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VIA RESS, EMAIL and COURIER

April 30, 2014

Ms. Kirsten Walli
Board Secretary
Ontario Energy Board
2300 Yonge Street, 27th Floor
Toronto, Ontario M4P 1E4

Dear Ms. Walli:

RE: EB-2013-0430 – New and Updated DSM Measures
Joint Submission from Enbridge Gas Distribution Inc. and Union Gas Ltd.

Enbridge Gas Distribution Inc. ("Enbridge") and Union Gas Ltd. ("Union") request the approval of the Ontario Energy Board (the "Board") for the new and updated DSM measures.

In the DSM Guidelines for Natural Gas Utilities (EB-2008-0346), the Board directed the utilities to make an annual application to update approved input assumptions and encouraged the utilities to file a joint application.

This application is a follow up to the letter filed by the utilities on December 19, 2013, stating that an application for the approval of 2013 DSM input assumptions would be filed in early 2014. Per the Joint Terms of Reference on Stakeholder Engagement for DSM Activities by Enbridge Gas Distribution and Union Gas Limited dated November 4, 2011, one of the Technical Evaluation Committee's ("TEC") major tasks is the development of a Technical Reference Manual for natural gas DSM activities. Currently in development, the Technical Reference Manual is envisioned to replace the common Table of Measure Assumptions and Substantiation Documents filed by the utilities with their 2012 to 2014 Plans.

Until such time as the Technical Reference Manual is completed in its entirety, and filed with the Board, the common Table of Measure Assumptions and Substantiation Documents will continue to document the Board approved measure assumptions.

This joint application is made in consultation with the TEC, to update the common Table of Measure Assumptions and Substantiation Documents. With respect to this update the TEC endorsement speaks only to the following measure assumptions:

- High Efficiency Water Heaters;
- Update to 2.0 GPM Low-Flow Showerheads for Low Income Single Family, Low Income Multi Residential and Multi Residential;
- Revised Measure Lives for Community Energy Retrofit (Enbridge), Home Reno Rebate (Union Gas), Low Income Weatherization (Enbridge) and Low Income Weatherization (Union Gas); and
- Revised Free Ridership value for Community Energy Retrofit (Enbridge) and Home Reno Rebate (Union Gas).

Further, the TEC endorses the addition of a new major measure to Community Energy Retrofit (Enbridge) and Home Reno Rebate (Union Gas).

This application includes:

- Current approved measures assumptions;
- Corrections to clerical errors or omissions in EB-2012-0441.

The application contains the following exhibits:

Exhibit A, Tab 1, Schedule 1 Table of Contents
Exhibit B, Tab 1, Schedule 1 Background and Introduction
Exhibit B, Tab 1, Schedule 2 Updated Table of Measure Assumptions
Exhibit B, Tab 1, Schedule 3 New and Updated Substantiation Document

This application was prepared jointly by Enbridge and Union. Please direct correspondence on this file to both Enbridge and Union representatives:

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Enbridge and Union request the Board's approval of the new and updated DSM measures.

Sincerely,

*(*Original signed by*)*

Stephanie Allman
Regulatory Coordinator

cc: Alexander Smith (Torys)
Vanessa Innis
EB-2011-0327 Intervenors

Dennis M. O'Leary
EB-2011-0295 Intervenors

TEC Members:
Ted Kesik – Independent Member
Bob Wirtshafter – Independent Member
Jay Shepherd – School Energy Coalition
Julie Girvan – Consumers Council of Canada
Chris Neme – Green Energy Coalition
Ravi Sigurdson – Enbridge Gas Distribution
Tina Nicholson – Union Gas

EXHIBIT LIST

Exhibit	Tab	Schedule	Description	Witness
A	1	1	Table of Contents	R. Sigurdson/ T. Nicholson
B	1	1	Background and Introduction	R. Sigurdson/ T. Nicholson
B	1	2	Updated Table of Measure Assumptions	R. Sigurdson/ T. Nicholson
B	1	3	New and Updated Substantiation Document	R. Sigurdson/ T. Nicholson

BACKGROUND AND INTRODUCTION

1. The Demand Side Management Guidelines for Natural Gas Utilities ("DSM Guidelines"; EB-2008-0346), encourages Enbridge Gas Distribution ("Enbridge") and Union Gas Ltd. ("Union") to file a joint application of approved input assumption on an annual basis:

   > "The application should be made annually, whether or not the natural gas utilities are requesting any changes to their set of input assumptions. The natural gas utilities' annual application will provide a Board forum for stakeholders that will allow them to, among other things, request updates and/or additions to the set of input assumptions that may not have been identified by the natural gas utilities."[1]

2. A joint Table of Measures Assumptions filed in 2012 brought together a common set of Substantiation Documents providing detailed information and savings calculations for each measure listed.

3. The DSM Guidelines request that a Terms of Reference for Stakeholder Engagement ("Terms of Reference"; EB-2011-0295 Exhibit B, Tab 2, Schedule 9, Appendix A) be developed by the natural gas utilities in cooperation with stakeholders for the multi-year plan period. Under the Terms of Reference, Enbridge and Union have engaged extensively with stakeholders through each utility's DSM Consultative, the utilities' respective Audit Committees and a joint Technical Evaluation Committee ("TEC").

4. The Terms of Reference for Stakeholder Engagement mandates the TEC to develop a Technical Reference Manual for natural gas DSM activities. In

[1] Demand Side Management Guidelines for Natural Gas Utilities, EB-2008-0346, Ontario Energy Board, June 30, 2011, page 19.

2013, the utilities, through the TEC, engaged a third party consultant to begin development of the Technical Reference Manual ("TRM").

5. Once completed, the TRM will replace the Table of Measure Assumptions, documenting efficiency measures savings assumptions and supporting information (e.g. algorithms, formulae, reference materials). Currently, the High Efficiency Water Heaters measure has been reviewed through the TRM process and is endorsed by the TEC.

This Update includes the following TEC endorsed elements:

Update Element	Measure(s)	Utility
Addition of a Major Measure to an Existing Offering	▪ Addition of Exposed Floor Insulation as a Major Measure to Community Energy Retrofit (Enbridge) and Home Reno Rebate (Union Gas)[2]	Both
New Measure	▪ High Efficiency Water Heaters	Both
Update to Measures	▪ 2.0 GPM Low-Flow Showerheads for Low Income Single Family, Low Income Multi Residential and Multi Residential	Both
Update to Measure Life	▪ Community Energy Retrofit (Enbridge) – Installations including a high efficiency furnace ▪ Community Energy Retrofit (Enbridge) – Installations excluding a high efficiency furnace ▪ Home Reno Rebate (Union Gas) – Installations including a high efficiency furnace ▪ Home Reno Rebate (Union Gas) – Installations excluding a high efficiency	Both

[2] As per Union Gas Settlement Agreement (EB-2011-0327), Technical Evaluation Committee endorsement is required for the addition of a measure to the Union Gas Home Reno Rebate offering.

	furnace	
Update to Measure Life as per 2012 Audit Recommendations	▪ Low Income Weatherization (Enbridge) ▪ Low Income Weatherization (Union Gas)	Both
Update to Free Ridership Value	▪ Community Energy Retrofit (Enbridge) and Home Reno Rebate (Union Gas)	Both

6. This application is comprised of the following exhibits:

- Exhibit B, Tab 1, Schedule 2 presents the Updated Table of Measure Assumptions; and
- Exhibit B, Tab 1, Schedule 3 presents assumptions for Low-Flow Showerheads (Low Income Single Family; Low Income Multi Residential; Multi Residential) and High Efficiency Water Heaters.

	Indicates an update (March 2014) to Board-approved list of input assumptions

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 (%)	Utility Measure Applies to	Decision Type
Residential Space Heating													
Residential	Existing	Attic Insulation	upgrade to R-40	R-10		105	105	0	20	$580	33%	UG	Retrofit
Residential	Existing	Basement Wall Insulation	upgrade to R-12	R-1		261	145	0	25	$1654	33%	UG	Retrofit
Residential	Existing	Draft Proofing Kit	(1) Spray Foam, can (1) Caulk, tube (30 ft) Foam Tape (4) Energy Saver Gasket with 2 child safety inserts	No Draft Proofing Kit		236	27	0	1	$20	55%	UG	Retrofit
Residential	New	Energy Star Home	version 3	Home built to OBC 2006		1018	1450	0	25	$3200	48%	EGD	New
Residential	Existing	Fireplace intermittent ignition control retrofit		Natural gas fireplace with a pilot		104	-31	0	8	$150	1%	UG	Retrofit
Residential	Existing	High Efficiency Condensing Furnace	AFUE 96	High-Efficiency Furnace	AFUE 90	129	0	0	18	$1767	0%	EGD	Replacement
Residential	New	High Efficiency Fireplace with Pilotless Ignition	Freestanding, Minimum 70% EnerGuide Rating	Freestanding fireplace	65% median efficiency	110	-31	0	20	$135	17%	EGD	New
Residential	New	High Efficiency Fireplace with Pilotless Ignition	Insert, Minimum 60% EnerGuide Rating	Insert	55% median efficiency	109	-31	0	20	$135	17%	EGD	New
Residential	New	High Efficiency Fireplace with Pilotless Ignition	Zero Clearance, >= 40 kBtu.h =Minimum 60% EnerGuide Rating	Zero Clearance		122	-31	0	20	$135	17%	EGD	New
Residential	New	High Efficiency Fireplace with Pilotless Ignition	Zero Clearance, < 40 kBtu.h =Minimum 70% EnerGuide Rating	Zero Clearance		108	-31	0	20	$135	17%	EGD	New
Residential	Existing	High Efficiency Fireplace with Pilotless Ignition	Freestanding, Minimum 70% EnerGuide Rating	Freestanding fireplace	65% median efficiency	110	-31	0	20	$135	17%	EGD	Replacement
Residential	Existing	High Efficiency Fireplace with Pilotless Ignition	Insert, Minimum 60% EnerGuide Rating	Insert	55% median efficiency	109	-31	0	20	$135	17%	EGD	Replacement
Residential	Existing	High Efficiency Fireplace with Pilotless Ignition	Zero Clearance, >= 40 kBtu.h =Minimum 60% EnerGuide Rating	Zero Clearance		122	-31	0	20	$135	17%	EGD	Replacement
Residential	Existing	High Efficiency Fireplace with Pilotless Ignition	Zero Clearance, < 40 kBtu.h =Minimum 70% EnerGuide Rating	Zero Clearance		108	-31	0	20	$135	17%	EGD	Replacement
Residential	New	Programmable Thermostat		Standard Thermostat		53	54	0	15	$25	10%	UG	New
Residential	Existing	Programmable Thermostat		Standard Thermostat		53	54	0	15	$25	43%	UG	Retrofit
Residential	New	Programmable Thermostat		Standard Thermostat		53	54	0	15	$53.22	10%	EGD	New
Residential	Existing	Programmable Thermostat		Standard Thermostat		53	54	0	15	$50	43%	EGD	Retrofit
Residential	Existing	Reflector Panels		No reflector panels		143	0	0	18	$229	0%	UG	Retrofit
Residential	Existing	Reflector Panels		Radiant heat w/o reflector panels		143	0	0	18	$238	0%	EGD	Retrofit
Residential Water Heating													
Residential	New	Faucet Aerator	Bathroom, 1.5 GPM, (3) aerators	Average Existing Stock	2.2 GPM	18	0	6012	10	$2.72	31%	EGD	New
Residential	New	Faucet Aerator	Bathroom, 1.0 GPM	Ontario Building Code 2006	2.2 GPM	10	0	3,435	10	$0.59	33%	UG	New
Residential	Existing	Faucet Aerator	Bathroom, 1.0 GPM	Average existing stock	2.2 GPM	10	0	3,435	10	$0.59	33%	UG	Retrofit
Residential	Existing	Faucet Aerator	Bathroom, 1.0 GPM	Replace existing 1.5 GPM	1.5 GPM	4		1,432	10	$0.59	33%	UG	Retrofit
Residential	New/Existing	Faucet Aerator	Bathroom, 1.5 GPM	Average existing stock	2.2 GPM	6	0	2,004	10	$0.49	33%	UG	New/Retrofit
Residential	New	Faucet Aerator	Kitchen, 1.0 GPM	Ontario Building Code 2006	2.2 GPM	32	0	10,631	10	$1.59	33%	UG	New
Residential	Existing	Faucet Aerator	Kitchen, 1.0 GPM	Average existing stock	2.5 GPM	35	0	11,694	10	$1.59	33%	UG	Retrofit
Residential	Existing	Faucet Aerator	Kitchen, 1.5 GPM	Average existing stock	2.5 GPM	23	0	7,797	10	$1.29	33%	UG	Retrofit

