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 off 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 79,783,000 m^3
- Total Resource Cost savings of $182,707,000
- Total spending of $23,027,000

Union Gas Limited

- Gas savings of 73,252,000 m^3
- Total Resource Cost savings of $262,754,000
- Total spending of $20,259,000

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ENBRIDGE

June 30, 2009

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 2008 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 2008 DSM Plan Audit Report by June 30, 2009.

EGD has completed the 2008 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

THE CADMUS GROUP, INC.

Report

Independent Audit of 2008 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
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June 26, 2009

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quantec

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Brian Hedman
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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 2008 DSM Annual Report. Cadmus staff reviewed calculations and assumptions, background material and supporting documentation, and internal Enbridge processes and procedures.

Cadmus' 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?

Cadmus 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 audit (included as Appendix B).
- In-person and telephone discussions with Enbridge staff.
- Meetings with Enbridge and EAC.
- "Live" Internet meetings and presentations of tracking databases and spreadsheet calculations.
- Detailed, in-person "walkthroughs" of program participation processes and quality assurances procedures.
- Follow-on telephone discussions with Enbridge staff, report, and with the authors of , reports, and other documents, as document authors, where necessary.

Key Meetings and Discussions

The Cadmus team met with Enbridge staff and the Evaluation and Audit Committee (EAC) on February 24 and 25, 2009, 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 they communicated via e-mail on a regular basis. Cadmus submitted more than 30 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 B.)

Our review of Enbridge program processes, data tracking, and oversight activities identified several areas reflective of industry best practices, among which are:

- The development of a free-ridership methodology for commercial and industrial custom measures
- The development and continual improvement of the E-Tools custom project screening tool, and
- Program QA/QC procedures, especially with regards to third-party implementation of residential direct install programs

On March 3 and 4, 2009, Enbridge hosted discussions between Cadmus and the commercial and industrial engineering review firms BII and Genivar to discuss the draft custom project reviews.

On May 5, 2009, Cadmus staff again met with Enbridge staff and the EAC in Toronto to review the final work plan. Following that meeting, bi-weekly conference calls with Enbridge staff and the EAC 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. The review was tiered according to the total claimed savings by the program and any issues identified in past audits. We compared the prescriptive savings with weather-adjusted savings for like measures in other jurisdictions.

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

- Showerheads
- Pre-rinse spray nozzles
- Custom engineering studies
- Prescriptive boiler savings

Findings and Opinion

For the calendar year ended December 31, 2008, 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 of recording and measuring 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 2008 DSM programs of Enbridge Gas Distribution:

TRC Savings	$182,706,679
SSM Amount Recoverable (Resource Acquisition)	$5,607,522
SSM Amount Recoverable (Market Transformation)	$318,825
LRAM (Recoverable from Ratepayer)	$37,291
DSMVA Amount Recoverable	$(73,340)

Table 1, on the following page, lists the individual program changes reflected in the final SSM, LRAM, and DSMVA amounts. SSM savings were adjusted only by the incorporation of the agricultural realization rate into the overall commercial realization rate, as noted in the custom commercial and industrial program discussion below.

Table 1. Adjusted TRC and LRAM Savings

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 SSM)
Existing Homes	934,150	14,857,208	8,281,218	$43,113,761	14,279,514	$43,113,761
Residential New Construction	1,768	1,709,833	320,693	$498,507	1,709,833	$498,507
Low Income	17,317	584,712	996,085	$1,184,153	581,351	$1,184,153
Total Residential	**953,235**	**17,151,753**	**9,597,996**	**$44,796,421**	**16,570,698**	**$44,796,421**
Small Commercial	1,040	2,229,460	477,251	$4,346,038	852,849	$4,346,038
Large Commercial	219	15,390,429	1,688,426	$33,112,388	15,613,113	$33,559,011
Multi-Residential	23,737	17,654,343	2,181,397	$32,232,293	17,678,287	$32,771,114
Large New Construction	59	3,485,097	570,519	$11,654,781	3,529,074	$11,667,996
Industrial	140	23,871,775	2,197,990	$61,411,882	23,846,594	$61,350,871
Total Business Markets	**25,195**	**62,631,104**	**7,115,583**	**$142,757,382**	**61,519,917**	**$143,695,030**
Market Transformation Programs			528,311			
Program Development and Market Research			685,777	($685,777)		($685,777)
Overheads			5,098,995	($5,098,995)		($5,098,995)
Total All Programs	**978,430**	**79,782,857**	**23,026,662**	**$181,769,031**	**78,090,615**	**$182,706,679**

Table 2 lists the individual measure assumptions that were incorporated in the adjusted LRAM gas savings.

