April 30, 2010

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

Attention: Ms. Kirsten Walli, Board Secretary

RE: EB-2009-0166 - Union Gas Limited - 2010 Demand Side Management Plan – 2010 Measures and Updated Input Assumptions

Dear Ms. Walli:

On September 30, 2009, the Ontario Energy Board (the "Board") issued its EB-2009-0166 Decision and Order approving Union Gas Limited's ("Union") 2010 Demand Side Management ("DSM") Plan. The approved DSM Plan included input assumptions based on the Navigant Report and proposed additions submitted by Union.

In its August 20, 2009 reply submission, Union stated: "*Any proposed changes to those input assumptions will be discussed with the EAC and will be submitted to the Board for approval*." The measures included in this submission are the result of completed research projects and DSM opportunities which were identified during the 2010 marketing planning process which occurred after the filing of the 2010 DSM Plan on May 29, 2009.

Union is applying for the 2010 measures and input assumptions attached as they represent opportunities for energy savings present in the market. It is important for these measures to be put before the Board at this time to avoid lost opportunities in the marketplace.

On March 8, 2010 Union initiated a consultation process with the 2010 EAC to discuss new measures which Union was considering filing for the 2010 program year. Union has consulted with the 2010 EAC on all measures included in this filing. The consultation process concluded on April 27, 2010 where Union achieved complete consensus with the 2010 EAC on all input assumptions included in this filing. Union requests an order of the Board approving the input assumptions as filed.

If you have any questions, please contact me at 519-436-5476.

Yours truly,

[original signed by]

Chris Ripley
Manager, Regulatory Applications

cc: Crawford Smith (Torys)
EB-2009-0166 Intervenors

2010 Input Assumptions for New Measures

Target Market		Equipment Details				Annual Resource Savings			Other		
Sector	**New/Existing**	**Efficient Equipment**	**Details of efficient equipment**	**Base Equipment**	**Details of base equipment**	**Natural Gas (m3)**	**Electricity (kWh)**	**Water (L)**	**EUL**	**Incremental Cost ($)**	**Free Rider (%)**
Residential Space Heating											
Residential	New	Programmable Thermostat		Standard Thermostat		53	54	0	15	$25	10%
Residential	Existing	Fireplace intermittent ignition control retrofit		Natural gas fireplace with a pilot		104	(-) 31	0	8	$150	1%
Residential Water Heating											
Residential	New	Faucet Aerator	Bathroom, 1.0 GPM	Ontario Building Code 2006	2.2 GPM	10	0	3,435	10	$0.55	33%
Residential	Existing	Faucet Aerator	Bathroom, 1.0 GPM	Average existing stock	2.2 GPM	10	0	3,435	10	$0.55	33%
Residential	New	Faucet Aerator	Kitchen, 1.0 GPM	Ontario Building Code 2006	2.2 GPM	32	0	10,631	10	$1.59	33%
Residential	Existing	Faucet Aerator	Kitchen, 1.0 GPM	Average existing stock	2.5 GPM	35	0	11,694	10	$1.59	33%
Residential	Existing	Solar Pool Heaters		Natural gas pool heater		1,116	-57	0	20	$1450	10%
Commercial Space Heating											
Commercial	New/Existing	Condensing Unit Heater		% Sales Weighted Average model	Equivalent in efficiency to a power vented or separated combustion unit heater (78% Annually Efficient)	0.00631 /Btu/hr	(-)0.00186 /Btu/hr	0	18	$0.0129 /Btu/hr	0%
Commercial Water Heating											
Commercial	Existing	Pre-Rinse Spray Nozzle (Full Service)	0.64 GPM	Pre-rinse spray nozzel	1.6 GPM	457	0	97,292	5	$150	0%
Commercial	Existing	Pre-Rinse Spray Nozzle (Limited)	0.64 GPM	Pre-rinse spray nozzel	1.6 GPM	90	0	19,197	5	$150	0%
Commercial	Existing	Pre-Rinse Spray Nozzle (Other)	0.64 GPM	Pre-rinse spray nozzle	1.6 GPM	109	0	23,166	5	$150	0%
Commercial	New/Existing	Energy Star Dishwasher	Undercounter – High Temperature	Non-Energy Star Dishwasher		801	3,754	112,795	10	(-)$13	40%
Commercial	New/Existing	Energy Star Dishwasher	Undercounter – Low Temperature	Non-Energy Star Dishwasher		326	559	45,891	10	(-)$13	40%
Commercial	New/Existing	Energy Star Dishwasher	Stationary Rack, (Door type, or Single rack) – High Temperature	Non-Energy Star Dishwasher		619	3,553	87,119	15	(-)$350	20%
Commercial	New/Existing	Energy Star Dishwasher	Stationary Rack, (Door type, or Single rack) – Low Temperature	Non-Energy Star Dishwasher		841	855	118,369	15	(-)$350	20%
Commercial	New/Existing	Energy Star Dishwasher	Rack Conveyor, Single (Tank) – High Temperature	Non-Energy Star Dishwasher		2,203	9,811	310,271	20	$2,375	27%
Commercial	New/Existing	Energy Star Dishwasher	Rack Conveyor, Multi (Tank) – High Temperature	Non-Energy Star Dishwasher		3,708	15,822	522,192	20	$288	27%
Commercial	New/Existing	Commercial Laundry Washing Equipment with Ozone	Washer extractor – 60 lbs	Commercial Laundry Washing Equipment without Ozone		0.0328 /lbs/yr	0.00219 /lbs/yr	2.01 /lbs/yr	15	$10,970	8%
Commercial	New/Existing	Commercial Laundry Washing Equipment with Ozone	Washer extractor – 500 lbs	Commercial Laundry Washing Equipment without Ozone		0.0328 /lbs/yr	0.00219 /lbs/yr	2.01 L/lbs/yr	15	$30,270	8%
Commercial	New/Existing	Commercial Laundry Washing Equipment with Ozone	Tunnel Washer – 120 lbs	Commercial Laundry Washing Equipment without Ozone		0.0240 /lbs/yr	0.00152 /lbs/yr	1.22 /lbs/yr	15	$49,667	8%
Commercial	New/Existing	Commercial Laundry Washing Equipment with Ozone	Tunnel Washer – 500 lbs	Commercial Laundry Washing Equipment without Ozone		0.0240 /lbs/yr	0.00152 /lbs/yr	1.22 /lbs/yr	15	$160,065	8%

Target Market		Equipment Details				Annual Resource Savings			Other		
Sector	New/Existing	Efficient Equipment	Details of efficient equipment	Base Equipment	Details of base equipment	Natural Gas (m3)	Electricity (kWh)	Water (L)	EUL	Incremental Cost ($)	Free Rider (%)
Multi-Family Water Heating											
Multi-Family	New/Existing	Energy Star Front-Loading Clothes Washer	MEF=1.72 ,WF=8.0	Conventional top loading vertical axis washers	MEF = 1.26, WF=9.5	76	201	19,814	11	$150	48%
Multi-Family	New	Faucet Aerator	Bathroom, 1.5 GPM	Ontario Building Code 2006	2.2 GPM	4	0	1,382	10	$0.55	10%
Multi-Family	New	Faucet Aerator	Kitchen 1.5 GPM	Ontario Building Code 2006	2.2 GPM	13	0	4,280	10	$1.39	10%
Multi-Family	New	Faucet Aerator	Bathroom, 1.0 GPM	Ontario Building Code 2006	2.2 GPM	7	0	2,371	10	$0.55	10%
Multi-Family	New	Faucet Aerator	Kitchen, 1.0 GPM	Ontario Building Code 2006	2.2 GPM	22	0	7,337	10	$1.59	10%
Multi-Family	New	Low-flow showerhead (Union Gas ESK)	1.5 GPM		2.2 GPM	33	0	5,228	10	$6	10%
Multi-Family	New	Low-flow showerhead (Union Gas ESK)	1.25 GPM		2.2 GPM	45	0	8,824	10	$3.69	10%

