Ontario Energy Board

Commission de l'Énergie de l'Ontario

EB-2006-0021

IN THE MATTER OF a generic proceeding initiated by the Ontario Energy Board to address a number of current and common issues related to demand side management activities for natural gas utilities.

PROCEDURAL ORDER NO. 5

In the Ontario Energy Board's (the "Board") recent partial decision in Enbridge Gas Distribution's Inc. ("Enbridge") 2006 rates application (EB-2005-0001 / EB-2005-0437), the Board announced its intention to convene a generic proceeding to address a number of current and common issues related to demand side management ("DSM") activities for natural gas utilities (the "utilities").

On February 15, 2006 the Board issued a Notice of Hearing under file number EB-2006-0021. Additional Procedural Orders were issued leading up to the oral hearing which took place from July 10, 2006 through July 28, 2006.

On August 25, 2006 the Board released its decision on the first phase of the EB-2006-0021 proceeding. As part of its decision, the Board indicated that it would convene a second phase to the hearing for the purpose of determining common input assumptions to be used by the utilities when compiling their DSM plans.

The Board is therefore circulating in this Procedural Order a draft input assumptions list. This draft list is the one the utilities filed in their evidence in the first phase of this proceeding and is attached as Appendix "A" to this order. Also attached as Appendix "B" is the substantiation documentation provided by the utilities. (In addition to the input assumptions within Appendix "A", parties are expected to consider a free ridership rate of 30% for custom projects.)

The Board expects that the parties will review the assumptions list and attempt to agree on as many assumptions as possible through a settlement conference. If there are assumptions for which agreement cannot be reached, or if the Board does not approve of any part of the settlement, parties will be permitted to file evidence on those disputed inputs for adjudication before the Board. If these steps become necessary the Board will issue further procedural orders providing details for those steps.

At this time, the Board considers it necessary to make provisions for the following procedural matter. Please be aware that further procedural orders may be issued from time to time.

THE BOARD ORDERS THAT:

1. A Settlement Conference will be convened on Monday, September 25, 2006 beginning at 9:00 a.m. and ending on Tuesday September 26, 2006 at 5:00 p.m. The objective of the Settlement Conference will be to reach a settlement among the parties on as many of the input assumptions as possible. The Settlement Conference will be held at 2300 Yonge Street, Toronto in the Board's hearing room.

2. Any Settlement Proposal arising from the Settlement Conference shall be filed with the Board for consideration no later than 5:00 p.m. on Friday, September 29, 2006. The Board expects that any settlement proposal will clearly state which input assumptions have been agreed to, complete with sufficient supporting evidence, and also which input assumptions are not agreed to.

3. **All filings with the Board noted in the Order must be in the form of 10 hard copies and received by the Board by 5:00 p.m. on the stated date.** The Board requires all correspondence to be in electronic form as well as paper. Therefore, all parties must also e-mail an electronic copy of their filings in searchable PDF or MS Word to the Board Secretary at Boardsec@oeb.gov.on.ca. Parties must also include the Case Manager, Michael Bell michael.bell@oeb.gov.on.ca and Board Counsel, Michael Millar michael.millar@oeb.gov.on.ca on all electronic correspondence related to this case.

DATED at Toronto, September 6, 2006

ONTARIO ENERGY BOARD

Original signed by

Peter H. O'Dell
Assistant Board Secretary

APPENDIX "A"

TO PROCEDURAL ORDER NO. 5

BOARD FILE NO. EB-2006-0021

DATED: September 6, 2006

DRAFT INPUT ASSUMPTIONS LIST

Appendix A: Measure Assumptions

RESIDENTIAL

Efficient Equipment & Technologies	Base Equipment & Technologies	Load Type	Resource Savings Assumptions			Equipment Life	Incremental Cost		Free Ridership
			Natural Gas	Electricity	Water		Customer Installed	Contractor Installed	
			m3	kWh	L	Years			%
NEW CONSTRUCTION									
Basement Insulation (R-12)	OBC basement insulation levels	weather	93	-	-	25	-	$700	0%
Energy Star Home	Home built to OBC	weather	800	1,000	-	25	-	$3,020	0%
High Efficiency Furnace	Mid-Efficiency Furnace	weather	226	-	-	18	-	$647	30%
High Efficiency Integrated Appliance	Mid-Efficiency Furnace / Storage Tank Water Heater	weather	287	-	-	18	-	$850	0%
EnerGuide for New Houses	Home built to OBC	weather	450	0	0	25	-	$2,000	0%
Programmable Thermostat	Standard Thermostat	weather	172	200	-	18	-	$65	30%
R-2000	Home built to OBC	weather	800	0	0	25	-	$4,000	0%
Tankless Water Heater	Storage Tank Water Heater	base	206	-	-	20	-	$650	0%
Two-Stage Furnace with ECM	Mid-Efficiency Furnace	weather	245	580	-	18	-	$1,563	30%
Waste Water Heat Recovery	No heat recovery	base	267	-	-	30	-	$625	0%

Efficient Equipment & Technologies	Base Equipment & Technologies	Load Type	Resource Savings Assumptions			Equipment Life	Incremental Cost		Free Ridership
			Natural Gas	Electricity	Water		Customer Installed	Contractor Installed	
			m3	kWh	L	Years			%
EXISTING HOMES									
Condensing Boiler - up to 299 Mbtu/h	Standard Boiler	weather	925	-	-	25	-	$1,300	0%
Condensing Gas Water Heater	Storage Tank Water Heater	base	203	-	-	9	-	$1,000	0%
Energy Star Clothes Washer	Standard Clothes Washer	base	55	31	28,731	13	-	$350	8%
Energy Star Window	Standard Window	weather	13	16	-	25	-	$52	20%
Enhanced Furnace	Mid-Efficiency Furnace	weather	320	730	-	18	-	$1,200	10%
Faucet Aerator	Faucet w/o aerator	base	17	-	7,592	10	$2	-	10%
Heat Traps	Storage Tank Water Heater w/o heat trap	base	73	0	0	10	-	$80	0%
High Efficiency Furnace	Mid-Efficiency Furnace	weather	385	-	-	18	-	$650	48%
Home Rewards w/o Program. Thermo	Existing Home Sample	weather	1,321	300	0	25	-	$2,708	8%
Low-Flow Showerhead	Average Existing Stock	base	134	-	27,634	10	$5	$15	10%
Pipe Insulation	Water Heater w/o pipe insulation	base	17	-	-	15	$1	$4	4%

Filed: 2006-04-10
EB-2006-0021
Exhibit B
Tab 3
Schedule 1

Efficient Equipment & Technologies	Base Equipment & Technologies	Load Type	Resource Savings Assumptions			Equipment Life	Incremental Cost		Free Ridership
			Natural Gas m3	Electricity kWh	Water L	Years	Customer Installed	Contractor Installed	%
EXISTING HOMES CONT'D									
Power Comb. Boiler - up to 299 Mbtu/h	Standard Boiler	weather	659	-	-	25	-	$500	51%
Programmable Thermostat	Standard Thermostat	weather	212	100	-	18	-	$65	11%
Tankless Water Heater	Storage Tank Water Heater	base	203	-	-	20	-	$650	0%
Two-Stage Furnace with ECM	Mid-Efficiency Furnace	weather	332	535	-	18	-	$1,563	30%
Waste Water Heat Recovery	No heat recovery	base	267	-	-	30	-	$625	0%

Efficient Equipment & Technologies	Base Equipment & Technologies	Load Type	Resource Savings Assumptions			Equipment Life	Incremental Cost		Free Ridership
			Natural Gas m3	Electricity kWh	Water L	Years	Customer Installed	Contractor Installed	%
LOW INCOME									
Faucet Aerator	Faucet w/o aerator	base	17	-	7,592	10	$2	-	0%
Low-Flow Showerhead	Average Existing Stock	base	134	-	27,634	10	$5	$15	0%
Pipe Insulation	Water Heater w/o pipe insulation	base	17	-	-	15	-	$4	0%
Programmable Thermostat	Standard Thermostat	weather	212	-	-	18	-	$90	0%

COMMERCIAL

Efficient Equipment & Technologies	Base Equipment & Technologies	Load Type	Resource Savings Assumptions			Equipment Life	Incremental Cost		Free Ridership
			Natural Gas m3	Electricity kWh	Water L	Years	Customer Installed	Contractor Installed	%
NEW BUILDING CONSTRUCTION									
Condensing Gas Water Heater	Storage Tank Water Heater	base	1,750	-	-	15	-	$4,200	5%
Rooftop Unit	Standard Rooftop Unit	weather	1,275	-	-	20	-	$1,250	0%
Programmable Thermostats	Standard Thermostat	weather	519	921	-	18	-	$65	11%
Tankless Water Heater	Storage Tank Water Heater	base	825	-	-	20	-	$2,200	0%

Efficient Equipment & Technologies	Base Equipment & Technologies	Load Type	Resource Savings Assumptions			Equipment Life	Incremental Cost		Free Ridership
			Natural Gas m3	Electricity kWh	Water L	Years	Customer Installed	Contractor Installed	%
EXISTING BUILDINGS									
Condensing Gas Water Heater	Storage Tank Water Heater	base	1,750	-	-	15	-	$4,200	5%
Faucet Aerators	Faucet w/o aerator	base	17	-	7,592	10	$2	-	10%
High Efficiency Furnace	Mid-Efficiency Furnace	weather	385	-	-	18	-	$650	10%
Low-Flow Showerhead	Average Existing Stock	base	134	-	27,634	10	$5	$15	10%

Efficient Equipment & Technologies	Base Equipment & Technologies	Load Type	Resource Savings Assumptions			Equipment Life	Incremental Cost		Free Ridership
			Natural Gas	Electricity	Water		Customer Installed	Contractor Installed	
			m3	kWh	L	Years			%
EXISTING BUILDINGS CONT'D									
Pre-Rinse Spray Nozzle	Average Existing Stock	base	2,434	-	432,800	5	-	$100	5%
Programmable Thermostats	Standard Thermostat	weather	519	921	-	18	-	$65	11%
Rooftop Unit	Standard Rooftop Unit	weather	1,275	-	-	20	-	$1,250	0%
Tankless Water Heater	Storage Tank Water Heater	base	825	-	-	20	-	$2,200	0%
Two-Stage Furnace with ECM	Mid-Efficiency Furnace	weather	332	535	-	18	-	$1,563	30%
Water Tank De-liming	Storage Tank Water Heater (with liming)	base	1,033	-	-	3	-	$150	0%