	Indicates an update (March 2014) to Board-approved list of input assumptions

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 (%)	Utility Measure Applies to	Decision Type
Residential	New	Faucet Aerator	Kitchen, 1.5 GPM	Ontario Building Code 2006	2.2 GPM	19	0	6,201	10	$1.29	33%	UG	New
Residential	New	Faucet Aerator (Distributed)	Bathroom, 1.0 GPM	Ontario Building Code 2006	2.2 GPM	10	0	3435	10	$0.55	31%	EGD	New
Residential	Existing	Faucet Aerator (Distributed)	Bathroom, 1.0 GPM	Average Existing Stock	2.2 GPM	10	0	3435	10	$0.55	31%	EGD	Retrofit
Residential	Existing	Faucet Aerator (Distributed)	Bathroom, 1.5 GPM	Average Existing Stock	2.2 GPM	6	0	2004	10	$1	31%	EGD	Retrofit
Residential	New	Faucet Aerator (Distributed)	Kitchen, 1.0 GPM	Ontario Building Code 2006	2.2 GPM	32	0	10631	10	$1	31%	EGD	New
Residential	Existing	Faucet Aerator (Distributed)	Kitchen, 1.0 GPM	Average Existing Stock	2.5 GPM	35	0	11694	10	$1	31%	EGD	Retrofit
Residential	New	Faucet Aerator (Distributed)	Kitchen, 1.5 GPM	Average Existing Stock	2.5 GPM	23	0	7797	10	$1.65	31%	EGD	New
Residential	Existing	Faucet Aerator (Distributed)	Kitchen, 1.5 GPM	Average Existing Stock	2.5 GPM	23	0	7797	10	$1	31%	EGD	Retrofit
Residential	New	Low-flow showerhead	1.25 & 1.5 GPM (Per Household)	Average Existing Stock	2.5 GPM	48	0	14391	10	$16.76	10%	EGD	New
Residential	Existing	Low-flow showerhead	1.25 GPM	Replace existing 2.0 GPM	2.0 GPM	33		11,584	10	$3.79	10%	UG	Retrofit
Residential	New	Low-flow showerhead	1.25 GPM (Per household)	Average Existing Stock	2.5 GPM	53	0	17187	10	$4.26	10%	EGD	New
Residential	New	Low-flow showerhead	1.5 GPM (Per Household)	Average Existing Stock	2.5 GPM	43	0	11596	10	$12.5	10%	EGD	New
Residential	Existing	Low-flow showerhead (Contractor Installed)	1.25 GPM	2.0 -2.5 GPM Showerhead	2.25 GPM	46	0	14294	10	$3.79	10%	UG	Retrofit
Residential	Existing	Low-flow showerhead (Contractor Installed)	1.25 GPM	2.6 + GPM Showerhead	3.0 GPM	88	0	22580	10	$3.79	10%	UG	Retrofit
Residential	Existing	Low-flow showerhead (Distributed)	1.25 GPM	2.6 + GPM Showerhead	3.07 GPM	82	0	23374	10	$4.26	10%	EGD	Retrofit
Residential	Existing	Low-flow showerhead (Distributed)	1.25 GPM	2.0 -2.5 GPM Showerhead	2.45 GPM	50	0	16631	10	$4.26	10%	EGD	Retrofit
Residential	New/Existing	Low-flow showerhead (Distributed)	1.25 GPM	Average existing stock	2.2 GPM	44	0	13,885	10	$3.79	10%	UG	New/Retrofit
Residential	Existing	Low-flow showerhead (Installed)	1.25 GPM	2.0 -2.5 GPM Showerhead	2.45 GPM	50	0	16631	10	$19	10%	EGD	Retrofit
Residential	Existing	Low-flow showerhead (Installed)	1.25 GPM	2.6 + GPM Showerhead	3.07 GPM	82	0	23374	10	$19	10%	EGD	Retrofit
Residential	Existing	Pipe Insulation		Water Heater w/o pipe insulation		18	0	0	10	$2/$4	4%	EGD	Retrofit
Residential	Existing	Pipe Wrap (R-4)	Insulation for DWH outlet pipe	Uninsulated DHW outlet pipes	R-1	18	0	0	10	$0.98	4%	UG	Retrofit
Residential	Existing	Solar Pool Heaters		Natural gas pool heater		1,116	-57	0	20	$1,450	10%	Both	Retrofit
Residential	New/Existing	Tankless Water Heater	EF 0.82	Storage Tank Water Heater		142	0	0	18	$750	2%	UG	New/Replacement
Residential	Existing	Tankless Water Heater		Storage Tank Water Heater		130	0	0	18	$750	2%	EGD	Replacement

