April 30, 2010

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

Attention: Ms. Kirsten Walli, Board Secretary

RE: EB-2010-0055 - Union Gas Limited - 2011 Demand Side Management Plan

Dear Ms. Walli:

On January 7, 2010, the Ontario Energy Board (the "Board") issued a letter to the EB-2008-0346 and EB-2008-0150 participants directing natural gas distributors to file a one-year Demand Side Management ("DSM") Plan for 2011. The letter notes that the Board expects the 2011 DSM Plan to be filed under the current DSM framework, including increases based on the established budget escalators.

Union's 2011 DSM Plan follows the submission made for the 2010 Plan. In addition, Union has included measures and updated input assumptions as filed with the Board on April 30, 2010 in its 2010 input assumption update. Union has received consensus from its Evaluation and Audit Committee for only the updated 2010 measures and input assumptions contained in its 2010 input assumption update.

Union may file additions or changes to measures and inputs relative to those found in the 2011 DSM Plan with the Board as appropriate. Changes would result from new measures being brought forward or updates based on 2010 evaluation studies.

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-2008-0346 Intervenors

Filed: 2010-04-30
EB-2010-0055

ONTARIO ENERGY BOARD

IN THE MATTER OF the Ontario Energy Board Act, 1998, S.O. 1998, c.15 (Sched. B);

AND IN THE MATTER OF an Application by Union Gas Limited, pursuant to section 36(1) of the *Ontario Energy Board Act, 1998*, for an order or orders approving its 2011 Demand Side Management Plan.

APPLICATION

1. Union Gas Limited ("Union") is a business corporation incorporated under the laws of the province of Ontario, with its head office in the Municipality of Chatham-Kent.

2. Union conducts both an integrated natural gas utility business that combines the operations of distributing, transmitting and storing natural gas, and a non-utility storage business.

3. Union offers Demand Side Management ("DSM") programs to its customers in accordance with the multi-year DSM framework established in the EB-2006-0021 proceeding (the "existing framework") which was to be in effect from 2007 through 2009.

4. On April 14, 2009, the Ontario Energy Board (the "Board") issued a letter directing Union to file a one year DSM plan for 2010 based on the existing framework, including increases based on the established budget escalators.

5. On January 7, 2010, the Board issued a letter directing Union to file a one year DSM plan for 2011 based on the existing framework, including increases based on the established budget escalators.

6. Union hereby applies to the Board, pursuant to section 36 of the Ontario Energy Board Act for an order or orders approving its 2011 DSM plan.

7. Union further applies to the Board for all necessary orders and directions concerning pre-hearing and hearing procedures for the determination of this application.

8. This application is supported by written evidence that will be filed with the Board and may be amended from time to time as circumstances may require.

9. The persons affected by this application are the customers resident or located in the municipalities, police villages and Indian reserves served by Union, together with those to whom Union sells gas, or on whose behalf Union distributes, transmits or stores gas. It is impractical to set out in this application the names and addresses of such persons because they are too numerous.

10. The address of service for Union is:

Union Gas Limited

P.O. Box 2001
50 Keil Drive North
Chatham, Ontario
N7M 5M1

Attention:	Chris Ripley Manager, Regulatory Applications
Telephone:	(519) 436-5476
Fax:	(519) 436-4641

- and -

Torys

Suite 3000, Maritime Life Tower
P.O. Box 270
Toronto Dominion Centre
Toronto, Ontario
M5K 1N2

Attention:	Crawford Smith
Telephone:	(416) 865-8209
Fax:	(416) 865-7380

DATED April 30, 2010.

UNION GAS LIMITED

By its Solicitors

Torys
Suite 3000, Maritime Life Tower
P.O. Box 270
Toronto Dominion Centre
Toronto, Ontario
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Attention: Crawford Smith
Telephone: (416) 865-8209
Fax: (416) 865-7380

Union Gas Limited

2011 DSM Plan

Table of Contents

1 Executive Summary

Union Gas Limited ("Union") is seeking approval of its 2011 Demand Side Management ("DSM") Plan (the "Plan"). The Plan adheres to the Ontario Energy Board (the "OEB" or the "Board") approved framework established in the DSM Generic Proceeding (EB-2006-0021) in accordance with the OEB's letter dated January 7, 2010. By way of this letter, the Board provided the following direction:

> *"The 2011 plans should be filed under the current DSM framework, including increases based on the established budget escalators. The measures and input assumptions that should be used for the development of the DSM plans for 2011 are those contained in "Measures and Assumptions for Demand Side Management (DSM) Planning" prepared by Navigant Consulting Inc. (issued by the Board April 29, 2009) and selectively updated by the utilities based on the evaluation results of their 2008 and 2009 DSM programs."*

Budget: The budget for 2011 will be $24.890 million. This budget represents the 2010 budget of $22.627 million increased by 10%. Included in this budget increase is $1.464 million allocated for market transformation programs, 14% of which will be allocated to low-income market transformation, and $1.903 million allocated to low-income DSM programs.

Target: For 2011, Union's Total Resource Cost ("TRC") target will be based on the TRC formula accepted in the DSM Generic Proceeding. The formula sets the annual target by averaging Union's actual audited TRC results over the previous three years, adjusted to reflect the 2011 avoided costs, and applying to this figure an escalation factor equal to 1.5 times the amount by which budget is increased, or 15%. Union's 2011 DSM target will be established once the 2010 audit results have been finalized, subject to the application of 2011 avoided costs.

SSM: In 2011 Union will be eligible to earn a Shared Savings Mechanism ("SSM") incentive payment for DSM results achieved. At 100% of the TRC target Union will be eligible for an SSM incentive payment of $4.75 million. An additional incentive of $0.5 million will be available for market transformation activities.

LRAM: Union will continue to apply the rules of the Lost Revenue Adjustment Mechanism ("LRAM") as outlined in the DSM Generic Proceeding Decision.

DSMVA: Union will continue to use the DSM Variance Account ("DSMVA") to "true-up" the variance between the DSM spending estimate built into rates for the year and the actual spending in that year. If actual spending is less than the amount built into rates, ratepayers shall be reimbursed. Union will be reimbursed for overspending, up to a maximum of 15% of its DSM budget for the year, provided additional funding is utilized on incremental program expenses, including market transformation programs.

Programs: Union's 2011 DSM Plan will be focused on programs in the following markets:

- Residential Markets;
    - New Home Construction
    - Residential Existing Customers
    - Low-Income Existing Customers
- Commercial Markets; and
    - New Build Construction
    - Existing Buildings
- Distribution Contract Markets.

Additionally, Union will implement a Market Transformation program.

Research: In 2011 Union will undertake research directed at performing technical and economic analysis of new technologies, as well as the expanded applications of existing technologies. Union's research will ensure energy saving opportunities are effectively identified and targeted.

Evaluation: Union will complete evaluation work as prioritized by Union in collaboration with its EAC prior to the start of 2011. Union will also complete an Annual Report which will be subject to an independent third party audit.

2 Regulatory Framework

This section outlines how the framework determined in the Decision on Phase 1 of the DSM Generic Proceeding will apply over the course of the 2011 DSM Plan.

2.1 Budget

The budget for 2011 will be $24.890 million. This budget represents the 2010 budget of $22.627 million increased by 10% in accordance with the existing, Board Approved, DSM framework. The budget for 2011 includes $1.464 million for Market Transformation programs, 14% of which will be allocated to low-income market transformation, and $1.903 million allocated to targeted low-income programs.

The budget for 2011 will be allocated to the market sectors based on historical results and Union's assessment of the potential in each sector. Table 1 provides a summary of the forecasted 2011 DSM budget. Union does not anticipate the actual sector level spending in 2011 will vary significantly from the ratios in 2008 and 2009. Union may adjust the planned sector level spending during the market planning process that will be undertaken in Q4 2010. The budget allocation to low-income DSM programs will be $1.903 million which is greater than 14% of Union's total residential DSM budget, and the allocation for Union's low-income market transformation program will be 14% of the total market transformation budget as established in EB-2006-0021. In 2011, Union will continue to spend a portion of the budget on research and evaluation activity.

Table 1

2011 DSM Planned Budget

	Actual		Plan	
	Year			
	2008	2009*	2010	2011
	($000)	($000)	($000)	($000)
Program Allocation				
Residential	3,044	2,838	2,964	3,139
Low-Income	1,445	2,170	1,732	1,903
Commercial	4,332	4,638	4,557	5,666
Distribution Contract	3,869	5,022	4,714	4,990
Market Transformation	1,097	1,175	1,330	1,464
Programs Sub-total	13,787	15,843	15,296	17,162
Research & Evaluation	1,578	1,142	1,634	1,778
Administration	144	70	134	74
Salaries and Overhead	4,750	5,167	5,564	5,875
DSM Budget Allocation	**$20,259**	**$22,222**	**$22,627**	**$24,890**
DSM Budget	$18,700	$20,570		
DSMVA	$1,559	$1,652		

* Pre-Audit Spend

As approved in EB-2006-0021, Union tracks the variance between the DSM budget included in rates, by rate class, and the actual DSM dollars spent by rate class. The variance, by rate class, is disposed of annually through Union's deferral disposition application.

2.2 Target

Union will continue to utilize the formula accepted in Phase 1 of the DSM Generic Proceeding, which sets the target by averaging Union's actual audited TRC results over the previous three years, adjusted to reflect the 2011 avoided costs, and applying to this figure an escalation factor equal to 1.5 times the amount by which budget is increased, or 15%.

For the 2011 Plan, Union's target will be established as follows:

- The simple average of the actual 2008, 2009, and 2010 audited TRC values as approved by the Board, adjusted to reflect the 2011 avoided costs, increased by 1.5 times the budget escalation factor (i.e. 15%).

As specified in the DSM Generic Proceeding Decision, the actual audited TRC values shall be the total TRC produced for the year in question as determined by the audit for the following year (i.e. 2008 audit completed and filed with the Board by June 30, 2009). Union's 2011 DSM target will be established once the 2010 audit results have been finalized, subject to the application of 2011 avoided costs.

2.3 Shared Savings Mechanism ("SSM")

In the 2011 DSM Plan, Union will be eligible to earn a SSM incentive payment which will be set by the established, Board approved, formula detailed below. The SSM payout associated with Union's achievement of its TRC target is $4.750 million.

- For achievement of between 0 and up to 25.0% of the annual target, the SSM payout shall equal $900 for each 1/10 of 1% of target achieved.
- For achievement of greater than 25.0% up to 50% of the annual target, the SSM payout shall equal $225,000 plus $1,800 for each 1/10 of 1% of target achieved.
- For achievement of greater than 50.0% up to 75.0% of the annual target, the SSM payout shall equal $675,000 plus $6,300 for each 1/10 of 1% of target achieved above 50.0%, and
- For achievement of greater than 75.0% of the annual target, the SSM payout shall equal $2,250,000 plus $10,000 for each 1/10 of 1% of target achieved above 75.0% to a maximum of the SSM annual cap.

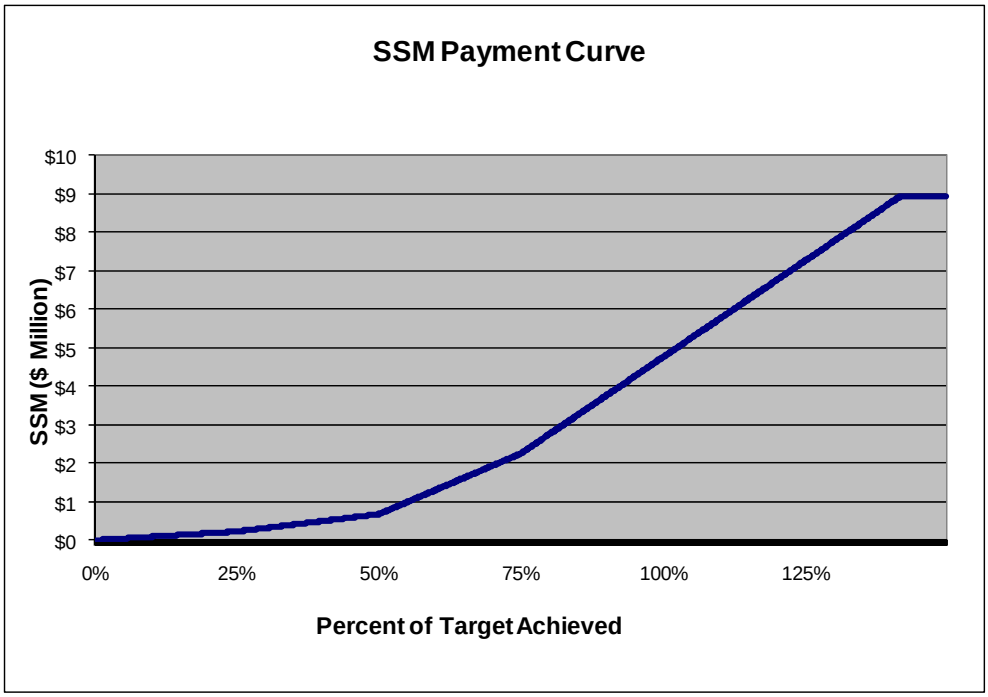
The SSM payout will be calculated based on the results as they apply along the curve and equates to the following:

- Up to 25% of the annual target, a total payout of $225,000,
- Up to 50% of the annual target, a total payout of $675,000,
- Up to 75% of the annual target, a total payout of $2,250,000,
- Up to 100% of the annual target, a total payout of $4,750,000,
- Up to 125% of the annual target, a total payout of $7,250,000, and
- In excess of 125% of the annual target, the total is capped at no more than $8,939,426 × (1 + Ontario CPI).