APPENDIX "B"

TO PROCEDURAL ORDER NO. 5

BOARD FILE NO. EB-2006-0021

DATED: September 6, 2006

SUBSTANTIATION DOCUMENTATION FOR THE DRAFT INPUT ASSUMPTIONS LIST

Exhibit JT2.23
Attachment #1

DSM Handbook

Substantiation Document for Input Assumptions

May 2006

Index

RESIDENTIAL - NEW CONSTRUCTION

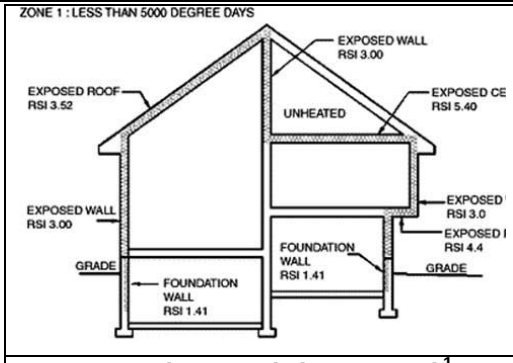
Efficient Equipment & Technologies	Base Equipment & Technologies	Load Type	Resource Savings Assumptions			Equipment Life	Incremental Cost		Free Ridership
			Natural Gas	Electricity	Water		Customer Installed	Contractor Installed	
			m3	kWh	L	Years			%
NEW CONSTRUCTION									
Basement Insulation (R-12)	OBC basement insulation levels	weather	93	-	-	25	-	$700	0%
Energy Star Home	Home built to OBC	weather	800	1,000	-	25	-	$3,020	0%
High Efficiency Furnace	Mid-Efficiency Furnace	weather	226	-	-	18	-	$647	30%
High Efficiency Integrated Appliance	Mid-Efficiency Furnace / Storage Tank Water Heater	weather	287	-	-	18	-	$850	0%
EnerGuide for New Houses	Home built to OBC	weather	450	0	0	25	-	$2,000	0%
Programmable Thermostat	Standard Thermostat	weather	172	200	-	18	-	$65	30%
R-2000	Home built to OBC	weather	800	0	0	25	-	$4,000	0%
Tankless Water Heater	Storage Tank Water Heater	base	206	-	-	20	-	$650	0%
Two-Stage Furnace with ECM	Mid-Efficiency Furnace	weather	245	580	-	18	-	$1,563	30%
Waste Water Heat Recovery	No heat recovery	base	267	-	-	30	-	$625	0%

BASEMENT INSULATION (R-12)

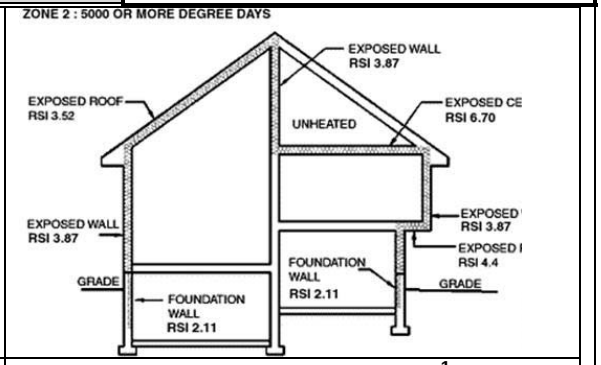
Efficient Technology & Equipment Description
Basement Insulation (R-12)
Base Technology & Equipment Description
No Basement Insulation

Resource Savings Assumptions

Natural Gas	93 m^3



Union South (< 5000 DD)[1]



Union North (≥ 5000 DD)[1]

The natural gas savings are based on ADR settlement numbers (Union Gas South – 114 m3, Union Gas North – 45 m3).[2] The single savings number is 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
Basement Insulation has an estimated service life of 25 years.[3]	
Incremental Cost (Cust. / Contr. Install)	**- $700**
Basement insulation has an estimated incremental cost of $700.	
Free Ridership	**0 %**
Free-ridership rate as per 2005 ADR Settlement – EB-2005-0211.[4]	

[1] Code 2004, Illustrated Guide to the Ontario Building Code – Code 2004 v2.3.7

[2] Independent Audit of Union Gas' 2002 DSM Evaluation Report – Section 3 Residential Programs, p 3 – 2, KEMA XENERGY Inc., September 29, 2003.

[3] U.S. Department of Housing and Urban Development's Residential Rehabilitation Inspection Guide, Appendix C – Life Expectancy of Housing Components, 2000.

[4] EB-2005-0211, Union Gas Settlement Agreement, April 7, 2005

ENERGY STAR HOMES

Efficient Technology & Equipment Description
Energy Star qualified home
Base Technology & Equipment Description
Home built to Ontario Building Code (1997) minimum standards.

Resource Savings Assumptions

Natural Gas	800 m^3
Natural gas savings are assumed to be similar to R-2000 savings. Union Gas internal research[5] suggests similar savings of 807 – 895 m3.	
Electricity	**1000 kWh**
"A minimum electrical savings of 1000 kWh/yr from HVAC distribution, and by use of ENERGY STAR qualified products for fixed lighting, AC, and other major appliances" is a requirement of an Energy Star qualified home.[6]	
Water	**n/a L**

Other Input Assumptions

Equipment Life	25 years
Energy Star homes have an estimated service life of 25 years (before major renovations are expected).	
Incremental Cost (Cust. / Contr. Install)	**- $3020**

Based on information provided by EnerQuality Corporation.

Measure	Description	Cost
Roof Insulation	Add RSI 0.9 blown cellulose to 130 m2 to achieve RSI 7.0	$290
Wall Insulation	Substitute OSB sheathing and building paper w/ 25 mm XPS to 276 m2 wall	$180
Basement Walls	Substitute RSI 2.1 batt to top 1.2m interior side (58 m2). Add RSI 2.1 batt to bottom 1.2m interior wall	$500
Windows	Energy Star windows	$400
House Air Sealing	Improvements to rim joist corners and penetrations, floors over garages, and other areas not covered by drywall	$800
Ventilation	Intermittent cycle control on furnace fan, upgraded exhaust fan w/ two speed control	$400
Duct Sealing	Seal all supply and return joints and penetrations	$300
Electrical Efficiency	Incremental cost of ES lighting, refrigerator	$150
	TOTAL	**$3,020**

Free Ridership	0 %
As approved in the Enbridge Partial Decision EB 2005-0001.	

[5] DSM Measure Input Assumption – Energy Star New Homes, 2005.

[6] Energy Star Technical Requirements – Qualified New Houses, April 2005, Natural Resources Canada

HIGH EFFICIENCY FURNACE

Efficient Technology & Equipment Description
High efficiency furnace (90% AFUE)
Base Technology & Equipment Description
Mid efficiency furnace (80% AFUE)

Resource Savings Assumptions

Natural Gas	226 m^3
Natural gas savings claims are based on HOT200O V 9.1 assessment for Union Gas franchise territory[7]. The assessment is based on 1800 ft^2 single-story house located in London (Union Gas South) and North Bay (Union Gas North) built in 2003, with 3 occupants, partially insulated heated basement. The base technology in this assessment is a mid-efficiency furnace (80% AFUE, single-stage, fan assisted with a conventional blower). The higher efficient technology in this assessment is a high efficiency furnace (90% AFUE, single-stage, fan assisted with a conventional blower). The single savings number is 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	18 years
High efficiency furnaces have an estimated service life of 18 years.[8,9]	
Incremental Cost (Cust. / Contr. Install)	**- $647**
The incremental cost is based on a pricing survey of 15 contractors in the Union Gas franchise area. The single incremental cost number is weighted average of Union Gas South (70%) and Union Gas North (30%) average incremental costs.	
Free Ridership	**30 %**
Free-ridership rate as per 2005 ADR Settlement – EB-2005-0211.[4]	

[7] Furnace Savings Update – 2004", John Overall, Union Gas, January 2004.
[8] ASHRAE Applications Handbook – 2003, Chapter 36 – Owning and Operating Costs, Table 3.
[9] "The Life Expectancy/Replacement Picture", Appliance Magazine, September 2005.

HIGH EFFICIENCY INTEGRATED APPLIANCE

Efficient Technology & Equipment Description
High efficiency integrated appliance (90% AFUE, EF = 0.65)
Base Technology & Equipment Description
Mid efficiency furnace (80% AFUE) with storage tank water heater (EF = 0.59)

Resource Savings Assumptions

Natural Gas	**287 m^3**
Natural gas savings claims are based on HOT200O V 9.1 analysis for Union Gas franchise territory. The assessment is based on 1800 ft2 single-story house located in London (Union Gas South) and North Bay (Union Gas North) built in 2003, with 3 occupants, partially insulated heated basement. The base technology in this assessment is a mid-efficiency furnace (80% AFUE, single-stage, fan assisted with a conventional blower) and a conventional (PV 50) storage tank water heater (EF = 0.59). The higher efficient technology in this assessment is a high efficiency integrated appliance (90% AFUE and EF = 0.65 – minimum to meet P.10 standard for integrated appliance). The single savings number is 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	**18 years**
Equipment life is estimated to be similar to tankless water heater – approximately 18 years.	
Incremental Cost (Cust. / Contr. Install)	**- $850**
The incremental cost is estimated to be $850.	
Free Ridership	**0 %**
Free rider rate is current rate used by Union Gas.	

ENERGUIDE FOR NEW HOUSES

Efficient Technology & Equipment Description
Base Technology & Equipment Description

Resource Savings Assumptions

Natural Gas	**450 m^3**
As approved in the 2006 Enbridge DSM Plan (EB-2005-0001).	
Electricity	**n/a kWh**
Water	**n/a L**

Other Input Assumptions

Equipment Life	**25 years**
New homes have an estimated service life of 25 years before major repair or renovations are expected.	
Incremental Cost (Cust. / Contr. Install)	**- $2000**
Estimated incremental cost as compared to costs for Energy Star New Homes and as approved in the 2006 Enbridge DSM Plan (EB-2005-0001).	
Free Ridership	**0 %**
As approved in the Enbridge Partial Decision EB 2005-0001.	

