~~	~~Programmable Thermostat~~		~~Standard thermostat~~		~~239~~	~~251~~	~~0~~	~~15~~	~~$110~~	0.9	Med			See below, line 60a and 60b
60a	Commercial	New / Existing	Programmable Thermostat (Warehouse, Recreation, Agriculture, Industrial)		Standard thermostat		674	524	0	15	$40			20%		Adjustments: New savings values developed on a sector basis. Incremental costs as per utility bulk purchase price. FR as per EB-2008-0384 and 0385.
60b	Commercial	New / Existing	Programmable Thermostat (Other, eg. Retail, Office)		Standard thermostat		191	246	0	15	$40			20%		Adjustments: New savings values developed on a sector basis. Incremental costs as per utility bulk purchase price. FR as per EB-2008-0384 and 0385.
60c	Commercial	Existing	Programmable Thermostat		Standard thermostat		519	921	0	15	$50					
61	Commercial	Existing	Prescriptive Boilers for Schools - Elementary	hydronic boiler with 83%+ efficiency	hydronic boiler with 80% - 82% efficiency		10,830	0	0	25	($5646) $8646	1.0	Low	12% (EGD) 27% (Union)	10% (EGD & Union)	Adjustments: Incemental costs based on weighted average of boiler types as per EB 20080384 and 0385. FR as per EB 2008-0384 and 0385. Spillover as per Summit Blue, Custom Projects Attribution Study, October 2008
61a	Commercial	Existing	Prescriptive Schools - Elementary	hydronic boiler with 83%+ efficiency	hydronic boiler with 80% - 82% efficiency		10,830	0	0	25	$8,646					
62	Commercial	Existing	Prescriptive Boilers for Schools - Secondary	hydronic boiler with 83%+ efficiency	hydronic boiler with 80% - 82% efficiency		43,859	0	0	25	($8470) $14470	0.4	Low	12% (EGD) 27% (Union)	10% (EGD & Union)	Adjustments: Incemental costs based on weighted average of boiler types as per EB 20080384 and 0385. FR as per EB 2008-0384 and 0385. Spillover as per Summit Blue, Custom Projects Attribution Study, October 2008
62a	Commercial	Existing	Prescriptive Schools - Secondary	hydronic boiler with 83%+ efficiency	hydronic boiler with 80% - 82% efficiency		43,859	0	0	25	$14,470					

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	Target Market		Equipment Details				Annual Resource Savings			Other						NOTES
	Sector	New / Existing	Efficient Equipment	Details of efficient equipment	Base Equipment	Details of base equipment	Natural Gas (m^3)	Electricity kWh	Water (L)	EUL	Inc. Cost ($)	Payback (Yrs)*	Market Share/Pen.+	Free Ridership	Spillover	
	Commercial Water Heating															
63	~~Commercial~~	~~New / Existing~~	~~Condensing Gas Water Heater~~	~~95% thermal efficiency~~	~~Conventional water heater~~	~~80% efficiency, 91 gal. tank.~~	~~338~~	~~0~~	~~0~~	~~13~~	~~$2,230~~	13	Low			See below, line 65a
64	~~Commercial~~	~~New / Existing~~	~~Condensing Gas Water Heater~~	~~95% thermal efficiency~~	~~Conventional water heater~~	~~80% efficiency, 91 gal. tank.~~	~~905~~	~~0~~	~~0~~	~~13~~	~~$2,230~~	5.0	Low			See below, line 65a
65	~~Commercial~~	~~New / Existing~~	~~Condensing Gas Water Heater~~	~~95% thermal efficiency~~	~~Conventional water heater~~	~~80% efficiency, 91 gal. tank.~~	~~1,614~~	~~0~~	~~0~~	~~13~~	~~$2,230~~	2.8	Low			See below, line 65a
65a	Commercial	New / Existing	Condensing Gas Water Heater	95% thermal efficiency	Conventional storage tank water heater	80% thermal efficiency	1,543	0	0	13	$2,230			5%		Adjustments; Savings updated. Measure life and incremental cost updated to reflect Navigant research, FR as per EB 2008-0384 and 0385
65b	Commercial	New / Existing	Condensing Gas Water Heater	EF=0.86	Conventional storage tank water heater	EF=0.59	1,412	0	0	15	$4,200					
66	Commercial	Existing	Pre-Rinse Spray Nozzle	1.6 GPM	Standard pre-rinse spray nozzle	3.0 GPM	387	0	116,086	5	$41	0.2	Med			See below
66a	Commercial	Existing	Pre-Rinse Spray Nozzle	1.6 GPM	Standard pre-rinse spray nozzle	3.0 GPM	2,434	0	432,800	5	$100					
67	~~Commercial~~	~~Existing~~	~~Pre-Rinse Spray Nozzle~~	~~1.24 GPM~~	~~Standard pre-rinse spray nozzle~~	~~3.0 GPM~~	~~486~~	~~0~~	~~145,937~~	~~5~~	~~$60~~	0.3	Low			See below, line 67a to 67f
67a	Commercial	New / Existing	Pre-Rinse Spray Nozzle (Full Service)	1.24 GPM	Standard pre-rinse spray nozzle	3.0 GPM	931	0	182,000	5	$100			12.4%	3%	Adjustments: New information based on Free Ridership and Spillover for Low Flow Pre Rinse Spray Nozzles (Nov. 26, 2008, PA Consulting Group); Savings based on Energy Profiles -Pre-rinse spray nozzle deemed savings study - January 30, 2009.
67b	Commercial	New / Existing	Pre-Rinse Spray Nozzle (Limited)	1.24 GPM	Standard pre-rinse spray nozzle	3.0 GPM	278	0	55,000	5	$100			12.4%	3%	Adjustments: New information based on Free Ridership and Spillover for Low Flow Pre Rinse Spray Nozzles (Nov. 26, 2008, PA Consulting Group); Savings based on Energy Profiles -Pre-rinse spray nozzle deemed savings study - January 30, 2009.
67c	Commercial	New / Existing	Pre-Rinse Spray Nozzle (Other)	1.24 GPM	Standard pre-rinse spray nozzle	3.0 GPM	272	0	53,000	5	$100			12.4%	3%	Adjustments: New information based on Free Ridership and Spillover for Low Flow Pre Rinse Spray Nozzles (Nov. 26, 2008, PA Consulting Group); Savings based on Energy Profiles -Pre-rinse spray nozzle deemed savings study - January 30, 2009.
67d	Commercial	New / Existing	Pre-Rinse Spray Nozzle (Full Service)	0.64 GPM	Standard pre-rinse spray nozzle	3.0 GPM	1,286	0	252,000	5	$88			0.0%		Adjustments: Relatively new product; currently only aware of one manufacturer - propose 0% FR; Savings based on Energy Profiles -Pre-rinse spray nozzle deemed savings study - January 30, 2009.
67e	Commercial	New / Existing	Pre-Rinse Spray Nozzle (Limited)	0.64 GPM	Standard pre-rinse spray nozzle	3.0 GPM	339	0	66,400	5	$88			0.0%		Adjustments: Relatively new product; currently only aware of one manufacturer - propose 0% FR; Savings based on Energy Profiles -Pre-rinse spray nozzle deemed savings study - January 30, 2009.
67f	Commercial	New / Existing	Pre-Rinse Spray Nozzle (Other)	0.64 GPM	Standard pre-rinse spray nozzle	3.0 GPM	318	0	62,200	5	$88			0.0%		Adjustments: Relatively new product; currently only aware of one manufacturer - propose 0% FR; Savings based on Energy Profiles -Pre-rinse spray nozzle deemed savings study - January 30, 2009.
68	~~Commercial~~	~~New / Existing~~	~~Tankless Water Heater 100 gal/day~~	~~84% thermal efficiency~~	~~Conventional water heater~~	~~80% efficiency, 91 gal. tank.~~	~~215~~	~~0~~	~~0~~	~~18~~	~~-$1,570~~	~~0.0~~	~~Low~~			See below, line 70a
69	~~Commercial~~	~~New / Existing~~	~~Tankless Water Heater (500 gal/day)~~	~~84% thermal efficiency~~	~~Conventional water heater~~	~~80% efficiency, 91 gal. tank.~~	~~57~~	~~0~~	~~0~~	~~18~~	~~$510~~	~~18~~	~~Low~~			See below, line 70a
70	~~Commercial~~	~~New / Existing~~	~~Tankless Water Heater (1000 gal/day)~~	~~84% thermal efficiency~~	~~Conventional water heater~~	~~80% efficiency, 91 gal. tank.~~	~~-142~~	~~0~~	~~0~~	~~18~~	~~$2,590~~	~~N/A~~	~~Low~~			See below, line 70a
70a	Commercial	New / Existing	Tankless Water Heater 50-150 USG gal/day	84% thermal efficiency	Conventional water heater	80% efficiency, 91 gal. tank.	221	0	0	20	-$1,570	0.0	Low	2%		Adjustments: Updated savings and measure life. FR as per EB2008-0384 and 0385.
70b	Commercial	New	Tankless Water Heater (950 gal/day)		Conventional storage tank water heater	140 gallon tank	825	0	0	20	$2,200					
	Multi-Family Water Heating															
71	Multi-Family	Existing	(Energy Star Clothes Washer) CEE qualified washers	(MEF=1.72, WF=8.0) MEF=2.20, WF=5.33	Conventional top-loading, vertical axis clothes washer	MEF=1.26, WF=9.5	(79) 222m3	(201) 296	(19814) 80,000	11	($150) $600	3.8	High	10%		Adjustments: Savings recalculated based on equipment in Enbridge program. FR as per EB 2008-0384 and 0385
71a	Multi-Residential	Existing	Energy Efficient Washer		Conventional top-loading, vertical axis clothes washer		342	306	90,790	10	$450					

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	Target Market		Equipment Details				Annual Resource Savings			Other						NOTES
	Sector	New / Existing	Efficient Equipment	Details of efficient equipment	Base Equipment	Details of base equipment	Natural Gas (m^3)	Electricity kWh	Water (L)	EUL	Inc. Cost ($)	Payback (Yrs)*	Market Share/Pen.+	Free Ridership	Spillover	
72	Multi-Family	Existing	Faucet Aerator	Kitchen, 1.5 GPM	Average existing stock	2.5 GPM	26	0	5,377	10	$2	0.2	90%	10%		Adjustments: FR as per EB 2008-0384 and 0385
72a	Multi-Family	Existing	Faucet Aerator	Kitchen, 1.0 GPM	Average existing stock	2.5 GPM	39	0	8,072	10	$2			10%		Adjustments: Savings calculation applied to a 1.0GPM aerator. FR as per EB 2008-0384 and 0385
72b	Multi-Residential	Existing	Faucet Aerator	Kitchen, 1.5 GPM	Average existing stock	2.5 GPM	22	0	7,800	10	$2					
73	Multi-Family	Existing	Faucet Aerator	Bathroom, 1.5 GPM	Average existing stock	2.2 GPM	7	0	1,382	10	$2	0.5	90%	10%		Adjustments: FR as per EB 2008-0384 and 0385
73a	Multi-Family	Existing	Faucet Aerator	Bathroom, 1.0 GPM	Average existing stock	2.2 GPM	11		2,371	10	($2) $1.50			10%		Adjustments: Savings calculation applied to a 1.0GPM aerator. Incremental costs to reflect utility bulk purchase price. FR as per EB 2008-0384 and 0385
73b	Multi-Residential	Existing	Faucet Aerator	Bathroom, 1.5 GPM	Average existing stock	2.2 GPM	6	0	2,000	10	$2					
74	Multi-Family	Existing	Low-flow showerhead	1.5 GPM (distributed, e.g., ESK)	Average existing stock	2.2 GPM	(23) 30	0	(4369) 5345	10	($6) $4	0.5	65%	10%		Adjustments: Savings adjusted to account for percentage of showers taken with efficient unit in Multi-residential setting (92%) compared to 76% in low rise residential as per Summit Blue, Resource Savings Values in Selected Residential DSM Prescriptive Programs, June 2008. Incremental costs as per utility bulk purchase price. FR as per EB 2008-0384 and 0385
74a	Multi-Residential	Existing	Low-flow showerhead	1.5 GPM, (Union ESK program)	Average existing stock	2.2 GPM (implicitly)	22	0	6,400	10	$4					
75	~~Multi-Family~~	~~Existing~~	~~Low-flow showerhead~~	~~1.25 GPM (installed)~~	~~Average existing stock~~	~~2.0 GPM~~	~~34~~	~~0~~	~~6,081~~	~~10~~	~~$13~~	0.7	65%			See below, line 76 to 77g
76	Multi-Family	Existing	Low-flow showerhead	1.25 GPM (installed)	Average existing stock in one of two ranges.	2.25 GPM (2.0 to 2.5 GPM)	(43) 53	0	(7507) 9078	10	($13) $17	0.6	65%	10%		Adjustments: Savings adjusted to account for percentage of showers taken with efficient unit in Multi-residential setting (92%) compared to 76% in low rise residential as per Summit Blue, Resource Savings Values in Selected Residential DSM Prescriptive Programs, June 2008. Incremental cost as per utility bulk purchase plus installation cost. FR as per EB 2008-0384 and 0385
77	Multi-Family	Existing	Low-flow showerhead	1.25 GPM (installed)	Average existing stock in one of two ranges.	3.0 GPM (2.6 GPM and above)	(70) 87	0	(11840) 14341	10	($13) $17	0.4	65%	10%		as above

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	Target Market		Equipment Details				Annual Resource Savings			Other						NOTES
	Sector	New / Existing	Efficient Equipment	Details of efficient equipment	Base Equipment	Details of base equipment	Natural Gas (m^3)	Electricity kWh	Water (L)	EUL	Inc. Cost ($)	Payback (Yrs)*	Market Share/Pen.+	Free Ridership	Spillover	
77a	Multi-Family	Existing	Low-flow showerhead	1.5 GPM (installed)	Average existing stock in one of four ranges.	2.25 GPM (2.0 to 2.5 GPM)	28	0	5,197	10	$17			10%		Adjustments: Navigant method used to calculate savings for 1.5 GPM showerhead with adjustment for percentage of showers influenced in Multi-residential application. Incremental cost as per utility bulk purchase plus installation cost. FR as per EB 2008-0384 and 0385
77b	Multi-Family	Existing	Low-flow showerhead	1.5 GPM (installed)	Average existing stock in one of four ranges.	2.75 GPM (2.6 to 3.0 GPM)	55	0	9,490	10	$17			10%		as above
77c	Multi-Family	Existing	Low-flow showerhead	1.5 GPM (installed)	Average existing stock in one of four ranges.	3.25 GPM (3.1 to 3.5 GPM)	79	0	13,250	10	$17			10%		as above
77d	Multi-Family	Existing	Low-flow showerhead	1.5 GPM (installed)	Average existing stock in one of four ranges.	3.6 GPM (3.6 GPM and above)	91	0	15,114	10	$17			10%		as above
77e	Multi-Family	Existing	Low-flow showerhead	2.0 GPM (installed)	Average existing stock in one of three ranges.	2.75 GPM (2.6 to 3.0 GPM)	4	0	1,727	10	$17			10%		Adjustments: Navigant method used to calculate savings for 2.0 GPM showerhead with adjustment for percentage of showers influenced in Multi-residential application. Incremental cost as per utility bulk purchase plus installation cost. FR as per EB 2008-0384 and 0385
77f	Multi-Family	Existing	Low-flow showerhead	2.0 GPM (installed)	Average existing stock in one of three ranges.	3.25 GPM (3.1 to 3.5 GPM)	28	0	5,487	10	$17			10%		as above
77g	Multi-Family	Existing	Low-flow showerhead	2.0 GPM (installed)	Average existing stock in one of three ranges.	3.6 GPM (3.6 GPM and above)	40	0	7,351	10	$17			10%		as above
77a	Multi-Residential	Existing	Low-flow showerhead		Average stock		115	0	30,966	10	$15					
78	Multi-Family	Existing	Low-flow showerhead (distributed, e.g., ESK)	1.25 GPM	Average existing stock	2.2 GPM	(42) 53.8	0	(7289) 8916	10	($6) $4	0.6	65%	10%		Adjustments: Savings adjusted to account for percentage of showers taken with efficient unit in Multi-residential setting (92%) compared to 76% in low rise residential as per Summit Blue, Resource Savings Values in Selected Residential DSM Prescriptive Programs, June 2008. FR as per EB 2008-0384 and 0385
78a	Multi-Residential	Existing	Low-flow showerhead	1.25 GPM (Union ESK program)	Average existing stock	2.2 GPM (implicitly)	40	0	10,700	10	$4					
	All	New / Existing	CFL	13W	60W incandescent		-	45	-	8	$0			24%		Adjustments: Measure as per EB 2008-0384 and 0385
	All	New / Existing	CFL	23W	75W incandescent		-	50	-	8	$0			24%		Adjustments: Measure as per EB 2008-0384 and 0385
	Residential	New	Energy Star New Homes	Energy Star for New Homes V4	New home built to OBC as of Jan 1, 2009		881	734		25	$4,275			5%		Adjustments: 2008 measure updated to reflect changes to Energy Star and Ontario Building Code and based on E Star V4