For 2011 the annual SSM incentive cap will be calculated by increasing the 2010 SSM cap of $8,939,426 by the Ontario CPI as determined in October 2010.

For illustrative purposes, the SSM curve is shown in Figure 1.

Figure 1



As outlined in the DSM Generic Proceeding Decision, for the purposes of determining whether Union has met its TRC target, the input assumptions for the calculation of SSM will not be changed retroactively. Fixed input assumptions allow Union the ability to effectively prioritize, design, and deliver energy efficiency initiatives while providing program continuity to the marketplace. Any adjustments confirmed through the audit process would apply in the year immediately following the year being audited. The treatment of input assumptions for the purpose of calculating the SSM incentive and DSMVA is summarized in Table 2. The Board approved 2010 measures and input assumptions have been used as the foundation of the 2011 SSM assumptions.

Table 2

Treatment of DSM Input Assumptions for the Purpose of Calculating SSM and DSMVA

ProgramType	Participants	Annual Unit Savings	Free Rider %	Measure Life	Unit Incremental Costs	Direct Program Costs
Prescriptive	Actual	Fixed	Fixed	Fixed	Fixed	Actual
Custom	Actual	Actual	Fixed	Actual	Actual	Actual

A summary of the program input assumptions used in the calculation of TRC benefits is included in Appendix A. The inputs assumptions are based on the values contained in the report "Measures and Assumptions for Demand Side Management ("DSM") Planning" (EB-2008-0346) prepared by Navigant Consulting Inc. and updated by Union to represent the best available information, with all updates indicated in Appendix A. In addition, Union has included additional measures which were not included in the 2010 Plan. Union undertook a consultation

process with the 2010 EAC for all new measures and has achieved complete EAC consensus on the input assumptions for these measures. Substantiation documents for all new measures are included in Appendix B. Union will file any changes to measures or inputs relative to those included in Appendix A with the Board as appropriate. Changes may result from new measures being brought forward or updated evaluation work.

An additional incentive of $0.5 million will be available for market transformation activities. Union will use a scorecard approach to evaluate program results achieved towards the incentive payment. A balanced scorecard is effective as it allows for the measurement of the indicators of program results which extend beyond unit energy savings. This approach drives Union to pursue program opportunities which would be limited if subjected to measurement under TRC.

The balance in the SSM Variance Account ("SSMVA") for 2011 will be cleared in Union's deferral disposition proceeding in 2012. DSM shareholder incentive amounts shall be allocated to Union's rate classes in proportion to the net TRC benefits attributable to the respective rate classes.

2.4 Lost Revenue Adjustment Mechanism ("LRAM")

To ensure that natural gas utilities are not penalized for implementing effective energy efficiency programs, the Board allows utilities to recover the lost distribution revenues that result from these programs. The mechanism used is the Lost Revenue Adjustment Mechanism.

Union will continue to use the LRAM deferral account for 2011 in the same manner as in previous years. The variance between the actual volume savings achieved and the target savings included in the current rates will be recorded in the LRAM account.

For Union, the first year impact will be calculated as 50% of the annual volumetric impact multiplied by the distribution rate for each of the rate classes that the volumetric variance occurred in. Input assumptions used in the calculation of the LRAM amount will be the best available at the time of the annual audit.

The LRAM shall be recovered in rates on the same basis as the lost revenues were experienced so that the LRAM ends up being a full true-up by rate class. The balance in the LRAM deferral account for 2011 will be cleared in Union's deferral disposition proceeding in 2012.

2.5 DSM Variance Account ("DSMVA")

The DSM Generic Proceeding confirmed the continuation of the DSMVA to "true-up" the variance between the spending estimate built into rates for the year and the actual spending in that year. If actual spending is less than the amount built into rates, ratepayers shall be reimbursed. If actual spending is more than was built into rates, Union shall be reimbursed up to a maximum of 15% of its DSM budget for the year. All additional funding must be utilized on incremental program expenses, including market transformation programs.

The DSMVA balance is calculated by comparing the actual DSM spend by rate class to the DSM budget allocated to each rate class as included in rates. The DSMVA balance for 2011 will be cleared in Union's deferral disposition proceeding in 2012.

2.6 DSM Screening

The TRC test is a benefit/cost test that determines the net present value of a DSM measure, program or portfolio's savings. The benefits are the costs avoided by the reduction in resource consumption (natural gas, electricity, and water) and the costs are the participant (equipment) and program costs. DSM measures are screened using the TRC test and must yield a benefit/cost ratio of 1.0 or more to be included in the portfolio.

The TRC measure screening will be calculated using the input assumptions summarized in Appendix A.

2.7 Avoided Costs

Avoided costs represent the benefits in the TRC calculation (i.e. the benefits of not having to supply natural gas, electricity and water) and are integral to the determination of TRC benefits for the purposes of determining overall program results.

In 2007 - 2010 Union adopted the methodology used by Enbridge for calculating avoided costs. The commodity portion of the avoided costs is updated annually. The same avoided costs will be used to calculate both the target and incentive amount for 2011, so that there is neither a gain nor a loss as a result of changes in the avoided costs relative to prior years.

For the 2011 DSM Plan, Union will continue the same approach for the calculation of avoided costs as used in 2007 – 2010.

2.8 Consultation Process

Union will continue to engage stakeholders and intervenors through a consultative process. This process will include formal and informal consultation as required by Union. As agreed to in the DSM Generic Proceeding, Union will hold two formal consultative meetings annually. The purpose of the meetings will be to:

- Review annual results (the Annual Report will be sent to the Consultative annually for review) and select the Evaluation and Audit Committee ("EAC"). In the current process, the members of the Consultative nominate individuals to stand on the committee. Then each member of the Consultative votes for the three members they would like on the committee. The three with the highest number of votes are included in the EAC. Union is the fourth member of the EAC.

- Review the completed evaluation results.

- Share ideas around program design and effectiveness.

All intervenors in Union's most recent rate case shall be entitled to participate in the Consultative meeting.

2.9 Evaluation and Audit Process

Union shall file annually a clear and concise Annual Report that summarizes the savings achieved, budget spent and the evaluations conducted in support of those numbers. The purpose of the evaluation and audit process is to review all input assumptions related to the delivery of DSM in 2011.

To assist with the evaluation and audit process, all parties of the EB-2006-0021 proceeding agreed to the establishment of an EAC to engage stakeholders in the development of evaluation priorities and in a review of the evaluation results as they become available over the term of the Plan.

The EAC will have an advisory role in the following evaluation activities:

- Consultation to set the evaluation priorities for 2011.

- Review and comment on evaluation study designs. Input on the research methodology used to determine the input assumptions.

- Selection of the independent auditor to audit the 2011 Annual Report and determine the scope of the audit. The EAC will ensure that all comments on the Annual Report from the Consultative are reviewed by the auditor.

- Following the audit, review of the Annual Report to confirm scope and priority of identified evaluation projects.

- The EAC will be responsible for meeting the reporting guidelines of the Board (found at Section 2.1.12 of the Natural Gas Reporting & Record Keeping Requirements Rule for Gas Utilities). The EAC will provide a final report within 10 weeks from the later of, the receipt of the Annual Report and supporting evaluation studies from the Utility, or the hiring of the auditor. Recommendations of the EAC with respect to DSMVA, LRAM and SSM clearances will be included in the EAC's final report. The EAC will not consider any further information subsequent to the Board's filing deadline each year.

A third party audit of the Annual Report will be completed annually. The auditor will be retained by Union who determines the scope of the audit. As determined in the DSM Generic Proceeding, it will be the role of the auditor to:

- Provide an opinion on the DSMVA, SSM and LRAM amounts proposed and any amendment thereto.

- Verify the financial results in the Annual Report to the extent necessary to give that opinion.

- Review the reasonableness of any input assumptions material to the provision of that opinion.

- Recommend any forward looking evaluation work to be considered.

- The auditor shall be expected to take such actions by way of investigation, verification or otherwise as are necessary for the auditor to form their opinion. The auditor, although hired by the utility, must be independent and must ultimately serve to protect the interests of stakeholders.

In addition to the audit, Union will also continue to complete a third party verification of custom projects annually. These verification studies are not intended to be duplicated by the auditor as they will based on a sampling methodology that has received EAC input and are carried out by a third party engineering company. As outlined in the Generic Proceeding Decision, projects selected for assessment will consist of a random selection of 10% of the large custom projects representing at least 10% of the total volume savings for all custom projects and consist of a minimum number of five projects.

2.10 Electricity Conservation and Demand Management ("CDM")

Union will focus on the delivery of energy efficiency and conservation efforts as they pertain to reductions in natural gas for our customers. Where those initiatives have other benefits, such as electricity, water or other resource savings benefits, Union will account for those through its TRC benefit calculations.

When appropriate, Union will work with other LDCs (both gas and electricity) in the delivery of DSM and CDM initiatives. Where that cooperation requires partnerships or the sharing of costs and/or benefits, Union will enter into upfront agreements as to the distribution of attributes of those activities.

In order to facilitate further integration between DSM and CDM to leverage the established delivery channels and relationships Union has built in the marketplace, the Board should ensure utilities are rewarded for the value they bring to a program. Attribution is most appropriately determined by the parties to the agreement, recognizing that the total value of resource savings claimed by all parties should not exceed the benefits generated by the program.

3 Programs / Activities

This section provides an outline of the planned programs as well as the research and evaluation activities Union plans to focus on over the 2011 Plan period. Changing market conditions, new information, or process improvements may compel Union to alter its DSM programs to effectively utilize the DSM budget. Union will remain focused on continual improvements with respect to its programs and approach to market as new information becomes available.

Programs for 2011 are organized into the following areas:

- Residential Markets;
  - New Home Construction
  - Residential Existing Customers
  - Low-Income Existing Customers
- Commercial Markets;
  - New Build Construction
  - Commercial Existing Buildings
- Distribution Contract Markets; and
- Market Transformation.

Below are descriptions of the various markets and related programs.

3.1 Residential Market

The Residential Sector includes customers in the M1 and R01 rate classes and consists of all single-family detached, attached row and individually-metered multi-family housing. In 2011, Union will deliver energy conservation programs to the new home construction and existing building market throughout its franchise area. Union will also deliver targeted programs to low-income existing customers.

3.1.1 Residential New Home Construction

New homes represent an opportunity to incorporate energy efficiency options at the time of construction. In 2011, Union's initiatives in the new home construction market will target single family individually metered residential homes. To be eligible for the programmable thermostat component of this program, builders will be pre-screened in order to verify that they do not install programmable thermostats as a standard in their homes. Through Union's Residential New Home Construction Program, measures will be delivered which are more efficient than the standard currently installed as mandated by the Ontario Building Code.

The primary barriers to the adoption of energy efficiency measures by builders are resistance from plumbers, who manage the procurement of showerheads and aerators, to deviate from their historical practices. The same is true of Heating Ventilation and Air Conditioning ("HVAC")

contractors with regard to programmable thermostats. In many cases, while the builder is the final decision maker, they do not directly manage the measure procurement process.

Strategy
The Residential New Home Construction program targets the adoption of energy efficient measures in the new housing segment of the residential market. Union will target water and space heating loads and will build on the partnerships developed with home builders. Union will target builders, both directly and indirectly, and will investigate promoting the program through local home builder associations ("HBAs"), HVAC channels, and the Ontario Home Builders' Association ("OHBA"). Union will also target the plumber community in 2011 through the Canadian Institute of Plumbing & Heating ("CIPH") in order to educate and have them influence the builders to utilize more efficient water measures in new home construction.

The overall objectives for the 2011 Plan are:

1. Drive strong builder, plumber and HVAC relationships to improve new home energy efficiency.
2. Influence builders to have higher efficiency measures installed in their developments.

Technologies
The measures which will be delivered through this program include the following:

- Energy efficient showerhead (1.25 GPM)
- Energy efficient kitchen aerator (1.50 GPM)
- Energy efficient bathroom aerator (1.00 GPM)
- Programmable thermostat.

Initiatives
Union will deliver a portfolio of water conservation measures and programmable thermostats both directly and indirectly to residential home builders. Union has identified that plumbers and HVACs can be utilized to influence the builders' decisions for water and space heating conservation measures. They each manage the procurement process for their respective product on behalf of the builder. This program will be supported through the plumber community, HVAC contractors and Union's Residential Account Managers ("RAMs"), who have established relationships with builders and the organizations to which they belong.

Union's RAMs will continue to work with key builders and will engage their plumbers and HVACs. These plumbers and HVACs will be invited to attend regional educational workshops to learn more about the program and how they can participate.

Union will continue to explore options to enhance efficiency in the new home construction market, such as additional measures or through the support of a new home labelling program, as opportunities arise.

3.1.2 Residential Existing Customers

Union promotes energy efficiency to its 1.2 million existing residential customers. Union's single family individually metered residential customers are eligible for the program. The primary barriers to the adoption of energy efficiency measures in this segment include a gap in consumer awareness and a lack of proactivity in seeking out and purchasing energy efficient measures. Residential customers are receptive to energy efficient programs and educational materials which are accessible and illustrate the actions they can take to reduce monthly energy expenses.

Strategy

In 2011, the Residential Existing Customers energy efficiency program will continue to target the reduction of natural gas consumption for space heating and water heating. The program is delivered through a combination of customer communication, education and incentives, and is largely consistent with the 2010 program.

Union's communication and education tools deliver the message that the best method to reduce energy bills is through conservation. These vehicles provide specific and relevant advice on actions residential customers can take to achieve energy savings. Education and awareness initiatives are supported by promotions that assist customers in making wise energy choices. Union delivers conservation measures and incentives through retailer and contractor partnerships, as well directly to residential customers.