PROGRAMMABLE THERMOSTAT

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

Resource Savings Assumptions

Natural Gas	172 m^3
Natural gas savings are based on percentage savings (10% - corresponding to an 18°C night and day setback), reported in CCHT report[10] applied to HOT2XP simulation results[7]. The single savings number is weighted average of Union Gas South (70%) and Union Gas North (30%) savings estimates.	
Electricity	**200 kWh**
The electricity savings are based on percentage savings (11% - corresponding to a 25°C day set-forward), reported in CCHT report[10]. An NRCan report on energy efficiency trends in Canada states that "A central air conditioner is used to cool a larger space such as a house. This type of unit (32,000 Btu per hour) can use about 1969 to 2317 kWh in a cooling season."[11] The average consumption is 2143 kWh. The savings from a 25°C set-forward strategy is taken as 10% of 2000 kWh, that is, 200 kWh.	
Water	**n/a L**

Other Input Assumptions

Equipment Life	18 years
Programmable thermostats have an estimated service life of 18 years (assumed to have the same life as a furnace).	
Incremental Cost (Cust. / Contr. Install)	**- $65**
Based on average thermostat cost from Enbridge survey of major home renovation and hardware chains.	
Free Ridership	**30 %**
Free-ridership rate as per 2005 ADR Settlement – EB-2005-0211.[4]	

[10] Manning, M.M; Swinton, M.C.; Szadkowski, F.; Gusdorf, J.; Ruest, K., "The Effects of Thermostat Setting on Seasonal Energy Consumption at the CCHT Research Facility", IRC-RR 191, February 14, 2005.
[11] "Energy Efficiency Trends in Canada, 1990 to 2003", Natural Resources Canada, June 2005.

R-2000

Efficient Technology & Equipment Description
New home certified to R-2000 standards.
Base Technology & Equipment Description
Home built to Ontario Building Code standards.

Resource Savings Assumptions

Natural Gas	**800 m^3**
As approved in the Enbridge 2006 Plan (EB-2005-0001).	
Electricity	**n/a kWh**
Water	**n/a L**

Other Input Assumptions

Equipment Life	**25 years**
New homes have an estimated service life of 25 years before major repairs or renovations are expected.	
Incremental Cost (Cust. / Contr. Install)	**- $4000**
As approved in the 2006 Enbridge DSM Plan (EB-2005-0001).	
Free Ridership	**0 %**
As approved in the 2006 Enbridge DSM Plan (EB-2005-0001).	

TANKLESS WATER HEATER

Efficient Technology & Equipment Description
Tankless water heater (EF = 0.82)
Base Technology & Equipment Description
Storage tank water heater (EF = 0.58)

Resource Savings Assumptions

Natural Gas	206 m^3
Natural gas savings claims are based calculations using the U.S. Department of Energy's Water Heater Analysis Model[12]. Calculations use assumptions of a typical family of 2.7 (assumed to use 2.7/4 of the nominal water use of a typical family of 4, i.e. 64.3 gallons x (2.7/4) = 43.4 gallons = 164 L)[13]. Differences in inlet water temperature between Union South (London) and Union North (North Bay) result in negligible differences in natural gas savings (1 m3). The lower (Union South) of the two savings estimates was used as the savings claim.	
Electricity	**n/a kWh**
Water	**n/a L**

Other Input Assumptions

Equipment Life	20 years
Tankless water heaters have an estimated service life of 20 years[14,15].	
Incremental Cost (Cust. / Contr. Install)	**- $650**
Tankless water heaters have an equipment life that is approximately twice that of a conventional storage tank water heater. A representative tankless water heater (Rinnai 2532 FFU) has an installed cost of $1800[16] compared with a PV50 from Union Energy at $850. Assuming a purchase of a second conventional tank type water heater will be required in 10 years at a cost in current dollars of approximately $300 (≈ $850/[1.1^10]), the incremental cost of a tankless water heater is $1800 - $850 - $300 = $650.	
Free Ridership	**0 %**
Free rider rate is the current free rider rate used by Union Gas.	

[12] Technical Support Document: Energy Efficiency Standards for Consumer Products – Residential Water Heaters, Appendix D-2, Water Heater Analysis Model, U.S. December 2000.

[13] Testing Method for Measuring Energy Consumption and Determining Efficiencies of Gas-Fired Storage Water Heaters, CAN/CSA-P.3-04.

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

[15] C. Aguilar, D.J. White, and David L. Ryan, "Domestic Water Heating and Water Heater Energy Consumption in Canada", CBEEDAC, April 2005.

[16] "Technical and Economic Analysis of Residential Tankless Water Heaters", March 2004, J. Overall, Union Gas

TWO-STAGE FURNACE WITH ECM

Efficient Technology & Equipment Description
Two-stage furnace with ECM (AFUE = 0.94)
Base Technology & Equipment Description
Mid efficiency furnace (80% AFUE)

Resource Savings Assumptions

Natural Gas	261 m^3

Natural gas savings claims are based on HOT200O V 9.1 assessment for Union Gas franchise territory[7]. The assessment is based on a 1800 ft2 single-story house located in London (Union Gas South) and North Bay (Union Gas North) built in 2003, with 3 occupants, partially insulated heated basement. The analysis assumes the efficiency of two-stage furnaces is 94% based on a manufacturer survey[7]. The generally higher AFUEs found in two-stage furnaces with ECMs is commented on in a Home Energy article, "It is worth noting that the reduced electricity draw by ECM furnaces means less waste motor heat in the home during the winter, which could be expected to increase gas consumption slightly… the AFUE of the ECM furnaces in the study averages about two percentage points higher, which would largely offset this amount."[17] Winter electric savings attributable to the higher efficiency ECM are assumed to be compensated by an increase in natural gas consumption. The fan electricity savings are converted into equivalent m3 (assuming 94% AFUE furnace) and deducted from the gross natural gas savings. The single savings number is weighted average of Union Gas South (70%) and Union Gas North (30%) savings estimates.

New Construction - Two Stage Furnace with ECM

	Natural Gas	Electricity		Incremental Cost
	m3	Total kWh	Winter kWh	
South	249	566	417	$1,510
North	289	614	450	$1,685
Combined	**261**	**580**		**$1,563**

Electricity	580 kWh

A standard fan (400W heating / 450W cooling) is assumed for the base case, the high efficiency fan (95W heating / 110W cooling) is assumed. With 50% over-sizing, the heating/cooling seasons have 1440 h / 337 h for Union South and 1567 h / 136 h for Union North. The single savings number is weighted average of Union Gas South (70%) and Union Gas North (30%) savings estimates.

Water	n/a L

Other Input Assumptions

Equipment Life	18 years
Two-stage, high efficiency furnace has an estimated service of 18 years.[8]	
Incremental Cost (Cust. / Contr. Install)	**- $1563**
The incremental cost is based on a pricing survey of 15 contractors in the Union Gas franchise area. The single incremental cost number is weighted average of Union Gas South (70%) and Union Gas North (30%) average incremental costs.	
Free Ridership	**30 %**
Free-ridership rate as per 2005 ADR Settlement – EB-2005-0211 for high efficiency furnaces.[4]	

[17] "The Electric Side of Gas Furnaces", Home Energy, November/December 2003.

WASTE WATER HEAT RECOVERY

Efficient Technology & Equipment Description
Waste water heat recovery
Base Technology & Equipment Description
No waste water heat recovery

Resource Savings Assumptions

Natural Gas	267 m^3
Natural gas savings claims are based on a Natural Resources Canada (NRCan) document describing waste water heat recovery system energy credits for houses. NRCan provides a savings credit of 10.1 GJ (~ 267 m3) for a natural gas heated domestic water hot water system[18].	
Electricity	**n/a kWh**
Water	**n/a L**

Other Input Assumptions

Equipment Life	30 years
Waste water heat recovery systems have an estimated service life of 30+ years[19].	
Incremental Cost (Cust. / Contr. Install)	**- $625**
Enbridge reference from analysis of ET field installations. DOE reports "Prices for drain-water heat recovery systems range from $300 to $500. You'll need a qualified plumbing and heating contractor to install the system. Installation will usually be less expensive in new home construction."[20]	
Free Ridership	**0 %**
As approved in the Enbridge Partial Decision EB 2005-0001.	

[18] Energy Credits for the Use of Drainwater Heat Recovery System for Houses, Natural Resources Canada.

[19] http://www.gfxstar.ca

[20] Energy Efficiency and Renewable Energy Consumer's Guide: Drain Water Heat Recovery; http://www.eere.doe.gov/consumer/your_home/water_heating

RESIDENTIAL - EXISTING HOMES

Efficient Equipment & Technologies	Base Equipment & Technologies	Load Type	Resource Savings Assumptions			Equipment Life	Incremental Cost		Free Ridership
			Natural Gas	Electricity	Water		Customer Installed	Contractor Installed	
			m3	kWh	L	Years			%
EXISTING HOMES									
Condensing Boiler - up to 299 Mbtu/h	Standard Boiler	weather	925	-	-	25	-	$1,300	0%
Condensing Gas Water Heater	Storage Tank Water Heater	base	203	-	-	9	-	$1,000	0%
Energy Star Clothes Washer	Standard Clothes Washer	base	55	31	28,731	13	-	$350	8%
Energy Star Window	Standard Window	weather	13	16	-	25	-	$52	20%
Enhanced Furnace	Mid-Efficiency Furnace	weather	320	730	-	18	-	$1,200	10%
Faucet Aerator	Faucet w/o aerator	base	17	-	7,592	10	$2	-	10%
Heat Traps	Storage Tank Water Heater w/o heat trap	base	73	0	0	10	-	$80	0%
High Efficiency Furnace	Mid-Efficiency Furnace	weather	385	-	-	18	-	$650	48%
Home Rewards w/o Program. Thermo	Existing Home Sample	weather	1,321	300	0	25	-	$2,708	8%
Low-Flow Showerhead	Average Existing Stock	base	134	-	27,634	10	$5	$15	10%
Pipe Insulation	Water Heater w/o pipe insulation	base	17	-	-	15	$1	$4	4%
Power Comb. Boiler - up to 299 Mbtu/h	Standard Boiler	weather	659	-	-	25	-	$500	51%
Programmable Thermostat	Standard Thermostat	weather	212	100	-	18	-	$65	11%
Tankless Water Heater	Storage Tank Water Heater	base	203	-	-	20	-	$650	0%
Two-Stage Furnace with ECM	Mid-Efficiency Furnace	weather	332	535	-	18	-	$1,563	30%
Waste Water Heat Recovery	No heat recovery	base	267	-	-	30	-	$625	0%