Table 2. LRAM Savings Adjustments

LRAM Savings Changes	2008 Draft Annual Report		Adjusted per Audit		Comment
Measure	Savings per Unit (m3)	Free-ridership	Savings per Unit (m3)	Free-ridership	
EXISTING RESIDENTIAL					
TAPS Partners Program - Kitchen Aerators	22	31%	23	31%	Navigant Report
TAPS Partners Program - Pipe wrap	17	4%	18	4%	Navigant Report
Furnace Replacements	385	82%	385	90%	Navigant Report
Thermostats ($15)	152	43%	146	43%	Navigant Report
RESIDENTIAL NEW CONSTRUCTION					
EnergyStar for New Houses	1,018	5%	1,018	5%	Navigant Report
LOW INCOME					
LI TAPS Partners Program - Pipe wrap	17	1%	18	1%	Navigant Report
LI TAPS Partners Program - Kitchen Aerators	22	1%	23	1%	Navigant Report
LI Prog Thermostats	152	1%	146	1%	Navigant Report
LI Weatherization program	1,143	0%	1,134	0%	Navigant Report
SMALL COMMERCIAL					
Air Doors	2,118	5%	667	5%	Navigant Report
Restaurants - CKV	3,660	5%	4,801	5%	Navigant Report
Restaurants - CKV2	5,960	5%	11,486	5%	Navigant Report
Restaurants - CKV3	10,910	5%	18,924	5%	Navigant Report
Restaurants - PRSV	3,059	5%	886	0%	Navigant Report - Large Restaurant
Rooftop Units	1,275	5%	255	5%	Navigant Report
Tankless Water Heaters	825	2%	154	2%	Navigant Report
Programmable thermostats	519	20%	310	20%	Navigant Report - Average

Table 3 illustrates the calculation of the SSM amount. The Market Transformation SSM in the original calculation is capped at the $450,000.

Table 3. SSM Calculation

	Original	Adjusted for Audit
2008 Actual TRC	$181,769,031	$182,706,679
2008 TRC Target	$168,276,583	$168,276,584
Percent of Actual	1.08	1.09
Base Target	75%	75%
Percent over 75%	33.02%	33.58%
$ 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%	$3,301,802	$3,357,522
Total Program Related	$5,551,802	$5,607,522
Market Transformation	$450,000	$318,825
Total SSM	**$6,001,802**	**$5,926,347**
Market Transformation Detail		
Energuide	$231,200	$231,200
Home Contactor	$152,867	
Boiler Market	$145,333	
Buisness Partners	$87,625	$87,625
Total	$617,025	$318,825

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:

- Gross savings were a product of participation and unit savings.
- Net savings for prescriptive measures were a product of gross savings, free-ridership, and reduction factors for deemed-savings measures.
- Net savings for customer projects were a product 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 product of savings determined by the respective study and the free-ridership rate.
    - Net savings for prescriptive school projects were calculated as the product 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 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 participant costs and direct program costs. Direct program costs include:
    - Incentive payments for the cancelled EnerGuide for New Houses program.
    - Costs associated with market transformation programs.
    - Costs associated with program development and market research.

Review of DSMVA Calculations

The draft DSM Annual Report for 2008 compares budgeted 2008 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 2008 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 included a Web-conference, during which Enbridge staff walked the Cadmus team through the calculations. We find the LRAM spreadsheet accurately calculates the LRAM adjustment. 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 m^3 saved to 78,090,615 for LRAM. Table 4 illustrates the final LRAM adjustment amount.