The overall objectives for the 2011 Plan are:

1. Increase customer awareness of energy efficiency, and energy efficient improvement options.
2. Provide education and incentives through multiple delivery channels.
3. Re-assess program design and program delivery to target customers who have not previously been reached by Union's conservation initiatives.
4. Implement improvement in program design to incorporate stakeholder input.

Union targets information and promotional materials to customers to increase the awareness and up-take of high efficiency measures. Union also works with HVAC contractors and retailers to deliver the program to customers.

Technologies

Union will continue to drive the distribution of its Energy Saving Kit (ESK) in 2011. Each ESK contains:

- Energy efficient showerhead (1.25 GPM)
- Roll of Teflon tape for ease of showerhead installation
- Energy efficient kitchen aerator (1.50 GPM)
- Energy efficient bathroom aerator (1.0 GPM)
- Pipe wrap (2 metres).

Union continually assesses the measures included in its program and seeks opportunities to provide further benefits to our customers. In 2011, Union's intention is to completely transition

from a 1.50 GPM bathroom aerator to a 1.0 GPM unit. This change will maximize the energy and water savings for the program participant.

Initiatives

In 2011 Union Gas will continue to deliver ESKs both directly to residential customers and through established partnerships which target this market. Through providing ESKs to residential customers, Union is able to efficiently and cost-effectively deliver a group of pre-packaged measures which will reduce household consumption of energy and water. In addition to the measures, each ESK includes a Hot Water Handbook which provides measure installation instructions as well as a $15 programmable thermostat on-bill rebate coupon. The handbook has been redesigned to provide straightforward energy saving tips to the homeowner.

Union has also implemented an installation component to the ESK program through participating HVAC contractors. Through Union's HVAC partnership initiative, customers are influenced while energy efficiency decisions are being made. ESKs are not only provided to customers but components are also installed, further simplifying the implementation process for the customer. In addition to distributing and installing ESKs, HVAC partners provide customers with conservation advice to help them save money on their energy bill.

Union will continually strive to identify additional delivery opportunities for 2011. Union plans to continue to utilize the following delivery channels to distribute ESKs:

- Customer initiated channels;
  - Online order form
  - Retailer pick-up depots
- Distribution events held at prominent banner retailers, home shows etc.;
- Third party installation initiatives; and
- School board partnerships encouraging staff, students and their family to sign up to receive a free kit.

Programmable thermostat rebate coupons are offered both as a component in Union's ESKs and as an independent promotion. In addition to its inclusion in ESKs this on-bill rebate coupon is delivered via the following channels:

- Bill inserts distributed to Union's residential customer base;
- Banner retailers;
- Direct mail to targeted conversion customers; and
- Union Gas website.

In addition to the coupon, Union has partnered with HVAC contractors to drive the sale and installation of programmable thermostats. The installation component of the program will remain for 2011, and Union will continue to leverage its existing and developing business relationships to drive greater uptake for this measure.

Union will continue to track ESKs and thermostats by customer premise in 2011. Where a duplicate thermostat or ESK is encountered at one address, it is disqualified and not counted toward Union's annual results.

Energy efficiency education and awareness will remain a priority for the residential market. Union will maintain its focus on informing residential customers through direct communication vehicles such as bill inserts, the residential section of Union's website (www.uniongas.com/energyefficiency) and EnerSmart magazine. EnerSmart is Union's bi-annual publication which provides information and practical articles that highlight ways customers can use energy more efficiently. On a monthly basis customers will continue to receive the InTouch customer information newsletter with their bill which highlights relevant topics throughout the year. Union also provides its Wise Energy Guide through the website and via ESK events to assist customers in understanding and executing conservation projects within their homes. In addition to complementing Union's program, the Guide also supports and explains the use of EnerGuide and ENERGY STAR appliance labels. Together, Union's mix of communication vehicles consistently delivers the message that the best method for residential customers to control their energy bills is through conservation.

In addition to educating residential customers, Union provides a dedicated HVAC partners section on its website (www.uniongas.com/hvac). Through education, HVAC partners will have the ability to explain the importance of conservation and communicate Union's program to their customers. Union also has a "Gas Facts" e-newsletter that is sent to over 1000 HVACs. This includes information on energy conservation programs, HVAC incentives as well as building code changes and internal process updates. Once a year, Union holds HVAC breakfast sessions which are face-to-face meetings across the franchise.

As Union continues to drive energy efficiency in the residential market, new opportunities will be investigated to ensure that a sustainable portfolio of DSM initiatives is maintained.

3.1.3 Low-Income Existing Customers

Participation in conservation programs is an effective and proven long-term solution for customers to manage their energy use and lower their energy costs. In 2011, Union will continue to deliver two programs to the low-income sector – Helping Homes Conserve and the Weatherization program. Customers are identified as low-income if they have an income which is at 125% or below Statistic Canada's pre-tax, post-transfer Low-Income Cut-Off ("LICO").

Union Gas recognizes the need to develop partnerships with low-income organizations and to provide tailored energy conservation education to low-income consumers. This approach is not specific to one of Union's low-income programs, but rather an overreaching strategy of the low-income DSM portfolio.

Establishing partnerships at the local level is an essential element of a successful low-income program. Local partners have extensive knowledge, experience and understanding of the issues within their community. Many of them also have trusted relationships with numerous low-income customers, which assist in bridging communication and awareness gaps with consumers.

Local partners can include social service agencies, municipalities, social housing providers, and additional organizations that serve this sector. Throughout the years, Union has established relationships with various partners, including; Housing Help Centre in Hamilton, Salvation Army of London, Cornwall and Area Housing, North Bay Area and Social Planning Council, etc. In 2011, Union will continue to establish further partnerships within existing and new communities in which the low-income programs are offered.

Union continuously updates and improves the education component of the programs as more information is gathered about the low-income customer base and the messages to which they are receptive. In 2009, Union developed an interactive education clinic that is delivered by Union in partnership with local social service agencies. These clinics teach customers various low-cost and no-cost tips to save energy in their home. Participants receive educational material as well as a home weatherization "starter kit". This kit contains items such as rope caulk, window film, caulk and a caulking gun. To ensure that customers understand how to use the products provided, there is an interactive component where attendees are given the opportunity to try out some of the products, such as a caulking gun, to give them the knowledge and comfort to use these products in their home. These kits do not generate TRC but are given as a value-add to Union's customers who have attended the education session.

Union also has a targeted education guide that speaks to low-cost and no-cost energy saving tips for the home. This guide educates low-income customers on home heating, lighting, water heating, doors and windows. These guides are distributed to all customers who participate in our Helping Homes Conserve and Weatherization program, and to the customers who participate in the education clinics.

In 2011, Union will continue to deliver education clinics throughout the franchise area and to distribute education materials to low-income customers.

The overall objectives for the 2011 low-income sector are to:

1. Reduce the overall energy related costs of low-income customers.
2. Provide awareness and education on conservation programs and benefits.
3. Provide access to conservation programs to low-income customers.

As low-income programs are more resource intensive and costly to deliver, the TRC approach currently limits the ability of the program to support a holistic approach to energy conservation in identified homes. This approach does not emphasize impacts which contribute to a more energy secure future for participants. TRC creates a disincentive in this market to pursue the higher cost measures which will drive deeper savings for these customers. In the next DSM framework, an appropriate screening and measurement approach which addresses the needs of the low-income segment should be established.

Helping Homes Conserve

Union's Helping Holmes Conserve program targets low-income customers who are private homeowners or are tenants who pay their own utilities; however, in the social housing market, tenants whose utilities are included in their rent remain eligible for the program. As social housing landlords do not realize profits, the benefits ultimately flow through to the buildings occupants. The energy savings which are realized by the landlord are utilized to offset energy costs or invested back into the building to fund capital improvements. Participants must reside in a residential dwelling to qualify for the program.

Low-income households face unique barriers in the adoption of energy efficient technologies. These customers do not typically have the time or tools to learn about conservation measures or the discretionary income to spend on energy efficiency. While Union Gas does not have access to any information on income levels and privacy laws restrain Union from purchasing lists that identify where individual low-income customers reside, Union works to identify areas in its franchise area with a higher concentration of low-income customers to ensure the Helping Homes Conserve program is effective.

Union currently plans to continue to deliver the program to Hamilton, Windsor, Sudbury, London, Brantford, Cornwall and North Bay in 2011. Union Gas will continue to work to expand the reach of the Helping Homes Conserve program based upon market capacity to deliver the program and available budget. Since its launch successful program expansion has been achieved each year, and Union's goal is to continue to expand the geographic reach of the program in 2011.

Strategy

The Helping Homes Conserve program will continue to target the reduction of natural gas consumption for space heating and water heating in the low-income sector. In order to remove any barriers to participation, the program is delivered right to the customer's door at no cost. Union will continue to utilize a door-to-door strategy in order to ensure that the program message is received by the customer. To locate low-income customers, Union works with third party data to identify postal codes with high-propensities of low-income customers. These lists are mapped for the technician base so they can visually see where clusters of low-income customers reside within a city in Union's franchise area. Once target lists are set, Union deploys third party professional technicians into the neighbourhoods to offer free installations.

Union also targets low-income tenants who reside in affordable housing units. Union works to establish partnerships with property mangers to get them on board with the program. By partnering with property managers, Union is able to leverage their communication channels with their tenants to promote the program.

Union works with various local community partners, such as social service agencies, to further extend the reach of the program. By working with these partners, Union is able to speak to customers about the program through trusted channels.

Technologies
Helping Homes Conserve offers low-income customers the free installation of:

- Energy Efficient Showerheads (1.25 GPM)
- Pipe Wrap (2 metres)
- Programmable Thermostat
- Energy efficient kitchen aerator* (1.5 GPM)
- Energy efficient bathroom aerator* (1.0 GPM).

**Aerators are left with the customer for self-installation.*

Initiatives
Union takes a very direct, hands-on approach when communicating with the low-income customer base. For the door-to-door strategy, Union targets low-income customers prior to the technician approaching households in the neighbourhood via a direct mail package and notification flyer. To ensure maximum impact within targeted neighbourhoods, a door-hanger is left when the customer is not home. Union has also established a toll free number, managed by its third party contractor, with dedicated staff to book appointments and field customer questions.

In addition, there is a dedicated section on the Union Gas website at www.uniongas/helpinghomes to allow customers to learn about the program and book an appointment online. Recognizing low-income customers may not have access to the internet; the door-to-door strategy will continue to be the primary focus in 2011.

The program provides customers with a Programmable Thermostat Instruction Sheet, which walks them through the programming process and addresses common concerns. To provide additional energy tips, a tailored low-income educational guide is left behind after an installation which provides further information on low-cost and no-cost initiatives customers can undertake in their home.

The partnerships and supporting educational initiatives described earlier on pages 17 and 18 will continue to be key components of Union's delivery of the Helping Homes Conserve program.

Weatherization

The Weatherization program targets low-income private homeowners or tenants who pay their own utilities and reside in a residential dwelling. Union identifies low-income customers as those with an income at or below 125% LICO for communities of 500,000 or more for the Home Weatherization program. These low-income customers often live in the most inefficient dwellings yet do not have the upfront capital to invest in additional insulation and draft-proofing measures. In addition, low-income customers may not be aware of the direct benefits of improving the efficiency of their home due to a lack of the time and tools available to learn about building envelope enhancements.

The delivery of the Weatherization program is both resource intensive and costly to deliver. The measures which are implemented in each home are dependant on the results of an initial energy

audit and are restricted to those which pass the TRC test. This causes challenges in communicating the expectations and limitations of the program to Union's low-income customer base. In many instances, while the customer has identified drafts in their home, or the contractor has provided notification to Union that an average residential customer would increase the attic insulation, the measures do not pass TRC. This limits the ability of the program to support a more holistic approach to the identified homes.

In addition to these restraints, there are a limited number of contractors in the market who have the experience and knowledge to work on low-income weatherization programs. This program requires contractors to have an understanding of Union's program measurement and reporting requirements. Two of the major contractors in this business reside outside of Union's territory which makes scheduling difficult and increases the cost of the service due to travel expenses.

To date, the Weatherization program has targeted Hamilton and Cornwall, and Union intends to continue delivery in these cities in 2011. Because of the local partnerships and hands-on approach required to effectively implement this program, it is important that Union expand the program at a pace which will ensure continued success. Union will continue to seek opportunities to expand the geographic reach of the program based upon market capacity and available budget.

Strategy

Union's weatherization program will continue to target the reduction of natural gas consumption for space heating in 2011 at no cost to the customer. The program provides benefits beyond energy savings by contributing towards increased comfort and indoor air quality in the home.

There are two distinct approaches to market depending on whether the target is a private homeowner or a tenant who pays their own utilities. As educating customers on the process and benefits of weatherization is a very complex task, both approaches rely heavily on local partnerships.

Union approaches the private homeowner market by partnering with local organizations to enrol low-income customers. By leveraging the established relationships of a trusted source in the community, Union is able to get the time required with the customer to provide the necessary information and address all of their concerns.

Union approaches the affordable housing market by developing relationships with local property managers who have a property mix of residential units with tenants who pay their own utilities. By informing the property managers about the program, Union is able to leverage the relationship with their tenants to enrol them in the program.

Under both approaches, Union partners with contracting companies who specialize in low-income weatherization programming to perform the audits and installations in the home.

Technologies
Union's low-income weatherization program offers customers the free installation of the following:

- Attic insulation
- Basement insulation
- Wall insulation
- Draft-proofing measures – caulking, weather-stripping, etc.