CONDENSING BOILER (< 299 MBtu/h)

Efficient Technology & Equipment Description
Condensing boiler (90% efficient)
Base Technology & Equipment Description
Standard boiler (standing pilot, chimney vented, no stack damper)

Resource Savings Assumptions

Natural Gas	925 m^3
Natural gas savings claims are based on HOT2XP assessment for Union Gas franchise territory. The assessment is based on a 1500 ft2 built in 1965 with modest insulation and air tightness upgrades (same upgrades as used in furnace savings[7]). The single savings number is 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.[8,3]	
Incremental Cost (Cust. / Contr. Install)	**- $1300**
The incremental cost is estimated at $1300.	
Free Ridership	**0 %**
Free-ridership rate as per 2005 ADR Settlement – EB-2005-0211.[4]	

CONDENSING GAS WATER HEATER

Efficient Technology & Equipment Description
Condensing storage tank water heater (EF = 0.86)
Base Technology & Equipment Description
Non-condensing storage tank water heater (EF = 0.59)

Resource Savings Assumptions

Natural Gas	203 m^3

Natural gas savings claims are based calculations using the U.S. Department of Energy's Water Heater Analysis Model[12]. Calculations use assumptions of a typical family of 2.7 (assumed to use (2.7/4) of the nominal water use of a typical family of 4, i.e. 64.3 gallons x (2.7/4) = 43.4 gallons = 164 L)[13]. The single savings number is weighted average of Union Gas South (70%) and Union Gas North (30%) savings estimates.

	Conventional		Condensing	
Daily Water Draw (USG)	43.4			
Energy Factor	0.59		0.86	
Storage Volume (USG)	40		34	
Input (Btu/h)	35,000		100,000	
Recovery Efficiency	0.78		0.94	
Water Outlet Temperature (F)	135			
Room Temperature (F)	68			
Annual Gas Consumption (m3) S/N	571	599	369	393

	South	North
NATURAL GAS SAVINGS (m3)	202	206
AVERAGE GAS SAVINGS (m3)	203	

Electricity	n/a kWh
Water	**n/a L**

Other Input Assumptions

Equipment Life	9 years
Condensing water heaters have an estimated service life of 9 years[21].	
Incremental Cost (Cust. / Contr. Install)	**- $1000**
The incremental cost is estimated at $1000.	
Free Ridership	**0 %**
Free-ridership rate as per 2005 ADR Settlement – EB-2005-0211.[4]	

[21] Appliance Magazine, September 2005

ENERGY STAR CLOTHES WASHER

Efficient Technology & Equipment Description
Energy Star clothes washer
Base Technology & Equipment Description
Standard clothes washer

Resource Savings Assumptions

Natural Gas	55 m^3
Natural gas savings claims are determined from the U.S. Department of Energy's / Energy Star "Life Cycle Cost Estimate for Energy Star Qualified Residential Clothes Washer"[22]. This calculation assumes 8 loads of laundry per week with gas water heating. "The best energy performers are ENERGY STAR qualified clothes washers, which use 35 to 50 percent less water and at least 50 percent less energy per load than other washers. Presently, only standard-size clothes washers with minimum tub capacities of 45 L (1.6 cu. ft.) qualify for the ENERGY STAR mark. ENERGY STAR qualified clothes washers are available in both top- and front-loading models"[23].	
Electricity	**31 kWh**
Electricity savings claims are determined from the U.S. Department of Energy's / Energy Star "Life Cycle Cost Estimate for Energy Star Qualified Residential Clothes Washer".[22]	
Water	**28,731 L**
Water savings claims are determined from the U.S. Department of Energy's / Energy Star "Life Cycle Cost Estimate for Energy Star Qualified Residential Clothes Washer".[22]	

Other Input Assumptions

Equipment Life	13 years
Energy Star clothes washers have an estimated service life of 13 years.	
Incremental Cost (Cust. / Contr. Install)	**- $350**
Incremental cost is based on based a MoneySense article.[24] The American Council for an Energy Efficient Economy (ACEEE) reports an incremental cost of $200.[25]	
Free Ridership	**8 %**
Free-ridership rate as per 2005 ADR Settlement – EB-2005-0211 for front load washers.[4]	

[22] http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/CalculatorConsumerClothesWasher.xls
[23] EnerGuide Appliance Directory 2005, http://oee.nrcan.gc.ca/Publications/infosource/Pub/appliances/clothes-wash.cfm?attr=4
[24] http://www.moneysense.ca/spending/shopping_sense/article.jsp?content=20050505_174644_6612
[25] "Increasing Appliance Energy Savings by Looking Beyond Energy Star", Steve Nadel – ACEEE, 2004 Market Transformation Symposium.

ENERGY STAR WINDOW

Efficient Technology & Equipment Description
Energy Star window
Base Technology & Equipment Description
Standard window - double glazed, 12mm gap, no inert gas fill or low-e coating (approx R2)

Resource Savings Assumptions

Natural Gas	13 m^3
Natural gas savings claims were derived from HOT2XP simulations using typical existing home characteristics for the Union Gas franchise area[7]. Full descriptions of assumption are in Union Gas internal report[26]. The single savings number is weighted average of Union Gas South (70%) and Union Gas North (30%) savings estimates.	
Electricity	**16 kWh**
Electricity savings claims are based on information in Natural Resources Canada report[27]. Space Cooling savings for Union South (zone B) and Union North (zone C) were reported as space cooling: 54 MJ/m2 and 50 MJ/m2 respectively. Standard window is 1.1 m2 so space cooling electrical savings are calculated as follows: (54 MJ/m2) x (1.1 m2/window) / (3.6 MJ/kWh) = 16.5 kWh/window (50 MJ/m2) x (1.1 m2/window) / (3.6 MJ/kWh) = 15.3 kWh/window The single savings number is weighted average of Union Gas South (70%) and Union Gas North (30%) savings estimates.	
Water	**n/a L**

Other Input Assumptions

Equipment Life	25 years
Energy Star windows have an estimated service life of 25 years.	
Incremental Cost (Cust. / Contr. Install)	**- $52**
Incremental cost is based Natural Resource Canada report[27]. $43.75/m3 (South) x (1.1 m2/window) = $48/window $54.89/m3 (North) x (1.1 m2/window) = $60/window The single incremental cost number is weighted average of Union Gas South (70%) and Union Gas North (30%) incremental costs.	
Free Ridership	**20 %**
Free rider rate is the current free rider rate used by Union Gas.	

[26] "Rationale Behind Natural Gas (and Electrical) Savings Attributed to Updgrading Base-Technology Windows (R-2) to Energy Star® Rated Windows", Darryl Yahoda – Union Gas, August 2004.
[27] "Potential Savings for Energy Star Windows, Doors, and Skylights", Natural Resources Canada – prepared by Enermodal Engineering, January 2005.

ENHANCED FURNACE

Efficient Technology & Equipment Description
High efficiency furnace with ECM
Base Technology & Equipment Description
Mid efficiency furnace w/o PSC

Resource Savings Assumptions

Natural Gas	320 m^3
Impact on natural gas use from an ECM and the resulting decrease in savings from a high efficiency furnace are based on the Final Report on ECM Motors by the Canadian Centre for Housing Technology. Using the Enbridge high-efficiency furnace savings number of 385m3, the resulting savings is reduced to 320m3.	
Electricity	**730 kWh**
Canadian Centre for Housing Technology – Final Report on the Effects of ECM Furnace Motors on Electricity and Gas Use: Results from the CCHT Research Facility and Projections.	
Water	**n/a L**

Other Input Assumptions

Equipment Life	18 years
Enhanced furnaces have an estimated service life of 18 years.[8]	
Incremental Cost (Cust. / Contr. Install)	**- $1200**
Enhanced furnaces have an estimated incremental cost of $1200.	
Free Ridership	**10 %**
As approved in the 2006 Enbridge DSM Plan (EB-2005-0001)	

FAUCET AERATOR

Efficient Technology & Equipment Description
Faucet Aerator
Base Technology & Equipment Description
Standard faucet without aerator

Resource Savings Assumptions

Natural Gas	17 m^3
The representative hot water temperature for lavatory hand washing is 40°C.[28] With hot water supplied at 54°C (130 F) and the cold water inlet temperature assumed to be 10°C (50 F), the hot water fraction is 0.68 [40°C = x(54°C)+(1-x)(10°C) -> x = 0.68]. Using the water savings calculated below, the hot water savings are 5163 L/y (0.68 x 7592). To provide a conservative estimate, mixed flow (both hot and cold taps open), is assumed to occur 50% of the time. Therefore, the hot water savings is 2582 L/y. The natural gas saved by not having to heat this water is calculated from the energy difference between the hot water (@ 54°C) and the cold water (@10°C) divided by the efficiency to heat this water, i.e., the water heater's recovery efficiency (typically 78%).[29]	
Electricity	**n/a kWh**
Water	**7,592 L**
A standard faucet is assumed to have a flowrate of 16 L/s (4.2 USGPM).[30] A faucet with aerator is assumed to have a flowrate of 5.6 L/min (1.5 USGPM) – Note: Union provides aerators with 1.0 USGPM flowrate.[36] Assuming the faucet is run, on average, for two minutes/day the water savings attributable to the aerator is (16 – 5.6)L/min x 2 min/day x 365 days/yr = 7592 L/yr.	

Other Input Assumptions

Equipment Life	10 years
Faucet aerators have an estimated service life of 10 years.[31]	
Incremental Cost (Cust. / Contr. Install)	**$2 -**
Incremental cost is based on invoice for aerators purchased for Union Gas' ESK kits - Kitchen Delux Aerator ($1.90) and Dual Basin Aerator (1.0 GPM) ($0.48). A cost of $2 was used.	
Free Ridership	**10 %**
As approved in the Enbridge Partial Decision EB 2005-0001.	