Appendix A

Target Market		Equipment Details				Annual Resource Savings			Other						NOTES
Sector	New / Existing	Efficient Equipment	Details of efficient equipment	Base Equipment	Details of base equipment	Natural Gas (m^3)	Electricity kWh	Water (L)	EUL	Inc. Cost ($)	Payback (Yrs)*	Market Share/Pen.+	Free Ridership	Spillover	
Small Commercial / Large Commercial and Multi-residential	Existing	Higher Efficiency Boilers (DHW)	300 MBH 83-84% efficient	boiler with 80% combustion efficiency		1,075	0	0	25	$3,900			Enbridge: 10/12/20% Union: 10/59/42%		Adjustments: New measure. EUL as per Measure life table from EB 2008-0384 and 0385. Free ridership by sector as per EB 2008-0384 at 10/12/20% for Enbridge and 10/59/42% for Union for small commercial, Commercial and Multi-residential applications.
Small Commercial / Large Commercial and Multi-residential	Existing	Higher Efficiency Boilers (DHW)	600 MBH 83-84% efficient	boiler with 80% combustion efficiency		1,777	0	0	25	$5,800			Enbridge: 10/12/20% Union: 10/59/42%		Adjustments: New measure. EUL as per Measure life table from EB 2008-0384 and 0385. Free ridership by sector as per EB 2008-0384 at 10/12/20% for Enbridge and 10/59/42% for Union for small commercial, Commercial and Multi-residential applications.
Small Commercial / Large Commercial and Multi-residential	Existing	Higher Efficiency Boilers (DHW)	1000 MBH 83-84% efficient	boiler with 80% combustion efficiency		3,136	0	0	25	$7,400			Enbridge: 10/12/20% Union: 10/59/42%		Adjustments: New measure. EUL as per Measure life table from EB 2008-0384 and 0385. Free ridership by sector as per EB 2008-0384 at 10/12/20% for Enbridge and 10/59/42% for Union for small commercial, Commercial and Multi-residential applications.
Small Commercial / Large Commercial and Multi-residential	Existing	Higher Efficiency Boilers (DHW)	1500 MBH 83-84% efficient	boiler with 80% combustion efficiency		4,317	0	0	25	$5,900			Enbridge: 10/12/20% Union: 10/59/42%		Adjustments: New measure. EUL as per Measure life table from EB 2008-0384 and 0385. Free ridership by sector as per EB 2008-0384 at 10/12/20% for Enbridge and 10/59/42% for Union for small commercial, Commercial and Multi-residential applications.
Small Commercial / Large Commercial and Multi-residential	Existing	Higher Efficiency Boilers (DHW)	300 MBH 85-88% efficient	boiler with 80% combustion efficiency		1,766	0	0	25	$4,500			Enbridge: 10/12/20% Union: 10/59/42%		Adjustments: New measure. EUL as per Measure life table from EB 2008-0384 and 0385. Free ridership by sector as per EB 2008-0384 at 10/12/20% for Enbridge and 10/59/42% for Union for small commercial, Commercial and Multi-residential applications.
Small Commercial / Large Commercial and Multi-residential	Existing	Higher Efficiency Boilers (DHW)	600 MBH 85-88% efficient	boiler with 80% combustion efficiency		2,290	0	0	25	$6,000			Enbridge: 10/12/20% Union: 10/59/42%		Adjustments: New measure. EUL as per Measure life table from EB 2008-0384 and 0385. Free ridership by sector as per EB 2008-0384 at 10/12/20% for Enbridge and 10/59/42% for Union for small commercial, Commercial and Multi-residential applications.
Small Commercial / Large Commercial and Multi-residential	Existing	Higher Efficiency Boilers (DHW)	1000 MBH 85-88% efficient	boiler with 80% combustion efficiency		5,155	0	0	25	$10,300			Enbridge: 10/12/20% Union: 10/59/42%		Adjustments: New measure. EUL as per Measure life table from EB 2008-0384 and 0385. Free ridership by sector as per EB 2008-0384 at 10/12/20% for Enbridge and 10/59/42% for Union for small commercial, Commercial and Multi-residential applications.
Small Commercial / Large Commercial and Multi-residential	Existing	Higher Efficiency Boilers (DHW)	1500 MBH 85-88% efficient	boiler with 80% combustion efficiency		7,095	0	0	25	$7,400			Enbridge: 10/12/20% Union: 10/59/42%		Adjustments: New measure. EUL as per Measure life table from EB 2008-0384 and 0385. Free ridership by sector as per EB 2008-0384 at 10/12/20% for Enbridge and 10/59/42% for Union for small commercial, Commercial and Multi-residential applications.
Small Commercial / Large Commercial and Multi-residential	Existing	Higher Efficiency Boilers (Space Heating)	300 MBH 83-84% efficient	boiler with 80% combustion efficiency		2,105	0	0	25	$3,900			Enbridge: 10/12/20% Union: 10/59/42%		Adjustments: New measure. EUL as per Measure life table from EB 2008-0384 and 0385. Free ridership by sector as per EB 2008-0384 at 10/12/20% for Enbridge and 10/59/42% for Union for small commercial, Commercial and Multi-residential applications.
Small Commercial / Large Commercial and Multi-residential	Existing	Higher Efficiency Boilers (Space Heating)	600 MBH 83-84% efficient	boiler with 80% combustion efficiency		3,994	0	0	25	$5,800			Enbridge: 10/12/20% Union: 10/59/42%		Adjustments: New measure. EUL as per Measure life table from EB 2008-0384 and 0385. Free ridership by sector as per EB 2008-0384 at 10/12/20% for Enbridge and 10/59/42% for Union for small commercial, Commercial and Multi-residential applications.

Appendix A

Target Market		Equipment Details				Annual Resource Savings			Other						NOTES
Sector	New / Existing	Efficient Equipment	Details of efficient equipment	Base Equipment	Details of base equipment	Natural Gas (m^3)	Electricity kWh	Water (L)	EUL	Inc. Cost ($)	Payback (Yrs)*	Market Share/Pen.+	Free Ridership	Spillover	
Small Commercial / Large Commercial and Multi-residential	Existing	Higher Efficiency Boilers (Space Heating)	1000 MBH 83-84% efficient	boiler with 80% combustion efficiency		7,310	0	0	25	$7,400			Enbridge: 10/12/20% Union: 10/59/42%		Adjustments: New measure. EUL as per Measure life table from EB 2008-0384 and 0385. Free ridership by sector as per EB 2008-0384 at 10/12/20% for Enbridge and 10/59/42% for Union for small commercial, Commercial and Multi-residential applications.
Small Commercial / Large Commercial and Multi-residential	Existing	Higher Efficiency Boilers (Space Heating)	1500 MBH 83-84% efficient	boiler with 80% combustion efficiency		11,554	0	0	25	$5,900			Enbridge: 10/12/20% Union: 10/59/42%		Adjustments: New measure. EUL as per Measure life table from EB 2008-0384 and 0385. Free ridership by sector as per EB 2008-0384 at 10/12/20% for Enbridge and 10/59/42% for Union for small commercial, Commercial and Multi-residential applications.
Small Commercial / Large Commercial and Multi-residential	Existing	Higher Efficiency Boilers (Space Heating)	2000 MBH 83-84% efficient	boiler with 80% combustion efficiency		16,452	0	0	25	$4,950			Enbridge: 10/12/20% Union: 10/59/42%		Adjustments: New measure. EUL as per Measure life table from EB 2008-0384 and 0385. Free ridership by sector as per EB 2008-0384 at 10/12/20% for Enbridge and 10/59/42% for Union for small commercial, Commercial and Multi-residential applications.
Small Commercial / Large Commercial and Multi-residential	Existing	Higher Efficiency Boilers (Space Heating)	300 MBH 85-88% efficient	boiler with 80% combustion efficiency		3,125	0	0	25	$4,500			Enbridge: 10/12/20% Union: 10/59/42%		Adjustments: New measure. EUL as per Measure life table from EB 2008-0384 and 0385. Free ridership by sector as per EB 2008-0384 at 10/12/20% for Enbridge and 10/59/42% for Union for small commercial, Commercial and Multi-residential applications.
Small Commercial / Large Commercial and Multi-residential	Existing	Higher Efficiency Boilers (Space Heating)	600 MBH 85-88% efficient	boiler with 80% combustion efficiency		5,930	0	0	25	$6,000			Enbridge: 10/12/20% Union: 10/59/42%		Adjustments: New measure. EUL as per Measure life table from EB 2008-0384 and 0385. Free ridership by sector as per EB 2008-0384 at 10/12/20% for Enbridge and 10/59/42% for Union for small commercial, Commercial and Multi-residential applications.
Small Commercial / Large Commercial and Multi-residential	Existing	Higher Efficiency Boilers (Space Heating)	1000 MBH 85-88% efficient	boiler with 80% combustion efficiency		10,856	0	0	25	$10,300			Enbridge: 10/12/20% Union: 10/59/42%		Adjustments: New measure. EUL as per Measure life table from EB 2008-0384 and 0385. Free ridership by sector as per EB 2008-0384 at 10/12/20% for Enbridge and 10/59/42% for Union for small commercial, Commercial and Multi-residential applications.
Small Commercial / Large Commercial and Multi-residential	Existing	Higher Efficiency Boilers (Space Heating)	1500 MBH 85-88% efficient	boiler with 80% combustion efficiency		17,157	0	0	25	$7,400			Enbridge: 10/12/20% Union: 10/59/42%		Adjustments: New measure. EUL as per Measure life table from EB 2008-0384 and 0385. Free ridership by sector as per EB 2008-0384 at 10/12/20% for Enbridge and 10/59/42% for Union for small commercial, Commercial and Multi-residential applications.
Small Commercial / Large Commercial and Multi-residential	Existing	Higher Efficiency Boilers (Space Heating)	2000 MBH 85-88% efficient	boiler with 80% combustion efficiency		24,431	0	0	25	$7,050			Enbridge: 10/12/20% Union: 10/59/42%		Adjustments: New measure. EUL as per Measure life table from EB 2008-0384 and 0385. Free ridership by sector as per EB 2008-0384 at 10/12/20% for Enbridge and 10/59/42% for Union for small commercial, Commercial and Multi-residential applications.
Commercial	Existing	Custom Retrofit											EGD 12% Union 59%	EGD 21% Union 10%	FR as per EB 2008-0384 and 0385. Spillover as per Summit Blue, Custom Projects Attribution Study October 31,2008
Commercial	Existing	Custom Multi-family											EGD 20% Union 42%	EGD 21% Union 10%	FR as per EB 2008-0384 and 0385. Spillover as per Summit Blue, Custom Projects Attribution Study October 31,2009
Commercial	New	Custom New Build											EGD 26% Union 33%	EGD 21% Union 10%	FR as per EB 2008-0384 and 0385. Spillover as per Summit Blue, Custom Projects Attribution Study October 31,2010
Agriculture	New/Existing	Custom Agriculture											EGD 40% Union 0%	EGD 21% Union 10%	FR as per EB 2008-0384 and 0385. Spillover as per Summit Blue, Custom Projects Attribution Study October 31,2011
Industrial	New/Existing	Custom Industrial											EGD 50% Union 56%	EGD 21% Union 10%	FR as per EB 2008-0384 and 0385. Spillover as per Summit Blue, Custom Projects Attribution Study October 31,2012
See also: Custom Resource Acquisition Technologies - Measure Life Assumptions															

Appendix A

Target Market		Equipment Details				Annual Resource Savings			Other						NOTES
Sector	New / Existing	Efficient Equipment	Details of efficient equipment	Base Equipment	Details of base equipment	Natural Gas (m^3)	Electricity kWh	Water (L)	EUL	Inc. Cost ($)	Payback (Yrs)*	Market Share/Pen.+	Free Ridership	Spillover	
* Payback for measures with natural gas savings is based on natural gas savings only; payback for measures that increase natural gas consumption (ie, furnaces with ECMs) is based on net energy cost savings (ie, electricity savings less incremental natural gas costs)															
+ When available, the current market penetration or market share percentage is provided, else, an estimated "low", "medium" or "high" scale is used, where "low" is below 5%, "medium" is between 5 and 50%, and "high" is greater than 50%.															

Appendix B

Substantiation Document for Input Assumptions

HEAT REFLECTOR PANELS

Residential Existing Homes

Efficient Technology & Equipment Description
A saw tooth panel made of clear PVC with a reflective surface placed behind a gas radiator reducing heat lost to poorly insulated exterior walls.
Base Technology & Equipment Description
Existing housing with radiant heat with no reflector panels.

Resource Savings Assumptions

Natural Gas (Updated)	**143 m^3**
As per EB 2008-0384 & 0385 and by Navigant Consulting.[1]	
Electricity	**kWh**
Water	**L**

Other Input Assumptions

Equipment Life	**18 Years**
Based on average space heat measure life.[1] As approved in EB 2008-0384 & 0385.	
Incremental Cost (Customer Install)	**$238**
As per utility program costs. (Cost of panels plus shipping)	
Free Ridership	**0 %**
Product not currently available to end-use consumers through typical retail channels. As approved in EB 2008-0384 & 0385.	

[1] Draft Report "Measures and Assumptions for Demand Side Management (DSM) Planning", Navigant Consulting Inc., Ontario Energy Board, Appendix C: Substantiation Sheets, pg. B-39-41, Feb. 6, 2009.

PROGRAMMABLE THERMOSTAT

Residential Existing Homes

Efficient Technology & Equipment Description
Programmable thermostat
Base Technology & Equipment Description
Standard thermostat

Resource Savings Assumptions

Natural Gas (Updated)	**146 m^3**
Savings adjustment recommended by Navigant Consulting.[1]	
Electricity (Updated)	**123 kWh**
Savings adjustm ent calculated by using a combination of Summit Blue and Navigant assumptions.[1, 2] Navigant electricity savings are based on OPA 2009 assumptions of 100% market penetration of central air.[1] Summit Blue reports a penetration rate of 57% for CAC across the province based on information from EGD and NRCan.[2] Using 57% penetration the electricity savings are (44 + (138*.57) = 122.7kWh.[1,2]	
Water	**n/a L**

Other Input Assumptions

Equipment Life	**15 Years**
Equipment life recommended by Summit Blue Consulting and as approved in EB 2008-0384 & 0385. Also recommended by Navigant Consulting.[1]	
Incremental Cost (Contr. Install) (UG/EGD)	**$50**
Based on average thermostat cost from Union survey of hardware chains.	
Free Ridership	**43 %**
Free Ridership rate recommended by Summit Blue Consulting.[3] As approved in EB 2008-0384 & 0385.	
Spillover	**14 %**
Spillover rate recommended by Summit Blue Consulting[3] .	

[1] Draft Report "Measures and Assumptions for Demand Side Management (DSM) Planning", Navigant Consulting Inc., Ontario Energy Board, Appendix C: Substantiation Sheets, pg. B-50-53, Feb. 6, 2009.

[2] "Resource Savings Values in Selected DSM Prescriptive Programs", Summit Blue Consulting, pg. 28, June 2008.

[3] "Residential Measure Free Ridership And Inside Spillover Study - Final Report", Summit Blue Consulting, June 2008.

1.5 GAL/MIN FAUCET AERATOR (Kitchen)

Residential Existing Homes

Efficient Technology & Equipment Description
Faucet Aerator (Kitchen) (1.5 GPM)
Base Technology & Equipment Description
Average existing stock (2.5 GPM)

Resource Savings Assumptions

Natural Gas (Updated)	**38 m^3**
Savings recommended by Navigant Consulting.[1]	
Electricity	**n/a kWh**
Water (Updated)	**7,797 L**
Savings recommended by Navigant Consulting.[1]	

Other Input Assumptions

Equipment Life	**10 years**
Faucet aerators have an estimated service life of 10 years.[1, 2] As approved in EB 2008-0384 & 0385.	
Incremental Cost (Cust. Install) (UG/EGD)	**$1**
As per utility program costs, bulk purchase of aerators.	
Free Ridership (Updated) (UG/EGD)	**33/31 %**
Free Ridership rate recommended by Summit Blue Consulting.[3] As approved in EB 2008-0384 & 0385.	
Spillover (TAPS/ESK)	**7/17 %**
Spillover rate recommended by Summit Blue Consulting[3] .	

[1] Draft Report "Measures and Assumptions for Demand Side Management (DSM) Planning", Navigant Consulting Inc., Ontario Energy Board, Appendix C: Substantiation Sheets, pg. B-65-68, Feb. 6, 2009.

[2] U.S. DOE – FEMP, Energy Cost Calculator for Faucets and Showerheads, http://www.eere.energy.gov/femp

[3] "Residential Measure Free Ridership And Inside Spillover Study - Final Report", Summit Blue Consulting, June 2008.

1.5 GAL/MIN FAUCET AERATOR (Bathroom)

Residential Existing Homes

Efficient Technology & Equipment Description
Faucet Aerator (Bathroom) (1.5 GPM)
Base Technology & Equipment Description
Average existing stock (2.2 GPM)

Resource Savings Assumptions

Natural Gas (Updated)	**10 m^3**
Savings recommended by Navigant Consulting.[1]	
Electricity	**n/a kWh**
Water (Updated)	**2,004 L**
Savings recommended by Navigant Consulting.[1]	

Other Input Assumptions

Equipment Life	**10 Years**
Faucet aerators have an estimated service life of 10 years.[1, 2] As approved in EB 2008-0384 & 0385.	
Incremental Cost (Cust. Install) (UG/EGD)	**$1**
As per utility program costs, bulk purchase of aerators.	
Free Ridership (Updated) (UG/EGD)	**33/31 %**
Free Ridership rate recommended by Summit Blue Consulting.[3] As approved in EB 2008-0384 & 0385.	
Spillover (TAPS/ESK)	**7/17 %**
Spillover rate recommended by Summit Blue Consulting[3] .	

[1] Draft Report "Measures and Assumptions for Demand Side Management (DSM) Planning", Navigant Consulting Inc., Ontario Energy Board, Appendix C: Substantiation Sheets, pg. B-61-64, Feb. 6, 2009.

[2] U.S. DOE – FEMP, Energy Cost Calculator for Faucets and Showerheads, http://www.eere.energy.gov/femp

[3] "Residential Measure Free Ridership And Inside Spillover Study - Final Report", Summit Blue Consulting, June 2008.

1.5 GAL/MIN LOW-FLOW SHOWERHEAD

Residential Existing Homes (Distribution)

Efficient Technology & Equipment Description
Low-flow showerhead (1.5 gal/min)
Base Technology & Equipment Description
Average existing stock (2.2 GPM)

Resource Savings Assumptions

Natural Gas	**33 m^3**
Savings recommended by Navigant Consulting.[1]	
Electricity	**n/a kWh**
Water	**6,334 L**
Savings recommended by Navigant Consulting.[1]	

Other Input Assumptions

Equipment Life	**10 Years**
Low flow showerheads have an estimated service life of 10 years.[1] As approved in EB 2008-0384 & 0385.	
Incremental Cost (Cust. Install)	**$4**
As per utility program costs, bulk purchase of showerheads.	
Free Ridership	**10 %**
Free Ridership rate recommended by Summit Blue Consulting.[2] As approved in EB 2008-0384 & 0385.	
Spillover (distributed – Union & EGD)	**19 %**
Spillover rate recommended by Summit Blue Consulting[2].	

[1] Draft Report "Measures and Assumptions for Demand Side Management (DSM) Planning", Navigant Consulting Inc., Ontario Energy Board, Appendix C: Substantiation Sheets, pg. B-69-72, Feb. 6, 2009.

[2] "Residential Measure Free Ridership And Inside Spillover Study - Final Report", Summit Blue Consulting, June 2008.

1.25 GAL/MIN LOW-FLOW SHOWERHEAD

Residential Existing Homes (Distribution)

Efficient Technology & Equipment Description
Low-flow showerhead (1.25 gal/min)
Base Technology & Equipment Description
Average existing stock (2.2 GPM)

Resource Savings Assumptions

Natural Gas	**60 m^3**
Savings recommended by Navigant Consulting.[1]	
Electricity	**n/a kWh**
Water	**10,570 L**
Savings recommended by Navigant Consulting.[1]	

Other Input Assumptions

Equipment Life	**10 Years**
Low flow showerheads have an estimated service life of 10 years.[1] As approved in EB 2008-0384 & 0385.	
Incremental Cost (Cust. Install)	**$4**
As per utility program costs, bulk purchase of showerheads.	
Free Ridership	**10 %**
Free Ridership rate recommended by Summit Blue Consulting.[2] As approved in EB 2008-0384 & 0385.	
Spillover (distributed – Union & EGD)	**19 %**
Spillover rate recommended by Summit Blue Consulting[2].	

[1] Draft Report "Measures and Assumptions for Demand Side Management (DSM) Planning", Navigant Consulting Inc., Ontario Energy Board, Appendix C: Substantiation Sheets, pg. B-79-82, Feb. 6, 2009.

[2] "Residential Measure Free Ridership And Inside Spillover Study - Final Report", Summit Blue Consulting, June 2008.