Table 4: LRAM Calculation

2008 Audit Report LRAM Calculation					
	based on	56,244,500	FE m3 built into rates		
Rate	Budget Net Partially Effective	Actual Net Partially Effective	Volume Variance	Q1 Distribution Margin	$
Rate 1	8,246,394	7,361,104	885,290	~~7.6921~~	~~$ 68,097~~
Rate 6	7,148,028	9,568,648	(2,420,620)	~~4.0023~~	~~$ (96,879)~~
Rate 100	5,703,303	7,408,034	(1,704,731)	2.9427	$ (50,165)
Rate 110	2,019,518	1,040,042	979,475	1.6537	$ 16,197
Rate 115	1,285,148	2,167,715	(882,567)	1.0185	$ (8,989)
Rate 145	1,780,944	1,580,389	200,556	1.9481	$ 3,907
Rate 170	4,282,436	3,968,053	314,383	0.5595	$ 1,759
Totals	**30,465,771**	**33,093,985**	**-2,628,214**		~~$ (66,073)~~
Total Excluding Rate 1 and Rate 6					**$ (37,291)**

TRC Inputs

Prescriptive Savings Programs

In the residential sector we reviewed the following programs:

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

Our review consisted of 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, and measure lives to be consistent with both OEB-approved assumptions and the assumptions employed in other jurisdictions.

Showerhead

While the showerhead savings values were within the range of those used in other jurisdictions, this measure was the source of some debate in the last audit. Ultimately, Enbridge updated the savings to those determined by Summit Blue in its report titled "Resource Savings Values in Selected Residential DSM Programs" (dated June 4, 2008). Subsequent to completion of that report, Enbridge commissioned a study conducted by the SAS Institute of Canada, which found savings to be higher than those in the Summit Blue study. However, the SAS report notes:

> *For a more accurate extrapolation of yearly consumption, the SAS team recommends this analysis be redone after one year post-installation data are available. Further, control households with no low-flow showerhead installation should be included.*

We concur with the SAS recommendation, in particular the absence of a control group substantially increases the uncertainty of the findings. Using a larger sample size, longer post-installation data, and a control group would yield a more accurate estimate. In the interim, we recommend continued use of the Summit Blue estimates for the 2008 and 2009 SSM and LRAM calculations. We recommend that an updated study be performed before the 2010 program and that the resulting savings estimates be filed for approval with the OEB

We confirmed the participants reported in the DSM Annual Report represent households rather than showerheads installed. Savings assumptions in the TRC calculation are correct on a per-household basis.

Novitherm

The Novitherm savings estimation suffers from the same deficiencies noted by the SAS Institute in its estimation of showerhead savings. Notably, the study would benefit from a full year of post-installation data and a control group that did not have Novitherm panels installed. The use of a control group is necessary to account for exogenous impacts, such as economic changes. We

recommend a more comprehensive evaluation of this technology. Pending further evaluation, the OEB-approved savings estimate should continue to be used for SSM and LRAM calculations

EnergyGuide for New Houses

This program was rendered impotent in 2008 due to changes in the Ontario furnace standards. Enbridge did not include the program in its 2008 filing for program assumptions before the OEB; however, the OEB did not act on that application until December of 2008. As a result, the program continued to see participation through October of 2008. The consequence of the OEB ruling is that Enbridge did not have an approved program for 2008. For the 2008 Annual Report , Enbridge has excluded all savings and participant costs from the TRC, SSM and LRAM calculations; however, the program costs it incurred are included.

ENERGY STAR® for New Houses

The savings estimates for ENERGY STAR® for New Houses are comparable to those employed in other jurisdictions; however, we believe the free-ridership value is unrealistic. Typically, ENERGY STAR® residential new construction programs consist of two incentives:

- First, there is an incentive paid to the builder that covers the cost of certifying the home, and this certification incentive is typically about $400.
- Second, some portion of the incremental cost associated with meeting ENERGY STAR® savings criteria is provided as an incentive, and this incentive, which varies with the measures installed, may be several thousand dollars.

The program currently offers a $100 incentive to builders who have their homes certified as meeting the ENERGY STAR® standard. Enbridge has indicated it costs builders between $300 and $600 to have the homes certified. Because the certification cost is significantly higher than the incentive provided and no incentive is offered for the incremental cost of meeting ENERGY STAR® specifications, it is unlikely the incentive is a motivating factor. Enbridge has supported the ENERGY STAR® program since its inception through workshops and other promotional activities. Although this support has likely impacted the market beyond the program participation and $100 incentive, direct attribution of savings is difficult to determine.

For the 2008 program year, in the absence of specific research on free-ridership, the savings and attribution have been unchanged from the OEB-approved values; however, it is highly likely that the free-ridership under the current program design is significantly higher than the 5 percent approved by the OEB.

