Site Specific EF Examples - Mild Climate

Site Specific Water Heating EF with and without Drain Water Heat Recovery

Zone: "Mild" Climate			Average Annual Water Mains Temperature:		65	°F
Rated Energy Factor:	EF= 0.67		Recovery Efficiency:		η_r= 82%	
House Detail:	**1 Bedroom**	**2 Bedrooms**	**3 Bedrooms**	**4 Bedrooms**	**5 Bedrooms**	**6 Bedrooms**
Hot Water Load [gal/day]	**40**	**50**	**60**	**70**	**80**	**90**
DWHR Efficiency						
None	0.625	0.652	0.672	0.686	0.698	0.707
40%	0.771	0.813	0.843	0.867	0.885	0.900
50%	0.819	0.866	0.901	0.928	0.949	0.966
60%	0.873	0.927	0.967	0.998	1.022	1.042

Site Specific EF Examples - Hot Climate

Site Specific Water Heating EF with and without Drain Water Heat Recovery

Zone: "Hot" Climate Average Annual Water Mains Temperature: 75 °F

Rated Energy Factor: EF= 0.67 Recovery Efficiency: η_r= 82%

House Detail:	1 Bedroom	2 Bedrooms	3 Bedrooms	4 Bedrooms	5 Bedrooms	6 Bedrooms
Hot Water Load [gal/day]	40	50	60	70	80	90
DWHR Efficiency						
None	0.649	0.673	0.690	0.703	0.713	0.721
40%	0.809	0.846	0.873	0.894	0.910	0.922
50%	0.862	0.904	0.935	0.959	0.977	0.992
60%	0.922	0.971	1.007	1.034	1.055	1.072

So in Summary....

A Water Heater with Rated EF=.67:

Will have a Site Specific EF ranging from:

0.613 (cold climate 2 bedroom home)

to

0.713 (hot climate 5 bedroom home)

A Water Heater with Rated EF=.67 and **DWHR Rated Efficiency=60%**:

Will have a Site Specific EF ranging from:

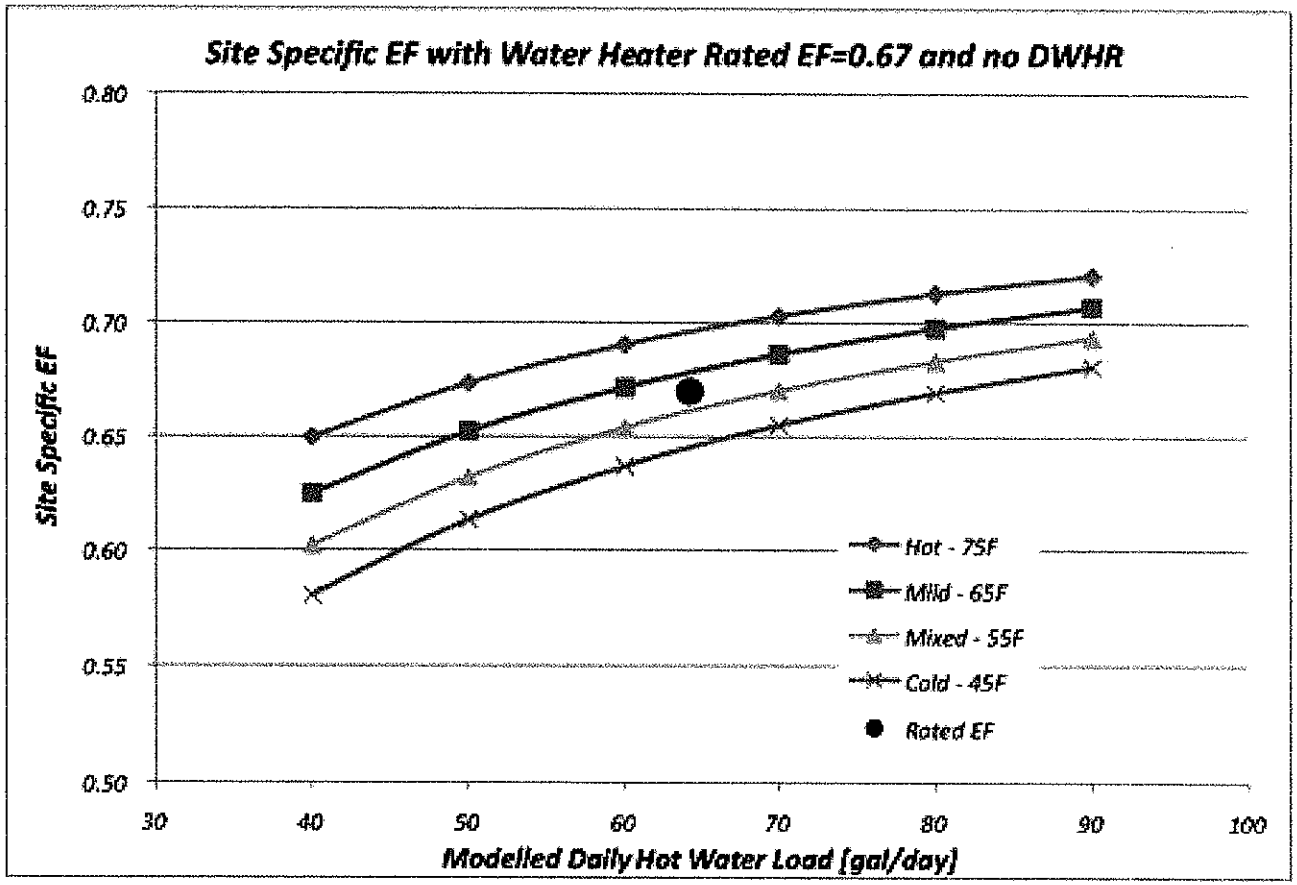
0.850 (cold climate 2 bedroom home)