1.25 GAL/MIN LOW-FLOW SHOWERHEAD

Residential Existing Homes (Installed per Household)

Efficient Technology & Equipment Description
Low-flow showerhead (1.25 gal/min)
Base Technology & Equipment Description
Average existing stock – see below for flow rates.

Resource Savings Assumptions

Natural Gas (Updated)	**See Below m^3**

Gas savings as per results of EGD load research.

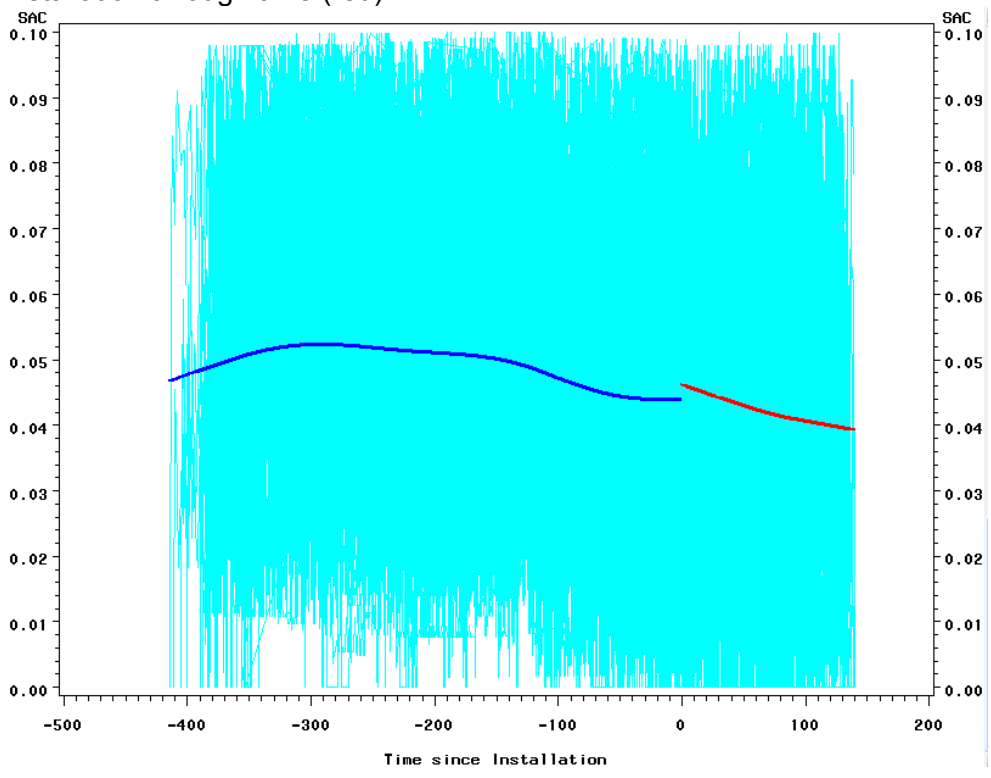
Data was analyzed for 69 households pre and post installation of low-flow shower-heads. Data records began on August 31 2007 until December 31 2008 date. Showerheads were installed between 13 August 2008 and 18 October 2008.
A simple paired t-test (before-after installation) was used to test for the magnitude and statistical significance of installation effect on consumption.

Longitudinal mixed models were used to explore relationships between inputs and low flow showerhead installation on consumption.

RESULTS

Data Exploration

A plot of seasonally adjusted consumption (SAC) by time shows that consumption is generally lower after low-flow showerhead installation (red) than before installation (blue). Surprisingly, immediately after installation (close to time 0) there appears to be an initial increase in consumption. But note the decreasing trend in consumption post-installation through time (red).



Paired T-Tests

Before-After Test on Seasonally Adjusted Data on 68 Households.

ALL DATA

paired t-test

Average hourly difference m^3/hour	Average daily difference m^3/day	Average annual difference m^3/year
0.0102	**0.245**	**89.35**

Lower 95% Confidence Bound

0.0065	**0.156**	**56.94**

Upper 95% Confidence Bound

0.0138	**0.331**	**120.89**

Longitudinal Mixed Model

The T-Test results above do not control for household attributes or time since installation. The following shows predictions from two mixed models explained in the Final Report.

Predictions Derived by comparing low-flow to normal shower heads at the mean value of all other attributes, and the mean value of time pre and post installation.

INTERACTION MODEL

MEAN Average	m^3/hour	Average daily m^3/day	Average annual m^3/year	Lower CI m3/hour	Upper CI m3/hour
LOW FLOW - YES	0.0583	1.399	510.5	0.0533	0.0633
LOW FLOW - NO	0.0478	1.147	418.8	0.0428	0.0528

Daily Savings	0.251
Annual Savings	91.7

Longitudinal Mixed Model: Accounting for Pre-Installation Flow

We added information on pre-existing showerheads (AVGFLOW) to estimate savings due to low-flow installation by previous showerhead flow-rates.

Three buckets were originally proposed. However, the lowest flow bucket (2.0 gpm or less) had too few observations and are rare in the population of households. Further, Enbridge will not be installing low-flow shower heads in

homes with existing low flow heads (less than 2.0 gpm). Therefore two buckets were used instead: 2.0 to 2.5 gpm heads (preflow=1) and greater than 2.5 gpm (preflow=0).

The FREQ Procedure

preflow	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	35	49.30	35	49.30
1	36	50.70	71	100.00

There were statistically significant effects of flow category of pre-existing showerheads on consumption.

The following prediction table shows that savings in consumption is greater for the 2.5 + gpm group of houses (0.316848 per day) than in the 2.0-2.5 gpm group (0.179616 per day).

Predictions Derived by comparing low-flow to normal shower heads at the mean value of all other attributes, **for homes with pre-existing showerheads 2.0-2.5 gpm.**

PREFLOW=LOW (2-2.5 gpm)	**SIMPLE MODEL**				
MEAN Average	m^3/hour	Average daily m^3/day	Average annual m^3/year	Lower CI m3/hour	Upper CI m3/hour
LOW FLOW -NO	0.0517	1.240	452.5	0.0446	0.0587
LOW FLOW -YES	0.0442	1.060	387.0	0.0370	0.0513
		Daily Savings	0.180		
		Annual Savings	65.6		

Homes with pre-existing showerheads 2.0-2.5 gpm.

PREFLOW=HIGH (> 2.5 gpm)	**SIMPLE MODEL**				
MEAN Average	m^3/hour	Average daily m^3/day	Average annual m^3/year	Lower CI m3/hour	Upper CI m3/hour
LOW FLOW -NO	0.0660	1.583	577.8	0.0589	0.0730
LOW FLOW -YES	0.0528	1.266	462.2	0.0456	0.0599
		Daily Savings	0.317		
		Annual Savings	115.6		

Participants to be tracked, and gas savings assigned, as per the following table:

Scenario	Flow Rate of 'OLD' showerhead (GPM)		Flow Rate of 'NEW' showerhead (GPM)	Gas Savings (m3)
1	2.0-2.5		1.25	65.6
2	2.6	+	1.25	115.6

Electricity	**n/a kWh**

Water (Updated)	**See Below L**

Savings recommended by Navigant Consulting
And approved in EB 2008-0384 and 0385.

Participants to be tracked, and water savings assigned, as per the following table:

Scenario	Flow Rate of 'OLD' showerhead (GPM)		Flow Rate of 'NEW' showerhead (GPM)	Water Savings (L)
2	2.0-2.5		1.25	10,886
3	2.6	+	1.25	17,168

Other Input Assumptions

Equipment Life	**10 Years**

As recommended by Navigant and
as approved in EB 2008-0384 & 0385.

Incremental Cost (Contr. Install)	**$19**

As per utility program costs, bulk purchase of showerheads plus cost of installation.

Free Ridership	**10 %**

As approved in EB 2008-0384 & 0385.

Spillover (installed - Union & EGD)	**8 %**

Spillover rate recommended by Summit Blue Consulting[1].

[1] "Residential Measure Free Ridership And Inside Spillover Study - Final Report", Summit Blue Consulting, June 2008.

PIPE WRAP (R-4)

Existing Residential

Efficient Technology & Equipment Description
Insulated hot water pipe for conventional gas storage tank-type hot water heater (R-4).
Base Technology & Equipment Description
Conventional gas storage tank-type hot water heater without pipe wrap (R-1).

Resource Savings Assumptions

Natural Gas	**25 m^3**

Assumptions and inputs:

- Gas savings calculated using method set out in 2006 Massachusetts study[1] except where noted.
- Average water heater energy factor: 0.57[2]
- Average household size: 3.1 persons[3]
- Assumed diameter of pipe to be wrapped: 0.75 inches
- Length of pipe to be wrapped: 6 feet.
- Surface area of pipe to be wrapped: 1.18 square feet.
- Ambient temperature around pipes: 16 ^oC (60 ^oF) [4]
- Average water heater set point temperature: 54 ^oC (130 ^oF)[5]
- Hot water temperature in outlet pipe: 52 ^oC (125 ^oF)[6]

Annual gas savings calculated as follows:

$$Savings = \left(\frac{1}{R_{base}} - \frac{1}{R_{eff}}\right) * Sa * \left(T_{pipe} - T_{amb}\right) * 24 * 365 * \frac{1}{EF} * 10^{-6} * 27.8$$

Where:

R_{base} = R-value of base equipment
R_{eff} = R-value of efficient equipment
Sa = Surface area of outlet pipe (ft^2)
T_{pipe} = Temperature of water in outlet pipe (^oF)
T_{amb} = Ambient temperature around pipe (^oF)
24 = Hours per day
365 = Days per year
EF = Water heater energy factor
10^{-6} = Factor to convert Btu to MMBtu
27.8 = Factor to convert MMBtu to m^3

Gas savings were determined to be 75% over base measure

$$Percent\ Savings = \frac{\left(G_{base} - G_{eff}\right)}{G_{base}}$$

Where:

G_{eff} = Annual natural gas use with efficient equipment, 8 m^3
G_{base} = Annual natural gas use with base equipment, 33 m^3

[1] RLW Analytics, *Final Market Potential Report Of Massachusetts Owner Occupied 1-4 Unit Dwellings*, July 2006 http://www.cee1.org/eval/db_pdf/575.pdf

[2] Assumption of the Ministry of Energy of Ontario. See Table 4,

Electricity	n/a kWh
Water	**0 L**
Navigant has assumed that adopting the measure would not affect the quantity of water consumed.	

Other Input Assumptions

Equipment Life	10 years
Based on the estimated measure lifetimes used in four other jurisdictions (Iowa - 15 years, Puget Sound Energy - 10 years, Efficiency Vermont – 10 years, and NYSERDA7 – 10 years). Navigant also recommends using an EUL of 10 years.	
Incremental Cost (Cust. / Contr. Install)	**$1 / $4**
As per EB-2008-0384, EB-2008-0385, and as per utility bulk purchase price.	
Free Ridership	**4 %**
Free-ridership rate as per EB-2008-0384 and 0385	

http://www.energy.gov.on.ca/index.cfm?fuseaction=conservation.guide13

[3] Summit Blue, *Resource Savings Values in Selected Residential DSM Prescriptive Programs*, June 2008.

[4] RLW Analytics (2006). Given geographic proximity, Massachusetts temperatures used unchanged for Ontario.

[5] As suggested by NRCan: http://oee.nrcan.gc.ca/residential/personal/new-homes/water-conservation.cfm?attr=4

[6] From source: "It is common to find a 5 - 10 F temperature drop from the water heater to the furthest fixtures in the house." Chinnery, G. *Policy recommendations for the HERS Community to consider regarding HERS scoring credit due to enhanced effective energy factors of water heaters resulting from volumetric hot water savings due to conservation devices/strategies,* EPA Energy Star for Homes, Sept 2006 http://www.energystar.gov/ia/partners/bldrs_lenders_raters/downloads/Volumetric_Hot_Water_Savings_Guidelines.pdf

PROGRAMMABLE THERMOSTAT

Low Income

Efficient Technology & Equipment Description
Programmable thermostat
Base Technology & Equipment Description
Standard thermostat

Resource Savings Assumptions

Natural Gas (Updated)	**146 m^3**
Savings recommended by Navigant Consulting.[1]	
Electricity (Updated)	**123 kWh**
Savings adjustment calculated by using a combination of Summit Blue and Navigant assumptions.[1, 2] Navigant electricity savings are based on OPA 2009 assumptions of 100% market penetration of central air.[1] Summit Blue reports a penetration rate of 57% for CAC across the province based on information from EGD and NRCan.[2] Using 57% penetration the electricity savings are (44 + (138*.57) – 122.7 kWh.[1,2]	
Water	**n/a L**

Other Input Assumptions

Equipment Life	**15 years**
Equipment life recommended by Summit Blue Consulting[2] and as approved in EB 2008-0384 & 0385.	
Incremental Cost (Contr. Install) (UG/EGD)	**$69**
As per utility program costs, bulk purchase of thermostats plus cost of installation.	
Free Ridership	**1 %**
As per EB 2008-0384 & 0385.	

[1] Draft Report "Measures and Assumptions for Demand Side Management (DSM) Planning", Navigant Consulting Inc., Ontario Energy Board, Appendix C: Substantiation Sheets, pg. B-100-103, Feb. 6, 2009.

[2] "Resource Savings Values in Selected DSM Prescriptive Programs", Summit Blue Consulting, pg. 28, June 2008.

WEATHERIZATION

Low Income

Efficient Technology & Equipment Description
Energy audits to identify and implement the most cost-effective energy retrofit to improve building envelope efficiencies.
Base Technology & Equipment Description
No weatherization.

Resource Savings Assumptions

Natural Gas (Updated)	**1,234 M^3**
Based on the average actual results per participant from the 284 weatherized homes completed in 2007 & 2008 homes.	
Electricity (Updated)	**255 kWh**
Based on the average actual results per participant from the 284 weatherized homes completed in 2007 & 2008 homes	
Water	**N/A L**

Other Input Assumptions

Equipment Life (Updated)	**23 Years**
Based on average measure life of measures installed in 61 2007 program participant homes. (EB 2008-0384 & 0385) Measures included attic insulation, wall insulation, door and weather stripping and caulking.[1]	
Incremental Cost (Contr. Install) (Updated)	**$2,667**
Based on the average actual results per participant from the 284 weatherized homes completed in 2007 & 2008 homes	
Free Ridership	**0 %**
As per Generic Hearing EB 2006-0021 & EB 2008-0384 & 0385.	

[1] Draft Report "Measures and Assumptions for Demand Side Management (DSM) Planning", Navigant Consulting Inc., Ontario Energy Board, Appendix C: Substantiation Sheets, pg. B-1104-106, Feb. 6, 2009.

1.5 GAL/MIN FAUCET AERATOR (Kitchen)

Low Income (Distributed)

Efficient Technology & Equipment Description
Faucet Aerator (Kitchen) (1.5 GPM)
Base Technology & Equipment Description
Average existing stock (2.5 GPM)

Resource Savings Assumptions

Natural Gas (Updated)	**38 m^3**
Savings recommended by Navigant Consulting.[1]	
Electricity	**n/a kWh**
Water (Updated)	**7,797 L**
Savings recommended by Navigant Consulting.[1]	

Other Input Assumptions

Equipment Life	**10 years**
Faucet aerators have an estimated service life of 10 years.[1, 2] As approved in EB 2008-0384 & 0385.	
Incremental Cost Customer Install	**$1**
As per utility program costs, bulk purchase of aerators.	
Free Ridership	**1 %**
As per EB 2008-0384 & 0385.	

[1] Draft Report "Measures and Assumptions for Demand Side Management (DSM) Planning", Navigant Consulting Inc., Ontario Energy Board, Appendix C: Substantiation Sheets, pg. B-112-115, Feb. 6, 2009.

[2] U.S. DOE – FEMP, Energy Cost Calculator for Faucets and Showerheads, http://www.eere.energy.gov/femp

1.5 GAL/MIN FAUCET AERATOR (Bathroom)

Low Income (Distributed)

Efficient Technology & Equipment Description
Faucet Aerator (Bathroom) (1.5 GPM)
Base Technology & Equipment Description
Average existing stock (2.2 GPM)

Resource Savings Assumptions

Natural Gas (Updated)	**10 m^3**
Savings recommended by Navigant Consulting.[1]	
Electricity	**n/a kWh**
Water (Updated)	**2,004 L**
Savings recommended by Navigant Consulting.[1]	

Other Input Assumptions

Equipment Life	**10 years**
Faucet aerators have an estimated service life of 10 years.[1, 2] As approved in EB 2008-0384 & 0385.	
Incremental Cost Customer Install	**$1**
As per utility program costs, bulk purchase of aerators.	
Free Ridership	**1 %**
As per EB 2008-0384 & 0385.	

[1] Draft Report "Measures and Assumptions for Demand Side Management (DSM) Planning", Navigant Consulting Inc., Ontario Energy Board, Appendix C: Substantiation Sheets, pg. B-108-111, Feb. 6, 2009.

[2] U.S. DOE – FEMP, Energy Cost Calculator for Faucets and Showerheads, http://www.eere.energy.gov/femp

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1.5 GAL/MIN LOW-FLOW SHOWERHEAD

Low Income (Distribution)

Efficient Technology & Equipment Description
Low-flow showerhead (1.5 gal/min)
Base Technology & Equipment Description
Average existing stock (2.2 GPM)

Resource Savings Assumptions

Natural Gas	**33 m^3**
Savings recommended by Navigant Consulting.[1]	
Electricity	**n/a kWh**
Water	**6,334 L**
Savings recommended by Navigant Consulting.[1]	

Other Input Assumptions

Equipment Life	**10 Years**
Low flow showerheads have an estimated service life of 10 years.[1] As approved in EB 2008-0384 & 0385.	
Incremental Cost (Cust. Install)	**$4**
As per utility program costs, bulk purchase of showerheads.	
Free Ridership (UG/EGD)	**1/5 %**
Free Ridership rate recommended by Summit Blue Consulting.[2] As approved in EB 2008-0384 & 0385.	

[1] Draft Report "Measures and Assumptions for Demand Side Management (DSM) Planning", Navigant Consulting Inc., Ontario Energy Board, Appendix C: Substantiation Sheets, pg. B-69-72, Feb. 6, 2009.

[2] "Residential Measure Free Ridership And Inside Spillover Study - Final Report", Summit Blue Consulting, June 2008.

1.25 GAL/MIN LOW-FLOW SHOWERHEAD

Low Income (Installed per Household)

Efficient Technology & Equipment Description
Low-flow showerhead (1.25 gal/min)
Base Technology & Equipment Description
Average existing stock – see below for flow rates.

Resource Savings Assumptions

Natural Gas (Updated)	**See Below m^3**

Gas savings as per results of EGD load research.

