The Ontario Energy Board's (the "Board") Reporting and Record Keeping Requirements for Gas Utilities requires under rule 2.1.12 that annually, by the last day of the sixth month after financial year end, the utilities file an audited report of the actual results compared to the Board approved demand side management plan with explanations of variances.

The results of the gas utilities are as follows:

Enbridge Gas Distribution Inc.

- Gas savings of 74,321,588 m^3
- Total Resource Cost savings of $215,833,455
- Total spending of $24,574,984

Union Gas Limited

- Gas savings of 92,604,301 m^3
- Total Resource Cost savings of $308,255,602
- Total spending of $22,222,457

500 Consumers Road
North York, Ontario
M2J 1P8
PO Box 650
Scarborough ON
M1K5E3

Kevin Culbert
Manager, Regulatory Accounting
phone: (416) 495-5778
fax: (416) 495-6072
Email: kevin.culbert@enbridge.com

June 29, 2010

Ms Kirsten Walli
Board Secretary
Ontario Energy Board
P.O Box 2319
2300 Yonge Street
Suite 2700
Toronto, ON M4P 1E4

Dear Ms. Walli:

Re: Natural Gas Reporting & Record Keeping Requirements
Enbridge Gas Distribution 2009 DSM Audit Report

The Ontario Energy Board's (the "Board") Reporting and Record Keeping Requirements for Gas Utilities requires under rule 2.1.12 that annually, by the last day of the sixth month after financial year end, the Utilities file an audited report of the actual results compared to the Board approved Demand Side Management ("DSM") plan with explanations of variances.

Under this rule, Enbridge Gas Distribution ("Enbridge") is required to file a fiscal 2009 DSM Plan Audit Report by June 30, 2010.

Enbridge has completed the 2009 DSM Plan Audit Report and attaches the results in accordance with the filing requirement as noted.

Should you have any questions related to this, please do not hesitate to call.

Yours truly,

Kevin Culbert
Manager, Regulatory Accounting

Attach.

THE CADMUS GROUP, INC.

Final Report

Independent Audit of 2009 DSM Program Results

Prepared for:

Marco Spinelli, DSM Research and Evaluation
Enbridge Gas Distribution

The Cadmus Group, Inc.
Energy Services
720 SW Washington Street, Suite 400
Portland, OR 97205
503-228-2992

June 28, 2010

Prepared by:
Brian Hedman
Ben Bronfman, Ph.D.

TABLE OF CONTENTS

Introduction and Overview

The Cadmus Group (Cadmus) was retained by Enbridge Gas Distribution (Enbridge), in consultation with the Enbridge Audit Committee (EAC), to conduct an audit of the Enbridge 2009 DSM Annual Report. Cadmus staff reviewed calculations and assumptions, background material and supporting documentation, and internal Enbridge processes and procedures.

In general we find the 2009 Annual Report to be a significant improvement over the 2008 Annual Report, which we also audited. The 2009 report is better organized and contains much of the backup documentation that was absent in the 2008 report. We commend Enbridge on their continued improvement of the Annual Report.

Approach to the Scope of Work

Our approach to the scope of work addresses five concerns:

- Are the inputs to the savings financial calculations based on assumptions approved by the Ontario Energy Board (OEB)? Are they gathered and documented in a reliable manner? Are they consistent with the best available current information?
- Are market effects adequately tracked and attributable? Are baseline data collected and available?
- Are the economic and financial calculations accurate and based on agreed-upon rules, protocols, and procedures? If not, where are the differences and to what can the deviations be attributed?
- Are the SSM, DSMVA, and LRAM calculations accurate and consistent with methodology and assumptions approved by the OEB? If not, where are they different?
- Are savings, free-ridership, and measure life assumptions consistent with the best available current information?

Approach to the Audit

The Cadmus approach to this audit involved the following general activities:

- Review of documents including memos, reports, filings and third-party assessments. (A list of documents reviewed is included in Appendix A.)
- Review and verification of EAC recommendations and Enbridge responses from the 2007 and 2008 audit (included as Appendix B).
- In-person and telephone discussions with Enbridge staff.
- Meetings with Enbridge and the EAC.
- Detailed, in-person "walkthroughs" of program participation processes and quality assurance procedures.
- Follow-on telephone discussions with Enbridge staff and report authors, as necessary.

Key Meetings and Discussions

The Cadmus team met with Enbridge staff and the EAC on January 26 and 27, 2010, to review the scope of work, collect initial documents, and gain an overview of the Enbridge DSM programs, data collection methodologies and systems, and the audit function.

Subsequent to that meeting, Cadmus and Enbridge staff conducted weekly or bi-weekly status-update phone calls, and communicated via e-mail on a regular basis. Cadmus submitted numerous requests for information and clarification to Enbridge during the course of the audit, and Enbridge was diligent in providing timely response to the requests. (A list of questions submitted and Enbridge's responses are included as Appendix C.)

Our review of Enbridge program processes, data tracking, and oversight activities identified several areas reflective of industry best practices, including recommending efficiency improvements to commercial and industrial customers that did not qualify for Enbridge incentives, but were in the customers' best interests.

On February 4 and 5, 2010, Enbridge hosted discussions between Cadmus and the commercial and industrial engineering review firms BII and Genivar to discuss the draft custom project reviews.

On April 15, 2010, Cadmus staff again met with Enbridge staff and the EAC to review the final work plan. Following that meeting, bi-weekly conference calls with Enbridge staff were conducted to discuss audit issues as they arose during report preparation.

The Cadmus team reviewed all programs included in the Total Resource Cost (TRC) calculation. We prioritized the review according to the total claimed savings by the program and any issues identified in past audits. We also compared the prescriptive savings with weather-adjusted savings for like measures in other jurisdictions.

Based on this initial review, we identified the following programs, measures and issues for more in-depth analysis:

- Showerheads
- Energy Star New Homes
- CFLs
- Thermostats
- Low Income Weatherization
- Tankless Water heaters
- Prescriptive Boilers in Schools
- Custom engineering studies
- Water realization rate extrapolation

Findings and Opinion

For the calendar year ended December 31, 2009, Cadmus has audited the following:

- Demand-Side Management (DSM) Annual Report
- TRC (Total Resource Cost) savings
- Shared Savings Mechanism (SSM)
- Lost Revenue Adjustment Mechanism (LRAM)
- Demand Side Management Variance Account (DSMVA) of Enbridge Gas Distribution

The DSM Annual Report and the calculations of TRC, SSM, LRAM, and DSMVA are the responsibility of Enbridge's management. Our responsibility is to provide an opinion on these amounts, based on our audit.

We conducted our audit in accordance with the rules and principles set down by the OEB in its Decision with Reasons, dated August 6, 2006, in EB-2006-0021. We followed directions given to us by the Evaluation and Audit Committee of Enbridge Gas Distribution with respect to the scope, depth, and focus of our audit. The audit included examining evidence (on a test basis) that supported the amounts and disclosures in the DSM Annual Report as well as the calculations used to determine the numbers proposed for TRC, SSM, LRAM, and DSMVA. The audit also included assessing assumptions used and methods for recording and documenting information. Details of the steps taken in this audit process are set forth in the audit report that follows, and this opinion is subject to the details and explanations described there.

In our opinion, and subject to the qualifications set forth above, the following figures are calculated (1) using reasonable assumptions, based on data gathered and recorded via methods that are reasonable and accurate in all material respects, and (2) following rules and principles established by the OEB and applicable to the 2009 DSM programs of Enbridge Gas Distribution:

TRC Savings	$215,833,455
SSM Amount Recoverable (Resource Acquisition)	$5,007,909
SSM Amount Recoverable (Market Transformation)	$356,303
LRAM (Recoverable from Ratepayer)	$45,722
DSMVA Amount Recoverable	$1,165,061

Table 1, provides a summary of the draft filing and audited results.

Table 1. Adjusted TRC and LRAM Savings

	Draft Annual Report				Audit Adjusted	
Program Area	Participants	Gas Savings (m3)	DSM Fixed and Variable Costs	Net TRC Results	Adjusted Net Gas Savings (for SSM)	Adjusted Net TRC Results (for SSM)
Existing Homes	813,254	14,084,047	$10,234,502	$55,851,242	14,084,047	$58,286,208
Residential New Construction	2,199	2,126,653	$241,527	$2,218,179	2,126,653	$2,218,179
Low Income	18,857	991,192	$1,512,339	$3,021,894	991,192	$3,045,256
Total Residential	**834,310**	**17,201,892**	**$11,988,368**	**$61,091,315**	**17,201,892**	**$63,549,643**
Small Commercial	3,261	2,116,485	$681,906	$5,631,139	2,029,469	$5,413,335
Large Commercial	85	4,939,382	$662,774	$11,728,493	4,941,743	$11,751,835
MUSH	233	10,395,978	$1,232,232	$25,528,858	10,435,933	$25,704,373
Multi-Residential	41,053	15,094,725	$2,333,850	$35,265,374	15,094,725	$35,265,374
Large New Construction	21	2,287,063	$488,615	$7,906,422	2,287,063	$7,906,422
Industrial	120	22,330,732	$2,400,862	$70,984,411	22,330,732	$70,984,411
Total Business Markets	**44,773**	**57,164,364**	**$7,800,239**	**$157,044,697**	**57,119,665**	**$157,025,752**
Market Transformation Programs	0	0	$44,439	$0	-	$0
Program Development	0	0	$155,632	($155,632)	-	($155,632)
Market Research	0	0	$71,084	($71,084)	-	($71,084)
Overheads	0	0	$4,515,222	($4,515,222)	-	($4,515,222)
Total All Programs	**879,083**	**74,366,257**	**$24,574,984**	**$213,394,074**	**74,321,558**	**$215,833,455**

Table 2 presents the draft filing and the LRAM adjustments. These adjustments are based on best currently available information and are used to create the LRAM and the 2010 TRC target.

Table 2. Best Currently Available Information Adjusted Savings

	Draft Annual Report				Audit Adjusted	
Program Area	Participants	Gas Savings (m3)	DSM Fixed and Variable Costs	Net TRC Results	Adjusted Net Gas Savings (for LRAM)	Adjusted Net TRC Results (for 2010 Target)
Existing Homes	813,254	14,084,047	$10,234,502	$55,851,242	10,887,952	48,988,731
Residential New Construction	2,199	2,126,653	$241,527	$2,218,179	2,126,653	$2,218,179
Low Income	18,857	991,192	$1,512,339	$3,021,894	685,181	$1,889,959
Total Residential	**834,310**	**17,201,892**	**$11,988,368**	**$61,091,315**	**13,699,786**	**$53,096,870**
Small Commercial	3,261	2,116,485	$681,906	$5,631,139	2,029,469	$5,413,335
Large Commercial	85	4,939,382	$662,774	$11,728,493	4,941,743	$11,751,835
MUSH	233	10,395,978	$1,232,232	$25,528,858	10,435,933	$25,704,373
Multi-Residential	41,053	15,094,725	$2,333,850	$35,265,374	15,094,725	$35,265,374
Large New Construction	21	2,287,063	$488,615	$7,906,422	2,287,063	$7,906,422
Industrial	120	22,330,732	$2,400,862	$70,984,411	22,330,732	$70,984,411
Total Business Markets	**44,773**	**57,164,364**	**$7,800,239**	**$157,044,697**	**57,119,665**	**$157,025,752**
Market Transformation Programs	0	0	$44,439	$0	-	$0
Program Development	0	0	$155,632	($155,632)	-	$ (155,632.11)
Market Research	0	0	$71,084	($71,084)	-	($71,084)
Overheads	0	0	$4,515,222	($4,515,222)	-	($4,515,222)
Total All Programs	**879,083**	**74,366,257**	**$24,574,984**	**$213,394,074**	**70,819,452**	**$205,380,682**

Table 3 lists specific adjustments made.

Table 3. SSM/LRAM Adjustment Detail

Adjustment	Original Value	Revised Value	SSM TRC Impact	LRAM m3 Impact	Source
CFL Installation Rate	4.0 CFLs per home	3.3 CFLs – TAPS, 3.4 CFLs – Low Income	-$1,609,809	0	TAPS Annual Report (see page 13)
Showerhead gas savings	116 m3 >2.5 gpm, 66 m3 2.1-2.5 gpm	88 m3 >2.5 gpm, 46 m3 2.1-2.5 gpm	$0	-2,161,874	SAS Showerhead study (see page 12)
Showerhead water savings	17.1 m3 >2.5 gpm, 10.89 m3 2.1-2.5 gpm	22.59 m3 >2.5 gpm, 14.33 m3 2.1-2.5 gpm	$4,068,136	0	Navigant report substantiation sheets adjusted for reduction factor (see page 12)
Residential Thermostats	146 m3 / 123 kWh	53 m3 / 54 kWh	$0	-1,340,231	Navigant report substantiation sheets (see page 13)
Infrared heaters	$2,860.56 / unit	$1,744.94 / unit	$107,635	0	Navigant report substantiation sheets (see page 13)
ERV project correction	135,593 m3	43,998 m3	-$325,438	-87,015	TRC spreadsheet correction (see page 14)
ERV cost correction	$3.4/cfm for November projects	$3.0/cfm for November projects	(embedded in ERV project correction)	0	TRC spreadsheet correction (see page 14)
Prescriptive School Boilers and Demand Controlled Kitchen Ventilation	Commercial realization rate applied	No realization rate applied	$198,858	42,316	TRC spreadsheet correction (see page 14)

Table 4 illustrates the calculation of the SSM amount.

Table 4. SSM Calculation

	Original	Adjusted for Audit
2009 Actual TRC	$213,483,107	$215,833,455
2009 TRC Target	$210,406,868	$210,406,868
Percent of Actual	101%	103%
Base Target	75%	75%
Percent over 75%	26.46%	27.58%
$ per 1/10 of 1 %	10,000.00	10,000.00
SSM @ 75%	$2,250,000	$2,250,000
$ @ 10,000 per 1/10 of 1 % over 75%	$2,646,204	$2,757,909
Total Program Related	$4,896,204	$5,007,909
Market Transformation	$375,512	$356,303
Total SSM	**$5,271,716**	**$5,364,212**
Market Transformation Detail		
Energuide	$8,750	$37,500
Home Contactor	$88,750	$36,303
Drain Water Heat Recovery	$278,012	$282,500
Total	$375,512	$356,303

Review of Shared Savings Mechanism (SSM) Calculations

Cadmus reviewed the SSM from two perspectives. The first was whether calculations in the Total Resource Cost (TRC) spreadsheet were correct. (That is, we checked for any mechanical errors in the spreadsheet.) The second was whether inputs to the TRC spreadsheet were accurate and reasonable. Discussion of the inputs follows in individual program sections below.

TRC Spreadsheet Calculations

Cadmus reviewed the individual cells to assure the mathematical formulations were correct in that:

- Gross savings were a product of participation and unit savings.
- Net savings for prescriptive measures were a function of gross savings, free-ridership, and verification survey reduction factors for deemed-savings measures.
- Net savings for custom projects were a function of gross savings, the realization rate determined by the commercial and industrial studies, and the free-ridership rate:
    - Net savings for projects selected as part of the commercial and industrial samples were calculated as the function of savings determined by the respective study and the free-ridership rate.
    - Net savings for prescriptive school projects were calculated as the function of the prescriptive savings estimate and the free-ridership rate.
- Total benefits were the net present value of the product of net savings and the appropriate avoided cost value, based on the project's characteristics:
    - Gas, electricity and water.
    - Measure life.
    - Dominant end use (water heat, space heat, combined or industrial).
- Net incremental participant costs were calculated as the product of the number of participants, the per-unit incremental costs, and the free-ridership rate
- Net TRC benefits were calculated as the difference between the avoided costs and the sum of net incremental participant costs, direct program costs and costs associated with market transformation, program development and market research.

Review of DSMVA Calculations

The draft DSM Annual Report for 2009 compares budgeted 2009 DSM expenditures with expenditures that actually incurred. Cadmus reviewed the OEB-approved three-year plan and confirmed the budgeted expenditures used in the DSMVA calculations match the plan. We also confirmed the 2009 actual expenditures in the DSMVA calculation matched the total DSM O&M included in the TRC worksheet. Our review did not include an audit of Enbridge's accounting records that form the basis of the DSM O&M amounts in the TRC worksheet.

Review of LRAM

Cadmus reviewed the LRAM spreadsheet provided by Enbridge. The review was based on a comparison of the methodology employed with that employed for the 2008 LRAM calculation and a reasonableness check of the distribution of monthly installations and distribution of partially effective savings, i.e. savings adjusted for the portion of the year that the measures were installed. We find the LRAM spreadsheet accurately calculates the LRAM adjustment.

Table 5: LRAM Calculation

2009 Audit Report LRAM Calculation

based on 60,011,037 FE m3 built into rates

Rate	Budget Net Partially Effective	Actual Net Partially Effective	Volume Variance	Q1 Distribution Margin (cents / m^3)	$	
Rate 1	8,153,242	6,459,826	1,693,416	~~7.01~~	~~$ 118,700~~	19.6%
Rate 6	14,235,533	11,489,960	2,745,573	~~3.77~~	~~$ 103,438~~	31.8%
Rate 110	2,191,564	1,499,067	692,497	1.54	$ 10,643	8.0%
Rate 115	1,394,632	1,032,480	362,152	0.97	$ 3,516	4.2%
Rate 135	0	18,796	(18,796)	1.39	$ (261)	-0.2%
Rate 145	1,921,623	936,892	984,731	1.92	$ 18,878	11.4%
Rate 170	4,609,385	2,441,975	2,167,410	0.60	$ 12,947	25.1%
Totals	32,505,979	23,878,994	8,626,985		~~$ 267,859~~	
Total Excluding Rate 1 and Rate 6					**$ 45,722**	

Review of 2010 Target

Cadmus reviewed the calculation of the 2010 TRC target. The determination of the 2010 TRC target relies on the LRAM adjusted TRC from the 2007, 2008 and 2009 programs. This TRC calculation reflects best available information for savings and incremental costs and reflects the Company's most recent avoided cost determination for natural gas, electricity and water. Table 5 presents the results of the calculation. We verified that the methodology employed adheres to the methodology outlined in the Ontario Energy Board's August 25, 2006 Decision with Reasons in docket EB-2006-0021.

Table 6: 2010 TRC Target

Actual 2007 TRC results for LRAM with 2010 avoided costs	Actual 2008 TRC results for LRAM with 2010 avoided costs	Latest 2009 TRC results (col E) with Final 2010 avoided costs with LRAM changes	2010 Target
A	B	C	=(A+B+C)/3 * 1.075%
$184,156,243	$200,474,811	$180,674,137	$202,567,693

TRC Inputs

Avoided Costs

Enbridge updated the avoided costs used for all programs in 2009. We reviewed the avoided cost methodology and found it to be consistent with the methodology used in the 2007 and 2008 Annual Report.

Prescriptive Savings Programs

In the residential sector we reviewed the following programs:

- TAPS
- Residential Equipment Replacement
- Residential New Construction
- Low Income

During the audit of the 2008 programs we conducted a measure-by-measure comparison of the deemed values with savings assumptions used in other jurisdictions, most notably from Iowa (where Cadmus completed a statewide DSM potential study and program design effort in 2008) and, to a lesser extent, the California Database for Energy Efficient Resources (DEER). The savings for weather-dependent measures were adjusted to reflect the difference in heating degree days between Iowa and Ontario. Except where noted below, we found the savings, free-ridership, reduction factors[1], and measure lives to be consistent with both OEB-approved assumptions and the assumptions employed in other jurisdictions.

Because of the comprehensive review conducted for the audit of the 2008 program and the acceptance of a Navigant report updating assumptions for each of the gas measures by the OEB we limited our review of savings for the audit of the 2009 program to a comparison of those used in the TRC calculations and the assumptions approved by the OEB for 2009. We found all values to be consistent with the approved values. Specific recommendations for each measure where indicated are listed below.

Showerhead

In the audit of the 2008 program we identified enhancements to the showerhead savings study that would provide more robust estimates. During 2009, Enbridge commissioned a revised study that incorporated a larger sample size, longer post-installation data, and a control group. This study addresses our concerns with the 2008 study. The 2009 showerhead savings LRAM values reflect the results of the revised study.

During a review of the TRC spreadsheet calculations Enbridge determined that an adjustment to account for the percentage of showers taken with Enbridge program showerheads was being inadvertently applied twice for water savings calculations. A reduction factor that incorporated the TAPS survey percentage of showers taken was being applied to the unit savings figure from the

[1] Enbridge calculates a reduction factor on a program specific basis based on participant surveys. The reduction factor adjusts savings for measure installation, usage and removal.

Navigant energy efficiency measure study. A review of the study indicated that Navigant had applied a 76% adjustment factor in determining the unit savings. Our audited water savings value has reversed the Navigant adjustment so that only the TAPS survey adjustment was applied.

ENERGY STAR® for New Houses

The 2008 Audit found the savings estimates for ENERGY STAR® for New Houses are comparable to those employed in other jurisdictions; however, we continue to believe the free-ridership value is unrealistic. In the 2008 Audit it was argued that the free rider rate could be 95% just as easily as 5%, given the level of incentive provided by EGD. A recent evaluation of a similar program with similar incentives in Arizona showed a free-ridership rate of 48%[2]. This may be a better estimate than either extreme. Enbridge has indicated that the program is being terminated or substantially revised based on negative TRC results under Version 4 of the ENERGY STAR® specifications.

CFL

In 2009 Enbridge added CFLs to the measures that are installed in the TAPS and Low Income TAPS programs. TRC is calculated on the assumption that 4 CFLs are distributed to each home. During 2009 Enbridge conducted a survey of TAPS participants and determined that 3.3 CFLs were received on average by participants in the TAPS program and 3.4 CFLs were received on average by participants in the TAPS Low Income program. We adjusted the TRC calculation to reflect the evaluated number of CFLs received.

Enbridge is also assuming zero incremental cost for CFLs based on a comparison of current CFL costs with the cost of incandescent bulbs required to last an equivalent lifetime. We concur with this assumption.

Thermostats

Enbridge has indicated that the reduction factor for low income thermostats declined from 66.5% in 2008 to 24.7% in 2009. The reduction is due to increased contractor installation of thermostats in 2009 as reported by the low income surveys. A survey wording change in 2009 clarified that contractors install the thermostats free of charge, resulting in a more accurate assessment.

Thermostat savings were approved by the OEB based on a draft finding by Navigant in decision EB 2008-0346. Navigant's final report filed in the same docket revised the natural gas savings from 146 m3 to 53 m3 and from 123 kWh to 54 kWh. LRAM calculations reflect the final values.

Low Income Weatherization

Low income weatherization savings per home remained constant between 2008 and 2009, however total TRC attributable to this measure increased significantly due to increased avoided costs and increased participation. Enbridge proposes to revise the annual savings estimates based on modeling of participant homes. The modeled homes in 2009 indicate a 44% increase in savings over the OEB approved deemed savings values. We recommend that an impact evaluation of the program be commissioned to verify that such an increase is warranted (recommendation 11, on p. 20). No adjustment to TRC was made.

[2] Cadmus, PowerWise Homes Program FY2009 Evaluation, conducted for Salt River Project, Pg 56. September 2009

Commercial Prescriptive Measures

In 2009 Prescriptive measures were installed in the following commercial programs:

- Small Commercial
- Multi-Residential
- Schools

Except where noted below, we found the savings, free-ridership, reduction factors, and measure lives to be consistent with OEB-approved assumptions and common industry practices.

Tankless Water Heaters

Commercial Tankless Water Heaters have a negative incremental cost. It is unusual that a more efficient option, in this case the tankless unit, is less expensive than the less efficient option, in this case a traditional storage water heater. The negative incremental cost is based on Navigant's comparison of a WaiWela PH28CIFS tankless water heater and installation kit at $2,080 and a Rheem G37-200 storage tank water heater at $3,182. Both the tankless and storage units are rated at 195-200 gallons per hour of 100 degree rise in water temperature. We have verified the unit operating characteristics and costs and find the comparison to be reasonable. No adjustment to TRC or LRAM was made.

Infrared Heaters

A review of the TRC spreadsheet indicated that the cost for infrared heaters was misstated due to a typographical error. We confirmed the error and adjusted the spreadsheet to reduce the cost from $0.02/kbtu/hr to the value approved by the OEB of $0.0112/kbtu/hr. This adjustment affects the TRC for both the SSM and the 2010 target.

Energy Recovery Ventilators

A review of the TRC spreadsheet indicated that the savings for one of the Energy Recovery Ventilator projects was overstated. The project's savings was adjusted from 135,593 m3 to 43,998 m3. Additionally, it was determined that the November cost calculation inadvertently used $3.4/cfm rather than the filed and approved $3.0/cfm. The costs were recalculated and updated. These adjustments affect the TRC and gas savings for both the SSM and the LRAM.

Prescriptive Boilers in Schools

The Prescriptive Boilers in Schools program was not included in the EGD draft Annual Report. The program was singled out for increased scrutiny in the 2008 Audit - together with a recommendation for further research - and is included in this Audit to indicate a continuing concern with the prescriptive criteria. The number of schools enrolled in EGD's program is documented in the draft Annual Report, as is the total number of boilers installed in the commercial offering, and we accept the aggregate findings. However, there are still some unanswered questions regarding the validity of boiler baseline assumptions. These questions affect not only the Prescriptive Boilers in Schools initiative, but all boiler replacements in the commercial portfolio.

Recently Union Gas commissioned a market study to examine current practice in boiler efficiency retrofits. The report found that current practice in boiler installation is averaging about 85 percent efficiency. This suggests that further work needs to be done in fine tuning EGD's baseline assumptions, given that some program boilers are less efficient than the current practice reported in the Union Gas study. We note that EGD's current baseline assumptions are also based on

systematic feedback from manufacturers and distributors, although the feedback appears to be anecdotal and undocumented. These contradictory findings strongly suggest the need for additional, systematic research into boiler current practice. We note that EGD in concurrence with the EAC is planning to undertake this additional research in the coming year, and commend this effort.

The TRC spreadsheet inadvertently applied the commercial realization rate to the prescriptive school boiler savings. We have adjusted the school boiler savings to 100% realization. This adjustment affects both the SSM and LRAM.

Demand Control Kitchen Ventilation

The TRC spreadsheet inadvertently applied the commercial realization rate to the prescriptive demand control kitchen ventilation savings. We have adjusted the savings to 100% realization. This adjustment affects both the SSM and LRAM.

Custom Savings Programs

Custom savings program verification was undertaken by BII for commercial programs and by Genivar for industrial programs. These studies and the supporting documentation were reviewed by Cadmus engineering and audit staff. Both studies employed Summit Blue's[3] recommended methodology for sampling.

As we did in the audit of the 2008 programs we note that free-ridership factors were agreed upon, based on the 2008 study conducted by Summit Blue Consulting. A review of the study and a discussion with the authors confirmed the free-rider ratios were savings-weighted numbers based on surveys of 2007 program participants. It is entirely possible—even likely—the 2009 cohort is sufficiently different from the 2007 cohort that the ratios are no longer applicable and, thus, should be applied to individual projects with caution.

EGD's incentive levels for their commercial and industrial programs averaged 14% of incremental cost in 2009. In general, there is an inverse relationship between free-ridership and incentive payment levels. As Enbridge's incentives are at the low end of comparable programs free-ridership is arguably higher than current estimates.

Yet, in the absence of a new study, we accept the 2007 numbers for the 2009 participant group. We note, in the disposition of 2008 recommendations (Recommendation 12), that EGD is actively pursuing a new study of free ridership directed at annual estimation of these ratios in a time frame appropriate for customer recollection of decision-making criteria. We strongly endorse this approach.

We also note that discussions with the Commercial Program manager revealed that EGD provides additional recommendations to proponents for measures and behaviors that are not eligible for incentives under current EGD programs. For example, compressed air systems efficiency improvements have been recommended, with anecdotal evidence suggesting the proponents either did not know about the opportunity or did not have the time or funding available to address the issue. We recommend that EGD consider claiming these savings, and work toward developing

[3] Summit Blue Consulting was acquired by Navigant Consulting in early 2010. The referenced studies were conducted by Summit Blue Consulting prior to the acquisition.

measurement and verification protocols and evaluation plans to substantiate the claims (see recommendation 2 on p. 18).

The issue of steam trap measure life is still an unresolved, open question. EGD is commended for developing terms of reference for an independent study of this issue.

Custom Commercial Programs

For commercial custom programs, the BII study:

- Examined 23 projects
- Reviewed the appropriate Project Application Files
- Conducted an independent review of the engineering calculations
- Resolved clarification issues with Enbridge and project staff
- Conducted on-site inspection of the selected projects (this activity was new to the 2009 sample)

Generally, the reviews focused on verification of calculation input assumptions, including operating hours, schedules, total gas usage, air flow and infiltration, weather characteristics and other assumptions based on reasonableness and current practice. Finally, the calculations themselves were checked for errors, and alternative calculations were provided as validity checks.

Cadmus engineering staff reviewed the Report, and the complete supporting files for 12 of the 23 projects. In general, we concluded that the project files contained most of the information normally employed to estimate energy savings but some still lacked details, including, for example, facility description (number of beds in a hospital, or number of dwelling units in an apartment building). These details would be important in benchmarking savings estimates, irrespective of whether the calculations themselves are correct. New construction project files contained the Enbridge New Construction Program Reports but did not contain the simulation calculations or the NRCan software input assumptions, architectural drawings and baseline vs. enhanced efficiency ratings and assumptions.

Cadmus made additional requests to EGD to resolve these issues. In some cases both the auditor and EGD agreed the additional data were deemed not critical to the audit review. In the remaining cases, the additional information was sufficient to resolve any outstanding questions.

The New Construction files do not contain the simulation input and output files, but rather contain the Program Reports, as noted above. EGD does not normally maintain these files. EGD did provide the auditor with the qualification requirements for modeling specialists for new construction and we agree that these requirements are indeed stringent. We recommend that the additional information be provided for future audits, recognizing that even with the additional information replication of the simulation runs are outside the scope of this audit.

BII made adjustments to gas savings as well as to electric and water savings. BII reviewed Enbridge files, developed and included file review forms, replicated calculations (where necessary), and documented reasons for recommended changes to savings, including for new construction.

With the exceptions noted above, the study and supporting documentation were reviewed by audit engineering staff and found to be reasonable and consistent with standard industry practices. Some calculations were again replicated by staff, and few discrepancies were found.

We accept the realization rates determined by the BII study.

The commercial sample did not include any participants with water savings[4]. Consequently, Enbridge applied the industrial water savings realization rate for those commercial projects that had water savings based on recommendations from Summit Blue, the author of the sample design methodology. While this may be expedient, we are concerned that a realization rate developed for industrial processes may not be representative of a commercial application. The few commercial projects in the 2009 program with water savings minimizes the impact for 2009 and no adjustment was made to the TRC calculation, however we recommend that for future program years commercial sector specific realization rates be developed.

Custom Industrial Programs

A verification study was commissioned by Enbridge for industrial programs. The study, produced by Genivar, examined 18 industrial and 2 agricultural sites and included document reviews, site visits, verification of input assumptions, and examination of operating conditions.

Cadmus staff reviewed the draft and final Genivar reports. Cadmus discussed the draft report with Genivar staff members, and conducted a detailed review of the 6 projects included in the draft report, and a review of all the projects included in the final report. The detailed review included reviews of all the backup files and documentation used in the report summaries. Comments and suggestions were communicated to Genivar during the discussions.

The overall assessment by Cadmus senior engineering staff concluded that the analysis presented in the report was sound, well documented and appeared to conform to good engineering practice. No differences or exceptions were noted, although some of the additional detail communicated in the discussions would have enhanced the evaluation report. We note, however, that more detail was provided in the 2009 evaluation report than in the 2008 report, which substantially improved the review process.

We conclude that the savings estimates and adjustments made by Genivar are reasonable and consistent with current practice in the industry. The study and supporting documentation together provide a reasonable review, consistent with current industry practices. We accept the realization rates determined by the Genivar study.

[4] The sampling plan does not specifically seek commercial water saving representation due to the relatively small occurrence.

Market Transformation Programs

Market Transformation metrics were established and agreed to for the current program cycle, and are applicable to the 2009 program results. The metrics still have the same underlying issues that have been noted in the 2007 and 2008 Audit reports: namely, that they are focused on program *activities* (things that the program does) rather than program *outcomes* (things that the program is supposed to accomplish). EGD in consultation with the EAC has is working to improve both the metrics and the weighting for new Market Transformation programs. This new approach is reflected in the Drain Water Heat Recovery System Market Transformation Program, as reviewed below. Notwithstanding the advances in Market Transformation metrics for new initiatives, , the underlying objective of this Audit is to assess whether the existing programs met their agreed-upon performance criteria for SSM claims.

We found a systematic calculation error resulting where EGD claimed '0' SSM accomplishments in cases where they should have claimed partial (pro-rated) accomplishments. Corrections were made in the SSM spreadsheet to reflect these additional claims.

EnerGuide for Natural Gas Fireplaces

The primary performance metric for the EnerGuide for Natural Gas Fireplaces Market Transformation Program is the presence or absence of EnerGuide Point of Purchase (POP) material on display at participating retailers. Enbridge conducted in-store audits of 129 retail establishments to ascertain whether the POP materials were on display. Overall, 82% of all stores had the material on display. These results met the program performance metric at the 50 percent level. Enbridge provided an overview of the process and results by type of retail establishment and by region within Ontario. In addition, Enbridge conducted a study of 489 purchasers of gas fireplaces. The content of the survey and the implementation method was the same as for the 2008 survey. Results showed a continued high awareness of the EnerGuide label at 81%, virtually the same at the 2008 cohort (80%). The influence of the EnerGuide label on purchase decisions was also consistent with the 2008 survey with 72% acknowledging influence (74% in 2008). The increase of 1% in customer awareness was 20% of the metric target and was the only one of approved metrics that contributed to the SSM claim.

We support the SSM claim for this program, as revised by the Audit, while noting that a 1% change in customer awareness does not appear to be a statistically significant difference.

Home Performance Contractor Market Transformation

The Home Performance Contractor Market Transformation Program seeks to increase the market penetration of weatherization activities in home renovations thorough the engagement of a range of residential market actors in training and workshops.

Workshop participants were surveyed at the beginning of the workshops about their current practice regarding weatherization measures. They were surveyed six months later to ascertain whether any their practices had changed. Survey respondents who answered both surveys reported an increase in the frequency of eight target measures implemented.

The 2008 Audit Report listed several reasons behind the recommendation not to support the SSM claim. These were:

- Lack of clarity as to how this program and these changes would affect the market (as opposed to just affecting the participants in the workshops),
- Lack of comparable baseline data from nonparticipating contractors (to ascertain what normal current practice is), and
- Lack of measures of statistical significance in the metric change

None of these issues were addressed in the Impact Evaluation Report or the Annual Report. EGD made a mid-year decision to cancel this program and, as such we cannot support the SSM claim.

Drain Water Heat Recovery System Market Transformation Program

The Drain Water Heat Recovery System Market Transformation Program is a new program initiated by Enbridge in 2009, and designed to complement the equivalent Union Gas program. Union Gas markets their program directly to builders, while Enbridge markets the Program to water heater rental service providers, who then promote the program to builders. While this technology is by no means new or experimental, knowledge of the measure is generally not widespread, and several utilities – including Black Hills Energy – include this measure in their "innovative" portfolio.

This program, the metrics and evaluation are well thought out and represent a good example of how market transformation programs can be successfully implemented and successfully evaluated. Among the strengths of this approach is a focus on true market transformation metrics (builder's behavior, nonparticipating builder knowledge, units installed) in addition to conventional program activities (outreach to providers, workshops held).

Additionally, EGD provided a draft logic model for this program, indicating to the auditor a significant advance in thinking about appropriate indicators for future market transformation programs. The short-term outcomes identified in the draft logic model are among the metrics used in calculating SSM.

It is important that questions in the survey of market actors produce unbiased results. Currently it is possible to criticize the survey as containing leading questions that bias results toward EGD preferred outcomes. We reviewed the questionnaire instrument to examine the face validity of the individual items. We note that for all of the questions the respondent is read a series of choices about the characteristics and benefits of the technology. A better design would be to ask about the technology without a prompt to ensure a non-biased answer. There is no evidence that there is actual bias in the response set, but the possibility exists that the answers were somehow compromised by the structure of the questions. We recommend that these surveys be reviewed in more depth going forward to eliminate this possibility.

Because of the balance between market transformation metrics and program activity metrics, we support the SSM claim for this program, as revised by the Audit.

Recommendations

Based upon the Audit of the 2009 programs, the Auditors make the following recommendations:

1. *EGD should collect the building simulation runs for the Commercial New Construction program.* Currently EGD documents the results of the simulation, but does not provide the inputs and interim results for review. While we feel that the results are reasonable, without the complete files the auditors cannot verify the assumptions. The auditors are not proposing to re-run the simulations.
2. *EGD should consider claiming savings for measures and operation changes recommended by staff, but not available for program incentives, if these measures are adopted and save energy.* Discussions with program staff indicated that efficiency improvements have been recommended in addition to program measures for commercial and industrial customers. These adoptions cannot be classified as "spillover", but rather they are direct effects of the program interaction with customers. While "spillover" is currently not counted, direct program effects legitimately could be. The process for claiming savings should include developing methodologies for documenting, monitoring and verification of the claims as well as independently evaluating the claims.
3. *EGD should provide the disposition of prior year recommendations as part of the draft Annual Report.* The disposition document was late and in draft form. Certainly an update would be reasonable as the Audit report is finalized, but an early disposition document would minimize surprises.
4. *EGD should begin implementing agreed-upon action items within a month of the final OEB close of proceedings*. While many of the recommendation were acted upon expeditiously, those involving commissioning of new studies lagged significantly. The effect of the lag means that results of new studies or activities may not be available until the end of 2010 or early 2011. In some cases the studies would have been useful to have for the 2009 Audit (the Steam Trap measure life review, for example).We understand that EGD staff is busy, and cannot control the regulatory process, but earlier attention to these action items agreed to would be helpful.
5. *EGD should work with their evaluators to refine the market transformation surveys of builders and market actors to eliminate "leading" questions that can bias responses*. Although we commend the approach to evaluating new market transformation programs (DWHR) and linking metrics to program logic models, care must be taken to ensure that questions and response categories lead to unbiased responses. This includes eliminating questions that steer respondents to response that EGD prefers. Since this is the first evaluation of the DWHR Program there is room for improvement.
6. *EGD should update the commercial and industrial sampling methodology if water savings becomes more prevalent*.
   The sampling methodology established in a memo from Summit Blue dated October 31, 2008 notes that water savings account for less than 1% of the TRC benefits. Consequently, sites with water savings are only evaluated if they happen to be part of the sample drawn for gas and electric savings. In the memo, Summit Blue notes that this may need to be revisited – "If TRC benefits from water savings increase substantially in the future, then this approach—that only verifies water savings if these savings happen to

occur in conjunction with sampled gas and electric savings within the joint-sample—might need to be modified".

7. *EGD should update the showerhead savings values based on the 2009 SAS study.*

   See discussion of showerhead values above.

8. *EGD should conduct a free-rider study for the ENERGY STAR® for New Houses if the program is continued.*

   See discussion of ENERGY STAR® for New Houses program above.

9. *EGD should adjust the CFL distribution rate based on the result of the participant surveys.*

   See discussion of TAPS and TAPS Low Income CFL distribution adjustment above.

10. *EGD should adopt the final Navigant thermostat savings assumptions for the 2009 LRAM and the 2010 savings estimate.*

    See discussion of thermostats above.

11. *EGD should conduct an impact evaluation of the low income program savings before adjusting the current OEB approved savings estimate.*

    See discussion of low income weatherization savings estimates above.

Appendix A: Documents Reviewed

OEB Documents

Decision in Docket EB-2006-0021 (August 2006)
DSM Handbook – EB-2006-0021 (April 2006)
Decision Phase III EB-2006-0021 - January 2007
Market Transformation Revision – February 2007
2009 Approved Assumptions EB-2008-0103
2010 Approved Assumptions – EB-2008-0346 (April 2009)
- Navigant Report
- GEC comments on Navigant Report

2008 Annual Report and Audit

2008 Audit Comments

2009 DSM Draft Annual Report

2009 Draft Annual Report Comments received from GEC

Research Studies

Custom Projects Attribution – Summit Blue

Verification Studies

Industrial project sample – Genivar
Commercial project sample – BII
C520100076 Multi-Res Rental Verification Report_Final
Drainwater Heat Recovery Program 2009 Builder Knowledge Report Final
Energuide for Natural Gas Fireplaces Program Performance Research 2009 report final
Fireplaces Awareness Research 2009 Report Final
Home Performance Contractor Market Transformation Program 2009 Final
TAPS_Low Income Yearend 2009 Final
TAPS_Year end report_2009 Final
Impact of low-flow showerheads Phase 2 – SAS

Custom Project Sampling Methodology

Appendix B: 2008 Audit Recommendations

Status Report: 2008 Audit Recommendations

Prepared for the 2009 Audit

May, 2010

DISPOSITION OF 2008 DSM AUDIT RECOMMENDATIONS

1. Recommendation:

"Remove the agriculture custom project realization rates from the industrial program and incorporate them into the commercial program results. This recommendation would make the reporting consistent with the sampling protocol."

Enbridge Response:

Enbridge is in agreement with this recommendation and recalculated the SSM accordingly.

EAC Response:

The EAC endorses this response.

Status as of May 2010:

- This recommendation has been **implemented**.

2. Recommendation:

Revise ENERGY STAR® program. The auditor recommended the following:

"We recommend Enbridge undertake a detailed free-ridership analysis and process evaluation of the program. The analysis should incorporate both participant and nonparticipant builders and home-buyers to determine the motivation behind building and purchasing ENERGY STAR® homes. Alternate program designs should be considered, including providing incentives to cover a portion of the incremental cost of building to ENERGY STAR® specification and the certification process."

Enbridge Response:

Enbridge intends to assess this recommendation in the context of a larger program review for the future. Enbridge is currently reviewing this program in light of the audit recommendations as well as upcoming changes to the Building Code and other industry developments that will affect the program in 2010 and beyond. Enbridge will discuss potential research relating to this program with the 2009 EAC.

EAC Response:

The EAC shared the auditor's concerns that adjusting a $100 builder incentive would neither address doubts regarding the influence of this incentive nor facilitate broader penetration of ENERGY STAR® standards. The EAC thus endorses Enbridge's response.

Status:

- Nov 17: OEB approved savings assumptions for 2009 & 2010 were published. The program is in flux due to the changing environment (green energy act, OBC code changes). Until program mangers decide on direction for this program, no free ridership study or process evaluation will be conducted.
- May 2010: The current version 4 of the Energy Star program generates negative TRC results and as a result will not be supported by EGD. Enbridge will honor and process all 2009 enrolments. Builders enrolled in the program have up to 2 years to build homes that meet version 3 of the energy star program. EGD will support current enrollments up to the end of 2011.
- With the program in its current state, a free ridership analysis or process evaluation is no longer warranted.

3. Recommendation:

The following recommendations were made by the auditor in their Final Report specific to the school prescriptive boiler program:

"We recommend accepting the 2008 claims for this program. However, we also recommend initiating a parallel custom savings calculation for schools and revisiting the program design in 2010, in the light of these additional data."