	Indicates an update (March 2014) to Board-approved list of input assumptions

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 (%)	Utility Measure Applies to	Decision Type
Low-Income Space Heating													
Low-Income	Existing	Early Furnace Replacement - 60% AFUE	90% AFUE Furnace	60% AFUE Furnace		781			3	$518	0%	UG	Retrofit
Low-Income	Existing	Early Furnace Replacement - 70% AFUE	90% AFUE Furnace	70% AFUE Furnace		466			3	$518	0%	UG	Retrofit
Low-Income	Existing	Programmable Thermostat		Standard manual thermostat		53	54	0	15	$26.95	1%	UG	Retrofit
Low Income	Existing	Programmable Thermostat		Standard Thermostat		53	54	0	15	$69.18	**0%**	EGD	Retrofit
Low-Income Water Heating													
Low-Income	Existing	Early Hot Water Heater Replacement (0.575 to 0.62 EF)	0.62 EF Water Heater	0.575 EF Water Heater		80			3	$168.00	1%	UG	Retrofit
Low-Income	Existing	Faucet Aerator	Bathroom, 1.0 GPM	Average existing stock	2.2 GPM	10	0	3,435	10	$0.59	1%	UG	Retrofit
Low-Income	Existing	Faucet Aerator	Bathroom, 1.0 GPM	Replace existing 1.5 GPM	1.5 GPM	4	0	1,432	11	$0.59	1%	UG	Retrofit
Low-Income	Existing	Faucet Aerator	Bathroom, 1.5 GPM	Average existing stock	2.2 GPM	6	0	2,004	10	$0.49	1%	UG	Retrofit
Low-Income	Existing	Faucet Aerator	Kitchen, 1.0 GPM	Average existing stock	2.5 GPM	35	0	11,694	10	$1.59	1%	UG	Retrofit
Low-Income	Existing	Faucet Aerator	Kitchen, 1.5 GPM	Average existing stock	2.5 GPM	23	0	7,797	10	$1.29	1%	UG	Retrofit
Low Income	Existing	Faucet Aerator	Bathroom, 1.0 GPM	Average Existing Stock	2.2 GPM	10	0	3435	10	$0.55	0%	EGD	Retrofit
Low Income	Existing	Faucet Aerator	Bathroom, 1.5 GPM	Average Existing Stock	2.2 GPM	6	0	2004	10	$0.46	0%	EGD	Retrofit
Low Income	Existing	Faucet Aerator	Kitchen, 1.0 GPM	Average Existing Stock	2.5 GPM	35	0	11694	10	$1	0%	EGD	Retrofit
Low Income	Existing	Faucet Aerator	Kitchen, 1.5 GPM	Average Existing Stock	2.5 GPM	23	0	7797	10	$0.94	0%	EGD	Retrofit
Low Income	Existing	Low-flow showerhead	1.25 GPM (Installed)	2.0 -2.5 GPM Showerhead	2.45 GPM	50	0	16631	10	$18.71	0%	EGD	Retrofit
Low Income	Existing	Low-flow showerhead	1.25 GPM (Installed)	2.6 + GPM Showerhead	3.07 GPM	82	0	23374	10	$18.71	0%	EGD	Retrofit
Low income	Existing	Low-flow showerhead	2.0 GPM	2.0 -2.5 GPM Showerhead	2.45	20	0	3418	10	$18.71	0%	EGD	Retrofit
Low income	Existing	Low-flow showerhead	2.0 GPM	2.6 + GPM Showerhead	3.07	52	0	7938	10	$18.71	0%	EGD	Retrofit
Low-Income	Existing	Low-flow showerhead (Contractor installed)	1.25 GPM	Average existing stock	2.25 GPM	46	0	14,294	10	$3.79	1%	UG	Retrofit
Low-Income	Existing	Low-flow showerhead (Contractor installed)	1.25 GPM	Average existing stock	3.0 GPM	88	0	22,580	10	$3.79	1%	UG	Retrofit
Low-Income	Existing	Pipe insulation for DHW outlet pipe	R-4 insulation	Uninsulated DHW outlet pipes (R-1)	R-1	18	0	0	10	$0.98	1%	UG	Retrofit
Low-Income	Existing	Low-flow showerhead	1.25 GPM	Replace existing 2.0 GPM	2.0 GPM	33	0	11,584	10	$3.79	1%	UG	Retrofit
Low-Income Multi-Family Water Heating													
Low-Income	Existing	Faucet Aerator	Kitchen, 1.5 GPM	Average existing stock	2.5 GPM	16	0	5,377	10	$1.14	0%	Both	Retrofit
Low-Income	Existing	Faucet Aerator	Bathroom, 1.0 GPM	Average existing stock	2.2 GPM	7		2,371	10	$0.56	0%	Both	Retrofit
Low-Income	Existing	Low-flow showerhead (Distributed)	1.25 GPM	Average existing stock	2.21 GPM	32	0	9,585	10	$3.79	1%	UG	Retrofit
Low-Income	Existing	Low-flow showerhead	1.25 GPM	2.0-2.5 GPM showerhead	2.25 GPM	33	0	9,892	10	$3.79	1%	UG	Retrofit
Low-Income	Existing	Low-flow showerhead	1.25 GPM	> 2.6 GPM showerhead	3.0 GPM	64	0	15,549	10	$3.79	1%	UG	Retrofit
Low-Income	Existing	Low-flow showerhead	1.25 GPM	Replace existing 1.5 GPM	1.5 GPM	8	0	3,846	10	$3.79	1%	UG	Retrofit
Low-Income	Existing	Low-flow showerhead	1.25 GPM	Replace existing 2.0 GPM	2.0 GPM	24	0	7,933	10	$3.79	1%	UG	Retrofit
Low Income	Existing	Low-Flow Showerhead (Per household, Installed)	1.5 GPM	2.0 -2.5 GPM showerhead	2.25 GPM	21	0	5931	10	$12.50	0%	EGD	Retrofit
Low Income	Existing	Low-Flow Showerhead (Per household, Installed)	1.5 GPM	2.6 -3.0 GPM GPM showerhead	2.8 GPM	40	0	10036	10	$12.50	0%	EGD	Retrofit
Low Income	Existing	Low-Flow Showerhead (Per household, Installed)	1.5 GPM	3.1 - 3.5 GPM showerhead	3.3 GPM	58	0	13621	10	$12.50	0%	EGD	Retrofit
Low Income	Existing	Low-Flow Showerhead (Per household, Installed)	1.5 GPM	3.6 GPM and above	3.6 GPM	69	0	15705	10	$12.50	0%	EGD	Retrofit
Low Income	Existing	Low-Flow Showerhead (Per household, Installed)	2.0 GPM	2.0 -2.5 GPM showerhead	2.25 GPM	7.6	0	1913	10	$18.71	0%	EGD	Retrofit
Low Income	Existing	Low-Flow Showerhead (Per household, Installed)	2.0 GPM	2.6 -3.0 GPM GPM showerhead	2.8 GPM	26	0	5996	10	$18.71	0%	EGD	Retrofit
Low Income	Existing	Low-Flow Showerhead (Per household, Installed)	2.0 GPM	3.1 - 3.5 GPM showerhead	3.3 GPM	44	0	9559	10	$18.71	0%	EGD	Retrofit

	Indicates an update (March 2014) to Board-approved list of input assumptions

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 (%)	Utility Measure Applies to	Decision Type
Low Income	Existing	Low-Flow Showerhead (Per household, Installed)	2.0 GPM	3.6 GPM and above	3.6 GPM	55	0	11628	10	$18.71	0%	EGD	Retrofit
Low-Income Multi-Family Space Heating													
Low income	New	Condensing Boiler - Space Heating (<100 Mbtu/h)	90% AFUE	Non-condensing Boiler	82% AFUE	0.01019 /Btu/hr	0	0	25	$1,475	Union 5%, EDG 0%	Both	New
Low income	New	Condensing Boiler - Space Heating (100 to 199 Mbtu/h)	90% AFUE	Non-condensing Boiler	82% AFUE	0.01019 /Btu/hr	0	0	25	$2,414	Union 5%, EDG 0%	Both	New
Low income	New	Condensing Boiler - Space Heating (200 to 299 Mbtu/h)	90% AFUE	Non-condensing Boiler	82% AFUE	0.01019 /Btu/hr	0	0	25	$3,227	Union 5%, EDG 0%	Both	New
Low income	Existing	Condensing Boiler - Space Heating (<100 Mbtu/h)	90% AFUE	Non-condensing Boiler	82% AFUE	0.01019 /Btu/hr	0	0	25	$2,045	Union 5%, EDG 0%	Both	Replacement
Low income	Existing	Condensing Boiler - Space Heating (100 to 199 Mbtu/h)	90% AFUE	Non-condensing Boiler	82% AFUE	0.01019 /Btu/hr	0	0	25	$2,984	Union 5%, EDG 0%	Both	Replacement
Low income	Existing	Condensing Boiler - Space Heating (200 to 299 Mbtu/h)	90% AFUE	Non-condensing Boiler	82% AFUE	0.01019 /Btu/hr	0	0	25	$3,797	Union 5%, EDG 0%	Both	Replacement
Low income	New/Existing	Condensing Boilers - Space Heating, 300 and above MBTUH	88% seasonal efficiency	Non-condensing boiler	76% estimated seasonal efficiency	0.0104 m3/Btu/hr	0	0	25	$12/Kbtu/hr	5%	UG	New/Replacement
Low income	New	High Efficiency Boiler - Space Heating (<100 Mbtu/h)	85% AFUE	Non-condensing Boiler	82% AFUE	0.00318 /Btu/hr	0	0	25	$1,238	Union 5%, EDG 0%	Both	New
Low income	New	High Efficiency Boiler - Space Heating (100 to 199 Mbtu/h)	85% AFUE	Non-condensing Boiler	82% AFUE	0.00318 /Btu/hr	0	0	25	$1,544	Union 5%, EDG 0%	Both	New
Low income	New	High Efficiency Boiler - Space Heating (200 to 299 Mbtu/h)	85% AFUE	Non-condensing Boiler	82% AFUE	0.00318 /Btu/hr	0	0	25	$1,388	Union 5%, EDG 0%	Both	New
Low income	Existing	High Efficiency Boiler - Space Heating (<100 Mbtu/h)	85% AFUE	Non-condensing Boiler	82% AFUE	0.00318 /Btu/hr	0	0	25	$1,808	Union 5%, EDG 0%	Both	Replacement
Low income	Existing	High Efficiency Boiler - Space Heating (100 to 199 Mbtu/h)	85% AFUE	Non-condensing Boiler	82% AFUE	0.00318 /Btu/hr	0	0	25	$2,114	Union 5%, EDG 0%	Both	Replacement
Low income	Existing	High Efficiency Boiler - Space Heating (200 to 299 Mbtu/h)	85% AFUE	Non-condensing Boiler	82% AFUE	0.00318 /Btu/hr	0	0	25	$1,958	Union 5%, EDG 0%	Both	Replacement
Low income	Existing	Prescriptive High Efficiency Boiler - Space Heating	83-84% Efficient, 300-2000 MBH	Space Heating Boiler	80.5% Thermal Efficiency	2,474-19,340	0	0	25	$3900-$4950	Union 5%, EDG 0%	Both	Replacement
Low income	Existing	Prescriptive High Efficiency Boiler - Space Heating	85-88% Efficient, 300-2000 MBH	Space Heating Boiler	80.5% Thermal Efficiency	3,496-27,325	0	0	25	$4,500-$7,050	Union 5%, EDG 0%	Both	Replacement
Low income	New	Prescriptive High Efficiency Boiler - Space Heating	83-84% Efficient, 300-2000 MBH	Space Heating Boiler	80.5% Thermal Efficiency	2,474-19,340	0	0	25	$3900-$4950	Union 5%, EDG 0%	Both	New
Low income	New	Prescriptive High Efficiency Boiler - Space Heating	85-88% Efficient, 300-2000 MBH	Space Heating Boiler	80.5% Thermal Efficiency	3,496-27,325	0	0	25	$4,500-$7,050	Union 5%, EDG 0%	Both	New
Commercial Cooking													
Commercial	New/Existing	Energy Star Fryer	Energy Star	Standard fryer		1083	17	0	12	$1,028	20%	Both	New/Replacement
Commercial	New/Existing	Energy Star Convection Ovens - Full Size	Energy Star	Standard Convection Oven		847	1		12	$875	20%	Both	New/Replacement
Commercial	New/Existing	Energy Star Steam Cookers	Energy Star	Standard Efficiency Steam Cooker		3224	162	42812	10	$2,000.00	20%	Both	New/Replacement
Commercial	New/Existing	High Efficiency Under-Fired Broilers		Standard Efficiency Broiler		1677			12	$1,270	20%	Both	New/Replacement
Commercial Space Heating													
Commercial	Existing	Air Curtains	Double door	Non-air curtain doors		1,529	1,023	0	15	$2,500	5%	Both	Retrofit
Commercial	New/Existing	Air Curtains	Shipping and Receiving Doors (10 x 10)	Non-air curtain doors		20605	-936		15	$10,170	5%	Both	New/Retrofit
Commercial	New/Existing	Air Curtains	Shipping and Receiving Doors (8 x 10)	Non-air curtain doors		9457	-5220		15	$8,242	5%	Both	New/Retrofit
Commercial	New/Existing	Air Curtains	Shipping and Receiving Doors (8 x 8)	Non-air curtain doors		7565	-5380		15	$8,242	5%	Both	New/Retrofit
Commercial	Existing	Air Curtains	Single door	Non-air curtain doors		667	172	0	15	$1,650	5%	Both	Retrofit
Commercial	New	Condensing Boiler - Space Heating (<100 Mbtu/h)	90% AFUE	Non-condensing Boiler	82% AFUE	0.01019 /Btu/hr	0	0	25	$1,475	5%	Both	New
Commercial	New	Condensing Boiler - Space Heating (100 to 199 Mbtu/h)	90% AFUE	Non-condensing Boiler	82% AFUE	0.01019 /Btu/hr	0	0	25	$2,414	5%	Both	New
Commercial	New	Condensing Boiler - Space Heating (200 to 299 Mbtu/h)	90% AFUE	Non-condensing Boiler	82% AFUE	0.01019 /Btu/hr	0	0	25	$3,227	5%	Both	New
Commercial	Existing	Condensing Boiler - Space Heating (<100 Mbtu/h)	90% AFUE	Non-condensing Boiler	82% AFUE	0.01019 /Btu/hr	0	0	25	$2,045	5%	Both	Replacement