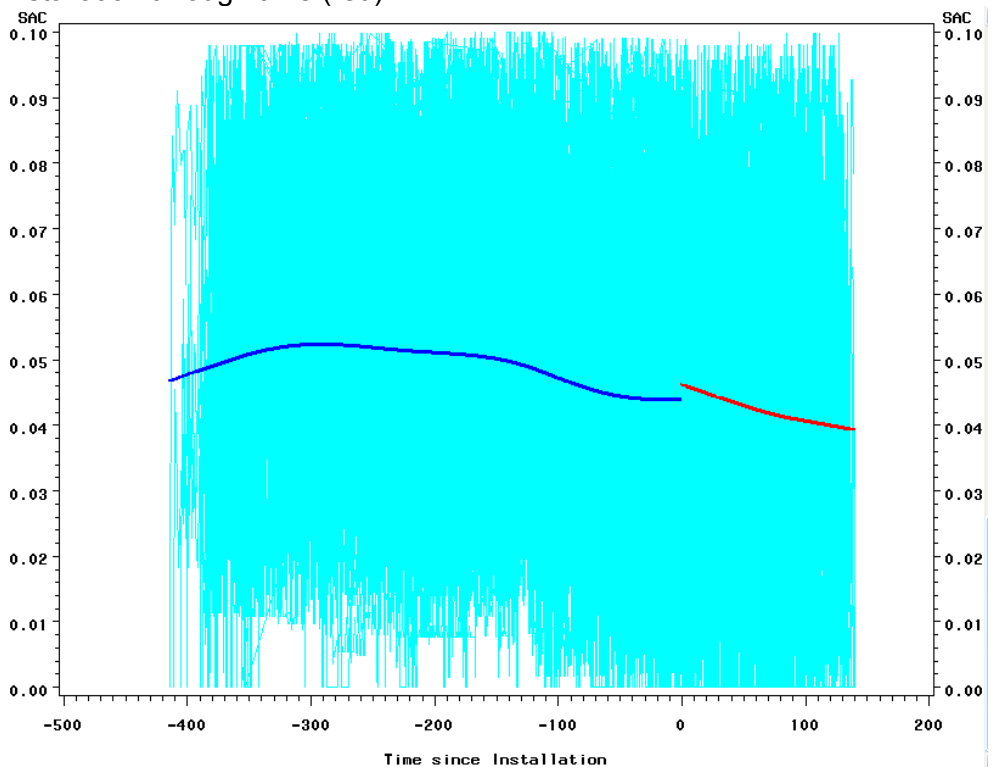
Data was analyzed for 69 households pre and post installation of low-flow shower-heads. Data records began on August 31 2007 until December 31 2008 date. Showerheads were installed between 13 August 2008 and 18 October 2008.
A simple paired t-test (before-after installation) was used to test for the magnitude and statistical significance of installation effect on consumption.

Longitudinal mixed models we used to explored relationships between inputs and low flow showerhead installation on consumption.

RESULTS

Data Exploration

A plot of seasonally adjusted consumption (SAC) by time shows that consumption is generally lower after low-flow showerhead installation (red) than before installation (blue). Surprisingly, immediately after installation (close to time 0) there appears to be an initial increase in consumption. But note the decreasing trend in consumption post-installation through time (red).



Paired T-Tests

Before-After Test on Seasonally Adjusted Data on 68 Households.

ALL DATA

paired t-test

Average hourly difference m^3/hour	Average daily difference m^3/day	Average annual difference m^3/year
0.0102	**0.245**	**89.35**
Lower 95% Confidence Bound		
0.0065	**0.156**	**56.94**
Upper 95% Confidence Bound		
0.0138	**0.331**	**120.89**

Longitudinal Mixed Model

The T-Test results above do not control for household attributes or time since installation. The following shows predictions from two mixed models explained in the Final Report.

Predictions Derived by comparing low-flow to normal shower heads at the mean value of all other attributes, and the mean value of time pre and post installation.

INTERACTION MODEL

MEAN Average	m^3/hour	Average daily m^3/day	Average annual m^3/year	Lower CI m3/hour	Upper CI m3/hour
LOW FLOW - YES	0.0583	1.399	510.5	0.0533	0.0633
LOW FLOW - NO	0.0478	1.147	418.8	0.0428	0.0528
		Daily Savings	0.251		
		Annual Savings	91.7		

Longitudinal Mixed Model: Accounting for Pre-Installation Flow

We added information on pre-existing showerheads (AVGFLOW) to estimate savings due to low-flow installation by previous showerhead flow-rates.

Three buckets were originally proposed. However, the lowest flow bucket (2.0 gpm or less) had too few observations and are rare in the population of households. Further, Enbridge will not be installing low-flow shower heads in homes with existing low flow heads (less than 2.0 gpm). Therefore two buckets

were used instead: 2.0 to 2.5 gpm heads (preflow=1) and greater than 2.5 gpm (preflow=0).

The FREQ Procedure

preflow	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	35	49.30	35	49.30
1	36	50.70	71	100.00

There were statistically significant effects of flow category of pre-existing showerheads on consumption.

The following prediction table shows that savings in consumption is greater for the 2.5 + gpm group of houses (0.316848 per day) than in the 2.0-2.5 gpm group (0.179616 per day).

Predictions Derived by comparing low-flow to normal shower heads at the mean value of all other attributes, **for homes with pre-existing showerheads 2.0-2.5 gpm.**

PREFLOW=LOW (2-2.5 gpm)	**SIMPLE MODEL**				
MEAN Average	m^3/hour	Average daily m^3/day	Average annual m^3/year	Lower CI m3/hour	Upper CI m3/hour
LOW FLOW -NO	0.0517	1.240	452.5	0.0446	0.0587
LOW FLOW -YES	0.0442	1.060	387.0	0.0370	0.0513
		Daily Savings	0.180		
		Annual Savings	65.6		

Homes with pre-existing showerheads 2.0-2.5 gpm.

PREFLOW=HIGH (> 2.5 gpm)	**SIMPLE MODEL**				
MEAN Average	m^3/hour	Average daily m^3/day	Average annual m^3/year	Lower CI m3/hour	Upper CI m3/hour
LOW FLOW -NO	0.0660	1.583	577.8	0.0589	0.0730
LOW FLOW -YES	0.0528	1.266	462.2	0.0456	0.0599
		Daily Savings	0.317		
		Annual Savings	115.6		

Participants to be tracked, and gas savings assigned, as per the following table:

Scenario	Flow Rate of 'OLD' showerhead (GPM)		Flow Rate of 'NEW' showerhead (GPM)	Gas Savings (m3)
1	2.0-2.5		1.25	65.6
2	2.6	+	1.25	115.6

Electricity	**n/a kWh**

Water (Updated)	**See Below L**

Savings recommended by Navigant Consulting
And approved in EB 2008-0384 and 0385.

Participants to be tracked, and water savings assigned, as per the following table:

Scenario	Flow Rate of 'OLD' showerhead (GPM)		Flow Rate of 'NEW' showerhead (GPM)	Water Savings (L)
2	2.0-2.5		1.25	10,886
3	2.6	+	1.25	17,168

Other Input Assumptions

Equipment Life	**10 Years**

As recommended by Navigant and
as approved in EB 2008-0384 & 0385.

Incremental Cost (Contr. Install)	**$19**

As per utility program costs, bulk purchase of showerheads plus cost of installation.

Free Ridership (Union/EGD)	**1/5 %**

As approved in EB 2008-0384 & 0385.

1.25 GAL/MIN LOW-FLOW SHOWERHEAD

Low Income (Distribution)

Efficient Technology & Equipment Description
Low-flow showerhead (1.25 gal/min)
Base Technology & Equipment Description
Average existing stock (2.2 GPM)

Resource Savings Assumptions

Natural Gas	**60 m^3**
Savings recommended by Navigant Consulting.[1]	
Electricity	**n/a kWh**
Water	**10,570 L**
Savings recommended by Navigant Consulting.[1]	

Other Input Assumptions

Equipment Life	**10 Years**
Low flow showerheads have an estimated service life of 10 years.[1] As approved in EB 2008-0384 & 0385.	
Incremental Cost (Cust. Install)	**$4**
As per utility program costs, bulk purchase of showerheads.	
Free Ridership (UG/EGD)	**1/5 %**
Free Ridership rate recommended by Summit Blue Consulting.[2] As approved in EB 2008-0384 & 0385.	

[1] Draft Report "Measures and Assumptions for Demand Side Management (DSM) Planning", Navigant Consulting Inc., Ontario Energy Board, Appendix C: Substantiation Sheets, pg. B-79-82, Feb. 6, 2009.

[2] "Residential Measure Free Ridership And Inside Spillover Study - Final Report", Summit Blue Consulting, June 2008.

PIPE WRAP (R-4)

Low-Income Residential - Existing

Efficient Technology & Equipment Description
Insulated hot water pipe for conventional gas storage tank-type hot water heater (R-4).
Base Technology & Equipment Description
Conventional gas storage tank-type hot water heater without pipe wrap (R-1).

Resource Savings Assumptions

Natural Gas	**25 m^3**

Assumptions and inputs:

- Gas savings calculated using method set out in 2006 Massachusetts study[7] except where noted.
- Average water heater energy factor: 0.57[8]
- Average household size: 3.1 persons[9]
- Assumed diameter of pipe to be wrapped: 0.75 inches
- Length of pipe to be wrapped: 6 feet.
- Surface area of pipe to be wrapped: 1.18 square feet.
- Ambient temperature around pipes: 16 °C (60 °F) [10]
- Average water heater set point temperature: 54 °C (130 °F)[11]
- Hot water temperature in outlet pipe: 52 °C (125 °F)[12]

Annual gas savings calculated as follows:

$$Savings = \left(\frac{1}{R_{base}} - \frac{1}{R_{eff}}\right) * Sa * \left(T_{pipe} - T_{amb}\right) * 24 * 365 * \frac{1}{EF} * 10^{-6} * 27.8$$

Where:

R_{base} = R-value of base equipment
R_{eff} = R-value of efficient equipment
Sa = Surface area of outlet pipe (ft^2)
T_{pipe} = Temperature of water in outlet pipe (°F)
T_{amb} = Ambient temperature around pipe (°F)
24 = Hours per day
365 = Days per year
EF = Water heater energy factor
10^{-6} = Factor to convert Btu to MMBtu
27.8 = Factor to convert MMBtu to m^3

Gas savings were determined to be 75% over base measure

$$Percent\ Savings = \frac{\left(G_{base} - G_{eff}\right)}{G_{base}}$$

Where:

G_{eff} = Annual natural gas use with efficient equipment, 8 m^3
G_{base} = Annual natural gas use with base equipment, 33 m^3

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7 RLW Analytics, *Final Market Potential Report Of Massachusetts Owner Occupied 1-4 Unit Dwellings*, July 2006 http://www.cee1.org/eval/db_pdf/575.pdf

8 Assumption of the Ministry of Energy of Ontario. See Table 4, http://www.energy.gov.on.ca/index.cfm?fuseaction=conservation.guide13

Electricity	n/a kWh
Water	**0 L**
Navigant has assumed that adopting the measure would not affect the quantity of water consumed.	

Other Input Assumptions

Equipment Life	10 years
Based on the estimated measure lifetimes used in four other jurisdictions (Iowa - 15 years, Puget Sound Energy - 10 years, Efficiency Vermont – 10 years, and NYSERDA7 – 10 years). Navigant also recommends using an EUL of 10 years.	
Incremental Cost (Contr. Install)	**$ 4**
Incremental cost as per utility bulk purchase price plus installation	
Free Ridership	**1 %**
Free-ridership rate as per EB-2008-0384 and 0385	

[9] Summit Blue, *Resource Savings Values in Selected Residential DSM Prescriptive Programs*, June 2008.

[10] RLW Analytics (2006). Given geographic proximity, Massachusetts temperatures used unchanged for Ontario.

[11] As suggested by NRCan: http://oee.nrcan.gc.ca/residential/personal/new-homes/water-conservation.cfm?attr=4

[12] From source: "It is common to find a 5 - 10 F temperature drop from the water heater to the furthest fixtures in the house." Chinnery, G. *Policy recommendations for the HERS Community to consider regarding HERS scoring credit due to enhanced effective energy factors of water heaters resulting from volumetric hot water savings due to conservation devices/strategies,* EPA Energy Star for Homes, Sept 2006 http://www.energystar.gov/ia/partners/bldrs_lenders_raters/downloads/Volumetric_Hot_Water_Savings_Guidelines.pdf

HIGH EFFICIENCY COMMERCIAL FRYER

New/Existing Commercial

Efficient Technology & Equipment Description
Energy Star commercial fryer (at least 50% cooking efficiency[13]) or at least 50% efficiency and less than 9,000 BTU/H idle energy rate according to ASTM2144-07[14].
Base Technology & Equipment Description
Standard commercial fryer (35% cooking efficiency)

Resource Savings Assumptions

Natural Gas	**916 m^3**

The natural gas savings is based on the Energy Star calculator, by market research specific to UG Territory. Input parameters for the calculator can be found below, along with their sources.

Category	Value Data		Source
Power			
ENERGY STAR Qualified Unit			
Initial Cost	**$3,740**		**Union Gas Contractors, Consortium for Energy Efficiency (NGTC 130908 report)**
Cooking Energy Efficiency	50%		ENERGY STAR Specification
Cooking Energy Production	114,000	Btu/day	Calculated - Cooking energy is fryer energy input while cooking, not energy absorbed by food
Capacity 6	5	lb/hour	FSTC 2004
Idle Energy Rate	9,000	B tu/hour	ENERGY STAR Specification
Total Idle Time	9.26	hour/day	Calculated
Idle Energy	83,354	Btu/day	Calculated
Energy to Food	570	Btu/lb	FSTC 2004
Heavy Load	3	lb	FSTC 2004
Preheat Energy	15,500	Btu/day	FSTC 2004
Preheat Time	15	minutes	FSTC 2007
Total Energy	212,854	Btu/day	Calculated
Lifetime 7		years	Garland (Frymaster) estimate to Victoria Falvo, Union Gas, October 2008
Conventional Unit			
Initial Cost	**$2,240**		**Union Gas contractors**
Cooking Energy Efficiency 35%			FSTC 2004
Cooking Energy Production	162,857	Btu/day	Calculated - Cooking energy is fryer energy input while cooking, not energy absorbed by food
Capacity	60	lb /hour	FSTC 2007
Idle Energy Rate 14	,000	Btu/hour	FSTC 2004

[13] Cooking energy efficiency is defined as the quantity of energy input to the food products expressed as a percentage of the quantity of energy input to the appliance.

14 NGTC, DEVELOPMENT OF MARKET INFORMATION AND DSM MEASURE FOR HIGH EFFICIENCY GAS FRYERS Final Report ver 1.2, October 30, 2008, Pg 36

Total Idle Time	9.13	hour/day	Calculated
Idle Energy	127,867	Btu/day	Calculated
Energy to Food	570	Btu/lb	FSTC 2004
Heavy Load	3	lb	FSTC 2004
Preheat Energy	16,000	Btu/day	FSTC 2004
Preheat Time	15	minutes	FSTC 2007
Total Energy	306,724	Btu/day	Calculated
Lifetime 7		years	Garland (Frymaster) estimate to Victoria Falvo, Union Gas, October 2008
Maintenance			
Labor cost (per hour) $	20		EPA 2004
Labor time (hours)	0		EPA 2004
Usage			
Average number of operating hours per day	11.05	hours/day	Restaurants on Union Gas' territory
Average number of operating hours per year	3,832	hours/year	Restaurants on Union Gas' territory
Number of Days of operation	346.75	day s/year	Restaurants on Union Gas' territory
Number of Preheats per day	1	preheat/day	FSTC 2004
Pounds of Food Cooked per day	100	lb/day	Restaurants on Union Gas' territory

The duty cycle of fryers was estimated by obtaining the operating hours of twenty restaurants on Union's territory.[15] The figure of 100 lbs/fryer/day correlates very well with FSTC 2007 estimate of 150 lbs/fryer/day used in the Energy Star calculator when one takes into account the reduced operating hours of Union Gas territory restaurants relative to US restaurants:
150 lbs/dryer/day * 11.05 hours / 16 hours = 103.6 lbs/dryer/day.

Electricity	**-546.3 kWh**
The difference in electricity usage, obtained separately from a simple calculation based on the manufacturer-specified power consumption, showed that high efficiency fryers use slightly more electricity than the base case fryer.[14]	
Water	**n/a L**

Other Input Assumptions

Equipment Life	**7 years**

[15] NGTC, DEVELOPMENT OF MARKET INFORMATION AND DSM MEASURE FOR HIGH EFFICIENCY GAS FRYERS Final Report ver 1.2, October 30, 2008, Pg 33

Equipment life (7 yrs) was estimated by local distributor, Garland, October 8, 2008.	
Incremental Cost (Cust. / Contr. Install)	**1500 $**
The incremental installed costs were estimated by surveying five contractors in UG territory.[14] This figure disagrees with the value used in the Energy-Star calculator, $6,206. We do not find it possible to substitute this hard field data by the number, almost three times as high, of the Energy-Star calculator. As noted before, fryer prices are heavily dependent on accessories, and it seems that the Energy-Star calculator chose a much better equipped base model than what is actually sold in the Union Gas market.[15]	
Free Ridership	**%**

CONDENSING BOILERS

Commercial New Building Construction and Building Retrofit

Efficient Technology & Equipment Description
Condensing Boiler (90% estimated seasonal efficiency)
Base Technology & Equipment Description
Non-condensing Boiler (76% estimated seasonal efficiency)

Resource Savings Assumptions

Natural Gas	0.0119 m^3 / Btu/hr
The natural gas savings are based on the reduction in space heating gas consumption from using a condensing boiler relative to a non-condensing boiler. The principle assumption in the calculation of the savings is that the condensing boiler is properly oversized by 20%. The heating load for the entire heating season can be determined from the installed capacity and boiler seasonal efficiency using degree day analysis. A generic rate of savings of 0.0119 m3 / Btu/hr of capacity was determined from this analysis. The single savings number is the weighted average of Union Gas South (70%) and Union Gas North (30%) savings estimates.	
Electricity	**n/a kWh**
Water	**n/a L**

Other Input Assumptions

Equipment Life	25 years
Condensing boilers have an estimated service life of 25 years.[16]	
Incremental Cost	**$12 / 10^3 Btu/hr**
A generic incremental cost of $14,000 per million Btu / hr (adjusted for the US/CDN exchange by a factor of 1.10) was used based on information recently published in the ASHRAE Journal.[17] Local Canadian manufacturers reported $9,800 for 230,000 Btu/hour condensing boilers[18], which is $43 / kBtu/hour. Baseline cost (conventional boilers) is $31/kBtu/hr. Incremental cost is $12 kBtu/hour.	
Free Ridership	**5 %**
Free Ridership as per 2008-0384 and 0385	

[16] ASHRAE Applications Handbook – 2003, Chapter 36 – Owning and Operating Costs, Table 3.
[17] "Boiler System Efficiency", Thomas H. Durkin, ASHRAE Journal - July 2006
[18] Veissmann Group, http://www.viessmann.ca/en

Demand Control Kitchen Ventilation (DCKV)

Building Retrofit

Efficient Technology & Equipment Description
Ventilation with DCKV
Base Technology & Equipment Description
Ventilation without DCKV

Resource Savings Assumptions

Natural Gas	**3,972 m3**	**0 – 4999 CFM**
	10,347 m3	**5000-9999 CFM**
	18,941 m3	**10000-15000 CFM**

The demand control kitchen ventilation savings were determined using the methodology described in the Detailed Energy Savings Report (www.melinkcorp.com). The savings were generated for three ranges of total range hood exhaust: 0 – 4999 CFM; 5000 – 9999 CFM; and 10,000 – 14,999 CFM. The midpoint of each exhaust range was used to generate the savings (both gas and electrical). The inputs for the savings calculations were supplied by MELINK as typical for each application range.