to

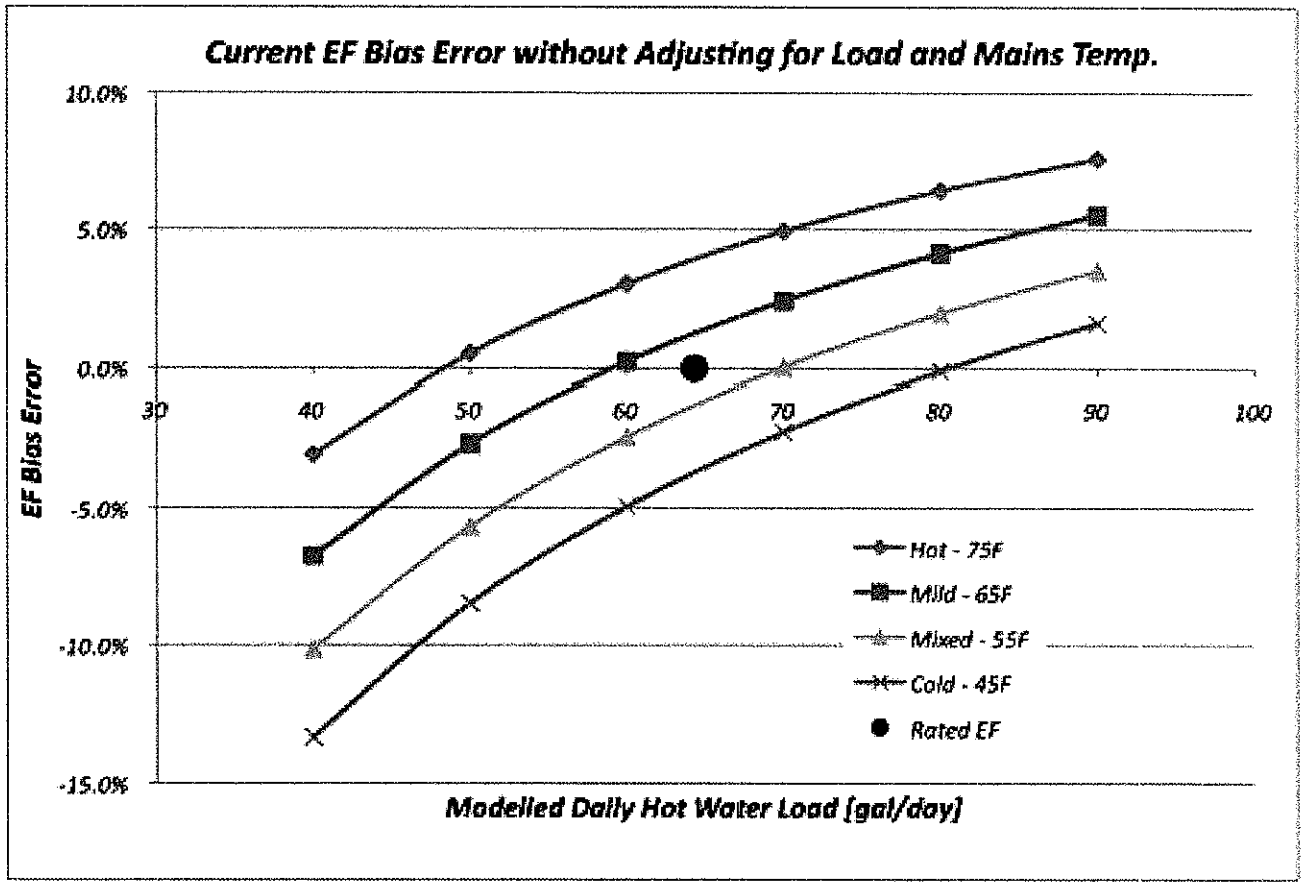
1.055 (hot climate 5 bedroom home)

BUT, of course, the Energy Consumption for Water Heating would then be accurately Calculated Directly in software by LOAD and Cold Mains Temperature but with a Site Specific EF

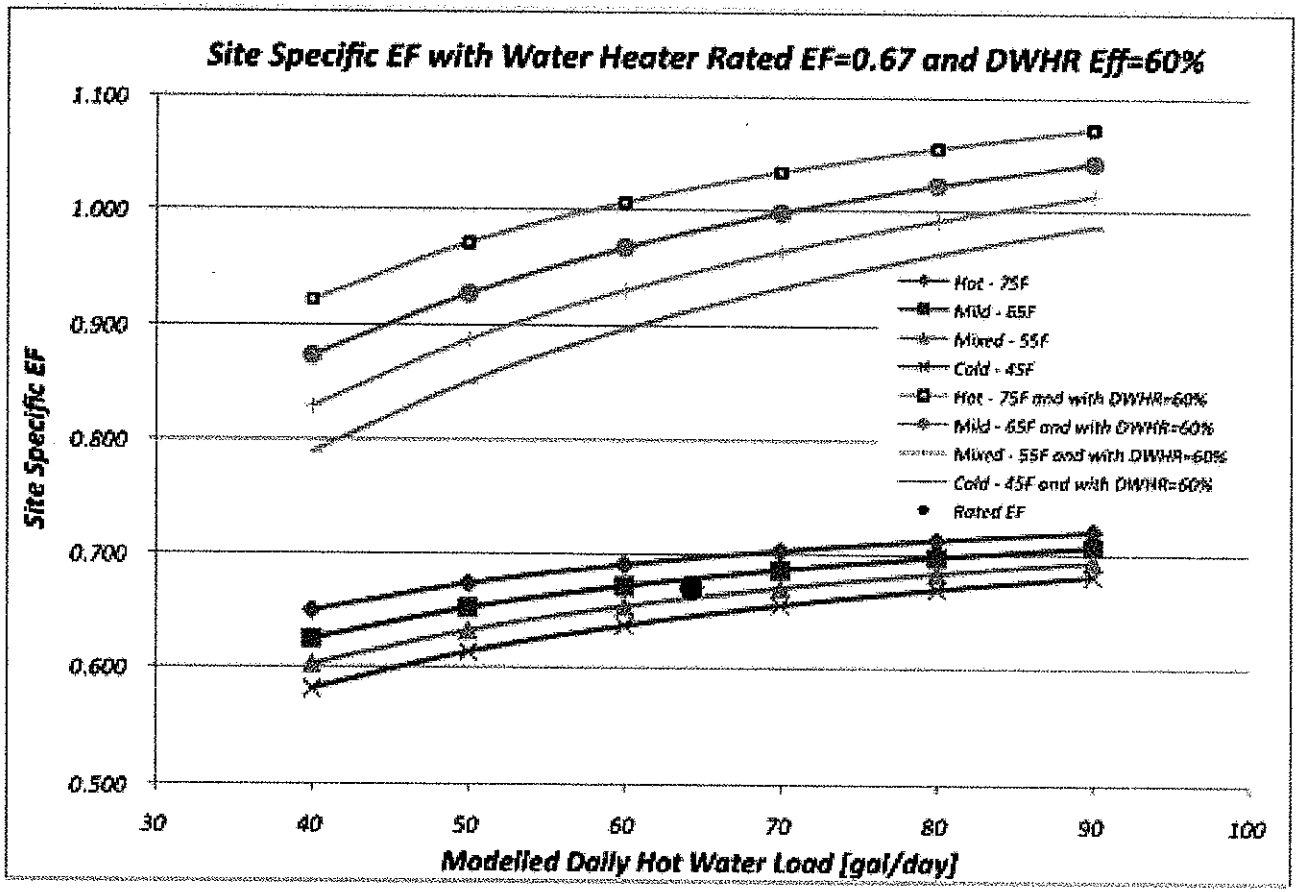
Site Specific EF Examples Without DWHR



Hot Water Load Bias Error by Assuming Constant EF...