"Reconsider the Prescriptive Schools Program design after additional data collection activities. The details required to conduct energy savings calculations in E-Tools do not appear to add burden on participants or staff. The tool has proven easy to use, elegant, and flexible. Once a history of school boiler project savings has been accumulated (using the prescriptive savings algorithm), the program design might be reconsidered. This recommendation may affect both SSM and LRAM in future years."

Enbridge Response:

The Auditor recommends that a "parallel custom savings" be established for schools and that Enbridge should revisit the program's design in 2010.

Because the program uses a "replacement scenario" rather than an "advancement scenario", all input assumptions are made against a theoretical base case installation that doesn't take place. The program standardizes these input assumptions rather than leaving it to the discretion of the customer or individual user. Savings have been estimated using the very same E-Tools vehicle that the Auditor would have Enbridge use on a Custom basis. The Auditor has also concurred that Enbridge's sampling methodology is statistically valid.

Although the Auditor states that E-Tools is an easy tool to use, there are other administrative elements not addressed by the Auditor's recommendation. These elements include the administrative time required to search multiple data bases for obtaining customer consumption, verifying individual building consumption, eliminating data outliers with respect to estimated bills and inputting and running E-Tools. There would also be a significant increase in the evaluation process. Each project would once again need an internal engineering review of the project's calculations and assumptions.

The prescriptive approach is acceptable when the size of the market is large, there is uniformity amongst participants and it provides administrative efficiencies.

Enbridge intends to continue with the current program design. The auditor's recommendation implies a potential abandonment or market place reversal of using a prescriptive approach. This would materially impact the Company's efforts to develop other prescriptive program offerings for the smaller end of its Large Commercial sector. Reverting back to a custom approach would be regressive.

Enbridge DSM staff reported that the Prescriptive Schools Program has been identified by the school sector as a far more popular program design for this sector. Enbridge staff reported that there is a resistance, within this sector towards the increased administrative demands required for custom projects.

Stated simply, a reversion back to a more administratively demanding custom approach would alienate the schools from participating in any meaningful way. A significant barrier for schools is complex and large administration. A custom program will place additional administrative demands

on the schools. From past experience, Enbridge recognizes that the schools are unlikely to allocate the time required to provide the back up information needed to support a custom project file and evaluation. For example, costs for performance improvements are often found in a proposal accepted by the schools that encompasses much larger projects. Specific costs such as the cost for a new boiler are often blended within the price quote and difficult to disaggregate.

As an alternative, Enbridge will investigate updating the current program design. Areas of interest that will need to be investigated before any change is made to the program include the following:

- Baseline -- One fundamental question that will need to be answered is what is an appropriate baseline for the Prescriptive Schools program?
- Market Data – Review and analyze available market data to better understand the state of, and trends in, the market.
- Revised questionnaire to be answered by the schools following the installation of upgrades or boilers. These surveys will provide a more detailed understanding of the features (such as flue dampening and number of stages) installed with new boilers.
- Hybrid Approach – investigate a program in which some elements of the savings and TRC calculation are prescriptive and others are custom.

EAC Response:

As noted in Enbridge's response, prescriptive assumptions can be appropriate when the market is large; there is significant uniformity among participants with respect to projected savings, incremental costs and other key assumptions; and there are significant administrative efficiencies to be realized. The company has not made a compelling case that any of these three conditions apply to the schools measures.

Perhaps most importantly, the Company has provided no evidence to suggest that savings per school do not vary considerably. There are at least two major factors that could lead to significant variation. The first is the size of the heating load. The partial histogram of gas use by schools that is provided in the report used to support the Company's prescriptive schools assumptions suggests that there is non-trivial variation in gas use. The second is the features of the boilers actually installed in schools. The Company's prescriptive savings estimate for schools is based on a set of assumptions regarding key features of the installed boilers, including efficiency rating, number of heating stages, average jacket temperature, etc. No data on the variability of the features installed in school projects have been provided. During the audit process, the EAC asked Enbridge to provide data on the range of savings estimated for school boilers from a couple of years ago when savings from all school boilers were estimated on a custom basis. Such actual data would have shown the degree to which there is variability in savings. The EAC also requested data to demonstrate increased uptake under the prescriptive model than previously under the custom program model. However, the Company has not provided such data.

The Company makes several statements in its response about the barriers to participation that reverting to a custom approach may create. However, there is no evidence to support the Company's assertions. Indeed, as the auditor itself noted, the Company had as many custom projects as prescriptive projects with schools in 2008. In 2006, the last year that school boiler projects were treated as entirely custom, the Company had more school projects than in any other year.

While we are sure that schools – like all customers – prefer DSM approaches that lessen their administrative burden, we do not see the evidence that the burden under the custom program approach is excessive. Indeed, it should be possible to adopt an approach that generates much greater accuracy on savings estimates without putting any burden on schools. Specifically, Enbridge could require the school to identify the make and model number of the boiler installed, with the Company then able to identify the boiler features and do a custom savings calculation with E-tools.

Status as of May 2010:

- Addressing baseline with study to be conducted by SeeLine (an extension to a study previously completed in 2009.)
- The scope of work has been circulated.
- The purpose of this study is to develop a more accurate estimate of the market share of efficient boilers. This knowledge will help determine baseline boiler efficiency for replacement projects.
- **In process**

4. Recommendation:

The auditor recommended the following: "[The aggregated] New construction measure life estimates should be savings-weighted. "

Enbridge Response:

Enbridge will investigate such an approach to determine if it is operationally feasible. At present we do not have an approved model that can calculate weighted measure life as described by the auditor nor do we have a complete understanding of the ramifications to program administration and customer interactions and requirements.

EAC Response:

The EAC accepts this response.

Status as of May 2010:

- The 2008 auditor concluded that even with the implementation of this recommendation, the relative affect on TRC, SSM and LRAM would not be material.
- At present it cannot be determined if such a change would increase or decrease TRC.
- On individual custom new construction projects, it is Enbridge current practice to indicate savings and measure life for individual measures in a project, where that information is available.
- EGD does not believe the effort required to implement such a change in the program design is required at this time due to the minimal affect (+ve or -ve) on TRC, SSM or LRAM.

5. Recommendation:

Include systematic documentation and back-up for industrial program verification report. Because the report did not include sufficient documentation for audit review, our auditors had to request project files from Enbridge to examine baseline conditions etc. These data should have been included in the report.

Enbridge Response:

Enbridge agrees with this recommendation. The industrial verification report was written assuming the reader would have all project files available to them at the same time as when reading the verification report. Enbridge will work with the third party responsible for the industrial verification report to ensure that, in future years, the report itself includes sufficient documentation for the auditor's review. It is expected that a detailed review of a project will still require the project file.

EAC Response:

The EAC accepts this response.

Status as of May 2010:

- This recommendation has been **implemented**.

6. Recommendation:

The auditor recommended the following: "Develop logic models and market progress indicators for market transformation programs."

Enbridge Response:

Enbridge agrees with this recommendation. Enbridge will begin work on logic models in 2009 and complete them as soon as practical. To the extent that the logic model work suggests changes in the design of Enbridge's market transformation programs, the Company will also pursue those changes as soon as possible.

In 2009 the following 3 market transformation programs are being delivered by Enbridge:

- EnerGuide for Natural Gas Fireplaces
- Home Performance Contractor Market Transformation
- Drain Water Heat Recovery

Some steps in line with the recommendation to develop market transformation logic models have been completed but finalized logic models are not yet available.

Because of the time line for development, regulatory filing and approval of program designs, it is possible that some program design changes may not go into effect until 2011. Those that can be put in place sooner, will be.

EAC Response:

The EAC accepts this response.

Status as of May 2010:

- This recommendation has been accepted and continues to be a work in progress.
- MT programs (other than the DWHR program) that were active in 2009 will not have logic models developed for them as they were not continued in 2010.
- The logic model for the drain water heat recovery (DWHR) program has been developed.
- Logic models will be developed for market transformation programs as new programs are developed and implemented.
- This recommendation has been **implemented**.

7. Recommendation:

The auditor recommended the following: "Implement a process to ensure consistent survey implementation approaches over time for Market Transformation programs. This is important because Market Transformation progress can only be understood over time. Where survey approaches change, an assessment of construct validity should be provided."

Enbridge Response:

Enbridge agrees with this recommendation with the understanding that programs may change over time and with such change, some adjustment to survey implementation approaches may be practically unavoidable.

EAC Response:

The EAC endorses this response.

Status as of May 2010:

- This recommendation has been **implemented**.

8. Recommendation:

The auditor recommended the following: "Change the measure life assumption for steam traps to six years for LRAM until better data are available."

Enbridge Response:

Enbridge has accepted prospective application of this recommendation. Following a review of the auditor's sources that suggest a 6 year life, Enbridge concluded that the references found in those sources are qualitative in nature, limited in scope and that an enhanced statistical analysis would prove to be the best available information for customers found in Enbridge's jurisdiction. Enbridge intends to enhance the current statistical analysis that recommends a 13 year measure life with additional customer sites and a greater number of steam traps in the sample. In addition, the approach to this analysis and key issues and questions that need to be addressed, including the concern expressed by the auditor about using "a straight line projection" from a few years of data "rather than the industry-standard logistic curve for survival functions", will be looked at with the EAC. The process to be used for the analysis and the terms of reference for this work will be agreed upon by both the EAC and Enbridge. In the interim, a 13 year measure life as approved by the OEB for 2009 will be used for the 2009 SSM calculation.

EAC Response:

The EAC endorses this response.

Status as of May 2010:

- The current OEB approved measure life for steam traps is 13 years
- EGD personnel have been engaged to develop an approach to enhance the current study.
- Terms of Reference are being prepared for a potential study
- **In process**

9. Recommendation:

"Document the decision rules for categorizing individual replacements versus advancements for custom projects."

Enbridge Response:

Enbridge agrees with this recommendation and will use the rules suggested by the auditor as a starting point to the development of Enbridge-specific decision rules. Enbridge intends to phase in this approach in 2009 and reach full implementation in 2010.

EAC Response:

The EAC endorses this response.

Status as of May 2010:

The following decision rules (as recommended by Cadmus) are being considered for implementation.

1. If a boiler is replaced beyond its effective useful life (if a boiler is older than 25 years), it should be categorized a replacement.
2. If a boiler burns out or is inoperable, regardless of its age, it should be categorized as a replacement.
3. If a customer had already decided to replace a boiler, regardless of age or condition, it should be a replacement.
4. Installing new equipment is should be characterized as advancement only when there is evidence that the utility program convinced the customer to replace an operating boiler before the end of its effective useful life.

The rules have been distributed for comment. Target close date for this recommendation is end of May 2010.

- **In process**

10. Recommendation:

"Evaluation and verification studies in support of annual reports need more time and should be planned and initiated earlier."

Enbridge Response:

Enbridge agrees with this recommendation and has already taken steps to ensure that, where feasible, verification studies will be completed earlier in the year than for the 2007 and 2008 results.

EAC Response:

The EAC endorses this response.

Status as of May 2010:

- This recommendation has been **implemented**.

11. Recommendation:

"Conduct site verification visits for commercial custom project verification studies."

Enbridge Response:

Enbridge will conduct sites visits for commercial custom projects in 2009 and use that experience to inform future commercial project verification efforts.

EAC Response:

The EAC endorses this response.

Status as of May 2010:

- This recommendation has been **implemented**.

12. Recommendation:

"Conduct annual free-rider surveys for custom project participants."

Enbridge Response:

Enbridge agrees to investigate this recommendation. Discussions with the Auditor indicate that few if any jurisdictions have successfully implemented this theoretical best practice. Enbridge will investigate the practical effects of implementing this recommendation on programs and customers. Areas that will need to be investigated before adopting this recommendation include the following:

- Cost and Resource demands. In previous years, the costs required to conduct free ridership surveys were high and these studies also required Enbridge resources.
- Impact on other evaluations and study work. Conducting annual free-ridership surveys for custom project participants may have an impact on what can be done for other programs.
- Survey design and implementation strategy to ensure reasonable free ridership estimates are calculated.
- Pilot design and implementation of a free-ridership survey that can be administered to all industrial customers at the time a project is being verified for implementation.

EAC Response:

The EAC accepts this response.

Status as of May 2010:

- A working committee has been formed to address this recommendation.
- The committee is composed of Peter, Walter, Judith, Rodney, Fai & Daniel
- The bidders list is complete.
- To avoid the risks associated with not knowing free ridership rates for 2010, EGD will apply 2009 free ridership rates to custom projects completed in 2010.
- Going forward, free ridership studies would be conducted each year. The free ridership rates developed in one year will be applied to custom projects in the following year.
- A study will be conducted in 2010 and the results will be applied to programs in 2011.
- EGD will discuss this approach with Cadmus. .

13. Recommendation:

"Stratify savings calculations for pre-rinse spray nozzles."

Enbridge Response:

Enbridge is in agreement with this recommendation. The OEB approved assumptions for 2009 includes stratified savings for pre-rinse spray valves. Enbridge recommends using a study called Deemed Savings for (Low-Flow) Pre-Rinse Spray Nozzles (Jan 2009) recently commissioned by Union Gas as best available information for pre-rinse spray nozzles. This study stratifies the savings by the nature of the commercial operation as recommended by Cadmus and is referenced in our submission to the OEB for recommended 2009 and 2010 assumptions. The savings values as approved by the OEB in the Decision for 2010 Assumptions and the Board's decision re: Enbridge 2009 assumptions were based on this report.

EAC Response:

The EAC endorses this response.

Status as of May 2010:

- This recommendation has been **implemented**.

14. Recommendation:

"Develop a comprehensive third-party evaluation strategy and schedule."

Enbridge Response:

Enbridge is in agreement with this recommendation. As part of the annual DSM cycle, Enbridge reviews the evaluation research priorities with the Evaluation Audit Committee following publication of the Audit Report. Enbridge has met with the 2009 EAC to begin this review for 2009.

EAC Response:

The EAC endorses this response.

Status as of May 2010:

- The EAC for 2010 has reviewed the evaluation priorities at the start of the year and will review them again in light of recommendations resulting from the audit of 2009 results
- This recommendation has been **implemented**

15. Recommendation:

"Document program process flows and QA/QC procedures."

Enbridge Response:

Enbridge is in agreement with this recommendation. As noted by the auditor, Enbridge QA / QC procedures reflect some industry best practices but they are not well documented. Enbridge will begin documenting QA/QC procedures in 2009.

EAC Response:

The EAC endorses this response.

Status as of May 2010:

- This recommendation has been partially implemented for new programs.
- The documentation of QA/QC procedures will be a requirement for new programs.
- Example: QA/QC procedures were documented for a potential condensing gas water heater program. Unfortunately the program did not provide positive TRC results and was not launched.
- **In process**

16. Recommendation:

"Review Commercial Custom Program water savings protocols as the verification report for the Commercial sector found water savings for projects where none were identified by Enbridge. "

Enbridge Response:

Enbridge is in agreement with this recommendation. Enbridge will begin this review in 2009.

EAC Response:

The EAC accepts this response.

Status as of May 2010:

- This recommendation has been **implemented**.

17. Recommendation

"On April 16, 2009, Navigant Consulting presented a comprehensive recommendation for measure savings to the OEB. With the exception of showerhead estimates (discussed below), we recommend adopting these savings for calculating the LRAM, as they represent the most current available savings estimates."

This adjustment decreases the m3 saved to 77,252,981 for LRAM.

Enbridge Response:

Enbridge agrees with this recommendation and has updated the calculation of 2008 LRAM to reflect this recommendation.

EAC Response:

The EAC endorses this response.

Status as of May 2010:

- This recommendation has been **implemented**.

18. Recommendation:

"Update the SAS shower head load study pursuant to the recommendations included as part of the report. These recommendations include (1) performing re-analysis after one-year post-installation data are available and (2) employing a comparative household sample with no installation (to control for trends)."

Enbridge Response:

Enbridge is in agreement with the recommendations made by Cadmus and will investigate how to address these recommendations. This research will be added to the master list of potential evaluation research for 2009 and 2010 for review with the EAC. The purpose of this research will be to develop savings estimates for both single family and multi-family dwellings.

EAC Response:

The EAC accepts this response.

Status as of May 2010:

- Discussed the extended research with EAC on Nov. 16th.
- No opposition to study as presented.
- Study results are included in the 2009 Annual Report.
- This recommendation has been **implemented**.

19. Recommendation:

"Conduct a comprehensive evaluation of the Novitherm program. As noted in the Novitherm review, savings estimates suffer from similar shortcomings as those identified in the showerhead study. We recommend analysis using a full year of post-installation gas usage, as well as the inclusion of a control group."

Enbridge Response:

Enbridge will investigate how to address these recommendations using the in-house services of the load research group. This research will be added to the master list of potential evaluation research for 2009 and 2010 for review with the EAC.

EAC Response:

The EAC accepts this response.

Status as of May 2010:

- An evaluation of the Novitherm program is no longer required as this program is no longer supported by EGD.

20. 150% Cap on Value of Individual Market Transformation Metrics

In its filing, the Company has suggested that it can earn bonus incentives for exceeding goals on individual market transformation metrics. The Company has assumed that the bonus is proportional to the margin by which it exceeded the goal, with no cap on the amount that can be earned for any one performance metric. Indeed its Draft 2008 Annual Report claimed more than 400% of the incentives set aside for one individual metric and over 200% for several others. The result is that metrics that were supposed to have limited weight when it comes to earning shareholder incentives dominate the Company's calculation of incentives for some market transformation programs. These

dominant impacts can result in significant incentive payments even where the program underperforms on key transformation indicative metrics.

Our read of the Company's own filing several years ago on market transformation incentives (which the OEB adopted) suggests that the Company can earn extra incentives on individual performance metrics, but only up to the point where it achieves 150% of the goal for that metric. Thus, very high numbers relative to goals on metrics that are not meant to have great weight should be allowed to only partially offset short-falls on more important metrics. Specifically, in the Company's Market Transformation Incentive Update filed 2/26/07 (EB-2006-0021, Exhibit B, Tab 1, Schedule 1, p. 1), the Company says:

> *"The MT Shared Savings Mechanism (SSM) amount for any program results will be prorated on a linear basis between the scorecard levels for each program (i.e. 0%, 50%, target or 100% and 150%) indicated in the program scorecards."*

None of the filed scorecards in subsequent pages in the referenced Enbridge filing has a "level" higher than 150%.

It should also be noted that although the auditor did not pass judgment on our or the Company's competing interpretations of the rules on this issue (because it was outside of the auditor's purview), the auditor agreed that an approach that would allow for less important metrics to disproportionately contribute to SSM claims is problematic.

Enbridge Response:

In the interest of avoiding ratepayer costs that would result from a Proceeding over this issue and to facilitate a full Settlement, Enbridge ahs agreed to apply a 150% cap on individual 2008 MT metrics. This applies only to 2008 and is contingent on a full Settlement. If a hearing process results due to lack of a full Settlement Agreement, Enbridge reserves the right to claim the full MT SSM.

EAC Response:

The EAC endorses this response.

Status as of May 2010:

- This recommendation has been **implemented**.

Appendix C: Questions and Responses

Date	Question	Response	Response Date
5/14/2020	1) Can you refresh my memory as to how the "net annual gas savings" and "net annual electric savings" columns are calculated? The values are hard coded in the spreadsheet.	"net annual gas savings" and "net annual electric savings" columns are calculated in DARTs using participant numbers, savings assumptions and reduction factors. Some reduction factors are updated quarterly. In order to have the 'correct' reduction factor in the 'actuals' tab, we had to calculate an equivalent reduction factor for programs that have quarterly surveys that provide quarterly reduction factors. The data in the chart was pulled directly from DARTs and the factors in the column named 'Reduction factor for Excel' were calculated. This allows the 'actuals' tab to calculate the correct net results. Unfortunately, that 'actuals' tab assumes one reduction factor for the year. Many of our programs have quarterly surveys that provide quarterly reduction factors. The process described above bridges the gap. This is the same process we followed last year.	5/17/2010
5/14/2020	2) Regarding EnergyStar for New Homes: the EnerQuality website indicates that version 3 technical specifications is for homes enrolled prior to March 31, 2009 and that version 4 applies thereafter. Does the 2009 Annual Report include only version 3 homes? How was the average savings employed in the report determined?	Yes, only version 3 homes are in the 2009 Annual Report. I'll upload the substantiation documents for the 2009 approved assumptions on the FTP site. Please see the attached file 'ENERGY STAR FOR NEW HOMES – sub docs for auditor/.doc' for a description of how average savings was determined.	5/17/2010, 5/18/2010

Date	Question	Response	Response Date
5/14/2020	3.) How were the number of measure installations for the TAPS program calculated? For example, the TAPS year-end report indicates that 98% of households received showerheads, 86% installed them and 4% removed them leaving 82% of the households that installed at least one. Does the number of showerheads in the TRC spreadsheet (146,802) represent the final installed number? a. Following on with this line of reasoning, if 146,802 is 82% of the total number of households, then the total number of households is 179,027. b. Assuming 179,027 is the total number of households, how was the number of CFL installations derived? The TAPS year-end report indicates that 59% of the households installed the CFLs. 59% of 179,027 is 105,625, however the TRC spreadsheet indicates that 135,236 households installed CFLs c. Again regarding the CFLs. The TAPS year-end report indicates that the average household installed 2.8 CFLs. Currently, the TRC spreadsheet assumes 4.0 CFLs per household. How do these two values relate to one another? d. Is there a spreadsheet that shows how each of the TAPS and low income measure number of installations was derived?	146,802 represents the number of participants before reduction factors are applied. Contractors provide excel files that are uploaded into the TAPS database. The records go through a 'scrubbing' process to ensure there are no duplicates or other problems with the data. A report is then provided which calculates how many of each device were delivered. It is this report that supplies us with the numbers provided on the summary sheet which feeds into DARTS/TRC. See the attached files 'DEC2009TAPS – FINAL –for auditor.xls' and 'ERIC Nov-Dec.xls' for details a) For the purpose of calculating energy savings, the number of households is tracked.For the purposes of billing, we track the number of showerheads installed and the number of households.. According to our back-up information there were a total of 146,900 households that received bag tests however only 146,802 showerheads qualified for a new showerhead. As some households receive more than one showerhead the total number of showerheads installed was 181,647. b) CFL's are counted on an individual basis as the other measures are. Not all households received CFL's for various reasons such as: the program didn't start at the beginning of the year, not all customers want CFL's etc. c) Industry standard assumes CFL's have a long shelf life. It is assumed that not all CFL's will be installed immediately upon delivery. However, it is assumed also that all CFL's handed out will be installed eventually. Enbridge has claimed saving for the delivery of 4 CLF's per participant in the TRC spreadsheet due to the assumption that all delivered CFL's will eventually be installed and result in energy savings. We understand that not all CFL's will be installed in the year they are delivered however, EGD should be TRC credited for the savings that will result regardless of the year in which the delivered CFL's start to be used. d) Yes – see attached files..	5/18/2010

Date	Question	Response	Response Date
5/14/2020	4) What is the rational for using the industrial water adjustment factor for commercial applications? It may be more appropriate to assume no adjustment or to use a average of the previous evaluation adjustments.	When applying the established sampling methodology to pull custom project files to be reviewed, the sampling methodology may pull more, less or no projects with water savings from commercial projects. When summit blue developed the sampling methodology, it was assumed projects would be pulled to establish water savings realization rates but it didn't matter if the projects were pulled from commercial or industrial projects. A side benefit of this decision is that the sampling size could be kept at a reasonable level. I believe you have the report from summit blue that recommended the sampling methodology. You may want to review the report or even call summit blue to get their perspective.	5/17/2010, 5/26/2010
5/14/2020	5) How were the average cost, gas and electric savings for the low income weatherization program calculated?	Discussed modeling tool during weekly status conference call.	5/18/2010
5/20/2010	CM.HOS.003.09 The project files had excellent usage data, incentive calculations, methodology but lacked information about the number of beds, the amount/type of insulation added to the pipe, (ASHRAE/Code), AHU specifications and associated calculations. 1. How much pipe insulation was installed (meters, feet) and what were the thermal characteristics of the pipe before and after the installation of the pipe insulation? 2. What is the HP and efficiency of the air handlers where scheduling changes to place? 3. What are the before and after operating hours? 4. What were the other control adjustments and what equipment was effected?	Files provided with responses and additional detail	5/26/2010

Date	Question	Response	Response Date
5/20/2010	CM.Multi-Priv.040.09 –The project files were fairly complete and provided details including the size of the boilers (base and enhanced capacities), boiler efficiencies; annual energy consumption, incentive calculations, E-Tools Worksheets and other project data. However, it still lacked detailed information about the window replacements and gas dryers. 1. The savings were established using the E-Tools program 2. What is the square footage of the facility and number of occupants? (this will assist in the analysis of space heating energy and water heating loads) 3. Additional measures were installed as part of larger project including windows, new domestic hot water risers, and new showerheads. The site also reported there were 5 new gas-fired dryers in the buildings laundry room. The new boiler was downsized as part of the window replacement. 4. What is the square footage and thermal characteristics of the pre and post case windows. 5. Additional information on each measure needs to be provided including a "base case" and "enhanced case" including efficiencies or other applicable data to provide a more accurate energy analysis.	Files provided with responses and additional detail	5/26/2010
5/20/2010	CM.Multi_Priv.082.09 –The project files were fairly complete and provided incentive calculations, consumption details, energy savings estimates, E-Tools Worksheets, EEM cost data and some specifics about the heat reflective materials. However, it lacked details about the space and water heating systems and details on residential building including square footage and occupancy level. 1. Need more details on residential buildings. 2. What is the occupancy level of residential apartment complex? 3. What are the operating hours and setpoints for the base and enhanced case measures? 4. Provide accurate square footage information.	Files provided with responses and additional detail	5/26/2010

Date	Question	Response	Response Date
5/20/2010	CM.MUN.044.09 –The project files were fairly complete and included incentive calculations, steam trap survey, EEM cost data but lacked information about the boilers and E-Tools Worksheets. 1. Provide more data on the building including square footage and operating hours. 2. If available, provide download steam metered data to obtain baseline consumption for the heating system or use typical EUI data to estimate the heating load based on the age of building and equipment efficiencies.	Files provided with responses and additional detail	5/26/2010

Date	Question	Response	Response Date
5/20/2010	CM.NC.001.09 –The project files were fairly complete and provided details on incentive calculations, end-use load estimates (Enbridge New Construction Program Report) and square footage data however it lacked data on building envelope (physical characteristics of building, heat load estimate), boiler types and efficiencies and additional information on the heat recovery system. Since this is a new construction project, the project files are their architectural plans, heating and cooling load estimates, baseline and enhanced efficiencies and operating conditions. 1. Need baseline building EUI for specific area. It appears the baseline was MNECM rather than ASHRAE 90.1. 2. What did the building envelope measures consists of and how will it effect energy savings? 3. What types of lighting controls were installed? 4. Need number of fixtures and operating hours of lighting control system. 5. What type of energy recovery system (ERS) was installed. 6. What is the typical savings associated with this type of ERS? 7. What types of space heating measures were installed? 8. What is the base and enhanced case efficiencies? 9. The final savings should be an interactive analysis. 10. A DOE2/eQuest or other hourly energy simulation model should be used to determine overall savings. A simulation was provided by a DAP model? However it was not sealed by professional engineer. 11. Staff reported higher actual usage (bills) than predicted energy usage (model). 12. Were heat pumps used in the analysis and does this effect fuel switching issues?	Files provided with responses and additional detail	5/26/2010

Date	Question	Response	Response Date
5/20/2010	CM.NC.004.09 –The project files provided details on incentive calculations, end-use load estimates (Enbridge New Construction Program Report), square footage data however it lacked data on building envelope including physical characteristics of building, HVAC base and enhanced case efficiencies and additional information on the heat recovery system. Since this is a new construction project, are there architectural plans, heating and cooling load estimates, baseline versus enhanced case efficiency ratings and operating conditions? 1. Need baseline building EUI for specific area (as approved by LEED, ASHRAE or other resources). 2. What is square footage of facility? 3. What did the building envelope measures consists of? 4. How would they affect energy savings? 5. What type of heat recovery system (HRS) was installed? 6. What are the typical savings associated with this type of HRS? 7. What types of high efficiency heating measures were installed? 8. What is the base and enhanced case efficiencies? 9. The final savings should be an interactive analysis. 10. A DOE2/eQuest or other hourly energy simulation model should be used to determine overall savings.	Files provided with responses and additional detail	5/26/2010

Date	Question	Response	Response Date
5/20/2010	CM.NC.006.09 –This project files provided details on incentive calculations, end-use load estimates (Enbridge New Construction Program Report), square footage data and details about the facility. Since this is a new construction project, are there architectural plans, heating and cooling load estimates, baseline and enhanced case efficiencies and operating conditions? 1. Need baseline building EUI for specific area (as approved by LEED, ASHRAE or other resources). 2. What did the building envelope measures consists of? 3. How with this affect energy savings? 4. What type of lighting measure was installed? 5. Need number of fixtures, operating hours, base and enhanced case wattages. 6. What type of heat recovery system (HRS) was installed? 7. What is the typical savings associated with this type of HRS? 8. What type of central heating plant efficiency measures were installed? 9. What are the base and enhanced case efficiencies? 10. What type of central cooling plant efficiency measures were installed? 11. What is the base and enhanced case efficiencies? 12. The final savings should be an interactive analysis. 13. A DOE2/eQuest or other hourly energy simulation model should be used to determine overall savings.	Files provided with responses and additional detail	5/26/2010
5/20/2010	1) The approved savings and incremental costs for Energy Recovery Ventilators, Furnace Replacements, Heat Recovery Ventilators and Infrared Heaters is based on the installed size of the unit, i.e. the approved savings and costs are on a Btu/hr or CFM basis. The TRC spreadsheet "Actuals" tab point to the "DPA - SC Custom (linked)" which has hard coded total values entered per project. Is there a backup spreadsheet that has the project detail that supports the hard coded totals?	There were 4 customers in the program in 2009. The savings for each customer was calculated by using the OEB approved savings per CFM and multiplying this factor by the CFM rating of the units installed. 2009 HRV calculations are found in the attached pdf file.	5/21/2010

Date	Question	Response	Response Date
5/20/2010	2) How were restaurants categorized into the three pre-rinse spray nozzle categories? Is there a backup spreadsheet that illustrates this?	Customers fill in a spray'n save program flyer (example in pdf file) or a tracking sheet is filled out by the customer or our partners. Data from the flyer and tracking sheet is used to categorize restaurants. The tracking spreadsheet can be provided if required	5/21/2010
5/20/2010	3) How were commercial programmable thermostats assigned to market segments? Is there a backup spreadsheet that illustrates this?	Customers filled in the back of a Programmable Thermostat Program flyer. The 1st section of the form on the back of the flyer asks the customer what business sector they are in. The tracking spread sheet can be provided if required	5/21/2010
5/21/2010	1) The TRC spreadsheet assumes 4 CFLs per household. The "Regular TAPS Partners Program Follow-up Study 2009 Year End" indicates that only 3.3 CFLs were distributed per household. I am proposing that we use 3.3 as the verified number. What are your thoughts?	Discussed during weekly status update conference calls and agreed to by EGD	n/a
5/21/2010	2) There is an inconsistency in the "Regular TAPS Partners Program Follow-up Study 2009 Year End" report. Slide 21 states that 1% of households removed their CFLs. Slide 22 indicates that 2% removed their CFLs. Can you confirm which is the correct figure?	Slide 21 states that 1% (33/2572) of households that were given CFLs as per contractor records removed one or more. Slide 22 states that 2% (33/1524) of households that installed CFLs removed one or more. If we want to determine a net install rate (based on all households that were given CFLs as per contractor records) after removal, then you should reduce your installation rate by 1%.	5/28/2010
5/21/2010	3) I'm also proposing we that we use 3.4 CFLs per home as the verified number for the low income TAPS program based on that year end report.	Discussed during weekly status update conference calls and agreed to by EGD	n/a

Date	Question	Response	Response Date
5/21/2010	4) Regarding extrapolation of the industrial water savings factor to the commercial sector, my interpretation of the Summit Blue sampling design is that commercial and industrial sectors are evaluated separately. Can you point me to the section that suggests a factor from one sector may be extrapolated to another or point me to an audited historical spreadsheet in which that was done? (In general, sampling design starts with the assumption that the characteristics of the population as a whole are represented by the sampled projects. This allows the extrapolation from the sample to the whole population. There are, of course, distinct differences between the commercial and industrial sectors such that it is less likely that a sample drawn from one sector would be representative of the population of the other sector.)	Please see the e-mail trail below between EGD and Navigant Consulting (formerly Summit Blue)EGD asked Navigant, "If there are no commercial water savings in this sample and in the Wave 1 sample, do the water results for the industrial sector apply to the commercial sector?" Navigant replied, "As for the water projects, I selected 5 water projects from the total population of water projects and none of the four commercial projects were selected. The results for this sample would be applied to all water projects, yes." With this information we are now in a position of who's opinion (Cadmus, GEC, EGD or Navigant) is more valid? I recommend the opinion of Navigant. They are unbiased. The sampling methodology and Summit Blue were approved by Enbridge and the EAC. If we only apply water realization rates to Industrial projects, we will have no realization rate to apply to commercial projects?	5/26/2010
5/21/2010	1) The 504 HRV project calculates to 10.276 m3/CFM which is outside the range of approved values. Can you tell me why?	The Market Development 2009 HRV Tracking Spreadsheet indicated incorrect calculated savings values. The savings values were corrected for the 2009 SSM Spreadsheet.	5/26/2010
5/21/2010	2) For ERV the 255 and 17 projects also calculate to m3/CFM greater than the range in the approved values. It is my understanding that the approved values are merely representative based on some generic assumptions. Please confirm and provide the calculations for these projects	The Market Development 2009 ERV Tracking Spreadsheet indicated incorrect calculated savings values. The savings values were corrected for the 2009 SSM Spreadsheet.	5/26/2010
5/21/2010	3) The total of the HRV savings in the attachment is 6,137 which is greater than the amount of 3,730 entered in the TRC spreadsheet. Do you know why?	The Market Development 2009 HRV Tracking Spreadsheet indicated incorrect calculated savings values. The savings values were corrected for the 2009 SSM Spreadsheet.	5/26/2010
5/21/2010	4) Similarly, the total of the ERV savings in the attachment is 315,338 which is greater than the amount of 312,469 entered in the TRC spreadsheet.	[response in 2 above]	5/26/2010
5/21/2010	5) I did not see an explanation of the calculation for infrared heaters.	Please find attached the Market Development 2009 tracking spreadsheet for infrared participants. I have checked to see if they were calculated correctly.	5/26/2010

Date	Question	Response	Response Date
5/21/2010	6) For completeness, if there is a summary spreadsheet for the pre-rinse spray nozzles and thermostats that shows the categorization please send it.		5/26/2010
5/24/1010	Regarding the avoided costs. 1) Natural gas avoided costs increased approximately 15% over the 2008 forecast. 2) Water prices increased approximately 70% over the 2008 forecast. Do you know the underlying reasons these increased? Are these avoided costs filed and approved by the OEB?	The 2009 avoided costs were calculated in the fall of 2008. The full impact of declining gas prices was not seen until the avoided costs for 2010 were calculated. The 2010 avoided costs for gas will show a decline compared to 2009. Water savings for 2008 for the city of Toronto were calculated at less than what they should have been. Our contact at The City of Toronto gave use water rates for only one 'block'. When the water rates for all 'blocks' were taken into account the water rate (avoided cost for water) increased. Avoided costs are not filed or approved by the OEB. However, the process by which avoided costs are calculated was approved in the EG-2006-0021 decision. Detailed calculations for the 2009 avoided costs are available if you wish to review them.	5/28/2010
5/26/2010	1) Regarding the thermostat reduction factor decrease from 66.5% in 2008 to 24.7% in 2009: I do not see any verification studies for thermostats. Your response indicates that we should have a study. Can you point me to the correct one for both 2008 and 2009 (or provide them if I do not already have them)?	I've uploaded to the FTP site the TAPs Low Income studies and a spreadsheet that calculates reduction factors. If you look at the spreadsheet you will see the following: • YTD 12 Month m3 results before reductions = 571, 222 • YTD Final 12 Month m3 results = 431,741 • A reduction factor can be calculated as follows: (571,222 – 431,741) / 571,222 = 24.4% • This number in not a perfect match to the 24.7% found in the TRC spreadsheet.	6/2/2010

Date	Question	Response	Response Date
5/26/2010	2) Regarding commercial tankless water heaters: I could not find any details for the 2008 incremental cost, however the incremental cost detail for the 2009 filing indicates that a commercial business may require 2-3 tankless systems to replace a single storage tank however the incremental cost compares a single system to a single tank. It seems more reasonable to assume 2 tankless systems to replace a single storage tank per the language in the backup. This would increase the incremental cost to $510 from the current -$1,570. Can you verify that a single tankless system is capable of replacing a storage tank?	• Please refer to the following report: Measures and Assumptions for Demand Side Management (DSM) Planning, presented to the OEB on April 16, 2009 by Navigant Consulting. • On page C-228 and C-229 of this report you will find the backup to our incremental cost of -ve $1,102. • In this document 3 scenarios are presented. Scenario A is the only scenario our DSM program supports. The incremental cost of -$1,102 = $2,080 (cost of 1 WaiWela PH28CIFS Tankless Water Heater) - $3,182 (cost of 1 Rheem G37-200 storage tank water heater). • The table of assumptions in the draft annual report notes an incremental cost of -$1,102 for base equipment described as a 91 gal tank. This is a typo. It should note a 37 gallon tank	6/2/2010
5/26/2010	3) Were the Energuide for Home Contractor Performance market transformation metrics those in Decision EB-2009-0103? That decision indicates that 5 workshops would result in a 50% score for the first metric. Consequently, the 4 workshops actual held would result in a score for that metric of 4/5 of 50%. Is that the correct interpretation?	Revised market transformation spreadsheet provided by EGD	6/1/2010
5/26/2010	4) Regarding industrial incremental costs. The Genivar report notes that the project files contain manufacturer's quotations or billings, which justify the incurred cost of the project. Can you verify tell me how the incremental cost reported in column "Y" (unit incremental cost) is derived from the manufacturer's quotations or billings? Specifically, is the total of the manufacturer's quotations or billings used or is some adjustment made to distinguish incremental cost from total cost?	The incremental cost of an energy savings measure is that portion of the cost specifically related to the measure. Project invoices are selectively apportioned to reflect only the incremental cost of the measure. This process is done on a best effort basis by the ESC. The following general rules are applied by our energy saving consultants: • If a project has no base case, then the incremental cost = total cost (based on selectively apportioned project invoices and billings) • If there is a base-case, then incremental cost = total cost(based on selectively apportioned project invoices and billings) – base case cost.	6/15/2010
5/27/2010	CFL Program Costs: the CFL lines in the TRC spreadsheet have no costs associated with them. Can you tell me where their program related costs (purchasing, delivery, etc) are located?	There are no incremental costs for CFLs. The direct costs are included at the program level; RE2R38S for regular CFLs and RE.LIHP.SH for low income CFLs.	5/28/2010

Date	Question	Response	Response Date
6/9/2010	Marco, I'm puzzled by the thermostat savings. The Navigant report shows 53 m3 and 54 kWh "MEASURES AND ASSUMPTIONS FOR DEMAND SIDE MANAGEMENT (DSM) PLANNING APPENDIX C: SUBSTANTIATION SHEETS", APRIL 16, 2009, page 43 and page 90 (low income). The substantiation sheet for the 2009 approved values references a draft version of the same report with 146 m3 and 123 kWh savings. Can you tell me why the final version of these values was not approved by the board? I see that we used the final version in the LRAM TRC calculations for the 2008 audit.	In EB-2009-0103, the OEB made the following decision: "Enbridge Gas Distribution Inc. is granted approval to use the Board approved Navigant 2010 input assumptions, with the revisions noted in Appendix B of Enbridge Gas Distribution Inc.'s reply submission." I think what happened is that when the considered the timing of the proceeding within the 2009 year, it was decided that it would be appropriate to agree to the assumption in Appendix B for 2009 and move to updated assumption in 2010.	6/15/2010
6/10/2010	Marco, I'm trying to compare the 2009 and 2008 low income thermostat reduction factors (see attached spreadsheets). The 2008 thermostat had a 61% not installed factor and a 14% survey reduction factor. The 2009 thermostat had a not installed rate of 30%, 30%, 35%, 7% by quarter and a survey reduction factor of 0%, 0%, 4%, 4% by quarter. This is a significant shift between 2008 and 2009. Was there a change in the TAPS Low Income program design that caused the contractors to install thermostats at twice the rate in 2009 compared to 2008?	We updated a survey question relating to the thermostats in 2009. In the past the question asked about whether the contractor offered to sell the customer a thermostat. In the low income TAPS program, the thermostats are installed for free so the question was updated to ask whether the contractor offered to install the free thermostat. This change in survey question affected the not installed factor. The removal rate (or reduction factor) changed from 2008 to 2009 as a result of different survey results between 2008 and 2009. In 2008 very few respondents answered the question. Approximately 1 in 7 (14%) of a small number of respondents answered the question. Better response rates in 2009 gave us a more accurate removal rates. From another perspective…. It is unlikely anyone would have removed a programmable thermostat once it was installed. The low removal rates found in 2009 seem to intuitively make more sense than the 1 in 7 removal rate used in 2008.	

Date	Question	Response	Response Date
6/11/2010	The files you attached show gas savings of 146 m3 and electric savings of 182 kWh. The 2009 DSM Input Assumptions approved by the board have 146 m3 for gas, but 123 kWh for electricity. Can you tell me why there is a difference? Also, the final Navigant report has 53 m3 for gas and 54 kWh for electricity. If I understand your filing you argue that they are double counting behavior impacts, i.e. the billing analysis that determined a 6% average savings fully incorporates the behavior impacts so Navigant's final report errs in that it provides a separate weighting for behavior. Are you arguing that the values should be 146 and 123 (182) for 2010 as well or should I be using the final Navigant report values for LRAM as best available information?	Navigant calculated electricity savings as follows: "assuming an average home has both space cooking using CAC and force air heating, the total electricity savings = 138 kWh/year + 44 kWh/year = 182 kWh/year." (see Feb. 2009 Navigant Assumptions Draft: Page B52). Enbridge calculated electricity savings as follows: Summit Blue reports a penetration rate of 57% for CAC across the province based on information from EGD and NRCan. Using 57% penetration the electricity savings are (44 + (138*.57) = 122.7kWh. (see EGD Appendix: Page 25 of 119, EB-2009-0103) Enbridge, applied the penetration rate of central air conditioners to the electricity savings estimate. Navigant assumed the average home has central air conditioning. Enbridge adopted a more conservative savings estimate. For 2010 EGD is using 53 m3 for gas and 54 kWh. For best available information for 2009 LRAM we recommend 53 m3 for gas and 54 kWh for electricity.	6/15/2010
6/11/2010	Marco, I have verified that the draft Navigant report uses $0.0122/kBtu/hr for installed cost of infrared heaters and that the cost included in the TRC spreadsheet is based on $.02/kBtu/hr. Do you plan to have updated TRC costs based on $0.0122 for the LRAM calculation. I don't see where those costs are calculated in either the attached spreadsheet or the TRC spreadsheet so that I may update them directly.	Good catch. We have changed the assumption from $0.02 to $0.0122 in our TRC calculation and $0.0122 should be used for LRAM purposes. It appears the change to TRC is around $25k.	6/15/2010

Date	Question	Response	Response Date
6/14/2010	Marco, while attempting to update the TRC spreadsheet for the changes you sent today I found that many of the totals that are pulled forward to the "Actuals" tab from the detail spreadsheet(s) are hard coded in the detail spreadsheet(s). Consequently, updating the cells as noted by Sharon does not flow through to the "Actuals" tab. Can you tell me the correct total for incentives for the ERV measure? The TRC spreadsheet shows $27,750, however the sum of the projects in the "DPA-SC Custom (linked)" tab is $28,000. It would be useful to have a version of the TRC spreadsheet with working formulas in the detail tabs to assure that all changes have been accurately reflected if one is available.	The source worksheets are hard coded because they come from a DARTS report. DARTS does the calculations and produces a report with values only. We take these values and input them into the "actuals" worksheet in order to show the calculations. For ERV, the incentive amount of $27,750 is correct. This is the value that has come through our EFS (Financial Tracking system). All programs that are input as "custom" in DARTS will have incentive amounts at the project level that will often not add up to what went through EFS for the year. This is due to payments being made in the next year, or carried over from the previous year. We record and show the incentive payment per project for cost per m3 or cost per participant/device analysis.	6/15/2010

Audited

Demand Side Management

2009 Annual Report

August 17, 2010

uniongas

A Spectra Energy Company

Glossary of Terms

Adjustment Factor An adjustment factor is the percentage of participants who install a measure and keep it installed. Adjustment factors are established through the interviewing of a random sample (statistically significant) of program participants conducted by a third party in order to validate measure installation. The adjustment factor is applied to an initiative's gross savings results

Avoided Costs Avoided costs are a measurement of the reduction in the delivered costs of supplying resources (natural gas, electricity and water) to customers as a consequence of a program which reduces resource use by customers.