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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 (%)	Utility Measure Applies to	Decision Type
Commercial	Existing	Condensing Boiler - Space Heating (100 to 199 Mbtu/h)	90% AFUE	Non-condensing Boiler	82% AFUE	0.01019 /Btu/hr	0	0	25	$2,984	5%	Both	Replacement
Commercial	Existing	Condensing Boiler - Space Heating (200 to 299 Mbtu/h)	90% AFUE	Non-condensing Boiler	82% AFUE	0.01019 /Btu/hr	0	0	25	$3,797	5%	Both	Replacement
Commercial	New/Existing	Condensing Boilers - Space Heating, 300 and above MBTUH	88% seasonal efficiency	Non-condensing boiler	76% estimated seasonal efficiency	0.0104 m3/Btu/hr	0	0	25	$12/Kbtu/hr	5%	UG	New/Replacement
Commercial	New/Existing	Condensing Make Up Air Unit - MR and LTC		Conventional MUA with constant speed drive		.84 m3/cfm - 2.92 m3/cfm	(0.00-1.48) kwh/cfm		15	$870 + (.66 - 1.02) per cfm	5%	Both	New/Replacement
Commercial	New/Existing	Condensing Make Up Air Unit - Retail and Comm		Conventional MUA with constant speed drive		.41 m3/cfm - 2.07 m3/cfm	(0.00-1.09) kwh/cfm		15	$870 + (.66 - 1.02) per cfm	5%	Both	New/Replacement
Commercial	New/Existing	Condensing Unit Heater		% Sales Weighted Average model	78% Annually Efficient	0.00631 m3/Btu/hr	(-)0.00186 kwh/Btu/hr	0	18	$0.0129 /Btu/hr	0%	Both	New/Replacement
Commercial	New/Existing	Demand Control Kitchen Ventilation	0 - 4,999 CFM	Kitchen ventilation without DCKV		4,801	13,521	0	15	$10,000	5%	Both	New/Replacement
Commercial	New/Existing	Demand Control Kitchen Ventilation	10,000 - 15,000 CFM	Kitchen ventilation without DCKV		18,924	49,102	0	15	$20,000	5%	Both	New/Replacement
Commercial	New/Existing	Demand Control Kitchen Ventilation	5,000 - 9,999 CFM	Kitchen ventilation without DCKV		11,486	30,901	0	15	$15,000	5%	Both	New/Replacement
Commercial	New/Existing	Destratification Fans		No destratification fans		0.5 $m3/ft^2$	(-)0.0034 kwh/ft^2	0	15	$7,021	10%	Both	New/Retrofit
Commercial	New	Energy Recovery Ventilation (Multi-Family, Health Care, Nursing Home)	Ventilation with ERV	Ventilation without ERV		5.77 m3/CFM	0	0	14	$3.18/CFM	5%	Both	New
Commercial	Existing	Energy Recovery Ventilation (Multi-Family, Health Care, Nursing Home)	Ventilation with ERV	Ventilation without ERV		6.12 m3/CFM	0	0	14	$3.18/CFM	5%	Both	Retrofit
Commercial	New	Energy Recovery Ventilation (Hotel, Restaurant, Retail)	Ventilation with ERV	Ventilation without ERV		3.21 m3/CFM	0	0	14	$3.18/CFM	5%	Both	New

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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 (%)	Utility Measure Applies to	Decision Type
Commercial	Existing	Energy Recovery Ventilation (Hotel, Restaurant, Retail)	Ventilation with ERV	Ventilation without ERV		3.4 m3/CFM	0	0	14	$3.18/CFM	5%	Both	Retrofit
Commercial	New	Energy Recovery Ventilation (Office, Warehouse, School)	Ventilation with ERV	Ventilation without ERV		2.05 m3/CFM	0	0	14	$3.18/CFM	5%	Both	New
Commercial	Existing	Energy Recovery Ventilation (Office, Warehouse, School)	Ventilation with ERV	Ventilation without ERV		2.17 m3/CFM	0	0	14	$3.18/CFM	5%	Both	Retrofit
Commercial	New	Heat Recovery Ventilation (Multi-Family, Health Care, Nursing Home)	Ventilation with HRV	Ventilation without HRV		4.28 m3/CFM	0	0	14	$3.61/CFM	5%	Both	New
Commercial	Existing	Heat Recovery Ventilation (Multi-Family, Health Care, Nursing Home)	Ventilation with HRV	Ventilation without HRV		4.70 m3/CFM	0	0	14	$3.61/CFM	5%	Both	Retrofit
Commercial	New	Heat Recovery Ventilation (Hotel, Restaurant, Retail)	Ventilation with HRV	Ventilation without HRV		2.38 m3/CFM	0	0	14	$3.61/CFM	5%	Both	New
Commercial	Existing	Heat Recovery Ventilation (Hotel, Restaurant, Retail)	Ventilation with HRV	Ventilation without HRV		2.61 m3/CFM	0	0	14	$3.61/CFM	5%	Both	Retrofit
Commercial	New	Heat Recovery Ventilation (Office, Warehouse, School)	Ventilation with HRV	Ventilation without HRV		1.52 m3/CFM	0	0	14	$3.61/CFM	5%	Both	New
Commercial	Existing	Heat Recovery Ventilation (Office, Warehouse, School)	Ventilation with HRV	Ventilation without HRV		1.67 m3/CFM	0	0	14	$3.61/CFM	5%	Both	Retrofit
Commercial	New	High Efficiency Boiler - Space Heating (<100 Mbtu/h)	85% AFUE	Non-condensing Boiler	82% AFUE	0.00318 /Btu/hr	0	0	25	$1,238	5%	Both	New
Commercial	New	High Efficiency Boiler - Space Heating (100 to 199 Mbtu/h)	85% AFUE	Non-condensing Boiler	82% AFUE	0.00318 /Btu/hr	0	0	25	$1,544	5%	Both	New
Commercial	New	High Efficiency Boiler - Space Heating (200 to 299 Mbtu/h)	85% AFUE	Non-condensing Boiler	82% AFUE	0.00318 /Btu/hr	0	0	25	$1,388	5%	Both	New
Commercial	Existing	High Efficiency Boiler - Space Heating (<100 Mbtu/h)	85% AFUE	Non-condensing Boiler	82% AFUE	0.00318 /Btu/hr	0	0	25	$1,808	5%	Both	Replacement
Commercial	Existing	High Efficiency Boiler - Space Heating (100 to 199 Mbtu/h)	85% AFUE	Non-condensing Boiler	82% AFUE	0.00318 /Btu/hr	0	0	25	$2,114	5%	Both	Replacement
Commercial	Existing	High Efficiency Boiler - Space Heating (200 to 299 Mbtu/h)	85% AFUE	Non-condensing Boiler	82% AFUE	0.00318 /Btu/hr	0	0	25	$1,958	5%	Both	Replacement
Commercial	Existing	High Efficiency Condensing Furnace	96% AFUE	AFUE 90%		1.7/kBtu/hr	0	0	18	$8.4/kBtu/hr	17.5%	Both	Replacement
Commercial	New/Existing	Single Stage & High Intensity Infrared Heaters	0 - 49,999 BTU/hr	Regular Unit Heater		0.0144 /Btu/hr	16	0	20	$0.0122 /BTUh	33%	Both	New/Replacement
Commercial	New/Existing	2-Stage Infrared Heaters	0 - 49,999 BTU/hr	Regular Unit Heater		0.0242 /Btu/hr	16	0	20	$0.0122 /BTUh	33%	Both	New/Replacement
Commercial	New/Existing	Single Stage & High Intensity Infrared Heaters	165,000 - 300,000 BTU/hr	Regular Unit Heater		0.0144 /Btu/hr	873	0	20	$0.0122 /BTUh	33%	Both	New/Replacement
Commercial	New/Existing	2-Stage Infrared Heaters	165,000 - 300,000 BTU/hr	Regular Unit Heater		0.0242 /Btu/hr	873	0	20	$0.0122 /BTUh	33%	Both	New/Replacement
Commercial	New/Existing	Single Stage & High Intensity Infrared Heaters	50,000 - 164,999 BTU/hr	Regular Unit Heater		0.0144 /Btu/hr	409	0	20	$0.0122 /BTUh	33%	Both	New/Replacement
Commercial	New/Existing	2-Stage Infrared Heaters	50,000 - 164,999 BTU/hr	Regular Unit Heater		0.0242 /Btu/hr	409	0	20	$0.0122 /BTUh	33%	Both	New/Replacement
Commercial	Existing	Prescriptive Higher Efficiency Boiler - Space Heating	83-84% Efficient, 300-2000 MBH	Space Heating Boiler	80.5% Thermal Efficiency	2,474-19,340	0	0	25	$3900-$4950	10/12/20%	Both	Replacement
Commercial	Existing	Prescriptive Higher Efficiency Boiler - Space Heating	85-88% Efficient, 300-2000 MBH	Space Heating Boiler	80.5% Thermal Efficiency	3,496-27,325	0	0	25	$4,500-$7,050	10/12/20%	Both	Replacement
Commercial	New	Prescriptive Higher Efficiency Boiler - Space Heating	83-84% Efficient, 300-2000 MBH	Space Heating Boiler	80.5% Thermal Efficiency	2,474-19,340	0	0	25	$3900-$4950	10/12/20%	Both	New
Commercial	New	Prescriptive Higher Efficiency Boiler - Space Heating	85-88% Efficient, 300-2000 MBH	Space Heating Boiler	80.5% Thermal Efficiency	3,496-27,325	0	0	25	$4,500-$7,050	10/12/20%	Both	New
Commercial	Existing	Prescriptive Schools - Elementary	hydronic boiler with 83%+ thermal efficiency	hydronic boiler with 80.5% thermal efficiency		12,217	0	0	25	$8,646	27%	UG	Replacement
Commercial	Existing	Prescriptive Schools - Elementary	hydronic boiler with 83%+ thermal efficiency	hydronic boiler with 80.5% thermal efficiency		12,217	0	0	25	$8,646	12%	EGD	Replacement
Commercial	Existing	Prescriptive Schools - Secondary	hydronic boiler with 83%+ thermal efficiency	hydronic boiler with 80.5% thermal efficiency		49,476	0	0	25	$14,470	27%	UG	Replacement
Commercial	Existing	Prescriptive Schools - Secondary	hydronic boiler with 83%+ thermal efficiency	hydronic boiler with 80.5% thermal efficiency		49,476	0	0	25	$14,470	12%	EGD	Replacement
Commercial	Existing	Programmable Thermostat		Standard thermostat		13 - 108**	15 - 77**	0	15	$110	20%	UG	Retrofit
Commercial	Existing	Programmable Thermostat	Educational - School	Standard thermostat		65	8	0	15	$110	20%	EGD	Retrofit
Commercial	Existing	Programmable Thermostat	Educational - University/College	Standard thermostat		58	57	0	0	$110	20%	EGD	Retrofit
Commercial	Existing	Programmable Thermostat	Food Service - Restaurant/Tavern	Standard thermostat		69	77	0	15	$110	20%	EGD	Retrofit
Commercial	Existing	Programmable Thermostat	Hotel/Motel	Standard thermostat		10	11	0	0	$110	20%	EGD	Retrofit
Commercial	Existing	Programmable Thermostat	Large Hotel	Standard thermostat		10	14	0	0	$110	20%	EGD	Retrofit
MultiFamily	Existing	Programmable Thermostat	Multi Family	Standard thermostat		15	13	0	15	$80	20%	Both	Retrofit
Commercial	Existing	Programmable Thermostat	Recreation - Small Fitness / Spa	Standard thermostat		35	87	0	15	$110	20%	EGD	Retrofit