Assuming the DCKV system is operating 16 hours/day, 7 days/week, 52 weeks/year, at 80% heating efficiency, 2.5 hp motor, and 3.0 COP for cooling,

· Using design weather data from the Outdoor Airload Calculator, baseline net heating loads for an exhaust volumes were determined for two locations: London (Union South) and North Bay (Union North)

· Weighted average natural gas savings is calculated by assigning 70% to Union Gas South consumption and 30% to Union Gas North consumption based on the customer population of Union Gas service territories.

			Savings			
CFM	range		London	North Bay	**70/30 blend**	
Existing Building	up to 4999	Natural Gas	3,660	4,699	**3,972**	m3
		Electricity	7,281	7,115	**7,231**	kWh
	5000-9,999	Natural Gas	9,535	12,240	**10,347**	m3
		Electricity	23,180	22,748	**23,051**	kWh
	10,000-15,000	Natural Gas	17,455	22,406	**18,941**	m3
		Electricity	40,929	40,138	**40,692**	kWh

Electricity	**7,231 kWh**	**0 – 4999 CFM**
	23,051 kWh	**5000-9999 CFM**
	40,692 kWh	**10000-15000 CFM**

(see table above)

Water	**n/a L**

Other Input Assumptions

Equipment Life	**15 years**	
Melink web site states "Each Optic Sensor enclosure has a purge fan that keeps the environment inside the enclosure under a positive air pressure. This prevents contaminated air from entering the sensor unit". Melink Canada representative George McGrath estimates their system life at 15 years[19].		
Incremental Cost	**$5,000**	**0 – 4999 CFM**
	$10,000	**5000-9999 CFM**
	$15,000	**10000-15000 CFM**
Typical costing information was provided by MELINK.		
Free Ridership	**5 %**	
FR as per 2008-0384 and 0385		

[19] MELINK Canada, February, 2009

Demand Control Kitchen Ventilation (DCKV)

New Building Construction

Efficient Technology & Equipment Description
Ventilation with DCKV
Base Technology & Equipment Description
Ventilation without DCKV

Resource Savings Assumptions

Natural Gas	**3,972 m3**	**0 – 4999 CFM**
	6,467 m3	**5000-9999 CFM**
	11,838 m3	**10000-15000 CFM**

The demand control kitchen ventilation savings were determined using the methodology described in the Detailed Energy Savings Report (www.melinkcorp.com). The savings were generated for three ranges of total range hood exhaust: 0 – 4999 CFM; 5000 – 9999 CFM; and 10,000 – 14,999 CFM. The midpoint of each exhaust range was used to generate the savings (both gas and electrical). The inputs for the savings calculations were supplied by MELINK as typical for each application range.

Assuming the DCKV system is operating 16 hours/day, 7 days/week, 52 weeks/year, at 80% heating efficiency, 2.5 hp motor, and 3.0 COP for cooling,

• Using design weather data from the Outdoor Airload Calculator, baseline net heating loads for exhaust volumes were determined for two locations: London (Union South) and North Bay (Union North)

• Weighted average natural gas savings is calculated by assigning 70% to Union Gas South consumption and 30% to Union Gas North consumption based on the customer population of Union Gas service territories.

These gas values were modified to take into account OBC-2006:
Modified so t hat 50 % of th e Mak eup Air is cond itioned to (i.e., 50% of the ex haust air is offset with unconditioned makeup air) for 5 000-9999 CFM an d 10000-15000 CFM sav ings assumptions. Th e 0-4999 CFM gas savings was unmodified[20], [21].

			Savings			
CFM	range		London	North Bay	**70/30 blend**	
New Building	up to 4999	Natural Gas	3,660	4,699	**3,972**	m3
		Electricity 7,229		7,098	**7,190**	kWh
	5000-9,999	Natural Gas	5,960	7,650	**6,467**	m3
		Electricity 22,855		22,643	**22,791**	kWh
	10,000-15,000	Natural Gas	10,910	14,004	**11,838**	m3
		Electricity 40,334		39,945	**40,217**	kWh

Electricity	**7,190 kWh**	**0 – 4999 CFM**
	22,791 kWh	**5000-9999 CFM**
	40,217 kWh	**10000-15000 CFM**

(see Natural Gas) All capacity categories were modified to reflect the OBC-2006 increase in minimum efficiency of the air conditioning COP from 3.0 to 3.81 (SEER = 13)[21]

Water	**n/a L**

Other Input Assumptions

Equipment Life	**15 years**

[20] from Ontario Building Code (OBC) 2006 via ASHRAE 90.1-2004 clause 6.5.7.1

[21] Caneta Research Inc, Quasi-Tool Changes and Commentary, August, 2008

Melink web site states "Each Optic Sensor enclosure has a purge fan that keeps the environment inside the enclosure under a positive air pressure. This prevents contaminated air from entering the sensor unit". Melink Canada representative George McGrath estimates their system life at 15 years[22].		
Incremental Cost	**$5,000**	**0 – 4999 CFM**
	$10,000	**5000-9999 CFM**
	$15,000	**10000-15000 CFM**
Typical costing information was provided by MELINK.		
Free Ridership	**5 %**	
FR as per 2008-0384 and 0385		

[22] MELINK Canada, February, 2009

DESTRATIFICATION FAN

Commercial New Buildings

Efficient Technology & Equipment Description
Destratification Fan. (per fan) For fans with minimum diameter of 20' located in warehousing, manufacturing, industrial or retail buildings with forced air space heating, including unit heaters.
Base Technology & Equipment Description
No destratification fan.

Resource Savings Assumptions

Natural Gas	7,020 m^3
Based on Agviro's report "Prescriptive Destratification Fan Program - Prescriptive Savings Analysis", by Agviro Inc., February 2009, which was based largely on an analysis of energy savings due to destratification fans installed at the commercial manufacturing and warehousing facility of Hunter Douglas during the winter of 2008. The results of this evaluation are included in the report "Cold Weather Destratification; Hunter Douglas Monitoring Results, Final Report, May 2008". The analysis showed an area of destratification influence of approximately 100' diameter (7,850 ft2). This would be considered as conservative energy savings versus the average installation since the fans were operated at a maximum 15 Hz instead of the typical 20 Hz. The energy savings is assumed to be an average for destratification fans installed in warehouses that have ceiling heights of 30'. Electrical savings are determined for reduced use of items that includes blower motors on space heating equipment. Savings were determined for a 1.5 hp destratification fan motor and the auxiliary electrical savings due to the heating energy savings.	
Electricity	**(123) kWh**
Based on Agviro's report and the same input parameters as above.	
Water	**n/a L**

Other Input Assumptions

Equipment Life	15 years
The estimated equipment life for destratification fans is 15 years [SEED Program Guidelines. J-20. December. 2004]. This value is also supported by ASHRAE [ASHRAE Handbook, HVAC Applications SI Edition. Chapter 36 -Table 4. Pg. 36.3. 2007], which lists the service life for propeller fans as 15 years. As approved in EB 2008-0384 & 0385.	
Incremental Cost (Cust. / Contr. Install)	**$ 7,021**
Weighted average of 20' and 24' diameter fans based on market data and cost data[23] As approved in EB 2008-0384 & 0385.	
Free Ridership	**10 %**
Based on market & total sales data for Ontario[24] and building type data from UG's Customer database. As per EB 2008-0384 & 0385.	

[23] Targeted Market Study. HVLS fans on Wisconsin Dairy Farms. State of Wisconsin Department of Administration Division of Energy. June 12, 2006., RSMeans. Mechanical Cost Data - 29th Annual Edition. 2006, and communications with Manufacturers.

[24] Email from Joan Wood (EnviraNorth) to Victoria Falvo (UG), May 30, 2008

INFRARED HEATERS

New Building Construction

Efficient Technology & Equipment Description
Infrared Heater, Single Stage or High Intensity
Qualifier/Restriction
OBC 2006 requires infrared heaters for unenclosed spaces excluding loading docks with air curtains. Therefore, infrared heaters are not applicable to these conditions. (Caneta Research, Inc. August, 2008)
Base Technology & Equipment Description
Unit Heater

Resource Savings Assumptions

Natural Gas	0.0102 m^3 / Btu/hr
The infrared heater gas savings were based on the analysis procedures previously created by Agviro Inc. for Union. The analysis was supplemented by adding a 20% over sizing factor on the equipment in the analysis. A generic rate of savings of 0.0102 m3 / Btu/hr of capacity was determined from this analysis. The single savings number is the weighted average of Union Gas South (70%) and Union Gas North (30%) savings estimates.	

Electricity	236 kWh	0-49,999 Btu/hr
	534 kWh	50,000 – 164,999 Btu/hr
	833 kWh	> 165,000 Btu/hr

Electricity savings are determined from the difference in electricity consumption of the infrared heater and a comparable unit heater.

		Blower Motor	Infrared Operating Hours[25]		Blower Motor	Infrared Savings	
Capacity (BTU/H)		kW	kW	Unit Heater (hrs/yr)	Infrared (hrs/yr) k	Wh/yr	kWh/yr	kWh/yr
less than	50,000	0.125	0.031	2405	2044	299	64	236
less than	165,000	0.248	0.031	2405	2044	597	64	534
greater than	165000	0.373	0.031	2405	2044	897	64	833

Electricity based on 1/24 hp Solaronics Radiant Tube heaters.[26]

- Electricity savings = Unit heater capacity x operating hours – Infrared Capacity x operating hours, the savings are summarised above for three ranges of capacities.
- Electricity savings % = Electricity savings (kWh) / Baseline Consumption (kWh)

Water	n/a L

Other Input Assumptions

Equipment Life	20 years
Infrared Heaters have an estimated service life of 20 years.[27]	
Incremental Cost	**$0.009 / 10^3 Btu/hr**
Local retailers reported an average of $0.009 / Btu/hr incremental cost as per Navigant's survey of local retailers.[28]	
Free Ridership	**33 %**
Free Ridership based on EB-2008-0384 and 0385	

[25] from "Infrared Analysis (Agviro Replicated).xls", which included UG North & South climates as well as a 20% oversizing factor.
[26] http://solaronics.thomasnet.com/Asset/SSTG-SSTU-GB_200010_Spec_Sheet.pdf
[27] "Prescriptive Incentives for Select Natural Gas Technologies", Prepared for Enbridge Consumers Gas and Union Gas Ltd., Prepared by: Jacques Whitford Environment Limited, Agviro Inc., and Engineering Interface Ltd., September 27, 2000.
[28] Navigant Consulting, MEASURES AND ASSUMPTIONS FOR DEMAND SIDE MANAGEMENT (DSM) PLANNING APPENDIX C: SUBSTANTIATION SHEETS - Draft Report, Pg 207

INFRARED HEATERS

Existing Building Construction

Efficient Technology & Equipment Description
Infrared Heater, Single Stage or High Intensity

Base Technology & Equipment Description
Unit Heater

Resource Savings Assumptions

Natural Gas	0.0102 m^3 / Btu/hr
The infrared heater gas savings were based on the analysis procedures previously created by Agviro Inc. for Union. The analysis was supplemented by adding a 20% over sizing factor on the equipment in the analysis. A generic rate of savings of 0.0102 m3 / Btu/hr of capacity was determined from this analysis. The single savings number is the weighted average of Union Gas South (70%) and Union Gas North (30%) savings estimates.	

Electricity	236 kWh	0-49,999 Btu/hr
	534 kWh	50,000 – 164,999 Btu/hr
	833 kWh	> 165,000 Btu/hr

Electricity savings are determined from the difference in electricity consumption of the infrared heater and a comparable unit heater.

		Blower Motor	Infrared Operating Hours[29]			Blower Motor	Infrared Savings	
Capacity (BTU/H)		kW	kW	Unit Heater (hrs/yr)	Infrared (hrs/yr) k	Wh/yr	kWh/yr	kWh/yr
less than	50,000	0.125	0.031	2405	2044	299	64	236
less than	165,000	0.248	0.031	2405	2044	597	64	534
greater than	165000	0.373	0.031	2405	2044	897	64	833

Electricity based on 1/24 hp Solaronics Radiant Tube heaters.[30]

- Electricity savings = Unit heater capacity x operating hours – Infrared Capacity x operating hours, the savings are summarised above for three ranges of capacities.
- Electricity savings % = Electricity savings (kWh) / Baseline Consumption (kWh)

Water	n/a L

Other Input Assumptions

Equipment Life	20 years
Infrared Heaters have an estimated service life of 20 years.[31]	

Incremental Cost	\$0.009 / 10^3 Btu/hr
Local retailers reported an average of \$0.009 / Btu/hr incremental cost as per Navigant's survey of local retailers.[32]	

Free Ridership	33 %
Free Ridership based on EB-2008-0384 and 0385	

[29] from "Infrared Analysis (Agviro Replicated).xls", which included UG North & South climates as well as a 20% oversizing factor.
[30] http://solaronics.thomasnet.com/Asset/SSTG-SSTU-GB_200010_Spec_Sheet.pdf
[31] "Prescriptive Incentives for Select Natural Gas Technologies", Prepared for Enbridge Consumers Gas and Union Gas Ltd., Prepared by: Jacques Whitford Environment Limited, Agviro Inc., and Engineering Interface Ltd., September 27, 2000.
[32] Navigant Consulting, MEASURES AND ASSUMPTIONS FOR DEMAND SIDE MANAGEMENT (DSM) PLANNING APPENDIX C: SUBSTANTIATION SHEETS - Draft Report, Pg 207

ROOFTOP UNIT

Commercial New/Existing

Efficient Technology & Equipment Description
Two-stage rooftop unit, up to and including 5 tons of cooling (85% efficient)
Base Technology & Equipment Description
Single-stage rooftop unit (80% efficient)

Resource Savings Assumptions

Natural Gas	300	m^3
The natural gas savings are estimated from the difference in annual gas consumption from single-stage to two-stage operation. Assuming the base case efficiency of 80% and the gas use for 5 rooftop units is 25,500 M3[33], the actual space heating load is 25,500*0.8 = 20,400 M3/y. A system of 85% efficiency would then use 20,400/0.85 = 24,000 for a savings of 1,500 M3 for 5 – 5 ton units or 300 M3 per unit.		
Electricity	**n/a**	**kWh**
Water	**n/a**	**L**

Other Input Assumptions

Equipment Life	15	years
As per Navigant Consulting[34] and ASHRAE Handbook, 2008		
Incremental Cost (Cust. / Contr. Install)	**-**	**$375**
The incremental cost of two-stage rooftop units compared with single-stage units is $250 per unit.[33] Local Canadian manufacturer disclosed an incremental cost of $500 for 2-stage rooftop units compared to single stage rooftop units. Therefore, an average cost of $375 is assumed (($250 + $500) / 2 = $375).[34]		
Free Ridership	**5**	**%**
Free-ridership rate as per EB-2008-0384 and 0385		

[33] "Prescriptive Incentives for Select Natural Gas Technologies", Prepared for Enbridge Consumers Gas and Union Gas Ltd., Prepared by: Jacques Whitford Environment Limited, Agviro Inc., and Engineering Interface Ltd., September 27, 2000.

[34] Navigant rooftop substantiation document, pg B-209 - EB-2008-0346 Ontario Energy Board DSM Assumptions, February 6, 2009

PROGRAMMABLE THERMOSTAT

New/Existing - Commercial (per thermostat)

Efficient Technology & Equipment Description

Programmable thermostat

Base Technology & Equipment Description

Standard manual thermostat

Resource Savings Assumptions

Natural Gas	varies	m^3

Energy use by market segment from space heating and cooling were based on NRCAN Energy intensity data[35],[36]. The percentage of gas savings are based on the assumption of 3% savings per degree F setback as applied in the Energy Star setback calculator and Honeywell commercial calculator, corrected for average outdoor heating season temperature to give a percentage savings of 2.4% per degree F for London, and 2.05% per degree F for North Bay[37],[38]. Setback duration was estimated for each market[39]. The actual setback temperatures used in each market were estimated based on best available information (72 degrees F to 64 degrees F for heating and 74 degrees F to 78 degrees F for cooling).

NRCAN Market Segment	Space Heating Energy Intensity (m3/ft2/yr)	Gas Savings %	Space Cooling Energy Intensity (kWh/ft2/yr)	Electrical Savings %	Space Cooling Market Saturation	Setback/ Forward Duration
1. Wholesale Trade	2.6	6.5%	5.1	6%	85%	7hrs/night
2. Retail Trade	2.2	6.5%	4.4	6%	85%	7hrs/night
3. Transportation and Warehousing 2.5		10.4%	3.2	11%	10%	12hrs/M-Sat night + 24hrs Sunday
4. Information and Cultural Industries	2.4 12.1%		4.8	12%	75%	12hrs/weekday night + 24hrs Sat & Sun
5. Offices	1.8	12.1%	3.6	12%	86%	12hrs/weekday night + 24hrs Sat & Sun
6. Educational Services	2.4 12.1%		4.9	12%	45%	12hrs/weekday night + 24hrs Sat & Sun
7. Health Care and Social Assistance	2.7	0.0%	5.4	0%	75%	0
8. Arts, Entertainment and Recreation	3.7	6.5%	7.5	6%	87%	7hrs/night
9. Accommodation and Food Services	3.5	6.5%	7.0	6%	70%	7hrs/night
10. Other Services	2.2	10.4%	4.3	6%	69%	7hrs/night

The market segments were converted from NRCAN to the UG market segments. In some cases a blend of up to 3 NRCAN market segments were used to describe the UG markets. The savings took into account typical heating/cooling zone areas covered by a thermostat for different market segments[40],[41],[42]. The institutional market varied so much that the floor areas were determined separately by its components[43]. Hospitals were not included, nor were Long Term Health Care Facilities, since many of the rooms are occupied 24/7 and would not benefit from temperature setback.

UG Market Segments	NRCAN Market Segment ID[44]	NRCAN Market Segment ID	NRCAN Market Segment ID	Thermostat Zone Area (SqFt)
1. Industrial	3 1		10	3,000
2. Warehouse	3			3,000
3. Multifamily	9			1,200
4. Office	4 5		6	650
5. Retail	1 2			600
6. Foodservice	9			1,175
7. Hotels/Motels	9			461
8. Institutional – (No Long Term Care), Schools, Universities, Colleges				
Information and Cultural Industries	4			650
Educational Services	6			986
9. Hospitals	7			NA
10. Recreation	8			2,500
11. Agriculture	10			3,000

The market segments were consolidated into segments below.