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

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.

Prescriptive Boilers in Schools

The savings for the prescriptive boiler program are based upon two reports by Agviro. These reports were reviewed as part of the previous (2007) audit, and Cadmus engineering staff reviewed them again for the 2008 audit. Results were based upon billing data analysis and modeling using E-Tools. No substantive flaws in the analysis were identified in either review.

However, we note that the demonstrated ease of use of E-tools for the custom commercial program suggests that a custom approach for this sector may be viable and would increase the confidence in the savings assumptions. We also note that the underlying reason for the Agviro report (published in 2007) was that "custom programs require significant supporting documentation to meet regulatory requirement (sic). In many cases it is difficult for the customer to estimate base case costs and incremental costs."[1] Enbridge's own statistics show a substantial number of schools involved in some custom projects (see Table 5), and the 2008 statistics appear to indicate that the burden of participation in custom projects is moot.

Table 5. School Participation in Enbridge Programs

	2007	2008
All Projects	46	96
Boiler Projects	45	57
Prescriptive Boiler Projects	29	48

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.

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 recommended methodology for sampling.

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 2008 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. Yet, in the absence of a new study, we accept the 2007 numbers for the 2008 participant group.

[1] Agviro Inc, Secondary Schools Prescriptive Savings Analysis, November 23, 2007, p. 1

The realization rate for agriculture custom projects was incorporated into the industrial program realization rate in the draft Annual Report. The sampling protocol developed by Summit Blue as a result of the 2007 audit incorporated the agriculture sample realization rates with the commercial projects. We recommend removing the agriculture realization rates from the industrial program and incorporating them in the commercial program to be consistent with the sampling protocol. This recommendation affects both the SSM and LRAM calculations.

Custom Commercial Programs

For commercial custom programs, the BII study did the following:

- examined 22 projects
- focused on verifying the input assumptions to E-Tools
- employed engineering reviews
- Conducted follow-one telephone conversations with customers

Adjustments were made 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.

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 no discrepancies were found.

While it is standard practice to use telephone verification for prescriptive and small custom projects, on-site verification is usually required for large and/or complex projects. We note that the sampling strategy accepted by Enbridge[2] involves dropping small projects from the sample frame and sampling from the largest stratum of projects. Verification site visits would increase the validity of the verification—although it may not change the results—and bring the verification effort up to industry best practices. We also note that water savings were adjusted by 38 percent because the verification contractor identified water savings that were not included in the initial Enbridge project savings estimate. From a statistical perspective, projecting the adjustment to the population of custom commercial projects is correct. However, it might also suggest a systematic under-reporting of water savings. . We encourage Enbridge to explore this issue for future program reporting.

The measure lives for the Large New Construction projects are currently listed as 25 years, and this measure life is approved for shell and boiler measures, which make up the majority of the savings. (However, other commercial measures have measure lives ranging from 10 to 20 years.) While we did not review the project files for commercial projects, it would be typical for such projects to have a very high percentage of savings resulting from the 25-year measures. Consequently, the impact of reducing the savings life by 5 to 15 years for a small fraction of the total savings will have a negligible impact on the overall SSM calculation. Nonetheless, we recommend that a weighted measure life be calculated for projects that have measures other than shell and boilers, based on the savings contribution of each technology for future TRC and SSM calculations.

We accept the realization rates determined by the BII study.

---

[2] Memorandum, **Sample Selection for 2008 Custom Projects,** Summit Blue Consulting, December 19, 2008.

Custom Industrial Programs

A verification study was commissioned by Enbridge for industrial programs. The study, produced by Genivar, examined 15 industrial and 3 agricultural sites and included document reviews, site visits, verification of input assumptions, and examination of operating conditions. The terms of reference requires the consultant to ". . . review the input assumptions and replicate the engineering algorithms to verify that the savings and costs were correctly calculated."

Cadmus staff reviewed the Genivar report and determined that the report lacked descriptions of the verified engineering algorithms, baseline conditions, and equipment installed, which would allow for an adequate audit. Cadmus then discussed the report with Genivar staff members, who confirmed that they had relied on Enbridge's files to confirm the engineering savings estimates and that no additional back-up was available.