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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 (%)	Utility Measure Applies to	Decision Type
Commercial	Existing	Programmable Thermostat	Retail - Food	Standard thermostat		22	16	0	15	$110	20%	EGD	Retrofit
Commercial	Existing	Programmable Thermostat	Retail - Mall	Standard thermostat		14	19	0	15	$110	20%	EGD	Retrofit
Commercial	Existing	Programmable Thermostat	Retail - Strip Mall	Standard thermostat		11	19	0	15	$110	20%	EGD	Retrofit
Commercial	Existing	Programmable Thermostat	Small Office	Standard thermostat		39	43	0	0	$110	20%	EGD	Retrofit
Commercial	Existing	Programmable Thermostat	Warehouse / Wholesale	Standard thermostat		132	9	0	15	$110	20%	EGD	Retrofit
Commercial	New/Existing	Rooftop Unit	Two-stage rooftop unit	Single stage rooftop unit		255	0	0	15	$375	5%	Both	New/Replacement
Commercial Water Heating													
Commercial	New/Existing	Commercial Laundry Washing Equipment with Ozone	Washer extractor – 60 lbs	Commercial Laundry Washing Equipment without Ozone		0.0328 m3/lbs/yr	0.00219 kwh/lbs/yr	2.01 L/lbs/yr	15	$10,970	8%	Both	New/Retrofit
Commercial	New/Existing	Commercial Laundry Washing Equipment with Ozone	Washer extractor – 500 lbs	Commercial Laundry Washing Equipment without Ozone		0.0328 m3/lbs/yr	0.00219 kwh/lbs/yr	2.01 L/lbs/yr	15	$30,270	8%	Both	New/Retrofit
Commercial	New/Existing	Commercial Laundry Washing Equipment with Ozone	Tunnel Washer – 120 lbs	Commercial Laundry Washing Equipment without Ozone		0.0240 m3/lbs/yr	0.00152 kwh/lbs/yr	1.22 L/lbs/yr	15	$49,667	8%	Both	New/Retrofit
Commercial	New/Existing	Commercial Laundry Washing Equipment with Ozone	Tunnel Washer – 500 lbs	Commercial Laundry Washing Equipment without Ozone		0.0240 m3/lbs/yr	0.00152 kwh/lbs/yr	1.22 L/lbs/yr	15	$160,065	8%	Both	New/Retrofit
Commercial	Existing	Condensing Boiler - DHW (<100 Mbtu/h)	90% or greater AFUE	Non-condensing Boiler	82% AFUE	0.02170 /Btu/hr	0	0	25	$2,045	5%	Both	Replacement
Commercial	Existing	Condensing Boiler - DHW (100 to 199 Mbtu/h)	90% or greater AFUE	Non-condensing Boiler	82% AFUE	0.01332 /Btu/hr	0	0	25	$2,984	5%	Both	Replacement
Commercial	Existing	Condensing Boiler - DHW (200 to 299 Mbtu/h)	90% or greater AFUE	Non-condensing Boiler	82% AFUE	0.00996 /Btu/hr	0	0	25	$3,797	5%	Both	Replacement
Commercial	New	Condensing Boiler - DHW (<100 Mbtu/h)	90% or greater AFUE	Non-condensing Boiler	82% AFUE	0.02170 /Btu/hr	0	0	25	$1,475	5%	Both	New
Commercial	New	Condensing Boiler - DHW (100 to 199 Mbtu/h)	90% or greater AFUE	Non-condensing Boiler	82% AFUE	0.01332 /Btu/hr	0	0	25	$2,414	5%	Both	New
Commercial	New	Condensing Boiler - DHW (200 to 299 Mbtu/h)	90% or greater AFUE	Non-condensing Boiler	82% AFUE	0.00996 /Btu/hr	0	0	25	$3,227	5%	Both	New
Commercial	New/Existing	Condensing Gas Water Heater (1,000gal/day)	95% thermal efficiency	Conventional storage tank water heater	80% efficiency, 91 gal. tank.	1,551	0	0	13	$2,230	5%	Both	New/Replacement
Commercial	New/Existing	Condensing Gas Water Heater (100gal/day)	95% thermal efficiency	Conventional storage tank water heater	80% efficiency, 91 gal. tank.	332	0	0	13	$2,230	5%	Both	New/Replacement
Commercial	New/Existing	Condensing Gas Water Heater (500gal/day)	95% thermal efficiency	Conventional storage tank water heater	80% efficiency, 91 gal. tank.	873	0	0	13	$2,230	5%	Both	New/Replacement
Commercial	New	Drain Water Heat Recovery (DWHR)	Laundromat	No DWHR		49735	0	0	25	$37,211.00	5%	Both	New
Commercial	New	Drain Water Heat Recovery (DWHR)	Entertainment, Arena	No DWHR		394 per Showerhead	0	0	25	$776 per Showerhead	5%	Both	New
Commercial	New	Drain Water Heat Recovery (DWHR)	University/College Cafeterias - Dishwashing	No DWHR		4.6 per Meal Served/Day	0	0	25	$3.41 per Meal Served/Day	5%	Both	New
Commercial	New	Drain Water Heat Recovery (DWHR)	Hospital - Dishwashing	No DWHR		12 per Bed	0	0	25	$11.88 per Bed	5%	Both	New
Commercial	New	Drain Water Heat Recovery (DWHR)	Hospital - Laundry	No DWHR		295 Per Bed	0	0	25	$250 per Bed	5%	Both	New
Commercial	New	Drain Water Heat Recovery (DWHR)	Nursing Home - Dishwashing	No DWHR		12 per Bed	0	0	25	$16.54 per Bed	5%	Both	New
Commercial	Existing	Drain Water Heat Recovery (DWHR)	Laundromat	No DWHR		49735	0	0	25	$40,811.00	5%	Both	Retrofit
Commercial	Existing	Drain Water Heat Recovery (DWHR)	Entertainment, Arena	No DWHR		394 per Showerhead	0	0	25	$1209 per Showerhead	5%	Both	Retrofit
Commercial	Existing	Drain Water Heat Recovery (DWHR)	University/College Cafeterias - Dishwashing	No DWHR		11.6 Meal Served per Day	0	0	25	$6.26 per Meal Served per day	5%	Both	Retrofit
Commercial	Existing	Drain Water Heat Recovery (DWHR)	Hospital - Dishwashing	No DWHR		31 per Bed	0	0	25	$18.19 per Bed	5%	Both	Retrofit
Commercial	Existing	Drain Water Heat Recovery (DWHR)	Hospital - Laundry	No DWHR		295 per Bed	0	0	25	$274 per Bed	5%	Both	Retrofit
Commercial	Existing	Drain Water Heat Recovery (DWHR)	Nursing Home - Dishwashing	No DWHR		31 per Bed	0	0	25	$25.33 per Bed	5%	Both	Retrofit
Commercial	New/Existing	Energy Star Dishwasher	Undercounter – High Temperature	Non-Energy Star Dishwasher		801	3,754	112,795	10	(-)$13	40%	Both	New/Replacement
Commercial	New/Existing	Energy Star Dishwasher	Undercounter – Low Temperature	Non-Energy Star Dishwasher		326	559	45,891	10	(-)$13	40%	Both	New/Replacement
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%	Both	New/Replacement
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%	Both	New/Replacement
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%	Both	New/Replacement
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%	Both	New/Replacement