[28] 2003 ASHRAE Applications Handbook (SI), Ch. 49.8 - Service Water Heating, Table 2.

[29] Faucet Aerator Savings Spreadsheet

[30] "Household Guide to Water Efficiency", CMHC, 2000.

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

HEAT TRAP

Efficient Technology & Equipment Description
Conventional gas water heater w/o heat trap
Base Technology & Equipment Description
Gas water heater with heat trap

Resource Savings Assumptions

Natural Gas	**73 m^3**
As approved in the 2006 Enbridge DSM Plan (EB-2005-0001).	
Electricity	**n/a kWh**
Water	**n/a L**

Other Input Assumptions

Equipment Life	**10 years**
As approved in the 2006 Enbridge DSM Plan (EB-2005-0001).	
Incremental Cost (Cust. / Contr. Install)	**- $80**
As approved in the 2006 Enbridge DSM Plan (EB-2005-0001).	
Free Ridership	**0 %**
As approved in the 2006 Enbridge DSM Plan (EB-2005-0001).	

HIGH EFFICIENCY FURNACE

Efficient Technology & Equipment Description
High efficiency furnace
Base Technology & Equipment Description
Mid-efficiency furnace

Resource Savings Assumptions

Natural Gas	385 m^3
Natural gas savings are based on Enbridge research that indicates the average consumption for a mid-efficiency furnace is 2,430 m3 and 2,045 m3 for a high efficiency furnace, suggesting annual savings of 385 m3 as approved in the Decision for the Enbridge 2006 DSM plan (EB-2005-0001).	
Electricity	**n/a kWh**
Water	**n/a L**

Other Input Assumptions

Equipment Life	18 years
High efficiency furnaces have an estimated service life of 18 years.[8,9]	
Incremental Cost (Cust. / Contr. Install)	**- $650**
The incremental cost is based on a pricing survey of 15 contractors in the Union Gas franchise area. The single incremental cost number is weighted average of Union Gas South (70%) and Union Gas North (30%) average incremental costs.	
Free Ridership	**48 %**
Estimate based on discrete choice modelling framework as reported in Appendix A of the 1999 DSM Plan (EBRO 497, Exhibit D2, Tab 6, Schedule 1).	

HOME REWARDS w/o PROGRAMMABLE THERMOSTAT

Efficient Technology & Equipment Description
Base Technology & Equipment Description
Existing Home Sample

Resource Savings Assumptions

Natural Gas	**1,321 m^3**
Based on the results from the Peterborough Project.	
Electricity	**300 kWh**
Based on the results from the Peterborough Project.	
Water	**n/a L**

Other Input Assumptions

Equipment Life	**25 years**
Estimated service life of retrofit measures.	
Incremental Cost (Cust. / Contr. Install)	**- $2,708**
As approved in the 2006 Enbridge DSM based on a detailed survey of EnerGuide for Houses retrofits as reported in EB-2005-0001 J36.1	
Free Ridership	**8 %**
Free ridership is based on the results from the Peterborough Project. Attribution of 50% as per Partial Decision for Enbridge 2006 DSM Plan (EB 2005-0001).	

LOW-FLOW SHOWERHEAD

Efficient Technology & Equipment Description
Low-flow showerhead
Base Technology & Equipment Description
Average existing stock (higher flow showerhead)

Resource Savings Assumptions

Natural Gas	134 m^3
Natural gas savings claims[32] are based on the reduction of hot water use achieved by switching from an average existing stock flow showerhead (3.75 USGPM) to a low-flow showerhead (2.0 USGPM). Savings are based on the assumption of 10 showers / week per showerhead[33] with an average showering time of 8 minutes[34]. Average existing stock showerheads are reported as 17.1 L/min (4.5 USGPM)[33] by Environment Canada and 14.8 L/min (3.9 USGPM) by the City of Toronto[35]	
Electricity	**n/a kWh**
Water	**27,634 L**
Water savings claims[32] are based on the reduction of water use (hot & cold) achieved by switching from a standard flow showerhead (3.75 USGPM) to a low-flow showerhead (2.0 USGPM).	

Other Input Assumptions

Equipment Life	10 years
Low flow showerheads have an estimated service life of 10 years.[31]	
Incremental Cost (Cust. / Contr. Install)	**$5 $15**
Invoice for ESK kits (Home Depot) has shower head cost of $3.15.[36] A cost of $5.00 was used. Enbridge reports $10 installation fee for showerhead program.	
Free Ridership	**10 %**
As approved in the Enbridge Partial Decision EB 2005-0001.	

[32] Low flow showerhead savings spreadsheet
[33] Environment Canada, http://www.ec.gc.ca/water/images/manage/effic/e_shower.htm
[34] Region of Waterloo, http://region.waterloo.on.ca
[35] City of Toronto, http://www.city.toronto.on.ca/watereff/water_saving_kits/indoor_kit.htm
[36] Home Depot ESK invoice

PIPE INSULATION

Efficient Technology & Equipment Description
Conventional storage tank water heater w/o pipe insulation
Base Technology & Equipment Description
Conventional storage tank water heater with pipe insulation

Resource Savings Assumptions

Natural Gas	17 m^3
Natural gas savings are based on : • City of Berkeley Energy & Sustainable Development estimates up to 14 therms/year or 40 m3 of gas/year[37] • Amalgamated Laboratories[38] reported that 35ft of ¾" copper pipe lost 3.14 kW/day more with un-insulated pipe than when insulated. This corresponds to 10,700 Btu/day for 35 feet or 1,000 Btu/M/d. Thus 2m of insulation might save 1,000 Btu/m/d* 2m*365*(1m3/35,300 Btu) = 21 m3. This is for a forced circulation system, natural convection would use less. Assuming 80% of the loss of a forced circulation system would give 21*.8 = 17 m3/y	
Electricity	**n/a kWh**
Water	**n/a L**

Other Input Assumptions

Equipment Life	15 years	
Pipe insulation has an estimated service life of 15 years.		
Incremental Cost (Cust. / Contr. Install)	**$1**	**$4**
Invoice for ESK kits (Home Depot) has a pipe insulation cost of $0.29/m.[36] Union provides 2 m and Enbridge provides 3 m. Enbridge reports $3 installation fee for pipe insulation.		
Free Ridership	**4 %**	
Free-ridership rate as per Enbridge 2003 ADR Settlement (RP2002-0133).		

[37] City of Berkeley & Sustainable Development
[38] http://www.envirotech.com/tests.html

POWER COMBUSTION BOILER (< 299 MBtu/h)

Efficient Technology & Equipment Description
Power combustion boiler (80% efficient, induced draft)
Base Technology & Equipment Description
Standard boiler (standing pilot, chimney vented, no stack damper)

Resource Savings Assumptions

Natural Gas	659 m^3
Natural gas savings claims are based on HOT2XP assessment for Union Gas franchise territory. The assessment is based on a 1500 ft2 built in 1965 with modest insulation and air tightness upgrades (same upgrades as used in furnace savings[1]). The single savings number is 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
Power combustion boilers have an estimated service life of 25 years.[8,3]	
Incremental Cost (Cust. / Contr. Install)	**- $500**
Incremental cost is estimated at $500.	
Free Ridership	**51 %**
Free-ridership rate as per 2005 ADR Settlement – EB-2005-0211.[4]	

PROGRAMMABLE THERMOSTAT

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

Resource Savings Assumptions

Natural Gas	212 m^3

Enbridge conducted load research in 1997 which indicated savings of 8.1% per year Based on the average annual consumption for Enbridge at the time (2,652m^3).[39] Union Gas estimates natural gas savings based on percentage savings (10% - corresponding to an 18°C night and day setback), reported in CCHT report applied to HOT2XP simulation results[7]. The single savings number is weighted average of Union Gas South (70%) and Union Gas North (30%) savings estimates and is similar to the savings reported by Enbridge.

Union Gas Programmable Thermostat Savings

	South	North
Space Heating Consumption (90% AFUE Furnace) [m3]	1,888	2,620
Programmable Thermostat Savings (10%)	189	262
Weighting	70%	30%
Single Savings Number	211	

Electricity	100 kWh

The electricity savings are based on percentage savings (11% - corresponding to a 25°C day set-forward), reported in CCHT report[10]. An NRCan report on energy efficiency trends in Canada states that "A central air conditioner is used to cool a larger space such as a house. This type of unit (32,000 Btu per hour) can use about 1969 to 2317 kWh in a cooling season."[11] The average consumption is 2143 kWh. This is value is similar to the 2000 kWh used in Ontario Hydro's End Use model[Error! Bookmark not defined.]. The savings from a 25°C set-forward strategy is taken as 10% of 2000 kWh, that is, 200 kWh. A 50% saturation rate for central air-conditioning in existing homes is assumed to further discount the savings.

Water	n/a L

Other Input Assumptions

Equipment Life	18 years
Programmable thermostats have an estimated service life of 18 years (assumed to have the same life as a furnace).	
Incremental Cost (Cust. / Contr. Install)	**- $65**
Based on average thermostat cost from Enbridge survey of major home renovation and hardware chains.	
Free Ridership	**11 %**
Free-ridership rate based on Enbridge Residential Market Survey 2000.	

[39] "Impact of 1997 Programmable Thermostat Program", reported at Consultative #14.

TANKLESS WATER HEATER

Efficient Technology & Equipment Description
Tankless water heater (EF = 0.82)
Base Technology & Equipment Description
Storage tank water heater (EF = 0.58)

Resource Savings Assumptions

Natural Gas	203 m^3
Natural gas savings claims are based on Exelon Services Report[40]. This savings estimate is similar to Union estimate of 206 m3 (see Tankless Water Heater – New Construction).	
Electricity	**n/a kWh**
Water	**n/a L**

Other Input Assumptions

Equipment Life	20 years
Tankless water heaters have an estimated service life of 20 years.[14,15]	
Incremental Cost (Cust. / Contr. Install)	**- $650**
Tankless water heaters have an equipment life that is approximately twice that of a conventional storage tank water heater. A representative tankless water heater (Rinnai 2532 FFU) has an installed cost of $1800[16] compared with a PV50 from Union Energy at $850. Assuming a purchase of a second conventional tank type water heater will be required in 10 years at a cost in current dollars of approximately $300 (≈ $850/[1.1^10]), the incremental cost of a tankless water heater is $1800 - $850 - $300 = $650.	
Free Ridership	**0 %**
As approved in the Enbridge Partial Decision EB 2005-0001.	