PROGRAMMABLE THERMOSTAT

Residential New Construction

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

Resource Savings Assumptions

Natural Gas	**53 m^3**
EB 2009-0154	
Electricity	**54 kWh**
EB 2009-0154	
Water	**n/a L**

Other Input Assumptions

Equipment Life	**15 Years**
EB 2009-0154	
Incremental Cost	**$25.00**
EB 2009-0154	
Free Ridership	**10 %**
Pre-screening will be conducted to ensure builders who install a programmable thermostat as standard are not targeted. Measure will not be delivered to Energy Star Labeled Homes. A builder survey will be conducted immediately prior to launch of the program in order to capture the majority of builders in the franchise area.	

FIREPLACE INTERMITTENT IGNITION CONTROL RETROFIT

Residential – Existing Homes

Efficient Technology & Equipment Description
Retrofitting a fireplace with a intermittent ignition control
Base Technology & Equipment Description
Natural gas fireplace with a pilot

Resource Savings Assumptions

Natural Gas	**104 m3/yr**

Gas savings were based on gas normally consumed by a pilot flame during the winter and the non-heating season discounted by the fraction of people who shut off their fireplace gas pilot in the non-heating season according to the NRCAN SHEU study. The pilot flame is estimated to consume 700 Btu/hr (which is at the lower end of the published values).[1],[2] The table below[3] shows approximately how much gas is consumed by a pilot flame in the heating and non-heating seasons.

Operation Mode	Btu/hr	~m3/hr	Annual hours	m3 Gas Per Year
Pilot Light- Heating Season	700	0.02	4,932[4]	96.6
Pilot Light - Non-Heating Season	700	0.02	3,650[5]	71.5

The table below shows the effects on the gas savings estimates from fireplace owners who shut off their pilot lights during the non-heating season.

	Annual m3	Percent of Fireplace Owners	Weighted Average (m3/yr)
Standing Pilot Use in Heating Season	96.6	100%	96.6
Standing Pilot Use in Non-Heating Season	71.5	38%[6]	27.2

[1] Leapfrog Energy Technologies, Market Assessment for Potential Natural Gas Fireplace DSM Initiatives, 2007, Union Gas Fireplace Consolodated Presentation 071221.ppt, slide 18.
[2] "A pilot light…can consume from 600 to 1500 Btu of gas per hour and, if left to run continuously, can significantly increase your annual energy costs." – "All About Gas Fireplaces", Office of Energy Efficiency, Natural Resources Canada – March 2004
[3] From Fireplace Backup Calculations for Pete 071221.xls
[4] The heating season was estimated to last for 7 months. The time that the pilot light runs during the heating season is 7 months/12 months X 365 days X 24 hours MINUS the number of hours when the fireplace is actually running.
[5] The non-heating hours per year are equivalent to 8760 minus the time that the fireplace is running and minus the time when the pilot flame is running during the heating season.
[6] Table 3.4 "NRCan - 2003 Survey of Household Energy Use" – 38% of households in Ontario do not extinguish pilot lights in non-heating season.

A small portion of the winter time pilot gas heat is assumed to contribute to space heating during the heating season, however the actual value is unknown. A nominal value of 20% was estimated by Skip Hayden of NRCAN[7].

104 m3/yr = 27.2 m3/yr + (96.6 m3/yr * 80%)

Electricity	**(-) 31 kWh/yr**

Intermittent ignition systems actually increase electricity consumption. The power supply for the electronic fireplace ignition consumes standby power anywhere from 2 Watts[8] to 5 Watts[9]. Power is drawn continuously through the year (8760 hours). The corresponding annual power consumption ranges from 17.5 to 43.8 kWh.

31 kWh/yr is the average between 17.5 and 43.8 kWh

Water	**NA**

Other Input Assumptions

Equipment Life	**8 yrs**

The intermittent ignition control equipment life was estimated from manufacturer technical service reps to last the lifetime of the fireplace (~20 years).[10] The average fireplace age is 12 years[11]. The Equipment life is estimated to be 8 years based on how many years the fireplaces are expected to operate with the intermittent ignition control (20 yrs – 12 yrs = 8 yrs).

Incremental Cost	**$150**

It is estimated that the capital cost for an intermittent ignition system is $75 and the cost of the labour is $75[12]. The total cost for retrofitting a fireplace would be approximately $150.

Free Ridership	**1 %**

For Retrofitting a fireplace with intermittent ignition, free ridership was estimated using market penetration according to a NRCAN survey. According to an NRCAN survey[13], approximately 0% of survey respondents said they have intermittent ignition. Two percent of existing fireplaces owners weren't sure if their fireplaces have them. Since the range of market penetration is between 0 and 2%, 1% is used for the current market penetration of intermittent ignition in fireplaces.

[7] Agreed upon at UG EAC meeting April 15, 2010.
[8] LeapFrog Energy Technology's phone conversations with Jatin at Majestic Fireplace technical services on 30/01/08.
[9] LeapFrog Energy Technology's phone conversations with Stan at ESA Heating Products technical services 30/01/08.
[10] LeapFrog Energy Technology's phone conversations with Jatin at Majestic Fireplace technical services on 30/01/08 and to Stan at ESA Heating Products technical services 30/01/08
[11] Union Gas Ltd., 2009 RESIDENTIAL SINGLE-FAMILY PENETRATION SURVEY, Pg 5
[12] Direct Energy verbal quote (888) 393-5553 November 12/2007
[13] Table 3.4 "2003 Survey of Household Energy Use" – Natural Resources Canada 2006

1.0 GAL/MIN FAUCET AERATOR (BATHROOM)

Residential New/Existing Homes

Efficient Technology & Equipment Description
Faucet Aerator (Bathroom) (1.0 GPM)
Base Technology & Equipment Description
Average existing stock & Ontario Building Code 2006 (2.2 GPM)

Resource Savings Assumptions

Natural Gas (Updated)	**10 m^3**
Savings recommended by Navigant Consulting[1] adjusted for 1.0 GPM efficient technology	
Electricity	**n/a kWh**
Water (Updated)	**3,435 L**
Savings recommended by Navigant Consulting[1] adjusted for 1.0 GPM efficient technology	

Other Input Assumptions

Equipment Life	**10 Years**
Faucet aerators have an estimated service life of 10 years.[1, 2] As approved in EB 2008-0384 & EB 2008-0385.	
Incremental Cost	**$0.55**
As per utility program costs, bulk purchase of aerators.	
Free Ridership	**33 %**
Free Ridership rate recommended by Summit Blue Consulting.[3] As approved in EB 2008-0384 & EB 2008-0385.	