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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 (%)	Utility Measure Applies to	Decision Type
Commercial	Existing	High Efficiency Boiler - DHW (<100 Mbtu/h)	85% or greater AFUE	Non-Condensing Boiler	82% AFUE	0.00468 /Btu/hr	0	0	25	$1,808.00	5%	Both	Replacement
Commercial	Existing	High Efficiency Boiler - DHW (100 to 199 Mbtu/h)	85% or greater AFUE	Non-Condensing Boiler	82% AFUE	0.00287 /Btu/hr	0	0	25	$2,114.00	5%	Both	Replacement
Commercial	Existing	High Efficiency Boiler - DHW (200 to 299 Mbtu/h)	85% or greater AFUE	Non-Condensing Boiler	82% AFUE	0.00215 /Btu/hr	0	0	25	$1,958.00	5%	Both	Replacement
Commercial	New	High Efficiency Boiler - DHW (<100 Mbtu/h)	85% or greater AFUE	Non-Condensing Boiler	82% AFUE	0.00468 /Btu/hr	0	0	25	$1,238.00	5%	Both	New
Commercial	New	High Efficiency Boiler - DHW (100 to 199 Mbtu/h)	85% or greater AFUE	Non-Condensing Boiler	82% AFUE	0.00287 /Btu/hr	0	0	25	$1,544.00	5%	Both	New
Commercial	New	High Efficiency Boiler - DHW (200 to 299 Mbtu/h)	85% or greater AFUE	Non-Condensing Boiler	82% AFUE	0.00215 /Btu/hr	0	0	25	$1,388.00	5%	Both	New
Commercial	Existing	Pre-Rinse Spray Nozzle	1.24 GPM	Standard pre-rinse spray nozzle	3.0 GPM	190 - 886**	0	36,484 - 170,326**	5	$60	12.40%	UG	Retrofit
Commercial	New	Pre-Rinse Spray Nozzle (Full Service)	0.64 GPM	Pre-rinse spray nozzle	3.0 GPM	1286	0	252000	5	$150	0%	EGD	New
Commercial	Existing	Pre-Rinse Spray Nozzle (Full Service)	0.64 GPM	Pre-rinse spray nozzle	3.0 GPM	1286	0	252000	5	$150	0%	Both	Retrofit
Commercial	Existing	Pre-Rinse Spray Nozzle (Full Service)	0.64 GPM	Pre-rinse spray nozzle	1.6 GPM	457	0	97,292	5	$150	0%	Both	Retrofit
Commercial	New	Pre-Rinse Spray Nozzle (Limited)	0.64 GPM	Pre-rinse spray nozzle	3.0 GPM	339	0	66400	5	$150	0%	EGD	New
Commercial	Existing	Pre-Rinse Spray Nozzle (Limited)	0.64 GPM	Pre-rinse spray nozzle	3.0 GPM	339	0	66400	5	$150	0%	Both	Retrofit
Commercial	Existing	Pre-Rinse Spray Nozzle (Limited)	0.64 GPM	Pre-rinse spray nozzle	1.6 GPM	90	0	19,197	5	$150	0%	Both	Retrofit
Commercial	New	Pre-Rinse Spray Nozzle (Other)	0.64 GPM	Pre-rinse spray nozzle	3.0 GPM	318	0	62200	5	$150	0%	EGD	New
Commercial	Existing	Pre-Rinse Spray Nozzle (Other)	0.64 GPM	Pre-rinse spray nozzle	3.0 GPM	318	0	62200	5	$150	0%	Both	Retrofit
Commercial	Existing	Pre-Rinse Spray Nozzle (Other)	0.64 GPM	Pre-rinse spray nozzle	1.6 GPM	109	0	23,166	5	$150	0%	Both	Retrofit
Commercial	New	Prescriptive Higher Efficiency Boiler - DWH	83-84% Efficient, 300-1500 MBH	DWH Boiler	80.5% Thermal Efficiency	1,168-4,693	0	0	25	$3900 -$5900	10/12/20%	Both	New
Commercial	New	Prescriptive Higher Efficiency Boiler - DWH	85-88% Efficient, 300-1500 MBH	DWH Boiler	80.5% Thermal Efficiency	1,861-7,475	0	0	25	$4500-$7400	10/12/20%	Both	New
Commercial	Existing	Prescriptive Higher Efficiency Boiler - DWH	83-84% Efficient, 300-1500 MBH	DWH Boiler	80.5% Thermal Efficiency	1,168-4,693	0	0	25	$3900 -$5900	10/12/20%	Both	Replacement
Commercial	Existing	Prescriptive Higher Efficiency Boiler - DWH	85-88% Efficient, 300-1500 MBH	DWH Boiler	80.5% Thermal Efficiency	1,861-7,475	0	0	25	$4500-$7400	10/12/20%	Both	Replacement
Commercial	New	Tankless Water Heater	100 USG/day, 84% thermal efficiency	Conventional Storage Tank Water Heater	80% thermal efficiency	154	0	0	18	(-)$1,102	2%	Both	New
Commercial	Existing	Tankless Water Heater	100 USG/day, 84% thermal efficiency	Conventional Storage Tank Water Heater	80% thermal efficiency	154	0	0	18	(-)$1,102	2%	Both	Replacement
Multi-Family Water Heating													
Multi-Family	New/Existing	CEE Tier 2 Front-Loading Clothes Washer	MEF=2.20, WF=5.1	Conventional top-loading, vertical axis clothes washer	MEF=1.26, WF=9.5	117	396	58,121	11	$600	10%	Both	New/Replacement
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%	UG	New/Replacement
MultiFamily	Existing	Faucet Aerator	Bathroom, 1.0 GPM	Average Existing Stock		7	0	2371	10	$1.5	10%	EGD	Retrofit
MultiFamily	Existing	Faucet Aerator	Bathroom, 1.5 GPM	Average Existing Stock		4	0	1382	10	$2.	10%	EGD	Retrofit
MultiFamily	Existing	Faucet Aerator	Kitchen, 1.0 GPM	Average Existing Stock		24	0	8072	10	$2.	10%	EGD	Retrofit
Multi-Family	New	Faucet Aerator	Kitchen, 1.0 GPM	Ontario Building Code 2006	2.2 GPM	22	0	7,337	10	$1.59	10%	UG	New
MultiFamily	Existing	Faucet Aerator	Kitchen, 1.5 GPM	Average Existing Stock		16	0	5377	10	$2.	10%	EGD	Retrofit
Multi-Family	New	Faucet Aerator	Bathroom, 1.0 GPM	Ontario Building Code 2006	2.2 GPM	7	0	2,371	10	$0.59	10%	UG	New
Multi-Family	Existing	Faucet Aerator	Bathroom, 1.0 GPM	Average existing stock	2.2 GPM	7	0	2,371	10	$0.59	10%	UG	Retrofit
Multi-Family	New	Faucet Aerator	Bathroom, 1.5 GPM	Ontario Building Code 2006	2.2 GPM	4	0	1,382	10	$0.49	10%	UG	New
Multi-Family	Existing	Faucet Aerator	Bathroom, 1.5 GPM	Average existing stock	2.2 GPM	4	0	1,382	10	$0.49	10%	UG	Retrofit
Multi-Family	New	Faucet Aerator	Kitchen, 1.5 GPM	Ontario Building Code 2006	2.2 GPM	13	0	4,280	10	$1.29	10%	UG	New
Multi-Family	Existing	Faucet Aerator	Kitchen, 1.0 GPM	Average existing stock	2.5 GPM	24	0	8,072	10	$1.59	10%	UG	Retrofit
Multi-Family	Existing	Faucet Aerator	Kitchen, 1.5 GPM	Average existing stock	2.5 GPM	16	0	5,377	10	$1.29	10%	UG	Retrofit
Multi-Family	New/Existing	Low-Flow Showerhead - (MF ONLY)	1.25 GPM	Replace existing 2.0 GPM	2.0 GPM	24	0	7,933	10	$3.79	10%	UG	New/Retrofit
Multi-Family	New	Low-flow showerhead (Distributed)	1.25 GPM	Average existing stock	2.2 GPM	32	0	9,585	10	$3.79	10%	UG	New
Multi-Family	Existing	Low-flow showerhead (Distributed)	1.25 GPM	Average existing stock	2.2 GPM	32	0	9,585	10	$3.79	10%	UG	Retrofit

	Indicates an update (March 2014) to Board-approved list of input assumptions

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 (%)	Utility Measure Applies to	Decision Type
Multi-Family	New	Low-flow showerhead (Distributed)	1.5 GPM		2.2 GPM	33	0	5,228	10	$6	10%	UG	New
Multi-Family	Existing	Low-flow showerhead (Distributed)	1.5 GPM	Average existing stock	2.2 GPM	33	0	5,228	10	$6	10%	UG	Retrofit
MultiFamily	New	Low-Flow Showerhead (Per household, Installed)	1.25 GPM		2.5 GPM	36	-	11587	10	$12.5	10%	EGD	New
MultiFamily	New	Low-Flow Showerhead (Per household, Installed)	1.5 GPM		2.5 GPM	29	-	7818	10	$12.5	10%	EGD	New
MultiFamily	Existing	Low-Flow Showerhead (Per household, Installed)	1.5 GPM	2.0 -2.5 GPM showerhead	2.25 GPM	21	0	5931	10	$12.5	10%	EGD	Retrofit
MultiFamily	Existing	Low-Flow Showerhead (Per household, Installed)	1.5 GPM	2.6 -3.0 GPM GPM showerhead	2.8 GPM	40	0	10036	10	$12.5	10%	EGD	Retrofit
MultiFamily	Existing	Low-Flow Showerhead (Per household, Installed)	1.5 GPM	3.1 - 3.5 GPM showerhead	3.3 GPM	58	0	13621	10	$12.5	10%	EGD	Retrofit
MultiFamily	Existing	Low-Flow Showerhead (Per household, Installed)	1.5 GPM	3.6 GPM and above	3.6 GPM	69	0	15705	10	$12.5	10%	EGD	Retrofit
MultiFamily	Existing	Low-Flow Showerhead (Per household, Installed)	2.0 GPM	2.0 -2.5 GPM showerhead	2.25 GPM	7.6	0	1913	10	$18.71	0%	EGD	Retrofit
MultiFamily	Existing	Low-Flow Showerhead (Per household, Installed)	2.0 GPM	2.6 -3.0 GPM GPM showerhead	2.8 GPM	26	0	5996	10	$18.71	0%	EGD	Retrofit
MultiFamily	Existing	Low-Flow Showerhead (Per household, Installed)	2.0 GPM	3.1 - 3.5 GPM showerhead	3.3 GPM	44	0	9559	10	$18.71	0%	EGD	Retrofit
MultiFamily	Existing	Low-Flow Showerhead (Per household, Installed)	2.0 GPM	3.6 GPM and above	3.6 GPM	55	0	11628	10	$18.71	0%	EGD	Retrofit

* Efficiency ratings and natural gas savings will vary by fireplace type. Please see substantiation sheet for type specific efficiency ratings and savings.