The Weatherization program will operate on a custom basis in 2011. Customers will receive a pre and post energy audit conducted by certified energy auditors using industry standard testing methods and tools for each home. The energy audits will be provided at no cost to the customer. Upgrades in the home are determined by the initial energy audit results.

Initiatives
Union leverages local community partners and affordable housing property managers to speak to low-income customers about the Weatherization program. A program brochure is used to outline the program. The partnerships and supporting educational initiatives described earlier on pages 17 and 18 will continue to be key components of Union's delivery of the Weatherization program.

3.2 Commercial Market

In 2011 Union will continue to develop, market and promote energy efficiency programs targeted at facilities in Union Gas' commercial and industrial general service rate classes. Programs will continue to target New Build Construction and Commercial Existing Buildings.

3.2.1 Commercial New Build Construction

In the new build market, decisions about efficiency are made during the design stage. Union's new build program targets the reduction of natural gas consumption in commercial, institutional and industrial new construction at this stage in the building process. Higher capital cost, customer indifference to efficiency, economic conditions and lack of knowledge/awareness are all potential barriers to the adoption of energy efficient equipment measures. Union will engage the market participants to design and construct new buildings that operate at higher levels of energy and environmental performance than required in the Model National Energy Code for Buildings.

Strategy
Initiatives in the New Build Program target space heating, water heating and ventilation measures, as well as initiatives that target process related loads. Energy efficiency initiatives are marketed through end-use customers and trade allies such as designers, architects, consulting engineers, equipment distributors and HVAC contractors. The target of Union's program is the key influencer. The key influencer on all matters of construction can be either the end-use customer or the trade allies. Either can influence the building design, HVAC system/equipment selection and the development of operating and maintenance procedures in the commercial/industrial new build market.

In 2009 Union thoroughly examined the means by which the DSM programs are designed and marketed. To provide continuity and consistency for those who have become familiar with our programs, the program design for 2011 will remain consistent with the 2010 program. The marketing of the programs however will be targeted to market segments where greater potential exists for new growth. There will additionally be an increasing focus on marketing directly to end use customers to increase awareness of Union's programs and services with the rate payers. Union will continue to work with key allies during the design stage to influence projects to be built above the requirements of the building code through the Design Assistance Program. Union will assist in advising customers and allies on technology and energy efficiency options, helping them calculate their return on investment, determining eligibility and assisting with customer presentations.

Union provides financial incentives as part of the new build strategy directly to trade allies to facilitate their own business development efforts and/or the end-use customer to encourage the adoption of energy efficiency in their design and construction decisions.

The overall objectives for the 2011 Plan are:

1. Improve and expand the knowledge base and awareness of end-use customers, HVAC contractors, architects, designers and engineers (key influencers) on energy efficiency technologies motivating them to take action and include high efficiency technology in their design plans.
2. Increase the awareness of Union's programs and role in the market with respect to energy efficiency through partnerships and relevant market opportunities.
3. Increase the energy efficiency of new commercial, institutional and industrial buildings

Technologies

Eligible technologies include but are not limited to:

- Condensing Boilers (heating load only),
- Energy Recovery Ventilators – up to 4,999 cfm,
- Heat Recovery Ventilators – up to 4,999 cfm,
- Rooftop Units,
- Infrared Heaters,
- Condensing Unit Heaters,
- De-stratification Fans,
- Demand Control Kitchen Ventilation,
- Energy Star Dishwashers
- Condensing Gas Water Heaters,
- Ozone Laundry,
- Front Load Clothes Washers, and
- Custom technologies that do not conform to prescriptive deemed savings.

Initiatives
Union encourages the consideration of efficiency in the design stage through its Design Assistance Program which has successfully engaged the design community in designing new buildings that exceed current building codes.

This program will continue to provide financial assistance in the design planning stages for facilitating modeling simulations. The simulations explore the various alternatives to achieving energy efficiency, including realizing energy savings of 25% or greater above the Model National Energy Code for Buildings. There are no planned changes from the current program that has been in existence for several years. Union will continue to promote the Design Assistance Program and will offer energy efficiency advice to developers, architects and consulting engineers through Union's sales staff, brochures and website.

In addition, to the Design Assistance Program, Union will continue to employ an integrated approach to the New Build market by delivering targeted equipment incentives to key influencers. These incentives are provided through initiatives in the EnerSmart Program, which includes both prescriptive and custom technologies.

Union uses a variety of marketing and account management tools to drive results in the new build market including direct selling efforts, working directly with corporate national account customers, advertising in targeted media, market support materials, educational seminars, "Lunch and Learn" meetings as well as through the sponsorship or partnership of forums hosted by other organizations that promote energy efficiency.

3.2.2 Commercial Existing Buildings

The Existing Buildings Program encourages the adoption of energy efficient technology in the commercial, institutional and industrial market using a market segment focus. Union encourages end-use customers, and the many target stakeholders and trade allies in this market, to use best practices when operating or replacing equipment and retrofitting existing buildings. The result is a reduction in natural gas consumption and improved energy and water efficiency within their facilities. Barriers to the adoption of energy efficiency measures include long project cycles, high capital cost, economic conditions and customer/trade allies' awareness of energy efficient equipment.

Strategy
As mentioned previously, Union spent significant time to segment the commercial market, to understand the potential for energy efficiency programs. To ensure continuity in the marketplace, Union's approach in 2011 will be largely consistent with the 2010 DSM Plan. Union will continue to tailor its program to the individual market segments with like characteristics to ensure the needs of each segment are addressed. For each segment, Union will continue to identify the key players and segment leaders, service providers, economic drivers and decision making criteria to help establish complete energy solutions with respect to the delivery approach and measures promotability.

Information on services and/or technologies will be tailored and marketed to the specific needs of each segment group. The energy efficiency programs will continue to be marketed through trade allies such as HVAC contractors, designers and engineers who recommend and install equipment. The programs will also be targeted directly to the end-use customer and supported by Union's Account Managers. The goal is to ensure rate payers recognize the value of Union's programs and avail themselves of these services.

The overall objectives for the 2011 Plan are:

1. Improve and expand the knowledge base and awareness of key influencers on energy efficiency technologies and measures.
2. Demonstrate the value of DSM programs to commercial customers.
3. Increase the energy efficiency of existing commercial, institutional and industrial buildings.

The following provides a brief description of the potential strategies by market segment.

Office Segment

Union will continue to identify and target owner occupied buildings as owners are more open to considering energy efficiency improvements. A key to success will be developing a greater understanding of the drivers for property owners and managers to pursue energy efficiency improvements. Union will also focus on national account end-use customers within this segment, to reach the decision makers that are part of a centralized management decision making process for undertaking energy improvements. Participation in industry tradeshows will support Union's direct communication strategy. Key energy efficiency improvements for this segment include space heating, domestic water heating through condensing boilers, hot water conservation measures, programmable thermostats, ventilation systems and controls. Service offerings include general energy efficiency assistance, HVAC audits and energy audits.

Retail Segment

Union's Account Managers will target this segment working directly with large property development companies that operate multiple retail locations. Union will assist these large national account customers to manage their energy use through opportunities in space heating and ventilation systems that can be replicated throughout their facilities. Initiatives in this segment will continue to be supported through Union's tradeshow involvement, website self-service strategy and via partnerships with trade allies to create awareness and complement our initiatives.

Foodservice Segment

A national accounts approach is the most appropriate in this segment targeting decision makers within corporate head offices. By working with the right key influencers Union can drive efficiency in multiple locations. Through partnerships with associations, third party providers and trade allies, as well as participation in industry tradeshows, Union will continue to build awareness and support the implementation of efficient technologies. Independent owners/operators within this segment will be targeted primarily through direct mail campaigns and advertisements. Energy efficiency opportunities within restaurants and commercial kitchens

will focus on higher efficiency ventilation through controls, and domestic hot water through cleaning and cooking equipment.

Institutional Segment
Union will continue to use an account management approach that targets decision makers in the various sub-segments within the institutional segment, including education, hospitals and long term care. Energy efficiency opportunities include space heating, domestic water heating through condensing boilers, hot water conservation measures, ventilation systems and commercial cooking and cleaning. Service offerings include general energy efficiency assistance, HVAC audits and energy audits.

Multi-Family Segment
The private multi-residential segment includes rental and condominium buildings as well as multi-residential social housing. Union will continue to play a key role in making trade allies and end-use customers, both independent and national accounts, aware of the benefits of choosing high efficiency natural gas options. Union's Account Managers will continue to leverage the strong relationships which have been developed with business partners and multi-family decision makers. Opportunities for energy efficiency improvements are found in space heating, domestic water heating through condensing boilers, hot water conservation measures and ventilation systems.

The hot water conservation program has been successful in providing low-flow showerheads and aerators to these customers at no charge. Union has seen excellent uptake on this program and will continue with this offering in 2011.

Warehouse Segment
Union will continue to target this segment directly and through business partners and direct mail to promote energy efficient equipment. Key end-use improvements in this segment will target space heating opportunities primarily through infrared heaters, controls, programmable thermostats and de-stratification fans.

Industrial Segment
The industrial segment continues to struggle in 2010 due to the economic downturn. Hopefully 2011 will begin to show greater signs of improvement and increased investment in energy efficiency. Union will target this segment directly through Union's Account Managers and via alliances with key organizations and service providers. This approach leverages established relationships with customers and key stakeholders to expand the reach of the program to as many customers as possible and assist them in identifying and prioritizing efficiency opportunities within their facilities. Union will be focusing on the end use customer to demonstrate the value of DSM to their operations. Opportunities within the industrial segment include process load efficiencies, space heating through infrared heaters, de-stratification fans, ventilation systems, controls, programmable thermostats and condensing boilers.

Agriculture Segment
Union will continue to approach this segment directly through an account management approach and through alliances with organizations and service providers to promote energy conservation opportunities. There is a significant amount of diversity in how natural gas is used in the agriculture segment. As a result DSM programs primarily focus on custom applications and technologies. The relationships developed with stakeholders in the industry are leveraged to influence as many facilities as possible to examine their energy use. Union assists these customers to identify and prioritize initiatives in order to facilitate informed decisions providing technical expertise on application use and process improvements.

Entertainment & Hotel/Motel Segments
Union continues to support these segments through participation in industry associations and tradeshow events. Efficiency improvements which are implemented within these segments include space heating, water heating through condensing boilers, hot water conservation measures, programmable thermostats, controls and ventilation systems. Opportunities in the hotel/motel segment additionally include commercial cooking and laundry.

Technologies
Eligible technologies include but are not limited to:

- Condensing Boilers,
- Energy Recovery Ventilators,
- Heat Recovery Ventilators,
- Infrared Heaters,
- Condensing Unit Heaters,
- Destratification Fans,
- Demand Control Kitchen Ventilation,
- Rooftop Units,
- Programmable Thermostats,
- Condensing Gas Water Heaters,
- Front Load Clothes Washers,
- Ozone Laundry,
- Pre-rinse Spray Nozzles,
- Energy Star Dishwashers,
- Energy Efficient Showerheads and Aerators,
- Furnaces, and
- Custom technologies that do not conform to prescriptive deemed savings.

Initiatives

Union's Account Managers will continue to engage customers, equipment manufacturers and energy efficiency experts in forums that range from individual meetings to trade association seminars. Customers and trade allies recognize the value of the expertise and industry knowledge brought to the market by Union's Commercial and Industrial sales team. The Account Managers will continue to promote and incent energy efficient measures to increase the adoption of these technologies in the market focusing on the key influencer in the decision to adopt energy efficiency equipment. Union will also continue to offer a custom program to support customers in improving the energy efficiency of their processes and measures that are specific to their needs and facilities.

Beyond Union's mix of prescriptive and custom incentives, education will be an integral component to the program to facilitate informed decisions and support program enrolment. Union will continue to provide information for trade allies as well as customers through case studies, technical newsletters, training videos and E-tools.
Union also offers educational and training opportunities to architectural, engineering, energy service companies (ESCO) and HVAC contractors on an ongoing basis. These include energy efficiency workshops and seminars, boiler audit seminars, marketing materials and case studies promoting energy efficiency.

Union is also committed to continually improving the website for business customers ensuring that relevant energy efficiency information and tools are easily accessible. We are also examining the potential for customers to apply for commercial energy efficiency programs and incentives online, reducing administration and paperwork.

In addition, Union is continually seeking out new measure and program ideas that will advance energy efficiency in the commercial market. Currently Union is examining the potential for a building optimization program that will encourage the adoption of new technologies and sustainable behaviour changes that can be quantified and measured. Continuous program enhancements are required to ensure a sustainable portfolio of DSM initiatives and provide added value to the rate payer.

3.3 Distribution Contract Market

The distribution contract energy efficiency program targets Union Gas' customers in contract rate classes included in industrial, agricultural, and commercial market segments.

There are a number of barriers to energy efficiency in these segments. Energy costs are often a small fraction of total production costs while competition for capital within corporate structures is intense. Long paybacks and lack of information about available technologies are also major barriers. The past success of this program also means that many high return projects have already been completed.

The market conditions that will impact customers over the next year and therefore impact the availability of both capital and operating budgets in facilities are:

1. Global economic conditions,
2. Access to capital markets to fund energy efficiency investments,
3. Canadian/U.S. exchange rate,
4. Increased competition,
5. Increased consolidation (mergers/buyouts),
6. Downward trend on production outputs, and
7. Relatively low energy prices due to lower demand and new sources of supply (i.e. Natural Gas, Electricity).

The goal of the 2011 Plan is to grow the DSM commercial and industrial capability and results including:

1. Position Union as an energy expert for all energy management related issues.
2. Deliver a comprehensive suite of cost effective initiatives across all sectors and customer types.
3. Increase the longer term value of Union's DSM efforts in commercial, institutional and industrial facilities.
4. Leverage Union's leadership position in energy conservation with Government and stakeholders to enhance the value of the DSM portfolio.