[1] Final Report "Measures and Assumptions for Demand Side Management (DSM) Planning", Navigant Consulting Inc., Ontario Energy Board, April 16, 2009

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

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

1.0 GAL/MIN FAUCET AERATOR (KITCHEN)

Residential New Homes

Efficient Technology & Equipment Description
Faucet Aerator (Kitchen) (1.0 GPM)
Base Technology & Equipment Description
Ontario Building Code 2006 (2.2 GPM)

Resource Savings Assumptions

Natural Gas	**32 m^3**
Savings based on the Navigant Report[1], except using 2.2 USGPM base case (opposed to 2.5) and 1.0 GPM efficient technology case	
Electricity	**n/a kWh**
Water	**10,631 L**
Savings based on the Navigant Report[1], except using 2.2 USGPM base case (opposed to 2.5) and 1.0 GPM efficient technology case	

Other Input Assumptions

Equipment Life	**10 years**
Faucet aerators have an estimated service life of 10 years.[2] As approved in EB 2008-0384 & EB 2008-0385.	
Incremental Cost	**$1.59**
As per utility program costs, bulk purchase of aerators.	
Free Ridership	**33 %**
Free Ridership rate recommended by Summit Blue Consulting.[3] As approved in EB 2008-0384 & EB 2008-0385.	

[1] Final Report "Measures and Assumptions for Demand Side Management (DSM) Planning", Navigant Consulting Inc., Ontario Energy Board, Appendix C: Substantiation Sheets, pg. C60-63, April 16, 2009.

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

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

1.0 GAL/MIN FAUCET AERATOR (KITCHEN)

Residential Existing Homes

Efficient Technology & Equipment Description
Faucet Aerator (Kitchen) (1.0 GPM)
Base Technology & Equipment Description
Average existing stock – 2.5 GPM Faucet Aerator (Kitchen)

Resource Savings Assumptions

Natural Gas	**35 m^3**
Savings based on the Navigant Report[1], except using a 1.0 GPM efficient technology case	
Electricity	**n/a kWh**
Water	**11,694 L**
Savings based on the Navigant Report[1], except using a 1.0 GPM efficient technology case	

Other Input Assumptions

Equipment Life	**10 years**
Faucet aerators have an estimated service life of 10 years.[2] As approved in EB 2008-0384 & EB 2008-0385.	
Incremental Cost	**$1.59**
As per utility program costs, bulk purchase of aerators.	
Free Ridership	**33 %**
Free Ridership rate recommended by Summit Blue Consulting.[3] As approved in EB 2008-0384 & EB 2008-0385.	

[1] Final Report "Measures and Assumptions for Demand Side Management (DSM) Planning", Navigant Consulting Inc., Ontario Energy Board, Appendix C: Substantiation Sheets, pg. C60-63, April 16, 2009.

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

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

Program: Solar Pool Heater

***Sector**: Residential Existing Homes*

Efficient Technology & Equipment Description
Solar Panels for pool heating
Qualifier/Restriction
Old gas pool heaters must be removed to qualify
Base Technology & Equipment Description
Natural Gas Heater

Resource Savings Assumptions

Natural Gas (Updated)	**1,116 m^3**
Based on Enbridge Territory Load Research results: 2007 – 14 directly metered natural gas pools = 1330 m3 2008 – 6 directly metered natural gas pools = 901m3 Average natural gas savings from a customer choosing a solar pool heater alternative = 1116 m3 (100% of natural gas pool heater use)	
Electricity	**-57 kWh**
2009 Board Approved assumption filed by Navigant April 16, 2009 page c 83	
Water	**L**

Other Input Assumptions

Equipment Life	**20 Years**
2009 Board Approved assumption filed by Navigant April 16, 2009 page c 81-84	
Incremental Cost (Contractor Installed)	**$ 1,450**
2009 Board Approved assumption filed by Navigant April 16, 2009 page c 83	
Free Ridership	**10 %**
NRCAN, Renewable Energy, Residential Solar Pool Heating Systems; A Buyer Guide page 3, 6	

CONDENSING UNIT HEATERS

Commercial – New/Existing

Efficient Technology & Equipment Description
Condensing Unit Heaters
Base Technology & Equipment Description
% Sales Weighted Average model, equivalent in efficiency to a power-vented or separated combustion unit heater (78% Annually Efficient)[1]. For the Existing Building case, as it's not cost-effective to replace an existing unit heater prematurely, this measure is only applicable when existing equipment requires replacement (i.e., in cases of "natural" replacement).

Resource Savings Assumptions

Natural Gas	**0.00631 m3/(BTU/H)**

Gas savings is based on the NGTC report, but modified to use a % Annual Sales Weighted base case scenario.[2] NGTC used the BIN Method combined with ASHRAE weather data[3] to estimate the annual operating hours of two Ontario regions: South (London) and North (North Bay). An oversizing factor of 100% was applied according to design practices.[4],[5] Operating hours were based on an average of the UG Northern & Southern climates (see table below).

Annual Operating Hours (BIN Method)

Region	Design Temp.	Indoor Temp.	Operating Hours
UG South (London)	-18.8 (°C)	18.3 (°C)	1,347 (hr/year)
UG North (North Bay)	-27.9 (°C)	18.3 (°C)	1,392 (hr/year)
Average	N/A	18.3 (°C)	1,370 (hr/year)

It should be noted that NRCan indicates that a unit heater's typical duty is 2,122 hrs/yr[6]. This number is significantly higher than the one obtained using the recognized ASHRAE standard. The difference could be explained by the fact that numbers obtained by NGTC using the BIN method account for the industry practice, which is to oversize unit heaters by 100%. Since no detailed information exists about how NRCan calculated typical operating hours, and given that the BIN method is an industry-recognized standard, an average operating time of 1,370 hours per year will be used for the energy consumption

[1] based on NGTC, "DSM Opportunities Associated with Unit Heaters", April 22, 2009, pg 6 and TRC Test Bed - Feb 25 2010 426pm.xlsx

[2] based on NGTC, "DSM Opportunities Associated with Unit Heaters", April 22, 2009, pg 6 and TRC Test Bed - Feb 25 2010 426pm.xlsx

[3] ASHRAE. Weather Data Viewer: London and North Bay (Ontario). Version 3.0. 2005.

[4] Davis Energy Group. Analysis of Standards Options for Unit Heaters and Duct Furnaces. May 2004, 8 pages.

[5] NGTC. NGTC Review (no. 123807-02) - Unit Heaters Savings (retainer task for Union Gas). August 17, 2007, 9 pages.

[6] NRCan. Canada's Energy Efficiency Regulations: Gas-Fired Unit Heaters – April 2007. [On line]. October 2008. http://oee.nrcan.gc.ca/regulations/bulletin/gas-unit-heatersaprilr007.cfm?text=N&printview=N.

calculations.

The annual savings was normalized using input capacity (BTU/H)

Electricity	**(-)0.00186 kWh/(BTU/H)**

Electrical consumption will increase with the installation of condensing unit heaters. The electrical savings is based the NGTC report results modified to use a % Annual Sales Weighted base case scenario.[7] Electrical consumption values were based on manufacturer's specifications which were aggregated and summarized below.