UG Market Segments	Gas Savings per Tstat (m3/yr/Tstat)
Warehouse, Recreation, Agriculture, Industrial	674
Office, Institutional (No Long Term Care), Multifamily, Foodservice, Hotels/Motels, Retail	191

Electricity	**varies**	**kWh**

The electricity savings is based on energy intensity from space cooling for different market segments[45] and the Energy Star/Honeywell Commercial calculator. Not all buildings have cooling, therefore the percentage of each segment that has cooling was included[46]. Otherwise, the electricity savings below were calculated in much the same way as the gas savings above.

UG Market Segments	Electrical Savings per Tstat (kWh/yr/Tstat)
Warehouse, Recreation, Agriculture, Industrial	524
Office, Institutional (No Long Term Care), Multifamily, Foodservice, Hotels/Motels, Retail	246

Water	**n/a**	**L**

Other Input Assumptions

Equipment Life	**15**	**years**

Sanchez, M., Webber, C., Brown, R. and Homan, G. *2007 Status Report: Savings Estimates for the ENERGY STAR® Voluntary Labelling Program,* LBNL-56380, Lawrence Berkeley Lab., March 2007.

Incremental Cost	**$40**

Incremental cost as per 2009 bulk purchase price.

Free Ridership	**20**	**%**

Free Ridership as per EB-2008-0384 and 0385

PRESCRIPTIVE SCHOOL BOILERS - ELEMENTARY

Commercial Existing Buildings

Efficient Technology & Equipment Description
Space Heating, Hydronic Boiler with Combustion Efficiency of 83% or higher
Base Technology & Equipment Description
Space Heating, Hydronic Boiler with Combustion Efficiency of 80% to 82%.

Resource Savings Assumptions

Natural Gas	**10,830 m^3**
As recommended by Navigant and approved in EB-2008-0384 / 0385.	
Electricity	**N/A kWh**
Water	**N/A L**

Other Input Assumptions

Equipment Life	**25 years**
As recommended by Navigant and approved in EB-2008-0384 / 0385.	
Incremental Cost (Contractor Install)	**$8,646**
Source: Elem entary Sc hools Prescriptive Savings Analysis Report, Agviro Inc., November 23, 2007. Increm ental costs are ba sed on the weighted average of boiler types as noted above.	
Free Ridership (EGD/Union)	**12/27 %**
As recommended by Summit Blue and approved in EB 2008-0384 & 0385.	
Spillover (UG and EGD)	**10 %**
As recommended by Summit Blue's Custom Projects Attribution Study, 2008.	

PRESCRIPTIVE SCHOOL BOILERS - SECONDARY

Commercial Existing Buildings

Efficient Technology & Equipment Description -
Space Heating, Hydronic Boiler with Combustion Efficiency of 83% or higher
Base Technology & Equipment Description
Space Heating, Hydronic Boiler with Combustion Efficiency of 80% to 82%.

Resource Savings Assumptions

Natural Gas	**43,859 m^3**
As recommended by Navigant and approved in EB 2008-0384 / 0385.	
Electricity	**N/A kWh**
Water	**N/A L**

Other Input Assumptions

Equipment Life	**25 years**
As recommended by Navigant and approved in EB-2008-0384 / 0385.	
Incremental Cost (Contractor Install)	**$14,470**
Source: Secondary Schools Prescriptive Sa vings Analysis Report, Agviro Inc., November 23, 2007. Increm ental costs are ba sed on the weighted average of boiler types as noted above.	
Free Ridership (EGD/Union)	**12/27 %**
As recommended in Summit Blue and approved in EB 2008-0384 & 0385.	
Spillover (UG and EGD)	**10 %**
As recommended by Summit Blue's Custom Projects Attribution Study, 2008.	

CONDENSING GAS WATER HEATER

New/Existing Commercial

Efficient Technology & Equipment Description
Condensing Gas Water Heater[47] (95% thermal efficiency), 50 gallons. Resource savings were calculated for 950[48] USG/day hot water use[49]:
Base Technology & Equipment Description
Conventional storage tank gas water heater[50] (thermal efficiency[51]=80%), 91 gallons.

Resource Savings Assumptions

Natural Gas	**1543 m^3/Btu/hr**

Assumptions and inputs:

- Daily hot water draw – 950 USG/day[48]
- Input rating for efficient and base equipment: 199,000 Btu.
- Average water inlet temperature: 7.22 DegC (45 degF)[52],[53]
- Average water heater set point temperature: 54 degC (130 degF)[54]
- Stand-by loss of (condensing) Polaris PC 199-50 3NV: 244 Btu/hr.[55]
- Stand-by loss of (non-condensing) Rheem G91-200: 1,050 Btu/hr.[56]

Annual gas savings calculated as follows:

$$Savings = \left[W * 8.33 * (T_{out} - T_{in}) * \left(\frac{1}{Eff_{base}} - \frac{1}{Eff_{eff}} \right) + \left(Stby_{base} - Stby_{eff} \right) * 24 * 365 \right] * 10^{-6} * 27.8$$

Where:

W = Annual hot water use (gallons)
8.33 = Energy content of water (Btu/gallon/°F)
T_{out} = Water heater set point temperature (°F)
T_{in} = Water inlet temperature (°F)
Eff_{base} = Thermal efficiency of base equipment
Eff_{eff} = Thermal efficiency of efficient equipment
10^{-6} = Factor to convert Btu to MMBtu
$Stby_{base}$ = Stand-by loss per hour for base equipment (Btu)
$Stby_{eff}$ = Stand-by loss per hour for efficient equipment (Btu)
24 = Hours per day
365 = Days per year
27.8 = Factor to convert MMBtu to m^3

Electricity	**n/a kWh**

Water	**n/a L**

Other Input Assumptions

Equipment Life	**13 years**
Studies conducted in two different jurisdictions (Iowa[57] and Washington State[58]) use an EUL of 13 years, whereas one conducted for Enbridge and Union in 2000[59] uses an EUL of 15 years. Given that the two most recent studies both use 13 years, 13 years is deemed appropriate.	
Incremental Cost (Cust. / Contr. Install)	**$ 2230**
Incremental cost determined from communication with local distributor[60,61]	
Free Ridership	**5 %**
Free-ridership rate as per EB-2008-0384 and 0385	

Pre-Rinse Spray Nozzle (1.24 GPM)

Commercial, Existing/New Market

Efficient Technology & Equipment Description
Low-flow pre-rinse spray nozzle/valve (1.24 GPM)
Base Technology & Equipment Description
Standard pre-rinse spray nozzle/valve (3.0 GPM)

Resource Savings Assumptions

Natural Gas	See below m^3

Market Segment	Natural Gas (m^3/yr
Full Dining Establishments	931
Limited Service Establishments	278
Other Establishments	272

A field study was undertaken at 37 sites across 4 regions in Union Gas territory. Measurements of water pressure, incoming and leaving (at both burner On and Off setpoints) water temperature at the water heater and supplied to the pre-rinse spray valve, details of the make, model and type of water heater, and type of food service establishment, were collected at each site.

Flow rate vs. pressure curves for high-flow and nominal 1.6 USgpm (1.24 USgpm @ 60 psig) pre-rinse spray valves (PRSV) were developed from the Veritec studies in Waterloo[62] and Calgary[63]. An average flow rate vs pressure curve for high-flow PRSVs was developed from the Veritec Waterloo study.

Water savings were evaluated for each region based on the difference between the flow rates of the high-flow and low-flow PRSV at the average measured water pressure, and the average usage of the PRSV for each of 3 food service establishmentc types from the Veritec studies in Waterloo and Calgary.

Natural gas savings were determined using the US-DOE WHAM[64] model to establish water heater efficiency. Inputs to the model from site measurements included the average cold water and hot water setpoint temperatures for each region. Additional inputs to the model included water heater energy factor and rated water heater input (both average for the region), ambient air temperature (assumed at 70°F), and average daily volume of hot water. This last item was determined from a combination of research undertaken by FSTC[65], and ASHRAE[66] recommendations, for each food service establishment type. The proportion of hot water delivered to the PRSV was determined from the average measured mixed water temperature for each region.

Electricity	0 kWh

Water	See below L

Market Segment	Water (L)
Full Dining Establishments	182,000
Limited Service Establishments	55,000
Other Establishments	53,000

Assumptions and inputs:

- Water savings were evaluated for 3 food service establishment types: Full Service Restaurants, Limited Service Restaurants, and Other
- The PRSV water usage was based on the 2 Veritec studies, and incorporated the measured differences in usage time for the high-flow and low-flow PRSVs.

Other Input Assumptions

Equipment Life	5 years
This is consistent with other studies[67,68]	

Incremental Cost (Cust. / Contr. Install)	100 $
The incremental cost is assumed to be $100 – the cost of the spray nozzle and installation. This is comparable to the incremental cost of $60 reported by the Region of Waterloo[69]	

Free Ridership	12.4 %
New information based on Free Ridership and Spillover for Low Flow Pre Rinse Spray Nozzles (Nov. 26, 2008, PA Consulting Group)	

Spillover	3 %
New information based on Free Ridership and Spillover for Low Flow Pre Rinse Spray Nozzles (Nov. 26, 2008, PA Consulting Group)	

Pre-Rinse Spray Nozzle (0.64 GPM)

Commercial, Existing/New Market

Efficient Technology & Equipment Description
Low-flow pre-rinse spray nozzle/valve (0.64 GPM)
Base Technology & Equipment Description
Standard pre-rinse spray nozzle/valve (3.0 GPM)

Resource Savings Assumptions

Natural Gas	See below m^3

Market Segment	Natural Gas (m^3/yr
Full Dining Establishments	1,286
Limited Service Establishments	339
Other Establishments	318

A field study was undertaken at 37 sites across 4 regions in Union Gas territory. Measurements of water pressure, incoming and leaving (at both burner On and Off setpoints) water temperature at the water heater and supplied to the pre-rinse spray valve, details of the make, model and type of water heater, and type of food service establishment, were collected at each site.

Flow rate vs. pressure curves for high-flow and nominal 0.64 USgpm pre-rinse spray valves (PRSV) were developed from the Veritec studies in Waterloo[70] and Calgary[71]. An average flow rate vs pressure curve for high-flow PRSVs was developed from the Veritec Waterloo study.

Water savings were evaluated for each region based on the difference between the flow rates of the high-flow and low-flow PRSV at the average measured water pressure, and the average usage of the PRSV for each of 3 food service establishment types from the Veritec studies in Waterloo and Calgary.

Natural gas savings were determined using the US-DOE WHAM[72] model to establish water heater efficiency. Inputs to the model from site measurements included the average cold water and hot water setpoint temperatures for each region. Additional inputs to the model included water heater energy factor and rated water heater input (both average for the region), ambient air temperature (assumed at 70°F), and average daily volume of hot water. This last item was determined from a combination of research undertaken by FSTC[73], and ASHRAE[74] recommendations, for each food service establishment type. The proportion of hot water delivered to the PRSV was determined from the average measured mixed water temperature for each region. Operating times are not
expected to be different between 1.24 & 0.64 (Bricor model B064) USgpm models based on cleanability times of 20-21 seconds according to the FTSC[75].

Electricity	0 kWh

Water	See below L

Market Segment	Water (L)[75]
Full Dining Establishments	252,000
Limited Service Establishments	66,400
Other Establishments	62,200

Assumptions and inputs:

- Water savings were evaluated for 3 food service establishment types: Full Service Restaurants, Limited Service Restaurants, and Other
- The PRSV water usage was based on the 2 Veritec studies, and incorporated the measured differences in usage time for the high-flow and low-flow PRSVs.

Other Input Assumptions

Equipment Life	**5 years**
This is consistent with other studies[76,77]	
Incremental Cost (Cust. / Contr. Install)	**$88**
$88 = ($50/pc* + $1/pc* shipping USD) x 1.28901** exchange rate + $22 installation*** *estimated by Bricor, March 2, 2009 **Exchange rate from March 2, 2009 - http://www.xe.com/ucc/convert.cgi ***estimated installation from Seattle Utilities ($21-23/pc), based on conversation with Bricor, March 2, 2009	
Free Ridership	**0 %**
Relatively new product; currently only aware one manufacturer. Propose 0% free ridership.	

TANKLESS WATER HEATER

Commercial – New Build

Efficient Technology & Equipment Description
Tankless Water Heater (84% thermal efficiency (77% adjusted thermal efficiency[80]), where approximately 50-150 USG/day will be used.
Base Technology & Equipment Description
Conventional storage tank gas water heater (thermal efficiency[78]=80%), 91 gallons.

Resource Savings Assumptions

Natural Gas	**221 m^3/Btu/hr**

Resource savings were calculated for 100 USG/day hot water use[79]:
Assumptions and inputs:
- Daily hot water draw – 100 USG/day
- Input rating for efficient and base equipment: 199,000 Btu.
- Average water inlet temperature: 7.22 DegC (45 degF)[80, 81]
- Average water heater set point temperature: 54 degC (130 degF)[82]
- Stand-by loss of (non-condensing) Rheem G91-200: 1,050 Btu/hr.[83]

Annual gas savings calculated as follows[80, 84]:

$$Savings = \left[W * 8.33 * (T_{out} - T_{in}) * \left(\frac{1}{Eff_{base}} - \frac{1}{Eff_{eff}} \right) + \left(Stby_{base} - Stby_{eff} \right) * 24 * 365 \right] * 10^{-6} * 27.8$$

Where:

W = Annual hot water use (gallons)
8.33 = Energy content of water (Btu/gallon/°F)
T_{out} = Water heater set point temperature (°F)
T_{in} = Water inlet temperature (°F)
Eff_{base} = Thermal efficiency of base equipment
Eff_{eff} = Thermal efficiency of efficient equipment
10^{-6} = Factor to convert Btu to MMBtu
$Stby_{base}$ = Stand-by loss per hour for base equipment (Btu)
$Stby_{eff}$ = Stand-by loss per hour for efficient equipment (Btu)
24 = Hours per day
365 = Days per year
27.8 = Factor to convert MMBtu to m^3

Electricity	**n/a kWh**

Water	**n/a L**

Other Input Assumptions

Equipment Life	**20 years**
Equipment life is assumed to be 20 years based on manufacturer literature estimates of over 20 years[85], Canadian Building Energy End-Use Data and Analysis Centre[86], Energy Star's High Efficiency Water Heaters brochure[87], and Energy Star's website[88].	

Incremental Cost (Cust. / Contr. Install)	**-$1,570**
Commercial tankless water heaters are typically scaled up by unit - a commercial user would likely need several tankless water heaters to replace a single storage tank. The tankless model cited has a maximum flow rate of 4.7 – 7.4 GPM depending on temperature rise required. Any large commercial enterprise would likely require 2 – 3 tankless units to accommodate peak demand.[89] Costs for the two systems were determined to be: · WaiWela PH28CIFS tankless water heater and installation kit = $2,080[90] · Rheem G91-200 storage tank water heater = $3,650.[91],[92]	
Free Ridership	**2 %**
Free-ridership rate as per EB-2008-0384 and 0385	

TANKLESS WATER HEATER

Commercial - Existing

Efficient Technology & Equipment Description
Tankless Water Heater (84% thermal efficiency (77% adjusted thermal efficiency[80]), where approximately 50-150 USG/day will be used.
Base Technology & Equipment Description
Conventional storage tank gas water heater (thermal efficiency[93]=80%), 91 gallons.

Resource Savings Assumptions

Natural Gas	**221 m^3/Btu/hr**

Resource savings were calculated for 100 USG/day hot water use[94]:
Assumptions and inputs:

- Daily hot water draw – 100 USG/day
- Input rating for efficient and base equipment: 199,000 Btu.
- Average water inlet temperature: 7.22 DegC (45 degF)[95],[96]
- Average water heater set point temperature: 54 degC (130 degF)[97]
- Stand-by loss of (non-condensing) Rheem G91-200: 1,050 Btu/hr.[98]

Annual gas savings calculated as follows[80],[99]:

$$Savings = \left[W * 8.33 * (T_{out} - T_{in}) * \left(\frac{1}{Eff_{base}} - \frac{1}{Eff_{eff}} \right) + \left(Stby_{base} - Stby_{eff} \right) * 24 * 365 \right] * 10^{-6} * 27.8$$

Where:

W = Annual hot water use (gallons)
8.33 = Energy content of water (Btu/gallon/°F)
T_{out} = Water heater set point temperature (°F)
T_{in} = Water inlet temperature (°F)
Eff_{base} = Thermal efficiency of base equipment
Eff_{eff} = Thermal efficiency of efficient equipment
10^{-6} = Factor to convert Btu to MMBtu
$Stby_{base}$ = Stand-by loss per hour for base equipment (Btu)
$Stby_{eff}$ = Stand-by loss per hour for efficient equipment (Btu)
24 = Hours per day
365 = Days per year
27.8 = Factor to convert MMBtu to m^3

Electricity	**n/a kWh**

Water	**n/a L**

Other Input Assumptions

Equipment Life	**20 years**
Equipment life is assumed to be 20 years based on manufacturer literature estimates of over 20 years[100], Canadian Building Energy End-Use Data and Analysis Centre[101], Energy Star's High Efficiency Water Heaters brochure[102], and Energy Star's website[103].	
Incremental Cost (Cust. / Contr. Install)	**-$1,570**
Commercial tankless water heaters are typically scaled up by unit - a commercial user would likely need several tankless water heaters to replace a single storage tank. The tankless model cited has a maximum flow rate of 4.7 – 7.4 GPM depending on temperature rise required. Any large commercial enterprise would likely require 2 – 3 tankless units to accommodate peak demand.[104] Costs for the two systems were determined to be: · WaiWela PH28CIFS tankless water heater and installation kit = $2,080[105] · Rheem G91-200 storage tank water heater = $3,650[106],[107]	
Free Ridership	**2 %**
Free-ridership rate as per EB-2008-0384 and 0385	

CEE QUALIFIED CLOTHES WASHER

Commercial Existing Buildings – Multi-Residential

Efficient Technology & Equipment Description
High Efficiency Front Load Washers for application in the Multi-residential sector. CEE qualified MEF = 2.20, WF = 5.33
Base Technology & Equipment Description
Conventional top loading vertical axis washers. MEF = 1.26, WF = 9..5

Resource Savings Assumptions

Natural Gas	**222 m ^{3}**
To utilize the Navigant annual gas savings calculation to reflect the conditions of the Enbridge Gas Distribution Front Load Washer Program the following are the suggested Inputs: • Average number of cycles (turns) per year 1,642 (4.5[108] cycles per day x 365) • Water use per cycle, base equipment: 29.26[109] US Gallons • Water use per cycle, CEE energy efficient washer : 16.39[4] US gallons • Percentage of water used by base equipment which is hot water:18%[110] • Percentage of water used by efficient equipment which is hot water: 10%[111] • Average water inlet temperature:7.22°C (45oF) • Average water heater set point temperature: 54°C (130°F) • Water heater thermal efficiency: 65%[112] • Gas use per cycle for commercial gas dryer with base equipment:0.138 m3 • Gas use per cycle for commercial gas dryer with CCE listed clothes washer:0.096m3[113] • Gas dryer penetration in Ontario Multi-family and Laundromat market:60%[114] $Savings = \left[\left(W_{base} * Hot_{base} - W_{eff} * Hot_{eff} \right) * 8.33 * \frac{1}{Eff} * \left(T_{out} - T_{in} \right) + \left(Dr_{base} - Dr_{eff} \right) * Pene \right] * 10^{-6} * 27.8$	
Electricity	**296 k Wh**
$Savings = \left[\left(Wa_{base} - Wa_{eff} \right) + \left(Dr_{base} - Dr_{eff} \right) * \left(1 - Pene \right) \right] * Cyc$	
Water	**80,000 L**
$Savings = \left(W_{base} - W_{eff} \right) * Cyc$	

Other Input Assumptions

Equipment Life	**11 years**
As recommended by Navigant.	
Incremental Cost (Cust. / Contr. Install)	**$600**
Enbridge route operator data.	
Free Ridership	**10 %**
EB 2008-0384 & 0385	

1.0 GAL/MIN FAUCET AERATOR (Kitchen)

Commercial Building Retrofit (Installed) – Multi-Residential

Efficient Technology & Equipment Description
1.0 GPM Faucet Aerator
Base Technology & Equipment Description
2.5 GPM Faucet Aerator

Resource Savings Assumptions

Natural Gas (Updated)	**39 m^3**
Based on Navigant savings calculation adjusted for a 1.0 GPM unit.	
Electricity	**n/a kWh**
Water (Updated)	**8,072 L**
Based on Navigant savings calculation adjusted for a 1.0 GPM unit.	