Strategy

The energy efficiency program for this market is communicated directly to the customer and supported through collaboration with key organizations and service providers. This collaboration is required to:

1. Expand the reach of Union's program offerings by targeting key market segments;
2. Build a solid foundation for long-term success by positioning Union's Account Managers as energy experts; and
3. Build strategic relationships with key organizations and service providers.

The program design for the distribution contract market in 2011 will remain consistent with the 2007-2010 DSM Plans. This will provide continuity and consistency for customers who have multi-year projects underway and for customers that are becoming familiar with existing offerings. In some instances, changes to program funding levels are required to encourage more difficult upgrades of process equipment, and the implementation of projects with longer paybacks.

The program will continue to leverage the relationships Union's Account Managers and Technical Project Managers have with customers, equipment manufacturers, consultants, trade organizations and energy service companies. Customers recognize the value of Union's overall contributions, which gives the company the opportunity to learn the details of specific processes and identify opportunities to influence where energy efficiency investments are made. Assisting customers with identifying and prioritizing energy efficiency opportunities provides added value

to our customers, and often gives them the means to take advantage of growth opportunities when they arise. The end result is a strong, viable industrial base that is capable of producing a better, more economical product.

Union's distribution contract market consists primarily of two groups; large commercial (larger hospitals, universities and institutions) and industrial customers. Industrial customers have an extensive variety of applications including process, parts manufacturing, assembly, cement, etc. The diversity of customer needs and requirements in this group represents a continuous opportunity to broaden the reach of the program. It takes incremental resources to inform and educate this customer segment and a greater number of projects are expected to be required to achieve a similar level of volume savings. As such it is important for Union to target those key customers and segments which provide the opportunity to achieve the greatest possible energy savings. An increased effort will be required to collaborate with industrial service providers, trade organizations, and other gas and electric utilities. This approach will be applied alongside our direct to customer initiatives in order to reach the maximum number of customers.

The overall objectives for the 2011 Plan are:

1. Advance customer energy efficiency and productivity to improve the long term viability of Union's customers in a global marketplace.
2. Increase direct customer participation in Union's DSM programs.
3. Increase awareness that emission reductions are an integral part of efficiency improvement.
4. Maximize alliance opportunities to expand the reach of the program.

Technologies

There are numerous applicable energy efficient technologies within every industrial process sector. Therefore, when defining eligible program technologies Union uses broad definitions so that new developments can be incorporated over the course of the DSM Plan.

Eligible technologies include:

- Process improvement technologies specific to each sector,
- Steam system improvements and equipment,
- Heat recovery systems,
- Process and building design improvements,
- Space-heating and water-heating technologies, and
- Application specific measurement and controls.

Initiatives
To maximize success both in 2011 and in the future, Union will provide a mix of custom incentive initiatives to meet the distinct needs of different customers. These initiatives are applicable to both contract and non-contract customers, and include the following program elements:

- Communication and Education
- Industrial Process Studies
- Steam Trap Surveys
- Energy Efficiency Feasibility Studies
- Equipment Incentives
- Demonstration of New Technology.

Below is a summary of the program elements eligible for the Custom Incentive Program.

Communication and Education
Education is a very important element to facilitate informed ideas and actions. Newsletters, technology magazines, case studies, other publications and workshops will continue to be offered to our customers to promote the efficient use of natural gas and to increase the awareness of energy saving opportunities.

Union Gas will utilize a targeted approach for customer education. Experience has allowed Union Gas to determine that not all customers have similar education requirements. Information will be delivered in a manner that matches customer needs with respect to the topic and level of detail offered.

Based on customer feedback and interest, Union Gas will develop and sponsor specific education forums. When independent professional development groups, trade organizations, or government offices offer workshops on relevant energy efficiency topics, Union will promote and / or co-sponsor those that provide added value to our customers.

Union Gas holds several customer meetings at various locations in its service territory throughout the year. An effort is made to include one or more presentations based on an energy efficiency topic at each meeting.

The following proven methods of communication will continue to be utilized:

- Brochures
- Website
- Gasworks newsletter
- Customer meetings
- Training sessions
- Industry associations.

An opportunity exists to improve efficiency in many production environments by changing the perception that production and product quality play a far more important role than efficiency

improvements. A two tiered communication and education plan is required to integrate a customized energy efficiency perspective into the mainstream planning of a facility's priorities. Once knowledge and experience demonstrate that efficiency is not a stand-alone idea, but rather an essential element that contributes to the continuous improvement philosophy of both production and product quality, then there is an opportunity to change organizational behaviour and influence action.
Union is in the unique position of being able to amalgamate information and lessons learned on a larger basis than each individual company's experience.

Industrial Process Studies
This program is designed for Union to work in conjunction with the customer and consultants to determine the equipment operating efficiency, identify and quantify energy and cost saving opportunities, and establish implementation costs and payback periods for:

- Steam generation systems,
- Furnaces,
- Thermal fluid heaters,
- Vaporizers,
- Process heaters, and
- Other combustion equipment.

At the completion of a study, Union works with the customers to formulate the recommendations into a prioritized list of energy efficiency projects. This enables customers to work projects into their own site-specific energy plans and budgets.

An additional benefit from this program is that projects can improve the safety and reliability of combustion equipment since NO_x and CO_2 emissions can also be reported as part of this analysis.

Steam Trap Surveys
This program is designed to reduce losses from steam distribution systems. A qualified service provider identifies leaking traps, over-sized or under-sized traps, blocked or flooded traps, and the need for improvements in condensate return systems. Boiler efficiency has the most value when the steam distribution system is working effectively.

Energy Efficiency Feasibility Studies
Customers work with their Union Gas Account Managers to identify initiatives that will improve overall energy efficiency. This program supports engineering feasibility studies, engineering simulations, energy audits, onsite energy managers, and metering and targeting assessments by supplying end-users with the information needed to invest in energy efficiency measures.

A customer can consider a feasibility study for the design and justification of:

- Replacing old inefficient equipment,
- Making process changes, and
- Designing new facilities – includes utilizing simulation software in the case of LEED buildings.

Energy Efficiency Studies may focus on all energy sources within a plant, including:

- Natural gas,
- Electricity,
- Compressed air,
- Water/wastewater, and
- HVAC/makeup air.

There is a need for practical engineering/technical experience in manufacturing facilities that is focused on the concepts of energy efficiency. In 2011 Union will continue partnerships with the University of Windsor and McMaster University to develop energy efficiency professionals by providing eligible manufacturers with no-cost energy assessments. The lessons learned in 2007-2010 have positioned Union to expand the program going forward in cooperation with other universities or colleges, and potentially with other utilities in Ontario.

The Energy Management research program element has been continued for 2011. The research around Metering and Targeting at three distinct industrial segments will continue, and Union will investigate the possibility of expanding the research at additional segment specific locations during 2011. It is Union's belief that Metering and Targeting is the next evolution of energy efficiency programs. As energy efficiency programs mature, so do the needs of customers. The initial element of DSM programs that most customers utilize is equipment related incentives. As these opportunities become exhausted, especially in a capital constrained environment, Metering and Targeting would be utilized for two specific purposes:

1) To identify opportunities for energy efficiency improvements which would not otherwise be readily apparent, and
2) To verify savings after improvements have been made.

Metering and Targeting requires a significant capital investment as the contract rate customers involved typically have large processes and facilities which are being monitored. Since the capital required to support this element is significant, Union will continue to investigate the concept of a Metering and Targeting program element by investigating, researching and piloting various initiatives during 2011. It is Union's intent to advance a Metering and Targeting program element as part of its 2012 DSM submission and to allocate budget dollars specific to this initiative.

Equipment Incentives

Union will continue to provide incentives targeted at energy savings opportunities that improve the utilization of natural gas. Equipment incentives are designed to promote the use of:

- New and retrofit high-efficiency equipment,
- Higher efficiency process improvements,
- Heat recovery devices, and
- Energy management and controls.

Incentives are available for installations identified with or without an audit. Under both circumstances, Union's role is as a knowledgeable third party that has cross-sector expertise in energy efficiency opportunities. The trend over the past several years has been to reduce overhead costs. Customers have fewer and fewer in-house experts available to analyze potential projects. With shorter payback requirements and limited capital budgets, new relationships will be developed in facilities to influence and direct customer operating budgets into energy savings versus other capital spending opportunities.

Demonstration of New Technology

Financial incentives for the demonstration of new technologies are an essential part of convincing customers to adopt products that are not yet standard convention. This initiative is designed to encourage the adoption of market-ready, new, repeatable, energy efficient gas-fired technologies. This initiative is not intended for research – it is limited to commercially available energy efficient products that do not have a foothold in Ontario. Union strives to have this funding option available to support customers willing to take on the additional risk to achieve innovative results.

3.4 Market Transformation Program

Market transformation presents a formalized approach to encouraging the adoption of specific energy efficient technologies within a pre-determined customer segment. Market transformation programs, as opposed to traditional DSM programs which target the end user, focus on influencing a broad array of factors in the marketplace.

The fundamental principle which supports market transformation activities is that energy efficient technology adoption is frequently slowed by a variety of barriers found in the marketplace. Through utility intervention these obstacles can be removed and accelerated adoption of the energy efficient technology will occur.

3.4.1 Drain Water Heat Recovery ("DWHR")

Since 2007, Union Gas has offered DWHR technology in single family, individually metered, new home construction as its market transformation program. DWHR technology works by allowing cold incoming water in a home to be pre-heated by outgoing grey water before entering a natural gas water heater or storage device. Substantial energy savings can be achieved by reclaiming the heat from drain water generated from processes such as showering, laundry, and dish washing. As market transformation is a process that occurs over a prolonged period of time, Union will continue to focus on DWHR in 2011 and will work with the EAC to develop scorecard metrics required to measure the program's success.

The Market Transformation program's long term goals consist of the following:

- Increasing market penetration.
- Succeeding in having DWHR added as a standard to the Ontario Building Code.
- Assisting in the development of a competitive marketplace for the technology.

3.4.2 Market Barriers

Market barriers, as defined by Eto et al[1], are "characteristics of the market for an energy-related product, service, or practice that help explain the gap between the actual level of adoption and an increased level that would appear to be cost beneficial".

Union has focused on addressing the barriers to adoption of DWHR in the new construction market, which include:

- High production costs,
- Lack of product knowledge in the marketplace,
- Incremental transactions and the associated costs,
- Performance and installation uncertainties, and
- Organization practices or customs.

3.4.3 Market Effects

Market effects are changes in the market, including the behaviour of participants, which reflect the increased adoption of energy efficiency products. Through its program results to date Union has increased awareness of DWHR with customers and within the builder community. The program has driven an increase in the percentage of housing starts that have a DWHR unit installed. Union will seek to build on its experience and will continue to engage customers, builders, and government agencies with dedicated program elements to influence transformation of the market. Starting in 2011, Union will begin to engage the plumber community as a way of indirectly targeting builders given their influence over the products a builder purchases and installs in their homes.

The market effects Union drives through its residential DWHR market transformation program in the new home construction market are summarized in Table 3.

[1] Eto, Joseph, Ralph Prahl, and Jeff Schlegel; "A Scoping Study of Energy-Efficiency Market Transformation by California Utility DSM Programs"; Energy & Environment Division – Earnest Orlando Lawerence Berkeley National Laboratory; Berkeley, California, July 1996.

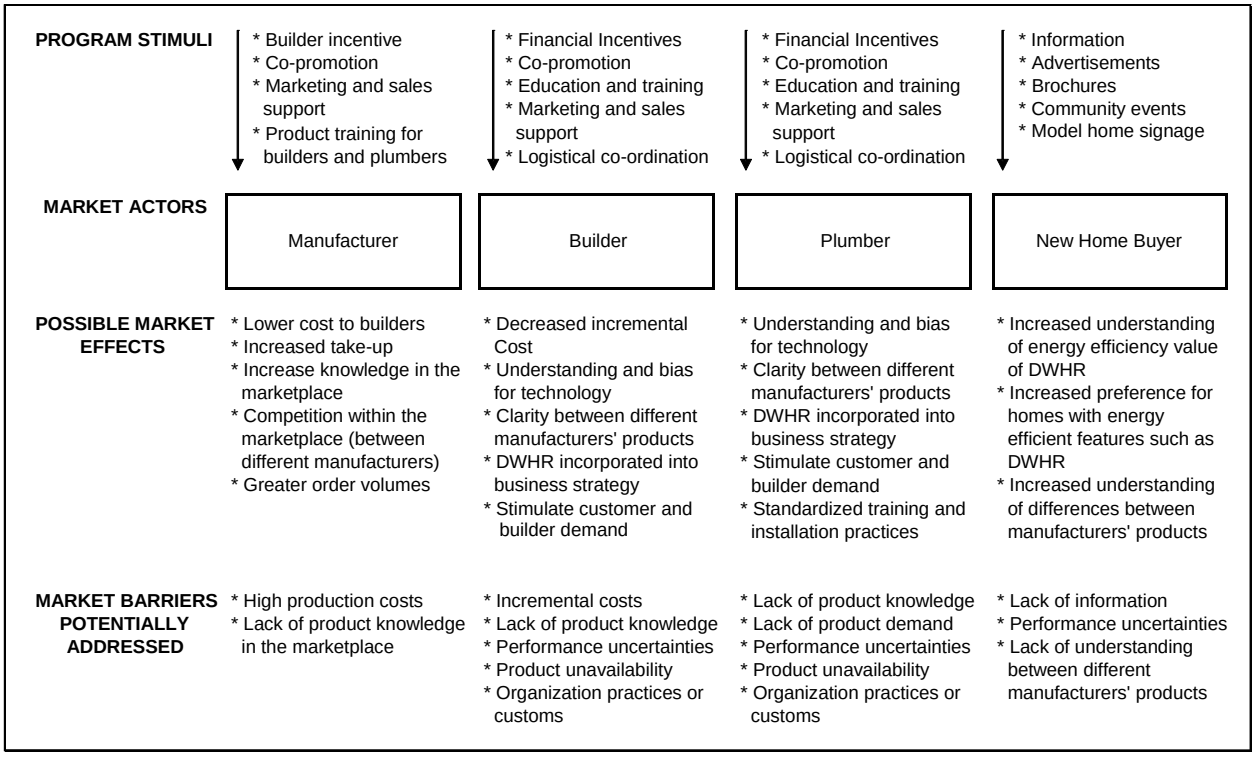
Table 3

Market Effects Attributable to Utility DWHR Program

Market Actor	**Market Effect**
New Home Buyer	Change in purchasing behaviour due to changes in: ▪ Awareness ▪ Attitude ▪ Knowledge
Builder	▪ Changes in promotion practice ▪ Changes in design practices ▪ Changes and standardization in installation practices ▪ Changes in service offerings ▪ Development of new skills
Plumbers	▪ Awareness ▪ Attitude ▪ Knowledge ▪ Changes and standardization in installation practices ▪ Changes in service offerings ▪ Development of new skills
Manufacturers	▪ Changes in promotion ▪ Changes in business strategies ▪ Changes in price ▪ Changes in shipping and distribution practices ▪ Changes in production schedule and quantity produced
Government	▪ Changes in codes, standards, or regulations ▪ Changes in promotion

3.4.4 Market Influence Diagram

Union created a market influence diagram to illustrate its market transformation efforts.