Electricity Consumption for Unit Heater[8]

Technology	125 – 200 kBtu/hr	225 – 300 kBtu/hr
Gravity-vented	275 kWh	280 kWh
Power-vented	392 kWh	747 kWh
Separated-combustion	392 kWh	747 kWh
Condensing	657 kWh	1,020 kWh

The annual savings was normalized using input capacity (BTU/H)

Water	**NA**

Other Input Assumptions

Equipment Life	**18 yrs**

Equipment life is based on NGTC, "DSM Opportunities Associated with Unit Heaters", April 22, 2009, pg 7

Lifetime (years)	Source
20-25	Gas Research Institute (GRI, 1998, US)
10-15	University of Wisconsin – greenhouse application, 2006
19 (North of US)	ACEEE (GRI source, 1997, US)
25 (South of US)	ACEEE (GRI source, 1997, US)
15	Davis Energy Group, 2004 (prepared for California)
21.5	DOE (average data from GRI, 1997, US)
18	NRCan, 2007
18	Ecotope, Inc., 2003, prepared for Oregon
18	NGTC's estimate

NGTC estimated 18 years for the average lifetime of unit heaters.

Incremental Cost	**$0.0129 /(BTU/H)**

Incremental costs were based equipment costs and installation costs found from Canadian manufacturers as well as a US website prices converted to Canadian currency.[9] The NGTC reported incremental costs were modified to use a % Sales Weighted average base case installed cost.

[7] based on NGTC, "DSM Opportunities Associated with Unit Heaters", April 22, 2009, pg 6 and TRC Test Bed - Feb 25 2010 426pm.xlsx

[8] based on NGTC, "DSM Opportunities Associated with Unit Heaters", April 22, 2009, pg 5

[9] based on NGTC, "DSM Opportunities Associated with Unit Heaters", April 22, 2009, pg 7-8 and TRC Test Bed - Feb 25 2010 426pm.xlsx

The incremental installed cost was normalized by input capacity (BTU/H)	
Free Ridership	**0 %**
Free Ridership was estimated using % annual sales for Condensing Unit Heaters (~0.01-0.02%) in UG territory.[10]	

[10] NGTC, "DSM Opportunities Associated with Unit Heaters", April 22, 2009, pg iii

Pre-Rinse Spray Nozzle (0.64 GPM)

Commercial – Existing Market

Efficient Equipment and Technologies Description
Low-flow pre-rinse spray nozzle/valve (0.64 GPM) Due to the variability in energy savings resulting from variability in daily water use, resource savings were calculated for three types of commercial enterprise using this technology[1]: Scenario **A**: Full service restaurant Scenario **B:** Limited service (fast food) restaurant Scenario **C:** Other
Base Equipment and Technologies Description
Less efficient pre-rinse spray nozzle/valve (1.6 GPM)

Decision Type	Target Market(s)	End Use
Retrofit	Commercial (existing)	Water heating

Codes, Standards, and Regulations

N/A

Resource Savings Table

	Electricity and Other Resource Savings			Equipment & O&M Costs of Conservation Measure	Equipment & O&M Costs of Base Measure
Year (EUL=)	Natural Gas (m^3)	Electricity (kWh)	Water (L)	($)	($)
1	**A:** 457 **B:** 90 **C:** 109	0	**A:** 97,292 **B:** 19,197 **C:** 23,166	150	0
2	**A:** 457 **B:** 90 **C:** 109	0	**A:** 97,292 **B:** 19,197 **C:** 23,166	0	0
3	**A:** 457 **B:** 90 **C:** 109	0	**A:** 97,292 **B:** 19,197 **C:** 23,166	0	0
4	**A:** 457 **B:** 90 **C:** 109	0	**A:** 97,292 **B:** 19,197 **C:** 23,166	0	0
5	**A:** 457 **B:** 90 **C:** 109	0	**A:** 97,292 **B:** 19,197 **C:** 23,166	0	0
TOTALS	**A:** 2,284 **B:** 451 **C:** 544	**0**	**A:** 486,462 **B:** 95,987 **C:** 115,829	**150**	**0**

[1] These bins are chosen based on empirical research conducted by Energy Profiles Ltd on behalf of Union Gas
Energy Profiles Ltd, *Deemed Savings for (Low Flow) Pre-Rinse Spray Nozzles*, January 2009

Resource Savings Assumptions

Annual Natural Gas Savings	**A:** 457 m^3 **B:** 90 m^3 **C:** 109 m^3

Assumptions and inputs:

- Average water inlet temperature: 14.5 ^oC (58 ^oF)[2]
- Average food service water heater set point temperature: 63 ^oC (145 ^oF)[3]
- Water heater thermal efficiency: 0.78[4]
- Percentage of water used that is hot: 69%[5]

Annual gas savings calculated as follows:

$$Savings = Ws * Phot * 8.33 * (T_{out} - T_{in}) * \frac{1}{Eff} * 10^{-6} * 27.8$$

Where:

Ws = Water savings (gallons)
Phot = Percentage of water used that is hot
T_{out} = Water heater set point temperature (^oF)
T_{in} = Water inlet temperature (^oF)
Eff = Water heater thermal efficiency
8.33 = Energy content of water (Btu/gallon/^oF)
10^{-6} = Factor to convert Btu to MMBtu
27.8 = Factor to convert MMBtu to m^3

Gas savings were determined to be 60% over base equipment:

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

Where:

Full service restaurant:
G_{eff} = Annual natural gas use with efficient equipment, 305 m^3
G_{base} = Annual natural gas use with base equipment, 761 m^3

[2] A simple average of Toronto inlet temperature, cited in the following as personal communication with City of Toronto Works Dept. VEIC, *Comments on Navigant's Draft Gas Measure Characterizations*, March 2009, and the average inlet water temperatures found in four jurisdictions examined as part of the following study: Energy Profiles Ltd, *Deemed Savings for (Low Flow) Pre-Rinse Spray Nozzles*, January 2009

[3] Average of temperatures found in a survey of restaurants in four Ontario municipalities. Energy Profiles Ltd, *Deemed Savings for (Low Flow) Pre-Rinse Spray Nozzles*, January 2009

[4] Minimum thermal efficiency for compliance with ASHRAE 90.1 standard.

[5] Average of ratio found in a survey of restaurants in four Ontario municipalities. Energy Profiles Ltd, *Deemed Savings for (Low Flow) Pre-Rinse Spray Nozzles*, January 2009

Limited service restaurant:
G_{eff} = Annual natural gas use with efficient equipment, 60 m^3
G_{base} = Annual natural gas use with base equipment, 150 m^3

Other:
G_{eff} = Annual natural gas use with efficient equipment, 73 m^3
G_{base} = Annual natural gas use with base equipment, 181 m^3

Annual Electricity Savings	**0 kWh**
N/A	
Annual Water Savings	**A:** 97,292 L **B:** 19,197 L **C:** 23,166 L

Assumptions and inputs:

- The study by Energy Profiles Ltd cited above measured average daily use for each facility examined before and after a 3.0 GPM nozzle was replaced with a 1.24 GPM nozzle. The difference in average usage time by facility, before and after replacement was tested by Navigant Consulting and found to be not statistically significant. Additionally, the same study reports that its findings suggest no difference in the duration of use between a 0.64 GPM nozzle and a 3.0 GPM nozzle. Given these results, Navigant Consulting has assumed that duration of use will be identical before and after replacement.
- From the Energy Profiles Ltd. study cited above, the following average durations of use were calculated:
  - Full-service restaurant: 1.26 hours per day.
  - Limited-service restaurant: 0.24 hours per day
  - Other: 0.33 hours per day
- The average numbers of days of operation per year for each restaurant type were drawn from the Energy Profiles Ltd. report. They are:
  - Full-service restaurant: 355 days per year.
  - Limited-service restaurant: 365 days per year.
  - Other: 320 days per year.