Base Case A base case reflects a projection of the future without the effects of the utility's DSM program. "Base cases" are required for each and every DSM scenario, even those which are just a single technology or a single participant. The difference between the base case and the energy efficient case represents the saving attributable to the energy efficient measure.

Building Envelope The building envelope refers to the exterior surfaces (such as walls, windows, roof and floor) of a building that separate the conditioned space from the outdoors.

Channel Partner A Channel Partner is a company that in the course of its business can influence consumers to choose gas over competing fuels. Examples include appliance retailers, HVAC contractors, engineers, and architects.

Cost Effectiveness Cost effectiveness refers to an analysis performed to determine whether the benefits of a project are greater than the costs. It is based on the net present value of savings over the equipment life of the measures.

Demand Side Management Variance Account (DSMVA) The existence and use of a DSM variance account provides a degree of flexibility for utilities as they undertake DSM investment. A DSM variance account may be used to rebate ratepayers at year end for unused budget allocation or to recover from ratepayers additional costs incurred for DSM programs.

Free Ridership Free riders are program participants who would have installed the energy efficient measure without the influence of Union's DSM program. Free rider rates are estimated based on research, market penetration studies or through negotiations in prior evaluation processes. The free rider rates are applied to the gross program savings results to derive actual savings.

Incentive An incentive is a transfer payment from the utility to participants aimed at encouraging participation in a DSM program.

Incremental Cost The incremental cost is the difference in price between the efficient technology or measure and the base case technology. In some early retirements and retrofits, the full cost of the efficient technology is the incremental cost.

Lost Revenue Adjustment Mechanism (LRAM)
The LRAM is the Ontario Energy Board approved method by which utilities recover the lost distribution revenues associated with DSM activity. These lost revenues are calculated for each rate class impacted by DSM energy efficiency programs.

Net Present Value (NPV) Net present value calculations rely on an discount rate to state, with a single number, what the value of a number of years of benefits are. The NPV then is the sum of the discounted yearly benefits arising from an investment over the life-time of that investment.

Net-to-Gross Ratio Gross impacts are the program impacts prior to accounting for program attribution effects. Net impacts are the program impacts once program attribution effects have been accounted for. The net-to-gross ratio is defined as 1 – (free ridership ratio) + (spill-over ratio).

Ontario Energy Board (OEB) A regulatory agency of the Ontario Government that is an independent, quasi-judicial tribunal created by the *Ontario Energy Board Act.* The OEB has regulatory oversight of both natural gas and electricity matters in the province.

Participants The units used by a utility to measure participation in its DSM programs; such units of measurement include customers, projects and measures or technologies installed. Not all participants result in energy savings.

a) **Participants (when natural gas savings are claimed)** include gas saving measures or equipment (i.e. Boilers), packages of measure (i.e. ESKs), custom applications and services such as water heater tank de-liming. These participants are tracked through the Demand Side Management Tracking System (DSMT).
b) **Participants (when no natural gas savings are claimed)** include Feasibility and DAP study participants, energy audit participants, those who receive educational material such as the Wise Energy Guide as well as those who attend training sessions. These participants are tracked through the DSMT.

Program A program is the utility's specifically designed approach to providing one or more demand-side options to customers.

Program Evaluation Program evaluation refers to activities related to the collection, analysis, and reporting of data for purposes of measuring program impacts from past, existing or potential program impacts.

Research Costs Research costs are the utility's costs associated with the research and evaluation of DSM programs. They are not included in direct costs because they may affect more than one program.

Spill-over Spillover represents energy savings that are due to the program but not counted in program records. Spillover can be broken out in three ways:

a) **Participant inside spill-over** represents energy savings from other measures taken by participants at participating sites not included in the program but directly attributable to the influence of the program.
b) **Participant outside spill-over** represents energy savings from measures taken by participants at non-participating sites not included in the program but directly attributable to the influence of the program.
c) **Non-participant spill-over** represents energy savings from measures that were taken by non-participating customers but are directly attributable to the influence of the program. Non-participant spill-over is sometimes called the "Free-Driver effect."

Shared Savings Mechanism (SSM) A Shared Savings Mechanism (SSM) is a financial tool that allows utilities and customers to "share" in the societal benefits that successful DSM programs generate. SSM can include incentives for both Resource Acquisition and Market Transformation DSM programs.

Total Resource Cost Test The Societal Cost Test provides a measure of the benefits and costs that accrue to society as a result of the installation of a DSM measure. The Societal Cost Test has a provision whereby externality benefits, when quantified, can be included in the result. The SCT at $0/tonne CO2 is also known as the Total Resource Cost Test (TRC).

Trade Allies Trade allies include organizations (e.g. architect and engineering firms, building contractors, appliance manufacturers and dealers, and banks) that affect the energy-related decisions of customers who might participate in DSM programs.

Executive Summary

2009 represents Union Gas' twelfth year of delivering cost effective Demand-Side Management (DSM) programs to its broad customer base. To date, Union Gas' commitment to DSM initiatives has translated to approximately 707 million m^3 of natural gas savings, equivalent to more than $1.3 billion in net Total Resource Cost (TRC) benefits.

Union is pleased to report that the 2009 DSM portfolio generated 92.6 million m^3 of natural gas savings from a program budget spend of $22.2 million, which equates to a Shared Savings Mechanism (SSM) incentive of $ 8.75 million. Union's 2009 Market Transformation activities as measured by the OEB approved scorecard metrics generated an incentive of $0.5 million. It is worth noting that the Low-income programs significantly exceeded expectations in 2009, yielding 2.7 million m^3 in natural gas savings, nearly twice the 2008 results.

Union's commitment, leadership, and advocacy fuel its successes, which are greatly dependent upon the relationships and strategic program delivery channels. Through the provision of energy expertise, guidance, and incentives to customers, and the emphasis on working collaboratively with stakeholders, it is with great satisfaction that Union accepted the ***Industry Partner of the Year Award of Excellence*** from EnerQuality in 2009. This award demonstrates that Union's energy expertise and industry knowledge are recognized and valued by customers and trade allies.

While Union celebrates its accomplishments to date, the outlook for DSM within the constraints of the current framework will prove challenging for 2010 and 2011. The existing framework was designed for three years, and operating within the escalation factors for TRC targets and budgets for a longer period of time presents a barrier to success, and limits the opportunities to optimize planning. Successful DSM programs require greater viewpoints than one year for plan creation, and Union eagerly awaits the next multi-generational framework from the OEB to contemplate even more effective DSM timelines and strategies.

1. Introduction

Primarily authored to present an annual retrospective of Union's energy efficiency initiatives and DSM portfolio results in terms of TRC, budget spend, Shared Savings Mechanism (SSM), and Lost Revenue Adjustment Mechanism (LRAM), the 2009 DSM Annual Report also serves as a vehicle through which to benchmark the results , highlight Union's successes and lessons learned, summarize evaluation research conducted in 2009, and to present Union's 2010 TRC target.

Since the introduction of Union's current DSM framework, the DSM budget has increased from $17 million in 2007 by 10% in each subsequent year,[1] reaching $20.570 million in 2009. Of the 2009 budget, $1.210 million was included for Market Transformation programs and $1.573 million for programs delivered to Low-income customers. Following the formula for calculating the TRC target,[2] Union's 2009 Net TRC Target of $220,163,371 was filed with the Board in Union's 2008 Annual DSM Report. Union surpassed that TRC target by $88 million, achieving $308,255,602 for the year's DSM portfolio at a total cost of $22,222,457.

Union's 2009 DSM portfolio included programs directed towards Residential, Low-income, Commercial, and Distribution Contract (DC) segments as listed below. Major TRC drivers are illustrated in Figure 1.0.

Residential Markets:

- ESK Program with multiple delivery strategies
- Programmable Thermostat Rebate

Low-income:

- Helping Homes Conserve
- Home Weatherization Program

Commercial:

- Energy Recovery Ventilators
- Condensing Boilers
- Rooftop Units
- Infrared Heaters
- Heat Recovery Ventilators
- High Efficiency Furnaces
- De-stratification Fans
- Programmable Thermostats
- Low Flow Pre-rinse Spray Nozzle
- Kitchen Ventilation
- Steam Trap Survey
- Design Assistance Program
- Feasibility Studies
- Custom Projects

Distribution Contract:

- Custom Projects

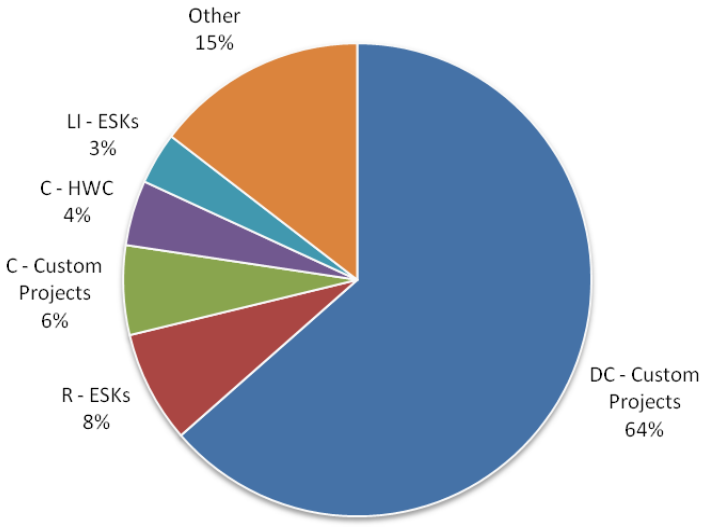


Figure 1.0, Major TRC Drivers

[1] As outlined in the OEB's Decision with Reasons dated August 25, 2006.
[2] As established in Phase 1 of the OEB DSM Generic Proceeding.

Program TRC results are presented in the body of this report and are benchmarked at the customer segment level against previous year's results in efficient technology units. Previously, Union's DSM Annual Report presented the year over year results in terms of TRC achieved, however input assumptions and adjustment factors for TRC vary from year to year, and as such, tracking program success on a unit basis is presented herein in order to provide a clearer picture of milestones and achievements.

2. Planning and Evaluation Background

Operating within the evaluation parameters of the OEB approved 2007-2009 DSM Plan, Union continues to demonstrate its leadership role in the cultural shift towards energy efficiency and conservation. Union's DSM activities are driving market change through focused efforts on delivering natural gas savings and related customer benefits. Union's DSM portfolio includes a mix of Resource Acquisition and Market Transformation efforts.

All resource acquisition measures are screened for cost effectiveness using the TRC test as outlined in the Decision with Reasons EB-2006-0021 and detailed in section 2.1 below. Although potential new measures for DSM were limited in 2009, Union strategically incorporated novel delivery methods to gain traction in the market, such as using a 'one and done' approach with delivery agents and the introduction of a National Accounts strategy for expanding retail partnerships. Programs that were not cost effective were scaled back or eliminated.

Two sets of input assumptions form the basis for 2009 DSM program evaluation as follows:

1) The planning input assumptions used in this report for natural gas m^3 savings, TRC results, and the SSM incentive are those filed by Union on May 26, 2009 and approved by the Board on June 29, 2009; and,
2) For the LRAM section of the annual report, the m^3 savings have been calculated using the most current input assumptions available at the time the Annual Report was completed.

Input assumptions for SSM and LRAM are provided in Appendix A.

2.1 Cost Effectiveness Screening

As mentioned above, potential DSM measures face a TRC screening test, which measures the benefits and costs of DSM investments from a resource perspective. Benefits include avoided natural gas, electricity, and water resource use and their associated costs, while the costs relate to the incremental cost of energy efficient equipment in relation to its non-efficient equivalent and any associated program support costs. Costs and benefits are projected over the Effective Useful Life (EUL) of the measure and discounted to calculate the Net Present Value (NPV).[3] All TRC results reported are net of free rider calculations.[4]

[3] A discount rate of 10% is used to calculate the net present value.
[4] Free riders are program participants who would have installed the energy efficient measure without the influence of Union's DSM program.

Measures delivered through Union's DSM portfolio (with the exception of Market Transformation) must yield a benefit-cost ratio of 1.0 or more. Programs are evaluated annually to ensure they pass the cost effectiveness screening.

In calculating the DSM associated avoided costs used in the TRC test , Union follows the methodology laid out by the OEB in the Phase 1 Decision of the DSM Generic Proceeding EB-2006-0021, as well as that approved by the OEB for Enbridge Gas Distribution in the EB-2005-0001/EB-2005-0437 proceeding. Calculating avoided costs for Union are related to customer rates as well as gas supply management policies and practices. The 2009 Union Gas Avoided Costs were included in the filing of the 2008 Union Gas DSM Annual Report.

2.2 Monitoring and Tracking

Effective and reliable tracking is recognized as essential to the veracity of program evaluation and reporting. In 2009, Union has continued rolling out a multiphase enhancement project for DSMt, Union's internal tracking system. Improvements to DSMt reduce manual reporting, improve data accuracy, streamline data tracking, and increase audit and verification controls.

2.3 Program Evaluation & Verification

There are two broad categories of evaluation activities; impact evaluation, and process evaluation. Impact evaluations focus on participation and related savings resulting from DSM programs. Process evaluations focus on the effectiveness of program design and delivery to assess why effects occurred. Union has historically focused on impact evaluation, but has expanded the focus in 2009 to include process evaluation for Commercial and Distribution Contract Custom Projects.

As part of Union's commitment to DSM impact evaluation, several verification studies are performed annually to examine the veracity of claimed savings. A summary of the verification studies undertaken in 2009 is provided in the Verification and Evaluation section (Section 9) of this report.

2.4 2009 Evaluation Priorities

Evaluation priorities are established through consultation with Union's Evaluation and Audit Committee (EAC) with the intention of evaluating input assumptions for each of the program measures included in the 2007-2009 DSM Plan over the course of the three years. While undertaking a third of measure evaluations annually was the initial strategy, many evaluation projects that might have been undertaken in 2009 were precluded by the OEB commissioning and approval of Navigant Consulting Inc.'s, *Measures and Assumptions for Demand Side Management (DSM) Planning*, dated April 16, 2009. In light of the Navigant Report, and in consultation with members of the EAC, four evaluation projects were identified as priorities for 2009 after the 2008 audit. Table 2.0 outlines the projects that were selected in consultation with the EAC and the current status of the project.

Table 2.0, 2009 Evaluation Priority Projects

2009 Evaluation Studies			
Name of Study	**Consulting Firm**	**Status**	**Appendix**
Process Evaluation of Commercial and Distribution Contract Custom Projects	PA Consulting Group	Phase One Complete	F
Evaluation of Energy and Heat Recovery Ventilator Input Assumptions	Nexant	Complete	G
Infrared Heater Study	Enermodal	Complete	H
Custom Measure Effective Useful Life Study	Diamond Engineering	In progress	N/A

Executive Summaries for completed evaluation research studies are appended to this report in Appendices F, G, and H. The outcomes of the Energy and Heat Recovery Ventilator technology evaluation and the Natural Gas Infrared Heater studies are reflected in the LRAM results, which are presented in Appendix C.

2.5 2009 Annual Report Audit

To substantiate Union's DSM Portfolio results, this DSM annual report is subject to an independent external audit, which is being performed by ECONorthwest for the 2009 program year. The intention of the audit is to confirm to stakeholders that claimed DSM savings are correct and that the SSM, LRAM, and Market Transformation incentive calculations are appropriate.

The auditor is required to express an opinion on the appropriateness of claimed TRC, SSM, LRAM and Demand Side Management Variance Account (DSMVA) based on their review of Union Annual Report. The auditor will provide a final opinion that the TRC Savings and amounts recoverable for SSM, LRAM and DSMVA are correctly calculated using reasonable assumptions.

3. Overall 2009 DSM Program Results

In 2009, Union's DSM program generated net TRC benefits of $308,255,602 and 92,604,301 m³ in natural gas savings. Program spending in 2009 totalled $22,222,457, including $1.210 million for Market Transformation and $1.573 million for Low-income. The Distribution Contract (DC) market continued to deliver the largest portion of savings in 2009 as well as the highest TRC value per dollar spent, followed by the Commercial, Residential and Low-income markets respectively.

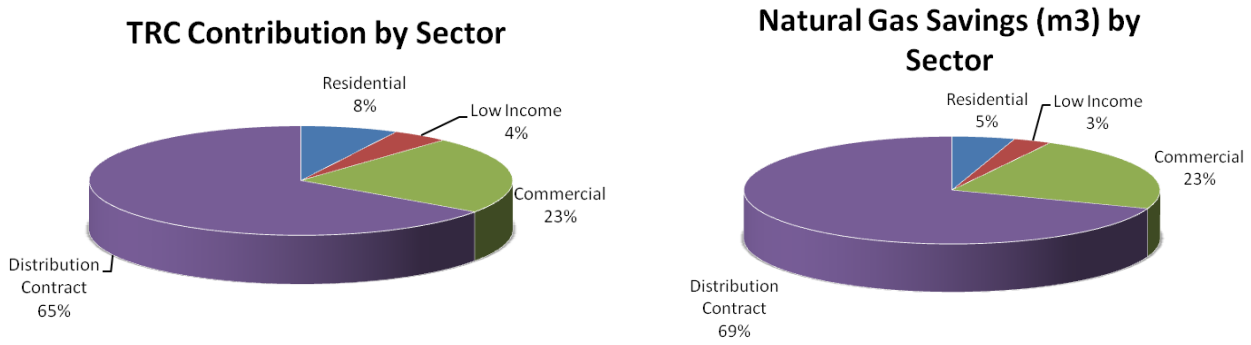


Figure 3.0, 2009 Results by Sector (Percentage)

Union's TRC target for 2009 as filed in the 2008 Annual Report was established as $220 million. In an effort to achieve this target, Union focused on a balance of programs in each sector. Table 3.0 summarizes Union's overall DSM results for 2009. It is worth noting that the cost associated with achieving the results over the past three years has risen.

Table 3.0 - Overall 2009 Program Results by Sector

Sector	Net TRC	Natural Gas Savings (m3)	Units	Expenditures	TRC per Dollar Spent
Residential	$ 26,073,066	4,515,861	363,922	$ 2,838,449	$ 9.19
Low Income	$ 13,497,387	2,746,452	87,549	$ 2,169,521	$ 6.22
Commercial	$ 74,008,306	21,069,115	149,677	$ 4,637,816	$ 15.96
Distribution Contract	$ 201,056,110	64,272,873	211	$ 5,022,108	$ 40.03
Market Transformation				$ 1,175,296	
Other Direct Program Costs				$ 6,379,267	
2009 Results	**$ 308,255,602**	**92,604,301**	**601,359**	**$ 22,222,457**	$ 13.87
2008 Results	$ 262,754,219	62,852,176	526,913	$ 20,258,900	$ 12.97
2007 Results	$ 215,895,940	55,852,485	458,057	$ 16,131,496	$ 13.38

**Expenditures include program and incentive costs*

DSM initiatives for 2009 were delivered through the sector-specific programs outlined in Table 3.1. These programs are designed to achieve savings in the areas of space heating, water heating, and the building envelope, as well as process-related energy applications.

Table 3.1 - Sector Programs

Sector	Program
Residential	Home Retrofit
Low Income	Low Income
Commercial	New Building Construction Building Retrofit
Distribution Contract	Custom Projects

Union targets each customer sector with specific DSM programs, results for which are shown in Table 3.2.

Table 3.2, Detailed 2009 Program Results by Sector

Sector	Program	Units	Natural Gas Savings (m3)	Program Costs	Program TRC
Residential	Home Retrofit	363,922	4,515,861	$ 1,258,124	$ 26,073,066
	Total Residential	**363,922**	**4,515,861**	**$ 1,258,124**	**$ 26,073,066**
Low Income	Low Income	87,549	2,746,452	$ 152,303	$ 13,497,387
	Total Low Income	**87,549**	**2,746,452**	**$ 152,303**	**$ 13,497,387**
Commercial	New Building Construction	1,359	3,682,428	$ 130,783	$ 12,342,405
	Building Retrofit	148,318	17,386,687	$ 497,743	$ 61,665,901
	Total Commercial	**149,677**	**21,069,115**	**$ 628,526**	**$ 74,008,306**
Distribution Contract	Distribution Contract	211	64,272,873	$ 790,439	$ 201,056,110
	Total Distribution Contract	**211**	**64,272,873**	**$ 790,439**	**$ 201,056,110**
Total Program Results		**601,359**	**92,604,301**	**$ 2,829,392**	**$ 314,634,869**

Other Direct Program Costs	Salaries	$ 5,166,952
	Research & Evaluation	$ 1,142,387
	Administration	$ 69,928
	Total Other Program Costs	**$ 6,379,267**

TOTAL 2009 TRC RESULTS	**$ 308,255,602**

Figure 3.2 demonstrates that Union's 2009 total natural gas savings across all programs was approximately 92.6 million m³. Distribution Contract accounted for 69% of the total DSM portfolio natural gas savings.

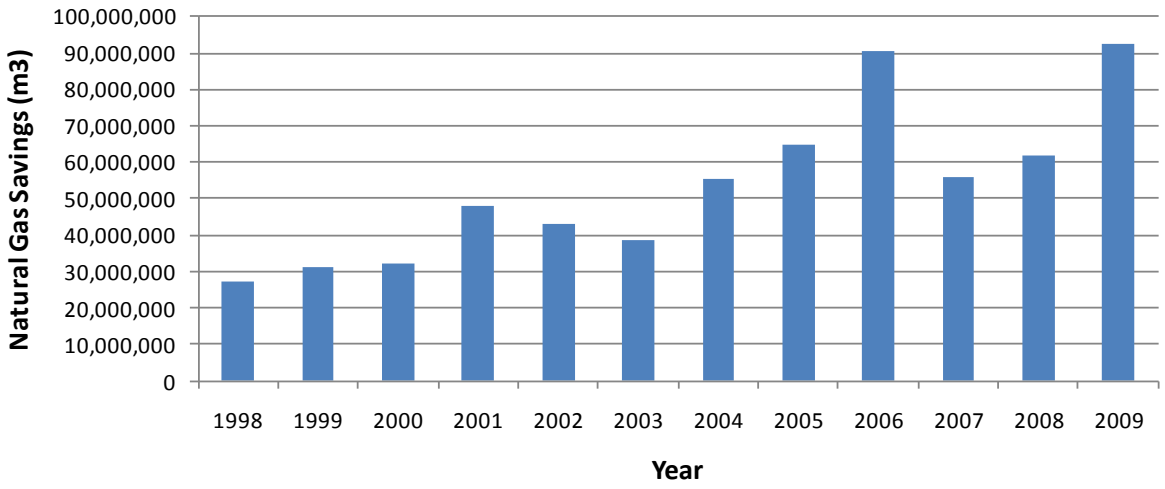


Figure 3.2, Historical Savings Results

The 2009 Board approved budget of $20.570 million was 10% higher than the $18.7 million budget approved in 2008. In 2009 Union spent over $22.2 million on DSM, including over $1.573 million on Low-income programs and $1.175 million on Market Transformation. A breakdown of 2009 expenditures by sector, compared to expenditures for 2007 and 2008, is shown in Table 3.4

Table 3.4 - Overall 2009 Direct DSM Program Costs

DSM Program Sector Costs	Incentives	Program Costs	2009 Total	2008 Total	2007 Total
Residential	$ 1,580,325	$ 1,258,124	$ 2,838,449	$ 3,043,684	$ 2,160,162
Low Income	$ 2,017,218	$ 152,303	$ 2,169,521	$ 1,445,269	$ 1,161,483
Commercial	$ 4,009,290	$ 628,526	$ 4,637,816	$ 4,332,476	$ 3,255,495
Distribution Contract	$ 4,231,669	$ 790,439	$ 5,022,108	$ 3,868,789	$ 2,539,282
Market Transformation	$ 825,330	$ 349,966	$ 1,175,296	$ 1,096,777	$ 770,172
Total Program Sector Costs	**$ 12,663,832**	**$ 3,179,358**	**$ 15,843,190**	**$ 13,786,995**	**$ 9,886,594**
Other Direct Program Costs			$ 6,379,267	$ 6,471,905	$ 6,244,902
Total Spending			**$ 22,222,457**	**$ 20,258,900**	**$ 16,131,496**

DSM Variance Account

Designed to reconcile the variance between the spending estimate built into rates for the year and the actual spending in that year, the OEB Decision with Reasons determined that the DSM Variance Account (DSMVA) shall reimburse the utility up to a maximum of 15% of its DSM budget for a given year. All additional funding must be utilized on incremental program expenses including market transformation programs.

A breakdown of spending by program is contained in Appendix B. Specific details on program savings, participants,[5] and costs by sector are outlined in the next three sections of this report.

[5] Participant counts are equivalent to the number of measures installed for each program

4. Residential Market

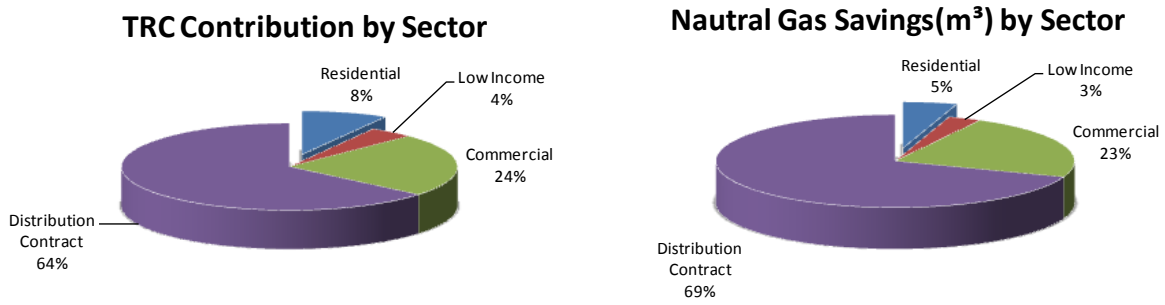


Figure 4.1, Results by Sector (Percentage)

Residential programs accounted for 8% of all DSM TRC in 2009, contributing 4.5 million m^3 of savings, and a net TRC of over $26 million. Direct program spending in the residential market was $2.838 million.

The residential sector delivered natural gas savings through the Home Retrofit program in 2009, results for which are summarized in Table 4.1.

Table 4.1, 2009 Residential Program Results

Residential	Net TRC	Natural Gas Savings (m3)	Units	Expenditures	TRC per Dollar Spent
2009 Results	**$ 26,073,066**	**4,515,861**	**363,922**	**$ 2,838,449**	**$ 9.19**
2008 Results	$ 25,949,245	6,725,838	405,992	$ 3,043,684	$ 8.53
2007 Results	$ 35,401,186	5,052,371	310,690	$ 2,160,162	$ 16.39

**Expenditures include program and incentive costs*

Although still the largest driver of TRC in the residential portfolio, Energy Savings Kit (ESK) units were down 13,698 for a total of 83,054 delivered in 2009 (see Table 4.4 for details).

4.1 Program Framework

Residential programs are designed to achieve savings in space and water heating for Union Gas' existing residential individually metered residences. These programs are marketed to residential customers and are delivered through a variety of channels, including retail partnerships, and third party delivery agents. New partnerships as well as working with existing trade allies, partners, and direct-to-customer promotions are strategically developed to cost-effectively promote energy efficiency within Union's residential customer base.

This section outlines the programs available to residential customers in 2009, including program changes, existing initiatives and delivery methods employed.

4.1.1 New Initiatives in 2009

Rona Energy Savings Kit (ESK) Distribution Event

Union has expanded its ESK (see existing programs below) approach and initiated a new channel through Rona Home and Garden (Rona). In 2009, this partnership was piloted in Southern Ontario for a one day event at five Rona locations. This partnership with Rona allowed Union to expand its promotion of ESKs new areas. This event was driven by a Union Gas bill insert, which was distributed to all 1.2 million residential customers, as well as local store event posters, and pre event flyers distributed by Rona to their customers. The one day events resulted in the distribution of approximately 1,700 kits (for ESK content details, see 4.1.2 below).

Figure 3.1: Rona ESK Event Bill Insert

ESK School Board Partnership

Given the success of the 2008 School Board ESK distribution pilot project with Windsor Essex Catholic District School Board, Union extended this partnership to various additional school boards across the franchise, including Thunder Bay Catholic District School Board, Greater Essex County District School Board, Northwest District School Board, Rainy River District School Board, Waterloo Region District School Board (UG locations only) and Lakehead District School Board. In partnership with these school boards Union distributed a letter offering an ESK to all staff and students, not only creating awareness of the energy saving measures but also educating young people about the importance of energy conservation. Nearly 3,275 energy saving kits were distributed through this partnership.

4.1.2 Existing Initiatives

Energy Savings Kit (ESK)

ESKs have been distributed to Union's customers since 2004. ESKs are pre-packaged measures designed to reduce a customer's energy demand and water consumption, as well as educate consumers on the efficient use of energy. In 2009 Union continued use of a 1.25 Gallon per Minute (GPM) showerhead as a component of the ESK offering. The 1.25 GPM showerheads are not sold at retail outlets in Ontario and were manufactured as a special order for Union with high quality chrome casing aesthetics. In addition to 1.25 GPM showerhead, the 2009 ESK consisted of:

- Pipe wrap (two 1 meter lengths)
- Energy efficient kitchen aerator (1.50 GPM)
- Energy efficient bathroom aerator (1.50 GPM)
- 1 roll of Teflon tape for ease of showerhead installation
- ESK Installation Guide, (see Figure 4.4a and 4.4b)[6]
- $15 Programmable Thermostat coupon

Figure 4.4a, 2009 ESK Installation Guide (front view)

Figure 4.4b, 2009 ESK Installation Guide (reverse view)

[6] The installation guide also directs our customer to an installation video on our website at uniongas.com

Union Gas delivered ESKs to franchise customers through a variety of delivery methods; results for each are shown in Table 4.2.

Table 4.2, 2009 ESK Summary of Delivery by Channel

ESK Results by Delivery Channel										
Residential Account Managers	Home Depot	Orders/ Pick up Depots	Energy Clinics	Rona	School Board	Direct Energy Distr.	Direct Energy Install	HVAC Program Install	HVAC Program Distr.	**Total**
15,754	15,461	22,627	2,246	1,724	3,273	2,862	581	1,403	17,123	**83,054**

In 2009 a total of 83,054 ESKs were distributed in Union's franchise area. This is 13, 698 less energy saving kits than the 96,752 ESKs in 2008, or a 14% decrease. Results indicated a significant decrease in participation at The Home Depot events and a shift in distribution of kits from the Union Gas Account Managers to the HVAC Channel. Overall, the greatest driver for ESKs in 2009 was the Union Gas website online order form and pick-up depots listed on uniongas.com/esk, a delivery method that increased 40% over 2008.

Home Depot ESK Distribution Events:

Over the last four years Union Gas has hosted ESK Distribution events in partnership with The Home Depot at various store locations across Union's franchise in the spring and fall. In 2009 we continued these events hosting a two day event in May and a one day event in September. Home Depot locations for 2009 were; Milton, Guelph, Waterloo, Thunder Bay, Belleville, Sault Ste Marie, London (3 stores), Burlington, Orillia, Oakville, Windsor (2 stores) Hamilton, Woodstock, North Bay, Cambridge, Sarnia, Timmins, Bracebridge, Cobourg, Ancaster, and Chatham. In total 15,461 ESKs were distributed through the Home Deport spring and fall events in 2009.

Residential Account Manager ESK Distribution:

Since Union Gas began offering the ESK the local Union Gas Account Managers have been managing local ESK distribution channels. These local ESK channels are in addition to the mass marketed ESK events. Examples of local events include home shows, trade shows, business partner sales events, community events and 'local' promotions. In 2009 account managers distributed approximately 15,754 ESKs in their territories, a marked decline from 42,255 in 2008.

ESK Co-branding Partnerships

Building on the success of partnering with Direct Energy in 2008, Union Gas expanded this working approach to include Reliance Home Comfort in 2009 to reach customers less likely to receive an ESK through existing delivery channels. Through the partnership, Union provided Direct Energy and Reliance with co-branded kits that were installed/ distributed by their sales force. ESK co-branding partners received a $25 incentive for installing ESK showerheads, and a $10 incentive for the distribution of an ESK to a qualified Union Gas customer. A key component of the installation strategy was that a showerhead bag test was performed prior to the installation of the new energy-saving showerhead and the results were tracked accordingly.

HVAC Partnership Initiative

Designed to influence energy conservation decisions at the point of purchase, incentives are paid directly to the HVAC partners for the promotion, sale, and installation of an energy efficient measure through the HVAC Partnership. For 2009 the following incentives were available to qualified HVAC partners;

- $10 for the distribution of an energy saving kit to a qualified Union Gas customer;
- $25 for the installation of an energy saving kit to a qualified Union Gas customer;
- $15 for the sale and installation of a high efficiency natural gas furnace (note: the furnace incentive was only available to HVAC partners who were willing to promote and install the ESK; this portion of the HVAC Partnership was ended in 2009 with the inclusion of high efficiency furnaces in the amended Ontario Building Code); and,
- $25 for the sale and installation of a programmable thermostat.

In 2009, HVAC partners installed 1,403 ESKs. Those partners participating in the ESK installation component of the program also qualified to apply for incentives for installations of high efficiency furnaces and programmable thermostats. Only sales to customers replacing a manual thermostat were counted as valid participants in the programmable thermostat offer.

Energy Clinics

In November of 2008 Union launched Energy Clinics in select Sears mall locations within Union's franchise area. The clinics continued in January 2009 and occurred again in October and November of 2009 in the following cities; Thunder Bay, Hamilton, Burlington, Cambridge, London and Windsor. The clinics included live weatherization demonstrations, conducted by industry experts, to promote draft proofing and air sealing during the heating season. The clinics also provided customers with free energy conservation tools, such as ESKs, programmable thermostat rebate coupons and Union Gas Wise Energy Guides. The clinic dates and locations were promoted through bill inserts, a press release**,** the Union Gas website and local newspapers.

Programmable Thermostat

Union promoted a $15 on-bill rebate (Figure 4.3) for the purchase and installation of a programmable thermostat to its customers. This rebate, offered in the form of a coupon, was distributed through a number of channels in 2009:

- Bill inserts distributed to the entire Union residential customer base
- ESK insert
- Home Depot and other retail stores
- HVAC dealers
- Union Gas website

Figure 4.3 – Programmable Thermostat: Bill Insert

As in 2008, coupons were also provided to Home Depot as a form of promotion to their customers. Residential Account Managers maintained and monitored coupon inventory levels and refilled stock. In order to receive the on-bill rebate customers had to submit their active Union Gas account number on the completed coupon, along with a copy of the bill of sale and the original UPC code. Only coupon participants who indicated they were replacing a manual set- back thermostat were eligible to participate in the program.

4.1.3 Initiatives Exited in 2009

Energy Star for New Homes

The Residential New Construction DSM program, Energy Star for New Homes was exited in 2009 due to negative TRC. The TRC level dropped with amendments to the Ontario Building Code, which increased energy efficiency standards, and reduced the savings in TRC calculations. While Union continued to educate customers on the benefits of Energy Star for New Homes in 2009, no incentives were offered to new home builders.

High Efficiency Furnaces

Since 2007 Union Gas has been reducing the focus on high efficiency furnaces due to the release of the new Ontario Building Code in 2010 requiring all furnaces sold in Canada to be high efficiency. This phase-out continued throughout 2009. This phase-out approach has prepared HVAC partners for the removal of the measure from the program in 2010, while encouraging their participation in other residential energy conservation measures.

4.1.4 Education and Awareness Efforts

Although education efforts in the residential sector do not generate TRC, affecting consumer decisions relating to the benefits of DSM through awareness is crucial to gaining, and not losing, ground. In an effort to overcome the barrier that awareness presents, Union targets educational outreach to customers to empower them to manage their energy costs. In 2009, Union continued to couple promotion of existing TRC positive measures with educational events such as Energy Clinics.

Union will continue to develop creative methods to make energy conservation education more effective.

In 2009 Union Gas continued to disseminate educational materials to inform customers and trade allies about energy efficiency through a variety of media:

- Interactive website
- Wise Energy Guides (WEG)
- InTouch monthly bill inserts
- Bi-Annual Residential HVAC Newsletter
- Energy conservation ESK events
- Energy Clinics

Residential Energy Efficient Website

The Union Gas corporate website was completely re-designed and re-launched in July of 2008. The focus of sites content has continued in 2009 to promote environmental stewardship and energy efficiency. The residential section of the website (uniongas.com/energyefficiency) has a dedicated Energy Conservation menu heading through which the following sub-segments can be viewed:

(a) Energy Saving Programs: Information and links to Union's different conservation initiatives (e.g. ESK, Drain Water Heat Recovery (DWHR), and the programmable thermostat Rebate).
(b) Education: Information and links on buying a new home, energy efficient labels and a downloadable Wise Energy Guide.
(c) Industry Links and Programs: Information on Union's major partners/stakeholders as well as links to conservation-related programs, both gas and non-gas focused, in the Ontario marketplace.
(d) Manage My Bill: 12 easy steps to help customers reduce their energy consumption and save money on their utility bill.
(e) Engee Kids: Child-friendly section explaining natural gas, its use and how to conserve it.

Features on the site include:

- Online videos (ESK, DWHR & programmable thermostat)
- Downloadable programmable thermostat rebate coupon
- Downloadable educational materials
- Comparison tools on energy costs
- Listing of upcoming ESK events held by Union Gas
- Listing of ESK depots across Union's territory that customers can visit in order to pick-up a free kit
- Online order form for customers to request an ESK and have it delivered to their home
- A "one stop shop" with links and information on different conservation rebate programs offered in the province

Wise Energy Guide (WEG)

In 2009 Union completely revised, updated and launched a new version of the WEG. The new guide included up-to-date information on code changes, information on the house as a system, tips and solutions to reduce heat loss, manage bills, and an easy-to-use checklist to assist customers achieve energy efficiency in the home. The new guide was launched at the fall energy clinics and was also

made available to all customers through the website for view and download by chapter or in its entirety.

InTouch Monthly Newsletter

Union continued to distribute monthly InTouch Newsletters in 2009. In addition to the monthly newsletter included as a bill insert in 2009, Union posted all monthly bill inserts and newsletters online as eFlyers on uniongas.com/residential. This allows a more interactive information tool that links to related sites from within the flyer (see Figure 4.6). These newsletters include an educational message on residential energy efficiency in each issue.

Bi-Annual Residential HVAC Newsletter

Union developed a spring and fall newsletter targeting residential HVAC contractors. The newsletters contained information on Union's energy efficiency programs, such as ESKs, high efficient furnaces and programmable thermostats. The newsletter also highlighted the Government of Ontario and Government of Canada ecoENERGY Retrofit grants in addition to the Ontario Power Authority's cool savings rebate program.

Dedicated HVAC Webpage

In the fall of 2008 Union Gas launched a section of the website dedicated to its HVAC partners (see Figure 4.4). One goal of this initiative is to drive further energy conservation messages and measures in the existing and retrofit markets.

Figure 4.4, HVAC Webpage: www.uniongas.com/hvac

4.2 Program Results

Accounting for 5% of 2009 DSM Savings, the Residential Home Retrofit program contributed 4,515,861 m^3 in natural gas savings with a net program TRC of $26,073,066. As identified in Table 4.4, the greatest driver of the residential results was the Energy Saving Kit.

Table 4.4 - Major Residential Savings Drivers in 2009

Initiative	2009 TRC*	2009 Units	2008 Units	2007 Units
Energy Savings Kit	$ 24,337,608	83,054	96,752	67,919
Programmable Thermostat	$ 1,910,212	17,460	9,296	22,762
High Efficiency Furnace	$ 1,083,370	14,246	8,407	14,824
Total	**$ 27,331,190**	**114,760**	**114,455**	**105,505**

*Program costs not included

Union annually commissions studies, based on ESK program delivery type, to verify that homeowners install the ESK measures. Adjustment factors applied to 2009 results reflect that only those participants who install the ESK measures, and keep them installed, are included in the savings calculations. The results of these 2009 verification studies are outlined in the Verification and Evaluation section (section 9) of this report.

4.3 Program Costs

Direct program spending in the residential market was over $2.838 million in 2009, a more than 8% reduction from 2008 spend of over $3 million which can be attributed to the removal of Energy Star for New Homes from the portfolio.

Since amendments to the Ontario Building Code resulted in the withdrawal of the Energy Star for New Homes program, Union's 2009 Residential DSM resource acquisition portfolio shifted completely to Home Retrofit programs, making Energy Savings Kits an even bigger focus for Union Gas. Within the first two quarters of 2009 Union saw a change in customer DSM participation. The source of previous years' highest ESK event participation rate, the Home Depot, saw a dramatic decline in participation while web/ online orders surpassed the total number of participants for the previous year by May 2009. This increase in online orders resulted in higher shipping costs for the delivery of online orders. Given the increased focus on ESKs, Union has undertaken a data mining exercise of Union Gas' customer database and the DSM Tracking database to identify where future DSM potential exists.

The overall residential program TRC per dollar spent for 2009 was $9.19, a slight increase from the 2008 TRC per dollar spending of $8.53.

4.4 Lessons Learned

1. Difficulty in identifying positive TRC measures for New Home Construction Market

The residential sector has few measures which generate positive TRC results and the cost of delivering programs continues to rise in relation to the TRC earned. Both the continual downward pressure on achievable savings and the stricter codes and standards for energy efficiency are diminishing measure opportunities for the residential market. Union's exploration of DSM measures for the Residential segment has heightened since the 2009 removal of the Energy Star for New Homes program and the 2010 phase out for the high efficiency furnace measure, both of which directly related to the introduction of a new Ontario Building Code standard. This underscores the unique challenge that Ontario's gas utilities are faced with in terms of identifying new viable technologies and/or strategies to incorporate into the residential DSM program portfolio using the TRC as a cost effectiveness screening test.