3.4.5 Strategy

For 2011, the DWHR program will continue to be offered solely in the residential new build market. The program will seek to drive adoption by engaging manufacturers, builders, plumbers, homeowners and government agencies.

The overall objectives of the 2011 Plan are:

- Educate homeowners about the benefits of DWHR when buying a new home
- Drive strong builder relationships to improve awareness and adoption
- Influence plumbers to promote the technology with builders
- Influence builders and plumbers to promote and install the technology
- Promote standardized installation practices across the industry
- Promote competition within the marketplace between the different manufacturers

3.4.6 Initiatives

Union will deliver DWHR technology both directly and indirectly to residential home builders and will work with various channels to help transform the marketplace as follows:

Manufacturers

In 2010, Union introduced a new manufacturer to the Ontario marketplace and will continue working with all participating manufactures to develop their infrastructure and distribution channels. Union will also continue to facilitate the sales process between the manufacturer(s) and home builders. Marketing and sales support will continue to be a priority. Union will work with the manufacturers to identify opportunities to reduce per unit costs and encourage the development of a competitive marketplace for DWHR.

Builders

Union will conduct DWHR workshops to train builders and sales agents in effectively marketing the value of the DWHR technology to new home buyers. This training provides the market participants with the ability to effectively convey the benefits of the technology to potential home buyers.

Union will also facilitate training for builders' contractors/sub-contractors to educate them on the proper installation and benefits of DWHR.

To further drive interest among new home builders, financial incentives will be provided to promote the inclusion of DWHR equipment as an option in their homes. In 2011 an incentive will be provided for the purchase and installation of each DWHR unit to increase builder interest and acceptance of the technology.

The educational components of Union's DWHR program will remain a focus in 2011. Direct communication tools such as direct mail and builder brochures will be utilized to provide information and further support the program. Union will continue to partner with service organizations such as EnerQuality and the OHBA to target builders and drive uptake of the program. Additional forums such as trade magazines, conferences and trade shows will be employed to ensure the message is received throughout the new build marketplace.

Plumbers

Union will begin working with the plumber community in 2011 to increase awareness of DWHR, provide education and develop a standardized installation process. Plumbers are an entirely new segment for Union and considerable effort will be made to understand, develop and leverage relationships with this group.

Initiatives may include:

- Workshops to train plumbers on the benefits of the technology and how to properly install the units, and
- Financial incentives to entice plumbers to start to use and promote the technology to builders and their customer base.

Union will also utilize various media channels and internal communication tools to create further awareness of DWHR among the plumber community.

New Home Buyers
Union will seek to increase residential customer awareness of DWHR through education and awareness campaigns which target new home buyers.

Initiatives may include:

- Marketing materials explaining the benefits of DWHR which are made available for distribution and for use by builders, and
- The inclusion of DWHR units in model homes and sales centres to influence home buyers when they are selecting features for their home.

Union will also utilize various media channels and internal communication tools such as www.uniongas.com/builder to create further awareness of DWHR amongst potential home buyers.

3.4.7 Research and Evaluation

Research and evaluation are necessary components of program planning and implementation to ensure Union's Market Transformation initiatives remain successful. Union will gauge the effectiveness of the program through the planned builder and plumber sessions, annual satisfaction surveys, as well as through the direct relationships Union's Account Managers have within this market. Feedback will be used to inform Union's program design and delivery strategy. Union will continue to investigate new Market Transformation approaches and opportunities, including a research project into the potential for an Energy Monitoring and Targeting program as outlined in Appendix C.

3.4.8 Low-Income Market Transformation

Union will seek out opportunities to partner with local social housing organizations across the franchise to offer DWHR units to be primarily installed in new social housing units constructed in 2011. Union will provide the DWHR unit, including installation, at no cost to each participating social housing provider.

3.4.9 Future Program Development

To ensure Union maintains a sustainable market transformation portfolio, Union will allocate a portion of the 2011 budget to test a pilot program for a new technology. The success of this pilot program will be assessed to evaluate its viability and to determine how it could be expanded moving forward. The pilot program will be delivered in addition to the DWHR program currently in the marketplace.

3.4.10 Incentive Scorecard

Union will use a scorecard approach to evaluate program effectiveness and eligibility for an incentive payment. This approach is effective as it allows for an assessment of the results of the program which address the identified barriers in the marketplace. A balanced scorecard allows for the measurement of the indicators of program effectiveness which extend beyond unit energy

savings and facilitate fundamental market changes. As has been the case in prior program years, Union will consult with the EAC in Q4 of 2010 to develop a performance scorecard for 2011. The actual score for each scorecard metric will be utilized as the multiplier applied to the metric's incentive weighting. The individual metric scores will be combined to determine Union's total incentive achieved for 2011. The maximum incentive that is achievable for any one scorecard metric is the 150% value. The overall maximum scorecard incentive that is achievable is the 100% total value of $0.5 million. The pilot measure will be monitored in 2011 and will not be included in, or formally evaluated against, scorecard metrics.

3.5 Research

Over the 2011 Plan period Union will focus on research to identify technology opportunities and improve overall program design and targeting.

Identified research projects of potential interest for 2011 include the following:

Residential	
	Homeowner DSM Software Development
	Infrared Residential Segmentation Techniques
	Window Insulation Kit
Low-Income	
	Energy Use in Residential Homes by Segment
	Energy Use in Multi-family Buildings by Segment
	Energy Star Windows market Study
Commercial	
	Building Optimization
	Commercial Clothes-Washers
	Demand Control Ventilation Systems
	Commercial Boiler Reset Controls
Industrial	
	Energy Monitoring and Targeting
	Direct Fired Recirculation Make-up Air
	Power Generation
	Industrial Drying Processes

A detailed research plan for 2011 is included in Appendix C.

Where appropriate, Union will look to partner with Enbridge on research work completed over the course of the Plan.

3.6 Evaluation Plan

Union will collaborate with the EAC to confirm evaluation priorities for 2011. There will be strong emphasis on selecting evaluation priorities by the end of the first quarter of 2011. The evaluation priorities will have some flexibility to be adjusted upon completion of the 2010 audit and if programs change over the course of the year.

Union completed a market potential study in 2008 based on the initial expectation of a new multi-year Plan beginning in 2010. Union may choose to update this study with new information for submission in 2012 with the next DSM Plan filing.

Where appropriate, Union will look to partner with Enbridge on evaluation work completed over the course of the Plan.

Appendix A – 2011 Measures and Inputs List

As per EB-2009-0166
Indicates change from EB-2009-0166
Indicates new measure

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 (%)	Reference
Residential Space Heating												
Residential	Existing	Reflector Panels		No reflector panels		143	0	0	18	$229	0%	
Residential	Existing	Programmable Thermostat		Standard Thermostat		53	54	0	15	$25	43%	
Residential	New	Programmable Thermostat		Standard Thermostat		53	54	0	15	$25	10%	Substantiation document provided in Appendix B.
Residential	Existing	Fireplace intermittent ignition control retrofit		Natural gas fireplace with a pilot		104	(-) 31	0	8	$150	1%	Substantiation document provided in Appendix B.
Residential Water Heating												
Residential	New/Existing	Faucet Aerator	Bathroom, 1.5 GPM	Average existing stock	2.2 GPM	6	0	2,004	10	$0.55	33%	Costs as per utility program costs, bulk purchase.
Residential	New	Faucet Aerator	Kitchen, 1.5 GPM	Ontario Building Code 2006	2.2 GPM	19	0	6,201	10	$1.39	33%	Base case adjusted to Ontario Building Code (2006). Costs as per utility program costs, bulk purchase. Substantiation document provided in Appendix B.
Residential	Existing	Faucet Aerator	Kitchen, 1.5 GPM	Average existing stock	2.5 GPM	23	0	7,797	10	$1.39	33%	Costs as per utility program costs, bulk purchase.
Residential	New	Faucet Aerator	Bathroom, 1.0 GPM	Ontario Building Code 2006	2.2 GPM	10	0	3,435	10	$0.55	33%	Substantiation document provided in Appendix B.
Residential	Existing	Faucet Aerator	Bathroom, 1.0 GPM	Average existing stock	2.2 GPM	10	0	3,435	10	$0.55	33%	Substantiation document provided in Appendix B.
Residential	New	Faucet Aerator	Kitchen, 1.0 GPM	Ontario Building Code 2006	2.2 GPM	32	0	10,631	10	$1.59	33%	Substantiation document provided in Appendix B.
Residential	Existing	Faucet Aerator	Kitchen, 1.0 GPM	Average existing stock	2.5 GPM	35	0	11,694	10	$1.59	33%	Substantiation document provided in Appendix B.
Residential	Existing	Low flow showerhead (Distributed)	1.5 GPM	Average existing stock	2.2 GPM	46	0	6,334	10	$6	10%	
Residential	New/Existing	Low-flow showerhead (Distributed)	1.25 GPM	Average existing stock	2.2 GPM	63	0	10,570	10	$3.69	10%	Costs as per utility program costs, bulk purchase.
Residential	Existing	Low-flow showerhead (Contractor Installed)	1.25 GPM	Average existing stock	2.25 GPM	66	0	10,886	10	$3.69	10%	Costs as per utility program costs, bulk purchase.
Residential	Existing	Low-flow showerhead (Contractor Installed)	1.25 GPM	Average existing stock	3.0 GPM	116	0	17,168	10	$3.69	10%	Costs as per utility program costs, bulk purchase.
Residential	Existing	Pipe Wrap (R-4)	Insulation for DWH outlet pipe	Uninsulated DHW outlet pipes	R-1	18	0	0	10	$0.98	4%	Costs as per utility program costs, bulk purchase.
Residential	Existing	Solar Pool Heaters		Natural gas pool heater		1,116	-57	0	20	$1,450	10%	Substantiation document provided in Appendix B.
Low-Income Space Heating												
Low-Income	Existing	Programmable Thermostat		Standard manual thermostat		53	54	0	15	$26.95	1%	Costs as per utility program costs, bulk purchase.
Low Income Water Heating												
Low-Income	Existing	Faucet Aerator	Bathroom, 1.5 GPM	Average existing stock	2.2 GPM	6	0	2,004	10	$0.55	1%	Costs as per utility program costs, bulk purchase.
Low-Income	Existing	Faucet Aerator	Kitchen, 1.5 GPM	Average existing stock	2.5 GPM	23	0	7,797	10	$1.39	1%	Costs as per utility program costs, bulk purchase.
Low-Income	Existing	Faucet Aerator	Bathroom, 1.0 GPM	Average existing stock	2.2 GPM	10	0	3,435	10	$0.55	1%	Costs as per utility program costs, bulk purchase.
Low-Income	Existing	Faucet Aerator	Kitchen, 1.0 GPM	Average existing stock	2.5 GPM	35	0	11,694	10	$1.59	1%	Costs as per utility program costs, bulk purchase.
Low-Income	Existing	Low-flow showerhead (Distributed)	1.5 GPM	Average existing stock	2.2 GPM	46	0	6,334	10	$6	1%	
Low-Income	Existing	Low-flow showerhead (Distributed)	1.25 GPM	Average existing stock	2.2 GPM	63	0	10,570	10	$3.69	1%	Costs as per utility program costs, bulk purchase.
Low-Income	Existing	Low-flow showerhead (Contractor installed)	1.25 GPM	Average existing stock	2.0 - 2.5 GPM	66	0	10,886	10	$3.69	5%	Costs as per utility program costs, bulk purchase.
Low-Income	Existing	Low-flow showerhead (Contractor installed)	1.25 GPM	Average existing stock	> 2.5 GPM	116	0	17,168	10	$3.69	5%	Costs as per utility program costs, bulk purchase.
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%	Costs as per utility program costs, bulk purchase.
Commercial Cooking												
Commercial	New/Existing	Energy Star Fryer	50% cooking efficiency	Standard fryer	35% cooking efficiency	913	0	0	12	$2,648	30%	
Commercial Space Heating												
Commercial	Existing	Air Curtains	Single door	Non-air curtain doors		667	172	0	15	$1,650	5%	
Commercial	Existing	Air Curtains	Double door	Non-air curtain doors		1,529	1,023	0	15	$2,500	5%	
Commercial	Existing	Condensing Boilers	88% seasonal efficiency (est.)	Non-condensing boiler	76% estimated seasonal efficiency	0.0104 / Btu/hr	0	0	25	$12/Kbtu/hr	5%	
Commercial	New/Existing	Demand Control Kitchen Ventilation	0 - 4,999 CFM	Kitchen ventilation without DCKV		4,801	13,521	0	15	$10,000	5%	
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%	