Annual water savings calculated as follows:

$$Savings = \left(Fl_{base} - Fl_{eff}\right) * 60 * Hr * Days$$

Where:

Fl_{base} = Flow rate of base equipment (GPM)
Fl_{eff} = Flow rate of efficient equipment (GPM)
60 = Minutes per hour
Hr = Hours used per day
Days = Days per year

Water savings were determined to be 60% over base equipment:

$$Percent\ Savings = \frac{(W_{base} - W_{eff})}{W_{base}}$$

Where:

Full service restaurant:

W_{eff} = Annual water consumed with efficient equipment, 64,862 litres

W_{base}= Annual water consumed by showers with base equipment: 162,154 litres

Limited service restaurant:

W_{eff} = Annual water consumed with efficient equipment, 12,798 litres

W_{base}= Annual water consumed by showers with base equipment: 31,996 litres

Other:

W_{eff} = Annual water consumed with efficient equipment, 15,444 litres

W_{base}= Annual water consumed by showers with base equipment: 38,610 litres

Other Input Assumptions

Effective Useful Life (EUL)	**5 Years**
Studies conducted for the City of Calgary[6], the U.S. DOE's FEMP[7] and by Puget Sound Energy[8] all give EUL for this measure as five years.	
Base & Incremental Conservation Measure Equipment and O&M Costs	**$ 150**
Equipment cost: $100 (Bulk price). Installation cost: $50 (Contracted price with third-party installer).	
Free Ridership	**0%**
Basis: Relatively new product probably only aware of one manufacturer (Bricor).	

[6] Ibid.

[7] U.S. DOE, Federal Energy Management Program, *How to Buy a Low-Flow Pre-Rinse Spray Valve* http://www1.eere.energy.gov/femp/pdfs/prerinsenozzle.pdf

[8] Quantec *Comprehensive Assessment of Demand-Side Resource Potentials (2008-2027)* Prepared for Puget Sound Energy

ENERGY STAR DISHWASHERS

Commercial – New/Existing

Efficient Technology & Equipment Description
Energy Star versions of (6) different types of Commercial Dishwashers: Undercounter Type – High Temperature (HT) Undercounter Type – Low Temperature (LT) Stationary Rack, (Door type, or Single rack) - HT Stationary Rack, (Door type, or Single rack) - LT Rack Conveyor, Single (Tank) – HT Rack Conveyor, Multi (Tank) - HT
Base Technology & Equipment Description
Non-Energy Star Dishwashers

Resource Savings Assumptions

Natural Gas	**See below**
Energy Savings were based on the results of NGTC study and savings calculator. NGTC racks or loads/day data for stationary Rack dishwashers was updated using UG territory data. The remaining load data came from FSTC & Energy Star. NGTC booster heater fuel type was updated to electric, due to popularity in Ontario. The idle energy rate & water use per rack values were adjusted by NGTC to represent an Energy Star dishwasher model that is not of average E-Star efficiency and not that just meets the minimum, but halfway in-between (25th percentile E-Star model, based on efficiency). **Assumptions[1]:** DW supply water temperature: 140°F (60°C) Temperature increase for building water heating: 90°F (50°C)[2] Natural gas water heater annual efficiency (recovery rate): 78%[3] Electric booster water heater efficiency: 96%[4] Wash water circulation temperature differential: 20°F (11°C)[5]. The 25th percentile E-Star models (in terms of efficiency) are sold more often than the average E-Star model.[6] Undercounter - HT **801 m3/yr** Undercounter - LT **326 m3/yr** Stationary Rack - HT **619 m3/yr** Stationary Rack - LT **841 m3/yr**	

[1] NGTC, DSM Opportunities Associated with Commercial Dishwashers, Final Report, April 27, 2009, Pg 13 and calculator, 100201_DSM_analysis_final - PK.xlsx.

[2] DHW DW supply – Water city average = 140°F-50°F = 90°F (60°C-10°C = 50°C).

[3] GAMA

[4] Minimum EF for a 5 gallon booster; 98% of boosters are electric (source: Steve Garvin, UG)

[5] Phone conversation with Joel Dipp from Hobart, worst case.

[6] As discussed with the EAC & UG during conversation, estimated, no data, April 2010.

Rack Conveyor Single – HT	**2,203 m3/yr**
Rack Conveyor Multi - HT	**3,708 m3/yr**

Electricity	**See below**

Electrical savings based on idle energy, pump energy, conveyor energy (where applicable), electric booster heater energy (for HT models). The assumptions above also apply.[7]

Undercounter - HT	**3,754 kWh/yr**
Undercounter - LT	**559 kWh/yr**
Stationary Rack - HT	**3,553 kWh/yr**
Stationary Rack - LT	**855 kWh/yr**
Rack Conveyor Single – HT	**9,811 kWh/yr**
Rack Conveyor Multi - HT	**15,822 kWh/yr**

Water	**See below**

Water savings is based on Energy Star Criteria, LBNL data, manufacturer wash tank capacity data, and associated differences in water use in wash & rinse cycles.[8]

Undercounter - HT	**112,795 L/yr**
Undercounter - LT	**45,891 L/yr**
Stationary Rack - HT	**87,119 L/yr**
Stationary Rack - LT	**118,369 L/yr**
Rack Conveyor Single – HT	**310,271 L/yr**
Rack Conveyor Multi - HT	**522,192 L/yr**

Other Input Assumptions

Equipment Life	**See below**

The equipment lifetime came from FSTC (Food Service Technology Centre) who contributed to the development of the Energy Star US calculator.[9],[10] No lifetime distinction was identified relative to the sanitation method (high or low temperature) or to the efficiency (Energy Star qualified or not) of the dishwashers.

Undercounter - HT	**10 yrs**
Undercounter - LT	**10 yrs**
Stationary Rack - HT	**15 yrs**
Stationary Rack - LT	**15 yrs**

[7] NGTC, DSM Opportunities Associated with Commercial Dishwashers, Final Report, April 27, 2009, Pg 13 and calculator, 100201_DSM_analysis_final - PK.xlsx.
[8] NGTC, DSM Opportunities Associated with Commercial Dishwashers, Final Report, April 27, 2009, Pg 14 and calculator, 100201_DSM_analysis_final - PK.xlsx.
[9] NGTC, DSM Opportunities Associated with Commercial Dishwashers, Final Report, April 27, 2009, Pg 17
[10] US Energy Star. Energy Star Program Requirements for Commercial Dishwashers. [On line]. September 2008. http://www.energystar.gov/ia/partners/product_specs/eligibility/comm_dishwashers_elig.pdf.

Rack Conveyor Single – HT	**20 yrs**
Rack Conveyor Multi - HT	**20 yrs**

Incremental Cost	**See below**

According to DW manufacturers and their sales representatives there is no distinguishable difference in installation costs between the base case & upgrade cases, therefore they were left out. NGTC updated their pricing to reflect the 25th percentile (in terms of efficiency) E-Star models because it was presumed to be sold more often than the average E-Star model.[11] List pricing was used because this analysis couldn't be done using the report's original pricing source because not enough information (pricing according to exact efficiency wasn't available).