Site Specific EF Examples With DWHR



Water Distribution Efficiency

--Gary Klein to discuss—

Efficient Water Distribution will result in a % Reduction in the Volume of Hot Water Load

With the Site Specific EF Model, one can simply take a reduced load for a given Bedroom Count (e.g. for 5 Bedroom from 80 gal/day to 70 gal/day) and use the EF at the lower volume.

Again, with actual load inputs and site conditions entered into software, one will now have an accurate calculation for Hot Water Load with or without Efficient Water Distribution

Multi Unit Residential Buildings (MURB)

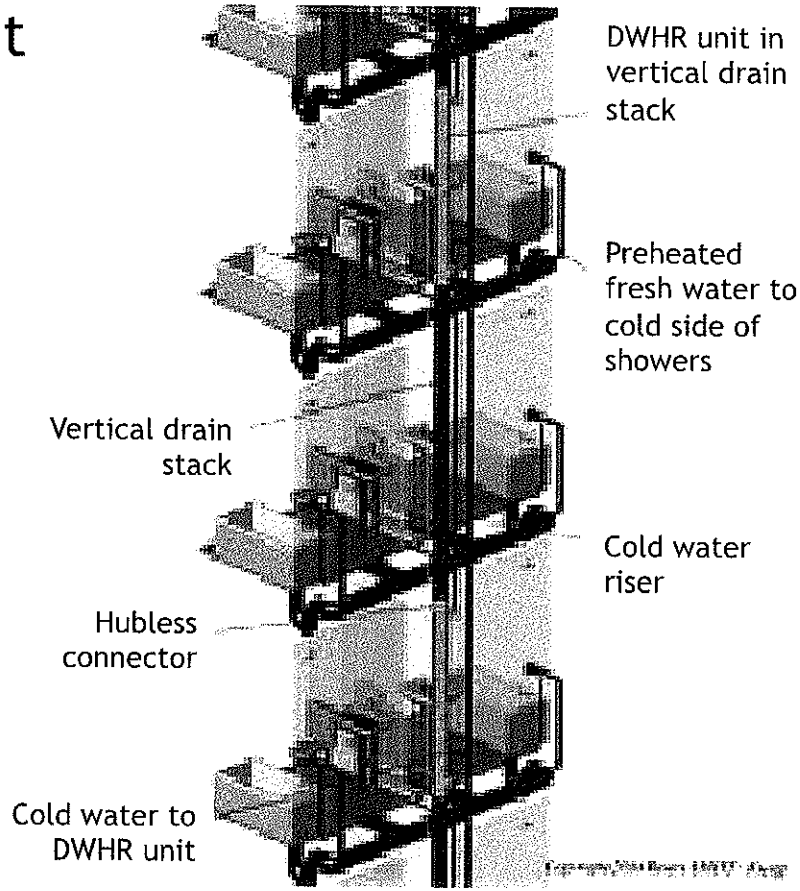
Contact Manufacturer for assistance on proper sizing.

Typical installation: up to 4 washrooms with 1 DWHR unit

MURBS and Lodging Design

- install DWHR units throughout building to preheat cold water for up to 4 washrooms above each unit

- multi-unit residential and lodging buildings – common design to preheat cold water for 2 or more washrooms above



Cold Water Preheating is Used in this Scenario

Central Water Heating

- DWHR unit placed in main drain stack with back-to-back washrooms or stacked vertically 1 to 4 washrooms/unit
- The annual savings will depend partly upon how many washrooms are connected to each DWHR unit

Apartment Buildings, Condos, and Dormitories

- water from DWHR unit supplies cold water to showers, lavatory and toilet

Hotels

- pre-heated water from DWHR unit supplies cold water line to showers and toilet, where desired. Not to the lavatory.

3-4 Washrooms per DWHR Unit

Application (Building Type)	Variation	Plumbing Configuration / Comments	Typical Hot Water Energy Load (% of total)	Typical Reduction in Hot Water Load	Typical Potential Savings of Total Energy Load (% of total)	Typical LEED Points Achievable for High-Rise (NC and Major Retrofit) Multi-Residential	Typical LEED Points Achievable for Mid-Rise (NRNR) Multi-Residential	Budgetary Total Cost Per Housing Unit
Multi-Res (2-4 apart's) w/ Central Water Heating	1-2 WC per DWHR Unit	CW Pre-Heating Only	18.4%	29.4%	5.4%	[redacted]	5.4	$580.00
	3-4 WC per DWHR Unit	**CW Pre-Heating Only**		**23.5%**	**4.3%**	[redacted]	**4.3**	**$310.00**
Multi-Res (>= 5 apart's) w/ Central Water Heating	1-2 WC per DWHR Unit	CW Pre-Heating Only	22.4%	29.4%	6.6%	3.3	6.6	$530.00
	3-4 WC per DWHR Unit	**CW Pre-Heating Only**		**23.5%**	**5.3%**	**2.6**	**5.3**	**$310.00**
	5-6 WC per DWHR Unit	CW Pre-Heating with 1.5gpm Showerheads		16.7%	3.7%	1.9	3.7	$230.00
	>=7 WC per DWHR Unit	recirc. loop / custom engineered		4.1%	0.9%	0.5	0.9	custom
Multi-Res (>= 5 apart's) w/ Individual Water Heating	1-2 WC per DWHR Unit	Equal Flow	22.4%	38.8%	8.7%	4.3	8.7	$580.00
	3-4 WC per DWHR Unit	Equal Flow with 1.5gpm Showerheads		29.8%	6.7%	3.3	6.7	$390.00
	5-6 WC per DWHR Unit	Equal Flow with 1.5gpm Showerheads		24.8%	5.6%	2.8	5.6	$260.00
Lodging (dorms, hotels, etc.) / always Central Water Heating	1-2 WC per DWHR Unit	CW Pre-Heating Only	33.4%	29.4%	9.2%	4.6	9.2	$530.00
	3-4 WC per DWHR Unit	**CW Pre-Heating Only**		**23.5%**	**7.4%**	**3.7**	**7.4**	**$310.00**
	5-6 WC per DWHR Unit	CW Pre-Heating with 1.5gpm Showerheads		16.7%	5.2%	2.6	5.2	$230.00
	>=7 WC per DWHR Unit	recirc. loop / custom engineered		4.1%	1.3%	0.6	1.3	custom

Typical Energy Savings: 4% to 7%

Typical Budgetary Cost: $310 per suite

Typical Payback Range: 3 to 4 years

RenewABILITY ENERGY INC.