[40] Exelon Services Report, December 2002

TWO-STAGE FURNACE WITH ECM

Efficient Technology & Equipment Description
Two-stage furnace with ECM (AFUE = 0.94)
Base Technology & Equipment Description
Mid efficiency furnace (80% AFUE)

Resource Savings Assumptions

Natural Gas	340 m^3

Natural gas savings claims are based on HOT200O V 9.1 assessment for Union Gas franchise territory[7]. The assessment is based on a 1500 ft2 single-story house located in London (Union Gas South) and North Bay (Union Gas North) built in 2003, with 3 occupants, partially insulated heated basement. The analysis assumes the efficiency of two-stage furnaces is 94% based on a manufacturer survey[7]. Winter electric savings attributable to the higher efficiency ECM are assumed to be compensated by an increase in natural gas consumption. The fan electricity savings are converted into equivalent m3 (assuming 94% AFUE furnace) and deducted from the gross natural gas savings. The single savings number is weighted average of Union Gas South (70%) and Union Gas North (30%) savings estimates.

Existing Homes - Two Stage Furnace with ECM

	Natural Gas m3	Electricity Total kWh	Electricity Winter kWh	Incremental Cost
South	298	550	446	$1,510
North	437	500	486	$1,685
Combined	**340**	**535**		**$1,563**

Electricity	535 kWh

A standard fan (400W heating / 450W cooling) is assumed for the base case, the high efficiency fan (95W heating / 110W cooling) is assumed. With 50% over-sizing, the heating/cooling seasons have 1440 h / 337 h for Union South and 1567 h / 136 h for Union North. The single savings number is weighted average of Union Gas South (70%) and Union Gas North (30%) savings estimates.

Water	n/a L

Other Input Assumptions

Equipment Life	18 years

Two-stage, high efficiency furnaces have an estimated service life of 18 years.[8]

Incremental Cost (Cust. / Contr. Install)	- $1563

The incremental cost is based on a pricing survey of 15 contractors[Error! Bookmark not defined.] in the Union Gas franchise area. The single incremental cost number is weighted average of Union Gas South (70%) and Union Gas North (30%) average incremental costs.

Free Ridership	30 %

Free-ridership rate as per 2005 ADR Settlement – EB-2005-0211 for "high-efficiency furnace with fan".[4]

WASTE WATER HEAT RECOVERY

Efficient Technology & Equipment Description
Waste water heat recovery
Base Technology & Equipment Description
No waste water heat recovery

Resource Savings Assumptions

Natural Gas	267 m^3
Natural gas savings claims are based on a Natural Resources Canada (NRCan) document describing waste water heat recovery system energy credits for houses.[18] NRCan provides a savings credit of 10.1 GJ (~ 267 m3) for a natural gas heated domestic water hot water system.	
Electricity	**n/a kWh**
Water	**n/a L**

Other Input Assumptions

Equipment Life	30 years
Waste water heat recovery systems have an estimated service life of 30 years.[19]	
Incremental Cost (Cust. / Contr. Install)	**- $625**
Enbridge reference from analysis of ET field installations.	
Free Ridership	**0 %**
As approved in the Enbridge Partial Decision EB 2005-0001.	

LOW INCOME

Efficient Equipment & Technologies	Base Equipment & Technologies	Load Type	Resource Savings Assumptions			Equipment Life	Incremental Cost		Free Ridership
			Natural Gas	Electricity	Water				
			m3	kWh	L	Years	Customer Installed	Contractor Installed	%
LOW INCOME									
Faucet Aerator	Faucet w/o aerator	base	17	-	7,592	10	$2	-	0%
Low-Flow Showerhead	Average Existing Stock	base	134	-	27,634	10	$5	$15	0%
Pipe Insulation	Water Heater w/o pipe insulation	base	17	-	-	15	-	$4	0%
Programmable Thermostat	Standard Thermostat	weather	212	-	-	18	-	$90	0%

FAUCET AERATOR

Efficient Technology & Equipment Description
Faucet Aerator
Base Technology & Equipment Description
Standard faucet without aerator

Resource Savings Assumptions

Natural Gas	17 m^3
The representative hot water temperature for lavatory hand washing is 40°C.[28] With hot water supplied at 54°C (130 F) and the cold water inlet temperature assumed to be 10°C (50 F), the hot water fraction is 0.68 [40°C = x(54°C)+(1-x)(10°C) -> x = 0.68]. Using the water savings calculated below, the hot water savings are 5163 L/y (0.68 x 7592). To provide a conservative estimate, mixed flow (both hot and cold taps open), is assumed to occur 50% of the time. Therefore, the hot water savings is 2582 L/y. The natural gas saved by not having to heat this water is calculated from the energy difference between the hot water (@ 54°C) and the cold water (@10°C) divided by the efficiency to heat this water, i.e., the water heater's recovery efficiency (typically 78%).[29]	
Electricity	**n/a kWh**
Water	**7,592 L**
A standard faucet is assumed to have a flowrate of 16 L/s (4.2 USGPM).[30] A faucet with aerator is assumed to have a flowrate of 5.6 L/min (1.5 USGPM) – Note: Union provides aerators with 1.0 USGPM flowrate.[36] Assuming the faucet is run, on average, for two minutes/day the water savings attributable to the aerator is (16 – 5.6)L/min x 2 min/day x 365 days/yr = 7592 L/yr.	

Other Input Assumptions

Equipment Life	10 years
Faucet aerators have an estimated service life of 10 years.[31]	
Incremental Cost (Cust. / Contr. Install)	**$2 -**
Incremental cost is based on invoice for aerators purchased for Union Gas' ESK kits - Kitchen Delux Aerator ($1.90) and Dual Basin Aerator (1.0 GPM) ($0.48). A cost of $2 was used.	
Free Ridership	**0 %**
Free-ridership rate assumed to be 0% for all Low Income measures.	

LOW-FLOW SHOWERHEAD

Efficient Technology & Equipment Description
Low-flow showerhead
Base Technology & Equipment Description
Average existing stock (higher flow showerhead)

Resource Savings Assumptions

Natural Gas	134 m^3
Natural gas savings claims[32] are based on the reduction of hot water use achieved by switching from an average existing stock flow showerhead (3.75 USGPM) to a low-flow showerhead (2.0 USGPM). Savings are based on the assumption of 10 showers / week per showerhead[33] with an average showering time of 8 minutes[34]. Average existing stock showerheads are reported as 17.1 L/min (4.5 USGPM)[33] by Environment Canada and 14.8 L/min (3.9 USGPM) by the City of Toronto.[35]	
Electricity	**n/a kWh**
Water	**27,634 L**
Water savings claims[32] are based on the reduction of water use (hot & cold) achieved by switching from a standard flow showerhead (3.75 USGPM) to a low-flow showerhead (2.0 USGPM).	

Other Input Assumptions

Equipment Life	10 years
Low flow showerheads have an estimated service life of 10 years.[31]	
Incremental Cost (Cust. / Contr. Install)	**$15**
Invoice for ESK kits (Home Depot) has shower head cost of $3.15.[36] Enbridge reports $10 installation fee for showerhead program.	
Free Ridership	**0 %**
Free-ridership rate assumed to be 0% for all Low Income measures.	

PIPE INSULATION

Efficient Technology & Equipment Description
Conventional storage tank water heater w/o pipe insulation
Base Technology & Equipment Description
Conventional storage tank water heater with pipe insulation

Resource Savings Assumptions

Natural Gas	17 m^3
Natural gas savings are based on : • City of Berkeley Energy & Sustainable Development[37] estimates up to 14 therms/year or 40 m3 of gas/year • Amalgamated Laboratories[38] reported that 35ft of ¾" copper pipe lost 3.14 kW/day more with un-insulated pipe than when insulated. This corresponds to 10,700 Btu/day for 35 feet or 1,000 Btu/M/d. Thus 2m of insulation might save 1,000 Btu/m/d* 2m*365*(1m3/35,300 Btu) = 21 m3. This is for a forced circulation system, natural convection would use less. Assuming 80% of the loss of a forced circulation system would give 21*.8 = 17 m3/y	
Electricity	**n/a kWh**
Water	**n/a L**

Other Input Assumptions

Equipment Life	15 years
Pipe insulation has an estimated service life of 15 years.	
Incremental Cost (Cust. / Contr. Install)	**$4**
Invoice for ESK kits (Home Depot) has a pipe insulation cost of $0.29/m.[36] Union provides 2 m and Enbridge provides 3 m. Enbridge reports $3 installation fee for pipe insulation.	
Free Ridership	**0 %**
Free-ridership rate assumed to be 0% for all Low Income measures.	

PROGRAMMABLE THERMOSTAT

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

Resource Savings Assumptions

Natural Gas	212 m^3

Enbridge conducted load research in 1997 which indicated savings of 8.1% per year. The average annual consumption for Enbridge is 2,652m3.[41] Union Gas estimates natural gas savings based on percentage savings (10% - corresponding to an 18°C night and day setback), reported in CCHT report applied to HOT2XP simulation results[7]. The single savings number is weighted average of Union Gas South (70%) and Union Gas North (30%) savings estimates and is similar to the savings reported by Enbridge.

Union Gas Programmable Thermostat Savings

	South	North
Space Heating Consumption (90% AFUE Furnace) [m3]	1,888	2,620
Programmable Thermostat Savings (10%)	189	262
Weighting	70%	30%
Single Savings Number	211	

Electricity	100 kWh

The electricity savings are based on percentage savings (11% - corresponding to a 25°C day set-forward), reported in CCHT report[10]. An NRCan report on energy efficiency trends in Canada states that "A central air conditioner is used to cool a larger space such as a house. This type of unit (32,000 Btu per hour) can use about 1969 to 2317 kWh in a cooling season."[11] The average consumption is 2143 kWh. This is value is similar to the 2000 kWh used in Ontario Hydro's End Use model. The savings from a 25°C set-forward strategy is taken as 10% of 2000 kWh, that is, 200 kWh. A 50% saturation rate for central air-conditioning in existing homes is assumed to further discount the savings.