2. Education

Education initiatives to reach the residential sector do not in themselves generate TRC. In an effort to offer this service to Union's customer base and empower them to manage their energy costs in 2009, Union continued to couple promotion of existing positive TRC measures with educational events such as Energy Clinics. Union will continue to develop creative methods to make energy conservation education more effective.

3. HVAC Partnership

In 2009, the HVAC partnership component of the program was altered in order to provide Union's HVAC partners with the option of either installing a showerhead for $25 or distributing an ESK for $10 as part of their service or sales calls. This dual approach resulted in a significant increase in distribution of ESK's through this channel. Providing additional opportunities to existing channels will help ensure the continued success of the program.

4. Technology

Union Gas continued to offer electronic ordering for both HVAC partners and customers in 2009 in support of our ongoing platform to encourage more electronic submissions. In 2009 Union also began investing in data mining the existing customer database and the DSM tracking database in an effort to understand where the DSM opportunities lay within Union's franchise area. Union's intends to use this information to develop a more focused and targeted approach to DSM in the future.

5. Strategically Targeting ESKs to Potential Customer

Due to the high numbers of ESKs distributed by the Account Managers in 2007 and 2008, distribution through these same events in 2009 was reduced. For that reason, strategy in 2009 was to offer an incentive of $10 to HVAC partners for the distribution of the ESK during their customer calls in an effort to expand the offer to more customers. In addition to the ESK distribution incentive, the installation incentive was also increased from $15 to $25 to encourage more promotion and participation in the program. This resulted in an increased installation rate by Direct Energy, while maintaining the installation rate through HVAC partners. This shift in program traction highlights an opportunity to further explore innovative strategies to increase penetration of the market.

5. Low-Income – Helping Homes Conserve

Union's DSM plan allocated $1.573 million in 2009 for programs targeted to low-income customers.

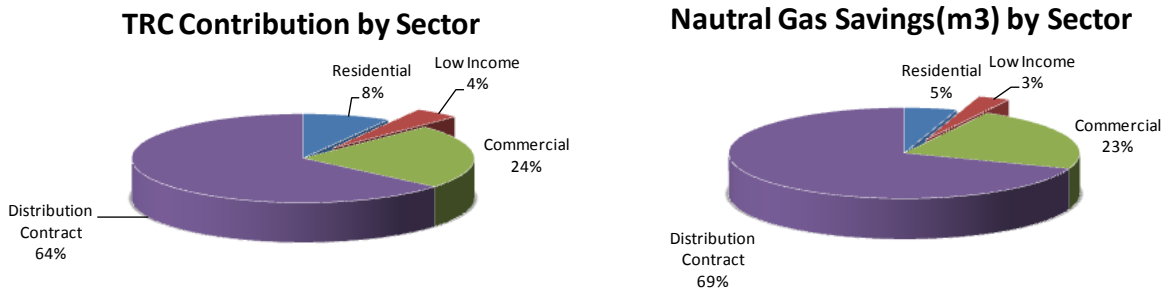


Figure 5.1, 2009 Results by Sector (Percentage)

Since the Helping Homes Conserve (HHC) program launched in the fall of 2006, it has contributed to over 5 million m³ in natural gas savings, and a net TRC of over $25 million. Table 5.1 summarizes the Helping Homes Conserve program results. In 2009, the program contributed over 2.7 million m³ of savings with a net program TRC of $13.497 million.

Table 5.2, 2009 Low-Income Program Results

Low Income	Net TRC	Natural Gas Savings (m3)	Units	Expenditures	TRC per Dollar Spent
2009 Results	**$ 13,497,387**	**2,746,452**	**87,549**	**$ 2,169,521**	**$ 6.22**
2008 Results	$ 5,948,872	1,575,000	35,699	$ 1,445,269	$ 4.12
2007 Results	$ 6,026,903	1,422,000	28,252	$ 1,161,483	$ 5.19

**Expenditures include program costs*

5.1 Program Framework

The Helping Homes Conserve program has been designed to reduce the energy burden facing low-income households. This section outlines the measures available to the low-income residential market including the Home Weatherization program, which was designed to address the building envelope more comprehensively.

5.1.1 New initiatives in 2009

Home Weatherization for Social Housing

In June of 2009, Union launched the Weatherization program directed at low-income tenants residing in social housing in the Cornwall franchise area. This initiative offered low-income tenants who paid their own utilities a free pre and post energy audit as well as building envelope upgrades including: basement insulation, wall insulation, attic insulation and draft-proofing measures. Union partnered with Cornwall and Area Housing, an affordable housing partner in the Cornwall area to bring their tenants on board with the program. Union also partnered with EnviroCentre, an installation contractor based in Ottawa to perform the energy audits and installation work in the units.

Figure 5.2, Cornwall Social Housing Exterior and interior view of installed basement insulation blanket

Based on the greatest need for efficiency upgrades, Union, Cornwall and Area Housing and EnviroCentre selected 60 row-house units within the Cornwall and Area Housing property mix to perform energy audits and building envelope upgrades. Through the audits, it was determined that the most cost-effective upgrades to the units would be realized through basement insulation and air sealing.

Overall this project was a great success and led to over 36,000 m^3 natural gas saved. In addition to the natural gas savings, tenants noted many non-energy benefits such as, “the basement is so warm and comfortable now” and “the basement is much dryer now making it more comfortable”. To celebrate the success of the project and partnerships, Union hosted a barbecue in September, 2009 for all of the tenants and their children in the Cornwall social housing community.

Figure 5.3, Cornwall Helping Homes Conserve Neighbourhood Celebration and Awareness Event

5.1.2 Existing Initiatives – Helping Homes Conserve

Union continued to provide the basic measure low-income program Helping Homes Conserve (HHC). This program offers low-income customers the free installation of energy-efficient showerheads, pipe

wrap, and a programmable thermostat. Bathroom and kitchen aerators were left with the customer for self-installation. Union continued offering the program in Hamilton, Windsor and Sudbury, and expanded into North Bay, Cornwall, Brantford and London.

This program was targeted at customers who had an income at 125%, or below, the Statistics Canada pre-tax, post-transfer Low-Income Cut-Off (LICO).

To qualify for the program, customers had to meet the following criteria:

- Pay own Union Gas bill
- Live in a low-rise dwelling (three stories or less)
- Have a gas-fired water heater (for energy-efficient showerhead & aerator)
- Have a gas-fired furnace (for programmable thermostats)

Union's main approach to the low-income market was through a targeted neighbourhood strategy. A target list of low-income customers was developed through third party postal code data that identified neighbourhoods with a high propensity of low-income residents. These postal codes were then scrubbed against Union's internal customer data and target lists were created. Once the target lists were created, grid maps were developed for technicians to visually see where clusters of low-income customers resided within a small area in each city. This led to further efficiency in the field. To ensure the privacy of customers, customer names were never used on any marketing materials and were never supplied to Union's third-party installation contractor, Annron Services Ltd (now called Eco-Fitt). Instead homes were always identified by address only.

Prior to a technician entering a neighbourhood, the identified customers were sent a direct mail educational package providing information on the program benefits and notifying them that a technician would be visiting their neighbourhood in the next few weeks. Customers then received a notification flyer two to three days prior to a technician's visit to remind them that personnel would be in the neighbourhood performing installations. Technicians would then visit the homes offering customers installations and/or booking an installation for a more convenient time. Once the installation was completed, the customer would sign an acknowledgement form and receive a programmable thermostat instruction sheet and education guide tailored to low-income customers. If a customer was not home, a door hanger would be left behind to let them know a representative from Union had visited and to encourage them to call the toll free number provided to book an appointment.

5.1.3 Education and Awareness

In 2007, Union recognized that there was a need not only to provide conservation programs directed at low-income customers, but also to educate customers on the direct benefits of energy-efficient behaviour. Union also learned that there was a lack of awareness amongst low-income customers and stakeholders on conservation programs available to them. To address these issues, Union added an education and awareness component to the HHC program.

Education Guide

In 2009, Union updated the existing education guide that was tailored to low-income customers. The revised version continued to focus on low-cost and no-cost tips for reducing home energy, but had a much simpler and clearer delivery of messages. The guide included energy tips for home heating, water heating, windows, doors & weather stripping and lighting. Every customer who participated in the HHC program or attended an energy clinic received an Education Guide with their installation.

Education Clinics

In partnership with social service agency partners, Union hosted education clinics in London, Sudbury and North Bay. Union took a different approach to the education clinics in 2009, and developed a hands-on interactive sessions for the attendees. A local Union Gas Account Manager would start the session by speaking to the attendees about various ways they can save energy in their home. After this, attendees were encouraged to try out some of the products that were discussed, such as caulking and applying window film. A mock window was available at every session for the attendees to practice on.

By hosting an interactive session which allowed the attendees to try out the products, Union was able to provide customers with the knowledge and comfort level to perform these applications in their home. At the end of the session, customers were provided with some home weatherization products such as caulking and weather-stripping for installation in their home. These products were not distributed for TRC generation but rather as an added-value for those who took the time to attend the clinic.

Local Partnerships

Establishing local partnerships in the community is critical to the success of low-income programs. These partners have extensive knowledge, experience and understanding of low-income issues, the neighbourhoods and needs of the residents. They also have trusted relationships with numerous low-income customers. To bring further awareness of Union's program to low-income customers, Union partnered with various organizations in the communities to help deliver its message and build awareness of the 2009 programs. Union partnered with the following agencies:

Hamilton

- Housing Help Centre
- Neighbour to Neighbour

Windsor

- The Corporation of the City of Windsor, Housing & Children's Services
- Windsor Essex Housing Corporation

Sudbury

- The Red Cross, Housing Division

London

- The Salvation Army of London
- Municipal Housing, London
- Families First

Cornwall

- Cornwall & Area Housing
- EnviroCentre

North Bay

- North Bay Area and Social Planning Council

Brantford

- The Corporation of the City of Brantford, Social Housing

These partners have been invaluable in generating awareness for the program by distributing Union's program brochures, speaking to their clients about the program, and by allowing Union to host education clinics for their clients.

5.2 Program Results

The Helping Homes Conserve program contributed more than 2.7 million m^3 of savings with a net program TRC of $13.5 million. 2009 saw a marked increase in customer participation, with over 18, 000 participants compared to 7,600 low-income customers in 2008 (see details in Table 5.2).

Table 5.2, Helping Homes Conserve Participant Summary

Measure	2009 Units	2008 Units	2007 Units
Energy-efficient Showerhead	20,061	7,888	7,338
Kitchen Aerator	18,478	7,694	6,363
Bathroom Aerator	18,478	7,694	6,519
Pipe Insulation	18,667	7,291	6,442
Programmable Thermostat	11,790	5,132	1,590
Weatherization	75	-	-

In comparison to 2008, the number of energy efficient showerheads delivered to participants increased by over 254%.

5.3 Program Costs

Direct program spending in the low-income market was just over $2 million, on target with the planned expenditure of $1.573 million outlined in Section 3 of this report.

5.4 Lessons Learned

1. Neighbourhood approach is an effective delivery strategy for basic measures

Delivering the HHC program primarily through a neighbourhood approach to market has proven to be an effective and efficient means of delivery to a large number of low-income customers. There is a tremendous need in Union's franchise area for similar programs. Union's current barriers to expansion are limitations in budget and a lack of workers in the field to perform installations (mainly gas fitters).

2. Costs and Savings Variances in Weatherization

In 2009, Union was able to launch the second low-income weatherization project in the Cornwall franchise area. Union focused efforts in 2009 on renters who resided in affordable housing and paid their own utilities. Having now experienced delivery of weatherization in both the private market

(2008) and affordable housing market, Union has learned valuable lessons on the variances of costs and associated savings realized through various housing stocks. The age of the home, size of the home and the current efficiency of the home play a great role in determining what type of energy saving potential there is and how much it will cost to achieve it. This variance creates challenges in setting firm participant targets and required budget on an annual basis.

3. Continuous Year to Year Program Transition

During the transition from the 2007 program year to 2008, program delivery stopped for a few months, which resulted in a loss of momentum. The transition from the 2008 to 2009 program year maintained outreach, which ensured the program continued on in existing cities to keep momentum in the field and to retain the technicians.

4. Refined Data-mining

In 2009, the data mining methodology was refined to enable a more effective and efficient process was established in the field. Data-mining refinements enabled the provision of neighbourhood maps for the field technicians that visually displayed the location of low-income customer clusters, with an accompanying list of addresses.

5. Partnership Development

Continuing to foster and develop local partnerships within the community is key to providing access to information on low-income customers, promoting the program to their clients/contacts, and gaining trust within the community. Partnerships included property management firms and municipalities, a top down approach that engendered greater program traction.

6. TRC Limits Deep Savings

Energy costs for low-income customers present a greater financial burden then for non low-income customers. Program experience has demonstrated that the energy burden for low-income customers is amplified by the inability to perform ongoing household efficiency upgrades, rendering low-income properties disproportionately inefficient compared to non-income constrained households. Providing energy efficiency upgrades for low-income customers has the potential to relieve a substantial amount of the energy burden, but using TRC as a screening tool to determine which measures are eligible for delivery limits the effectiveness of the program. In order to capitalize on these missed opportunities to both generate deeper savings and relieve the undue energy burden for low-income customers, screening options specific to the needs of low-income customers should be considered.

6. Commercial Market

Commercial energy efficiency programs accounted for 23% of DSM savings in 2009, totalling over 21 million m^3 in natural gas savings with a net program TRC of $74.008 million. Direct program spending in the commercial market was just over $4.6 million.

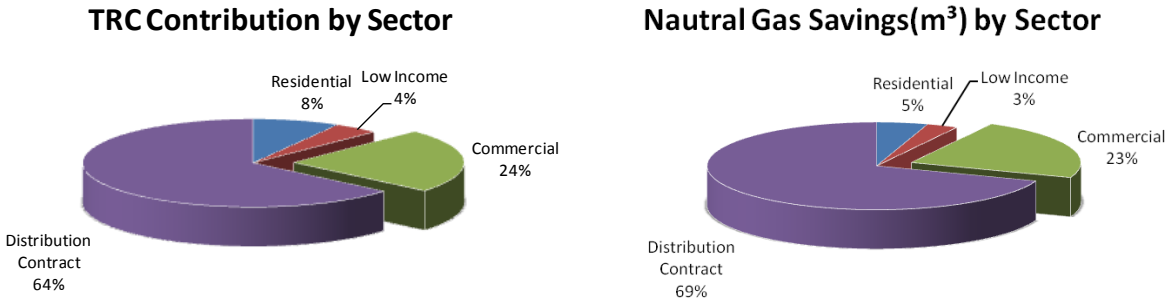


Figure 6.1, 2009 Results by Sector (Percentage)

In 2009, Union continued to offer commercial programs in the New Build Construction and Building Retrofit markets. Commercial savings driven through the building retrofit market represented 83% of sector savings in 2009. Table 6.1 summarizes the commercial market program results for 2009.

Table 6.1, 2009 Commercial Program Results

Commercial	Net TRC	Natural Gas Savings (m3)	Units	Expenditures	TRC per Dollar Spent
New Building Construction	$ 12,342,405	3,682,428	1,359	$ 965,033	$ 12.79
Building Retrofit	$ 61,665,901	17,386,687	148,318	$ 3,672,783	$ 16.79
2009 Results	**$ 74,008,306**	**21,069,115**	**149,677**	**$ 4,637,816**	**$ 15.96**
2008 Results	$ 71,428,055	13,186,116	85,095	$ 4,332,476	$ 16.49
2007 Results	$ 56,333,527	14,057,559	119,014	$ 3,255,495	$ 17.30

** Expenditures include direct program costs.*

The three incentives that delivered the largest savings in 2009 were custom projects, hot water conservation, and Energy Recovery Ventilators (ERVs). Custom projects represented the largest portion of savings with 6 million m^3 or 29% percent of the overall commercial result.

The 2009 TRC results in the Commercial sector were slightly (4%) higher than in 2008. In terms of HWC, the greatest success driver in 2009 was the pre-rinse spray nozzle which saw an increase in 2,443 units over 2008.

Given the diverse nature of commercial custom projects and their importance to the overall DSM portfolio, Union prioritized the implementation of a new process that provides quality control reviews of custom project files as recommended through the audit of Union's 2008 DSM Annual Report. Quality control management for custom projects came into effect in July of 2009.

6.1 Program Framework

Commercial programs are designed to achieve savings in the areas of space heating, water heating, and ventilation systems spanning ten customer segments – office, institutional, retail, multi-family, food service, hotel/motel, industrial, warehouse, recreational, and small agricultural within the commercial M1, M2, R01 and R10 rate classes.

Union's Account Managers market the programs directly to end-use customers and trade allies with the objective of increasing the adoption of energy efficiency technologies and processes through cost effective promotions and incentives. This section outlines the programs available to commercial customers in 2009. It covers incentives paid, program changes in 2009, existing programs and the delivery methods utilized.

6.1.1 Commercial Program – 2009 Incentives

A portfolio of energy efficient technologies was available to commercial customers in 2009 through the New Building Construction and Building Retrofit programs. Table 6.2 outlines the incentive levels for technologies supported in 2009.

Table 6.2, Financial Incentives for 2009 Programs

Technology	2009 Incentive per Unit
Energy Recovery Ventilators	$250-$1,000
Condensing Boilers	$500-$3,000
Rooftop Units	$100
Infrared Heaters	$150
Heat Recovery Ventilators	$250
High Efficiency Furnaces	$100
De-stratification Fans	$1,000
Programmable Thermostats	$40 + $40
Low Flow Pre-rinse Spray Nozzle	$150
Kitchen Ventilation	$1,000-$2,500
Custom Project Equipment Incentives	$0.05/m³ saved up to $15,000
Steam Trap Survey	50% of the cost (up to $6,000)
Design Assistance Program	$4,000 per project
Feasibility Studies	30% of the cost (up to $4,000)

6.1.2 New Initiatives in 2009

Programmable Thermostat Incentives

Learning from past missed opportunities, Union reviewed the market potential and modified the incentive structure for programmable thermostats for the 2009 DSM Program Plan. In addition to the incentive of $40 dollars per unit, Union offered a $40 installation incentive to encourage commercial building owners to replace their mercury models for energy efficient programmable thermostats. This allowed Union to successfully influence the customer and significantly increase the widespread usage of this energy saving technology. In 2009 a total of 9,320 programmable thermostats were installed.

ECO-FITT PARTNERSHIP

A strategic door-to-door program was implemented through a new partnership with a third party installation provider, Eco-fitt Corporation (Eco-fitt), in October of 2009. Through this partnership, Eco-fitt technicians approach Union customers as identified on a target list and offer the free installation of programmable thermostats. This new approach to market improved efficiency, eliminating a time lag of 6-8 weeks from order to installation, and generated a significant increase in results. In 2009, this initiative resulted in the installation of over 9300 programmable thermostats, a more than 280% increase. As part of this partnership, a web based interactive central database was also developed to capture the customer orders for more efficient program delivery and installations. This system ensures that customers are being serviced in a timely manner and that Union has accurate records.

"SWITCH THE 'STAT"

Union also sponsored the *Switch the 'Stat* Program offered by the Clean Air Foundation, a program that promotes the installation of programmable thermostats that increase energy efficiency and save money. Delivered in partnership with heating, ventilating, and air conditioning contractors, *Switch the 'Stat* also ensures the responsible recovery of older, mercury-containing thermostats. In addition to efforts by the Clean Air Foundation, Union included program promotions in direct mail and Union Account Managers communicated information to HVAC partners.

De-stratification Fans

In 2009, Union introduced a de-stratification fan program as part of the prescriptive portfolio. De-stratification fans offer the highest potential for energy savings in facilities with large stratified temperature differences; typically, the greater the ceiling height, the greater the potential for savings in the heating load. Marketing efforts included working with manufacturers and targeting potential customers, such as warehousing and industrial segments, via direct mail efforts and targeted communication.

6.1.3 Existing Initiatives

The following DSM initiatives were continued for 2009 in the commercial market. With the exception of the Design Assistance Program, these initiatives are promoted to customers in both the New Building Construction and Building Retrofit markets.

EnerSmart Program

Unified under the EnerSmart brand platform, the EnerSmart Program (ESP) program (formally known as the *Energy Savings Program)*, was designed to promote the adoption of high efficiency natural gas technologies to commercial end users as well as channel partners. Included in the ESP offerings are water heating technologies, space heating technologies, as well as audit, design, and custom programs.

There is a wide variety of technologies (listed below) that have predictable energy savings based on the size and classification of the equipment. The energy savings for these measures are prescriptive

in nature and have been accepted by the OEB in EB 2008-0385 for use by Union in calculating TRC. Within this group of OEB approved measures are a few technologies where potential energy savings differ based on the actual piece of equipment used, application, and location of installation. Union has developed an automated tool to accurately calculate the energy savings associated with these measures. The input assumptions and calculations embedded in this automated tool have been validated by the OEB for use by Union in calculating TRC. A further explanation is provided in the section titled "Quasi-Prescriptive Measures."

In order to ensure program success, Union provided incentives, technology information, and savings calculator tools in addition to support and training to educate and promote participation in the EnerSmart Program.

Water Heating

The technologies supported in this area included:

- Energy Efficient Pre-Rinse Spray Nozzles
- Showerheads and Aerators (Hot Water Conservation Program)

Energy-Efficient Pre-Rinse Spray Nozzle

In 2009 Union shifted program delivery of pre-rinse spray nozzles from partial to complete third party delivery with Ecolab Corporation (Ecolab). Expanding the partnership formed with Ecolab in 2006, was a natural progression given their large presence in the food service market, which is the target segment for this program. Union and Ecolab have worked together to establish market participant target lists and to develop co-branded marketing material largely led by Union. Ecolab's field service representatives capitalized on their long standing business relationships with food service establishments across the Union franchise area to deliver this program.

As the program has been in place since 2006, and based on the approximate 7,000 food service establishments in the Union franchise area, the result of 1,987 units in 2009 is impressive as the program nears market saturation.

Figure 6.3, Pre-rinse Spray Nozzle Promotional Literature

In addition to sole third party program delivery, Union introduced and promoted a more efficient spray nozzle in 2009; a 0.64 gallons per minute spray nozzle. 1,071 of these efficient pre-rinse spray nozzles were installed through the program in 2009. Ecolab representatives performed the installation of the pre-rinse spray nozzles ensuring the units were installed and operating as intended.

Union marketed the benefits of energy-efficient pre-rinse spray nozzles through the following communication vehicles:

- Direct mail pieces sent to 6,500 commercial kitchens
- Online submission form (approx 400 requests received)
- Industry trade magazine advertisements
- Newsletter communication through the Ontario Restaurant, Hotel, & Motel Association (ORHMA)
- New marketing material
- Trade show participation

Hot Water Conservation (HWC)

This program was designed to reduce hot water consumption, and the corresponding natural gas required to heat the water, through the installation of energy efficient showerheads and faucet aerators. Union supplied the measures at no charge to participating agencies who installed them as a part of their maintenance program. This program targeted property managers and multi-family facilities.

In 2009, there was a significant marketing effort to promote these measures in the multi-family market in core areas. Over 18,000 direct mail pieces were sent to building owners and property managers in high density areas of Windsor, Waterloo, London, Oakville and Burlington to generate interest and encourage participation. A more efficient bathroom aerator was promoted beginning in June 2009; 1.0 GPM versus the previously promoted 1.5 GPM model.

Follow up phone calls or site visits were made to confirm the installation of the units. Only confirmed installations were tracked as participants.

Demand Control Kitchen Ventilation

Working closely with manufacturers and end use customers to promote Demand Control Kitchen Ventilation (DCKV) systems, Union made this program a priority prescriptive measure in 2009. Union's efforts resulted in 42 installations, an increase of 22 units from 2008. Union marketed the benefits of DCKV through the following communication vehicles:

- Industry trade magazine advertisements
- Newsletter communication through association (ORHMA)
- Re-designed communication material
- Trade show participation

Traditional ventilation systems operate at only one speed, whereas the speed of demand control kitchen ventilation systems automatically respond to changes in cooking volume and heat, resulting in much greater efficiency. The prescriptive savings for DCKV were based on three ranges of total range hood exhaust: 0 – 4999 CFM, 5000 – 9999 CFM, and 10,000 – 14,999 CFM. The midpoint of each exhaust range was used to calculate energy savings for both gas and electricity.

As a result of the program marketing and communication efforts, Union helped grow awareness and increase adoption rates for this technology. In addition, after a program review, an increase in the incentive for the 5,000-9,999 CFM hoods to $2,500 per unit was implemented.

Space Heating Technologies-Prescriptive

Measures that fall within this category included:

- Roof top units
- High efficiency furnaces
- Enhanced furnaces (up to 299 Mbtu/h)
- Programmable thermostats

As mentioned above, the EnerSmart Program includes technologies with predictable savings by classification sizes, which are referred to as prescriptive measures. Union did not change the marketing or promotion of the prescriptive space heating technologies in 2009.

Space Heating Technologies, Quasi-Prescriptive

As described previously, the energy savings for some measures are dependent on the application and location of the installation and employ an automated savings calculator. These quasi-prescriptive measures include:

- Infrared heaters
- Boilers
- Energy Recovery Ventilator (ERV)
- Heat Recovery Ventilator (HRV)

The quasi-prescriptive tool enables an assessment of energy savings while still allowing incentive amounts to be applied consistently across the program. Relatively common efficient technologies can be promoted effectively with a scaled approach through the tool, since size and building segment will not produce like savings. In essence, the quasi-prescriptive tool is an effective TRC screening device for specific applications of a small number of technologies, as approved by the OEB in EB-2008-0385.

Custom Projects

Custom projects cover opportunities where energy savings are linked to unique building specifications or design concepts, processes or new technologies that are outside the scope of prescriptive and/or quasi-prescriptive programs. Trade allies in the design and engineering communities, and key commercial customers are the targeted audience for this program, which includes both incentives and educational support. Custom project incentives were set at $\$0.05/m^3$ saved, up to a maximum of $15,000 per project. All custom projects must pass a TRC test for cost-effectiveness before being approved.

In 2009 commercial custom projects were classified and tracked in one of the following four segments to align with free rider research completed in the previous year:

- Commercial new construction
- Commercial retrofit
- Multi-family
- Agriculture

As described in the Commercial Program introduction, Union recognized the value of the 2008 audit recommendation to improve quality control for custom projects and immediately after the audit created a quality control process. Professional engineers review every project as they are submitted to validate the savings calculations and ensure the appropriate supporting documentation is provided. This substantial process improvement resulted in a marked improvement in commercial projects as validated through the independent verification of 2009 Commercial Custom Projects (see Section 9).

Design Assistance Program (DAP)

Union continued to offer incentives under the Design Assistance Program to channel partners in the design and engineering communities as well as key commercial customers that are responsible for the design and management of multiple facilities. A $4,000 incentive per project was provided to eligible participants to assist with breaking down the financial barriers associated with modeling high efficient buildings. This program demonstrated that energy efficient options beyond the building code are cost effective to new building developers. The DAP program was available to new build construction participants only.

Feasibility Studies and Boiler Audits

Through the provision of financial support to channel partners and end use customers, energy efficiency audits are conducted to analyze the efficiency of natural gas equipment, including a review of gas, electric and water use, if applicable. An incentive equal to 30% of the audit cost (up to a maximum of $4,000) was offered for feasibility studies, and $250 per boiler audit. Given the TRC

neutral nature of audit programs, no savings are attributed, but participation rates are tracked. Feasibility studies have proven to help identify future project opportunities that ensure the sustainability of energy efficiency in the commercial sector.

6.1.5 Commercial Program – Delivery

Union has a highly skilled team of Commercial Account Managers that deliver commercial DSM programs to participants located throughout Union's franchise area. A significant effort was required to educate potential participants on the benefits that can result from participation in the energy efficiency programs. A variety of communication methods to reach potential participants are used by Union's Account Managers as outlined below.

The Channel Approach

Union's Account Managers worked with trade allies found in the engineering, design/build, distribution, manufacturing, and HVAC community. These trade allies have an influence on the technologies adopted by Union's commercial customers because they are core to the design and building of both new construction and retrofit projects. They have the ability to influence end users in a variety of ways ranging from the inclusion of energy efficient technologies in the design phase of new build and retrofit plans, to directly educating and selling upgraded efficient technologies to end users looking to replace existing equipment.

Strengthening relationships with trade allies and educating them on the benefits of higher efficiency technologies and Union's programs, the Account Managers have successfully been able to reach a far greater audience than if they had solely worked directly with end users.

Direct to Customer

As the title denotes, the 'direct-to-customer' approach of delivering DSM programs involves the Account Manager working directly with the end-user educating them on programs and potential options to improve the energy efficiency of their facilities. Direct-to-customer approaches are particularly effective for portfolio managers and/or multi-regional businesses, termed National Accounts. National Accounts have multiple property locations throughout Union's franchise area with similar design and use, such as retail chains, government buildings, schools, property management firms, and food service chains. Accounts Managers worked with these National Accounts to educate them on energy efficient technologies, Union's DSM initiatives and the benefits of participation in these programs.

In 2009, additional focus was placed on the direct-to-customer approach to program delivery. This proved to be a challenge because the focus in recent history was largely on the channel strategy mentioned previously. Recent research results indicated that, while the channel approach was very effective in gaining widespread acceptance of energy efficient measures, the level of Union's influence was not apparent to the end use customer, only to the channel partner. This was reflected in increased free rider rates as a result of research conducted in 2008. The main focus of the new communication elements for end-use consumers was to drive program awareness. The resources required to manage a direct-to-customer approach were considerable, however, early results indicated there was benefit to this approach.

The channel and direct-to-customer approach complement each other ensuring all key decision makers are influenced by, and aware of, Union's DSM programs. In order to continue driving DSM results in the commercial market, strong relationship building and on-going account management is required throughout all levels of the commercial customer chain to deliver meaningful natural gas savings.

6.2 Programs Results

The commercial sector delivered natural gas savings of over 21 million m^3 with a net program TRC of $74 million through the New Building Construction and Building Retrofit markets in 2009. As shown in Table 6.3 below, the largest commercial results came from the building retrofit market which represented 83% of TRC results.

Table 6.3 - 2009 Commercial Results by Program

Commercial Programs	Natural Gas Savings (m3s)	% of Total	Program TRC	% of Total
New Building Construction	3,682,428	17.5%	$ 12,473,188	16.7%
Building Retrofit	17,386,687	82.5%	$ 62,163,644	83.3%
Total	**21,069,115**	**100.0%**	**$ 74,636,832**	**100.0%**

Overall, 2009 TRC results in the commercial sector were 4% higher than in 2008. The two initiatives that delivered the largest savings in 2009 were custom projects and HWC, as presented in Table 6.4. HWC represented the largest portion of prescriptive savings with over $14 million in TRC and more than 134,478 units distributed in 2009.

Table 6.4, Major Commercial Savings Drivers in 2009

Program	2009 Gross TRC	2009 Units	2008 Units	2007 Units
Custom Projects	$ 19,392,484	144	165	255
Hot Water Conservation	$ 14,177,214	134,478	75,700	115,781
ERVs	$ 10,583,394	466	191	437
Condensing Boilers	$ 9,727,266	508	318	352
Programmable Thermostats	$ 9,050,246	9,320	3,307	830
Pre-Rinse Spray Nozzles	$ 4,090,269	1,987	3,349	906
Infrared Heaters	$ 3,848,577	926	931	558
HRVs	$ 1,472,557	213	50	96
DCKVs	$ 1,183,810	42	20	28
Rooftop Units	$ 557,927	1,224	830	242
Destratification Fans	$ 300,189	13	-	-
HE Furnaces	$ 252,899	356	140	562
Total	**$ 74,636,832**	**149,677**	**85,001**	**120,047**

Commercial Custom Projects continue to play a pivotal role in driving DSM Savings for Union, generating over $19 million in TRC in 2009. Figure 6.2 displays the adjusted TRC benefits, excluding cost, by resource type as a percentage of total TRC benefits from commercial custom projects in 2009.

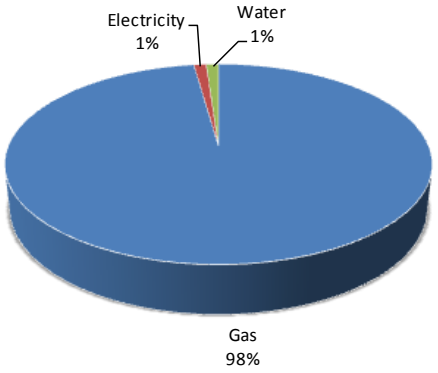


Figure 6.2, Commercial Custom Projects Benefits by Resource Type

Due to the diverse nature of custom projects, verifying claimed savings of a representative sample of projects is essential to ensuring accurate results. To this end, a new sampling methodology was developed by Summit Blue Consulting to generate optimal custom project representation for verification. Implemented in 2008, this new stratified approach captures projects representing not only a meaningful sample of claimed gas savings, but also water and electricity savings. The sampling methodology addressing these issues can be found in Appendix F. In 2009, Michaels Engineering was contracted to complete commercial custom project paper reviews utilizing the new sampling methodology. Study details and results are provided in Section 9, Verification and Evaluation.

As shown in Table 6.5, participation in the feasibility study decreased 75% in 2009, while the number of boiler audits completed decreased by 55% since 2008.

Table 6.5, Feasibility Studies and Audits

Commercial Feasibility Study and Audit Participation

	2009	2008	2007
Feasibility Studies and DAP	121	160	135
Boiler Audits	46	85	35
Total	167	245	170

6.3 Program Costs

Direct commercial program expenditures in 2009 equalled approximately $4 million, an increase of 7% from 2008. Table 6.6 summarizes the direct expenditures for the commercial sector in 2009.

Table 6.6, 2009 Commercial Program Direct Expenditures

Commercial Program	Incentives	Program Costs	Total Costs
New Building Construction	$ 834,250	$ 130,783	$ 965,033
Building retrofit	$ 3,175,040	$ 497,743	$ 3,672,783
Total	**$ 4,009,290**	**$ 628,526**	**$ 4,637,816**

Overall the commercial sector achieved a TRC of $15.96 for every direct dollar spent in 2009, a slight decrease from the TRC per dollar spent of $16.49 in 2008.

6.4 Lessons Learned

1. Incorporated Quality Control Recommendations into Program Procedures

In 2009, Union incorporated a series of recommendations from the 2008 DSM Annual Report Audit into our Commercial Custom Program Procedures. The recommendations identified opportunities to improve data collection procedures, thereby ensuring the appropriate level of detail is available during project verification. One of the most important implementations subsequent to the 2008 audit was placement of quality control professional engineers to review projects as they were entered into the tracking system.

The addition of quality control engineers improved the quality of commercial custom project submissions. It also substantially increased the time and cost of processing these submissions. In 2010, Union will be looking to better establish an appropriate balance between project validation and TRC value or alternatively consider instituting a minimum TRC savings threshold before a project qualifies for funding. Unfortunately, this could result in removing support for small commercial customers with custom projects, however there needs to be a balance between level of effort, resource requirements, and the value of the project.

2. Focused Efforts Increase Results

Some resources were re-aligned in 2009 to better enable Account Managers to focus on specific programs, which resulted in the achievement of higher installations and adoption rates. For example, additional resources were added to promote HWC in high density areas of the franchise that had previously not participated in the program to any great extent. The increased marketing and field attention produced excellent results. Union will continue to effectively manage and focus all resources to deliver DSM programs in the most optimal manner possible.

3. Balancing Channel and Direct to Customer Approaches

The commercial/industrial market has over 115,000 customers across nine market segments making it a challenging market to manage. An approach that works closely with both trade allies and end use customers balances the need to gain widespread acceptance of programs with the need to demonstrate the true value Union brings to the market with its programs, education, training, and incentives. Union will continue to refine its approach to market going forward to optimize outreach, such as targeting energy-intensive customers for increased access to Union's Commercial Account Managers and incentives.

4. Optimizing the Value Chain

The infrared heater program provided manufacturers, wholesale distributors, and HVAC contractors with marketing materials and incentives. This approach ensured everyone in the value chain was offering the efficient infrared option to end-use customers, removing barriers to this energy-saving

solution. A comprehensive account management approach that involves all of the key touch points along the value chain will continue to be investigated for appropriate technologies.

5. Targeted Segmented Marketing

In 2009, Union completed the segmentation data scrub project for the commercial sector to improve marketing's ability to target specific measures, training and technologies to appropriate end use segments. This more sophisticated approach to defining the market will facilitate a more cost-effective use of resources with the greatest likelihood of increasing the adoption of energy efficient technologies.

6. Automating Custom Project Process (DSM Tracking and Reporting Upgrade)

2009 was the first complete year utilizing the upgraded DSM Tracking and Reporting System. The electronic database and filing system allowed for project information to be inputted and instantly reviewed. This enhancement resulted in the elimination of hardcopy files being forwarded via interoffice mail, and sped up the turnaround time. The automated system allowed administrators to process 286 projects, an increase of 58 projects, in a timely manner while enabling the new quality control procedures which are very time intensive.

7. Distribution Contract Market

As noted in the Commercial Market section, Commercial and Distribution Contract (DC) market programs were aligned under one brand platform, the EnerSmart Program (ESP) program (formally known as the *EnergyWise Program).* This created a seamless, recognizable brand throughout Union's franchise. Unlike other DSM market segments, the DC market falls entirely within the scope of custom projects.

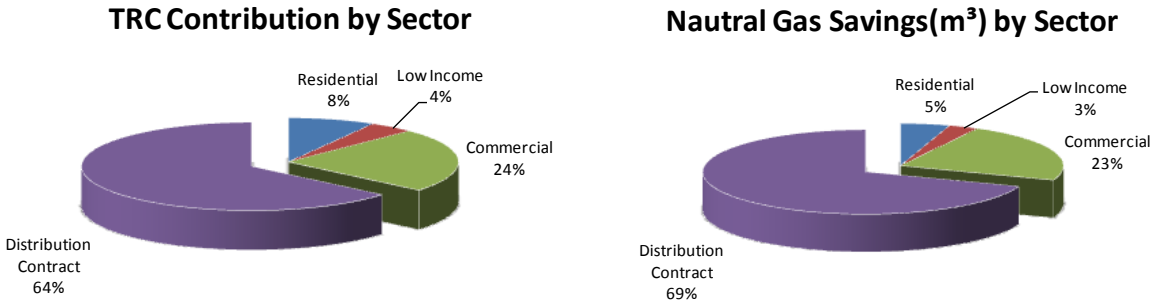


Figure 7.1, Results by Sector (Percentage)

The EnerSmart program for the DC market accounted for 64% of total TRC results in 2009, with a net program TRC of $201 million. Programs in this sector achieved 64.3 million m³ in natural gas savings. Direct program expenditures were $5.022 million.

TRC results in the DC sector were 22% higher than in 2008, and the overall number of participants in custom projects including boiler audits and feasibility studies increased from 116 participants in 2008 to 211 in 2009. Table7.1 summarizes the DC market program results for 2009.

Table 7.1, 2009 DC Results

Distribution Contact	Net TRC	Natural Gas Savings (m3)	Projects	Expenditures	TRC per Dollar Spent
2009 Results	**$ 201,056,110**	**64,272,873**	**211**	**$ 5,022,108**	**$ 40.03**
2008 Results	$ 166,246,469	40,828,151	127	$ 3,868,789	$ 42.97
2007 Results	$ 124,743,752	36,258,973	101	$ 2,539,282	$ 49.13

**Expenditures include program costs*

Enhancements made to the DSM tracking and reporting system in 2008 were implemented in 2009 to assist with the sales cycle process. The automated tracking features allow Account Managers to track feasibility studies and boiler audits and monitor the future potential energy efficiency projects identified as part of the audit process. The enhancements provide a reporting basis to allow for follow-up of potential projects, thereby encouraging the adoption of efficient processes and technologies identified within feasibility audits. In addition, it enables Union to demonstrate its influence on projects from inception to commissioning. As demonstrated in Table 7.1, 211 projects were completed through the automated DSM tracking and reporting system in 2009.

7.1 Program Framework

The DC market is not differentiated into new build and existing buildings as there is very little new build activity in this sector. The contract market is not a homogenous one, with most projects tied directly to unique processes or technology requirements. Each project is validated on a stand-alone basis by a comprehensive professional engineering review and is required to pass a TRC screening process.

The following section outlines the program available to DC participants as well as the delivery methods utilized in 2009.

The EnerSmart program was designed to achieve savings in process-specific energy applications, as well as space heating, water heating and the building envelope. This program was marketed to contract-rate customers. Account Managers marketed the program directly to customers and indirectly through trade allies, channel partners, ESCO's, engineering firms, and equipment manufacturers. They worked to cost-effectively promote energy efficiency within Union's DC customer base.

All projects were jointly delivered through Union's Account Managers and Technical Project Managers. Success was achieved by combining strong engineering expertise with the customer knowledge derived from established account-managed relationships. This approach was critical to influencing the market and achieving successful implementation of the program.

7.1.1 DC Program 2009 Incentives

Table 7.2 shows the incentive guidelines for the 2009 DC initiatives. Funding guidelines did not change from 2008 levels.

Figure 7.2, Program Incentives

Program Element	Incentive Guideline
Equipment Incentive	10% of cost (up to $30,000)
Boiler Performance Testing and Steam Plant Audits	2/3 of cost (up to $20,000)
Engineering Analysis and Energy Audits	50% of cost (up to $10,000)
Steam Trap Surveys	50% of cost (up to $6,000)
Education and Promotion	up to 100% of cost
Demonstration of New Technologies	10% of cost (up to $50,000)

Equipment incentives

Union's role in promoting and implementing energy efficient options continued to help companies control energy costs and remain competitive in a global environment. Equipment incentives were available for eligible energy saving technologies. The instability of the current economic climate is a threat to the industrial customer base in Union's franchise area. With the continual focus on cost

reduction, many industries lack the expertise to analyze potential energy saving opportunities. Union helped fill this gap, utilizing its knowledge and reputation, as well as incentives, to influence equipment choices.

Boiler performance testing and steam plant audits

Union provided customer incentives up to $20,000 to conduct a boiler performance test (boiler audit) to reduce losses from steam generation systems. The program worked to support performance testing and analyses of industrial boilers, total steam plants, thermal fluid heaters, vaporizers, furnaces and special process equipment. Analysis of the testing identified and quantified energy saving opportunities, cost saving opportunities, implementation costs and payback periods as well as NOx and CO2 impacts.

Engineering analysis and energy audits

Energy efficiency audits that included an analysis of natural gas equipment as well as electricity, compressed air, water and wastewater were incented up to $10,000. These engineering feasibility studies were used by Union to help customers formulate a priority list of energy efficiency projects geared to site-specific energy plans and budgets. Union also assisted the customer's technical staff in generating business cases to enable the customer to secure corporate capital funding for energy efficient equipment and/or process changes.

In 2009, Union continued a research pilot in the area of Metering and Targeting (M&T) to provide insight into conservation opportunities for customers. The research project provides statistically based, predictive modelling driven by variables affecting consumption and quantified change events normally hidden within typical billing data. In cooperation with Energent, the M&T service provider, Union incented two customers, who agreed to pilot the electronic monitoring systems and corresponding reporting capability. The final reports outlining the results are anticipated for Q3, 2010.