Questions & Discussion

Thank You for Attending!

www.RenewABILITY.com

SETTLEMENT PROPOSAL
COMPLETELY SETTLED ISSUES

TABLE OF CONTENTS

INTRODUCTION AND CONTEXT

This Settlement Proposal is filed with the Ontario Energy Board (the "Board") in connection with the Board's proceeding, commenced on its own motion, regarding natural gas demand side management ("DSM"). By Procedural Order No. 5, the Board convened a second phase to this proceeding for the purposes of determining common input assumptions to be used by the Utilities when compiling their DSM plans. The Board appended to this Procedural Order a draft input assumptions list and the substantiation documentation provided by the Utilities. The Procedural Order required parties to review the assumptions list (and a freeridership rate of 30% for custom projects) with a view to attempting to agree upon as many assumptions as possible through a settlement conference. This Settlement Proposal is filed jointly by Enbridge Gas Distribution Inc. ("EGD") and Union Gas Limited ("Union") (jointly referred to as the "Utilities").

A Settlement Conference for Phase II of this proceeding was conducted on September 25 and 25, 2006, in accordance in the *Ontario Energy Board's Rules of Practice and Procedure* (the "Rules") and the Board's *Settlement Conference Guidelines* ("Settlement Guidelines"). This Settlement Proposal arises from the Settlement Conference.

EGD, Union, and the following intervenors (collectively, the "parties"), as well as Ontario Energy Board hearing staff ("Board Staff"), participated in the Settlement Conference:

Consumers Council of Canada ("CCC")
Energy Probe Research Foundation ("Energy Probe")
Green Energy Coalition ("GEC")
Industrial Gas Users Association ("IGUA")
London Property Management Association ("LPMA")
Low Income Energy Network ("LIEN")
Pollution Probe
School Energy Coalition ("Schools")
Vulnerable Energy Consumers Coalition ("VECC")

This Settlement Proposal constitutes a complete settlement because the Utilities and all of the other parties who participated in the settlement conference agree with this Settlement Proposal. All parties participated in the negotiation of this Settlement Proposal. Board Staff take no position and as a result, are not a party to the Settlement Proposal.

It is acknowledged and agreed that none of the provisions of this Complete Settlement are severable. If the Board does not accept this Settlement Proposal in its entirely, there is no Settlement Proposal (unless the parties agree that any

portion of the Settlement Proposal that the Board does accept may continue as a valid Settlement Proposal).

The role adopted by Board Staff in Settlement Conferences is set out on page 5 of the Board's *Settlement Conference Guidelines,* "Board Staff who participate in the settlement conference are bound by the same confidentiality standards that apply to parties to the proceeding."

It is further acknowledged and agreed that parties will not withdraw from this Settlement proposal under any circumstances except as provided under Rule 32.05 of the Rules.

It is also acknowledged and agreed that the values in the list of input assumptions attached to the Settlement Proposal have been developed and agreed to by the parties in the context of the design of existing programs. Some of these values are sensitive to program design. The parties anticipate that these values will be applicable to the multi-year plans to be filed by the Utilities for the multi-year period beginning in 2007. In the event that either Utility proposes programs which are sufficiently different from those which were used in the development of the list of input assumptions that any of these assumptions are no longer appropriate, then consistent with issue 3.1 of the Board's decision in Phase 1 of this proceeding, the applicable input assumptions should be assessed for reasonableness prior to approval of the multi-year plan.

The agreed upon list of input assumptions is attached as Appendix "A" to this Settlement Proposal. Best efforts have been made to identify all of the evidence which supports the values contained in the list of input assumptions in the Substantiation Documentation appended to this Settlement Proposal as Appendix "B". Parties have made best efforts to rely upon the best available data at this time for the establishment of the values set out in Appendix "A". Where utilities intend to no longer undertake a program or to significantly change a program's description, programs have been removed from the attached list of input assumptions.

Many of the input assumptions which were the subject of this phase of the proceeding have been subjected to review by the parties and approval by the Board in prior proceedings. The Settlement Conference afforded parties an opportunity to further review those and other input assumptions, ask questions, and explain their position in respect of same. As a result, some input assumptions that have been approved in prior proceedings have been changed.

Appendix A: Input Assumptions

			Resource Savings Assumptions							
Efficient Equipment & Technologies	Base Equipment & Technologies	Load Type	Natural Gas m3	Electricity kWh	Water L	Equipment Life Years	Incremental Cost		Free Ridership %	Comment
							Customer Installed	Contractor Installed		
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
RESIDENTIAL NEW CONSTRUCTION										
1. Basement Insulation (R-12)	OBC basement insulation levels	weather	93	-	-	25	-	$700	20%	Values to be used for recording 2007 completions from the 2006 permit approvals.
2. Energy Star Home	Home built to OBC	weather	818	1,000	-	25	-	$3,020	5%	Values to be used for recording 2007 completions from the 2006 permit approvals.
3. High Efficiency Furnace	Mid-Efficiency Furnace	weather	226	-	-	18	-	$647	60%	Values to be used for recording 2007 completions from the 2006 permit approvals.
4. High Efficiency Integrated Appliance	Mid-Efficiency Furnace / Storage Tank Water Heater	weather	287	-	-	18	-	$850	1%	Values to be used for recording 2007 completions from the 2006 permit approvals.
5. EnerGuide for New Houses	Home built to OBC	weather	517	0	0	25	-	$2,000	5%	For completion of buildings subject to existing OBC. Assess 2008 impacts through research.
6. Programmable Thermostat	Standard Thermostat	weather	150	200	-	18	-	$65	30%	
7. Tankless Water Heater	Storage Tank Water Heater	base	206	-	-	20	-	$650	2%	
8. Waste Water Heat Recovery	No heat recovery	base	267	-	-	30	-	$625	1%	
RESIDENTIAL EXISTING HOMES										
1. Energy Star Clothes Washer	Standard Clothes Washer	base	55	31	28,731	13	-	$350	8%	Values effective until June 30, 2007
2. Energy Star Window	Standard Window	weather	13	16	-	25	-	$52	80%	
3a. Enhanced Furnace (ECM only)	Mid-Efficiency Furnace	weather	-65	730	-	18	-	$550	15%	Recommended Evaluation Priority
3b. Enhanced Furnace (Furnace only)	Mid-Efficiency Furnace	weather	385	-	-	18	-	$650	48%	Recommended Evaluation Priority
4. Faucet Aerator	Faucet w/o aerator	base	14	-	6,520	10	$2	$3	10%	Savings per aerator.
5. High Efficiency Furnace	Mid-Efficiency Furnace	weather	385	-	-	18	-	$650	48%	Recommended Evaluation Priority