As per EB-2009-0166
Indicates change from EB-2009-0166
Indicates new measure

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 (%)	Reference
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%	
Commercial	New/Existing	Destratification Fans		No destratification fans		0.5/ft^2	(-)0.0034 /ft^2	0	15	$7,021	10%	
Commercial	Existing	Energy Recovery Ventilator		Ventilation without ERV		1.84 - 5.14/CFM**	0	0	20	$3/CFM	5%	
Commercial	New	Energy Recovery Ventilator		Ventilation without ERV		1.75 - 4.89/CFM**	0	0	20	$3/CFM	5%	
Commercial	Existing	Heat Recovery Ventilation	Ventilation with HRV	Ventilation without HRV		1.75 - 4.90/CFM**	0	0	20	$3.40	5%	
Commercial	New	Heat Recovery Ventilation	Ventilation with HRV	Ventilation without HRV		1.62 - 4.55/CFM**	0	0	20	$3.40	5%	
Commercial	New/Existing	Infrared Heaters	0 - 49,999 BTU/hr	Regular Unit Heater		0.015 /Btu/hr	245	0	20	$0.0122	33%	
Commercial	New/Existing	Infrared Heaters	50,000 - 164,999 BTU/hr	Regular Unit Heater		0.015 /Btu/hr	559	0	20	$0.0122	33%	
Commercial	New/Existing	Infrared Heaters	165,000 - 300,000 BTU/hr	Regular Unit Heater		0.015 /Btu/hr	870	0	20	$0.0122	33%	
Commercial	New/Existing	Rooftop Unit	Two-stage rooftop unit	Single stage rooftop unit		255	0	0	15	$375	5%	
Commercial	Existing	Programmable Thermostat		Standard thermostat		82 - 538**	63 - 266**	0	15	$40	20%	Costs as per utility program costs, bulk purchase.
Commercial	Existing	Prescriptive Schools - Elementary	hydronic boiler with 83%+ efficiency	hydronic boiler with 80%-82% efficiency		10,830	0	0	25	$8,646	27%	
Commercial	Existing	Prescriptive Schools - Secondary	hydronic boiler with 83%+ efficiency	hydronic boiler with 80%-82% efficiency		43,859	0	0	25	$14,470	27%	
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%	Substantiation document provided in Appendix B.
Commercial Water Heating												
Commercial	New/Existing	Condensing Gas Water Heater (100gal/day)	95% thermal efficiency	Conventional water heater	80% efficiency, 91gal. tank.	332	0	0	13	$2,230	5%	
Commercial	New/Existing	Condensing Gas Water Heater (500gal/day)	95% thermal efficiency	Conventional water heater	80% efficiency, 91 gal. tank.	873	0	0	13	$2,230	5%	
Commercial	New/Existing	Condensing Gas Water Heater (1,000gal/day)	95% thermal efficiency	Conventional water heater	80% efficiency, 91 gal. tank.	1,551	0	0	13	$2,230	5%	
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	12.4%	
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%	Substantiation document provided in Appendix B.
Commercial	Existing	Pre-Rinse Spray Nozzle (Limited)	0.64 GPM	Pre-rinse spray nozzel	1.6 GPM	90	0	19,197	5	$150	0%	Substantiation document provided in Appendix B.
Commercial	Existing	Pre-Rinse Spray Nozzle (Other)	0.64 GPM	Pre-rinse spray nozzle	1.6 GPM	109	0	23,166	5	$150	0%	Substantiation document provided in Appendix B.
Commercial	Existing	Pre-Rinse Spray Nozzle (Full Service)	0.64 GPM	Standard pre-rinse spray nozzle	3.0 GPM	1,286	0	252,000	5	$150	0%	Costs as per utility program costs, bulk purchase.
Commercial	Existing	Pre-Rinse Spray Nozzle (Limited)	0.64 GPM	Standard pre-rinse spray nozzle	3.0 GPM	339	0	66,400	5	$150	0%	Costs as per utility program costs, bulk purchase.
Commercial	Existing	Pre-Rinse Spray Nozzle (Other)	0.64 GPM	Standard pre-rinse spray nozzel	3.0 GPM	318	0	62,200	5	$150	0%	Costs as per utility program costs, bulk purchase.
Commercial	New/Existing	Energy Star Dishwasher	Undercounter – High Temperature	Non-Energy Star Dishwasher		801	3,754	112,795	10	(-)$13	40%	Substantiation document provided in Appendix B.
Commercial	New/Existing	Energy Star Dishwasher	Undercounter – Low Temperature	Non-Energy Star Dishwasher		326	559	45,891	10	(-)$13	40%	Substantiation document provided in Appendix B.
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%	Substantiation document provided in Appendix B.
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%	Substantiation document provided in Appendix B.
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%	Substantiation document provided in Appendix B.
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%	Substantiation document provided in Appendix B.
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%	Substantiation document provided in Appendix B.
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%	Substantiation document provided in Appendix B.
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%	Substantiation document provided in Appendix B.
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%	Substantiation document provided in Appendix B.
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%	

As per EB-2009-0166
Indicates change from EB-2009-0166
Indicates new measure

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 (%)	Reference
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%	Substantiation document provided in Appendix B.
Multi-Family	New	Faucet Aerator	Bathroom, 1.5 GPM	Ontario Building Code 2006	2.2 GPM	4	0	1,382	10	$0.55	10%	Substantiation document provided in Appendix B.
Multi-Family	Existing	Faucet Aerator	Bathroom, 1.5 GPM	Average existing stock	2.2 GPM	4	0	1,382	10	$0.55	10%	Costs as per utility program costs, bulk purchase.
Multi-Family	New	Faucet Aerator	Kitchen 1.5 GPM	Ontario Building Code 2006	2.2 GPM	13	0	4,280	10	$1.39	10%	Substantiation document provided in Appendix B.
Multi-Family	Existing	Faucet Aerator	Kitchen, 1.5 GPM	Average existing stock	2.5 GPM	16	0	5,377	10	$1.39	10%	Costs as per utility program costs, bulk purchase.
Multi-Family	New	Faucet Aerator	Bathroom, 1.0 GPM	Ontario Building Code 2006	2.2 GPM	7	0	2,371	10	$0.55	10%	Substantiation document provided in Appendix B.
Multi-Family	Existing	Faucet Aerator	Bathroom, 1.0 GPM	Average existing stock	2.2 GPM	7	0	2,371	10	$0.55	10%	Costs as per utility program costs, bulk purchase.
Multi-Family	New	Faucet Aerator	Kitchen, 1.0 GPM	Ontario Building Code 2006	2.2 GPM	22		7,337	10	$1.59	10%	Substantiation document provided in Appendix B.
Multi-Family	Existing	Faucet Aerator	Kitchen, 1.0 GPM	Average existing stock	2.5 GPM	24	0	8,072	10	$1.59	10%	Costs as per utility program costs, bulk purchase.
Multi-Family	New	Low-flow showerhead (Distributed)	1.5 GPM		2.2 GPM	33	0	5,228	10	$6	10%	Substantiation document provided in Appendix B.
Multi-Family	Existing	Low-flow showerhead (Distributed)	1.5 GPM	Average existing stock	2.2 GPM	33	0	5,228	10	$6	10%	Costs as per utility program costs, bulk purchase.
Multi-Family	New	Low-flow showerhead (Distributed)	1.25 GPM		2.2 GPM	45	0	8,824	10	$3.69	10%	Substantiation document provided in Appendix B.
Multi-Family	Existing	Low-flow showerhead (Distributed)	1.25 GPM	Average existing stock	2.2 GPM	45	0	8,824	10	$3.69	10%	Costs as per utility program costs, bulk purchase.
Multi-Family	Existing	Low-flow showerhead (Contractor Installed)	1.25 GPM	Average stock	2.25 GPM	48	0	9,088	10	$3.69	10%	Costs as per utility program costs, bulk purchase.
Multi-Family	Existing	Low-flow showerhead (Contractor Installed)	1.25 GPM	Average stock	3.0 GPM	84	0	14,333	10	$3.69	10%	Costs as per utility program costs, bulk purchase.

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

Union Gas Custom Projects		
Sector	Free Rider (%)	Measure Life (Years)
Agriculture	0%	
Industrial	56%	
Commercial	59%	
Multi-Residential	42%	
New Construction	33%	
Low-Income - Weatherization	0%	23

Appendix B – 2011 New Measure Substantiation Documents

RESIDENTIAL

COMMERCIAL

MULTI-FAMILY

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).[2],[3] The table below[4] shows approximately how much gas is consumed by a pilot flame in the heating and non-heating seasons.

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%[5]	27.2

Operation Mode	Btu/hr	~m3/hr	Annual hours	m3 Gas Per Year
Pilot Light- Heating Season	700	0.02	4,932[6]	96.6
Pilot Light - Non-Heating Season	700	0.02	3,650[7]	71.5

A small portion of the winter time pilot gas heat is assumed to contribute to space heating during

[2] Leapfrog Energy Technologies, Market Assessment for Potential Natural Gas Fireplace DSM Initiatives, 2007, Union Gas Fireplace Consolidated Presentation 071221.ppt, slide 18.

[3] "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

[4] From Fireplace Backup Calculations for Pete 071221.xls

[5] Table 3.4 "NRCan - 2003 Survey of Household Energy Use" – 38% of households in Ontario do not extinguish pilot lights in non-heating season.

[6] 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.

[7] 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.

the heating season, however the actual value is unknown. A nominal value of 20% was estimated by Skip Hayden of NRCAN[8]. 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[9] to 5 Watts[10]. 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).[11] The average fireplace age is 12 years[12]. 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[13]. 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[14], 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.	

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

1.5 GAL/MIN FAUCET AERATOR (KITCHEN)

Residential New Homes

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	**19 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	**6,201 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	**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 (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	
Electricity	**n/a kWh**
Water (Updated)	**3,435 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	**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.

SOLAR POOL HEATER

***Sector**: Residential Existing Homes*

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

Resource Savings Assumptions

Natural Gas (Updated)	**1116 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)	**$ 1450**
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)[15]. 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.[16] NGTC used the BIN Method combined with ASHRAE weather data[17] 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.[18],[19] 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[20]. 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

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

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

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

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

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

[20] 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.[21] Electrical consumption values were based on manufacturer's specifications which were aggregated and summarized below.

Electricity Consumption for Unit Heater[22]

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.[23] The NGTC reported incremental costs were modified to use a % Sales Weighted average base case installed cost.

[21] based on NGTC, "DSM Opportunities Associated with Unit Heaters", April 22, 2009, pg 6 and TRC Test Bed - Feb 25 2010 426pm.xlsx
[22] based on NGTC, "DSM Opportunities Associated with Unit Heaters", April 22, 2009, pg 5
[23] 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.[24]	

[24] 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[25]: 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**

[25] 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)[26]
- Average food service water heater set point temperature: 63 ^oC (145 ^oF)[27]
- Water heater thermal efficiency: 0.78[28]
- Percentage of water used that is hot: 69%[29]

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

[26] 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

[27] 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
[28] Minimum thermal efficiency for compliance with ASHRAE 90.1 standard.
[29] 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:

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

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[30], the U.S. DOE's FEMP[31] and by Puget Sound Energy[32] all give EUL for this measure as five years.	
Base & Incremental Conservation Measure Equipment and O&M Costs	**$150**
Equipment cost: $100 (utility 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).	

[30] Ibid.

[31] 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

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

ENERGY STAR DISHWASHER

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[33]:** DW supply water temperature: 140°F (60°C) Temperature increase for building water heating: 90°F (50°C)[34] Natural gas water heater annual efficiency (recovery rate): 78%[35] Electric booster water heater efficiency: 96%[36] Wash water circulation temperature differential: 20°F (11°C)[37]. The 25th percentile E-Star models (in terms of efficiency) are sold more often than the average E-Star model.[38] Undercounter - HT **801 m3/yr** Undercounter - LT **326 m3/yr** Stationary Rack - HT **619 m3/yr** Stationary Rack - LT **841 m3/yr**	

[33] NGTC, DSM Opportunities Associated with Commercial Dishwashers, Final Report, April 27, 2009, Pg 13 and calculator, 100201_DSM_analysis_final - PK.xlsx.
[34] DHW DW supply – Water city average = 140°F-50°F = 90°F (60°C-10°C = 50°C).
[35] GAMA
[36] Minimum EF for a 5 gallon booster; 98% of boosters are electric (source: Steve Garvin, UG)
[37] Phone conversation with Joel Dipp from Hobart, worst case.
[38] 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.[39]

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.[40]

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.[41],[42] 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**
Rack Conveyor Single – HT	**20 yrs**

[39] NGTC, DSM Opportunities Associated with Commercial Dishwashers, Final Report, April 27, 2009, Pg 13 and calculator, 100201_DSM_analysis_final - PK.xlsx.
[40] NGTC, DSM Opportunities Associated with Commercial Dishwashers, Final Report, April 27, 2009, Pg 14 and calculator, 100201_DSM_analysis_final - PK.xlsx.
[41] NGTC, DSM Opportunities Associated with Commercial Dishwashers, Final Report, April 27, 2009, Pg 17
[42] 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 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.[43] 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.[44]

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

[43] As agreed upon with the EAC & UG, estimated, no data, April 9, 2010.
[44] 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[45]. 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.