Steam trap surveys

Steam trap surveys conducted by qualified service companies were designed to reduce losses from steam distribution systems and were incented up to $6,000. Each survey identified leaking, over-sized or under-sized, blocked and/or flooded traps, as well as the need for improvements in condensate return systems.

Education and promotion

Customers have repeatedly told Union they find significant value in the training and educational material provided by the utility. As part of the rebranding efforts, all program materials were updated in 2009 to reflect the EnerSmart platform.

Union continued to expand investment in the following educational and promotional tools:

- GasWorks newsletter
- EnerSmart brochures
- EnerCase reports

- Workshops to promote the efficient use of natural gas and increase the awareness of energy saving opportunities
- Sponsorship of specific educational forums
- Promotion and attendance at independent professional development groups, trade organizations, and government workshops

GasWorks is a technology and energy conservation newsletter, designed to assist large users of natural gas to better manage their business. The newsletter not only provided links to Union's website but also various tools, calculators, an online library, and the "Ask an Expert" service provided by Union's technical resources. Throughout 2009, GasWorks maintained a distribution list of over 1,050 individuals which is slightly lower than the 1,100 individuals subscribed to the newsletter in January 2009.

Below is a summary of the most accessed articles of 2009.

- Part 1: Monitoring and Targeting Energy Use – How to Collect the Data you Need
- Summer Energy and Fuel Price Forecasts for 2009
- Selecting Flow Meters – One Size Does Not Fit All
- Steam Pipe Insulation: What is Heat Loss Costing You?
- Financial Incentives for Energy Efficiency

In 2009, Union developed two new *EnerCase* brochures, one promoting program opportunities for the Health Care segment (see Figure 7.2), and one showcasing Maple Leaf Foods. The two new *EnerCase* brochures were designed to assist in the education of DC customers.


EnerSmart Programs

enersmart
Health Care

Union Gas Incentive Programs for Health Care

Union Gas has a variety of financial incentives that can help health care facilities fuel energy projects. The EnerSmart incentives will help pay for audits, surveys and studies, identifying energy efficiency projects that save money and reduce natural gas consumption. Union Gas will also help fund the purchase and installation of new equipment that will make your facility more energy efficient. These incentives are the first step in helping you reduce energy costs and increasing your efficiency — every year the improvements remain in operation.

The energy experts at Union Gas will help identify available funding and assist you in completing the necessary applications.

Call the energy experts at Union Gas

For more information about EnerSmart financial incentives, call your Union Gas Account Manager or visit our website at: enersmart.com/largebusiness

Program elements	Funding guidelines
Investigate, Evaluate, Design	
Industrial process studies	66% of cost up to $20,000
Steam trap surveys	50% up to $6,000
Energy efficiency feasibility studies	50% up to $10,000

Figure 7.2, EnerSmart HealthCare Insert

Union's webpage, dedicated to the EnerSmart program, contains an application form, technology information, conversion calculations, technical presentations from customer meetings, and a series of

links for additional references. Included in the links are the newly developed brochures and inserts, which were added to a growing library of ***EnerSmart*** and ***EnerCase*** brochures. These brochures include customer testimonials regarding challenges encountered and solutions Union helped provide. In addition, two new video testimonials were developed in 2009 and are viewable on the website (see Figure 7.3).

Figure 7.3, Website screenshot: uniongas.com/largebusiness/energyconservation

Union hosted several workshops throughout 2009 to promote energy conservation to DC customers. These workshops were attended by 150 delegates in total. Table 7.3 provides a summary of seminars and number of participants.

Table 7.3, 2009 Seminar's Hosted by Union

Name of Seminar	# of Participants
Tap Your Steam System Training in four cities across Ontario	79
Monitoring, Targeting and Reporting workshop at Ontario Hospital Association (OHA)	3
NRCAN Dollar$ to $ense - Energy Efficiency Financing and Energy Monitoring	32
NRCAN Dollar$ to $ense - Spot the Energy Savings Opportunities	12
Sustainable Energy Plan Workshop	31

Education does not stop with customer training and seminars. Union prides itself on providing highly valued energy expertise, technical support, and resources for industrial customers. As a leader in

energy efficiency committed to working closely with government efficiency, environmental, and professional organizations, Union fully understands the latest trends and technologies, not only as potential solutions for customers, but also with the co-benefit of shared learning. Some examples of industry partnerships include:

Canadian Manufacturers and Exporters (CME)

- Union actively promoted and provided financial support to the CME's *Energy Benchmarking Study of Ontario Manufacturers* by offering assistance and a Free Energy Audit to customers participating in the program.
- In addition, Union participated in CME's Smart Program Presentations to inform Ontario manufacturers of additional energy efficiency programs offering incentives. 2009 Smart Program Presentations took place in March at the following locations:
    - Woodstock, ON
    - Brantford, ON
    - Mississauga, ON

Ontario Ministry of Small Business and Consumer Services

- The Ontario Ministry of Small Business and Customer Services developed a one day session to introduce small businesses in the Windsor, ON area to programs and funding sources, including Union's energy efficiency programs.

Consortium for Energy Efficiency (CEE)

- Through this partnership, Union networked with efficiency program administrators from across the United States and Canada on developing common approaches to advancing energy efficiency.

Energy Solutions Centre (ESC)

- Through the ESC, Union collaborated with energy utilities, municipal energy authorities, equipment manufacturers, and vendors to accelerate the acceptance and deployment of new energy-efficient, gas-fuelled technologies.

Natural Resources Canada (NRCan)

Union's involvement with NRCan includes participation in research activities, funding of industry-specific benchmark studies, and offering Union customers assistance in obtaining government funding for energy efficiency projects. Specific NRCan programs include:

- Office of Energy Efficiency (OEE)
- Canadian Industry Program for Energy Conservation (CIPEC)
- CANMET Energy Technology Centre

Other

- Union also worked Municipal Economic Development Coordinators to share information and build awareness on Union programs offerings that may benefit their constituents.

7.2 Program Results

Under the new uniformed DC EnerSmart program branding, DC Custom projects continued to generate the largest contribution to Union's DSM portfolio, with a net program TRC of $201.1 million, approximately 64.3 million m^3 in natural gas savings, and direct program spending of $5 million. With

211 TRC generating projects in 2009, Union's EnerSmart program continues to gain presence in the DC market segment.

The continued success of the DC custom program was a result of ongoing efforts over the last several years to identify and implement multi-year projects. Accomplishing an increase in DC project results despite slow economic recovery in 2009 can be attributed to increased communications, strong account relationships, and provision of technical initiatives to customers to help implement shorter term projects while identifying multi-year project opportunities.

Custom Project Analysis

The custom projects program completed 211 TRC generating projects in 2009, representing a total of 386 installed measures as shown in Table 7.4; nearly 60% increase over 2008.

Table 7.4, DC Custom Project Analysis

		Customer Investment	
Year	# of Measures	Customer Invested Capital	Capital $ / Measure
2006	232	$72,066,652	$ 310,632
2007	176	$50,242,007	$ 275,466
2008	243	$56,485,631	$ 232,451
2009	386	$94,266,048	$ 244,109

7.3 Program Results

DC represents more than half of the DSM savings achieved across the overall portfolio; given the customized nature through which these results are generated, Union conducts a third party on-site engineering study to verify the results of a representative project sampling. Diamond Engineering provided the DC on-site custom project verification services in 2009, the sample for which was pulled using the stratified sampling method established in 2008. The verification report is presented Section 9 of this report.

One particularly large project in 2009 contributed approximately $41million of TRC or 20% of the total TRC generated by DC custom projects.

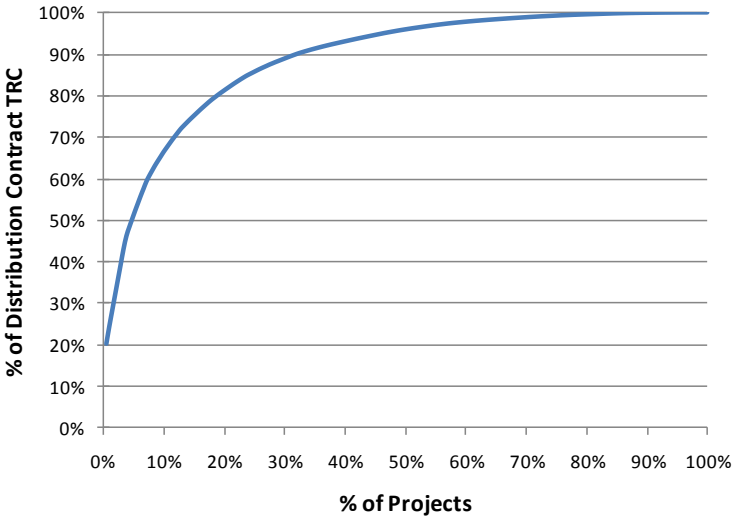


Figure 7.4, Distribution Analysis of Custom

As depicted in Figure 7.4, 20% of distribution custom projects accounted for approximately 80% of the TRC savings generated by this group of customers. These large, and in many cases multi-year projects require significant capital investment by the customer, as well as engineering resources from both the customer and Union. It is therefore logical that the customers require sizeable energy savings and reasonable payback periods in order to meet their own internal return on capital requirements to support the initial investment.

A number of these projects also had multiple utility savings, including electricity and water, which contributed to higher benefits and, therefore, a higher TRC. The level of effort and expertise required for these multi-year, multi-disciplinary projects was high for both the customer and Union. Figure 7.5 displays the adjusted TRC benefits, excluding cost, by resource type as a percentage of total TRC benefits from DC custom projects in 2009.

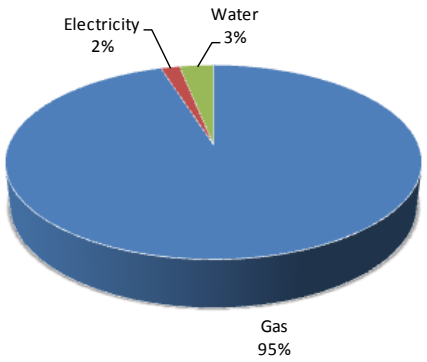


Figure 7.5, Distribution Custom Projects Benefits by Resource Type

Facility Audit Results

Facility audits continued as an important part of the EnerSmart program in 2009. Securing the necessary funding to complete facility efficiency upgrades is often difficult for customers, and many are unclear where or how to start evaluating their facility's potential for energy conservation. Feasibility studies work to effectively demonstrate the potential energy and cost savings associated with improving energy efficiency within a facility. These studies are often the basis used by the customer to build a business case that will allocate the necessary corporate funding for project implementation. 121 feasibility studies were completed in 2009, as shown in Table 7.5. Participation in the boiler audit program showed a significant increase in 2009. Tracking also shows that 43% of the participants who received a facility audit in 2006 implemented the recommended measures by 2009.

Table 7.5 – Facility Audit Participation

Facility Audit Participation				
Type	**2009 Studies Completed**	**2008 Studies Completed**	**2007 Studies Completed**	**2006 Studies Completed**
Feasibility Studies	121	95	59	56
Boiler Audits	46	17	18	29
Seminars	5	4	2	2
Total	172	116	79	87

7.4. Program Costs

Direct budget expenditures in 2009 totalled just over $5 million, almost 30% higher than 2008 levels.

Table 7.6, DC Program Expenditures

Distribution Contract Expenditures	Incentives	Program Costs	Total Costs
2009	$ 4,231,669	$ 790,439	$ 5,022,108
2008	$ 3,205,029	$ 663,760	$ 3,868,789
2007	$ 2,246,597	$ 292,685	$ 2,539,282

Table 7.6 shows that the majority of the budget in 2009 went to incentives, which were required to support the increased number of projects. However, the average incentive per project was consistent with previous years. The 32% increase in incentives was proportionate to the approximate 30% increase in the capital cost of projects.

7.4. Lessons Learned

1. Monthly communications with customers help keep energy efficiency in the forefront

Union has been able to maintain high retention and interest in monthly energy efficiency topics since launching the GasWorks monthly newsletter. The interest in the EnerSmart website more than doubled from approximately 2,000 visits in 2007 to over 4,700 in 2009.

2. Decrease in customer invested capital

Union has noticed an overall downward trend in the average capital investment per project since 2006. The effects of the high Canadian dollar and current unfavourable economic conditions have had a significant impact on the ability of customers to invest in energy efficient technologies and processes, particularly in the pulp and paper as well as manufacturing sectors. This downward trend in customer invested capital is expected to continue well into 2010. This will significantly challenge Union's ability to drive DSM as Union's budget is not sufficient to make up for this funding shortfall.

3. Shift in technology

Metering installations (both hardware and software) showed the largest single year increase since 2007 (see Table 7.7 below). Many of the technologies are experiencing either steady or upward trending. The largest decrease occurred in heat recovery installations. Union will continue to monitor results to determine trends and adjust its focus accordingly.

Table 7.8, Number of Installed Technology and Per Cent of Total Projects

Number of Installed Technology Measure (as % of Total Projects)

	2009	2008	2007	2006	Trend
Process Improvements	99 (47.8%)	56 (44.1%)	24 (24.7%)	32 (22.9%)	Increasing
Steam System Improvements	30 (14.5%)	20 (15.7%)	14 (14.4%)	10 (7.1%)	Increasing
Heat Recovery Systems	26 (12.6%)	29 (22.8%)	9 (9.2%)	52 (37.1%)	Variable
Space & Water Heating System Improvements	26 (12.6%)	24 (18.9%)	5 (5.2%)	19 (13.6%)	Variable
Application Specific Measurements & Controls	11 (5.3%)	9 (7.1%)	5 (5.2%)	4 (2.9%)	Increasing

4. Research: tying research to program design

Previously initiated and ongoing Metering and Targeting (M&T) projects have been augmented by a series of research projects undertaken in 2009 with future program design in mind. In addition, the Building Optimization Program Design (BOPD) project also began in 2009. For the BOPD project, Union hired an industry leader in building optimization/commissioning program design to provide expertise and guidance as Union embarks on developing a building optimization program.

5. Partnerships

Union has partnered with a series of entities in 2009 to offer feasibility studies and coaching opportunities to our customers, including:

Canadian Manufacturers and Exporters (CME)

- Union facilitated customer participation in the CME's Energy Benchmark Program, which provided many customers the guidance necessary to complete the survey tool. Customers who participated in the benchmark study were offered a free energy audit. Free energy

audits enabled those customers who were experiencing capital resource constraints to assess the current state of energy use and identify opportunities for improved efficiency.

360 Energy

- Union funded and partnered with 360 Energy to bring their Sustainability Energy Plan development expertise to customers. The Sustainable Energy Plan is an assessment of energy efficiency opportunities, which can be used as a starting point for capital investments. An introduction to the techniques used for developing a Sustainable Energy Plan was provided to customers who attended a training session, and those interested in creating their own plan were offered incentive funding towards the cost of 360 Energy services.

Universities/EnerSmart for Business with University of Windsor and McMaster University

Establishing a partnership with universities has numerous mutually beneficial outcomes, not only does it build energy management expertise for participating students, it also provides Union's commercial industrial clients with free energy audits. Union Gas initially partnered with the Department of Civil and Environmental Engineering at the University of Windsor. This unique business-academia partnership has received accolades and recognition from students, the academic world, and media across Canada. Due to the great success of the University of Windsor partnership, Union Gas initiated a new partnership with McMaster University.

Through the partnerships with both the Universities of Windsor and McMaster, Union's Energy Audit Program targets local schools as well as businesses with free energy audits to enable the reduction of energy use and greenhouse gas emissions. Union Gas provided $500,000 in funding for the program and donated the specialized equipment needed to conduct the audits.

As with the University of Windsor partnership, McMaster is responsible for managing the program and reporting on program results. The Energy Audit Program is part of Union Gas' broader EnerSmart program, which offers incentives to its larger commercial and industrial customers to implement projects that will use natural gas more efficiently and lower operating costs.

In 2009, Union Gas helped provide the University of Windsor with two databases (ARC & ARTT) to assist with data management of identified potential saving measures. Additionally, Union Gas also provided equipment training, educational presentations as well as government training sessions to both universities to share industry specific knowledge and tools that address energy savings in industrial applications with students. Performing the energy audits is a practical lesson for the students, entrenching what they have learned and improving their overall engineering approach to conserve energy.

The partnership has significantly contributed to capacity building for Ontario, and real life experience for participating engineering students. It functions as a way to immerse each student involved into a post-graduation mindset.

6. Automating Project Processing, DSM Tracking and Reporting Upgrade

2009 was the first complete year that the upgraded Account Information Management System (AIMs) was in operation. The electronic database and filing system allowed for project information to be input and instantly reviewed. This enhancement resulted in the elimination of hardcopy files being forwarded via interoffice mail, and sped up the turnaround time. 386 project measures were put through the enhanced DSM Tracking system, 143 more than 2008. This reduced the administrative process burden despite the increase in project files.

8.0 Market Transformation (Drain Water Heat Recovery)

As determined through the OEB Decision with Reasons August 25, 2006, EB-2006-0021, $1 million was allocated for Market Transformation in 2007, with a 10% escalating factor for each subsequent year of the three year plan. Converse to Resource Acquisition programs, Market Transformation is not required to pass the TRC test; however, it is expected to meet clear criteria as outlined in the approved Market Transformation Scorecard for 2009 (Table 8.1 below). The utility is "entitled to an incentive payment of up to $0.5 million in each year of the multi-year plan based on the measured success of market transformation programs."

8.1 Program Framework

In 2007, Union selected Drain Water Heat Recovery (DWHR) for the purpose of Market Transformation (MT) specific to the residential new construction market. Given its well defined and sizeable market, the residential new construction segment provides a significant opportunity for increasing the technology's overall market penetration.

Residential builders and contractors are the program's primary focus for training. Incentives are offered to builders that participate in the program. Union worked collaboratively with channel partners, such as HVAC contractors and the DWHR manufacturer to provide effective education and program participation incentives. As in previous years, the 2009 MT scorecard tracked results against a number of different metrics to effectively measure program performance. Weighed against survey and tracking results from 2008, these metrics included:

- Number of participating builders as tracked by the program;
- Overall number of units installed as a percentage of housing starts as tracked by the program and available housing starts for Union's franchise;
- Customer awareness of the technology as determined through a market survey; and,
- Builder's awareness of the technology as determined through a market survey.

To enhance transformation of the DWHR market, Union revised its program approach in 2009 to focus on direct marketing and one-to-one builder outreach. By switching to a direct marketing approach Union was able to target builders on a more personal level which resulted in increased take-up and participation within the builder community. Direct marketing approaches included:

- Builder education sessions held in all major regions across Union's franchise area
- Co-branded marketing communication material with individual builders
- Working closely with builders to install units and signage in their model homes
- Outreach at local builder events (i.e. golf tournaments, local home builder association gatherings, etc)

Union also provided builder incentives to encourage the purchase and installation of units including:

- $400 builder purchase incentive

8.2 Program Results

Table 8.1 outlines the results achieved in the MT program in 2009.

Table 8.1, 2009 Market Transformation Scorecard Results

Element	Metrics	50%	100%	150%	Outcome	Score	Result
ULTIMATE OUTCOMES	Participating Builders	51	61	71	101	**22.5/15**	150%
	Units Installed as a percentage of 2009 housing starts*	9% 983	11% 1,202	12% 1,311	>15% 1564	**82.5/55**	150%
MARKET EFFECTS	Customer Awareness Survey	32%	36%	40%	30%	**3.75/15**	25%
	Builder Knowledge Survey	75%	79%	83%	70%	**0/15**	0%
TOTAL:						**108.75/100**	**109%**

Having surpassed 100% of the performance metrics, Union achieved the maximum MT incentive payout for 2009. Union undertook the following initiatives to promote DWHR to builders resulting in over 100 participating builders and a total of 1,563 installations. This is equivalent to having a unit installed in more than 15% of all new build homes (a six percentage point increase over 2008).

While Union celebrates the successful increase in participating builders and DWHR installations, the 2009 market surveys indicate an opportunity to improve upon awareness of DWHR units and the program among customers and builders. It is worth noting market transformation programs are typically designed to influence consumer behaviour and attitudes through education. Based on DSM program delivery experience, Union has found that education, awareness, and outreach are critical components to program success, be they market transformation or resource acquisition. Although customer and builder surveys will be removed from the 2010 Market Transformation scorecard, Union will continue to invest in public and strategic outreach to promote the efficiency benefits achieved through drain water heat recovery.

Efforts to promote the program and educate builders in 2009 included:

- An updated and dedicated builder section on Union Gas' website (www.uniongas.com/builder);
- Provision of editorials in builder magazines;
- Direct mail-out was sent to builders promoting the DWHR unit;
- Dissemination of a 'New Build Package' that included a DWHR brochure, construction heating brochure, and customer attachment process sell sheet in a branded folder;
- Co-branded builder model home signage with various partnering builders; and,
- Co-branded personalized sell sheets with various partnering builders.

Promotional and educational efforts targeting customers included:

- Union Gas Website;
- Customer DWHR video; and,
- Customer brochure;

Participated as a sponsor/exhibitor in the following:

- Ontario Home Builders Association (OHBA) Builder Forum;
- OHBA Annual Conference;
- Construct Canada/Homebuilder and Reno Forum;
- Habitat for Humanity sponsorships (including sponsorship of local homes, working with Habitat for Humanity and a local manufacturer to get a DWHR unit installed in all homes, volunteer days to raise awareness, editorials, press releases, recognition on corporate and local websites, signage on local build sites, etc);
- London OHBA golf tournament; and,
- Five HBA golf tournaments;

Advertised in Ontario Home Builder Builder/Architect Magazine as well as the following newspapers:

- Belleville Intelligencer;
- Brantford Expositor;
- Guelph Mercury;
- Hamilton Spectator;
- London Free Press;
- North Bay Nugget;
- Sudbury Northern Life;
- Sudbury Star;
- Sault Ste. Marie Star;
- Thunder Bay Chronicle-Journal;
- Thunder Bay Source; and,
- Windsor Star.

Facilitated the following:

- Builder sessions;
- ENERGY STAR® for New Homes workshops; and,
- Home Builder Association (HBA) meetings.

8.3 Program Costs

Union budgeted $1.210 million for its 2009 MT activity and spent $ 1,175,296 (as shown in Table 8.2). Union was able to mitigate some costs related to builder and contractor training sessions as a result of leveraging partnerships with EnerQuality, HBA, other internal Union Gas departments and various individual builders.

Table 8.2, 2009 Market Transformation Expenditures

Market Transformation Expenditures		Incentives	Program Costs	Total Costs
	2009	$ 825,330	$ 349,966	$ 1,175,296
	2008	$ 750,261	$ 346,516	$ 1,096,777
	2007	$ 405,645	$ 364,527	$ 770,172

8.4 Lessons Learned

1. Lack of awareness with plumbers

Union has recognized that even though builders are accountable for the homes, in many cases, the plumber is the decision maker, installer and/or influencer for this type of product. Since inception of the MT program, all efforts have focused exclusively on getting the builder to adopt the technology. Going forward, more emphasis will be placed on educating plumbers and working with manufacturers to properly train them on how to do installations. By developing a bias with plumbers, one of the major influences of the technology, Union hopes to create a pull strategy that will increase builder adoption and rapidly transform the marketplace.

9. Verification and Evaluation – 2009 Results

In order to provide assurance of the accuracy of claimed savings, Union undertakes several verification studies each year. These evaluation projects are designed to ensure that the claimed participation and installation rates for technologies delivered through Union's programs are accurate. An assessment of claimed savings obtained through custom projects is also completed. Union also carries out related research to better understand the overall impacts and benefits that specific programs provide its customers.

9.1 Residential Verification Studies

Union undertook two verification studies for 2009 residential programs to ensure the savings claimed were accurate, as listed in Table 9.1. Specifically, the residential verifications determined the number of ESK elements that were installed and remained installed for 2009. The purpose of these studies was to provide an 'adjustment' or 'persistence' factor to be applied to the claimed savings. Union also uses the collected information to assess areas of program success and areas for potential improvement.

Table 9.1, Summary of Program Verifications for Residential Programs

Program	Title	Source	Objective
ESKs: Union Direct and HVAC Partnership	Final Report Following an Audit in 2009 of the Union Gas ESK Residential Push (2009)	Beslin Communications Group Inc.	·Validate consumers' awareness of products received; ·Verify product installation; ·Gauge customer satisfaction with equipment; ·Determine influence of channel partners in end-users' decisions to install products; and, ·Gauge performance of channel partners in delivery of products and ESK information.
ESKs: Home Depot	Final Report Following an Audit in 2009 of the Union Gas ESK Home Depot Initiative (2009)	Beslin Communications Group Inc.	·Validate accuracy of information tracking sent by partners claiming incentices; ·Verify product installation; ·Understand end-users' knowledge of energy efficiency, purchase motivations, and general satisfaction; ·Determine factors affecting end-users' decisions to install; and, ·Opinions on other incentives Union Gas could offer

The results of these evaluations are summarized below.

9.1.1 ESK Program Audit

In order to fully assess the impact of the ESK program on participants, Union completed a verification study to determine the rate at which measures were installed and persisted post installation with participants. As with all DSM portfolio results, TRC associated with claimed savings contribute to Union's SSM and LRAM calculations. The results from the verification study of the ESK program are presented in Table 9.2 and Table 9.3.

Table 9.2, Adjustment Factors: Union Gas Direct and HVAC

Measure	Measure Verified Installed	Measure Remained Installed	Adjustment Factor
Bath Aerator	54%	76%	41.05%
Kitchen Aerator	66%	88%	58.42%
Pipe Wrap	76%	95%	72.63%
Showerheard	74%	91%	67.37%

Table 9.3, Adjustment Factors: Home Depot

Measure	Measure Verified Installed	Measure Remained Installed	Adjustment Factor
Bath Aerator	66%	90%	59.47%
Kitchen Aerator	74%	96%	70.53%
Pipe Wrap	69%	95%	65.79%
Showerheard	78%	94%	73.68%

The higher adjustments factors for the Union Gas Direct and HVAC campaign indicate that the additional efforts made to promote the initiative through those partners had a positive impact on results.

9.2 Custom Project Verification Study

Each year Union conducts a verification study of both the commercial and industrial sector custom projects. In completing this work, Union looks to validate that the claimed savings reported through the custom project process are accurate and recommend any adjustment factors to the savings if required.

In 2007 Summit Blue developed sampling methodology for the annual engineering review of custom DSM projects based, at a minimum, on the OEB's TRC guide for electric CDM requirements for sampling and incorporated the following:

- A review of verification protocols developed by a number of organizations;
- The application of industry practice as demonstrated in program evaluation; and,
- The application of appropriate assumptions for a custom project program.

Upon recommendation from the 2007 independent audit of Union's Annual Report, and in discussion with the EAC, Union and Enbridge Gas Distribution (EGD) jointly contracted Summit Blue Consulting to develop revisions to the 2007 sampling methodology to address the following:

- Develop an approach that considers the significance of water and electricity savings;
- Adjust strata sizes to meet practical challenges in field applications, specifically census samples for the largest projects; and,
- Accommodate two sample assessment periods per year towards more real time evaluations.

These issues were addressed and the revised sampling method developed by Summit Blue for verification in 2008.

9.2.1 Commercial Custom Project Verification Study

As noted previously, Summit Blue was contracted to extract a sample group for commercial custom project verification using the methodology established in 2008. The objective was to provide a sample of projects in order to verify the TRC benefits not only of natural gas but also electricity and water.

Due to differences across customers and project types, the commercial sector was stratified by segment: new construction, building renovation and multi-residential. For each segment, a sample was first drawn from the projects with the largest electricity TRC benefits, and then each stratum was filled out from projects with the largest gas TRC benefits. Water benefits were not used as a basis for sampling because they contributed only 5% of TRC. Also, their addition would have increased sample size and costs while yielding little additional information. Table 9.4 summarizes the commercial sector sample selected based on the size and strata recommended in the report.

Table 9.4, Sample of Commercial Custom Projects for Verification

		Total Sample Claimed Adjusted Benefits			
Rate Class	**Random Sample**	**NATURAL GAS**	**WATER**	**ELECTRICITY**	**TRC**
Agriculture & Small Industrial Top 3	3	$ 298,526	$ -	$ -	$ 259,214
Agriculture & Small Industrial Remainin	6	$ 74,719	$ 16,908	$ -	$ 89,495
Building Retrofit Top 6	5	$ 10,533,824	$ 143,148	$ 391,526	$ 10,179,898
Building Retrofit Remaining	11	$ 5,845,079	$ 25,396	$ 8,768	$ 5,594,275
New Construction	3	$ 631,989	$ -	$ 23,726	$ 623,325
Total Projects Sampled	**28**	**$ 17,384,136.62**	**$ 185,451.55**	**$ 424,020.44**	**$ 16,746,206.38**
Commercial Custom Total Project Population	**144**	$ 19,756,466.74	$ 316,786.20	$ 594,546.57	$ 18,848,882.86
% of population sampled	**19%**	**88%**	**53.6%**	**71.3%**	**88.8%**

*Pre-audited savings claims

Summit Blue recommended a paper review study for the verification of savings results for these 23 commercial projects. The deliverables of the paper verification studies included:

- A description of approach used to measure savings (including gas, water, and electricity savings, incremental cost and measure life, as appropriate);
- The results of telephone interviews to confirm installation and operating conditions;
- A detailed review of the methodology used by the evaluator to project the savings that would result from project implementation;
- A discussion of reasons (if applicable) for any variance between the projected and the evaluated savings;
- The evaluator's recommended adjustment factors based on the variance between the projected and evaluated savings claims; and,
- A report on calculation methodologies employed and recommendations for refinements for future savings calculations.

Summit Blue Consulting pulled a sample total of 28 projects for the 2009 Commercial Custom Projects program, 24 of which were verified by Michaels Engineering. Due to the significantly larger than average size that the additional four projects represented, and that they were all installed at the same location for the same customer, Union elected to take the precaution of conducting an on-site

verification. Since Diamond Engineering was already in the field verifying Union's DC Custom Projects, it seems reasonable to ask them to perform the on-site verification of the four project files in question. Diamond Engineering then provided the verification reports for these project files to Michael's Engineering to be included in the 2009 Commercial Custom Project Verification Report. Overall, the 2009 Commercial Custom Project sample represented more than 88% of the total net TRC commercial custom project claimed savings.

The number of verifications completed exceeded the OEB requirement in EB-2006-0021 Decision with Reasons that "the projects selected for assessment should consist of a random selection of at least 10% of the total volume savings for all custom projects and consists of a minimum number of five projects."

The commercial project verification study resulted in adjustment factors to the projected savings of 1.38 for natural gas, 0.52 for electricity and 0.97 for water. The results of the Commercial Custom Project Verification Study adjustment factors are shown in Table 9.5 below.

Table 9.5, Commercial Custom Project Verification Study Results

Commercial				
	Claimed Savings	**Audited Savings**	**Realization Rate**	
Natural Gas Savings	10,776,740	14,820,463	138%	m3/year
Water Savings	26,709,860	25,783,193	97%	litres/year
Electricity Savings	1,116,729	580,927	52%	kWh/year
Incremental Cost	$ 1,385,645	$ 1,264,601	91%	

Through the audit process it was determined that projects undertaken at one customer site were significantly different from the sample population, and as a result it was treated as an outlier and had a different adjustment factor applied specifically to it. The adjustments for the remainder of the sample population was revised by the auditor as shown in Table 9.6 below.

Table 9.6, Commercial Custom Project Audit Adjustments

Variable	**2009 Draft Annual Report**	**2009 Audit Value**
Natural Gas	137.5%	50%
Electricity	52.02%	50%
Water	96.5%	50%
Costs	91.2%	91.26%

These revised results were applied to all commercial custom savings projects as recommended by the 2009 Auditor.

9.2.2 DC Custom Project Verification Study

As described in the sampling for commercial custom project verification study above, a sample of thirteen custom projects from the DC sector was selected for the verification study based on the revised Summit Blue methodology.

The sample for the industrial sector is stratified based on size of projects for gas, water, and electricity savings. Projects were randomly selected from among the largest projects based on TRC benefits from gas savings and the largest based on electricity savings. Table 9.7 summarizes the DC sector custom projects that were randomly selected sample based on three strata.

Table 9.7, Sample of DC Custom Projects for Verification

		Total Adjusted Benefits			
Rate Class	**Random Sample**	**NATURAL GAS**	**WATER**	**ELECTRICITY**	**Adjusted TRC**
Top Natural Gas Saving Projects	3	$ 13,004,123	$ 537,204	$ -	$ 13,237,910
Top Electricity and Water Saving Projects	3	$ 47,221,922	$ 4,168,930	$ 8,149,169	$ 55,350,407
Remaining Natural Gas Saving Projects	4	$ 1,561,749	$ -	$ -	$ 1,147,645
Remaining Electricity and Water Saving Projects	3	$ 2,130,888	$ -	$ 168,168	$ 2,073,094
Total Projects Sampled	**13**	**$ 63,918,681.23**	**$ 4,706,134**	**$ 8,317,337**	**$ 71,809,057**
Custom Distribution Contract Total Project Population	**211**	**$ 206,554,183**	**8,954,381**	**13,198,440**	**$ 206,300,101**
% of population sampled		**31%**	**53.6%**	**63.0%**	**34.8%**

On-site verification studies were conducted by Diamond Engineering. In completing this work, the focus was to validate whether or not the claimed savings reported through the custom projects process were accurate and recommend any adjustment factors to the savings if required. The objectives of the on-site verification studies included:

- Determination of whether savings calculations in the application were reasonable based on information available at the time made;
- Review of the assumptions used in calculations;
- Discussion of variations between projected savings and measures savings;
- Recommend adjustment factors based on the variance between the projected and evaluated savings;
- Verify that the equipment installation was completed at the site; and,
- Review of the confidence interval levels achieved in the results and statement of errors for calculations.

The thirteen randomly-selected projects represent almost 35% of the total adjusted TRC savings of all DC custom projects.

Table 9.8, DC Custom Project Verification Study Results

Distribution Contract				
	Claimed Savings	Audited Savings	Realization Rate	
Natural Gas Savings	42,782,735	47,679,973	111%	m3/year
Water Savings	631,076,970	661,606,577	105%	litres/year
Electricity Savings	22,633,414	22,372,116	99%	kWh/year
Incremental Cost	$ 11,172,104	$ 11,178,057	100%	

Through the Audit process, new adjustment factors were recommended and have been applied to the Distribution Contract savings projects as shown in table 9.9 with the exception of the adjustment for one project which was determined to be an outlier and was not applied to the remaining project population.

Table 9.9, DC Custom Project Audit Adjustments Study Results

Account	2009 Annual Report	2009 Audit Value
Natural Gas	111.5%	105.92%
Electricity	98.9%	47.50%
Water	104.8%	110.27%
Costs	100%	100.24%

10. 2009 Measures Evaluation Research

During the course of the three-year DSM framework, Union agreed to provide a review of each measure within the portfolio. This was roughly expected to translate into one-third of the measures for each year of the plan.

In 2009 based on priorities set in consultation with the Evaluation and Audit Committee, Union undertook four evaluation research projects detailed in Table 10.1

Table 10.1 – 2009 Evaluation Research Measure Priorities

2009 Evaluation Studies			
Name of Study	Consulting Firm	Status	Appendix
Process Evaluation of Commercial and Distribution Contract Custom Projects	PA Consulting Group	Phase One Complete	F
Evaluation of Energy and Heat Recovery Ventilator Input Assumptions	Nexant	Complete	G
Infrared Heater Study	Enermodal	Complete	H
Custom Measure Effective Useful Life Study	Diamond Engineering	In progress	N/A

Under the current three year framework, Union's measure evaluation strategy has been to undertake evaluations of a third of each program measure included in the 2007-2009 DSM Plan annually. 2009 presented an unusual challenge because many of the evaluation projects that might have been undertaken in 2009 were precluded by the OEB commissioning and approving of Navigant Consulting Inc.'s, *Measures and Assumptions for Demand Side Management (DSM) Planning*, dated April 16, 2009. In light of the Navigant Report, in consideration of 2008 audit recommendations, and in

consultation with members of the EAC, four evaluation projects were identified as priorities for 2009. The following three Evaluation reports have been provided to the EAC for review:

- Evaluation of Energy Recovery Ventilator and Heat Recovery Ventilator input assumptions;
- Infrared Heater Base Case Fan Removal Impact Study; and,
- Process Evaluation of Commercial and DC Custom Project Programs.

The fourth study, Custom Measure Effective Useful Life Study for common DC custom project technologies, is still in progress and will be forwarded for review upon completion.

Of the four evaluation projects, the Process Evaluation Study on Commercial and DC Custom Project Programs has a longer timeline and will be completed in three phases. The initial phase, which included the delivery of two program logic models and a detailed evaluation plan in 2009, is scheduled for completion by the end of 2010.

Executive Summaries for the Phase One Commercial and DC Custom Project Process Evaluation Study is included in the appendices, as are those of the Energy and Heat Recovery Ventilator and Infrared Heater Base Fan Removal Study. The outcomes of the Energy and Heat Recovery Ventilator technology evaluation and the Natural Gas Infrared Heater studies are reflected in the LRAM results, which are presented in Appendix C.

Establishing priority measures for 2010 evaluation will be determined in consultation with the EAC as recommendations from the 2009 become available.

11. Lost Revenue Adjustment Mechanism (LRAM)

The LRAM was approved by the Ontario Energy Board to allow Union to recover the lost distribution revenues associated with DSM activity. These lost revenues are calculated for each rate class impacted by DSM energy efficiency programs using the following formula:

Σ(Rate Class Volume Reduction x 2009 Delivery Rate) = LRAM Claimed

For 2009, the year one LRAM amount is $0.989 million based on 2009 delivery rates and natural gas savings of 92.6 million m³. The 2009 LRAM statement is detailed in Table 11.1 below.

Table 11.1, 2009 LRAM Statement

UNION GAS LIMITED
Lost Revenue Adjustment Mechanism
2009 Audited Results

Line No.	Particulars	Audited Volumes (10^3 m^3)		2009 Delivery Rates ($/$10^3$ m^3)		Revenue Impact ($)
		(a)		(b)		(a) x (b) x 50%
	South					
1	M1 Residential	6,067	$	48.500	$	147,120
2	M1 Commercial	6,355	$	48.500	$	154,104
3	M1 Industrial	537	$	48.500	$	13,026
4	M2 Commercial	9,233	$	41.989	$	193,836
5	M2 Industrial	2,065	$	41.989	$	43,348
6	M4 Industrial	3,631	$	9.602	$	17,434
7	M5 Industrial	6,411	$	16.182	$	51,870
8	M7 Industrial	1,218	$	3.812	$	2,322
9	T1 Industrial	26,146	$	0.846	$	11,060
10		61,662			$	634,118
	North					
11	01 Residential	1,196	$	100.505	$	60,078
12	01 Commercial	1,464	$	93.755	$	68,623
13	10 Commercial	1,206	$	67.834	$	40,899
14	10 Industrial	5,072	$	62.218	$	157,782
15	20 Industrial	4,652	$	3.280	$	7,630
16	100 Industrial	17,353	$	2.255	$	19,565
17		30,942			$	354,576
18	Total	92,604			$	988,695

The 2009 LRAM statement has been prepared using the 2010 input assumptions approved by the OEB. These assumptions are detailed in Appendix A. LRAM results by measure are shown in Appendix C. In EB-2006-0021 Decision with Reasons the Board ruled that the year one impact of DSM activities is equivalent to 50% of the savings in the first year in which the DSM measure is undertaken.

12. Shared Savings Mechanism (SSM)

For 2009, Union is eligible to earn an SSM incentive based on DSM program results. The SSM incentive payment has been calculated using the methodology approved by the Board in the DSM Generic Hearings. The SSM incentive is calculated using the following structure:

- For TRC savings between 0 percent and 25 percent of the TRC target, an SSM payout shall equal $900 for each 1/10 of 1 percent of target reached;
- For TRC savings between 25 percent and 50 percent of the TRC target, an SSM payout shall equal $225,000 plus $1,800 for each 1/10 of 1 percent of target reached;
- For TRC savings between 50 percent and 75 percent of the TRC target, an SSM payout shall equal $675,000 plus $6,300 for each 1/10 of 1 percent of target reached; and,
- For TRC savings greater than 75 percent of the TRC target, an SSM payout shall equal $2,250,000 plus $10,000 for each 1/10 of 1 percent of target reached up to the maximum SSM annual cap of $8,500,000.

For 2009, the 2008 SSM incentive cap of $8,695,500 million will increase annually by the Ontario CPI as determined in October of the preceding year. For 2009, the annual SSM incentive cap increased to **$8,921,583**. This was reflective of the 2.3% annual increase of the Ontario CPI as determined October 2008. Union's net TRC calculation for 2009 is shown in Table 12.1.

Table 12.1, 2009 Net TRC Calculation

Home Retrofit	$ 27,331,190		
Residential Program Costs	$ (1,258,124)		
Net Residential TRC		**$ 26,073,066**	
Low Income	$ 13,649,689		
Low Income Program Costs	$ (152,303)		
Net Low Income TRC		**$ 13,497,387**	
New Building Construction	$ 12,473,188		
Building Retrofit	$ 62,163,644		
Commercial Program Costs	$ (628,526)		
Net Commercial TRC		**$ 74,008,306**	
Distribution Contract	$ 201,846,549		
Distribution Contract Program Costs	$ (790,439)		
Net Distribution Contract TRC		**$ 201,056,110**	
Salaries	$ (5,166,952)		
Research & Evaluation	$ (1,142,387)		
Administration	$ (69,928)		
Total Other Program Costs		**$ (6,379,267)**	
Net TRC			**$ 308,255,602**

Union's TRC target for 2009 is $220,163,371 million, which results in the following SSM calculation:

SSM = {[(Net TRC – (Range End Percentage x Target TRC)) / (Payout Increment Percentage x Target TRC)] x Incremental Payout} + Base Payout

= {[(Net TRC – (75% x $220,163,371)) / (0.1 % x $220,163,371)] x $10,000} + $2,250,000

= {[($308,255,602 - $165,122,528)/$220,163] x $10,000} + $2,250,000

= $650.12 x $10,000 + $2,250,000

= $8,751,232

The TRC breakdown by measure is included in Appendix D. The SSM breakdown by rate class is shown in Table 12.2 below.

Table 12.2 – 2009 SSM by Rate

UNION GAS LIMITED
Shared Savings Mechanism
2009 Audited Results

Line No.	Particulars		Amount[1] ($)
	South		
1	M1 Residential	$	941,236
2	M1 Commercial	$	637,298
3	M1 Industrial	$	56,936
4	M2 Commercial	$	882,345
5	M2 Industrial	$	183,970
6	M4 Industrial	$	340,348
7	M5 Industrial	$	426,894
8	M7 Industrial	$	126,158
9	T1 Industrial	$	2,240,804
10		$	5,835,988
	North		
11	01 Residential	$	188,444
12	01 Commercial	$	152,840
13	10 Commercial	$	103,582
14	10 Industrial	$	434,293
15	20 Industrial	$	322,488
16	100 Industrial	$	1,713,596
17		$	2,915,244
18	Total	$	8,751,232

[1] The allocation is based on 2009 TRC achieved by rate class

13. DSM in 2010

The primary purpose of this Annual Report is to review program outcomes from the preceding year. The secondary purpose is to establish targets for 2010. This section focuses on the items that need to be considered for 2010.