Other Input Assumptions

Equipment Life	**10 years**
As recommended by Navigant.	
Incremental Cost (Contractor Install)	**$2**
As per utility program costs.	
Free Ridership (Updated)	**10 %**
Free ridership – EB 2008-0384 & 0385	

1.0 GAL/MIN FAUCET AERATOR (Bathroom)

Commercial Building Retrofit (Installed) - Multi-Residential

Efficient Technology & Equipment Description
1.0 GPM Faucet Aerator
Base Technology & Equipment Description
2.2 GPM Faucet Aerator

Resource Savings Assumptions

Natural Gas (Updated)	**11 m^3**
Based on Navigant savings calculation adjusted for a 1.0 GPM unit.	
Electricity	**n/a kWh**
Water (Updated)	**2,371 L**
Based on Navigant savings calculation adjusted for a 1.0 GPM unit.	

Other Input Assumptions

Equipment Life	**10 years**
As recommended by Navigant.	
Incremental Cost (Contractor Install)	**$1.50**
As per utility program costs.	
Free Ridership (Updated)	**10 %**
Free ridership – EB 2008-0384 & 0385	

1.5 GAL/MIN LOW-FLOW SHOWERHEAD

Commercial Building Retrofit (Distributed) – Multi-Residential

Efficient Technology & Equipment Description
Low-flow showerhead 1.5 gal/min.
Base Technology & Equipment Description
Average existing stock. (2.2 gpm)

Resource Savings Assumptions

Natural Gas	**30 m3**	**2.2 GPM**
Based on Navigant savings calculation adjusted to account for percentage of showers taken with efficient unit in Multi-Residential setting (92 %) compared to 76 % in Low Rise residential as per Summit Blue, Resource Savings in selected Residential DSM Programs, June 2008.		
Water	**5345 L**	**2.2 GPM**
Based on Navigant savings calculation adjusted to account for percentage of showers taken with efficient unit in Multi-Residential setting (92 %) compared to 76 % in Low Rise residential as per Summit Blue, Resource Savings in selected Residential DSM Programs, June 2008.		
Electricity	**n/a kWh**	

Other Input Assumptions

Equipment Life	**10 years**
Low flow showerheads have an estimated service life of 10 years as recommended by Navigant and approved in EB 2008-0384 & 0385.	
Incremental Cost (Cust Install)	**$4**
As per utility program costs.	
Free Ridership	**10 %**
As per EB 2008-00384 & 0385	

1.25 GAL/MIN LOW-FLOW SHOWERHEAD

Commercial Building Retrofit (Installed) – Multi-Residential

Efficient Technology & Equipment Description
Low-flow showerhead 1.25 gal/min.
Base Technology & Equipment Description
Average existing stock.

Resource Savings Assumptions

Natural Gas		
	53 m3	**2.0 - 2.5 GPM**
	87 m3	**2.6 +**
Based on Navigant savings calculation adjusted to account for percentage of showers taken with efficient unit in Multi-Residential setting (92 %) compared to 76 % in Low Rise residential as per Summit Blue, Resource Savings in selected Residential DSM Programs, June 2008.		
Water	**9078**	**2.0 - 2.5 GPM**
	14341	**2.6 +**
Based on Navigant savings calculation adjusted to account for percentage of showers taken with efficient unit in Multi-Residential setting (92 %) compared to 76 % in Low Rise residential as per Summit Blue, Resource Savings in selected Residential DSM Programs, June 2008.		
Electricity	**n/a kWh**	

Other Input Assumptions

Equipment Life	**10 years**
Low flow showerheads have an estimated service life of 10 years as recommended by Navigant and approved in EB 2008-0384 & 0385.	
Incremental Cost (Contractor Install)	**$17**
As per utility program costs.	
Free Ridership	**10 %**
As per EB 2008-0384 & 0385	

1.5 GAL/MIN LOW-FLOW SHOWERHEAD

Commercial Building Retrofit (Installed) – Multi-Residential

Efficient Technology & Equipment Description
Low-flow showerhead 1.5 gal/min.
Base Technology & Equipment Description
Average existing stock. (See below)

Resource Savings Assumptions

Natural Gas		
	28 m3	**2.0 - 2.5 GPM**
	55 m3	**2.6 - 3.0 GPM**
	79 m3	**3.1 – 3.5 GPM**
	91 m3	**3.6 + GPM**
Based on Navigant savings calculation adjusted to account for 1.5 gpm replacement unit and percentage of showers taken with efficient unit in Multi-Residential setting (92%) compared to 76% in Low Rise residential as per Summit Blue, Resource Savings in selected Residential DSM Programs, June 2008		
Water		
	5197 L	**2.0 - 2.5 GPM**
	9490 L	**2.6 - 3.0 GPM**
	13250 L	**3.1 – 3.5 GPM**
	15114 L	**3.6 + GPM**
Based on Navigant savings calculation adjusted to account for 1.5 gpm replacement and percentage of showers taken with efficient unit in Multi-Residential setting (92%) compared to 76% in Low Rise residential as per Summit Blue, Resource Savings in selected Residential DSM Programs, June 2008.		
Electricity	**n/a kWh**	

Other Input Assumptions

Equipment Life	**10 Years**
Low flow showerheads have an estimated service life of 10 years as recommended by Navigant and approved in EB 2008-0384 & 0385.	
Incremental Cost (Contractor Install)	**$17**
As per utility program costs.	
Free Ridership	**10 %**
As per EB 2008-00384 & 0385	

2.0 GAL/MIN LOW-FLOW SHOWERHEAD

Commercial Building Retrofit (Installed) – Multi-Residential

Efficient Technology & Equipment Description
Low-flow showerhead 2.0 gal/min.
Base Technology & Equipment Description
Average existing stock. (See below)

Resource Savings Assumptions

Natural Gas	**4 m3**	**2.6 – 3.0 GPM**
	28 m3	**3.1 – 3.5 GPM**
	40 m3	**3.6 + GPM**
Based on Navigant savings calculation adjusted for a 2.0 GPM unit.		
Water	**1727 L**	**2.6 – 3.0 GPM**
	5487 L	**3.1 – 3.5 GPM**
	7351 L	**3.6 + GPM**
Based on Navigant savings calculation adjusted for a 2.0 GPM unit.		
Electricity	**n/a kWh**	

Other Input Assumptions

Equipment Life	**10 years**
Low flow showerheads have an estimated service life of 10 years as recommended by Navigant and approved in EB 2008-0384 & 0385.	
Incremental Cost (Contractor Install)	**$17**
As per utility program costs.	
Free Ridership	**10 %**
As per EB 2008 -0384 & 0385	

1.25 GAL/MIN LOW-FLOW SHOWERHEAD

Commercial Building Retrofit (Distributed) – Multi-Residential

Efficient Technology & Equipment Description
Low-flow showerhead 1.25 gal/min.
Base Technology & Equipment Description
Average existing stock. (2.2 GPM)

Resource Savings Assumptions

Natural Gas		
	54 m3	**2.2 GPM**
Based on Navigant savings calculation adjusted to account for percentage of showers taken with efficient unit in Multi-Residential setting (92 %) compared to 76 % in Low Rise residential as per Summit Blue, Resource Savings in selected Residential DSM Programs, June 2008.		
Water	**8916**	**2.2 GPM**
Based on Navigant savings calculation adjusted to account for percentage of showers taken with efficient unit in Multi-Residential setting (92 %) compared to 76 % in Low Rise residential as per Summit Blue, Resource Savings in selected Residential DSM Programs, June 2008.		
Electricity	**n/a kWh**	

Other Input Assumptions

Equipment Life	**10 years**
Low flow showerheads have an estimated service life of 10 years as recommended by Navigant and approved in EB 2008-0384 & 0385.	
Incremental Cost (Cust Install)	**$4**
As per utility program costs.	
Free Ridership	**10 %**
As per EB 2008-00384 & 0385	

CFL SCREW-IN (13W)

Existing/New developments in all sectors

Efficient Technology & Equipment Description
CFL screw-in 13W
Base Technology & Equipment Description
60W Incandescent

Resource Savings Assumptions

Natural Gas (Updated)	**0 m^3**
Electricity	**45 kWh**
Substantiation provided by the OPA, dated Septem ber 23, 2008 and approved in EB 2008-0384 & 0385.	
Water (Updated)	**0 L**

Other Input Assumptions

Equipment Life	**8 years**
Substantiation provided by the OPA, dated September 23, 2008 and approved in EB 2008-0384 & 0385.	
Incremental Cost Contractor/Customer Install	**0.00 $**
• Average cost of 60 W incandescent bulb = $0.75 / bulb based on Canadian Tire website (2007). OPA assumes each incandescent bulb has a one year life. • Supplied cost of 13 W CFL = $1.72 / bulb (based on 2009 distributor price to EGD) + $0.50 (Contractor Delivery Charge) = $2.22 $2.22 CFL cost – $6.00 (8 incandescent bulbs x .75) = ($3.78)	
Free Ridership	**24 %**
Based on the results of an OPA program evaluation and as approved in EB 2008-0384 & 0385.	

CFL SCREW-IN (23W)

Existing/New developments in all sectors

Efficient Technology & Equipment Description
CFL screw-in 23W
Base Technology & Equipment Description
75W Incandescent

Resource Savings Assumptions

Natural Gas (Updated)	**0 m^3**
Electricity	**49.7 kWh**
Substantiation provided by the OPA, dated October 17, 2008 and as approved in EB 2008-0384 & 0385.	
Water (Updated)	**0 L**

Other Input Assumptions

Equipment Life	**8 years**
Substantiation provided by the OPA, dated October 17, 2008 and as approved in EB 2008-0384 & 0385 .	
Incremental Cost Contractor/Customer Install	**0.00 $**
• Average cost of 75 W incandescent bulb = $0.75 / bulb based on Canadian Tire website (2007). OPA assumes that each incandescent bulb has a one year life. • Supplied cost of a 23 W CFL = $2.05 (based on 2009 distributor cost to EGD) + $0.50 (Contractor Delivery Charge) = $2.55 $2.55 CFL cost - $6.00 (8 incandescent bulbs x .75) = ($3.45)	
Free Ridership	**24 %**
Based on the results of an OPA program evaluation and as approved in EB 2008-0384 & 0385.	

Energy Star for New Homes

Residential, New Construction

Efficient Technology & Equipment Description
Energy Star for New Homes, version 4, qualified home
Base Technology & Equipment Description
New Home built in Ontario, compliant to OBC-2006 (as of January 1, 2009)

Resource Savings Assumptions

Natural Gas	881 m^3

Gas savings is based on a simple average of a new reference house, a 1 storey house, and a 2 storey house with London's climate, and another set in North Bay's climate. The sample houses are three houses which represent the mid-range of new homes built in UG Territory. The results were weighted 70% UG South and 30% UG North.[115] The software used for analysis is HOT2000 version 9.34c with weather file 9.10wthr. A mix of 90% AFUE furnace (weighted 80%) and 80% AFUE combo heater (weighted 20%) was assumed as the base case heating system. A 3.57 ACH50 air leakage was used to describe the simply OBC-2006 houses (default present in HOT2000), which is representative of average new home construction[116].

Most of the following specifications are based on the OBC 2009, specifically section 12.3: Some of the specifications are upgrades in excess of what is actually required in the code. These were established based on observations of what is representative of the market place for certain items. These items are marked with an asterisk.

Walls - 2x6 @ 16", R20 batt Insulation (Southern)
- 2x6 @ 16" R20 batt Insulation, R5 Code-board sheathing (Northern)
- ½" Gypsum interior
- 3/8" OSB Sheathing
- Brick Veneer

Roof - 2x4 Attic Truss w R40 Blown Insulation
- ½" Drywall interior on resilient channel

Basement: - Poured Concrete foundation
- R12 Insulation blanket to within 15" of floor slab

Windows: Double glazed, single low-E, air fill, metal spacer, vinyl frame

Ventilation: Exhaust fans (Kitchen & bath) without heat recovery

Heating: a) Combination Heating System
- hot-water air-handler
- Induced draft fan water heater with spark ignition
(Steady State efficiency = 80%, e.g. Rheem PV75ce)

b) Conventional Heating System*
- 90% AFUE forced air furnace, PSC Blower
The model presumes that 20% of houses are equipped with Combination Heating Systems (code minimum) and the 80% are equipped with Conventional Heating Systems*

Air Cond: -SEER 13 entry level 410a split system*

DHW: a) Combination Heating System
- Induced Draft spark ignition 75 usg tank (Rheem PV75ce).

b) Conventional Heating System
- Induced Draft spark ignition 40 usg tank (GSW 5G40)

Envelope: 3.57 Air changes per hour @ 50 pa. ("Present" air-tightness default in HOT2000)

- General mode in HOT2000 was used. This allows overrides of default ventilation and occupancy values
- The HOT 2000 Weather file "910wthr" was used. This is an older Canadian weather file that is consistent with Hot2000 version 9.34
- Occupancy was assumed to be 2 Adults and 1 child. This models the supposition that family size and average house hold size is less than the EnergyStar baseline of 2 adults and 2 children
- 50 cfm constant ventilation rate was assumed for all houses and for all ventilation systems. This

models the supposition that occupants in general do not operate their ventilation systems as intended, rather they tend to under-use them
- 13 SEER air conditioning systems were considered to be installed in all homes. The London area homes were considered to operate with 20% open windows and the North Bay homes were considered to operate with 50% open windows

The following upgrades from the OBC 2009 specification were applied to the three sample homes[117]

Southern House[118]

Walls No upgrade
Roof No upgrade
Basement: No upgrade
Windows: Upgrade to Energy Star Zone C windows
Ventilation: Upgrade to simplified HRV (0.65/0.55 efficiency)
Heating: Upgrade to 92% AFUE ECM Blower EnergyStar furnace
Supply & return trunk ducts sealed
Air Cond: Upgrade to SEER 14 from SEER 13
DHW: Upgrade to Instantaneous Gas water heater (Noritz N0751DV, E.F. = 0.83)
Envelope: 2.0 Air changes per hour @ 50 pa.
Electrical: No Upgrade

Northern House[119]

Walls No upgrade
Roof No upgrade
Basement: No upgrade
Windows: Upgrade to Energy Star Zone C windows
Ventilation: Upgrade to simplified HRV (0.65/0.55 efficiency)
Heating: Upgrade to 95% AFUE ECM Blower EnergyStar furnace
Supply & return trunk ducts sealed
Air Cond: Upgrade to SEER 14 from SEER 13
DHW: Upgrade to Instantaneous Gas water heater (Noritz N0751DV, E.F. = 0.83)
Envelope: 2.0 Air changes per hour @ 50 pa.
Electrical: No Upgrade

Electricity	**734 kWh**
Electrical saving were calculated from the same models as above.	
Water	**n/a L**

Other Input Assumptions

Equipment Life	**25 years**
Energy Star homes have an estimated life of 25 years (before major renovations are expected).	
Incremental Cost (Cust. / Contr. Install)	**4275 $**

Cost estimates for the upgrade measures were obtained from HVAC Trades and Builders who are actively building energy star homes and based on a 70/30 UG South & North. The upgrade cost is based on a simple average of a new reference house, a 1 storey house, and a 2 storey house.

The costs assigned to the particular upgrade follow:
Walls: $0.0/ft$_2$ upgrade from R20 to R25 (add codeboard to 2x6 wall)
$0.30/ft$_2$ upgrade from R25 to R27.5 (increase codeboard thickness)

s $0.00/ft2 upgrade to 2x6 @ 20" c.c. R20 (possible savings)
Roof: $0.60/ft2 upgrade from R40 to R50
Basement: $0.20/ft2 coverage upgrade to R20 full height insulation
Windows: $1.00 per square foot of glazed surface upgrade to EnergyStar
Ventilation: $1,500 upgrade to simple HRV
$250 upgrade to 1.5 Sone Bath fan & Interlock
Heating: $871 upgrade to 92% afue Energy Star Furnace (ECM Blower)
$871 upgrade to 95% afue Energy Star Furnace (ECM Blower)
$250 duct sealing
$166 saving for furnace size reduction 60 MBH to 50 MBH
Air Cond. $61 saving for air conditioner size reduction 2.0 ton to 1.5 ton
$275 saving for air conditioner size reduction 2.5 ton to 2.0 ton
$194 upgrade to SEER 14 from SEER 13, 1.5 ton
$168 upgrade to SEER 14 from SEER 13, 2.0 ton
$80 upgrade to SEER 14 from SEER 13, 2.5 ton
DHW: $218 upgrade to instantaneous gas water heater
Envelope: $500 budget for increased air-tightness. This is highly variable from Builder to builder. Some builders will have no incremental costs.
Electrical: $2.00 per Compact Fluorescent Bulb
Consulting: $500 evaluation, testing, review and file processing.
Fees: $125 home enrolment fees.

Upgrade costs to ver 4.0 Upgrade Cost 4.0

1 Storey Southern	$4,324
1 Storey Northern	$4,324
2 Storey Southern	$4,292
2 Storey Northern	$4,198
Reference House Southern	$4,292
Reference House Northern	$4,105

Free Ridership	**5 %**

Free Ridership based on EB-2008-0384 and 0385

Higher Efficiency Boilers – Domestic Water Heating

Existing and New Commercial and Multi- Residential

Efficient Technology & Equipment Description
Hydronic Boilers for water heating (Non Seasonal)
Base Technology & Equipment Description
80% Combustion Efficiency Domestic Water Heating Boiler

Resource Savings Assumptions

Natural Gas (Updated)

	Domestic Water Heating (Non Seasonal) M3 Savings by Combustion Efficiency	
Boiler Size	**83-84%**	**85-88%**
300 MBH	**1,075**	**1,766**
600 MBH	**1,777**	**2,290**
1,000 MBH	**3,136**	**5,155**
1,500 MBH	**4,317**	**7,095**

Source: Prescriptive Commercial Boiler Program – Prescriptive Savings Analysis – Agviro Report Sept 10, 2008.