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

Electricity	**See below**

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.[46]

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.[47],[48]

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)[49].

[46] NGTC, DSM OZONE LAUNDRY TREATMENT Final Report_v02 (#134809) November 25, 2009, Pgs iv-vi
[47] NGTC, DSM OZONE LAUNDRY TREATMENT Final Report_v02 (#134809) November 25, 2009, Pg 6
[48] NGTC, DSM OZONE LAUNDRY TREATMENT Final Report_v02 (#134809) November 25, 2009, Pgs iv-vi
[49] 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)[50]
Base Technology & Equipment Description
Conventional top loading vertical axis washers (MEF = 1.26, WF=9.5, tub size = 2.8 ft)[51]

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 m3[52]

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

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

[51] Ibid.

[52] 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"

Gas savings were determined to be 43% over base equipment.[53]

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

Where:
G_{eff} = Annual natural gas use with efficient equipment, 104 m3[54]
G_{base} = Annual natural gas use with base equipment, 180 m3[55]

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[56]:

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

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

[53] Navigant Report, pg B-233 MEASURES AND ASSUMPTIONS FOR DEMAND SIDE MANAGEMENT (DSM) PLANNING APPENDIX C: SUBSTANTIATION SHEETS – April 16, 2009
[54] 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"
[55] 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"
[56] Navigant Report, pg B-233 MEASURES AND ASSUMPTIONS FOR DEMAND SIDE MANAGEMENT (DSM) PLANNING APPENDIX C: SUBSTANTIATION SHEETS – April 16, 2009

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

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

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.[57]	
Incremental Cost (Cust. / Contr. Install)	**$ 150**
Incremental cost based on prices offered online by a local retailer.[58]	
Free Ridership	**48 %**
Estimated based on Puget Sound Energy's findings.[59]	

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

[58] 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.

[59] 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	
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)	

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)

Multi-Family – 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 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[60] which also conforms to Ontario Building Code 2006 requirements[61]

Resource Savings Assumptions

Natural Gas	**33 m3**
Based on Navigant savings calculation[62].	
Water	**5,228 L**
Based on Navigant savings calculation[63].	
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[64]. Incremental cost based on a survey of online retailers[65]. This does not include installation costs	
Free Ridership	**10 %**
As per EB 2008-0384 & EB 2008-0385	

[60] Summit Blue, *Resource Savings Values in Selected Residential DSM Prescriptive Programs*, June 2008.
[61] Ontario Building Code 2006 – Table 7.6.4.2
[62] Navigant Consulting, MEASURES AND ASSUMPTIONS FOR DEMAND SIDE MANAGEMENT (DSM) PLANNING - APPENDIX C: SUBSTANTIATION SHEETS, April 16, 2009, Pg. C-251-254
[63] Navigant Consulting, MEASURES AND ASSUMPTIONS FOR DEMAND SIDE MANAGEMENT (DSM) PLANNING - APPENDIX C: SUBSTANTIATION SHEETS, April 16, 2009, Pg. C-251-254
[64] Navigant Consulting, MEASURES AND ASSUMPTIONS FOR DEMAND SIDE MANAGEMENT (DSM) PLANNING - APPENDIX C: SUBSTANTIATION SHEETS, April 16, 2009, Pg. C-251-254
[65] 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[66], which also conforms to Ontario Building Code 2006 requirements[67]

Resource Savings Assumptions

Natural Gas	**45 m3**
Based on Navigant savings calculation[68].	
Water	**8,824 L**
Based on Navigant savings calculation[69].	
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	

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

Appendix C – 2011 Research Plan

RESIDENTIAL

Customer and Program Development Plan

Topic	Research Description
Homeowner DSM Software	Many homeowners are likely not aware how their gas use compares to the use within an average comparable home. Online software could be developed to give homeowners' an automated, comparative analysis of their gas use efficiency. Additional information would be needed for the analysis. Factors like floor area, building type, and age could be obtained from an online software tool. The analysis could be offered to the customer as a service through My-Account. It could also automatically establish a base-case usage for that customer, and establish a set of gas use-reduction goals and incent them if the goals are reached for a period of time. This would promote behavioural energy savings. ▪ Get permission to use customer account information in exchange for additional services ▪ Empower the customer by giving them feedback on their gas use efficiency ▪ Collect critical home characteristics data, necessary for the analysis ▪ Provide resources for a new residential program (i.e., based on the owner's own or prescribed energy efficiency goals) ▪ Use it as a platform for behavioural or custom DSM measures ▪ Advice could be provided on how to reduce energy use
Infrared - Residential Segmentation Techniques	Infrared cameras have been used to identify missing insulation and air leakage (excessive heat loss) from individual homes by weatherization experts. There may be an opportunity to identify and possibly quantify inefficient homes in entire neighbourhoods/cities using aerial infrared technology. IR imagery at the neighbourhood/city level may improve a weatherization program's cost-effectiveness. Targeting techniques using aerial IR imagery showing roofs and/or images showing walls of multiple homes could be developed to optimize the correlation between IR imagery, home efficiency levels, and weatherization energy savings potential. For example, aerial IR images that show a warm or hot roof may have some correlation to a poorly insulated and/or sealed top-storey ceiling. Differing levels of attic ventilation and roof emissivity may cause some problems and will have to be taken into account.

Technology Research Plan

Technology	Research Description
Draft Proofing Kit	There are a number of things a homeowner can do to reduce air leakage in their homes. Caulking, weather stripping and spray foam insulation can reduce air leakage. As homeowners aren't as well trained in weather proofing as professionals the initiatives they undertake are likely not as effective. This research could determine what the savings typically is from homeowners installing different weather proofing options themselves. Assistance with inexpensive infrared thermometers and instructions could also be investigated. This research would determine the DSM opportunity in a home draft proofing kit.
Window Insulation Kit	Window wrap or films are estimated to be cost-effective on single pane windows. This research would determine the market size in Union's territory of single pane windows in heated spaces (such as in basements in pre-1980's homes or in heritage homes, etc). If there is sufficient market opportunity, the DSM input assumptions should be determined. This research will include savings for installation performed by a homeowner in average residential homes in Union's territory, and in low-income homes. The research would also identify opportunities to reach this market (perhaps through other businesses which service the same target population).
To Be Determined	Residential technology research opportunities manifest themselves periodically through the year. These are generally co-funded research opportunities with other utilities, government agencies, and/or manufacturers. Research may include: ▪ Technical/economic analysis of new technologies or new applications of existing technologies. ▪ Laboratory/field testing of new technologies.

Low-Income

Customer and Program Development Plan

Topic	Research Description
Low-Income Energy Use in Residential Homes by Segment	Low-income homes are believed to be typically less efficient and use more energy than average. This research would determine and then compare their energy use for natural gas and hot-water using devices vs. normalized average values in attached and detached homes within Union's territory. The intent is to provide a basis for developing base-cases and estimating opportunity for future low-income DSM measures. Average gas use by segment would be determined, as well as use of supplemental space heaters, age of home, floor areas, furnace type, other home characteristics and possibly owner behaviour useful for determining base case energy use by segment. Social and private housing should be considered. As applicable, this research would identify opportunities that include tenants who don't pay their own utility bills.
Low-Income Energy Use in Multifamily Buildings by Segment	Low-income apartments are believed to be less efficient than average. This research would determine and then compare their energy usefor natural gas and hot-water using devices vs. normalized average values in multi-family buildings in Union's territory. The intent is to provide a basis for developing base-cases and estimating opportunity for future low-income DSM measures. Average gas use by segment would be determined, as well as use of supplemental space heaters, age of unit, floor areas, furnace type, other home characteristics and possibly owner behaviour useful for determining base case energy use by segment. Social and private housing should be considered. This research would identify opportunities that include tenants that don't pay their own utility bills.

Technology Research Plan

Technology	Research Description
Energy Star Windows Market Study	Low-income homes may use more gas for space heating. This research would investigate DSM opportunities with Energy Star windows (low-E) in the low income sector. The project would establish a base case for current window types and associated energy use. It would look at an "upgrade when purchasing a new window" and consider an early replacement (& upgrade) measure scenarios. The research could identify any differences in behaviour specific to the low-income market that would affect such things as the measure life.
To Be Determined	Residential/low-income technology research opportunities manifest themselves periodically through the year. These are generally co-funded research opportunities with other utilities, government agencies, and/or manufacturers. Research may include: ▪ Technical/economic analysis of new technologies or new applications of existing technologies. ▪ Laboratory/field testing of new technologies.

COMMERCIAL

Customer and Program Development Plan

Topic	Research Description
Building Optimization Pilot Project	Union is currently establishing a program outline for a potential Whole Building Optimization program. The program may benefit from refinement of the initially planned processes and documentation requirements, identified in a pilot project. Improvements to process documentation and procedures could be made to streamline and optimize the process from a customer, service provider, and utility's perspective.

Technology Research Plan

Technology	Research Description
Commercial Clothes-Washers	There are numerous makes and models of commercial clothes-washers on the market. This research is to determine the DSM opportunity using higher efficiency models, including Energy Star models, in the non-multifamily markets.
Demand Control Ventilation Systems	Demand Control Ventilation systems reduce the amount of time that ventilation & make-up air heating systems run during the winter, based on occupancy of a building. These may involve CO2 sensors, zone schedules, or motion sensors, depending on use characteristics.
Commercial Boiler Reset Controls	Commercial boilers can heat water to provide space heating. Outdoor boiler reset controls reduce the boiler water output temperature from the high design temperatures when they are not needed, thus reducing flue gas temperatures and saving natural gas. These controls figure out what boiler output temperature is needed by sensing how cold it is outside. This project would look at the savings and costs of boiler reset controls on existing and new boilers by market segment.
To Be Determined	Commercial technology research opportunities manifest themselves periodically through the year. These are generally co-funded research opportunities with other utilities, government agencies, and/or manufacturers. Research may include: ▪ Technical/economic analysis of new technologies or new applications of existing technologies. ▪ Laboratory/field testing of new technologies.

INDUSTRIAL

Customer and Program Development Plan

Topic	Research Description
EnerSmart for Business	Identifying DSM opportunities in Industrial buildings can be difficult without an energy audit. This project works with Universities in Ontario to show students how to perform energy audits and to establish an energy audit training program at the University. The University looks after and administers the project. ▪ Union will seek to expand the project to other University sites. ▪ Union's C/I Energy Efficiency Program Group will provide energy audit results to our Account Managers to help target their DSM measure promotion.
Energy Monitoring and Targeting ("EM&T")	Union Gas is interested in developing a Market Transformation program for EM&T targeting manufacturing sectors. EM&T is a management technique that utilizes energy data as a basis to analyze historical energy performance of a facility, set energy reduction targets, and control current energy performance to improve existing operating procedures. EM&T employs regular collection and analysis of energy performance information to establish the existing pattern of energy consumption, allowing for the identification of energy consumption targets to work towards. This research would identify EM&T market players active in Union's territory and quantify the current market penetration of these services in industrial plants by segment. Forecasts would then be created to show the current market penetration trend. This would be used to form a baseline of comparison for a market transformation scorecard.

Technology Research Plan

Technology	Research Description
Demand Control Ventilation for Make-up Air Systems	Some industrial processes require large amounts of air to be brought in from the outside during the winter and heated, which consumes large amounts of gas. Some of these systems have simplistic controls which run these heating systems more than necessary, therefore wasting energy. Demand Control Ventilation systems reduce the amount of time that make-up air heating systems run during the winter, based on the required process load.
Direct Fired Recirculation Make-up Air Systems	Some industrial processes require large amounts of air to be brought in from the outside during the winter and heated, which consumes large amounts of gas. Indirectly fired make-up air heating systems usually aren't more efficient than ~80-90% efficient. Direct-Fired Make-up air systems can be up to 99% efficient. This research would determine the DSM opportunity in Union's territory for this technology.

Power Generation DSM Opportunity	Natural gas driven electrical power generation plants consume a large amount of natural gas. There are a number of plant design options available that make better use of natural gas than the standard systems popular in the past. The research would determine the base case plant design (including turbine-generator system and other energy-efficiency related features) that would comply with current code and standard requirements. With respect to the current and near term future build years – what plant design can be considered status-quo and what would the costs be for each major component or system that effects gas use efficiency? For reference, higher efficiency options may include 3 power generating philosophies: Simple Cycle, Simple Cycle Co-generation & Combined Cycle. The output is electricity, but the simple cycle co-generation can also output steam for use at an industrial site which could displace natural gas.
Increasing Efficiency of Industrial Drying Processes	There is a number of natural gas driven drying processes in industrial plants in Union's territory. This research would determine the DSM opportunity in improving industrial drying processes common in Union's territory. It would involve visiting several customer sites, characterizing the current drying processes by market or application, energy consumption, and costs. The research would determine energy savings, costs, and equipment service life for different improvement suggestions such as process reconfiguration, recirculation, latent heat capture, and pressurization. The market opportunity would be quantified by market segment in Union territory.
To Be Determined	Industrial technology research opportunities manifest themselves periodically through the year. These are generally co-funded research opportunities with other utilities, government agencies, and/or manufacturers. Research may include: ▪ Technical/economic analysis of new technologies or new applications of existing technologies. ▪ Laboratory/field testing of new technologies.