Appendix A: Input Assumptions

			Resource Savings Assumptions							
Efficient Equipment & Technologies	Base Equipment & Technologies	Load Type	Natural Gas m3	Electricity kWh	Water L	Equipment Life Years	Incremental Cost		Free Ridership %	Comment
							Customer Installed	Contractor Installed		
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
6. Home Rewards w/o Program. Thermo	Existing Home Sample	weather	1,321	300	0	25	-	$2,708	8%	Final participants in current federal program. Assess 2008 impacts through research.
7. Low-Flow Showerhead (Contractor installed per household)	Average Existing Stock	base	115	-	30,966	10	-	$15	10%	Recommended Evaluation Priority
8. Low-Flow Showerhead (Customer installed per unit)	Average Existing Stock	base	91	-	19,354	10	$5	-	17.5%	Recommended Evaluation Priority
9. Pipe Insulation	Water Heater w/o pipe insulation	base	17	-	-	15	$1	$4	4%	
10. Programmable Thermostat	Standard Thermostat	weather	212	100	-	18	-	$65	11%	Per building. Utilities to ensure results for customers replacing existing setback T-stats are accounted for or reduce NG savings by 35% to 138 m^{*3}
11. Tankless Water Heater	Storage Tank Water Heater	base	203	-	-	20	-	$650	2%	
12. Waste Water Heat Recovery	No heat recovery	base	267	-	-	30	-	$625	1%	
LOW INCOME										
1. Faucet Aerator	Faucet w/o aerator	base	14	-	6,520	10	-	$3	1%	Savings per aerator.
2. Low-Flow Showerhead (Contractor installed per household)	Average Existing Stock	base	115	-	30,966	10	-	$15	5%	
3. Pipe Insulation	Water Heater w/o pipe insulation	base	17	-	-	15	-	$4	1%	
4. Programmable Thermostat	Standard Thermostat	weather	212	100	-	18	-	$90	1%	

Appendix A: Input Assumptions

			Resource Savings Assumptions							
Efficient Equipment & Technologies	Base Equipment & Technologies	Load Type	Natural Gas m3	Electricity kWh	Water L	Equipment Life Years	Incremental Cost		Free Ridership %	Comment
							Customer Installed	Contractor Installed		
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
COMMERCIAL NEW BUILDING CONSTRUCTION										
1. Condensing Gas Water Heater	Storage Tank Water Heater	base	1,412	-	-	15	-	$4,200	5%	Food services application
2. Rooftop Unit	Standard Rooftop Unit	weather	1,275	-	-	20	-	$1,250	5%	Minimum $450 incentive per unit
3. Tankless Water Heater	Storage Tank Water Heater	base	825	-	-	20	-	$2,200	2%	Food services application
COMMERCIAL EXISTING BUILDINGS										
1. Condensing Gas Water Heater	Storage Tank Water Heater	base	1,412	-	-	15	-	$4,200	5%	Food services application
2. Faucet Aerators	Faucet w/o aerator	base	14	-	6,520	10	$2	$3	10%	Savings per aerator.
3. High Efficiency Furnace	Mid-Efficiency Furnace	weather	5.1 per 1000 BTUH furnace capacity	-	-	18	-	$650	17.5%	Based on 75,000 BTUH residential application. Scalable m3 from residential base
4. Low-Flow Showerhead (Contractor installed per multi-res. household)	Average Existing Stock	base	115	-	30,966	10	-	$15	10%	Recommended Evaluation Priority
5. Low-Flow Showerhead (Customer installed per unit)	Average Existing Stock	base	91	-	19,354	10	$5	-	10%	Free rider value assumes a screening of existing showerhead or else it become 17.5%
6. Pre-Rinse Spray Nozzle	Average Existing Stock	base	2,434	-	432,800	5	-	$100	5%	Food services application, retrofit only
7. Programmable Thermostats	Standard Thermostat	weather	519	921	-	18	-	$65	20%	Per building.
8. Rooftop Unit	Standard Rooftop Unit	weather	1,275	-	-	20	-	$1,250	5%	Minimum incentive $450 per unit
9. Tankless Water Heater	Storage Tank Water Heater	base	825	-	-	20	-	$2,200	2%	Food services application
10 a. Enhanced Furnace - up to 299 mbtu/h (ECM only)	Mid-Efficiency Furnace	weather	-0.87 per 1000 BTUH	9.7 per 1000 BTUH	-	18	-	$550	10%	Based on 75,000 BTUH residential application.
10 b. Enhanced Furnace - up to 299 mbtu/h (furnace only)	Mid-Efficiency Furnace	weather	5.1 per 1000 BTUH		-	18	-	$650	30%	Based on 75,000 BTUH residential application.

Appendix A: Input Assumptions

			Resource Savings Assumptions							
Efficient Equipment & Technologies	Base Equipment & Technologies	Load Type	Natural Gas m3	Electricity kWh	Water L	Equipment Life Years	Incremental Cost		Free Ridership %	Comment
							Customer Installed	Contractor Installed		
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
COMMERCIAL/INDUSTRIAL CUSTOM PROJECTS										
1. Custom Projects									30%	The 30% freerider rate is an interim assumption until further evaluation work is done on a priority basis on the custom project free rider rate. The Utilities recognize that an internal guideline and enhanced validation process was in place at Enbridge when parties agreed to the 30% free rider rate in prior proceedings. For example, this guideline was shown in EGD's evidence in the RP-2003-0203 proceeding at Exhibit A7, Tab 2, Schedule 1, Page 9 of 19 and states: "Enbridge Gas Distribution will provide $0.05 per m3 of gas saved for higher efficiency boilers in projects that are cost effective using the Societal Cost Test and that have a simple payback of not less than two years for Industrial Projects and 1-1/2 years for Commercial Projects." The Utilities will continue their current practice in this regard but reserve their right to revisit validation mechanisms and criteria as required.

Appendix B:

Substantiation Document for Input Assumptions

*indicates assumption has changed from previously filed Substantiation Document.

Index

***indicates assumption has changed from previously filed Substantiation Document.**

*indicates assumption has changed from previously filed Substantiation Document.

RESIDENTIAL - NEW CONSTRUCTION

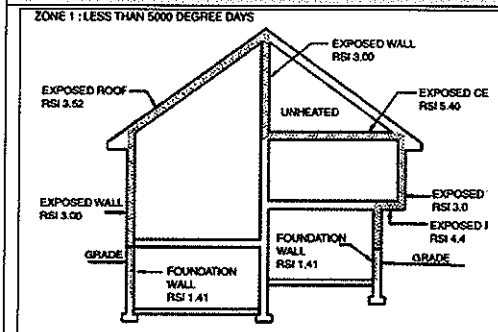
*indicates assumption has changed from previously filed Substantiation Document.