The new TRC target for 2010 is based upon the 2009 results as outlined in EB-2006-0021 Decision with Reasons:

> Parties to this partial settlement further agree that there will be an annual TRC target. The parties agree to phase in a formula over the next three years which will set this target, as described below, by averaging the Utility's actual audited TRC results over the previous three years and applying to this figure an escalation factor equal to 1.5 times the amount by which the utility's budget is increased. The parties agree to phase in the aforementioned formula over the three year plan, beginning with an agreed upon target for each utility in 2007 which, for Union was $188 million.
>
> In addition, the parties agree that, in the event the avoided costs used by the utility are, at a later date, updated, the actual audited results from previous years used to calculate the target will be adjusted to reflect these updated avoided costs.

Based upon the TRC target guidelines outlined above, the 2010 TRC target is calculated utilizing audited 2007, 2008, and 2009 results adjusted to reflect 2010 avoided costs.

Table 13.1, 2010 Target

2007 Audited Results with 2010 Avoided Costs	2008 Audited Results with 2010 Avoided Costs	2009 Audited Results with 2010 Avoided Costs
$ 115,994,005	$ 241,127,498	269,634,561

2010 TRC Target
$ 240,256,491

13.1 2010 Avoided Costs

The Avoided Costs for 2010 are attached in Appendix E.

Appendix A: Input Assumptions (SSM) and (LRAM)

		Measure	SSM Input Assumptions							LRAM Input Assumptions		
			Equipment Life	Free Rider Rate	Adjustment Factor	Natural Gas Savings (m3)	Water Savings (L)	Electricity Savings (kWh)	Incremental Cost	Free Rider Rate	Adjustment Factor	Natural Gas Savings (m3)
HR	ESK	Install - Faucet Aerator - Bath	10	33%	-	6	2,004	-	$2	33%	-	6
		Install - Faucet Aerator - Kitchen	10	33%	-	23	7,797	-	$2	33%	-	23
		Install - Pipe Insulation - 2m	10	4%	-	18	-	-	$2	4%	-	18
		Install - Showerhead - 1.25gpm	10	10%	-	63	10,570	-	$13	10%	-	27
	ESK	Pull - Faucet Aerator - Bath	10	33%	59.47%	6	2,004	-	$2	33%	59.47%	6
		Pull - Faucet Aerator - Kitchen	10	33%	70.53%	23	7,797	-	$2	33%	70.53%	23
		Pull - Pipe Insulation - 2m	10	4%	65.79%	18	-	-	$2	4%	65.79%	18
		Pull - Showerhead - 1.25gpm	10	10%	73.68%	63	10,570	-	$13	10%	73.68%	27
		Pull - Showerhead - 1.5gpm	10	10%	73.68%	46	6,334	-	$6	10%	73.68%	20
	ESK	Push - Faucet Aerator - Bath	10	33%	41.05%	6	2,004	-	$2	33%	41.05%	6
		Push - Faucet Aerator - Kitchen	10	33%	58.42%	23	7,797	-	$2	33%	58.42%	23
		Push - Pipe Insulation - 2m	10	4%	72.63%	18	-	-	$2	4%	72.63%	18
		Push - Showerhead - 1.25gpm	10	10%	67.37%	63	10,570	-	$13	10%	67.37%	27
		Push - Showerhead - 1.5gpm	10	10%	67.37%	46	6,334	-	$6	10%	67.37%	20
		Furnace - High Efficiency	18	90%	-	385	-	-	$650	90%	-	385
		Thermostat - Programmable	15	43%	-	53	-	54	$25	43%	-	53
LI	ESK	HHC - Faucet Aerator - Bath	10	1%	41.05%	6	2,004	-	$2	1%	41.05%	6
		HHC - Faucet Aerator - Kitchen	10	1%	58.42%	23	7,797	-	$2	1%	58.42%	23
		HHC - Pipe Insulation - 2m	10	1%	-	18	-	-	$2	1%	-	18
		HHC - Showerhead - 1.25gpm exist 2.0-2.5	10	5%	-	66	10,886	-	$13	5%	-	46
		HHC - Showerhead - 1.25gpm exist 2.6+	10	5%	-	116	17,168	-	$13	5%	-	88
		Thermostat - Programmable - HHC	15	1%	-	53	-	54	$25	1%	-	53
		Weatherization	23	0%	-	Actual	Actual	Actual	Actual	0%	-	Actual
NBC		Condensing Boiler	25	5%	-	Quasi	Quasi	Quasi	Quasi	5%	-	Quasi
		Custom - Agriculture	Actual	0%	-	Actual	Actual	Actual	Actual	0%	-	Actual
		Custom - New Construction	Actual	33%	-	Actual	Actual	Actual	Actual	33%	-	Actual
		DCKV Dinner House (10000 - 15000 cfm)	15	5%	-	18,924	-	49,102	$20,000	5%	-	18,924
		DCKV Fast Casual (< 5000 cfm)	15	5%	-	4,801	-	13,521	$10,000	5%	-	4,801
		DCKV Full Menu (5000 - 9999 cfm)	15	5%	-	11,486	-	30,901	$15,000	5%	-	11,486
		Destratification Fan	15	10%	-	Quasi	Quasi	Quasi	Quasi	10%	-	Quasi
		ERV	20	5%	-	Quasi	Quasi	Quasi	Quasi	5%	-	Quasi
		Infrared Heating	20	33%	-	Quasi	Quasi	Quasi	Quasi	33%	-	Quasi
		HRV	20	5%	-	Quasi	Quasi	Quasi	Quasi	5%	-	Quasi
		Rooftop Unit	15	5%	-	255	-	-	$375	5%	-	255
BR		Condensing Boiler	25	5%	-	Quasi	Quasi	Quasi	Quasi	5%	-	Quasi
		Custom - Agriculture	Actual	0%	-	Actual	Actual	Actual	Actual	0%	-	Actual
		Custom - Multifamily	Actual	42%	-	Actual	Actual	Actual	Actual	42%	-	Actual
		Custom - Retrofit	Actual	59%	-	Actual	Actual	Actual	Actual	59%	-	Actual
		DCKV Dinner House (10000 - 15000 cfm)	15	5%	-	18,924	-	49,102	$20,000	5%	-	18,924
		DCKV Fast Casual (< 5000 cfm)	15	5%	-	4,801	-	13,521	$10,000	5%	-	4,801
		DCKV Full Menu (5000 - 9999 cfm)	15	5%	-	11,486	-	30,901	$15,000	5%	-	11,486
		Destratification Fan	15	10%	-	Quasi	Quasi	Quasi	Quasi	10%	-	Quasi
		ERV	20	5%	-	Quasi	Quasi	Quasi	Quasi	5%	-	Quasi
		Furnace - High Efficiency	18	17.5%	-	Quasi	Quasi	Quasi	Quasi	17.5%	-	Quasi
		Furnace Enhanced (up to 299 Mbtu/h) - NG	18	17.5%	-	Quasi	Quasi	Quasi	Quasi	17.5%	-	Quasi
		HRV	20	5%	-	Quasi	Quasi	Quasi	Quasi	5%	-	Quasi
		HWC - Faucet Aerator - Bath - 1.0gpm	10	10%	-	11	2,371	-	$1.50	10%	-	11
		HWC - Faucet Aerator - Bath - 1.5gpm	10	10%	-	4	1,382	-	$2	10%	-	4
		HWC - Faucet Aerator - Kitchen	10	10%	-	16	5,377	-	$2	10%	-	16
		HWC - Showerhead - 1.25gpm	10	10%	-	45	8,824	-	$13	10%	-	45
		HWC - Showerhead - 1.5gpm	10	10%	-	33	5,228	-	$6	10%	-	33
		Infrared Heating	20	33%	-	Quasi	Quasi	Quasi	Quasi	33%	-	Quasi
		Pre-Rinse Spray Nozzle - Full - 0.64gpm	5	0%	-	1,286	252,000	-	$88	0%	-	1,286
		Pre-Rinse Spray Nozzle - Full - 1.24gpm	5	12%	-	886	170,326	-	$60	12%	-	886
		Pre-Rinse Spray Nozzle - Limited - 0.64gpm	5	0%	-	339	66,400	-	$88	0%	-	339
		Pre-Rinse Spray Nozzle - Limited - 1.24gpm	5	12%	-	190	36,484	-	$60	12%	-	190
		Pre-Rinse Spray Nozzle - Other - 0.64gpm	5	0%	-	318	62,200	-	$88	0%	-	318
		Pre-Rinse Spray Nozzle - Other - 1.24gpm	5	12%	-	200	38,383	-	$60	12%	-	200
		Rooftop Unit	15	5%	-	255	-	-	$375	5%	-	255
		Thermostat - Programmable - Ware, Ind, Rec, Agr	15	20%	-	538	-	266	$110	20%	-	538
		Thermostat - Programmable - Multifamily, Food Service	15	20%	-	223	-	156	$110	20%	-	223
		Thermostat - Programmable - Office, Institution, Education	15	20%	-	211	-	112	$110	20%	-	211
		Thermostat - Programmable - Retail, Hotel	15	20%	-	82	-	63	$110	20%	-	82
DCM		Custom - Agriculture	Actual	0%	-	Actual	Actual	Actual	Actual	0%	-	Actual
		Custom - DC	Actual	56%	-	Actual	Actual	Actual	Actual	56%	-	Actual

Appendix B: 2009 DSM Spending by Program

Sector	Program	Program Costs	Incentive Costs	Total
	*Home Retrofit	$ 1,258,124	$ 1,580,325	$ 2,838,449
	Total Residential	**$ 1,258,124**	**$ 1,580,325**	**$ 2,838,449**
Low Income	Low Income	$ 152,303	$ 2,017,218	$ 2,169,521
	Total Low Income	**$ 152,303**	**$ 2,017,218**	**$ 2,169,521**
Commercial	*New Building Construction	$ 130,783	$ 834,250	$ 965,033
	*Building Retrofit	$ 497,743	$ 3,175,040	$ 3,672,783
	Total Commercial	**$ 628,526**	**$ 4,009,290**	**$ 4,637,816**
Distribution Contract	Distribution Contract	$ 790,439	$ 4,231,669	$ 5,022,108
	Total Distribution Contract	**$ 790,439**	**$ 4,231,669**	**$ 5,022,108**
Market Transformation	DWHR	$ 349,966	$ 825,330	$ 1,175,296
	Total Market Transformation	**$ 349,966**	**$ 825,330**	**$ 1,175,296**
Total Program Sector Costs		**$ 3,179,358**	**$ 12,663,832**	**$ 15,843,190**
Other Direct Program Costs	Salaries & Expenses			$ 5,166,952
	Research & Evaluation			$ 1,142,387
	Administration			$ 69,928
Total 2009 DSM Spending				**$ 22,222,457**

* Program costs allocate between new and retrofit markets based on percentage of incentives paid in each program

Appendix C: 2009 LRAM Results by Measure

2009 LRAM Results					
Program	**Measure**		**Net Natural Gas Savings (m3) Per Unit**	**Units**	**Net Natural Gas Savings (m3)**
			(a)	**(b)**	**(c) = (a) * (b)**
Home Retrofit	ESK	Install - Faucet Aerator - Bath	4	1,984	7,976
		Install - Faucet Aerator - Kitchen	15	1,984	30,573
		Install - Pipe Insulation - 2m	17	1,984	34,284
		Install - Showerhead - 1.25gpm	24	1,984	47,443
	ESK	Pull - Faucet Aerator - Bath	2	45,331	108,373
		Pull - Faucet Aerator - Kitchen	11	45,331	492,688
		Pull - Pipe Insulation - 2m	11	45,331	515,346
		Pull - Showerhead - 1.25gpm	18	45,267	797,552
		Pull - Showerhead - 1.5gpm	13	64	833
	ESK	Push - Faucet Aerator - Bath	2	35,739	58,977
		Push - Faucet Aerator - Kitchen	9	35,739	321,741
		Push - Pipe Insulation - 2m	13	35,739	448,541
		Push - Showerhead - 1.25gpm	16	35,702	575,157
		Push - Showerhead - 1.5gpm	12	37	441
	Furnace - High Efficiency		39	14,246	548,471
	Thermostat - Programmable		30	17,460	527,467
	Total Home Retrofit			**363,922**	**4,515,861**
Low Income	ESK	HHC - Faucet Aerator - Bath	2	18,478	45,056
		HHC - Faucet Aerator - Kitchen	13	18,478	245,799
		HHC - Pipe Insulation - 2m	18	18,667	332,646
		HHC - Showerhead - 1.25gpm exist 2.0-2.5	44	5,963	260,583
		HHC - Showerhead - 1.25gpm exist 2.6+	84	14,098	1,178,593
	Thermostat - Programmable - HHC		52	11,790	618,621
	Weatherization			75	65,154
	Total Low Income			**87,549**	**2,746,452**
New Building Construction	Condensing Boiler			113	668,330
	Custom - Agriculture			1	29,776
	Custom - New Construction			11	55,570
	DCKV Dinner House (10000 - 15000 cfm)		17,978	-	-
	DCKV Fast Casual (< 5000 cfm)		4,561	8	36,488
	DCKV Full Menu (5000 - 9999 cfm)		10,912	1	10,912
	Destratification Fan			2	12,636
	ERV			315	2,426,697
	Infrared Heating			311	141,446
	HRV			80	175,330
	Rooftop Unit		242	517	125,243
	Total New Building Construction			**1,359**	**3,682,427**
Building Retrofit	Condensing Boiler			395	2,569,934
	Custom - Agriculture			5	77,465
	Custom - Multifamily			11	68,746
	Custom - Retrofit			116	5,795,965
	DCKV Dinner House (10000 - 15000 cfm)		17,978	2	35,956
	DCKV Fast Casual (< 5000 cfm)		4,561	17	77,536
	DCKV Full Menu (5000 - 9999 cfm)		10,912	14	152,764
	Destratification Fan			11	101,646
	ERV			151	966,414
	Furnace - High Efficiency			347	118,133
	Furnace Enhanced (up to 299 Mbtu/h) - NG			9	2,807
	HRV			133	303,096
	HWC - Faucet Aerator - Bath - 1.0gpm		10	20,290	200,871
	HWC - Faucet Aerator - Bath - 1.5gpm		4	28,981	104,332
	HWC - Faucet Aerator - Kitchen		14	40,471	582,782
	HWC - Showerhead - 1.25gpm		41	40,946	1,658,313
	HWC - Showerhead - 1.5gpm		30	3,790	112,563
	Infrared Heating			615	255,978
	Pre-Rinse Spray Nozzle - Full - 0.64gpm		1,286	568	730,448
	Pre-Rinse Spray Nozzle - Full - 1.24gpm		776	544	422,218
	Pre-Rinse Spray Nozzle - Limited - 0.64gpm		339	314	106,446
	Pre-Rinse Spray Nozzle - Limited - 1.24gpm		166	244	40,611
	Pre-Rinse Spray Nozzle - Other - 0.64gpm		318	189	60,102
	Pre-Rinse Spray Nozzle - Other - 1.24gpm		175	128	22,426
	Rooftop Unit		242	707	171,271
	Thermostat - Programmable - Warehouse, Industrial, Recreation, Agricu		430	4,770	2,053,008
	Thermostat - Programmable - Multifamily, Food Service		178	321	57,266
	Thermostat - Programmable - Office, Institution, Education		169	2,521	425,545
	Thermostat - Programmable - Retail, Hotel		66	1,708	112,045
	Total Building Retrofit			**148,318**	**17,386,687**
Distribution Contract Markets	Custom - Agriculture			25	5,342,705
	Custom - DC			186	58,930,168
	Total Distribution Contract Markets			**211**	**64,272,873**
Total Program Results				**601,359**	**92,604,300**

Appendix D: 2009 TRC Results by Measure

2009 TRC Results								
Program		Measure	TRC Per Unit	Units	Gross TRC	Program Costs	Net Program TRC	
			(a)	(b)	(c) = (a) * (b)	(d)	(e) = (c) - (d)	
Home Retrofit	ESK	Install - Faucet Aerator - Bath	$ 26.28	1,984	$ 52,137			
		Install - Faucet Aerator - Kitchen	$ 105.51	1,984	$ 209,338			
		Install - Pipe Insulation - 2m	$ 43.27	1,984	$ 85,843			
		Install - Showerhead - 1.25gpm	$ 257.77	1,984	$ 511,418			
	ESK	Pull - Faucet Aerator - Bath	$ 15.08	45,331	$ 683,810			
		Pull - Faucet Aerator - Kitchen	$ 74.02	45,331	$ 3,355,564			
		Pull - Pipe Insulation - 2m	$ 27.81	45,331	$ 1,260,606			
		Pull - Showerhead - 1.25gpm	$ 186.85	45,267	$ 8,457,977			
		Pull - Showerhead - 1.5gpm	$ 127.88	64	$ 8,184			
	ESK	Push - Faucet Aerator - Bath	$ 10.00	35,739	$ 357,300			
		Push - Faucet Aerator - Kitchen	$ 61.08	35,739	$ 2,183,069			
		Push - Pipe Insulation - 2m	$ 30.90	35,739	$ 1,104,326			
		Push - Showerhead - 1.25gpm	$ 169.84	35,702	$ 6,063,727			
		Push - Showerhead - 1.5gpm	$ 116.47	37	$ 4,309			
	Furnace - High Efficiency		$ 76.05	14,246	$ 1,083,370			
	Thermostat - Programmable		$ 109.41	17,460	$ 1,910,212			
	Total Home Retrofit			**363,922**	**$ 27,331,190**	**$ 1,258,124**	**$ 26,073,066**	
Low Income	ESK	HHC - Faucet Aerator - Bath	$ 14.77	18,478	$ 272,964			
		HHC - Faucet Aerator - Kitchen	$ 90.26	18,478	$ 1,667,787			
		HHC - Pipe Insulation - 2m	$ 44.62	18,667	$ 832,916			
		HHC - Showerhead - 1.25gpm exist 2.0-2.5	$ 283.37	5,963	$ 1,689,731			
		HHC - Showerhead - 1.25gpm exist 2.6+	$ 483.62	14,098	$ 6,818,024			
	Thermostat - Programmable - HHC		$ 190.02	11,790	$ 2,240,328			
	Weatherization			75	$ 127,940			
	Total Low Income			**87,549**	**$ 13,649,689**	**$ 152,303**	**$ 13,497,387**	
New Building Construction	Condensing Boiler			113	$ 2,013,022			
	Custom - Agriculture			1	$ 281,044			
	Custom - New Construction			11	$ 153,740			
	DCKV Dinner House (10000 - 15000 cfm)		$ 75,189.40	-	$ -			
	DCKV Fast Casual (< 5000 cfm)		$ 15,130.78	8	$ 121,046			
	DCKV Full Menu (5000 - 9999 cfm)		$ 43,677.48	1	$ 43,677			
	Destratification Fan			2	$ 29,560			
	ERV			315	$ 7,673,591			
	Infrared Heating			311	$ 1,368,111			
	HRV			80	$ 553,737			
	Rooftop Unit		$ 455.82	517	$ 235,660			
	Total New Building Construction			**1,359**	**$ 12,473,188**	**$ 130,783**	**$ 12,342,405**	
Building Retrofit	Condensing Boiler			395	$ 7,714,244			
	Custom - Agriculture			5	$ 243,287			
	Custom - Multifamily			11	$ 251,559			
	Custom - Retrofit			116	$ 18,462,854			
	DCKV Dinner House (10000 - 15000 cfm)		$ 75,189.40	2	$ 150,379			
	DCKV Fast Casual (< 5000 cfm)		$ 15,130.78	17	$ 257,223			
	DCKV Full Menu (5000 - 9999 cfm)		$ 43,677.48	14	$ 611,485			
	Destratification Fan			11	$ 270,629			
	ERV			151	$ 2,909,802			
	Furnace - High Efficiency			347	$ 246,711			
	Furnace Enhanced (up to 299 Mbtu/h) - NG			9	$ 6,189			
	HRV			133	$ 918,820			
	HWC - Faucet Aerator - Bath - 1.0gpm		$ 51.73	20,290	$ 1,049,510			
	HWC - Faucet Aerator - Bath - 1.5gpm		$ 23.46	28,981	$ 679,912			
	HWC - Faucet Aerator - Kitchen		$ 97.51	40,471	$ 3,946,367			
	HWC - Showerhead - 1.25gpm		$ 195.39	40,946	$ 8,000,341			
	HWC - Showerhead - 1.5gpm		$ 132.21	3,790	$ 501,085			
	Infrared Heating			615	$ 2,480,466			
	Pre-Rinse Spray Nozzle - Full - 0.64gpm		$ 3,862.96	568	$ 2,194,162			
	Pre-Rinse Spray Nozzle - Full - 1.24gpm		$ 2,310.12	544	$ 1,256,703			
	Pre-Rinse Spray Nozzle - Limited - 0.64gpm		$ 953.28	314	$ 299,331			
	Pre-Rinse Spray Nozzle - Limited - 1.24gpm		$ 453.83	244	$ 110,735			
	Pre-Rinse Spray Nozzle - Other - 0.64gpm		$ 888.12	189	$ 167,855			
	Pre-Rinse Spray Nozzle - Other - 1.24gpm		$ 480.34	128	$ 61,484			
	Rooftop Unit		$ 455.82	707	$ 322,267			
	Thermostat - Programmable - Warehouse, Industrial, Recreation, Agricu		$ 1,509.55	4,770	$ 7,200,553			
	Thermostat - Programmable - Multifamily, Food Service		$ 600.80	321	$ 192,855			
	Thermostat - Programmable - Office, Institution, Education		$ 543.01	2,521	$ 1,368,940			
	Thermostat - Programmable - Retail, Hotel		$ 168.56	1,708	$ 287,898			
	Total Building Retrofit			**148,318**	**$ 62,163,644**	**$ 497,743**	**$ 61,665,901**	
Distribution Contract Markets	Custom - Agriculture			25	$ 36,638,163			
	Custom - DC			186	$ 165,208,386			
	Total Distribution Contract Markets			**211**	**$ 201,846,549**	**$ 790,439**	**$ 201,056,110**	
Total Program Results				**601,359**	**$ 317,464,261**	**$ 2,829,392**	**$ 314,634,869**	
Other Direct Program Costs						$ 6,379,267		
2009 Total Net TRC							**$ 308,255,602**	

Appendix E: 2010 Avoided Costs

2010 AVOIDED COSTS

Inflation Factor	1.9%
Discount Rate	10%

	Gas Avoided Costs					
	Residential/Commercial				Industrial	
	Baseload (m3)		Weather-Sensitive (m3)		Baseload (m3)	
	Rate	NPV	Rate	NPV	Rate	NPV
1	0.28805	0.28805	0.29045	0.29045	0.27964	0.27964
2	0.32765	0.58591	0.33207	0.59233	0.31775	0.56850
3	0.33450	0.86236	0.34036	0.87362	0.32600	0.83793
4	0.34086	1.11845	0.34683	1.13420	0.33219	1.08751
5	0.34733	1.35568	0.35342	1.37559	0.33851	1.31871
6	0.35393	1.57545	0.36013	1.59920	0.34494	1.53289
7	0.36066	1.77903	0.36697	1.80635	0.35149	1.73130
8	0.36751	1.96762	0.37395	1.99824	0.35817	1.91510
9	0.37449	2.14232	0.38105	2.17600	0.36497	2.08536
10	0.38161	2.30416	0.38829	2.34068	0.37191	2.24308
11	0.38886	2.45408	0.39567	2.49322	0.37898	2.38920
12	0.39624	2.59296	0.40319	2.63454	0.38618	2.52455
13	0.40377	2.72161	0.41085	2.76545	0.39351	2.64993
14	0.41145	2.84080	0.41865	2.88672	0.40099	2.76609
15	0.41926	2.95120	0.42661	2.99906	0.40861	2.87369
16	0.42723	3.05348	0.43471	3.10312	0.41637	2.97336
17	0.43535	3.14822	0.44297	3.19953	0.42428	3.06570
18	0.44362	3.23599	0.45139	3.28883	0.43234	3.15124
19	0.45205	3.31729	0.45997	3.37156	0.44056	3.23047
20	0.46064	3.39261	0.46871	3.44820	0.44893	3.30388
21	0.46939	3.46238	0.47761	3.51919	0.45746	3.37188
22	0.47831	3.52701	0.48669	3.58496	0.46615	3.43487
23	0.48739	3.58689	0.49593	3.64588	0.47501	3.49322
24	0.49665	3.64235	0.50535	3.70232	0.48403	3.54728
25	0.50609	3.69373	0.51496	3.75460	0.49323	3.59735
26	0.51571	3.74133	0.52474	3.80303	0.50260	3.64374
27	0.52550	3.78543	0.53471	3.84789	0.51215	3.68671
28	0.53549	3.82627	0.54487	3.88946	0.52188	3.72652
29	0.54566	3.86411	0.55522	3.92796	0.53180	3.76340
30	0.55603	3.89916	0.56577	3.96362	0.54190	3.79756

	Water and Electricity Avoided Costs			
	Residential/Commercial/Industrial			
	Water (m3)		Electricity (kWh)	
	Rate	NPV	Rate	NPV
1	1.91250	1.91250	0.08325	0.08325
2	1.94884	3.68417	0.08483	0.16037
3	1.98586	5.32538	0.08645	0.23182
4	2.02359	6.84573	0.08809	0.29800
5	2.06204	8.25414	0.08976	0.35931
6	2.10122	9.55883	0.09147	0.41610
7	2.14115	10.76745	0.09321	0.46871
8	2.18183	11.88707	0.09498	0.51745
9	2.22328	12.92425	0.09678	0.56260
10	2.26552	13.88505	0.09862	0.60443
11	2.30857	14.77511	0.10049	0.64317
12	2.35243	15.59962	0.10240	0.67906
13	2.39713	16.36342	0.10435	0.71231
14	2.44267	17.07097	0.10633	0.74311
15	2.48908	17.72643	0.10835	0.77164
16	2.53638	18.33362	0.11041	0.79807
17	2.58457	18.89609	0.11251	0.82256
18	2.63367	19.41715	0.11465	0.84524
19	2.68371	19.89984	0.11682	0.86625
20	2.73471	20.34699	0.11904	0.88572
21	2.78666	20.76121	0.12131	0.90375
22	2.83961	21.14492	0.12361	0.92045
23	2.89356	21.50039	0.12596	0.93593
24	2.94854	21.82968	0.12835	0.95026
25	3.00456	22.13472	0.13079	0.96354
26	3.06165	22.41729	0.13328	0.97584
27	3.11982	22.67906	0.13581	0.98723
28	3.17910	22.92156	0.13839	0.99779
29	3.23950	23.14620	0.14102	1.00757
30	3.30105	23.35429	0.14370	1.01663

Appendix F: Abridged Phase One Report
Commercial and Distribution contract Custom Project Process Evaluation, PA Consulting Group

Union selected PA Consulting Group (PA) to conduct a comprehensive evaluation of the Commercial and Distribution Contract Custom Project Programs in 2010. Answering questions concerning how best to position the program to achieve continuing energy savings targets is an important step towards enhancing program success. A formal and thorough process evaluation will assess the current suite of offerings/services and how they are delivered, identify gaps in the offerings, and develop recommendations to fill these gaps. This *market facing* component of the process evaluation will solidify Union Gas's ability to reach a greater proportion of the cost-effective program savings potential. In addition, the process evaluation will examine *internal program processes* to explore ways the Custom Program process might be improved. Optimizing the processes would increase efficiency, reduce transaction costs, and improve Program cost-effectiveness.

Overview of the Process Evaluation

The process evaluation for the Commercial and Distribution Contract Custom Programs is organized in three distinct phases, and is intended as a formal and systematic effort to assess the Custom Programs for the purposes of improving design, delivery, and savings performance. The three phases are:

1. Phase One: process evaluation plan & logic model
2. Phase Two: project implementation
3. Phase Three: final report & implementation workshop.

This Program Logic Model Report and Evaluation Plan covers Phase One of the Process evaluation. In this plan, we include:

- A discussion of the activities conducted and program-related documents that were reviewed as part of Phase One
- Logic models for the Commercial and Distribution Contract Custom Programs that show the linkages between program barriers, resources, activities, participants in the activities, outputs, short-term outcomes, and intermediate-term outcomes (and identifying potential external influences)
- A table listing the logic model outcomes and identification of relevant measurement indicators and potential data collection approaches
- An evaluation plan that links researchable questions to measurement indicators and proposed Phase Two data collection activities
- A plan for reporting the final results and presenting them in a workshop as part of Phase Three.

Commercial and Distribution Contract Custom Projects Program Logic Models

The Custom Programs undertake a number of activities to capture energy savings. Union runs the program internally; therefore, the development and refinement of the program infrastructure is a major activity of the program.

Based on review of the program-relevant documents, and the interviews conducted with Union Gas staff involved with the Custom Programs as part of the kick-off meeting, the following summarizes: (1) barriers to program delivery; (2) program resources; and, (3) the primary program activities. These elements are depicted in the two logic models developed for the Commercial and Distribution Contract Custom Programs where they are organized by the sequence of program activities, and then further broken out by market-facing (external) and internal process activities. For each activity the participants are identified, and anticipated short-term outcomes (typically within a program year), and intermediate-term outcomes (typically within a three-year cycle of DSM programming) are indicated.

Program Resources

The summary below of resources (inputs) available to the program categorizes separately external (market facing) resources and internal (program process) resources (1-1). Also shown is the differentiation between program delivery to Distribution Contract and Commercial customers.

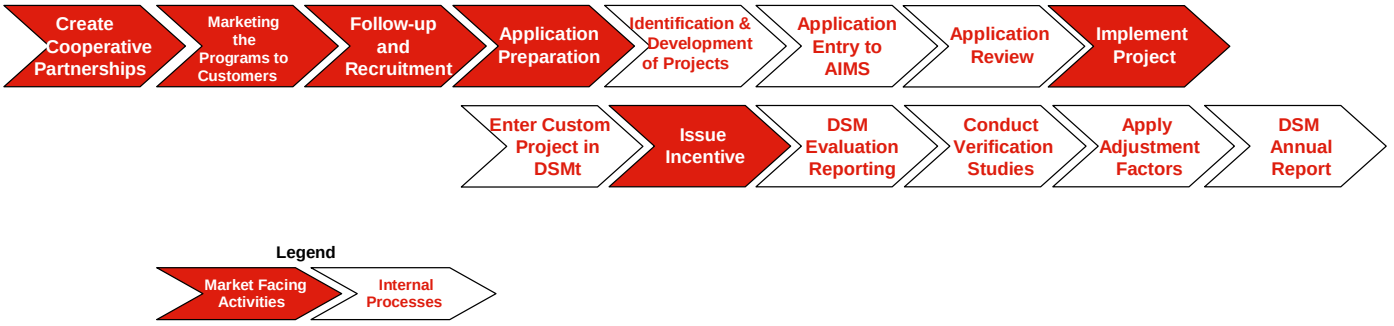
Table 1-1, Program Resources Summary

Resources		Distribution Contract	Commercial
Market Facing Resources	Channel partners/service providers	X	X
	Customer cooperation	X	X
	Skilled Account Managers	X	X
	Co-operative Partnerships	X	X
	Skilled Project Engineers	X	X
	One-on-one customer relationships	X	X
	Experience in program delivery	X	X
	Program incentives	X	X
	Technical trainings	X	
Internal Program Process Resources	Program budget	X	X
	Marketing staff and Marketing Plan	X	X
	3-Year DSM Plan	X	X
	AIMS project tools, project views	X	X
	Program managers	X	X
	Example base case descriptions		X
	Custom Application Documentation Guidelines (for AIMS)	X	X
	Previous R&E Verification Studies and external audit opinions	X	X
	DSM Tracking Team	X	X
	Other Direct Program Costs in DSM Administrative budget	X	X
	DSMt	X	X
	OEB TRC guide for electric CDM requirements for Verification Study sampling	X	X
	Industry verification (M&V) protocols	X	X
	Verification Study contractors	X	X
	Annual DSM Program evaluations	X	X

Primary Program Activities

The logic models presented in this evaluation plan are organized around 14 distinct activities. They are shown schematically in **Error! Reference source not found.** below, again noting the distinction etween activities that involve customers and service providers (market facing, colored as red) and activities that primarily involve internal program processes (color-coded as white).

Figure 0-1. Primary Program Activities Schematic

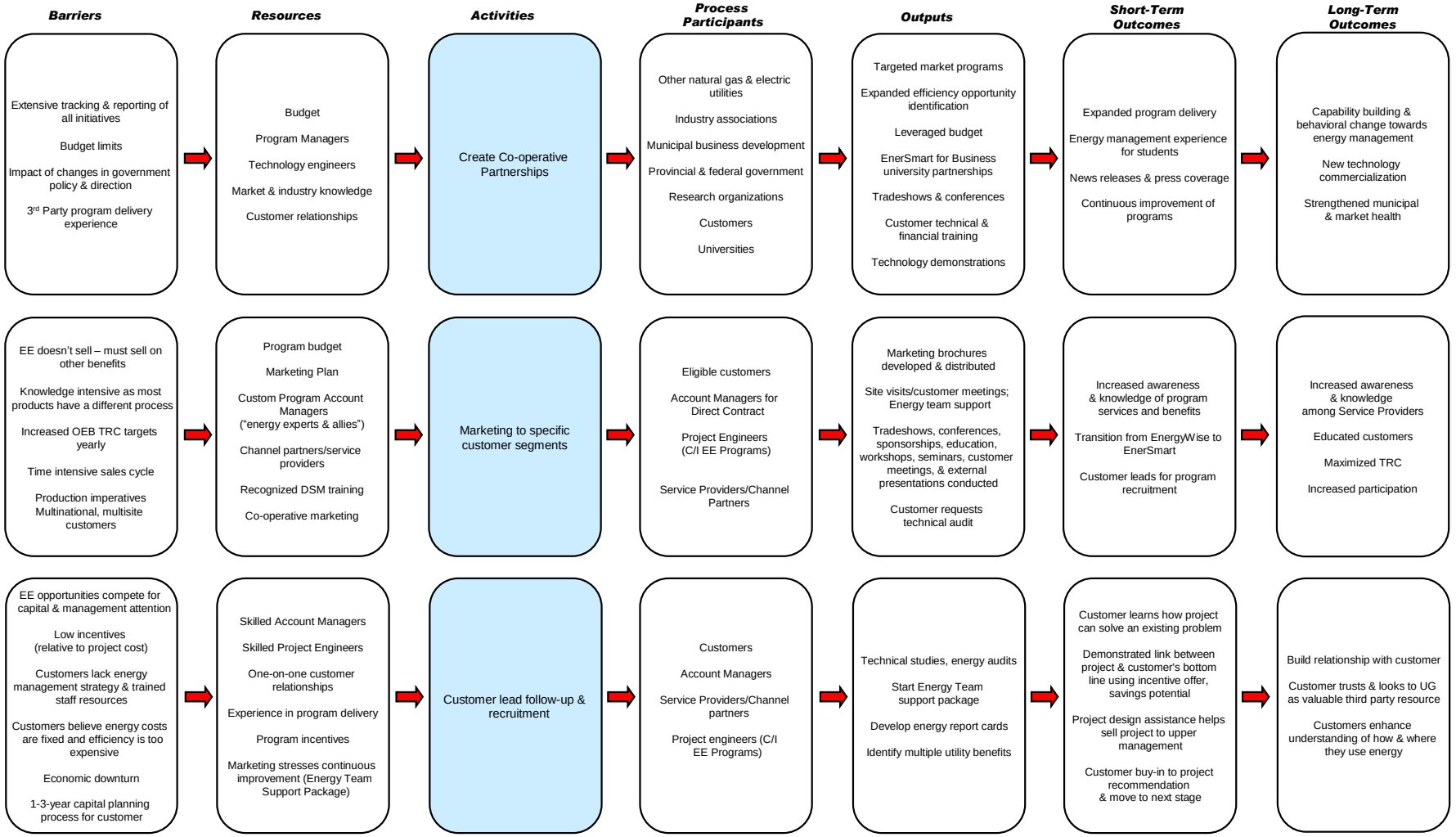


Program Logic Model Diagrams

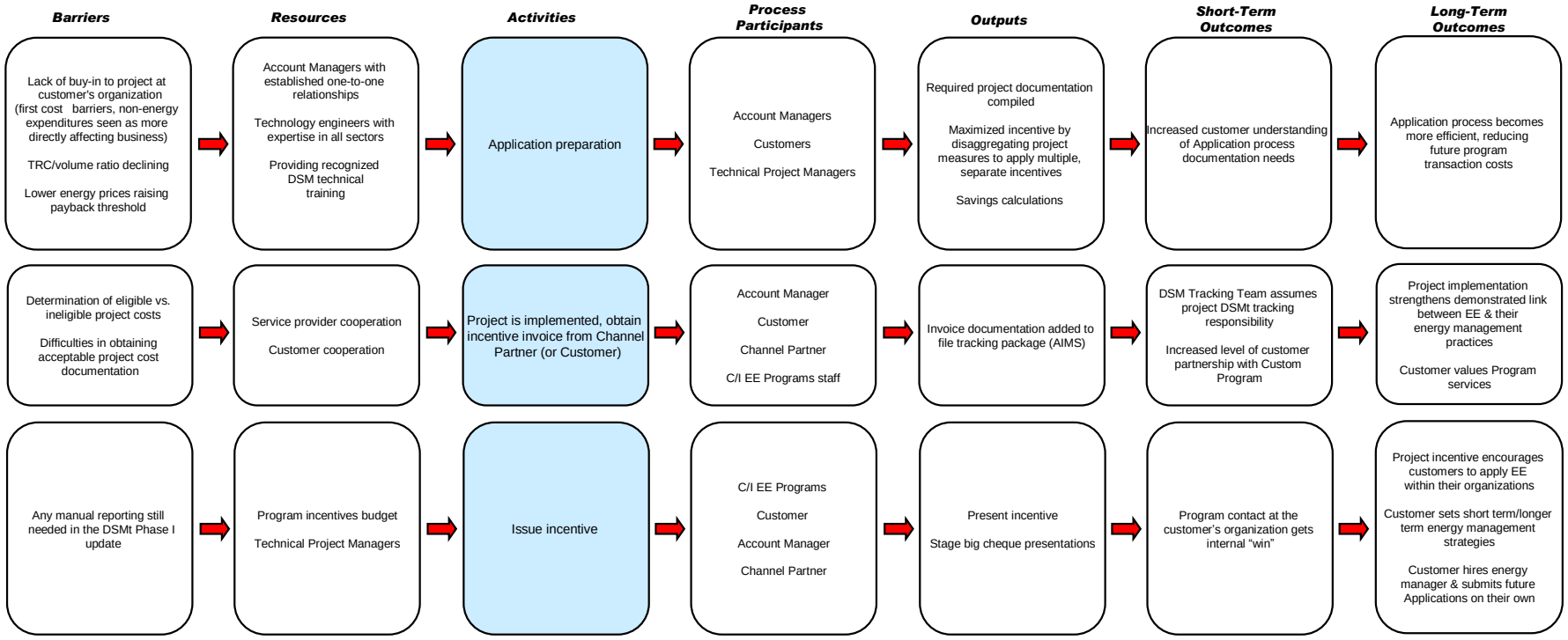
The draft logic models for the Custom Programs are presented in two versions: (1) activities for delivering the program to Distribution Contract customers; and (2) activities for delivering the program to Commercial customers. Again, each programs' logic model distinguishes between *market facing* activities and *internal program process* activities. Activities are highlighted in the logic models in blue. These logic models will be refined as part of the Phase Two evaluation activities.

The models include more detail than is typically shown in program logic models. However, this should offer improved "diagnostic" benefits for the purposes of improving design, delivery, and savings performance. That is, the ability to more closely examine specific linkages between barriers → resources → activities → outputs → outcomes should contribute to an evaluation plan that links the most important researchable questions to measurement indicators and proposed Phase Two data collection activities.