** Savings will vary for different segments. Please see substantiation sheet for segment specific savings.

	Indicates an update (March 2014) to Board-approved list of input assumptions

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 (%)	Utility Measure Applies to	Decision Type

Union Gas Custom Projects

Sector	Free Rider (%)
Agriculture	54%
Industrial	54%
Commercial	54%
Multi-Residential	54%
New Construction	54%
Low-Income - Weatherization	0%
Low-Income - Custom	5%
Residential - Home Reno Rebate	15%

Enbridge Custom Projects

Sector		Free Rider (%)
Agriculture		40%
Industrial		50%
Commercial		12%
Multi-Residential		20%
New construction		26%
Low-Income - Custom		0%
Residential - Community Energy Retrofit		15%

Enbridge Measure Life Assumptions for Custom Measures and Offerings

	Commercial	Industrial	Multi Residential
Boiler Related			
Boilers – DHW	25[2]	n/a	25[2]
Boilers - Industrial Process	n/a	20	n/a
Boilers – Space Heating	25[2]	25[2]	25[2]
Combustion Tune-up	5	5	n/a
Controls	15	15	15
Steam pipe/tank insulation	n/a	15	n/a
Steam trap	5[3]	5[3]	n/a
Building Related			
Building envelope	25	25	25
Windows	25	25	25
Greenhouse curtains	n/a	10	n/a
Double Poly greenhouse	n/a	5	n/a
HVAC Related			
Dessicant cooling	15	n/a	n/a
Heat Recovery	15	15	n/a
Infra-red heaters	10	10	n/a
Make-up Air	15	15	15
Novitherm panels	15	n/a	15
Furnaces (gas-fired)	18[4]	n/a	18[4]
Re-Commissioning	5[5]	n/a	5[5]
Process Related			
Furnaces (gas-fired)	n/a	18[4]	n/a
Measure Life for Residential and Low Income Offerings			
Enbridge Community Energy Retrofit – without furnace upgrade	25[6]		
Enbridge Community Energy Retrofit – with furnace upgrade	15[6]		
Enbridge Low Income Weatherization	25[7]		

[2] 2007 ASHRAE handbook, HVAC applications, I-P edition, Chapter 36 section 3, Table 4 (Comparison of Service Life Estimates).
[3] Enbridge Gas Distribution Independent Audit of 2010 DSM Program Results, June 30, 2011, p. 54.
[4] 2007 ASHRAE handbook, HVAC applications, I-P edition, Chapter 36 section 3, Table 4 (Comparison of Service Life Estimates).
[5] "Measure Life for Retro-Commissioning and Continuous Commissioning Projects", Finn Projects. December 31, 2008.
[6] Endorsed by Enbridge Audit Committee, February 2014. Applicable to 2014 results only.
[7] Endorsed by the Technical Evaluation Committee, February 13, 2014

Union Gas Effective Useful Life for Custom Project Measures

Union Gas Ltd.'s Custom Offering
Equipment Useful Life (EUL) and Base Case Assumptions

Equipment Type	Sector	EUL		Base Case	
		Years	Source	Description	Source
Boilers					
Industrial Process - greater than 2500 MBHp	Industrial	20	2	80% thermal efficiency	7
Space heating - Under 300 MBHp	Commercial & Multi-Residential	20*	4	83% thermal efficiency	7
Space heating - 300 to 2500 MBHp	Commercial & Multi-Residential	20*	4	81% thermal efficiency	7
Domestic Hot Water	Commercial & Multi-Residential	20*	4		
Controls	All	20*			
Combustion Tune-Up	Industrial & Commercial	1			
Air Makeup (line)	Industrial	20			
Oxy-Fuel	Industrial	20			
Low NOx Boiler	Industrial	20			
Building Optimization					
Building Optimization Program - Behavioral Savings Project	Commercial	5	3		
Economizers					
New with boiler - conventional and condensing	Industrial & Commercial	20			
Retrofit - conventional and condensing	Industrial & Commercial	10	2		
Repair	Industrial & Commercial	5	2	No repair	
Electronic Burner Controls					
Linkage-Less Controls, Modulating Motors, Mod Motors		20			
Agriculture					
IR Poly	Greenhouse	4		Double Poly	
Energy Curtains	Greenhouse	5	1	No Energy Curtain	
Grain Dryer	Commercial	20	5		
HVAC					
Air Curtains (single and double door)	Commercial	15	2		
Building Automation System - New	Commercial	15	2		
Cooling tower for HVAC systems	Commercial	15	1		
Combustion Tune-Up	Industrial & Commercial	1	5	No tune up	
Demand Control Ventilation	Commercial & Multi-Residential	15	5		
Dessicant Cooling	Commercial	15	6		
Exhaust Fan Controls	Commercial	15	5		
Heat Recovery	Industrial & Commercial	15			
Infiltration Controls - Dock Seals, Air Doors	Commercial	15	2		
Make-Up Air	All	15			
Novitherm panels	Commercial & Multi-Residential	15		No panels	
VFD retrofit on MUA	Commercial & Multi-Residential	10			
Turndown controls on Modulating Boiler	Commercial	20	5		
Heat Exchangers					
Plate - Plate or Tube-Tube	Industrial & Commercial	14	2		
Air -Air	Commercial	14	2		
Insulation					
Roof/Ceiling insulation	Industrial & Commercial	20	2	OBC for Year built	
Outside Pipe - exposed to the environment, properly protected	Industrial & Commercial	20			
Building Weatherization - Air sealing	Commercial	15	1		
Tank Exterior Insulation	Industrial & Commercial	15	2		
Ovens and Thermal oxidizers					
Low Temperature (less than 300°C)	Industrial	20			
Medium Temperature (300°C - 1000°C)	Industrial	20			
High Temperature (>1000°C)	Industrial	15			
Process Controls					
Electronic Loop Controllers	Industrial	20			
PLC's	Industrial	20			
Flame Supervision (relays)	Industrial	20			

Flame Detectors (UV-Flame Rods)	Industrial	5			

Steam Distribution

Steam Traps	Industrial & Commercial	7		Do not replace	
Steam Piping Leaks	Industrial & Commercial	20	5		
Steam Valve	Industrial Food Services	5	5, 8		

Water Conditioners

Reverse Osmosis (RO)	Industrial	20			
Ion Exchange	Industrial	20			

References

*	Useful Life estimates are most dependent on the application and quality of maintenance. Any equipment life that was reported higher than 20 years was reduced to 20 years to conform to Union Gas's 20 year limit.
1	2011 Commercial Opportunity Screening Report May 02 2011, Navigant for Union Gas
2	DEER EUL Summary 2010-1-08
3	Measure Life for Retro-Commissioning and Continuous Commissioning Projects, Finn Projects for Enbridge
4	ASHRAE
5	Union Gas 2010 DSM Annual report filing
6	Enbridge Approved IA
7	2011 Commercial Hydronic Boiler System Baseline Study, ICF Marbek for Enbridge
8	Confirmation of high quality feed water required for 10 year life

Union Gas Effective Useful Life for Custom Project Measures

Effective Useful Life for Residential / Low Income Offerings	
Union Gas Home Reno Rebate – without furnace upgrade	25[8]
Union Gas Home Reno Rebate – with furnace upgrade	15[8]
Union Gas Low Income Weatherization – Attic Insulation	25[7]
Union Gas Low Income Weatherization – Basement Insulation	25[7]
Union Gas Low Income Weatherization – Wall Insulation	25[7]
Union Gas Low Income Weatherization – Draft Sealing	25[7]

Where site specific information or a relevant prescriptive Equipment Useful Life (EUL) is available to support an alternate EUL value for a specific custom project (Union / Enbridge) will use the alternate value for that custom project.[9]

[8] Union Gas Independent Audit of 2012 DSM Program Results. Applies to 2014 results only.
[9] EB-2012-0441; Exhibit B, Tab 1, Schedule 3

2.0 GPM Showerheads: Low Income Single Family, Low Income Multi Residential and Multi Residential

The assumptions are filed with endorsement from the Technical Evaluation Committee.

Current approved assumptions for Low Flow Showerheads will be reviewed as part of the creation of the Technical Reference Manual.

Incremental Cost for 2.0GPM (Low Income Single Family and Multi Residential)	$18.71
Effective Useful Life (EUL)	10 Years

Savings Assumptions – 2.0 GPM Low Income Single Family		
Program	Low Income	Low Income
Applicable Customer Group	Low Income	Low Income
Base Flow Rate (GPM)	2.45	3.07
Annual Gas Savings (m^3)	20	52
Lifetime Gas Savings (m^3)	204	517
Base Flow Rate (as-used)	2.02	2.35
Efficient Flow Rate (as-used)	1.78	1.78
Water Savings (L)	3,418	7,938
Lifetime Water Savings (L)	34,178	79,378

Savings Assumptions – 2.0 GPM Low Income Multifamily and Multifamily				
Program	Multi Residential and Low Income Multi Residential	Multi Residential and Low Income Multi Residential	Multi Residential and Low Income Multi Residential	Multi Residential and Low Income Multi Residential
Applicable Customer Group	Multi Residential and Low Income Multi Residential	Multi Residential and Low Income Multi Residential	Multi Residential and Low Income Multi Residential	Multi Residential and Low Income Multi Residential
Base Flow Rate (GPM)	2.25	2.8	3.3	3.6
Annual Gas Savings (m^3)	7.6	26	44	55
Lifetime Gas Savings (m^3)	76	256	437	553
Base Flow Rate (as-used)	1.91	2.21	2.48	2.64
Efficient Flow Rate (as-used)	1.78	1.78	1.78	1.78
Water Savings (L)	1,913	5,996	9,559	11,628
Lifetime Water Savings (L)	19,130	59,963	95,588	116,278

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HIGH EFFICIENCY GAS STORAGE WATER HEATERS – NEW CONSTRUCTION

DATE: 3/12/14

TO: Ontario TEC Committee

FROM: ERS

RE: High Efficiency Gas Storage Water Heaters – New Construction

Residential → High Efficiency Gas Storage Water Heaters → New Construction

HIGH EFFICIENCY GAS STORAGE WATER HEATERS – NEW CONSTRUCTION

Version Date and Revision History	
Draft date	2/14/2014
Version history	v.1
Effective date	TBD
End date	N/A
Residential → High Efficiency Gas Storage Water Heaters → New Construction	

Table 1 provides a summary of the key measure parameters with a deemed savings coefficient.