BASEMENT INSULATION (R-12)

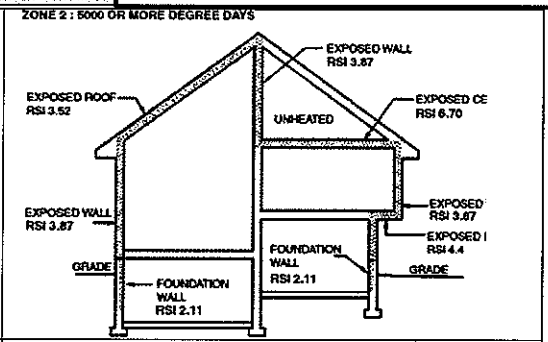
Efficient Technology & Equipment Description
Basement Insulation (R-12) – full height
Base Technology & Equipment Description
1997 OBC Basement Insulation Levels

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	20* %
Free-ridership rate adjusted during ADR Settlement – September 2006.	

[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.

***indicates assumption has changed from previously filed Substantiation Document.**

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	**818* m^3**
Natural gas savings based on EnerQuality Corporation data and EGD load research.	
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.[4]	
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	**5* %**
Free-ridership rate adjusted during ADR Settlement – September 2006.	

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

***indicates assumption has changed from previously filed Substantiation Document.**

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 HOT2000 V 9.1 assessment for Union Gas franchise territory[5]. 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.[6,7]	
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	60* %
Free-ridership rate adjusted during ADR Settlement – September 2006.	

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

*indicates assumption has changed from previously filed Substantiation Document.

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	1* %
Free-ridership rate adjusted during ADR Settlement – September 2006.	

*indicates assumption has changed from previously filed Substantiation Document.

ENERGUIDE FOR NEW HOUSES

Efficient Technology & Equipment Description
EnerGuide for New Houses
Base Technology & Equipment Description
Home built to Ontario Building Code (1997) minimum standards.

Resource Savings Assumptions

Natural Gas	**517* m^3**
Natural gas savings based on EnerQuality Corporation data and EGD load research.	
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	**5* %**
Free-ridership rate adjusted during ADR Settlement – September 2006.	

*indicates assumption has changed from previously filed Substantiation Document.

PROGRAMMABLE THERMOSTAT

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

Resource Savings Assumptions

Natural Gas	150* m^3
Natural gas savings adjusted for new OBC during ADR Settlement – September 2006.	
Electricity	**200 kWh**
The electricity savings are based on percentage savings (11% - corresponding to a 25°C day set-forward), reported in CCHT report[8]. 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."[9] 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.[10]	

[8] 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.
[9] "Energy Efficiency Trends in Canada, 1990 to 2003", Natural Resources Canada, June 2005.
[10] EB-2005-0211, Union Gas Settlement Agreement, April 7, 2005.

***indicates assumption has changed from previously filed Substantiation Document.**

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[11]. 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)[12]. 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[13,14].	
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[15] 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	**2* %**
Free-ridership rate adjusted during ADR Settlement – September 2006. Nominal free-ridership included pending better information developed through the Evaluation and Audit Committee process.	

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

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

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

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

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

*indicates assumption has changed from previously filed Substantiation Document.

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[16].	
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[17].	
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."[18]	
Free Ridership	1* %
Free-ridership rate adjusted during ADR Settlement – September 2006. Nominal free-ridership included pending better information developed through the Evaluation and Audit Committee process.	

[16] Energy Credits for the Use of Drainwater Heat Recovery System for Houses, Natural Resources Canada.
[17] http://www.gfxstar.ca
[18] Energy Efficiency and Renewable Energy Consumer's Guide: Drain Water Heat Recovery; http://www.eere.doe.gov/consumer/your_home/water_heating

*indicates assumption has changed from previously filed Substantiation Document.

RESIDENTIAL - EXISTING HOMES

*indicates assumption has changed from previously filed Substantiation Document.

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"[19]. 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"[20].	
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".[19]	
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".[19]	

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.[21] The American Council for an Energy Efficient Economy (ACEEE) reports an incremental cost of $200.[22]	
Free Ridership	**8 %**
Free-ridership rate as per 2005 ADR Settlement – EB-2005-0211 for front load washers.[23]	

[19] http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/CalculatorConsumerClothesWasher.xls
[20] EnerGuide Appliance Directory 2005, http://oee.nrcan.gc.ca/Publications/infosource/Pub/appliances/clothes-wash.cfm?attr=4
[21] http://www.moneysense.ca/spending/shopping_sense/article.jsp?content=20050505_174644_6612
[22] "Increasing Appliance Energy Savings by Looking Beyond Energy Star", Steve Nadel – ACEEE, 2004 Market Transformation Symposium.
[23] EB-2005-0211, Union Gas Settlement Agreement, April 7, 2005.

*indicates assumption has changed from previously filed Substantiation Document.

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[24]. Full descriptions of assumption are in Union Gas internal report[25]. 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[26]. 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[26]. $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	**80* %**
Free-ridership rate adjusted during ADR Settlement – September 2006, based on Marbek study.	

[24] Furnace Savings Update – 2004", John Overall, Union Gas, January 2004.
[25] "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.
[26] "Potential Savings for Energy Star Windows, Doors, and Skylights", Natural Resources Canada – prepared by Enermodal Engineering, January 2005.

***indicates assumption has changed from previously filed Substantiation Document.**

ENHANCED FURNACE

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

Resource Savings Assumptions - (Furnace / ECM)

Natural Gas	**385 / -65 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 net gas savings are reduced to 320m3.	
Electricity	**0 / 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 - (Furnace / ECM)

Equipment Life	**18 years**
Enhanced furnaces have an estimated service life of 18 years.[27]	
Incremental Cost	**- $650/$550**
Enhanced furnaces have an estimated incremental cost of $1200.	
Free Ridership	**48* / 15* %**
Free-ridership rate adjusted during ADR Settlement – September 2006.	

[27] ASHRAE Applications Handbook – 2003, Chapter 36 – Owning and Operating Costs, Table 3.

*indicates assumption has changed from previously filed Substantiation Document.

FAUCET AERATOR

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

Resource Savings Assumptions

Natural Gas	14* m^3
Natural gas savings as per Summit Blue recommendation – UG 2005 Audit.	
Electricity	**n/a kWh**
Water	**6,520* L**
Water savings as per Summit Blue recommendation – UG 2005 Audit.	

Other Input Assumptions

Equipment Life	10 years
Faucet aerators have an estimated service life of 10 years.[28]	
Incremental Cost (Cust. / Contr. Install)	**$2 $3**
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] U.S. DOE – FEMP, Energy Cost Calculator for Faucets and Showerheads, http://www.eere.energy.gov/femp

*indicates assumption has changed from previously filed Substantiation Document.

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.[29]	
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).	

[29] ASHRAE Applications Handbook – 2003, Chapter 36 – Owning and Operating Costs, Table 3.

*indicates assumption has changed from previously filed Substantiation Document.

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).	

*indicates assumption has changed from previously filed Substantiation Document.