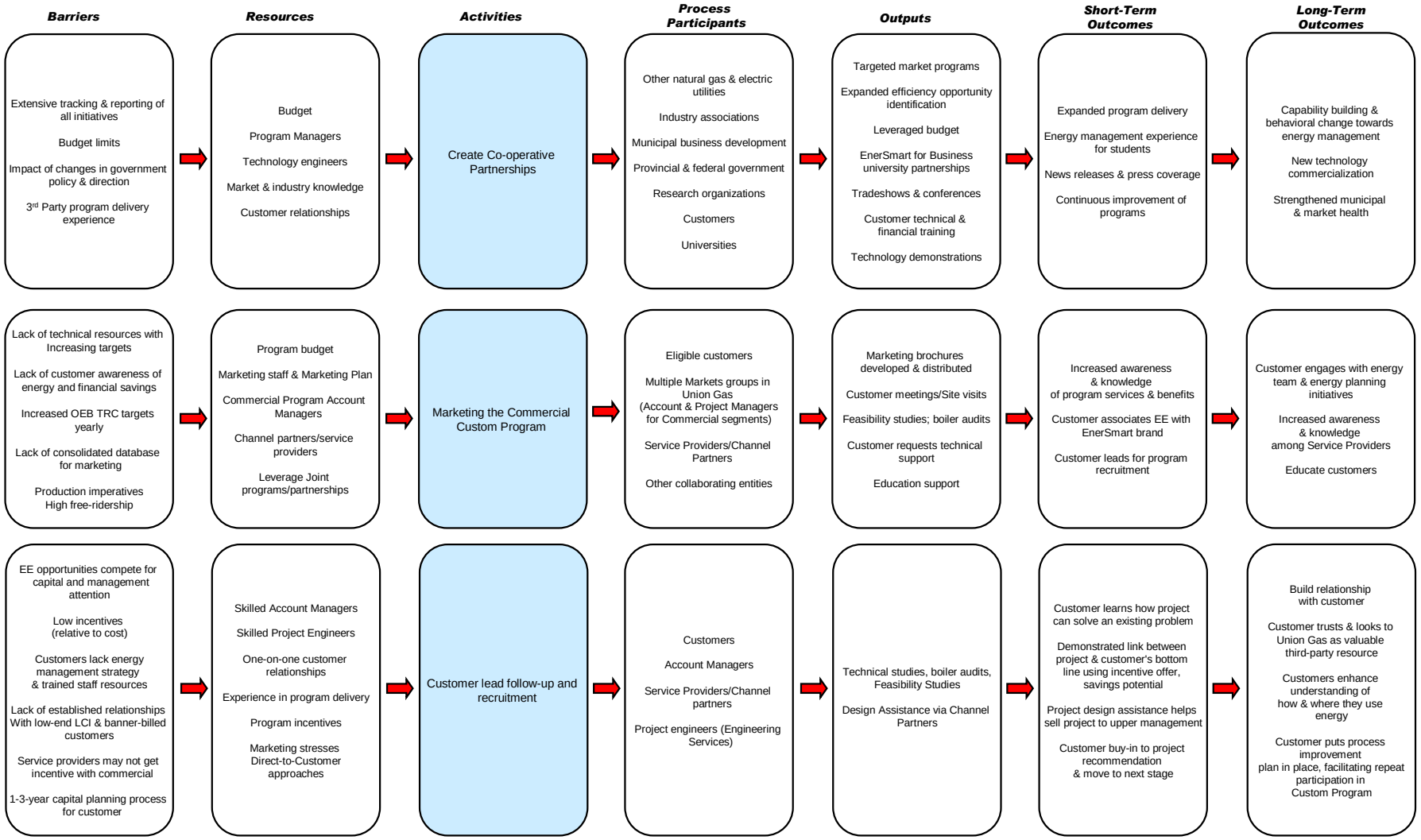
Union Gas Logic Model - External Program Activities for Distribution Contract



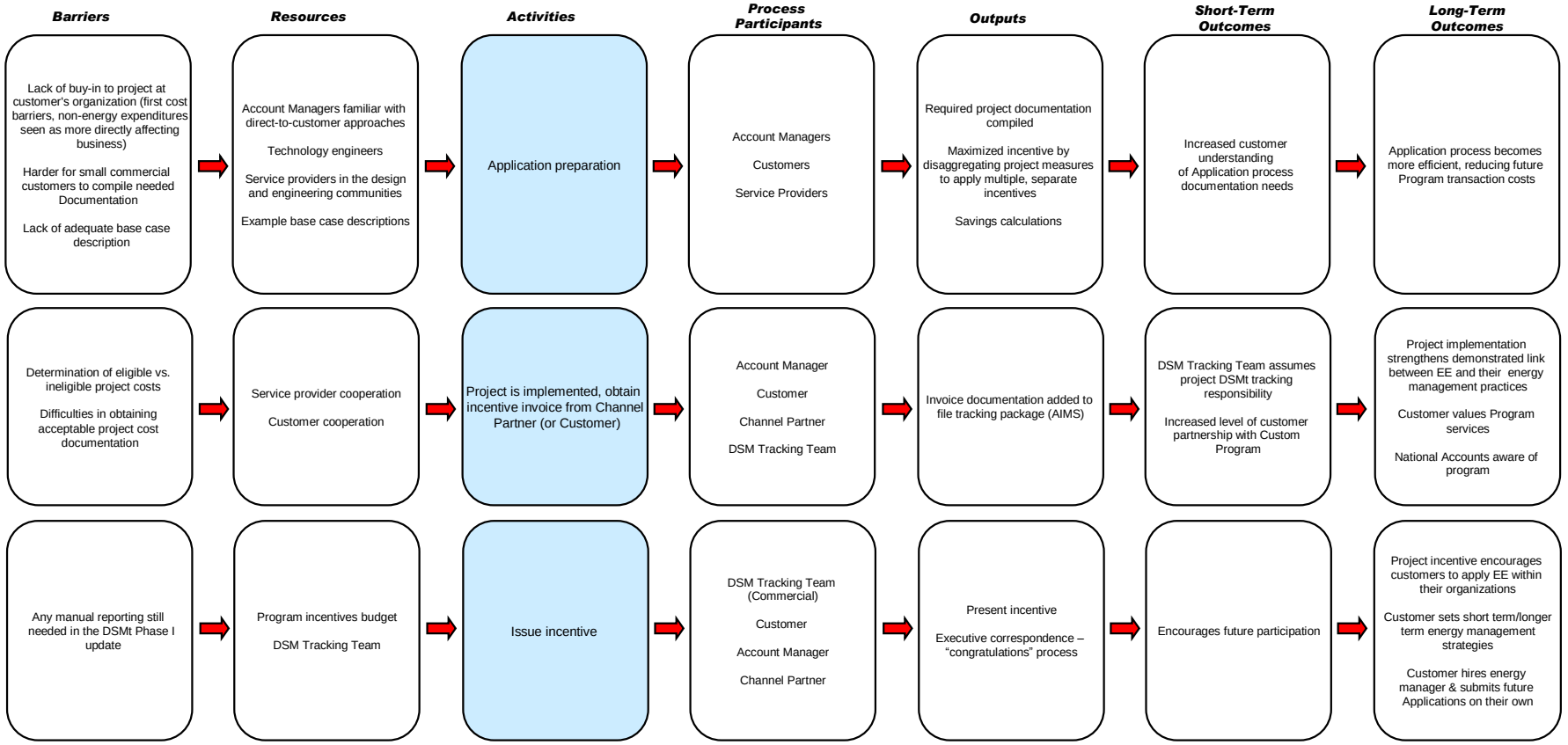
Union Gas Logic Model - External Program Activities for Distribution Contract Cont'd



Union Gas Logic Model - External Program Activities for Commercial



Union Gas Logic Model - External Program Activities for Commercial Cont'd



External Influences

Increased OEB TRC targets yearly; Federal efficiency programs; Funding levels; Energy costs and supply; Environmental regulations/policies; Economic factors

Outcomes, Measurement Indicators, Data Sources, and Potential Data Collection Approaches

The following tables 2-1 and 2-2 list outcomes (sampled from the program logic models) and associated measurement (performance) indicators. For each indicator, a proposed data source and/or data collection approach is suggested. Items in these tables are then prioritized and were considered as potential areas for incorporation in the proposed Phase Two evaluation plan, presented in the next section of this evaluation plan.

Table 2-1. Short-Term Outcomes and Measurement Indicators (Within Program Year)

Outcomes	Indicators	Data Sources and Potential Collection Approaches
Increased awareness and knowledge of program services and benefits	Customer and channel partner change in awareness of program services/benefits	Interviews (or surveys) with eligible customers and channel partners (participants and nonparticipants)
Customer learns how project can solve an existing problem	Quantity of customer leads attributable to program marketing	Interviews (or surveys) with customers and channel partners (participants); Account Manager interviews
Customer buy-in to project recommendations – move to next stage	Ratio of customer leads that generate follow-up contacts with customers to specify a Custom project	Program tracking and interviews with Account Managers
Increased customer understanding of Application process documentation needs	Self-reported change in understanding of Application requirements	Interviews (or surveys) with eligible customers and channel partners (participants and nonparticipants)
Successfully completed and AIMS-entered Applications contributes to monitoring program targets	Satisfaction with ability of the AIMS process to provide needed information to departments using the information in their program responsibilities	Program tracking system review, interviews with Account Managers, interviews with DSMT and C/I EE Programs staff
Applications are moved through the system more efficiently and verification requires less time	Proportion of AIMS Application entries that are returned to Account Managers for correction; processing time required	Program tracking system review, interviews with Account Managers, interviews with DSMT and C/I EE Programs staff
Increased level of customer partnership with Custom Program	Satisfaction with program participation process; repeat participation (intent and actual)	Interviews (or surveys) with eligible customers and channel partners (participants and nonparticipants)
Progress toward Custom Program savings target	Trends over time in achieving savings targets	Program tracking system review, interviews with Account Managers, interviews with DSMT and C/I EE Programs staff
Program contact at the customer's organization gets recognition (a "win")	Increased sense of partnership between the customer's organization and Union Gas	Interviews (or surveys) with customers and channel partners (participants); Account Manager interviews
Validate TRC results are in-line with DSMT Summary Report	Fewer "surprises" in reconciling DSM accomplishment reporting	Interviews with DSMT and C/I EE Programs staff

Outcomes	Indicators	Data Sources and Potential Collection Approaches
Recommended adjustment factors are applied (separately) to the Commercial and Distribution Contract savings projects	Timely preparation of DSM savings reporting	Interviews with DSMT, C/I EE Programs, and DSM R&E staff
Measure evaluation research priorities selected	Timely and accurate responsiveness to regulator	Interviews with C/I EE Programs and DSM R&E staff
External Auditor provides final opinion on the correct calculation of TRC Savings and amounts recoverable for SSM, LRAM, and DSMVA	Timely completion of DSM Annual Report	Interviews with C/I EE Programs and DSM R&E staff

Table 2-2. Intermediate-Term Outcomes and Measurement Indicators (1+ Years)

Outcomes	Indicators	Data Sources and Potential Collection Approaches
Educated customers (energy costs are variable, EE is cost-effective, etc.)	Self-reported change in understanding of energy costs and value that accrues from EE investments	Interviews (or surveys) with customers (participants)
Customer trusts and looks to UG as valuable third party resource	Increase in number of repeat Applications from customers; total number of projects increases over time; percentage of total TRC is distributed over more projects	Program tracking system review, interviews with Account Managers, interviews with DSMT and C/I EE Programs staff
Application process becomes more efficient, reducing future program transaction costs	Processing time required per Application decreases; TRC per direct dollars spent increases; percent of total program costs going to incentives increases	Program tracking system review, interviews with Account Managers, interviews with DSMT and C/I EE Programs staff
Account Managers increase knowledge and experience delivering Custom Program	Fewer program difficulties experienced by Account Managers; free-ridership decreases	Account Manager interviews; interviews with C/I EE Programs staff
Application documentation effectively supports external audit review	Audit adjustment factors increase over time (i.e., less discounting of savings)	Interviews with C/I EE Programs and DSM R&E staff
Customer values Program services	Proportion of eligible customer population participating in Program increases	Program tracking system review, interviews with Account Managers, interviews C/I EE Programs staff
DSM tracking processes increase Custom Program efficiency, reduce transaction costs and improves cost-effectiveness	TRC per dollar spent increases; incentives from SSM increase	Interviews with C/I EE Programs and DSM R&E staff
Project incentive encourages customers to apply EE within their organizations	More customers create internal energy management teams	Interviews (or surveys) with eligible customers and channel partners (participants)

Outcomes	Indicators	Data Sources and Potential Collection Approaches
DSM Reporting System (monitoring and tracking) effectively informs evaluation and verification annual reporting	DSM Annual Report completed on schedule	Interviews with DSM R&E staff
Adjustment factors inform ongoing savings calculations	Further adjustment factors from Verification Studies and External Audit increase over time(i.e., less discounting of savings)	Interviews with C/I EE Programs and DSM R&E staff
Progress toward 3-year DSM Plan objective of evaluating input assumptions for all measures	Updated LRAM input assumptions receive OEB approval	Interviews with C/I EE Programs and DSM R&E staff
DSM Evaluation Reporting supports due diligence, risk management, and savings goal attainment	SSM incentive earnings increase for Union Gas	Interviews with C/I EE Programs and DSM R&E staff

Phase Two: Project Implementation Work Plan

Task 2: Internal Review

PA conducted in-depth interviews with 12 Union Gas staff during the project kick-off. As part of Phase Two activities, PA will want to follow-up with some of these staff, and talk with additional account managers and project engineers not previously interviewed to provide a more complete picture of program processes and operations. The results of the Phase One and Two interviews will also be used to refine the program logic models and solidify key researchable issues to examine as part of other data collection activities. We have assumed an additional 14 in-depth interviews will be completed, likely to be split about evenly between staff involved with Distribution Contract customers and those involved with program delivery to Commercial customers.

Customized interview guides will be developed that are tailored to the program roles and customer sector focus of different interviewees. We also expect to include review of selected aspects of the logic models in the interviews, thereby obtaining refinements, corrections, and updates as to how the program is actually operating with each customer type.

These interviews will include emphasis on areas that may be promising for current and future Custom Programs development. An example is assessing program attention to “enablers,” activities that assist customers with identifying, evaluating, and implementing projects that reduce natural gas consumption. A focus on enablers is appropriate for the Custom Programs because of the near-term challenges of higher savings targets, and also because these are tools that help customers on a path to continuous improvement in energy use.

We will explore with interviewees a range of enabler tools – many of which Union Gas is already using with Distribution Contract and Commercial customers – that help facilitate more optimal energy management. For example, energy information services (e.g., sub-metering) and equipment energy use screening tools. The intent of providing these enabler services is to improve customer knowledge of their energy use and to bring

about behavioural and operational changes. These changes are likely to be precursors of future adoption of additional efficient gas-using equipment. The hope is – and we will pursue this in these interviews – that these technology tools will work in synergy with the customer one-on-one relationship strengths of the Account Managers to assist customers toward continuous improvement in energy management.

Deliverables – Distribution Contract

- In-depth interview guides customized for the Distribution Contract sector
- High-level summary of findings from Phase One and Two in-depth interviews with staff delivering the Custom Program to Distribution Contract customers.

Deliverables – Commercial

- In-depth interview guides customized for the Commercial sector
- High-level summary of findings from Phase One and Two in-depth interviews with staff delivering the Custom Program to Commercial customers.

Task 3: Primary Research—Participant Surveys

We believe that surveys with participants (and nonparticipants) are needed to provide a complete picture of program processes, operations, barriers, and decision-making. We expect to coordinate closely with the Manager of Market Research and Analysis at Union Gas in all respects of planned survey research.

The participant (and nonparticipant) survey designs will build upon information from the kick-off meeting and internal review. Survey designs will be tailored to Distribution Contract vs. Commercial customers. The participant surveys will collect information about participant characteristics and firmographics, equipment decision-making processes (including remaining markets for existing program participants), satisfaction with key aspects of the program and the application process, barriers to participation, the effect of the program on their decision to install qualifying equipment outside of the program, current and potential future interest in enablers (see discussion in Task 2, above), and suggestions for program improvements. With respect to program participation decisions, we will also explore the role of other sources of funds (for equipment efficiency upgrades) such as stimulus monies. If stimulus monies are influencing program Custom Programs participation it could help inform free-rider study measurement approaches.

To minimize burden on participants, we will carefully prioritize researchable issues in order to keep the survey to a reasonable length (less than 20 minutes). We will also send sampled participants a letter in advance of the telephone survey. We suggest the letters be customized and signed by the appropriate account managers. The letter will explain the purpose of the telephone call, and take care to explain that the results are confidential, and also explain the purpose of the evaluation (i.e., this is NOT an audit, it is simply to be used to improve program processes. All survey materials (letter, survey instrument) will be sent to Union for review and approval prior to fielding the survey.

We have assumed we will complete surveys with approximately 85 customers. This will result in a precision level of $\pm$ ten percent at the 95 percent confidence level for the total population. We are proposing to stratify the sample by Distribution Contract and Commercial projects to examine differences in customer

perspectives and experiences across the two groups, if possible. Once we have had a chance to examine the count of participants by project, we will prepare a sample plan for review and approval by Union.

The sample plan will include purposive selection of a small number of participants who are national firms (or multinational), have multiple facility sites, and where we believe that other sites have participated in similar custom programs sponsored by other utilities. With these customers we will explicitly seek to obtain comparison information across their experiences with both Union's Custom Programs and other large custom programs. An additional survey module will be developed for use with these customers. Also, if the value of program comparison information obtained would be enhanced by interviews with managers of other similar programs we will conduct a limited number of interviews with those managers.

The participant (and nonparticipant) telephone surveys will be implemented through PA's in-house survey lab over a three to four week period. We will establish a survey protocol that includes multiple attempts to achieve the highest possible response from the smaller group of Distribution Contract accounts.

Deliverables

- Draft and final survey instruments and introduction letter
- Participant sample plan – Distribution Contract
- Participant sample plan – Commercial
- High-level summary of findings – Distribution Contract
- High-level summary of findings – Commercial.

Task 4: Primary Research—Nonparticipant Surveys

The nonparticipant surveys will provide valuable data on market barriers and reasons for participation rates among various business customer segments and potential changes that could be made to the programs to improve participation uptake including identifying untapped markets of nonparticipants.

The nonparticipant survey will consist of three samples. The first sample includes Commercial customers who declined to participate after being approached by an account manager or from attending a training session. The second sample will consist of a random sample of Commercial customs who have not been informed of the program. The third sample will be comprised of Distribution Contract customers who have not previously participated in the Custom Programs. These samples will be used to better understand interest in the program and potential barriers to participation.

The nonparticipant survey will collect information on program awareness and familiarity, interest in the program and equipment promoted through the program, preferred sources of information, suppliers typically used, barriers to participation, characteristics and firmographics, equipment decision-making processes, and program potential through quantifying program saturation.

We recommend that the nonparticipant survey average no longer than 15 minutes in length by focusing on the key research questions. All survey materials will be sent to Union for review and approval prior to fielding the survey.

We will complete 150 surveys (approximately 50 for each sample group) with nonparticipants to ensure that we understand the decision-making processes and potential barriers to participation among the different types (and sizes) of nonparticipating businesses. The nonparticipant data collection will occur at the same time as the participant data collection, will incorporate the same set of core questions (e.g., firmographics) for comparability to the participant data, and will follow the same research methodology. After the data have been collected and processed, we will analyze the data and provide high-level summaries by sample group of the results for review.

Deliverables

- Draft and final survey instruments, by sample group, and introduction letters
- Nonparticipant sample plans
- High-level summaries of findings by sample group.

Task 5: Primary Research—Channel Partner Interviews

The evaluation team will conduct interviews with 12 participating channel partners. This research with channel partners provides meaningful information regarding market barriers, their participation in the programs (Distribution Contract vs. Commercial), and reasons for nonparticipation by their customers. The interviews will also probe on issues such as the change in access to program incentives in the program as delivered to Commercial segment customers, their perspectives on the use of enablers, and other topics relevant to expanding penetration of the programs in the respective eligible customer populations.

PA will work with Union to identify the channel partner sample. Ideally, it will include channel partners who are both very active and less active in the program – and represent program involvement with both the Distribution Contract and Commercial segment delivery.

Deliverables

- Channel partner sample plans – Distribution Contract and Commercial
- Channel partner interview guides tailored by customer segment
- Interim memorandum summarizing results, with specific attention to issues differentiating Distribution Contract and Commercial aspects of Custom Programs delivery.

Task 6: Program Tracking System Review

For several indicators associated with outcomes in the logic models, a program tracking system review is the best data source. This task will typically be coupled with interviews with DSMT and C/I EE Programs staff.

The creation and maintenance of data tracking systems and the dissemination of information from those systems is one of the major functions in DSM programs. As compared to prescriptive DSM programs, for custom programs there are typically additional complexities in program tracking (e.g., project-specific TRC screening, ability to include savings calculation documentation, etc.). In addition, for Union Gas there are some important program tracking system differences between Custom project applications for Distribution Contract customers vs. commercial customers.

The effective collection and dissemination of information can help make the difference between a program (and associated evaluation reporting) that provides too little information too late to be of any real use to anyone, and one that supports dynamic programs to help them adjust to changing markets and regulatory requirements. With the tracking system review, and associated staff interviews, we anticipate exploring the following issues:

- Process complexity and efficiency (review and approval steps; any undefined accountability)
- Resource/time requirements (e.g., process orientation vs. customer orientation; paper vs. electronic files; resources typically needed to do full QA on application preparation/documentation)
- Internal communication and coordination (e.g., Programs, DSM R&E, and DSMT&R)
- Systems user-friendliness (e.g., data entry; data extraction; linkages to other data systems such as banner or contrax; remote use; "fixes" needed).

Deliverables

- Summary memorandum

Task 7: Progress Reporting

We will conduct project updates with Union by teleconference biweekly. We will provide a brief status report to guide the discussion that includes progress to date, tasks for the next reporting period, data needs or questions to be resolved, and items for review. These teleconferences may be held more or less frequently depending on the level of activity and the issues to be resolved.

Deliverable

- Biweekly status reports.

Task 8: Reporting

While the initial (Phase One) Logic Models for the Custom Programs served as a guide for the Phase Two evaluation research, revised logic models will also be an end product of the evaluation. PA will update the logic models after the Phase Two process evaluation activities are completed to capture any differences between how the programs were designed and how they are actually operating. The revised logic models will be presented at the Phase Three Implementation Workshop.

We will provide interim memorandum reports and discussion of results throughout the evaluation period. These interim reports and discussions will provide information separately for the Distribution Contract and Commercial Programs, where applicable. However, each interim reporting task only provides a part of the puzzle, providing evidence from a limited perspective. Therefore, while Union will have seen the results in early reporting after completing each task, we believe it is important to discuss the complete set of high-level results before we complete the draft report. We have found that these discussions are particularly valuable in developing final recommendations for program changes that consider factors such as resource requirements to make those changes. At the same time, these open discussions are conducted in the context of not compromising the objectiveness of the evaluation. In some cases, the discussion may dictate the need for some additional analysis to support findings.

Deliverables

- Interim reports
- Revised logic models—Distribution Contract and Commercial.

Phase Three: Final Report and Implementation Workshop

Task 9: Final Report and Implementation Workshop

Along with the final report and a high-level presentation, we will develop an Executive Summary appropriate for submittal to regulators. The draft Executive Summary will be submitted to Union two weeks prior to the report deadline.

The Executive Summary will contain:

- A description of the program
- Methodologies used for the evaluation
- Results of the evaluation
- Recommendations on process improvements.

Since outputs from this project will be of interest to a wide audience of Union's management, account managers and program engineers, we will hold a one-day workshop at Union to present our key findings and recommendations for program and/or process improvements. We firmly believe that this workshop will be key to engaging internal program stakeholders and stimulating discussions of how recommendations might be enacted.

Deliverables

- Draft report
- Final report
- High-level results presentation
- Separate executive summary
- Survey data files and documentation

Appendix G: Executive Summary
Evaluation of Natural Gas Energy Recovery Ventilators & Heat Recovery Ventilators, Nexant

Union Gas Ltd. retained Nexant, Inc (Nexant), to complete an evaluation study and report the findings of the inputs and assumptions used by Union Gas in the quasi-prescriptive ERV and HRV tool. The primary objective of the evaluation is to develop a Final Report of our conclusions summarizing key findings, providing updated input assumptions and addressing the possible need for unique inputs for new versus existing commercial buildings.

To accomplish the study objectives, Nexant has focused on and completed the following Tasks:

1. Conducted a Project Kick-Off Meeting on December 18, 2009.
2. Generated and delivered a project Work Plan on December 23, 2009.
3. Performed a due diligence review of the existing input assumptions used in Union's quasi-prescriptive tool for HRV and ERV measures (operational parameters, HVAC system type, design and application, equipment specifications, etc.).
4. Conducted a thorough review of secondary literature of HRV / ERV energy saving measures.
5. Investigated New versus Existing HRV/ERV applications.
6. Executed an independent engineering review of new vs. existing building HRV / ERV applications including focus on input assumptions, HVAC design implications, energy saving calculation methods and control strategies to ensure that accurate and relevant numbers will be provided as updated assumptions for use in the quasi-prescriptive tool.
7. Provided the Interim Findings Report and conducted a review meeting to determine if additional investigation is required. As directed by Union Gas, Nexant carried out additional investigation into heating equipment efficiency and the number of hours of operation per week in each market segment.
8. Generated a Final Report of our conclusions summarizing key findings, providing updated input assumptions and addressing the possible need for unique inputs for new versus existing commercial buildings.

Nexant's evaluation study of the inputs and assumptions used by Union Gas in the quasi-prescriptive ERV and HRV tool have resulted in several findings and recommendations detailed in the body of the report.

Summary of Specific Answers to Questions

Union Gas presented several specific questions from the *Navigant* Audit Report and two (2) Intervenors that this report is to address. Below is a summary of Nexant's responses to specific questions.

Audit Report – Operation Hours

Question:

> *"The ERV / HRV tabs include assumptions on hours of operation that seem very high for average conditions. They also include degree-day factors that are potentially misapplied to buildings such as schools and offices that are not occupied at night."*

Nexant Response:

The existing tool used weather information from the London area, with original values of 4,800 and 5,800 hours in the heating season for new building construction and existing buildings, respectively. Nexant reviewed Canadian weather files as part of the tool analysis. The results showed that for the London area, the hours in the heating season are 4,846 for new building construction, and 6,306 for existing buildings. This analysis shows that the existing assumptions for hours in the heating season are a conservative estimate and do not overstate savings.

Buildings that are not occupied throughout the entire day are already factored into the existing tool via the user input *1 – Market Segment*, which changes the *Number of Hours of Operation per Week*. Section 6 describes the calculation, which indicates the existing tool does adjust the operation hours and gas savings for different market segments.

The calculations are not specific to buildings that are unoccupied at night. Depending on the actual building schedule and scheduled hours of HRV/ERV operation, the average temperature within the heating season may change since daytime temperatures are generally higher than night time temperatures. Accounting for such variances would require a much more complex tool utilizing hourly weather data and additional information from the applicant regarding HRV/ERV scheduling. Such a calculation is commonplace for custom measures, but it is not typically applicable to prescriptive measure programs.

Intervenor – Operation Hours

Question:

> *"Navigant's estimates of savings for new buildings are slightly lower than for existing buildings. Intuitively that makes sense, because one would expect newer buildings to have more efficient heating systems. However, the inputs Navigant presents for computing savings are the same for both building types. While Navigant notes that "New buildings and existing buildings mainly differ in the enthalpy (BTU/LBs) that is used to calculate the Specific Supply Air Conditions Volume in formula (B)," it is not clear why the specific energy content of the supply air would be different for the two situations."*

Nexant Response:

After the review of the existing tool, Nexant found that the inputs for computing savings are different for new construction buildings and existing buildings (Table 1-1). The assumptions changed are the *Number of*

Hours in Heating Season and the *Average Outside Air Temperature* based on the assumption that the building balance temperature is lower for a new building.

Table 1-1: Difference in key variables between new building construction and existing buildings

Symbol	Variable Name	Units	New Building Construction - Existing Value	Existing Building - Existing Value
2	Program		New Building Construction	Existing Building
E	Average Outside Air Temperature	°F	31.5	35.5
H	No. of Hours in Heating Season	hrs	4,800	5,800
N	Enthalpy of Inlet Supply Air	Btu/lba	10.38	11.86
O	Enthalpy of Outlet Supply Air	Btu/lba	16.89	17.69
S	Average Hourly Heat Recovery	MBH	27	24
U	Average Annual Gas Reduction	m^3	4,547	4,903

New construction buildings and existing buildings do have different supply air enthalpy (Symbol *O*) in the tool, but the difference is calculated based on the assumptions for the *Number of Hours in Heating Season* and the *Average Outside Air Temperature*. Since new construction buildings are assumed to only require heating below 50°F outdoor temperature, compared to 60°F for existing buildings, new construction buildings therefore have a lower average outside air temperature during the heating season hours (Table 1-1). Consequently, the enthalpy of outside air is lower, and the resulting enthalpy of the outlet supply air is lower since the heat recovery equipment is operating with a greater difference between indoor and outdoor enthalpy. The existing tool calculates the change in supply air enthalpy between the two different building types correctly.

The difference in the tool between the new construction buildings and existing buildings is only slightly impacted by the change in specific volume of supply air in the calculation. A larger contributor to the different values for the two different buildings is the difference between the *Enthalpy of Outlet Supply Air* and the *Enthalpy of Inlet Supply air*. When reviewing the calculations, it can be seen that the average hourly heat recovery actually increases for new building construction (Table 1-1) when the impact of the outside air conditions are factored into the equation.

The main difference between new and existing buildings that causes the difference in gas savings is the *Number of Hours in Heating Season.* The *Average Hourly Heat Recovery* actually decreases by 11% for existing buildings, while the *Average Annual Gas Reduction* increases by 8%. Overall, the calculations in the existing tool are correct for the two building types.

Intervenor – Incremental Cost

Question:

> *"The incremental cost assumption is presumably based on the 2000 Jacques Whitford study suggestion that the incremental cost for a 1000 CFM unit is $2500. Given inflation, wouldn't the incremental cost be higher in 2009?"*

Nexant Response:

Given the cost data gathered by Nexant, the cost of ERVs and HRVs has been found to increase by an average of 6.1% annually. Nexant recommends that the current incremental cost is increased by 6.1% to account for the annual increase in cost. In addition, Union Gas should update the incremental cost annually to account

for inflation. Nexant's recommendations regarding the *Incremental Cost* is thoroughly discussed in Section 6.1, as is our recommendation that an additional tool input be added to accommodate actual equipment cost to further improve the accuracy of the tool and/or further studies to more accurately consider total costs.

Recommendations for Tool Improvements

As discussed in Section 6, a few slight modifications to the existing Union Gas tool would greatly improve the accuracy of the final values for the *Average Annual Gas Savings* and *TRC* calculations. These recommendations are shown in Table 1-2 and Table 1-3 for HRVs and ERVs, respectively.

Table 1-2: Summary of HRV tool recommendations

Symbol	Variable Name	Units	Exisitng Value	Recommended Value
4	Equipment Useful Life	yrs	20	14
5	Incremental Cost	$/CFM	3.40	3.61
E	Average Outside Air Temperature (Exist. Bldgs)	°F	35.5	Adjust based on district
E	Average Outside Air Temperature (New Bldgs)	°F	31.5	Adjust based on district
F	Average Outdoor Relative Humidity	%	70	75
H	No. of Hours in Heating Season (Exist. Bldgs)	hrs	5800	Adjust based on district
H	No. of Hours in Heating Season (New Bldgs)	hrs	4800	Adjust based on district
I1	Demand Controlled Ventilation?	-	no	Remove from analysis
I2	No. of Hours of Operation per Week	hrs/wk	60-168	54-168
J	Make and Model of Heat Recovery Equipment		Eng A HRW-2100	Remove from analysis
K	Effectiveness of Heat Recovery Equipment	%	70	61

Table 1-3: Summary of ERV tool recommendations

Symbol	Variable Name	Units	Exisitng Value	Recommended Value
4	Equipment Useful Life	yrs	20	14
5	Incremental Cost	$/CFM	3.00	3.18
E	Average Outside Air Temperature (Exist. Bldgs)	°F	35.5	Adjust based on district
E	Average Outside Air Temperature (New Bldgs)	°F	31.5	Adjust based on district
F	Average Outdoor Relative Humidity	%	70	75
H	No. of Hours in Heating Season (Exist. Bldgs)	hrs	5800	Adjust based on district
H	No. of Hours in Heating Season (New Bldgs)	hrs	4800	Adjust based on district
I1	Demand Controlled Ventilation?	-	no	Remove from analysis
I2	No. of Hours of Operation per Week	hrs/wk	60-168	54-168
J	Make and Model of Heat Recovery Equipment		Eng A HRW-2100	Remove from analysis
K	Effectiveness of Heat Recovery Equipment	%	60	67

Nexant also recommends that the tool be modified to add additional user inputs and existing variable values be updated accordingly as discussed below.

Additional Tool Inputs

By adding three (3) additional user inputs to the tool Union Gas can expect to increase the accuracy of the tool calculations, see Table 1-4. While one (1) of the new user inputs will utilize data already acquired by Union Gas on the customer application, the other inputs will require further information from the customer. Nexant believes that the customer will have this data readily available. In the case that the applicant does

not supply the additional information, Union Gas could default to Nexant's recommendations discussed in Section 6.

Table 1-4: Recommended additional tool inputs

Symbol	User Input Name	Create New Tool Input?	Collect New Data from Customer?
6	Union Gas District	Yes	No
7	Weekly Operating Hours	Yes	Yes
8	Thermal Effectiveness	Yes	Yes

Modifications to Existing Tool Variable values

Several modifications will need to be made to the existing values for variables to properly account for Nexant's recommended values and the additional user inputs described in Section 6. Table 1-5 below is a summary the recommended values.

Table 1-5: Summary of recommended value modifications

Symbol	Variable Name	Recommendation
5	Incremental Cost	Allow user input of Equipment Cost
E	Average Outside Air Temperature	Make dependent on user input *6*
H	No. of Hours in Heating Season	Make dependent on user input *6*
I2	No. of Hours of Operation per Week	Make dependent on user input *7*
K	Effectiveness of Heat Recovery Equipment	Make dependent on user input *8*

Base Case Results from Recommendations

The assumed base case impacts of all of the recommended changes in input assumptions are shown in Table 1-6. Table 1-6 values are based on a 1,000 CFM HRV/ERV, 168-hours per week of operation, and London, Ontario weather location. The results show that gas savings decrease for HRVs, which is primarily a result of Nexant's recommendation to decrease the effectiveness of the HRV. Gas savings increase for ERVs with the recommended changes. TRC decreases for both HRVs and ERVs, which is primarily a result of Nexant's recommendation to the decrease the EUL.

Table 1-6: Results from changing input assumptions for the London, ON weather location

	Existing Gas Savings (m^3)	Recommended Gas Savings (m^3)	% Increase	Existing TRC	Recommended TRC	% Increase
HRV Tool for New Construction Buildings	4,547	4,182	-8%	13,334	9,410	-29%
HRV Tool for Existing Buildings	4,903	4,618	-6%	14,633	10,748	-27%
ERV Tool for New Construction Buildings	4,888	5,621	15%	14,957	14,235	-5%
ERV Tool for Existing Buildings	5,139	5,965	16%	15,871	15,291	-4%

Base Case: 1,000 CFM HRV/ERV Capacity, 168 hrs per week operation, London, ON weather files

If the London, Ontario location also has the operating hours for the warehouse reduced as recommended, the gas savings and TRC greatly decrease, as shown in Table 1-7. The gas savings and TRC decrease by as much as 67% and 91%, respectively, for the HRV tool for new construction buildings. Other cases do not have

as much of a decrease in savings and TRC, but are still significant. It should be noted that these impacts are only for warehouses; other market segments that do not have a recommended decrease in hours would not be impacted.

Table 1-7: Results from changing warehouse input assumptions for the London, ON weather location

	Existing Gas Savings (m3)	Recommended Gas Savings (m3)	% Increase	Existing TRC	Recommended TRC	% Increase
HRV Tool for New Construction Buildings	4,547	1,519	-67%	13,334	1,233	-91%
HRV Tool for Existing Buildings	4,903	1,677	-66%	14,633	1,718	-88%
ERV Tool for New Construction Buildings	4,888	2,041	-58%	14,957	3,244	-78%
ERV Tool for Existing Buildings	5,139	2,166	-58%	15,871	3,628	-77%

Base Case: 1,000 CFM HRV/ERV Capacity, Warehouse market segment, London, ON weather files

To show the impact of including multiple weather file locations on the tool, the same analysis was completed for the North Bay, Ontario weather location (Northeast Union Gas district). The results are shown in Table 1-8. For this location, gas savings increases for ERVs and HRVs for both new construction and existing buildings. The increase is very large for ERVs, with a 52% increase for both new construction and existing buildings, respectively. TRC increases for ERVs, and remains approximately the same for HRVs. Overall, this shows that the selected weather file location has a significant impact on tool savings and the recommended change to include weather from other locations will greatly improve the accuracy of the tool.

Table 1-8: Results from changing input assumptions for the North Bay, ON weather location

	Existing Gas Savings (m^3)	Recommended Gas Savings (m^3)	% Increase	Existing TRC	Recommended TRC	% Increase
HRV Tool for New Construction Buildings	4,547	5,447	20%	13,334	13,292	0%
HRV Tool for Existing Buildings	4,903	5,840	19%	14,633	14,500	-1%
ERV Tool for New Construction Buildings	4,888	7,441	52%	14,957	19,823	33%
ERV Tool for Existing Buildings	5,139	7,826	52%	15,871	21,005	32%

Base Case: 1,000 CFM HRV/ERV Capacity, 168 hrs per week operation, North Bay, ON weather files (Northeast Union Gas district)

All of the recommended weather file locations are north of London, except for the Windsor, Ontario weather location (Windsor/Chatham Union Gas district). Since this is the only gas district with warmer weather and a shorter heating season than London, Ontario, Nexant also reviewed the impact on the Windsor/Chatham district to the determine the impact of the changes (Table 1-9). For this location gas savings decreases for HRVs, and it stays approximately the same for ERVs. TRC decreases for all ERV and HRV projects.

Table 1-9: Results from changing input assumptions for the Windsor, ON weather location

	Existing Gas Savings (m3)	Recommended Gas Savings (m3)	% Increase	Existing TRC	Recommended TRC	% Increase
HRV Tool for New Construction Buildings	4,547	3,602	-21%	13,334	7,628	-43%
HRV Tool for Existing Buildings	4,903	4,017	-18%	14,633	8,902	-39%
ERV Tool for New Construction Buildings	4,888	4,807	-2%	14,957	11,736	-22%
ERV Tool for Existing Buildings	5,139	5,119	0%	15,871	12,695	-20%

Base Case: 1,000 CFM HRV/ERV Capacity, 168 hrs per week operation, Windsor, ON weather files (Windsor/Chatham Union Gas district)

Recommendations for Further Review

End of Useful Life (EUL) has a significant reduction on the TRC results for these projects and programs. While data exists from a DEER study based on empirical data, more data could be collected in the Province of Ontario where different weather conditions may result in a different EUL than the DEER study. If ERV/HRV

quasi-prescriptive programs are highly valued, Nexant recommends a long-term empirical study to regionally evaluate the EUL of ERV/HRV equipment.

Incremental costs also have a significant impact on the TRC results for these projects and programs. The current incremental cost approach may not be the most accurate and may also be outdated. The incremental cost accuracy could be improved by using installed cost data, as noted in the report. Nexant recommends the incremental cost be further evaluated with empirical data collected by the program in the next program year or through surveys of the previous three years of installed projects.

Lastly, while the sensitivity analysis provided may be adequate to consider for general program guidance for Union Gas's DSM program goals and targets; Nexant is available to provide additional base-case sensitivity analysis services upon the request of Union Gas. Specifically, sensitivity analysis may be of value to Union Gas for different market segments and ERV/HRV capacities.

Appendix H: Executive summary
Evaluation of Infrared Heaters, Enermodal engineering limited

Enermodal was hired by Union Gas Ltd to conduct a study addressing questions related to infra-red heating equipment used in commercial buildings. The specific objective was to estimate the impact of reduced fan power consumption when switching from unit heaters to radiant heaters, and the corresponding increase in natural gas consumption.

This impact was assessed through energy modeling using DOE2.2 software. A secondary literature review was conducted to inform the modelling inputs. Both unit heaters and infrared heaters were modeled in a warehouse selected to typify the Ontario building stock. Simulations were performed for three sizes of unit heater and at various temperature set points and locations to assess performance over a range of conditions.

The unit heaters were sized according to ASHRAE handbook heating method. To isolate the impact of infra-red heaters reduced fan power, the infra-red heaters were modeled with the same installed capacity as the unit heaters. When removing the fan from the base case unit heater, there is a slight increase in gas consumption as the fan waste heat contributes to meeting the heating load. The reduced fan power increased gas consumption for the infra-red heater by a modest average of 1.4%.

Since the heat gain from the greater fan energy of unit heaters is on average only 1.4% of overall related gas savings, and given the other factors influencing heating systems design and operations, altering the program gas savings inputs related to the removal of the base case unit heater fan motor is not recommended.

Results from the market share survey of infrared heating manufacturers and distributors were inconclusive given respondents reluctance to provide quantitative information. Further study is recommended.

Audit Report on Union Gas 2009 Annual Report

A Report to the Audit Subcommittee of the DSM Consultative

Final Report

July 16, 2010

ECONorthwest
ECONOMICS • FINANCE • PLANNING
888 SW Fifth Avenue, Suite 1460
Portland, Oregon 97204
503-222-6060

Acknowledgements

This report was prepared by ECONorthwest's Portland office for Union Gas and the Audit Subcommittee of the DSM Consultative. Dr. Stephen Grover was the ECONorthwest project manager for this analysis and was the primary author of this report. Questions regarding the report should be directed to him at grover@portland.econw.com or by phoning the Portland office at (503) 222-6060. Anne Fifield at ECONorthwest assisted with this analysis. Mike Kennedy also provided a review of the engineering studies and other supporting research reports.

TABLE OF CONTENTS

1. INTRODUCTION

Union Gas Limited (Union) in consultation with the Evaluation and Audit Committee (EAC) asked ECONorthwest to conduct an audit of the Union Gas DSM 2009 Annual Report. A review of project files was conducted by a third party engineering firm as part of Union Gas' 2009 DSM evaluation. The audit was limited to a general review of the 2009 savings estimates and reviewing the supporting research provided by Union for these programs. Throughout this process, Union was very responsive and provided us with all the requested background materials in a timely manner.

The tasks completed as part of the 2009 audit include the following:

- Audited the draft 2009 Annual Report to identify if there are claims made by Union that have not been substantiated.
- Compared the overall evaluation approach with that stated in the DSM Annual Report including a review of the completeness of the evaluation work.
- Verified that the calculation methodology and assumptions used in calculating the SSM incentive adhered to Board-approved methods.
- Considered and responded to EAC comments on Union Gas's DSM 2009 Annual Report.
- Reviewed studies conducted in support of the DSM Annual Report.
- Identified assumptions underlying Union Gas's DSM program design strategy and TRC calculation that should be modified prospectively.
- Identified opportunities to enhance the assumptions used to calculate the SSM and LRAM that should be addressed in future evaluation work.
- Replicated the savings and TRC amounts reported in the SSM.
- Reviewed two third party engineering reports that evaluated the savings estimates for a sample of custom commercial, industrial, and agricultural projects.
- Interviewed the firms that conducted the engineering reviews.
- Reviewed the sampling methodology for custom projects developed by Summit Blue.
- Reviewed the ERV/HRV report by Nexant
- Reviewed the Infrared heating report by Enermodal Engineering
- Reviewed Union Gas survey results used for 2009 market transformation activities.
- Assessed the underlying assumptions used in savings estimates.
- Reviewed the target calculations for the 2010 TRC target.

Our review focused on the 2009 program areas as defined in the 2009 Annual Report:

- Residential Sector
- Residential-Low Income

- Commercial Sector
  - New Building Construction
  - Building Retrofit, Audit Programs
  - Custom Projects
- Distribution Contract
  - Custom Projects, Audit Programs
- Market Transformation
  - Drain Water Heat Recovery

The level of savings and TRC benefits associated with the program sectors as reported by Union in the 2009 Annual Report is shown in Table 1. (This table is consistent with Table 3.0 in the draft 2009 Annual Report).

Table 1: 2009 Program Savings and Net Benefits (TRC) From Union's 2009 Draft Annual Report

Program Area	Participants	Gas Savings (m^3)	Net TRC ($)
Residential	363,922	6,488, 359	$26,172,041
Low Income	87,549	3,474,404	$15,154,993
Commercial	149,677	23,636,773	$80,740,504
Distribution Contract	211	75,376,729	$229,422,302
Total All Programs	**601,359**	**108,975,265**	**$345,110,572**

2. Review of DSMVA Calculations and 2010 Targets

A separate task in this audit was to review the calculations used to determine the Demand Side Management Variance Account (DSMVA) adjustment. This involved reviewing the values input by Union into the TRC spreadsheet provided for the audit review. Union provided a table of program costs, but for both program costs and incentives, no further detail was provided other than what was already presented in the annual report. Our review did not involve any review of financial records beyond what was included in the TRC spreadsheet.

Based on our review, we accept the DSMVA numbers as reported in the 2009 Annual Report.

An additional task was to review Union's calculations of its 2010 savings targets. As part of this audit, we have reviewed the 2010 target savings values with Union and confirmed that these have been calculated correctly.

3. REVIEW OF SSM CALCULATIONS

As part of this audit, ECONorthwest replicated the SSM calculations as shown in the 2009 Annual Report. This was done by obtaining Excel workbooks from Union that contained all the savings and TRC calculations and reviewing the calculations to make sure that they were done correctly and match the numbers shown in the 2009 Annual Report.

The SSM calculations were obtained from Union and then replicated and checked for the following:

- Accuracy with the final savings totals shown in the Annual Report.
- Consistency with the agreed-upon assumptions for calculation parameters (e.g., free ridership, per unit savings, savings adjustments).

We found no discrepancies between the SSM calculations and the figures presented in the 2009 Annual Report.

In our review of the approved input assumptions, we found one small error in the Demand Control Kitchen Ventilation Dinner House (10,000-15,000 cfm) measure under New Building Construction. The savings per unit for natural gas was incorrectly entered into the TRC and LRAM "Input Assumptions" worksheet. The savings per unit in Appendix A-2009 Input Assumptions for the Decision with Reasons is 18,924 cubic meters; it was incorrectly entered as 18,624 cubic meters. The same measure under Building Retrofit was correctly entered. ECONorthwest found no other errors.