An iterative approach was used to determine the annual savings in the commercial sector. The following steps were taken:
a. The Rate 6 accounts were subdivided into bins of annual gas use. This provided the annual average gas use, number of accounts, seasonal, non-seasonal and total gas use.
b. The seasonal portion of the annual gas use was normalized to 30 year weather data. This normalized gas use was correlated to a seasonal boiler size required for gas consumption.
c. Categories of boiler sizes were selected to provide a suitable range of boilers available within the sector.
d. The Rate 6 accounts were subdivided using the normalized average seasonal gas use for the respective categories of boilers selected. This provided the annual average gas use, number of accounts, and total gas use per seasonal boiler size category.
e. Seasonal annual gas use normalization of the boiler size category accounts was completed.
f. Annual seasonal efficiency of the boiler size categories for each of the combustion efficiency ranges was determined.
g. Boiler costs for the boiler size categories was compiled.
h. A TRC analysis was completed for each of the boiler size categories.
i. A similar approached was used for the non-seasonal gas use with the exception of normalizing the data.

Electricity (Updated)	**0 kWh**
Water	**0 L**

Other Input Assumptions

Equipment Life	**25**	**years**
EB 2008-0384 & 0385		
Incremental Cost (Contr. Install)	**Boiler Size** **300 MBH** **600 MBH** **1,000 MBH** **1,500 MBH**	**Domestic Water Heating (Non Seasonal) Incremental Cost by Combustion Efficiency** **83-84% 85-88%** **$3,900 $ 4,500** **$5,800 $ 6,000** **$7,400 $10,300** **$5,900 $ 7,400**
Source: Prescriptive Commercial Boiler Program – Prescriptive Savings Analysis – Agviro Report Sept 10, 2008.		
Free Ridership	**Small Commercial** **Large Commercial**	**EGD/Union 10%** **EGD 12%/Union 59%** **for all sectors except** **:Multi-family EGD 20%/Union 42%**
EB 2008-0384 - 0385		

Higher Efficiency Boilers –Space Heating

Existing and New Commercial and Multi- Residential

Efficient Technology & Equipment Description
Hydronic Boilers for space heating (Seasonal)
Base Technology & Equipment Description
80% Combustion Efficiency Space Heating Boiler

Resource Savings Assumptions

Natural Gas (Updated)

	Space Heating (Seasonal) M3 Savings by Combustion Efficiency	
Boiler Size	**83-84%**	**85-88%**
300 MBH	**2,105**	**3,125**
600 MBH	**3,994**	**5,930**
1,000 MBH	**7,310**	**10,856**
1,500 MBH	**11,554**	**17,157**
2,000 MBH	**16,452**	**24,431**

Source: Prescriptive Commercial Boiler Program – Prescriptive Savings Analysis – Agviro Report Sept 10, 2008.

An iterative approach was used to determine the annual savings in the commercial sector. The following steps were taken:
a. The Rate 6 accounts were subdivided into bins of annual gas use. This provided the annual average gas use, number of accounts, seasonal, non-seasonal and total gas use.
b. The seasonal portion of the annual gas use was normalized to 30 year weather data. This normalized gas use was correlated to a seasonal boiler size required for gas consumption.
c. Categories of boiler sizes were selected to provide a suitable range of boilers available within the sector.
d. The Rate 6 accounts were subdivided using the normalized average seasonal gas use for the respective categories of boilers selected. This provided the annual average gas use, number of accounts, and total gas use per seasonal boiler size category.
e. Seasonal annual gas use normalization of the boiler size category accounts was completed.
f. Annual seasonal efficiency of the boiler size categories for each of the combustion efficiency ranges was determined.
g. Boiler costs for the boiler size categories was compiled.
h. A TRC analysis was completed for each of the boiler size categories.
i. A similar approached was used for the non-seasonal gas use with the exception of normalizing the data.

Electricity (Updated)	**0 kWh**
Water	**0 L**

Other Input Assumptions

Equipment Life	**25**	**years**
EB 2008-0384 & 0385		
Incremental Cost (Contr. Install)	**Boiler Size** **300 MBH** **600 MBH** **1,000 MBH** **1,500 MBH** **2,000 MBH**	**Space Heating (Seasonal) Incremental Cost by Combustion Efficiency** **83-84% 85-88%** **$3,900 $ 4,500** **$5,800 $ 6,000** **$7,400 $10,300** **$5,900 $ 7,400** **$4,950 $ 7,050**
Source: Prescriptive Commercial Boiler Program – Prescriptive Savings Analysis – Agviro Report Sept 10, 2008.		
Free Ridership	**Small Commercial** **Large Commercial**	**EGD/Union 10%** **EGD 12%/Union 59%** **for all sectors except** **:Multi-family EGD 20%/Union 42%**
EB 2008 - 0384 & 0385		

[35] NEUD database space heating for 1990-2006 & HHV of natural gas (as of January 2009)
[36] NEUD database space cooling using for 1990-2006, (as of January 2009)
[37] "UG Thermostat_calculator_rv2 - JO.xls"
[38] This analysis includes a weighted average of UG North 30% and UG South 70%.
[39] As per UG's understanding of typical operating schedules
[40] Kim Ellis, Sr. Salesperson at Engineered Air, London office, Feb 13, 2009
[41] Ian Dunbar, Feb 13, 2009 referring to a restaurant designed by Millennium Engineering, Burlington
[42] John Paleczny, March 6, 2009, from Yorkland Controls, London
[43] The "Institutional" market was assumed to comprise of "Information & Cultural Industries" and "Educational Services" for the purposes of this analysis.
[44] Refers to table above.
[45] National Energy Use Database, Commercial/Institutional Sectors, NRCAN, September 2008, covering 1990 to 2006.
[46] "Natural Gas Energy Efficiency Potential Commercial Sector –Draft Final Report", Dec 2, 2008, Marbek Resource Consultants
[47] Locally available commercial condensing gas water heater, trade name: Polaris, model #: PC 199-50 http://www.johnwoodwaterheaters.com/pdfs/GSW_PolarisSpecSheet.pdf
[48] as per typical full service restaurant draw (EB-2006-0021, pg 31, Appendix B)
[49] One of the input assumptions required for calculating resource savings for this measure is the stand-by heat loss of storage tank water heaters. Hourly stand-by losses are treated as constant using values drawn from GAMA's Consumer Directory (see citation below). This means that marginal percentage gas savings will fall as hot water use rises.
[50] Locally available commercial conventional (non-condensing) gas water heater with the same input rating as the Polaris. Manufacturer: Rheem, model #: G91-200.
[51] Although the required minimum thermal efficiency to be in compliance with ASHRAE 90.1 is 78%, http://www.energycodes.gov/comcheck/pdfs/404text.pdf, only an very small percentage of commercial gas water heaters listed in the GAMA Consumer's Directory of Certified Efficiency Ratings had a thermal efficiency of less than 80%. http://www.neo.ne.gov/neq_online/july2006/commgaswtrhtr.pdf
[52] Navigant draft report, pg B-224 MEASURES AND ASSUMPTIONS FOR DEMAND SIDE MANAGEMENT (DSM) PLANNING APPENDIX C: SUBSTANTIATION SHEETS - February 6, 2009
[53] Chinnery, Glen. Policy Recommendations for the HERS Community to Consider regarding HERS point credit for Waste Water Heat Recovery Devices,EPA, Energy Star for homes, March 2004 http://www.energystar.gov/ia/partners/bldrs_lenders_raters/downloads/Waste_Water_Heat_Recovery_Guidelines.pdf
[54] As suggested by NRCan: http://oee.nrcan.gc.ca/residential/personal/new-homes/water-conservation.cfm?attr=4
[55] Consumer's Directory of Certified Efficiency Ratings http://www.neo.ne.gov/neq_online/july2006/commgaswtrhtr.pdf In this case stand-by losses are constant. Recalculating gas savings using the WHAM algorithm, in which stand-by losses are afunction of water draw, results in less than 3% variation over the figures presented above. Lutz, J.D., C.D. Whitehead, A.B. Lekov, G.J. Rosenquist., and D.W. Winiarski. 1999. WHAM: Simplified tool for calculating water heater energy use. ASHRAE Transactions 105 (1): 1005-1015.
[56] Consumer's Directory of Certified Efficiency Ratings http://www.neo.ne.gov/neq_online/july2006/commgaswtrhtr.pdf
[57] Iowa Utilities Board. Docket No. EEP-08-02 MidAmerican Energy Company. Volume IV, Appendix D, Part 1 of 2
[58] Quantec Comprehensive Assessment of Demand-Side Resource Potentials (2008-2027) Prepared for Puget Sound Energy
[59] Jacques Whitford Environment Ltd, Prescriptive Incentives for Select Natural Gas Technologies, Sept 2000
[60] Rheem G91-200: $3,650; Polaris PC 199-50: $5,880
[61] Navigant Consulting, Draft Report MEASURES AND ASSUMPTIONS FOR DEMAND SIDE MANAGEMENT (DSM) PLANNING APPENDIX C: SUBSTANTIATION SHEETS, February 6, 2009, pg 225
[62] "Region of Waterloo – Pre-Rinse Spray Valve Pilot Study – Final Report", Veritec Consulting Inc., January 2005
[63] "City of Calgary" – Pre-Rinse Spray Valve Pilot Study – Final Report", Veritec Consulting Inc., December 2005.
[64] Appendix D-2. Water Heater Analysis Model. Water Heater Rulemaking Technical Support Documents. http://www1.eere.energy.gov/buildings/appliance_standards/residential/waterheat_0300_r.html
[65] Charles Wallace and Don Fisher Energy Efficiency Potential of Gas-Fired Commercial Hot Water Heating Systems in Restaurants. FSTC April 2007
[66] ASHRAE Handbook 2007HVAC Applications. Chapter 49
[67] CEE Commercial Kitchens Initiative - Program Guidance on Pre-Rinse Spray Valves
[68] Enbridge market survey of average usage
[69] "Region of Waterloo – Pre-Rinse Spray Valve Pilot Study – Final Report", Veritec Consulting Inc., January 2005
[70] "Region of Waterloo – Pre-Rinse Spray Valve Pilot Study – Final Report", Veritec Consulting Inc., January 2005
[71] "City of Calgary" – Pre-Rinse Spray Valve Pilot Study – Final Report", Veritec Consulting Inc., December 2005.
[72] Appendix D-2. Water Heater Analysis Model. Water Heater Rulemaking Technical Support Documents. http://www1.eere.energy.gov/buildings/appliance_standards/residential/waterheat_0300_r.html
[73] Charles Wallace and Don Fisher Energy Efficiency Potential of Gas-Fired Commercial Hot Water Heating Systems in Restaurants. FSTC April 2007
[74] ASHRAE Handbook 2007HVAC Applications. Chapter 49
[75] pg 32 & 37 "Deemed Savings for (Low Flow) Pre-Rinse Spray Nozzles" by Energy Profiles, January 30, 2009.
[76] CEE Commercial Kitchens Initiative - Program Guidance on Pre-Rinse Spray Valves
[77] Enbridge market survey of average usage
[78] Although the required minimum thermal efficiency to be in compliance with ASHRAE 90.1 is 78%,

http://www.energycodes.gov/comcheck/pdfs/404text.pdf, only an very small percentage of commercial gas water heaters listed in the GAMA Consumer's Directory of Certified Efficiency Ratings had a thermal efficiency of less than 80%. http://www.neo.ne.gov/neq_online/july2006/commgaswtrhtr.pdf

[79] One of the input assumptions required for calculating resource savings for this measure is the stand-by heat loss of storage tank water heaters. Hourly stand-by losses are treated as constant using values drawn from GAMA's Consumer Directory (see citation below). This means that marginal percentage gas savings will fall as hot water use rises.

[80] Navigant draft report, pg B-237 MEASURES AND ASSUMPTIONS FOR DEMAND SIDE MANAGEMENT (DSM) PLANNING APPENDIX C: SUBSTANTIATION SHEETS - February 6, 2009

[81] Chinnery, Glen. Policy Recommendations for the HERS Community to Consider regarding HERS point credit for Waste Water Heat Recovery Devices,EPA, Energy Star for homes, March 2004, pg 15 http://www.energystar.gov/ia/partners/bldrs_lenders_raters/downloads/Waste_Water_Heat_Recovery_Guidelines.pdf

[82] As suggested by NRCan: http://oee.nrcan.gc.ca/residential/personal/new-homes/water-conservation.cfm?attr=4

[83] Consumer's Directory of Certified Efficiency Ratings http://www.neo.ne.gov/neq_online/july2006/commgaswtrhtr.pdf

[84] hot water heating - calculator - tankless comml - March 10 2009.xls

[85] "Introduction to Rinnai Water Heating Product – Course #101", page 7

[86] Canadian Building Energy End-Use Data and Analysis Centre - Domestic Water Heating and Water Heater Energy Consumption in Canada, C. Aguilar, D.J. White, and David L. Ryan, April 2005, http://www.ualberta.ca/~cbeedac/publications/documents/domwater_000.pdf

[87] Energy Star's High Efficiency Water Heaters brochure, http://www.energystar.gov/ia/new_homes/features/WaterHtrs_062906.pdf pg 2, March 10, 2009

[88] Energy Star website, http://www.energystar.gov/index.cfm?c=gas_tankless.pr_savings_benefits , March 10, 2009

[89] A study for Pacific Gas and Electric of a chain casual dining restaurant found peak water draws of up to 20 GPM. Wallace, C. and D. Fisher, Energy Efficiency Potential of Gas-Fired Commercial Hot Water Heating Systems in Restaurants.April 2007

[90] http://www.tanklesswaterheaters.ca/waiwelaph28ci.html

[91] From correspondence with local distributor by Navigant Consulting.

[92] Rheem G91-200: $3,650

[93] Although the required minimum thermal efficiency to be in compliance with ASHRAE 90.1 is 78%, http://www.energycodes.gov/comcheck/pdfs/404text.pdf, only an very small percentage of commercial gas water heaters listed in the GAMA Consumer's Directory of Certified Efficiency Ratings had a thermal efficiency of less than 80%. http://www.neo.ne.gov/neq_online/july2006/commgaswtrhtr.pdf

[94] One of the input assumptions required for calculating resource savings for this measure is the stand-by heat loss of storage tank water heaters. Hourly stand-by losses are treated as constant using values drawn from GAMA's Consumer Directory (see citation below). This means that marginal percentage gas savings will fall as hot water use rises.

[95] Navigant draft report, pg B-237 MEASURES AND ASSUMPTIONS FOR DEMAND SIDE MANAGEMENT (DSM) PLANNING APPENDIX C: SUBSTANTIATION SHEETS - February 6, 2009

[96] Chinnery, Glen. Policy Recommendations for the HERS Community to Consider regarding HERS point credit for Waste Water Heat Recovery Devices,EPA, Energy Star for homes, March 2004, pg 15 http://www.energystar.gov/ia/partners/bldrs_lenders_raters/downloads/Waste_Water_Heat_Recovery_Guidelines.pdf

[97] As suggested by NRCan: http://oee.nrcan.gc.ca/residential/personal/new-homes/water-conservation.cfm?attr=4

[98] Consumer's Directory of Certified Efficiency Ratings http://www.neo.ne.gov/neq_online/july2006/commgaswtrhtr.pdf

[99] hot water heating - calculator - tankless comml - March 10 2009.xls

[100] "Introduction to Rinnai Water Heating Product – Course #101", page 7

[101] Canadian Building Energy End-Use Data and Analysis Centre - Domestic Water Heating and Water Heater Energy Consumption in Canada, C. Aguilar, D.J. White, and David L. Ryan, April 2005, http://www.ualberta.ca/~cbeedac/publications/documents/domwater_000.pdf

[102] Energy Star's High Efficiency Water Heaters brochure, http://www.energystar.gov/ia/new_homes/features/WaterHtrs_062906.pdf pg 2, March 10, 2009

[103] Energy Star website, http://www.energystar.gov/index.cfm?c=gas_tankless.pr_savings_benefits , March 10, 2009

[104] A study for Pacific Gas and Electric of a chain casual dining restaurant found peak water draws of up to 20 GPM. Wallace, C. and D. Fisher, Energy Efficiency Potential of Gas-Fired Commercial Hot Water Heating Systems in Restaurants.April 2007

[105] http://www.tanklesswaterheaters.ca/waiwelaph28ci.html

[106] From correspondence with local distributor by Navigant Consulting.

[107] Rheem G91-200: $3,650

[108] Average number of cycles per day based on "Multi-Residential High efficiency clothes washer pilot project", City of Toronto, April 2001. Average cycles per day from all sites in report except Louvain & Tyndall, pre-conversion 4.73 cyc/day, post 4.24 cyc/day average 4.49 round to 4.5.

[109] Water consumption in US Gallons for base case clothes washer, from US DOE Federal Energy Management Program, Life-Cycle and Cost spreadsheet, tab Energy and water use. The consumption calculated 26.6 gallons for base case and 14.9 for CEE average washer, both values adjusted by 10% to account for commercial usage, see Enbridge discussion document

[110] Hot water consumption for both the base case and CEE case are adjusted for the total water consumption (ref 4) and the hot water is corrected based on original usage ratio then this value is increased by 10% to adjust for commercial clothes washer use, see Enbridge discussion document.

[111] Average all clothes washers listed in CEE to obtain average MEF and WF(MEF 2.2, WF 5.33), input into US DOE Life-Cycle and Cost and Payback Period spreadsheet. Increase water use and hot water consumption by 10%.
[112] See item Enbridge Discussion document item a. , Efficiency range for annual usage efficiency of water heaters estimated between 55% to 70%, 65% was selected as conservative estimate base on Enbridge experience. Further analysis is needed to quantify the efficiency of water heaters in commercial clothes washer facilities.
[113] Dryer energy usage is calculated using the US DOE Life-Cycle and Cost and Payback spreadsheet (0.9 kwh/cycle)
[114] 60% penetration for commercial clothes dryers "CEE Commercial, Family-Sized Washers:An Initiative Description of the Consortium for Energy Efficiency) 1998
[115] Bowser Technical, Inc., Comparison of EnerQuality EnergyStar Version 3.0 & EnergyStar Version 4.0 Vs Ontario Building Code 2009 Energy use, March 10 2009
[116] Jennifer Tausman, ESNH files coordinator, NRCAN OEE, July 21, 2008

[118] The upgrades are based on the EnerQuality Energy-Star for New Homes Technical Specifications Version 4.0 D, February '09 performance compliance method (section 5.1).
[119] The EnerQuality EnergyStar Version 4.0 Prescriptive options are not applicable to homes North of the Muskoka climate zone. Upgrades are based on the performance Compliance Method (section 5.1) as set out in the EnerQuality EnergyStar for New Homes Technical Specification Version 4.0, February '09..