LOW-FLOW SHOWERHEAD (per household)

Efficient Technology & Equipment Description
Low-flow showerhead
Base Technology & Equipment Description
Based on contractor testing and replacement of high flow units.

Resource Savings Assumptions

Natural Gas	**115* m^3**
September 2006 ADR agreement.	
Electricity	**n/a kWh**
Water	**30,966* L**
September 2006 ADR agreement.	

Other Input Assumptions

Equipment Life	**10 Years**
Low flow showerheads have an estimated service life of 10 years.	
Incremental Cost (Cust. / Contr. Install)	**- $15**
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.	

*indicates assumption has changed from previously filed Substantiation Document.

LOW-FLOW SHOWERHEAD (per showerhead)

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

Resource Savings Assumptions

Natural Gas	91* m^3
Natural gas savings claims[30] 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 7 showers / week per showerhead (48 weeks/year) with an average showering time of 8 minutes[31]. Average existing stock showerheads are reported as 17.1 L/min (4.5 USGPM) by Environment Canada[32] and 14.8 L/min (3.9 USGPM) by the City of Toronto[33]. Natural gas savings as per Summit Blue recommendation – UG 2005 Audit.	
Electricity	n/a kWh
Water	19,354* L
Water savings claims[30] 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). Natural gas savings as per Summit Blue recommendation – UG 2005 Audit.	

Other Input Assumptions

Equipment Life	10 years
Low flow showerheads have an estimated service life of 10 years.	
Incremental Cost (Cust. / Contr. Install)	$5 -
Invoice for ESK kits (Home Depot) has shower head cost of $3.15.[34] A cost of $5.00 was used. Enbridge reports $10 installation fee for showerhead program.	
Free Ridership	17.5* %
Free-ridership rate adjusted (+7.5%) during ADR Settlement – September 2006 to reflect the uncertainty of whether existing low-flow showerheads were being replaced with new low-flow showerheads.	

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

*indicates assumption has changed from previously filed Substantiation Document.

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[35] • Amalgamated Laboratories[36] 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.[37] 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).	

[35] City of Berkeley & Sustainable Development
[36] http://www.envirotech.com/tests.html
[37] Home Depot ESK invoice

*indicates assumption has changed from previously filed Substantiation Document.

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).[38]	
Electricity	**100 kWh**
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." 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 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.	

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

*indicates assumption has changed from previously filed Substantiation Document.

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[39]. 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[40,41].	
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[42] 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	**2* %**
Free-ridership rate adjusted during ADR Settlement – September 2006. Nominal free-ridership included pending better information developed through the Evaluation and Audit Committee process.	

[39] Exelon Services Report, December 2002
[40] Introduction to Rinnai Water Heating Product – Course #101", page 7
[41] C. Aguilar, D.J. White, and David L. Ryan, "Domestic Water Heating and Water Heater Energy Consumption in Canada", CBEEDAC, April 2005.
[42] "Technical and Economic Analysis of Residential Tankless Water Heaters", March 2004, J. Overall, Union Gas

*indicates assumption has changed from previously filed Substantiation Document.

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.[16] 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.[17]	
Incremental Cost (Cust. / Contr. Install)	- $625
Enbridge reference from analysis of ET field installations.	
Free Ridership	1* %
Free-ridership rate adjusted during ADR Settlement – September 2006. Nominal free-ridership included pending better information developed through the Evaluation and Audit Committee process.	

*indicates assumption has changed from previously filed Substantiation Document.

LOW INCOME

*indicates assumption has changed from previously filed Substantiation Document.

FAUCET AERATOR

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

Resource Savings Assumptions

Natural Gas	**14* m^3**
(see Existing Homes - Faucet Aerator)	
Electricity	**n/a kWh**
Water	**6,520* L**
(see Existing Homes - Faucet Aerator)	

Other Input Assumptions

Equipment Life	**10 years**
(see Existing Homes - Faucet Aerator)	
Incremental Cost (Cust. / Contr. Install)	**- $3**
(see Existing Homes - Faucet Aerator)	
Free Ridership	**1* %**
Free-ridership rate adjusted during ADR Settlement – September 2006.	

*indicates assumption has changed from previously filed Substantiation Document.

LOW-FLOW SHOWERHEAD

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

Resource Savings Assumptions

Natural Gas	**115* m^3**
(see Existing Homes – Low-Flow Showerhead (per household))	
Electricity	**n/a kWh**
Water	**30,966* L**
(see Existing Homes – Low-Flow Showerhead (per household))	

Other Input Assumptions

Equipment Life	**10 years**
(see Existing Homes – Low-Flow Showerhead (per household))	
Incremental Cost (Cust. / Contr. Install)	**- $15**
(see Existing Homes – Low-Flow Showerhead (per household))	
Free Ridership	**5* %**
Free-ridership rate adjusted during ADR Settlement – September 2006.	

*indicates assumption has changed from previously filed Substantiation Document.

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**
(see Existing Homes – Pipe Insulation)	
Electricity	**n/a kWh**
Water	**n/a L**

Other Input Assumptions

Equipment Life	**15 years**
(see Existing Homes – Pipe Insulation)	
Incremental Cost (Cust. / Contr. Install)	**$4**
(see Existing Homes – Pipe Insulation)	
Free Ridership	**1* %**
Free-ridership rate adjusted during ADR Settlement – September 2006.	

*indicates assumption has changed from previously filed Substantiation Document.

PROGRAMMABLE THERMOSTAT

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

Resource Savings Assumptions

Natural Gas	**212 m^3**
(see Existing Homes – Programmable Thermostat)	
Electricity	**100 kWh**
(see Existing Homes – Programmable Thermostat)	
Water	**n/a L**

Other Input Assumptions

Equipment Life	**18 years**
(see Existing Homes – Programmable Thermostat)	
Incremental Cost (Cust. / Contr. Install)	**- $90**
(see Existing Homes – Programmable Thermostat)	
Free Ridership	**1* %**
Free-ridership rate adjusted during ADR Settlement – September 2006.	

*indicates assumption has changed from previously filed Substantiation Document.

COMMERCIAL - NEW BUILDING CONSTRUCTION

*indicates assumption has changed from previously filed Substantiation Document.

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	1412*	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	15	years
Condensing gas water heaters have an estimated service life of 15 years.[44]		
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.[45]		

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

[44] "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.

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

*indicates assumption has changed from previously filed Substantiation Document.

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.[46]		
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.[44]		
Free Ridership	**5***	**%**
Free-ridership rate adjusted during ADR Settlement – September 2006. Nominal free-ridership included pending better information developed through the Evaluation and Audit Committee process.		

[46] "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.

*indicates assumption has changed from previously filed Substantiation Document.