List prices for Energy Star (ES) and Non-ES models were obtained from manufacturers' lists when available and from online commercial dishwasher vendors such as dishwasherworld.com, greatdishwashers.com, restaurantequipment.net, foodservicewarehouse.com and retrevo.com.

Undercounter - HT	(-) **$13**
Undercounter - LT	(-) **$13**
Stationary Rack - HT	(-) **$350**
Stationary Rack - LT	(-) **$350**
Rack Conveyor Single – HT	**$2,375**
Rack Conveyor Multi - HT	**$288**

Free Ridership	**See below**

Free Ridership is estimated using market share for Energy Star Dishwashers in UG territory.[12]

Undercounter - HT	**40%**
Undercounter - LT	**40%**
Stationary Rack - HT	**20%**
Stationary Rack - LT	**20%**
Rack Conveyor Single – HT	**27%**
Rack Conveyor Multi - HT	**27%**

[11] As agreed upon with the EAC & UG, estimated, no data, April 9, 2010.
[12] NGTC, DSM Opportunities Associated with Commercial Dishwashers, Final Report, April 27, 2009, Pg 11

OZONE LAUNDRY

Commercial – New/Existing

Efficient Technology & Equipment Description
Commercial Laundry Washing Equipment with Ozone In the commercial laundry industry, ozone is generated via corona discharge or ultraviolet light. It dissolves in cold to ambient temperature water (light and medium soil laundry) and activates the detergents, improving their activity and leading to a stronger cleaning action. However, since the solubility of ozone is low and its decomposition is faster at higher temperatures (38degC, (100degF)), the use of ozone is not recommended for heavy soils, which require warmer water. Generally, heavy soil laundry is treated with traditional laundry techniques.
Qualifier/Restriction
- No residential style clothes washers - Minimum required annual laundry load for each washer using ozone is: Washer Type — Minimum Laundry Load (Lbs/yr) Washer extractor – 60 lbs — 100,000 lbs/yr Washer extractor – 500 lbs — 260,000 lbs/yr Tunnel Washer – 120 lbs — 600,000 lbs/yr Tunnel Washer – 500 lbs — 1,900,000 lbs/yr
Base Technology & Equipment Description
Commercial Laundry Washing Equipment without Ozone

Resource Savings Assumptions

Natural Gas	**See below**

Washer Type	Gas Savings per Pounds washed per year (Lbs/yr)	
Washer extractor – 60 lbs	**0.0328**	**m3/(lbs/yr)**
Washer extractor – 500 lbs	**0.0328**	**m3/(lbs/yr)**
Tunnel Washer – 120 lbs	**0.0240**	**m3/(lbs/yr)**
Tunnel Washer – 500 lbs	**0.0240**	**m3/(lbs/yr)**

Operating conditions used to calculate the energy consumptions per pound of laundry evaluated using input data from the "Ozone Company" and from a linen service: "La Buanderie Centrale de Montréal". These operating conditions are typical of what may be found in high production industrial laundries[1]. Assumptions: supply water temperature of 9 degC and natural gas water heater efficiency of 78%. Note that 120 lbs is a typical tunnel washer capacity. Larger tunnel washers (up to 500 lbs) do exist but are less frequent.

The savings was normalized by dividing the estimated savings by the annual laundry load (lbs/yr) of laundry found in the report.

Electricity	**See below**

[1] Riesenberg, James, "PBMP- Commercial Laundry Facilities", Koeller and Company, November 4th, 2005

Electrical savings were based on the same conditions as described above.

Washer Type	Electricity savings per Pounds washed per year (Lbs/yr)	
Washer extractor – 60 lbs	**0.00219**	**kWh/(lbs/yr)**
Washer extractor – 500 lbs	**0.00219**	**kWh/(lbs/yr)**
Tunnel Washer – 120 lbs	**0.00152**	**kWh/(lbs/yr)**
Tunnel Washer – 500 lbs	**0.00152**	**kWh/(lbs/yr)**

Water	**See below**

Electrical savings were based on the same conditions as described above.

Washer Type	Water savings	
Washer extractor – 60 lbs	**2.01**	**L/(lbs/yr)**
Washer extractor – 500 lbs	**2.01**	**L/(lbs/yr)**
Tunnel Washer – 120 lbs	**1.22**	**L/(lbs/yr)**
Tunnel Washer – 500 lbs	**1.22**	**L/(lbs/yr)**

Other Input Assumptions

Equipment Life	**15 yrs**

Savings attributed to the measures are expected to last the life expectancy of the equipment. This data was obtained from suppliers.[2]

Incremental Cost	**See below**

Washer Type	Incremental Costs
Washer extractor – 60 lbs	**$10,970**
Washer extractor – 500 lbs	**$30,270**
Tunnel Washer – 120 lbs	**$49,667**
Tunnel Washer – 500 lbs	**$160,065**

Capital and installation costs were obtained in US dollars from The Ozone Company and converted to Canadian dollars.[3],[4]

Free Ridership	**8 %**

Free Ridership was estimated using market penetration in UG territory, according to the results of a survey conducted by TNS Canadian Facts. Further penetration of ozone systems for laundry is presently limited by the type of washing machines used (ozone cannot be used with residential type commercial machines)[5].

[2] NGTC, DSM OZONE LAUNDRY TREATMENT Final Report_v02 (#134809) November 25, 2009, Pgs iv-vi
[3] NGTC, DSM OZONE LAUNDRY TREATMENT Final Report_v02 (#134809) November 25, 2009, Pg 6
[4] NGTC, DSM OZONE LAUNDRY TREATMENT Final Report_v02 (#134809) November 25, 2009, Pgs iv-vi
[5] NGTC, DSM OZONE LAUNDRY TREATMENT Final Report_v02 (#134809) November 25, 2009, Pgs 19

ENERGY STAR CLOTHES WASHER

Multi-Family – New/Existing

Efficient Technology & Equipment Description
Energy Star high efficiency front load washers for application in the Multi-Family sector (MEF=1.72 ,WF=8.0, tub size = 2.8 ft)[1]
Base Technology & Equipment Description
Conventional top loading vertical axis washers (MEF = 1.26, WF=9.5, tub size = 2.8 ft)[2]

Resource Savings Assumptions

Natural Gas	**76 m^3**

Assumptions and inputs:

- Percentage of water used by base equipment which is hot water: 17%.
- Percentage of water used by efficient equipment which is hot water: 10%
- Average water inlet temperature: 9.33 degC (48.8 degF)
- Average water heater set point temperature: 54 degC (130 degF)
- Water heater thermal efficiency: 0.78
- Gas use per cycle[7] for commercial gas dryer with base equipment: 0.138 m3
- Gas use per cycle for commercial gas dryer with Energy Star clothes washer: 0.117 m3
- Gas dryer penetration in Ontario Multi-Family market: 25.5%
- Annual gas savings from reduced dryer use: 7 m3
- Annual gas savings from reduced hot water use: 69[3] m3

Annual gas savings calculated as follows:

$$Savings = \left[\left(W_{base} * Hot_{base} - W_{eff} * Hot_{eff} \right) * 8.33 * \frac{1}{Eff} * \left(T_{out} - T_{in} \right) + \left(Dr_{base} - Dr_{eff} \right) * Pene \right] * 10^{-6} * 27.8$$