Table 1. Measure Key Data

Parameter	Definition	
Measure category	New Construction (NC)	
Baseline technology	ENERGY STAR power vented storage tank water heater	Energy factor of 0.67
Efficient technology	High efficiency storage tank water heater	Energy factor of 0.80
Market type	Residential	
Annual natural gas savings	Natural gas savings = 68.3 m^3	
Measure life	16 years [1]	

Parameter	Definition
Incremental cost	$540
Restrictions	This measure is restricted to new construction installations in residential homes.

OVERVIEW

This measure is for the installation of a new high efficiency gas storage water heater in the case of residential new construction.

There are two major categories of water heating equipment for domestic use: storage water heaters, which keep a supply of hot water in a tank, and those that do not store hot water and only heat water when it is needed.

Gas storage water heaters can further be differentiated by natural draft or power vented flue gas exhaust. A power vent is a fan that speeds the exhaust of combustion gases, which increases efficiency, which increases overall performance but requires additional capital cost. An ENERGY STAR power vent storage water heater is considered the baseline for this measure.

Storage water heaters have a lower capital cost than on-demand water heaters, but they also have standby heat losses associated with continuously maintaining water stored at high temperatures. Higher efficiency storage water heaters have tanks with generous amounts of insulation to reduce these losses and more efficient gas burners than standard efficiency storage water heaters.

APPLICATION

This measure focuses on high efficiency gas storage water heaters that have efficiencies above the basic code requirements (new construction projects or time of natural replacement) in a residential setting.

Gas storage water heaters are performance rated using an energy factor (EF). The EF is a measure of efficiency and it can be defined as the total energy delivered as hot water divided by the total energy consumed by the water heater over a 24-hour period in simulated use.

These ENERGY STAR units have an EF of 0.67 and the ability to produce at least 67 US gallons per hour of hot water after warm-up. This measure is intended to provide an incentive to install the highest efficiency power vented water heaters with an EF of 0.80 or greater. The energy consumption of high efficiency water heaters is calculated based on the daily and annual water consumption of a household (according to the number of people in the household) extrapolated from a hot water consumption research study undertaken by Natural Resources Canada (NRCan) [2]. Tank volume capacity requirements are associated with the number of occupants and what is standard issue according to the manufacturers, e.g., a typical family of three to four people would warrant a 50-US gallon tank in order to meet the hot water demand for the household.

BASELINE TECHNOLOGY

For the new construction market, the ENERGY STAR rated power vented storage water heaters are considered baseline because experience indicates that this is a popular choice amongst homebuilders todayin order to achieve an efficiency level that falls within the OBC SB-12 required compliance path as referenced in Table 2.1.1.2.A of that supplementary standard. [3] [4] A gas storage water heater with a minimum EF to qualify for ENERGY STAR is shown in Table 2.

Table 2. Baseline Gas Storage Water Heater

Type	Water Heater Input (Btu/hr)	EF
Gas storage water heater	<75,000	0.67

EFFICIENT TECHNOLOGY

A high efficiency gas storage heater with a minimum energy factor is shown in Table 3.

Table 3. New Gas Storage Water Heater Minimum Efficiency Requirements

Type	Water Heater Input (Btu/hr)	Minimum EF
Gas storage water heater	<75,000	0.80

ENERGY IMPACTS

Natural gas savings are achieved due to the difference in efficiencies between a high efficiency option and the baseline efficiency gas storage water heaters. The higher-efficiency equipment is typically able to both heat and store hot water more efficiently than the standard equipment.

There is a small amount of electrical savings for this measure, which have been shown to be negligible (<1 kWh annually) in the calculations.

NATURAL GAS SAVINGS ALGORITHMS

The following algorithms are referenced from the DOE Water Heater Analysis Model (WHAM) [5] and were used to calculate the stipulated gas impact in cubic meters per year and electric impact in kWh per year.

The total annual energy consumption for the water heater, Q_{In}, is calculated with the inlet water temperature specific to Ontario installations derived from the reference provided in Table 4 below. The total annual natural gas consumption of the water heater is the total annual energy consumption of the unit converted from British thermal units (Btus) to meters cubed.

The energy consumption of the high efficiency water heaters is calculated based on the daily and annual water consumption of a household (according to the number of people in the

household) extrapolated from a hot water consumption research study undertaken by NRCan [6]. Tank volume capacity requirements are associated with the number of occupants and what is standard issue according to the manufacturers, e.g., a typical family of three to four people would warrant a 50-US gallon tank in order to meet the hot water demand for the household.

$$Q_{Out} = \rho \times V \times C_P \times (T_F - T_I)$$

where,

Q_{Out} = Energy required to heat tap water to tank temperature (Btu/day)

ρ = The density of water (lb/gal), see Table 4 below

V = The daily drawn water (gal/day), see Table 4

C_P = The specific heat of water (Btu/lb °F), see Table 4

T_F = The water tank temperature (°F), see Table 4

T_I = The inlet water temperature to the water heater (°F), see Table 4

$$Q_{In} = 365 \times (\frac{Q_{Out}}{RE} + UA \cdot (T_{Tank} - T_{Amb}) \times \left(24 - \frac{Q_{Out}}{RE \cdot P_{On}}\right))$$

where,

Q_{In} = The total annual water-heater energy consumption (Btu/year)

Q_{Out} = Energy required to heat tap water to tank temperature (Btu/day)

RE = Recovery efficiency, see Table 4

UA = Standby heat-loss coefficient, see Table 4

T_{Tank} = Average tank temperature (°F), see Table 4

T_{Amb} = Ambient air temperature (°F), see Table 4

P_{On} = Water heater input rate (kBtu/hr), see Table 4

$$Annual\ NG\ consumption = Q_{In}$$

$$Annual\ NG\ savings = Annual\ NG\ consumption\ (baseline) - Annual\ NG\ consumption\ (high\ efficiency)$$

LIST OF ASSUMPTIONS

Table 4 provides a list of assumptions utilized in the measure savings algorithms to derive the stipulated savings values listed in Table 1 above. The algorithms are provided in the following section.

Filed: 2014-04-30
EB-2014-0430
Exhibit B
Tab 1
Schedule 3
Page 7 of 9

Table 4. General Assumptions

Variable	Definition	Inputs		Source/Comments
		Base Efficiency	High Efficiency	
	Average household size	3		Common assumptions table
C_p	Specific heat of water (Btu/lb ˚F)	1.00		Common assumptions table
ρ	Water density (lb/gal)	8.30		Common assumptions table
V	Daily drawn water (US gallons)	42		[8]
RE	Recovery efficiency	0.78	0.90	[9]
UA	Standby heat-loss coefficient	5.78		[5]
T_{Amb}	Ambient air temperature	67.5°F (19.7˚C)		[7]
T_{In}	Inlet water temperature	48.9°F (9.39˚C)		Common assumptions table
T_{Tank}	Average tank temperature	120°F (48.9˚C)		Common assumptions table
P_{on}	Water heater input rate (kBtu/hr)	44.89	40.00	[9]
	Tank size (US gallons)	50		[8]
	Energy density of natural gas	35,738 m^3/Btu		Common assumptions table

SAVINGS CALCULATION EXAMPLE

The example below illustrates how the deemed savings value is determined for a retrofit installation of a high efficiency storage tank hot water heater. For this example, it will be assumed that the equipment is sized for installation in a household size of three, which is the average household size in Ontario.

Q_{out} can be calculated with actual values for the daily drawn water volume and inlet temperature, but similarly to above. This value is the same for both the baseline and the high efficiency technology:

$$Q_{Out} = 8.30 \times 30 \times 1.00 \times (120°F - 48.9°F) = 17{,}442\ Btu$$

Using Q_{Out}, the total annual water heater energy consumption can be calculated as Q_{In} for both the baseline and the high efficiency equipment:

$$Q_{In\ base} = 365/1000 \times \left(\frac{17{,}442}{0.784} + 5.78 \times (120°F - 67.5°F) \times \left(24 - \frac{17{,}442}{0.784 \cdot 44{,}894}\right)\right)$$
$$= 14{,}145\ kBtu$$

Similarly,

$$Q_{In\ HE} = 11{,}724\ kBtu$$

Now the Q_{In} for the baseline and high efficiency technology can be subtracted and converted to meters cubed of natural gas savings.

$$Annual\ NG\ savings = 14{,}145 - 11{,}724 = 2{,}420\ kBtu$$

$$Annual\ NG\ savings = 2{,}420\ kBtu \times \frac{1{,}008}{35{,}738} = 68.3\ m^3$$

USES AND EXCLUSIONS

This measure requires that the gas storage water heaters be of a nominal input of 75 KBtu/hr or less and also be of the highest power vented efficiency or at least 0.80 EF.

MEASURE LIFE

The measure life is 16 years [1].

Residential high efficiency water heaters have a highly variable life expectancy because maintenance and water quality factors, such as hardness, can have a great effect on the equipment's lifetime [10] [11]. Most water heaters used in the Enbridge and Union areas are provided through water heater rental businesses and are therefore constructed of higher durability than standard units for purchase. This measure is also for the highest-efficiency units, which will have a more durable construction than standard units. Considering this, the lifetime referenced, though it's at the high end for typical residential units, is deemed appropriate.

INCREMENTAL COST

The average approximate incremental cost, including installation, for a 40 to 50 US-gallon storage tank water heater is $540[1].

Note: At this point there is only one manufacturer of water heaters that meet the high efficiency criteria, but the units are sold under different trade names.

[1]Costs estimated and averaged for qualifying models using Home Depot, Menards, and Warners' Stellian websites.

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