Based on our review, we recommend that the following adjustments be made to the 2009 SSM claim:

- For Low Income bath and kitchen aerators, apply the Beslin retention adjustments from the ESK programs in the input assumptions.
- For showerheads in the Home Retrofit program, move all participants falling in the two highest savings ranges (2.0-2.5 gpm existing and greater than 2.6 gpm existing) into the lowest savings category.
- For commercial custom projects, adjust savings for projects 244 and 245 using the revised savings calculations provided by Diamond Engineering during the audit.
- Savings for all other commercial custom projects should be reduced by 50 percent for gas, water, and electricity. These adjustments are to be done in place of the adjustment factors recommended the by the 3rd party engineer.
- For Distribution Contract custom projects, adopt the adjusted savings values developed by Diamond Engineering during the course of the audit for the 12 projects included in the evaluation sample. Of these twelve projects, Customer 193 should be removed from the sample when calculating the realization rate to be applied to the Distribution Contract custom project population.

- For the remaining Distribution Contract custom projects outside the sample of 12, apply an adjustment factor of 105 percent for gas savings, 47 percent for electricity savings, and 110 percent for water savings. These adjustments are to be done in place of the adjustment factors recommended the by the 3rd party engineer.

These recommendations are discussed in more detail below.

4. Review of LRAM Calculations

ECONorthwest reviewed the LRAM calculations provided by Union and found them to be calculated correctly using the same per unit gas savings values used in the 2009 SSM calculation provided in the 2009 Annual Report.

In our review of the 2009 report, we recommended two adjustments be made to the 2009 LRAM claim to reflect the best information currently available.

- Adopt the savings values from Nexant report on ERV and HRV savings. This was done with an average adjustment for 2009. In 2010, the building-specific savings values should be applied to each individual project.

- Reduce infrared heater savings by 66 percent. Additional evaluation work should be conducted to develop a new savings estimate for use in 2010.

- Apply a free ridership rate of 54 percent to all custom projects (industrial, commercial, agriculture, and distribution) as recommended by Summit Blue in Custom Projects Attribution Study, dated October 31, 2008.

- For showerheads in the ESK program, adopt values from the Enbridge showerhead study, and reduce the per unit gas savings by an additional 57.76 percent.

- For showerheads in the Low Income program, change the natural gas savings per unit from 66 m^3 for the 2.0-2.5 existing category to 46 m^3, and from 116 m^3 for the greater 2.6 gpm existing category to 88 m^3.

The combined effect of our recommended changes on the SSM, TRC, and LRAM are shown in Table 2. If the changes recommended by the 2009 Audit are adopted, we believe that the TRC savings, SSM amount recoverable, LRAM amount recoverable and DSMVA amount recoverable are correctly calculated using reasonable assumptions, based on data that have been gathered and recorded using reasonable methods and accurate in all material respects, and following the rules and principles set down by the Ontario Energy Board.

Table 2: Audit Adjustments to SSM, TRC, LRAM, and DSMVA

Account	2009 Annual Report	2009 Audit Value	% Change
Gas Savings SSM (m^3 000's)	108,975	99,343	-9%
Gas Savings LRAM (m^3 000's)	108,975	92,604	-15%
SSM	$8,921,583*	$8,751,232	-2%
TRC	$345,110,572	$308,255,602	-11%
DSMVA (Total Program Spending)	$22,222,457	$22,222,457	0%

*The SSM payout is capped at $8,921,583. The actual calculated annual report SSM was $10,425,218.

5. Residential Program Audit Results

For the Residential programs, we reviewed the savings calculations as well as some of the major assumptions and evaluation research that is used in developing the savings estimates. The audit process also involved investigating specific issues raised by the EAC. The programs reviewed included:

- Home Retrofit
- Low Income

We also reviewed an evaluation report completed by Summit Blue Canada that addressed free ridership values for selected measures.[1] While we have expressed concerns with this report in previous audits for Enbridge and Union Gas, we will not repeat our comments here.

5.1 Low Income and ESK Showerheads

Due to concerns raised by the auditor and the EAC on the accuracy of the bag test used to categorize the ESK showerhead installations, Union agreed to use an average savings value for the showerheads installed through the Home Retrofit program. This shift in participation for these customers (and the resulting savings) is shown in the top three rows of Table 3. This change applies to both SSM and LRAM for 2009.

During the audit, a new study on the showerhead savings was completed for the Enbridge evaluation[2], and the savings values from that study are being recommended for use for Union's 2009 LRAM claim. For all ESK programs (Install, Push, and Pull), the natural gas savings per unit was reduced by an additional 76 percent to account for the percentage of showering that occurred under the single installed showerhead. An additional 76 reduction was applied to the per unit savings, based on the Beslin verification studies to account for the fraction of showerheads that are actually installed. These changes are also shown in Table 3.

[1] *Residential Measure Free Ridership and Inside Spillover Study*, June 4, 2008.

[2] The Enbridge showerhead study was not reviewed as part of this audit.

The new savings values from Enbridge are applicable for the Low Income segment and have been applied to this customer group for LRAM purposes. No additional adjustments were needed for the Low Income segment.

Table 3: Showerhead Savings Adjustment

Program / Savings Group	Net Gas Savings (m3) per unit	2009 Annual Report Units	2009 Annual Report Savings	2009 Audit Savings (m3) per unit	2009 Audit Units	2009 Audit Revised Savings	% Change in Savings
Home Retrofit Install (existing 2.6+)	104	489	51,052	104	0	0	-100%
Home Retrofit Install (existing 2-2.5 gpm)	59	92	5,465	59	0	0	-100%
Home Retrofit Install (1.25 gpm)	57	1,403	79,550	24	1,984	47,443	-40%
Home Retrofit Pull - 1.5gpm	31	64	1,952	13	64	833	-57%
Home Retrofit Pull - 1.25gpm	42	45,267	1,891,100	18	45,267	797,552	-58%
Home Retrofit Push - 1.5gpm	28	37	1,032	12	37	441	-57%
Home Retrofit Push - 1.25gpm	38	35,702	1,363,773	16	35,702	575,157	-58%
Low Income (existing 2.6+)	110	14,098	1,553,600	84	14,098	1,178,593	-24%
Low Income (existing 2-2.5 gpm)	63	5,963	373,880	44	5,963	260,583	-30%
Totals	--	**103,115**	**5,321,404**	--	**103,115**	**2,860,602**	**-46%**

5.2 Additional Residential Issues Raised by the Audit Subcommittee

Additional issues raised by the Audit Subcommittee are listed below, along with the information obtained during the audit addressing these issues.

With respect to the Residential ESK program – is the way Union verifies that the savings were achieved appropriate from the auditor's perspective?

Union has contracted with Beslin to verify the installation of the various measures included in the ESK (showerheads, pipe insulation, aerators). The verification consists of a phone survey of participants to determine if the measure is still installed. We have reviewed the Beslin studies for the 2009 Annual Report and believe that this method is adequate for verifying these measures. While the verification could be improved with a sample of onsite inspection visits to determine the persistence of the measures, this is a lower priority relative to other evaluation research needs.

For programmable thermostats – how does Union verify that they were installed and were being used differently than manual thermostats?

Union Gas is relying on the savings estimates from the 2009 Navigant study[3] for the programmable thermostat savings value. We reviewed this study as part of the audit and confirmed it that some behavioral information was used to develop the final savings value. While the savings estimate may benefit from additional evaluation research on this topic, this should be considered a lower priority relative to more pressing evaluation needs such as custom project evaluation.

6. COMMERCIAL AND DISTRIBUTION CONTRACT AUDIT RESULTS

As part of the audit, we reviewed the sampling process used to select projects for the engineering review for commercial and distribution contract custom projects. We also reviewed the two studies completed by engineering firms to review the savings estimates for custom projects for commercial customer and direct contract customers. Our review was limited to reviewing the reports and discussing the results with the engineers who managed these projects.

6.1 PROJECT SAMPLING

The sampling method used for evaluating the custom projects is consistent with the method agreed on for the 2008 program year and is based on a method designed by Summit Blue. We reviewed the sampling procedure and had several recommendations on how the process could be improved. Union Gas adopted some of these for 2009 and for those that were not we reiterate our previous recommendations below for the remaining sampling issues.

1. **Develop a stratified sampling method that has very large projects included in the evaluation sample.** This can be accomplished by developing a "certainty" stratum where large projects are sampled with certainty for the evaluation.

2. **Adopt a larger sample size.** We understand that the sample size was set in an agreement with the OEB for 2008. However, given the wide range of business and measure types covered by the custom projects (and the suggested modifications discussed below), the sample size should be increased in order to achieve a 90/10 relative precision level for important sub-categories of customer types and measures. For example, samples could be drawn separately for retrofit and new construction projects. It may be desirable to have

[3] *Measures and Assumptions for Demand Side Management (DSM) Planning Appendix C: Substantiation Sheets* by Navigant Consulting (April 16, 2009).

samples for several size categories (i.e., small, medium, large) to further improve the reliability of the sample estimates.

A larger sample size will also provide insurance against having to discard some sample points once the sample is drawn. All of the sample precision calculations assume that each sampled project is well documented, for example, so that the sample results can be readily extrapolated to the population. In situations where projects are not well documented, the value as a sample point is reduced, as we cannot be sure that the project is representative. This was a particular issue with the commercial custom projects, where documentation was deficient in most of the sampled projects. A separate case is the issue where projects are adequately documented but still are not very representative of projects in the population. For example, Customer 193 in the Distribution Contract custom program is a very large new construction project that is significantly different from the other custom projects in this group both in terms of size and technology and therefore is not very useful as a sample point.

Two-Stage Sampling

As was done in the 2008, the 2009 sample is drawn in two stages in order to allow more calendar time for the verification of savings. In principle, this approach is logical and often necessary. In practice, however, the analyst must be careful not to introduce unintended bias into the sample by not maintaining a consistent probability of selection for each project.[4]

The first-stage portion of the sample (Wave 1) is drawn based on projects installed in the first three quarters of the project year. In the second stage, the remainder of the sample is drawn based on projects installed in the fourth quarter and those projects installed in the first three quarters, but not selected in the first sample. This method violates the assumption of equal probability of selection because projects in the first stage have a different probability of selection than projects in the second stage. Without a properly developed post-hoc weighting scheme, the findings from the sample may be biased in an unknown direction (*i.e.*, indicate either greater or lesser savings that was actually achieved).

Recommendations for Future Sampling

What is the optimal number of strata? There are two issues to consider in answering this: how does variance decrease as the number of strata increase and how does an increase in the number of strata affect cost? The purpose of stratifying the DSM projects by expected savings is to reduce cost. Stratification reduces sample variance, which in turns reduces the sample size necessary to meet precision requirements (relative to simple random sampling). Fieldwork—especially for custom commercial and industrial projects—is expensive. The optimal sample design is the one that meets precision (and any other) requirements at the lowest cost. This is achieved through stratification.

[4] The issue of bias is relevant regardless of whether or not the probability of selection of a project is weighted by the expected energy savings of the project.

How should size of expected energy savings be incorporated into stratification?[5] There are a number of methods to develop the stratification. Regardless of method, the objective is to minimize sample variance. One approach is to sort the projects in descending order of expected savings. Starting at the top of the list, create a running tally of the cumulative expected saving of the projects. Divide the cumulative savings of all projects by the number of strata to get the *target savings per stratum*. Beginning at the top, allocate each consecutive project into stratum 1 until the cumulative savings of the stratum is (approximately) equal to the target savings per stratum. Once this is done, continue down the list, allocating projects into stratum 2 until the cumulative savings is approximately equal to the target savings per stratum. Continue this process until all projects are assigned to a stratum.

Random Sampling with Replacement. Setting aside that it may be desirable to weight the probability of sample selection by expected savings, a fundamental characteristic of random sampling for program evaluations is that all projects have an equal and unchanging likelihood of selection into the sample.[6] Although there is added complexity to the overall process, this can be accomplished in multi-stage sampling. We recommend that sampling *with replacement* is conducted. This method not only results in simpler formulas for variances estimated from the sample, but may also allow for a smaller overall number of projects selected in the sample (*i.e.*, the same project may be chosen for the sample two or more times).

6.2 AGRICULTURE CUSTOM PROJECTS

In both the commercial custom and distribution custom projects, agricultural customers are assigned a free ridership rate of zero. This rate comes from the Summit Blue free ridership study[7] that provides separate rates by customer group. While we understand that the free ridership rates broken out by customer group are the rates that have been approved for use by the OEB for 2009, the actual free ridership rate for agricultural customer is certainly higher than zero.

Using separate free ridership rates for the customer groups also runs counter the recommendation provided in the same Summit Blue report (page ii):

> Summit Blue recommends that the utilities use the utility-specific total free ridership values of 41% and 54% as the best estimate of free ridership. Those results are based on larger sample sizes than the sector-specific results and proved more stable in the sensitivity analysis. The sector-specific results are based on smaller sample sizes and should only be used to support program management, for example to support targeting and marketing decisions.

---

[5] Stratification by one or more descriptive criteria (e.g. fuel type, measure type, etc.) may be mandated by the utility. Such additional stratification does add complexity to the sample design process, however the process of conducting the stratification by size does not change.

[6] Even if a projects probability of selection is based on expected energy savings, the probability of selection should not change during the selection process.

[7] *Custom Projects Attribution Study*, prepared for Enbridge by Summit Blue (October 31, 2008).

To correct these issues, we recommend that the overall free ridership rate of 54 percent from the Summit Blue report be applied to all custom projects for commercial and distribution customers for LRAM purposes.

6.3 ERV / HRV REPORT

The Nexant report *Evaluation of Natural Gas DSM Measures: Energy Recovery Ventilators & Heat Recovery Ventilators* (March 12, 2010) was reviewed as part of the 2009 Audit. The study is very in depth and did address the hours of operation assumptions (an issue raised in the 2008 Audit), and include recommended changes to the hours of operation for several building types. The potential impact of the recommended changes to operating hours can be seen in Table 1-8 of the Nexant report.

The evaluation did not examine the night temperature issue raised as part of the 2008 Audit despite going into considerable depth on other aspects of the model. Since the calculation is using an average temperature for all heating hours and it is based upon 24/7 operation, any project where the ERV/HRV is not operating at night would have over-estimated savings. It would have been simple to analyze the impact of daytime only operation on the average outdoor temperature yet they indicate that accounting for this issue is too complicated for this type of project.

Rather than dismiss this issue entirely, a very simple sensitivity study could and should be done. If the sensitivity analysis finds the night temperature issue to be an important factor, then this can be addressed easily within the current spreadsheet calculation by having both an average temperature for 24/7 operation and one for a 10-hour day operation. The applicable temperature can be interpolated based upon the hours of operation assuming that short hour units are operating during the day.

Despite these concerns, we believe that the Nexant report should be used for LRAM purposes. It was not possible for Union to adjust all the individual project values in time for this audit, instead an average adjustment was used across all building types. This adjustment reduced the claimed savings by 4 percent for ERV and 23 percent for HRV for the 2009 LRAM value. In future years (2010 and beyond), the building-specific savings values from the Nexant report should be applied to the individual ERV and HRV projects.

6.4 INFRARED HEATER REPORT

Enermodal Study

As part of the 2009 audit, we reviewed the Enermodal Engineering report *Evaluation of Natural gas Fired Infra-red Heaters* (March 22, 2010). We do not find that the Enermodel study addressed issues raised in the previous audit and also found an additional area of concern regarding the current infrared heater savings values.

The Enermodal study was conducted in response to an auditor comment on the quasi-prescriptive calculation from the 2008 audit. They indicate the fan power savings for going from unit heaters to infrared heaters is only 1.4 percent of total TRC and conclude, “the slight increase in gas use should be ignored”. Unfortunately, this study completely misses the point of the auditor comments on this issue in 2008. From the 2008 Audit Report:

> ”The estimates for infrared heaters take credit for reduced electric consumption from the removal of air handler fans, but there is no indication that gas savings were adjusted for this reduction in electric use. Also, the electric use value for unit heaters seems quite high and should be re-checked.”

This study does not provide the assumed base case unit heater fan power or the basis for it, and it does not compare the assumption used with that used in the quasi-prescriptive calculator. The study claims that fan energy is a very small number, however it is apparently large enough to justify having electricity savings in calculator. Either the quasi-prescription calculator needs to not claim fan power savings, or they need to document typical fan power and also account for the decrease in gas savings that result from the reduced fan power. It should be noted that the unit heater fan runs when heat is needed and as such all of the reduced fan heat must be offset by increased heater use. The two numbers are of the same magnitude, so including the electric savings without the gas increase is without merit.

Additional Infrared Heater Issues

New issues are raised from our current review of the infrared savings values and relate primarily to the total baseline gas usage assumed in the calculator, and secondarily to the fraction of total consumption that is assumed to be savings. The 2008 quasi-prescriptive tool provided in May of 2009 predicts infrared heater savings of 5,100m^3 for each 500 kBtuh of heater capacity. The tool used during 2009 was not provided, but the Navigant report that is purported to be the basis for the new number estimates savings of 0.015m^3 per Btuh of heater capacity (7,500m^3 for each 500 kBtuh of capacity) with a savings rate of 18.4 percent. From this the assumed base usage of a 500 kBtuh heater is 40,760m^3.

The Enermodal Engineering report *Evaluation of Natural Gas Fired Infra-red Heaters* (March 22, 2010) used a set of simulations comparing unit heaters to infrared heaters to investigate the amount of increased infrared heating from removing the unit heater fan. The study simulations predict total gas use averaged across 3 climates and 2 prototypes of 11,800 m^3 per 500 kBtuh of heater capacity. In more detail, the average across 3 climates for partially heated spaces is near 6,000 m^3 and for fully heated spaces is 17,500 m^3.

Comparing the baseline usage from the Navigant report to the Enermodal simulations finds a 400 percent difference in baseline usage on average. We recognize there are limits of using Enermodel simulations since they were designed to assess typical fan TRC and not total gas usage. However, the magnitude of difference raises a substantial red flag regarding the prescriptive savings supporting work. Concern is further supported by the relative sophistication of the Enermodel simulations compared to the work supporting the calculator assumptions. The Navigant estimate is based on a 2004 Agviro report that uses an extremely basic bin calculation done in 2 climates with a single set point assumption. The Enermodal estimate is the result of simulations done in three climates with 2 typical set point conditions thus providing significantly more detail.

Several issues were identified that would lead the Navigant work to overestimate base usage and savings.[8] Our concerns are summarized below.

1) Base Heating Load. The baseline heating load, which the prescriptive savings are based upon, is calculated by Agviro using a bin calculation assuming a 65F balance point. Given a minimal amount of lighting, this basically assumes 24/7 operation at 70F or higher. While not impossible, this clearly represents the extreme case for heat energy use for a given unit capacity. Facilities that are not heated 24/7, are not fully heated, and/or are only heated seasonally will have significantly reduced energy use for the same unit capacity. Plenty of warehouses are operated with the heat totally off until the heart of the heating season and most keep it significantly cooler than 70F. All these factors reduce energy use but leave heater capacity unchanged thus reducing the potential savings for a given capacity. Energy use typically decreases by 3-4 percent per degree reduction in set point, so small changes in average conditions will have a very significant impact on usage and therefore on savings.

2) Baseline Equipment Efficiency. Agviro states they use 80 percent for the unit heater efficiency, but dividing heat load by energy use indicates the actual efficiency level assumed is 68 percent - thus inflating base energy use. The fact the report states 80 percent but uses 68 percent is concerning, and given increased saturation of forced draft unit heaters the use of 68 percent is low.

3) Equipment Sizing. Agviro sizes the heaters to exactly meet the steady state heating load with no extra capacity. Any oversizing of equipment increases the installed capacity but does not change the energy use, thus reducing savings per unit capacity. The Navigant study states that a 20 percent oversizing adjustment is made, but the backup tables are identical to the earlier Agviro study where no oversizing assumed. We suspect that the Navigant study forgot to make the oversizing adjustment for its savings estimates, and the lack of such an adjustment inflates the savings estimate. Furthermore, we believe that a 20 percent oversizing would reflect best practices and actual oversizing is likely to be higher.

4) Infrared heater efficiency. Infrared heater efficiency is assumed to be 15 percent for "conventional" units and 27 percent for 2-stage units. A 1993 paper (MacDonald, R.D., Technical Report: Fuel (HL Series) Infra-Red Heaters. 1993.) is referenced to support the efficiency differential. It is a isolated test conducted on older infrared technology, it assumes a set of controls that may or may not be typical, and Agviro assumes a third of installed units are two-stage with no information supporting the assumption. This results in an average savings of 19 percent. (Note the 18.4% savings estimate by Navigant results from dividing the Agviro savings estimate by a total use estimate of another study). Given that 15 percent is a common estimate of *average* savings, it already includes the impact of 2-stage units and explicit treatment needs to be based upon significantly better documentation than that presented.

[8] The Navigant work is largely based upon work by Agviro that is summarized in "Assessment of Average Infared Heater Savings" (2004).

The combined effect of these factors is a savings value from the infrared heater quasi-prescriptive tool that is likely to overestimate savings substantially. Consequently, we recommend that savings from the quasi-prescriptive infrared calculator be reduced by 66 percent for LRAM purposes. This adjustment uses the Enermodel estimates of base consumption and averaging all the simulations from the Enermodal study results in an average base usage of 11,800 m^3 per 500 kBtuh of heater capacity. Assuming a savings value of 15 percent yields a savings value of 1770 m^3, which is approximately a 66 percent reduction of the average savings value of 5,000 m^3 per 500 kBtuh capacity.

As discussed above, we do not believe that the 2009 savings values for infrared heaters are accurate. However, developing a new savings estimate for use as an input assumption for 2010 is beyond the scope of this audit and should be conducted as part of Union's evaluation process. Our recommended adjustment should be applied as part of the 2009 LRAM, but we do not recommend that it be used as an input assumption for 2010 as we did not conduct the evaluation research needed to develop a rigorous savings value. We recommend that Union conduct additional simulations on infrared heaters to address the issues raised above and create a more realistic savings value for 2010.

6.5 Commercial Custom Project Review

The firm Michaels Engineering conducted an engineering review of the Commercial Custom program. Their final report Union *Gas 2009 Commercial and Industrial Markets Project Verification Final Report* (March 2010) was reviewed as part of the 2009 Audit. The evaluation entailed a desk review of 28 custom energy efficiency projects, four of which were subsequently assigned to Diamond Engineering since they were already in the field and therefore could conduct on-sites. The remaining sites did not receive a site visit as part of the evaluation.

An interview was conducted of personnel from Michaels Engineering regarding their general approach and also specific projects. They indicated that several project files contained very little information regarding the savings claim. Twelve of the twenty-eight projects that were directly reviewed by Michaels Engineering had very little information of how savings were calculated or in some cases even what the measure was. There was a slight improvement in Wave 2 applications, which were processed after changes to the claim process. Although the number of poorly documented claims appears to drop off, only one-third of the claims in the sample were considered to have adequate data. Michaels Engineering often calculated savings based on almost no information.

The evaluators reviewed the information available for each project and then assembled questions for the customer. These were submitted to the utility for review and then Michaels called the site and conducted the interview. They indicated that the baseline was an area they actively examined, although in several cases key factors could not be determined. At one site (Site 161), pollution control standards were forcing the change from an ancient burner control to a modern control, they questioned whether the old burner should be the base case and the utility indicated that this treatment had been "deemed appropriate" by the directors and regulators.

The four projects that received a site visit are all at one facility and we recommend a fairly significant adjustment for of these projects due to differing treatment of the interior film coefficients. These sites were actually reviewed by Diamond Engineering as they were able to

conduct on-sites for these projects. The savings estimates were revised downward from Diamond's original estimates based on conversations with the auditor regarding the interior film coefficient. Given that these projects received significantly different evaluation review from the other projects in the sample, we have removed them from the calculations of the 2009 Audit realization rates discussed below.

These projects demonstrate a situation that really needs M&V planning prior to the measure installation, as the largest uncertainty is the actual performance of the base case. We would only anticipate this on large projects such as these and some distribution contract projects. We recommend that Union establish a savings threshold above which an M&V plan is developed prior to measure installation.

In the majority of cases, there was not enough detail available to allow the audit to compare Michaels Engineering's savings estimates and verify the underlying assumptions with the actual project conditions. Given the very limited project documentation available for Michaels to review and the very small evaluation budget, we do not believe that this program has been adequately evaluated and do not have any confidence in the savings results presented in this report. However, it is likely that some savings did result from these projects. To correct for the lack of documentation and limited evaluation review, we recommend that an adjustment factor of 0.50 (*i.e.*, savings be reduced by 50 percent) be applied to all commercial custom projects to adjust for potential errors in the savings calculations. As we recommended in the 2008 Audit, we also recommend that zero savings be allowed for custom projects where savings calculations are not adequately documented and evaluated.

The original realization rates and the 2009 Audit realization rates are shown in Table 4. As discussed above, the projects that were reviewed by Diamond Engineering were removed from the sample used to calculate the realization rates for the commercial custom projects, as these projects were less representative of the commercial custom project population in terms of the level of evaluation analysis conducted.

Table 4: Audit Realization Rates for Commercial Contract Custom Projects

Account	2009 Annual Report	2009 Audit Value
Natural Gas	137.5%	50%
Electricity	52.02%	50%
Water	96.5%	50%
Costs	91.2%	91.26%

6.6 Distribution Contract Customers Custom Projects

The third party engineering report *2009 Evaluation of Distribution Contract Custom Projects* March 17, 2010) by Diamond Engineering was also reviewed as part of the 2009 Audit. We also interviewed the engineer that produced the final report.

The distribution contract report is very detailed and the calculations were found to be robust. The evaluator provided a high and low estimate of savings from generally new calculations performed on the basis of data collected during site visits. In this case the level of effort allowed key information to be gathered from the site

For the evaluation, Diamond Engineering reviewed 12 projects that were selected by Summit Blue using the sampling method developing in 2007. For five projects, the evaluator increased the measure life was increased from 20 to 30 years. This is highly questionable in cases where the savings are determined over an existing base case. The issue is not whether the new equipment will last 30 years but whether the old existing equipment would have lasted another 30 years. We recommend that clearer standards be developed for the measure life assumptions for these custom projects.

Our primary concern for these projects is with a single customer site (Customer 193) that had a very large savings claim involving a new plant. This single project accounted for over 27 million m^3 in claimed savings, which is 36 percent of the claimed Distribution Contract custom project savings and 25 percent of the entire 2009 savings claim.

For this particular project, Diamond Engineering was required by Union to use as a baseline a 1997 plant that is still in operation. Using the 1997 plant as a starting point, a series of questionable adjustments are made in an attempt to make the plant comparable to the new 2007 plant. From the audit standpoint, the mandated baseline and subsequent calculations are entirely inappropriate. An appropriate baseline would be to compare the project with a similar *new construction* facility that has a less efficient design. Even taking the new facility and simply assuming it was 10 or 20 percent more efficient than some hypothetical new standard efficiency facility would result in a savings estimate that is a fraction of what Union is claiming for this project.

Based on our review of the Diamond Engineering Report and talking to the engineer that did the analysis, Union was able to revise savings for this project based on an alternative base case using a plant that was built around the same period. While this solution was not ideal, it was the best attainable given the audit timeline. Using this new baseline, gas savings were recalculated at 77 percent of the original claimed savings. The revised savings numbers are used as the audit values for both SSM and LRAM. Given the unique nature of this project, its differences from the other projects in the program, and considering its size, we have removed it from the sample used to calculate the realization rates for the other distribution contract custom projects.

In addition to this project, there was a separate project (Customer 256) where we did not believe the savings calculations treat the insulation factor appropriately and therefore significantly over estimate the project savings. Diamond engineering did some additional analysis and lowered their initial savings claim for this project based on comments from the auditor.

The original realization rates and the audit realization rate are shown in Table 5. The adjustment factors from the 2009 Annual Report are those adjustments recommended by Diamond Engineering to be applied to the savings values from the original project application. The 2009 Audit Value adjustments are those recommended by the current audit to be applied to the original claimed savings (in place of the adjustments recommended by Diamond Engineering).

The audit adjustments were developed by reviewing the same sample of project applications analyzed by Diamond Engineering. Note that the 2009 Audit realization rates have been calculated with Customer 193 removed..

Table 5: Audit Realization Rates for Distribution Contract Custom Projects

Account	2009 Annual Report	2009 Audit Value
Natural Gas	111.5%	105.92%
Electricity	98.9%	47.50%
Water	104.8%	110.27%
Costs	100%	100.24%

We recommend that these adjustments be applied to all 2009 Distribution Contract custom projects for both the 2009 SSM and LRAM. As with the commercial custom projects, in future years we recommend that zero savings be allowed for Distribution Contract custom projects where savings calculations are not adequately documented and evaluated or when an inappropriate baseline is used to calculate savings.

6.7 Custom Project Review Summary

For both the commercial and distribution contract custom projects, we strongly urge that more formal and detailed evaluation procedures be established for custom projects that include a minimum amount of documentation on key savings parameters. The issue of documentation of better documentation has been repeatedly emphasized in past audits for Union but it still remains an area that needs to be significantly improved.

Information that we recommend be kept for all custom projects includes the following:

- Engineering study (if completed as part of project)
- Documentation of whether the project involves an expansion of production capacity
- Historical billing data prior to equipment installation.
- Assumptions regarding baseline conditions and (importantly) the source for the assumptions (*e.g.*, estimated by evaluator, customer, manufacturer/vendor, industry literature, etc.)
- Assumed operating hours for equipment and source for assumption (*e.g.*, customer, historical customer data, vendor, manufacturer, etc.)
- For product claims of savings, these should be backed up with independent evaluation research (literature) or by customer billing data showing the savings (if there is sufficient post-installation data available in time for the evaluation).
- For situations where energy simulations and electronic calculators are used to estimate savings all input and output information should be saved and the calculation tool identified. Information on the source for all key input assumptions should be clearly documented. In some cases measurements might be appropriate. This will help the evaluator determine if the inputs are reasonable (like stratified ceiling

temperature). If the information on the inputs is not available, the evaluator should not just accept the savings estimate at face value but instead develop a new estimate based on what they consider reasonable parameters. This should also be clearly documented so that an auditor can review.

- More information about measure context should be gathered by Union and reviewed during the evaluation. For EMS controls, this includes documenting which end uses are being included in the savings estimate (EMS savings are currently calculated as a percentage of overall building energy use). If the measure is EMS for multi-residential, then applying a savings fraction developed for general commercial buildings should raise some flags. It should be clear whether in-unit gas and electric use is included in the overall usage numbers for the site and adjustments made for usage that is not controlled. For boiler measures impacting cycling or standby losses, this would involve a review of the operating characteristics to insure that savings factors appropriate to space heating load boilers are not being applied to boilers with block loads.

It is not feasible for the evaluator to collect all this information after the project has been completed. We recommend that Union Gas develop a procedure where they maintain a file on each custom project and develop a checklist for the key information requirements. This will ensure that relevant information is collected as the project progresses and will be readily available later when the evaluation begins.

We also recommend that all custom projects have an engineering review (perhaps conducted by Union staff as part of the rebate application process) that screens for and asks for documentation of basic inputs to savings calculations. Hours of operation and assumed temperatures should have a few sentences about their origin (*e.g.*, facility operations staff estimate, measurement, manufacturer) and whether there was any check of these numbers. The project files should also include information on gas usage at the customer site.

A related issue is the timing of the evaluation. If an evaluator were engaged earlier in the year, it would be possible to visit some of the custom sites prior to the equipment being installed. It would also allow pre-metering at sites with large and complex projects, which would greatly improve the evaluation results. Having an engineer on staff at Union would help identify potential metering projects and allow for the evaluation team to be involved early in the process. It will also allow for an M&V plan to be created and vetted prior to the project being completed.

Of critical importance is determining the appropriate baseline for custom projects. This was a particular issue this year given several of the custom projects (especially Customer 193). We recommend that along with developing an M&V plan, a standard process be developed that identifies an appropriate baseline for large custom projects. The baseline assumptions should be reviewed and approved by a 3rd party during the first stage of the evaluation process. As the current audit illustrates, it is not feasible to identify and resolve baseline issues after the evaluation work has been completed.

Finally, we strongly recommend that more time and resources should be devoted to evaluating these projects to ensure that the evaluators are able to delve deeper into the custom savings issues. Based on the RFP and contracts developed by Union for both engineering firms, only a

minimal amount of resources were allocated for these programs. A general guideline for evaluation is for evaluation budgets to be roughly 5 percent of implementation budgets. This threshold is shown in Table 6 and compared with the actual evaluation budgets for the 2009 custom programs.

Table 6: Evaluation Spending

Program	2009 Implementation Budget	5% of Implementation Budget	Actual 2009 3rd Party Engineering Studies*
Commercial	$4,637,816	$231,891	$26,247
Distribution Customer Custom	$5,022,108	$251,105	$66,017

*Total includes only 3rd party engineering studies, does not include any other evaluation research.

7. MARKET TRANSFORMATION

ECONorthwest reviewed the work completed by Union to show progress on its market transformation programs. We also reviewed the action taken on our recommendations in our audit of the 2008 Annual Report.

In our audit of the 2008 Annual Report, ECONorthwest made three recommendations for the Market Transformation program. In its "Summary Results and Responses to the Audit," Union Gas responded that it will review the recommendations with the EAC for consideration in future Market transformation survey and scorecard design. The recommendations and their status are as follows.

- **Define the various levels of familiarity.** Union Gas incorporated this recommendation into the 2009 Customer and Builder surveys—the surveys now include more descriptive levels of familiarity.
- **Accept progress on market transformation metrics only in cases where there is a statistically significant change.** This recommendation was not incorporated into the 2009 metrics.

The Union Gas market transformation program targeted the Drain Water Heat Recovery (DWHR) technology to the residential new construction sector in 2007, 2008, and 2009. Union Gas developed several market transformation metrics to assess progress toward its goals. According to the Union Gas 2009 Annual Report, the metrics are:

- Number of participating builders as tracked by the program;
- Overall number of units installed as a percentage of housing starts as tracked by the program and available housing starts for Union's franchise;
- Customer awareness of the technology as determined through a market survey; and
- Builder awareness of the technology as determined through a market survey.

The 2009 Annual Report shows the 2009 MT Scorecard Results in Table 8.1 of the report. Union Gas provided ECONorthwest a corrected version of the table in a spreadsheet to ECO titled "MT Scorecard updated April 9.xlsx", shown below in Figure 1. The MT Scorecard records progress toward each metric. The metrics are divided between ultimate outcomes and market effects.

Figure 1. 2009 Market Transformation Scorecard Results (Revised)

Element	Metrics	50%	100%	150%	Outcome	Score	Result
ULTIMATE OUTCOMES	Participating Builders	51	61	71	101	**22.5/15**	150%
	Units Installed as a percentage of 2009 housing starts*	9% 983	11% 1,202	12% 1,311	>15% 1564	**82.5/55**	150%
MARKET EFFECTS	Customer Awareness Survey	32%	36%	40%	30%	**3.75/15**	25%
	Builder Knowledge Survey	75%	79%	83%	70%	**0/15**	0%
TOTAL:						**108.75/100**	**109%**

We assume the program's ultimate outcomes—the number of builders enrolled and number of units installed as a percentage of 2009 housing starts—are tracked by internal program databases. ECONorthwest did not attempt to verify the builder enrollment or units installed as part of this audit.

The market effects metrics are measured with two different survey instruments, one for household (customers) and one for builders. Union Gas provided ECO the survey instruments for the Customer Awareness and Builder Knowledge as well as the raw data from the survey respondents.

Calculation of Score

The 2009 Annual Report does not explain how the score shown in the scorecard is calculated, but Union Gas provided an explanation during the course of this audit. The scorecard shows the required results to meet 50, 100, and 150 percent of the performance metrics. For example, for Customer Awareness, 32 percent of the respondents must have confirmed awareness for Union Gas to receive 50 percent of the score for that metric. To receive 100 percent, 36 percent of the respondents must have confirmed awareness. The difference between a 50 and 100 percent score is the difference between 32 and 36 percent confirmed awareness, or four percentage points. The result this year was 30 percent awareness, two percentage points below the 50 percent score. Union Gas explained that since the difference between 50 and 100 percent is four percentage points, they calculated that a decline of two percentage points is half of four, so the percent score should 50 percent divided by two, or 25 percent.

Residential customers survey

The Survey Report for Residential customers states that 502 interviews were completed with new housing customers in Union's franchise area. The Survey Report states that the survey sample size yielded an overall margin of error of +/-3.5 percent at a 90 percent confidence interval. To measure market effects, the report used what it called confirmed awareness. Confirmed awareness is calculated by cross-tabulating respondents who answered yes to the question "Have you heard of a DWHR system for residential homes?" with respondents who reported to have a thorough understanding or know something of the DWHR technology.

According to the data and the survey report, 30 percent of the respondents had confirmed awareness, two percentage points lower than in 2008.

In the 2009 ECONorthwest audit, we recommended that Union Gas only accept progress on market transformation metrics in cases where there is a statistically significant change. The 2009 Annual Report did not incorporate this recommendation. We also reiterate our recommendation that the confidence bounds for the specific questions used to measure market transformation progress be included in the Annual Report.

The survey results are actually lower in 2009, and no improvement in market effects can be shown. Because the margin is +/-3.5 percent, the difference is not statistically significant. If no improvement can be shown, we recommend that zero points be applied for that element. ECONorthwest recommends changing the score from 3.75 (of 15 points) to 0 points for this metric. This change reduces the total score to 105 out of 100 points, or 105 percent.

Home Builders survey

The Survey Report for Home Builders states that 100 interviews were completed with builders across Ontario. The Survey Report states that the survey sample size yielded an overall margin of error of +/-7.8 percent at a 90 percent confidence interval. Confirmed awareness is determined in the same manner as in the Residential sector. According to the data and the survey report, 70 percent of the respondents had confirmed awareness, five percentage points lower than in 2008. Because the margin is +/-7.8 percent, the difference is not significantly different. The score for the Builder Knowledge survey is already 0 in the updated MT Scorecard, and ECONorthwest believes that score is appropriate.

The combined effect of the zero scores for both the Customer and Builders survey metrics results in the overall MT score dropping from 108.75 to 105, or 105 percent. We recommend that the score of 105 be used for the 2009 Union Gas Market Transformation program and that the recommendations discussed above be adopted in future years.

8. AUDIT RECOMMENDATIONS

We recommend the following adjustments be applied to the 2009 DSM results:

- For Low Income bath and kitchen aerators, apply the Beslin retention adjustments from the ESK programs in the input assumptions.
- For showerheads in the Home Retrofit program, move all participants falling in the two highest savings ranges (2.0-2.5 gpm existing and greater than 2.6 gpm existing) into the lowest savings category.
- For commercial custom projects, adjust savings for projects 244 and 245 using the revised savings calculations provided by Diamond Engineering during the audit.
- Savings for all other commercial custom projects should be reduced by 50 percent for gas, water, and electricity. These adjustments are to be done in place of the adjustment factors recommended the by the 3rd party engineer.

- For Distribution Contract custom projects, adopt the adjusted savings values developed by Diamond Engineering during the course of the audit for the 12 projects included in the evaluation sample. Of these twelve projects, Customer 193 should be removed from the sample when calculating the realization rate to be applied to the Distribution Contract custom project population.

- For the remaining Distribution Contract custom projects outside the sample of 12, apply an adjustment factor of 105 percent for gas savings, 47 percent for electricity savings, and 110 percent for water savings. These adjustments are to be done in place of the adjustment factors recommended the by the 3rd party engineer.

- Adopt the savings values from Nexant report on ERV and HRV savings. This was done with an average adjustment for 2009. In 2010, the building-specific savings values should be applied to each individual project.

- Reduce infrared heater savings by 66 percent. Additional evaluation work should be conducted to develop a new savings estimate for use in 2010.

- Apply a free ridership rate of 54 percent to all custom projects (industrial, commercial, agriculture, and distribution) as recommended by Summit Blue in Custom Projects Attribution Study, dated October 31, 2008.

- For showerheads in the Low Income program, change the natural gas savings per unit from 66 m^3 for the 2.0-2.5 existing category to 46 m^3, and from 116 m^3 for the greater 2.6 gpm existing category to 88 m^3.

We reiterate the same issues from the 2008 audit and recommend that the following adjustments be made to future DSM claims:

- Disallow savings for custom projects that are not adequately documented and/or evaluated.

- Only allow market transformation claims when the relevant survey results show statistically significant progress from the baseline.

Table 7 shows the original values for SSM, TRC, and LRAM from the 2009 Annual Report and with the changes recommended as part of the 2009 Audit. If the changes recommended by the 2009 Audit are adopted, we believe that the TRC savings, SSM amount recoverable, LRAM amount recoverable and DSMVA amount recoverable are correctly calculated using reasonable assumptions, based on data that have been gathered and recorded using reasonable methods and accurate in all material respects, and following the rules and principles set down by the Ontario Energy Board.

Table 7: Audit Adjustments to SSM, TRC, LRAM, and DSMVA

Account	2009 Annual Report	2009 Audit Value	% Change
Gas Savings SSM (m^3 000's)	108,975	99,343	-9%
Gas Savings LRAM (m^3 000's)	108,975	92,604	-15%
SSM	$8,921,583*	$8,751,232	-2%
TRC	$345,110,572	$308,255,602	-11%
DSMVA (Total Program Spending)	$22,222,457	$22,222,457	0%

*The SSM payout is capped at $8,921,583. The actual calculated annual report SSM was $10,425,218.

The following are recommendations for future evaluation research.

- **Conduct new free ridership studies (both residential and commercial) with the survey questions and scoring methods thoroughly vetted prior to fielding the survey.** This will allow for a study to be completed that provides results that can be applied with confidence to the savings estimates. We also recommend a method that utilizes fewer questions with a less complicated weighting scheme. Having the survey questions and scoring method reviewed prior to fielding the survey will help ensure that the study produces results that can be used in the net savings calculations.

- **Use larger samples for engineering review, covering the major equipment types and end uses.** Future engineering reviews should utilize larger project samples so that statistically representative samples for the major measures and end uses within sectors are represented. This will allow the sample results to be extrapolated to the population with a greater degree of confidence. Additional suggestions for the custom project sampling are included in the main body of this report.

- **More project detail needed in the engineering review report.** For the projects reviewed by the third party engineers, much more detail should be made available. This includes any engineering site or design reports, documentation of assumptions used to calculate savings, information on existing equipment, and any other information that is necessary for an auditor to see how savings are calculated and to have confidence in the underlying savings calculation parameters. Examples of the types of documentation that should be maintained and the types of issues that should be addressed in the evaluation are discussed in the main body of this audit report.

- **Allocate more resources for evaluation, particularly for custom projects.** As discussed above, 2009 spending on custom project evaluation is much lower than what is typically done in other jurisdictions and consequently is not yielding reliable estimates of savings. Having an engineer at Union monitor applications and require M&V plans for larger projects will also help improve the evaluation results for these programs.

- **Establish a process for identifying and vetting baseline assumptions early in the evaluation.** Baseline issues were a significant source of contention during this audit and will always be a critical part of determining program savings. In the cases of custom projects, we recommend that the baseline assumptions be identified early in the evaluation process (such as during the application approval stage) and then vetted by an independent 3rd party. Given the complexity of the baseline issues for these projects, discussion of the appropriate baseline should not be postponed until the audit stage as it has been in recent years.