Where:

W_{base} = Annual water use with base equipment (gallons)
W_{eff} = Annual water use with efficient equipment (gallons)
Hot_{base} = Percentage of water used that's hot with base equipment
Hot_{eff} = Percentage of water used that's hot with efficient equipment
8.33 = Energy content of water (Btu/gallon/ degF)
Eff = Eff = Water heater thermal efficiency
T_{out} = Water heater set point temperature (degF)
T_{in} = Water inlet temperature (degF)
Dr_{base} = Annual dryer gas use with base equipment (Btu)
Dr_{eff} = Annual dryer gas use with efficient equipment (Btu)
Pene = Penetration rate of natural gas powered clothes dryers in Ontario
10^-6 = Factor to convert Btu to MMBtu
27.8 = Factor to convert MMBtu to m3

Gas savings were determined to be 43% over base equipment.[1]

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[1] Navigant Report, pg B-233 MEASURES AND ASSUMPTIONS FOR DEMAND SIDE MANAGEMENT (DSM) PLANNING APPENDIX C: SUBSTANTIATION SHEETS – April 16, 2009

[2] Ibid.

[3] Corrected from Navigant's original value (73), based completely on Navigant's own calculation methodology & input assumptions. "E-star comml clothes washer - Navigant calculations check - April 29 2010 - 1137am.xlsx"

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

Where:
G_{eff} = Annual natural gas use with efficient equipment, 104 m3[4]
G_{base} = Annual natural gas use with base equipment, 180 m3[5]

Electricity	**201 kWh**

Assumptions and inputs:

- Water heated by natural gas (see above).
- Washer electricity use per cycle, base equipment: 0.13 kWh.
- Washer electricity use per cycle, efficient equipment: 0.11 kWh.
- Dryer electricity use per cycle, base equipment: 1.3 kWh.
- Dryer electricity use per cycle, efficient equipment: 1.11 kWh.
- Average number of cycles per year for clothes washer serving Multi-Family: 1246 cycles.

Annual electricity savings calculated as follows:

$$Savings = \left[(Wa_{base} - Wa_{eff}) + (Dr_{base} - Dr_{eff}) * (1 - Pene)\right] * Cyc$$

Where:

Wa_{base} = Washer electricity use per cycle, base equipment (kWh)
Wa_{eff} = Washer electricity use per cycle, efficient equipment (kWh)
Dr_{base} = Dryer electricity use per cycle, base equipment (kWh)
Dr_{eff} = Dry electricity use per cycle, efficient equipment (kWh)
Pene = Penetration rate of natural gas powered clothes dryers in Ontario
Cyc = Average number of cycles per year machine is used

Electricity savings were determined to be 15% over base equipment[2]:

$$Percent\ Savings = \frac{(Elec_{base} - Elec_{new})}{Elec_{base}}$$

Where:

$Elec_{eff}$ = Annual natural gas use with efficient equipment, 1,167 kWh
$Elec_{base}$ = Annual natural gas use with base equipment, 1,369 kWh

Water	**19,814 L**

Assumptions and inputs:

- Water use per cycle, base equipment: 101 litres (26.6 gallons).
- Water use per cycle, new technology: 85 litres (22.4 gallons).
- Average number of cycles per year for clothes washer serving Multi-Family: 1,246 cycles

Annual water savings calculated as follows

[4] Corrected from Navigant's original value (110 m3), based completely on Navigant's own calculation methodology & input assumptions. It is now consistent with the savings value (76 m3/yr) "E-star comml clothes washer - Navigant calculations check - April 29 2010 - 1137am.xlsx"

[5] Corrected from Navigant's original value (182 m3), based completely on Navigant's own calculation methodology & input assumptions. It is now consistent with the savings value (76 m3/yr) "E-star comml clothes washer - Navigant calculations check - April 29 2010 - 1137am.xlsx"

$$Savings = (W_{base} - W_{eff}) * Cyc$$

Where:

W_{base} = Annual water use with base equipment (gallons or litres)
W_{eff} = Annual water use with efficient equipment (gallons or litres)
Cyc = Average number of cycles per year machine is used

Water savings were determined to be 16% over base measure:

$$PercentSavings = \frac{(W_{base} - W_{eff})}{W_{base}}$$

Where:

W_{eff} = Annual water consumed with efficient equipment, 105,675 litres (27,910 gallons).
W_{base}= Annual water consumed by showers with base equipment: 125,489 litres (33,144 gallons).

Other Input Assumptions

Equipment Life	**11 years**
The U.S. DOE's Federal Energy Management Program has determined that commercial/Multi-Family clothes washers have an average EUL of 11.25 years. Navigant Consulting recommends adopting an EUL of 11 years.[3]	
Incremental Cost (Cust. / Contr. Install)	**$ 150**
Incremental cost based on prices offered online by a local retailer.[4]	
Free Ridership	**48 %**
Estimated based on Puget Sound Energy's findings.[5]	

[1] Navigant Report, pg B-233 MEASURES AND ASSUMPTIONS FOR DEMAND SIDE MANAGEMENT (DSM) PLANNING APPENDIX C: SUBSTANTIATION SHEETS – April 16, 2009
[2] Navigant Report, pg B-233 MEASURES AND ASSUMPTIONS FOR DEMAND SIDE MANAGEMENT (DSM) PLANNING APPENDIX C: SUBSTANTIATION SHEETS – April 16, 2009
[3] Navigant Report, pg B-233 MEASURES AND ASSUMPTIONS FOR DEMAND SIDE MANAGEMENT (DSM) PLANNING APPENDIX C: SUBSTANTIATION SHEETS – April 16, 2009
[4] Base measure (3.5 cu/ft top loader, GE): $850
New technology (3.5 cu/ft front loader, LG): $1,000
www.homedepot.ca. Assuming the base equipment cost/ efficient equipment cost ratio of the two 3.5 cu/ft washers is equivalent to that of two 2.8 cu/ft washers.
[5] Quantec, Comprehensive Assessment of Demand-Side Resource Potentials (2008-2027), Prepared for Puget Sound Energy

1.5 GAL/MIN FAUCET AERATOR (BATHROOM)

Multi-Family – New

Efficient Technology & Equipment Description
Faucet Aerator (Bathroom) (1.5 GPM)
Base Technology & Equipment Description
Ontario Building Code 2006 (2.2 GPM)

Resource Savings Assumptions

Natural Gas (Updated)	**4 m^3**
Savings recommended by Navigant Consulting.[1]	
Electricity	**n/a kWh**
Water (Updated)	**1,382 L**
Savings recommended by Navigant Consulting.[1]	

Other Input Assumptions

Equipment Life	**10 Years**
Faucet aerators have an estimated service life of 10 years.[1, 2] As approved in EB 2008-0384 & EB 2008-0385.	
Incremental Cost	**$0.55**
As per utility program costs, bulk purchase of aerators.	
Free Ridership (Updated)	**10 %**
Free ridership – EB 2008-0384 & EB 2008-0385	

[1] Final Report "Measures and Assumptions for Demand Side Management (DSM) Planning", Navigant Consulting Inc., Ontario Energy Board, April 16, 2009