Water	n/a L

Other Input Assumptions

Equipment Life	18 years

Programmable thermostats have an estimated service life of 18 years (assumed to be the same as a furnace).

Incremental Cost (Cust. / Contr. Install)	- $90

The programmable thermostat cost is based on average thermostat costs from Enbridge survey of major home renovation and hardware chains. Enbridge reports an installation cost of $25.

Free Ridership	0 %

Free-ridership rate assumed to be 0% for all Low Income measures.

COMMERCIAL - NEW BUILDING CONSTRUCTION

Efficient Equipment & Technologies	Base Equipment & Technologies	Load Type	Resource Savings Assumptions			Equipment Life	Incremental Cost		Free Ridership
			Natural Gas	Electricity	Water		Customer Installed	Contractor Installed	
			m3	kWh	L	Years			%
NEW BUILDING CONSTRUCTION									
Condensing Gas Water Heater	Storage Tank Water Heater	base	1,750	-	-	15	-	$4,200	5%
Rooftop Unit	Standard Rooftop Unit	weather	1,275	-	-	20	-	$1,250	0%
Programmable Thermostats	Standard Thermostat	weather	519	921	-	18	-	$65	11%
Tankless Water Heater	Storage Tank Water Heater	base	825	-	-	20	-	$2,200	0%

CONDENSING GAS WATER HEATER

Efficient Technology & Equipment Description
Condensing storage tank water heater (EF = 0.86)
Base Technology & Equipment Description
Non-condensing storage tank water heater (EF = 0.59)

Resource Savings Assumptions

Natural Gas	**1750**	**m^3**
Natural gas savings claims are based on Union Gas Commercial Water Heater Comparison Screening Tool using a typical full service restaurant water draw of 950 gallons/day.[41]		
Electricity	**n/a**	**kWh**
Water	**n/a**	**L**

Other Input Assumptions

Equipment Life	**15**	**years**
Condensing gas water heaters have an estimated service life of 15 years.[42]		
Incremental Cost (Cust. / Contr. Install)	**-**	**$4,200**
Condensing gas water heaters have an estimated cost of $5,000 and ASHRAE 90.1b tank has an estimated cost of $800 – therefore the incremental cost is $4,200.[42]		
Free Ridership		**5 %**
Free-ridership rate as per 2005 ADR Settlement – EB-2005-0211.[4]		

[41] "Union Gas Commercial Water Heater Comparison Screening Tool" output for commercial condensing water heater

[42] "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.

ROOFTOP UNIT

Efficient Technology & Equipment Description
Two-stage rooftop units
Base Technology & Equipment Description
Single-stage rooftop units

Resource Savings Assumptions

Natural Gas	1275	m^3
The natural gas savings are estimated from the difference in annual gas consumption from single-stage to two-stage operation.[42]		
Electricity	**n/a**	**kWh**
Water	**n/a**	**L**

Other Input Assumptions

Equipment Life	20	years
Rooftop units have an estimated service life of 20 years.		
Incremental Cost (Cust. / Contr. Install)	**-**	**$1,250**
The incremental cost of two-stage rooftop units compared with single-stage units is $1250.[42]		
Free Ridership	**0**	**%**
Free-ridership rate as per 2005 ADR Settlement – EB-2005-0211.[4]		

PROGRAMMABLE THERMOSTAT

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

Resource Savings Assumptions

Natural Gas	519	m^3

The natural gas savings are based on average space heating gas consumption for office buildings in the Union Gas franchise area. The savings are determined using the same methodology used for the residential programmable thermostat savings which were based on a CCHT report.[10]

Normalized Use per customer 2003

Segment	J	F	M	A	M	J	J	A	S	O	N	D	Total
Office Total	1693	2274	1782	1235	750	367	246	208	240	325	798	1143	
Assume baseload is average of June - Sept consumption												265	
Space heating	1427	2009	1517	970	485	101				59	533	878	**7979**

From CCHT report, 18 C night setback results in 6.5% annual gas savings **519** **m3**

Electricity	921	kWh

The electricity savings are determined using the same methodology used for the residential programmable thermostat savings. It is assumed that a night-time / weekend "setforward" strategy is suitable for office buildings and that this will result in similar savings to the day setforward strategy. The electricity consumption for air conditioning is assumed to be proportional to the gas consumption with the same ratio as residential. From HOT2XP residential simulations, the ratio of space cooling to space heating was found to be 1.05 kWh/m3. Applying this ratio to the space heating gas consumption result, the annual space cooling electricity consumption is estimated to be 8370 kWh. Applying the 11% electricity savings, reported in the CCHT report[10], to this derived consumption results in estimated savings of 921 kWh.

Water	n/a	L

Other Input Assumptions

Equipment Life	18	years

Programmable thermostats have an estimated service life of 18 years (assumed to be the same as a furnace).

Incremental Cost (Cust. / Contr. Install)	-	$65

Based on average thermostat cost from Enbridge survey of major home renovation and hardware chains.

Free Ridership	11	%

Free ridership for the small commercial sector is estimated as 11%.

TANKLESS WATER HEATER

Efficient Technology & Equipment Description
Tankless water heater
Base Technology & Equipment Description
Conventional storage tank water heater (140 US Gallon)

Resource Savings Assumptions

Natural Gas	825	m^3
Natural gas savings claims are based on Union Gas Commercial Water Heater Comparison Screening Tool using a typical full service restaurant water draw of 950 gallons/day.[43]		
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 estimate of "20+ years".[14,15]		
Incremental Cost (Cust. / Contr. Install)	**-**	**$2,200**
Incremental cost is estimated at $2,200.		
Free Ridership	**0**	**%**
Free-ridership rate is current rate used by Union Gas.		

[43] "Union Gas Commercial Water Heater Comparison Screening Tool" output for commercial tankless water heater

COMMERCIAL - EXISTING BUILDINGS

Efficient Equipment & Technologies	Base Equipment & Technologies	Load Type	Resource Savings Assumptions			Equipment Life	Incremental Cost		Free Ridership
			Natural Gas	Electricity	Water		Customer Installed	Contractor Installed	
			m3	kWh	L	Years			%
EXISTING BUILDINGS									
Condensing Gas Water Heater	Storage Tank Water Heater	base	1,750	-	-	15	-	$4,200	5%
Faucet Aerators	Faucet w/o aerator	base	17	-	7,592	10	$2	-	10%
High Efficiency Furnace	Mid-Efficiency Furnace	weather	385	-	-	18	-	$650	10%
Low-Flow Showerhead	Average Existing Stock	base	134	-	27,634	10	$5	$15	10%
Pre-Rinse Spray Nozzle	Average Existing Stock	base	2,434	-	432,800	5	-	$100	5%
Programmable Thermostats	Standard Thermostat	weather	519	921	-	18	-	$65	11%
Rooftop Unit	Standard Rooftop Unit	weather	1,275	-	-	20	-	$1,250	0%
Tankless Water Heater	Storage Tank Water Heater	base	825	-	-	20	-	$2,200	0%
Two-Stage Furnace with ECM	Mid-Efficiency Furnace	weather	332	535	-	18	-	$1,563	30%
Water Tank De-liming	Storage Tank Water Heater (with liming)	base	1,033	-	-	3	-	$150	0%

CONDENSING GAS WATER HEATER

Efficient Technology & Equipment Description
Condensing storage tank water heater (EF = 0.86)
Base Technology & Equipment Description
Non-condensing storage tank water heater (EF = 0.59)

Resource Savings Assumptions

Natural Gas	1750	m^3
Natural gas savings claims are based on Union Gas Commercial Water Heater Comparison Screening Tool using a typical full service restaurant water draw of 950 gallons/day.[41]		
Electricity	**n/a**	**kWh**
Water	**n/a**	**L**

Other Input Assumptions

Equipment Life	15	years
Condensing gas water heaters have an estimated service life of 15 years.		
Incremental Cost (Cust. / Contr. Install)	**-**	**$4,200**
Condensing gas water heaters have an estimated cost of $5,000 and ASHRAE 90.1b tank has an estimated cost of $800 – therefore the incremental cost is $4,200.		
Free Ridership	**5**	**%**
Free-ridership rate as per 2005 ADR Settlement – EB-2005-0211.[4]		

FAUCET AERATOR

Efficient Technology & Equipment Description
Faucet Aerator
Base Technology & Equipment Description
Standard faucet without aerator

Resource Savings Assumptions

Natural Gas	17 m^3
The representative hot water temperature for lavatory hand washing is 40°C.[28] With hot water supplied at 54°C (130 F) and the cold water inlet temperature assumed to be 10°C (50 F), the hot water fraction is 0.68 [40°C = x(54°C)+(1-x)(10°C) -> x = 0.68]. Using the water savings calculated below, the hot water savings are 5163 L/y (0.68 x 7592). To provide a conservative estimate, mixed flow (both hot and cold taps open), is assumed to occur 50% of the time. Therefore, the hot water savings is 2582 L/y. The natural gas saved by not having to heat this water is calculated from the energy difference between the hot water (@ 54°C) and the cold water (@10°C) divided by the efficiency to heat this water, i.e., the water heater's recovery efficiency (typically 78%).[29]	
Electricity	**n/a kWh**
Water	**7,592 L**
A standard faucet is assumed to have a flowrate of 16 L/s (4.2 USGPM).[30] A faucet with aerator is assumed to have a flowrate of 5.6 L/min (1.5 USGPM) – Note: Union provides aerators with 1.0 USGPM flowrate. Assuming the faucet is run, on average, for two minutes/day the water savings attributable to the aerator is (16 – 5.6)L/min x 2 min/day x 365 days/yr = 7592 L/yr.	

Other Input Assumptions

Equipment Life	10 Years
Faucet aerators have an estimated service life of 10 years.[31]	
Incremental Cost (Cust. / Contr. Install)	**$2 -**
Incremental cost is based on invoice for aerators purchased for Union Gas' ESK kits – Kitchen Delux Aerator ($1.90) and Dual Basin Aerator (1.0 GPM) ($0.48).[36] A cost of $2 was used.	
Free Ridership	**10 %**
As approved in the Enbridge Partial Decision EB 2005-0001.	