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.[47]		
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".		
Incremental Cost (Cust. / Contr. Install)	**-**	**$2,200**
Incremental cost is estimated at $2,200.		
Free Ridership	**2***	**%**
Free-ridership rate adjusted during ADR Settlement – September 2006. Nominal free-ridership included pending better information developed through the Evaluation and Audit Committee process.		

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

*indicates assumption has changed from previously filed Substantiation Document.

COMMERCIAL - EXISTING BUILDINGS

*indicates assumption has changed from previously filed Substantiation Document.

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	1412*	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.[48]		
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.[49]		

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

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

*indicates assumption has changed from previously filed Substantiation Document.

FAUCET AERATOR

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

Resource Savings Assumptions

Natural Gas	**14* m^3**
(see Existing Homes - Faucet Aerator)	
Electricity	**n/a kWh**
Water	**6,520* L**
(see Existing Homes - Faucet Aerator)	

Other Input Assumptions

Equipment Life	**10 Years**	
(see Existing Homes - Faucet Aerator)		
Incremental Cost (Cust. / Contr. Install)	**$2**	**$3**
(see Existing Homes - Faucet Aerator)		
Free Ridership	**10 %**	
As approved in the Enbridge Partial Decision EB 2005-0001.		

*indicates assumption has changed from previously filed Substantiation Document.

HIGH EFFICIENCY FURNACE (up to 299 MBtu/h)

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

Resource Savings Assumptions

Natural Gas	5.1* m^3 / 1000 Btu/h
Based on residential high-efficiency gas savings of 385 m3 (see Existing Homes – High Efficiency Furnace) and a typical residential furnace input of 75,000 Btu/h furnace –> 385/75 = 5 m3 / 1000 Btu/h.	
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.[50]	
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	17.5* %
Free-ridership rate adjusted during ADR Settlement – September 2006.	

[50] ASHRAE Applications Handbook – 2003, Chapter 36 – Owning and Operating Costs, Table 3.

*indicates assumption has changed from previously filed Substantiation Document.

LOW-FLOW SHOWERHEAD (per household)

Efficient Technology & Equipment Description
Low-flow showerhead
Base Technology & Equipment Description
Based on contractor testing and replacement of high flow units.

Resource Savings Assumptions

Natural Gas	**115* m^3**
(See Existing Homes – Low-Flow Showerhead (per household))	
Electricity	**n/a kWh**
Water	**30,966* L**
(See Existing Homes – Low-Flow Showerhead (per household))	

Other Input Assumptions

Equipment Life	**10 Years**
(See Existing Homes – Low-Flow Showerhead (per household))	
Incremental Cost (Cust. / Contr. Install)	**- $15**
(See Existing Homes – Low-Flow Showerhead (per household))	
Free Ridership	**10 %**
As approved in the Enbridge Partial Decision EB 2005-0001.	

*indicates assumption has changed from previously filed Substantiation Document.

LOW-FLOW SHOWERHEAD (per showerhead)

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

Resource Savings Assumptions

Natural Gas	**91* m^3**
(See Existing Homes – Low-Flow Showerhead (per showerhead))	
Electricity	**n/a kWh**
Water	**19,354* L**
(See Existing Homes – Low-Flow Showerhead (per showerhead))	

Other Input Assumptions

Equipment Life	**10 years**
(See Existing Homes – Low-Flow Showerhead (per showerhead))	
Incremental Cost (Cust. / Contr. Install)	**$5 -**
(See Existing Homes – Low-Flow Showerhead (per showerhead))	
Free Ridership	**10 %**
As approved in the Enbridge Partial Decision EB 2005-0001.	

*indicates assumption has changed from previously filed Substantiation Document.

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	2,434 m^3
Natural gas savings claims are based on the reduction of hot water use achieved by switching from an old pre-rinse spray nozzle (3 USGPM)[51] 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[52], 363 days per year. Savings were determined using the Pre-Rinse Spray Nozzle Savings spreadsheet[53] which provides consistent results with the Food Service Technology Centre's "Pre-Rinse Spray Valve Calculator".[54]	
Electricity	n/a kWh
Water	432,800 L
Water savings claims[54,53] are based on the reduction of water use achieved by switching from an old 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.[51,55]	
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[56]	
Free Ridership	5 %
A free-ridership rate of 5% is based on Enbridge's consultation with distributor.	

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

*indicates assumption has changed from previously filed Substantiation Document.

PROGRAMMABLE THERMOSTAT

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

Resource Savings Assumptions (per building)

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.[57]

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 "set-forward" strategy is suitable for office buildings and that this will result in similar savings to the day set-forward 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, 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	20*	%

Free-ridership rate adjusted during ADR Settlement – September 2006.

[57] 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.

*indicates assumption has changed from previously filed Substantiation Document.

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
(See New Building Construction – Rooftop Unit)		
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
(See New Building Construction – Rooftop Unit)		
Free Ridership	5*	%
Free-ridership rate adjusted during ADR Settlement – September 2006. Nominal free-ridership included pending better information developed through the Evaluation and Audit Committee process.		

*indicates assumption has changed from previously filed Substantiation Document.

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.[47]		
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".[13,14]		
Incremental Cost (Cust. / Contr. Install)	-	$2,200
The incremental cost of tankless water heater is estimated to be $2,200.		
Free Ridership	2*	%
Free-ridership rate adjusted during ADR Settlement – September 2006. Nominal free-ridership included pending better information developed through the Evaluation and Audit Committee process.		

*indicates assumption has changed from previously filed Substantiation Document.

ENHANCED FURNACE (up to 299 MBtu/h)

Efficient Technology & Equipment Description
Two-stage furnace with ECM
Base Technology & Equipment Description
Mid efficiency furnace

Resource Savings Assumptions - (Furnace / ECM)

Natural Gas	5.1* / -0.87* m^3 / 1000 Btu/h
Based on residential enhanced furnace gas savings of 385 m3 and gas penalty of -65 m3 (see Existing Homes – Enhanced Furnace) and a typical residential furnace input of 75,000 Btu/h furnace –> 385/75 = 4.3 m3 / 1000 Btu/h and -65/75 = -0.87 m3 / 1000 Btu/h.	
Electricity	0* / 9.7* kWh / 1000 Btu/h
Based on residential enhanced furnace electricity savings of 730 m3 (see Existing Homes – Enhanced Furnace) and a typical residential furnace input of 75,000 Btu/h furnace –> 730/75 = 9.7 kWh / 1000 Btu/h.	
Water	n/a L

Other Input Assumptions - (Furnace / ECM)

Equipment Life	18 years
Two-stage, high efficiency furnaces have an estimated service life of 18 years.[58]	
Incremental Cost	- $650/$550
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* / 10* %
Free-ridership rate adjusted during ADR Settlement – September 2006.	

[58] ASHRAE Applications Handbook – 2003, Chapter 36 – Owning and Operating Costs, Table 3.