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

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

1.5 GAL/MIN FAUCET AERATOR (KITCHEN)

Multi-Family - New

Efficient Technology & Equipment Description
Faucet Aerator (Kitchen) (1.5 GPM)
Base Technology & Equipment Description
Ontario Building Code 2006 (2.2 GPM)

Resource Savings Assumptions

Natural Gas	**13 m^3**
Savings based on the Navigant Report[1], except using 2.2 USGPM base case (opposed to 2.5 GPM)	
Electricity	**n/a kWh**
Water	**4,280 L**
Savings based on the Navigant Report[1], except using 2.2 USGPM base case (opposed to 2.5 GPM)	

Other Input Assumptions

Equipment Life	**10 years**
Faucet aerators have an estimated service life of 10 years.[2] As approved in EB 2008-0384 & EB 2008-0385.	
Incremental Cost	**$1.39**
As per utility program costs, bulk purchase of aerators.	
Free Ridership	**10 %**
Free ridership – EB 2008-0384 & EB 2008-0385	

[1] Final Report "Measures and Assumptions for Demand Side Management (DSM) Planning", Navigant Consulting Inc., Ontario Energy Board, Appendix C: Substantiation Sheets, pg. C248-250, April 16, 2009.

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

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

1.0 GAL/MIN FAUCET AERATOR (BATHROOM)

MultiFamily – New

Efficient Technology & Equipment Description
Faucet Aerator (Bathroom) (1.0 GPM)
Base Technology & Equipment Description
Ontario Building Code 2006 (2.2 GPM)

Resource Savings Assumptions

Natural Gas (Updated)	**7 m^3**
Savings recommended by Navigant Consulting[1] adjusted for 1.0 GPM	
Electricity	**n/a kWh**
Water (Updated)	**2,371 L**
Savings recommended by Navigant Consulting[1] adjusted for 1.0 GPM	

Other Input Assumptions

Equipment Life	**10 Years**
Faucet aerators have an estimated service life of 10 years.[1, 2] As approved in EB 2008-0384 & EB 2008-0385.	
Incremental Cost	**$0.55**
As per utility program costs, bulk purchase of aerators.	
Free Ridership (Updated)	**10 %**
Free ridership – EB 2008-0384 & EB 2008-0385	

[1] Final Report "Measures and Assumptions for Demand Side Management (DSM) Planning", Navigant Consulting Inc., Ontario Energy Board, April 16, 2009

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

1.0 GAL/MIN FAUCET AERATOR (KITCHEN)

Multi-Familiy - New

Efficient Technology & Equipment Description
Faucet Aerator (Kitchen) (1.0 GPM)
Base Technology & Equipment Description
Ontario Building Code 2006 (2.2 GPM)

Resource Savings Assumptions

Natural Gas	**22 m^3**
Savings based on the Navigant Report[1], except using 2.2 USGPM base case (opposed to 2.5) and 1.0 GPM efficient technology case	
Electricity	**n/a kWh**
Water	**7,337 L**
Savings based on the Navigant Report[1], except using 2.2 USGPM base case (opposed to 2.5) and 1.0 GPM efficient technology case	

Other Input Assumptions

Equipment Life	**10 years**
Faucet aerators have an estimated service life of 10 years.[2] As approved in EB 2008-0384 & EB 2008-0385.	
Incremental Cost	**$1.59**
As per utility program costs, bulk purchase of aerators.	
Free Ridership (Updated)	**10 %**
Free ridership – EB 2008-0384 & EB 2008-0385	

[1] Final Report "Measures and Assumptions for Demand Side Management (DSM) Planning", Navigant Consulting Inc., Ontario Energy Board, Appendix C: Substantiation Sheets, pg. C248-250, April 16, 2009..

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

LOW-FLOW SHOWERHEAD - 1.5 GAL/MIN

Multi-Family – New

Efficient Technology & Equipment Description
Low-flow showerhead 1.5 gal/min.
Base Technology & Equipment Description
2.2 gpm[1] which also conforms to Ontario Building Code 2006 requirements[2]

Resource Savings Assumptions

Natural Gas	**33 m3**
Based on Navigant savings calculation[3].	
Water	**5,228 L**
Based on Navigant savings calculation[4].	
Electricity	**n/a kWh**

Other Input Assumptions

Equipment Life	**10 years**
Low flow showerheads have an estimated service life of 10 years as recommended by Navigant and approved in EB 2008-0384 & EB 2008-0385.	
Incremental Cost (Cust Install)	**$6**
Based on Navigant's values[5]. Incremental cost based on a survey of online retailers[6]. This does not include installation costs	
Free Ridership	**10 %**
As per EB 2008-0384 & EB 2008-0385	

[1] Summit Blue, *Resource Savings Values in Selected Residential DSM Prescriptive Programs*, June 2008.
[2] Ontario Building Code 2006 – Table 7.6.4.2
[3] Navigant Consulting, MEASURES AND ASSUMPTIONS FOR DEMAND SIDE MANAGEMENT (DSM) PLANNING - APPENDIX C: SUBSTANTIATION SHEETS, April 16, 2009, Pg. C-251-254
[4] Navigant Consulting, MEASURES AND ASSUMPTIONS FOR DEMAND SIDE MANAGEMENT (DSM) PLANNING - APPENDIX C: SUBSTANTIATION SHEETS, April 16, 2009, Pg. C-251-254
[5] Navigant Consulting, MEASURES AND ASSUMPTIONS FOR DEMAND SIDE MANAGEMENT (DSM) PLANNING - APPENDIX C: SUBSTANTIATION SHEETS, April 16, 2009, Pg. C-251-254
[6] Whedon Products 1.5 GPM Ultra Saver Showerhead. http://www.antonline.com/p_USB3C-GP_398829.htm

LOW-FLOW SHOWERHEAD - 1.25 GAL/MIN

Multi-Family –New

Efficient Technology & Equipment Description
Low-flow showerhead 1.25 gal/min.
Base Technology & Equipment Description
2.2 gpm[1], which also conforms to Ontario Building Code 2006 requirements[2]

Resource Savings Assumptions

Natural Gas	**45 m3**
Based on Navigant savings calculation[3].	
Water	**8,824 L**
Based on Navigant savings calculation[4].	
Electricity	**n/a kWh**

Other Input Assumptions

Equipment Life	**10 years**
Low flow showerheads have an estimated service life of 10 years as recommended by Navigant and approved in EB 2008-0384 & EB 2008-0385.	
Incremental Cost (Cust Install)	**$3.69**
As per utility program costs, bulk purchase of showerheads.	
Free Ridership	**10 %**
As per EB 2008-0384 & EB 2008-0385	

[1] Summit Blue, *Resource Savings Values in Selected Residential DSM Prescriptive Programs*, June 2008.
[2] Ontario Building Code 2006 – Table 7.6.4.2
[3] Navigant Consulting, MEASURES AND ASSUMPTIONS FOR DEMAND SIDE MANAGEMENT (DSM) PLANNING - APPENDIX C: SUBSTANTIATION SHEETS, April 16, 2009, Pg. C-255-258
[4] Navigant Consulting, MEASURES AND ASSUMPTIONS FOR DEMAND SIDE MANAGEMENT (DSM) PLANNING - APPENDIX C: SUBSTANTIATION SHEETS, April 16, 2009, Pg. C-255-258