HIGH EFFICIENCY FURNACE

Efficient Technology & Equipment Description
High efficiency furnace
Base Technology & Equipment Description
Mid-efficiency furnace

Resource Savings Assumptions

Natural Gas	385 m^3
Natural gas savings are based on Enbridge research that indicates the average consumption for a mid-efficiency furnace is 2,430 m3 and 2,045 m3 for a high efficiency furnace, suggesting annual savings of 385 m3 as approved in the Decision for the Enbridge 2006 DSM plan (EB-2005-0001).	
Electricity	**n/a kWh**
Water	**n/a L**

Other Input Assumptions

Equipment Life	18 Years
High efficiency furnaces have an estimated service life of 18 years.[8]	
Incremental Cost (Cust. / Contr. Install)	**- $650**
The incremental cost is based on a pricing survey of 15 contractors in the Union Gas franchise area. The single incremental cost number is weighted average of Union Gas South (70%) and Union Gas North (30%) average incremental costs.	
Free Ridership	**10 %**
Estimated free ridership for the small commercial sector is 10%.	

LOW-FLOW SHOWERHEAD

Efficient Technology & Equipment Description
Low-flow showerhead
Base Technology & Equipment Description
Average existing stock (higher flow showerhead)

Resource Savings Assumptions

Natural Gas	134 m^3
Natural gas savings claims[32] are based on the reduction of hot water use achieved by switching from an average existing stock flow showerhead (3.75 USGPM) to a low-flow showerhead (2.0 USGPM). Savings are based on the assumption of 10 showers / week per showerhead[33] with an average showering time of 8 minutes[34]. Average existing stock showerheads are reported as 17.1 L/min (4.5 USGPM)[33] by Environment Canada and 14.8 L/min (3.9 USGPM) by the City of Toronto[35].	
Electricity	**n/a kWh**
Water	**27,634 L**
Water savings claims[32] are based on the reduction of water use (hot & cold) achieved by switching from a standard flow showerhead (3.75 USGPM) to a low-flow showerhead (2.0 USGPM).	

Other Input Assumptions

Equipment Life	10 years
Low flow showerheads have an estimated service life of 10 years.[31]	
Incremental Cost (Cust. / Contr. Install)	**$5 $15**
Invoice for ESK kits (Home Depot) has shower head cost of $3.15.[36] A customer-installed cost of $5 was used. Enbridge reports $10 installation fee for showerhead program.	
Free Ridership	**10 %**
As approved in the Enbridge Partial Decision EB 2005-0001.	

PRE-RINSE SPRAY NOZZLE

Efficient Technology & Equipment Description
Low-flow pre-rinse spray nozzle
Base Technology & Equipment Description
Standard pre-rinse spray nozzle

Resource Savings Assumptions

Natural Gas	2434 m^3
Natural gas savings claims are based on the reduction of hot water use achieved by switching from a standard flow pre-rinse spray nozzle (3 USGPM)[44] to a low-flow pre-rinse spray nozzle(1.6 USGPM). Savings are based on the assumption of 3.75 hours of use per day[45], 363 days per year. Savings were determined using the Pre-Rinse Spray Nozzle Savings spreadsheet[46] which provides consistent results with the Food Service Technology Centre's "Pre-Rinse Spray Valve Calculator".[47]	
Electricity	**n/a kWh**
Water	**432,800 L**
Water savings claims[47,46] are based on the reduction of water use achieved by switching from a standard flow spray nozzle (3 USGPM) to a low-flow spray nozzle (1.6 USGPM).	

Other Input Assumptions

Equipment Life	5 years
Pre-rinse spray nozzles have an estimated service life of 5 years.[44,48]	
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[49]	
Free Ridership	**5 %**
A free ridership rate of 5% is based on Enbridge's consultation with distributor.	

[44] "How to Buy a Low Flow Pre-Rinse Spray Valve", DOE Bulletin WS-5, September 2004.
[45] Enbridge market survey of average usage
[46] Pre-Rinse Spray Nozzle Savings spreadsheet, Union Gas
[47] www.fishnick.com/tools/watercost/
[48] CEE Commercial Kitchens Initiative - Program Guidance on Pre-Rinse Spray Valves
[49] "Region of Waterloo – Pre-Rinse Spray Valve Pilot Study – Final Report", Veritec Consulting Inc., January 2005

PROGRAMMABLE THERMOSTAT

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

Resource Savings Assumptions

Natural Gas	519	m^3

The natural gas savings are based on average space heating gas consumption for office buildings in the Union Gas franchise area. The savings are determined using the same methodology used for the residential programmable thermostat savings which were based on a CCHT report.[10]

Normalized Use per customer 2003

Segment	J	F	M	A	M	J	J	A	S	O	N	D	Total
Office Total	1693	2274	1782	1235	750	367	246	208	240	325	798	1143	
Assume baseload is average of June - Sept consumption												265	
Space heating	1427	2009	1517	970	485	101				59	533	878	**7979**

From CCHT report, 18 C night setback results in 6.5% annual gas savings **519** **m3**

Electricity	921	kWh

The electricity savings are determined using the same methodology used for the residential programmable thermostat savings. It is assumed that a night-time / weekend "setforward" strategy is suitable for office buildings and that this will result in similar savings to the day setforward strategy. The electricity consumption for air conditioning is assumed to be proportional to the gas consumption with the same ratio as residential. From HOT2XP residential simulations, the ratio of space cooling to space heating was found to be 1.05 kWh/m3. Applying this ratio to the space heating gas consumption result, the annual space cooling electricity consumption is estimated to be 8370 kWh. Applying the 11% electricity savings, reported in the CCHT report[10], to this derived consumption results in estimated savings of 921 kWh.

Water	n/a	L

Other Input Assumptions

Equipment Life	18	years

Programmable thermostats have an estimated service life of 18 years (assumed to be the same as a furnace).

Incremental Cost (Cust. / Contr. Install)	-	$65

Based on average thermostat cost from Enbridge survey of major home renovation and hardware chains.

Free Ridership	10	%

Free ridership for the small commercial sector is estimated as 10%.

ROOFTOP UNIT

Efficient Technology & Equipment Description
Two-stage rooftop units
Base Technology & Equipment Description
Single-stage rooftop units

Resource Savings Assumptions

Natural Gas	1275	m^3
The natural gas savings are estimated from the difference in annual gas consumption from single-stage to two-stage operation.[42]		
Electricity	**n/a**	**kWh**
Water	**n/a**	**L**

Other Input Assumptions

Equipment Life	20	years
Rooftop units have an estimated service life of 20 years.		
Incremental Cost (Cust. / Contr. Install)	**-**	**$1,250**
The incremental cost of two-stage rooftop units compared with single-stage units is $1250.[42]		
Free Ridership	**0**	**%**
Free-ridership rate as per 2005 ADR Settlement – EB-2005-0211.[4]		

TANKLESS WATER HEATER

Efficient Technology & Equipment Description
Tankless water heater
Base Technology & Equipment Description
Conventional storage tank water heater (140 US Gallon)

Resource Savings Assumptions

Natural Gas	825	m^3
Natural gas savings claims are based on Union Gas Commercial Water Heater Comparison Screening Tool using a typical full service restaurant water draw of 950 gallons/day.[43]		
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 estimate of "20+ years".[14,15]		
Incremental Cost (Cust. / Contr. Install)	**-**	**$2,200**
The incremental cost of tankless water heater is estimated to be $2,200.		
Free Ridership	**0**	**%**
Free-ridership rate is current rate used by Union Gas.		

TWO-STAGE FURNACE WITH ECM

Efficient Technology & Equipment Description
Two-stage furnace with ECM (AFUE = 0.94)
Base Technology & Equipment Description
Mid efficiency furnace (80% AFUE)

Resource Savings Assumptions

Natural Gas	340 m^3

Natural gas savings claims are based on HOT200O V 9.1 assessment for Union Gas franchise territory[7]. The assessment is based on a 1500 ft2 single-story house located in London (Union Gas South) and North Bay (Union Gas North) built in 2003, with 3 occupants, partially insulated heated basement. The analysis assumes the efficiency of two-stage furnaces is 94% based on a manufacturer survey[7]. Winter electric savings attributable to the higher efficiency ECM are assumed to be compensated by an increase in natural gas consumption. The fan electricity savings are converted into equivalent m3 (assuming 94% AFUE furnace) and deducted from the gross natural gas savings. The single savings number is weighted average of Union Gas South (70%) and Union Gas North (30%) savings estimates.

Existing Homes - Two Stage Furnace with ECM

	Natural Gas	Electricity		Incremental Cost
	m3	Total kWh	Winter kWh	
South	298	550	446	$1,510
North	437	500	486	$1,685
Combined	**340**	**535**		**$1,563**

Electricity	535 kWh

A standard fan (400W heating / 450W cooling) is assumed for the base case, the high efficiency fan (95W heating / 110W cooling) is assumed. With 50% over-sizing, the heating/cooling seasons have 1440 h / 337 h for Union South and 1567 h / 136 h for Union North. The single savings number is weighted average of Union Gas South (70%) and Union Gas North (30%) savings estimates.

Water	n/a L

Other Input Assumptions

Equipment Life	18 years

Two-stage, high efficiency furnaces have an estimated service life of 18 years.[8]

Incremental Cost (Cust. / Contr. Install)	- $1563

The incremental cost is based on a pricing survey of 15 contractors in the Union Gas franchise area. The single incremental cost number is weighted average of Union Gas South (70%) and Union Gas North (30%) average incremental costs.

Free Ridership	30 %

Free-ridership rate as per 2005 ADR Settlement – EB-2005-0211 (Residential –New Home Construction – Furnace – High Efficiency w Fan).[4]

WATER TANK DELIMING

Efficient Technology & Equipment Description
De-limed storage tank water heater
Base Technology & Equipment Description
Storage tank water heater (with liming)

Resource Savings Assumptions

Natural Gas	**1,033**	**m^3**
Electricity	**n/a**	**kWh**
Water	**n/a**	**L**

Other Input Assumptions

Equipment Life	**3**	**years**
Incremental Cost (Cust. / Contr. Install)	**-**	**$150**
Free Ridership	**0**	**%**