Enbridge provided Cadmus the detailed projects files, including input assumptions, detailed project descriptions, E-Tools screen shots, equipment descriptions, equipment invoices, savings calculations, measure costs, and incentives. Cadmus engineering staff then independently reviewed a sample of input assumptions and calculations and compared them to the Genivar conclusions. No differences or exceptions were noted.

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 were reviewed by Cadmus staff and, together they provide a reasonable review, consistent with current industry practices. We accept the realization rates determined by the Genivar study. However, we recommend that, going forward, more systematic documentation and back-up be provided as part of the verification report.

Market Transformation Programs

A critical component of measurement of market transformation programs is the establishment of meaningful metrics that indicate a program is on a logical trajectory to transform the market, coupled with defensible market indicators (including equipment sales and surveys of current practice). The 2007 audit recommended a more systematic review of current indicators and the development of program logic models to develop performance metrics. Additionally, a recommendation was made to base claims on whether changes in current metrics were statistically significant. However, (1) no logic models were developed, (2) nor were any new indicators or metrics, (3) nor were any measures of statistical significance reported for assessing changes in current indicators.

We are also concerned with the weighting of the metrics and the treatment of metrics that exceed goals. For example, the Business Partners program includes a metric of targeting early adopters and top market players, but it assigns only a 5-percent weight to the metric. This metric is implicitly tied to a program theory based on diffusion of innovation, but does not appear to be appropriately weighted. On the other hand—as noted in the 2007 audit—program activities (such as number of workshops) are given substantial weight even though they may not be indicators of market transformation program effects.

Finally, the approved weighting structure allows for less-relevant metric performance to be exceeded and disproportionally contribute to SSM claims.

Consider the metrics, performance, and contribution to SSM of the Home Performance Contractor Market Transformation Program (Table 6).

Table 6. Metric reports, Weights and Performance

Metric	2008 Reported	2008 Target	Weight	Metric Performance	SSM
Contractor Training (events)	15	6	20%	250%	$50,000
Increase in Weatherization Frequency	.37	1	60%	37%	$22,200
Number of Participating Contractors	242	60	20%	403%	$80,667

Exceeding the number of workshops offered and the number of workshop attendees results in these two metrics contributing 85% toward the SSM, even though the metrics themselves might be inappropriate as market transformation progress indicators. For these reasons, the Market Transformation portfolio claims for 2008 suffer from the same shortcomings as the 2007 portfolio.

EnerGuide for Natural Fireplaces

Enbridge conducted a study of 357 purchasers of gas fireplaces. Results showed a substantial increase in awareness from previous surveys (80 percent of respondents up from 61 percent). Additionally, 74 percent of customers indicated that the label had an influence on their purchase decision. While the numbers are not tests of statistical significance, on face, the numbers appear to validate the SSM claim.

The method for gathering information from purchasers changed from the 2007 to the 2008 report. In 2007, customers were contacted by telephone at some time after the purchase had been made. In 2008, customers were intercepted in the store and offered a $50 inventive to participate in the survey.

There are essentially two major issues that could impact comparison survey results over time:

- changes in the survey instrument itself
- changes in the administration of the survey

Cadmus has confirmed that the wording of the questions for the metric has not changed. The issue for the audit is whether the survey implementation methodologies could have impacted the results.

Unfortunately, there is no clear answer. Intercept surveys are used in evaluation research because they provide immediate feedback when purchase decisions are fresh in consumers' minds. As such, they are very appropriate for a point-of purchase program such as EnerGuide for Natural Gas Fireplaces. Telephone surveys, while more common, have the disadvantage of introducing non-response bias (the incentive provided customers in the intercept situation are targeted at decreasing this bias), as well as giving customers more time to think about the decision and perhaps overestimate the program effect by rationalizing decisions already made. Or customers may have forgotten the reasons for making the original decision, and so they offer what they think is a socially acceptable response.

What we do know, however, is that a consistent approach to tracking and survey implementation produces the most reliable results over the long run. We recommend that Enbridge continue the current approach for this program, and we propose no changes to the 2008 claims.

Home Performance Contractor Market Transformation

Enbridge conducted surveys with attendees of a workshop for contractor and then conducted follow-up surveys some months later. Based upon self-reports from participants who responded to both initial and follow-up surveys (72 sets), Enbridge reported an increase of 0.37 (out of a 5-point scale) in the frequency of the top three weatherization measures.

While some progress may be attributable the survey participants, this study has several flaws, amongst which are:

- lack of clarity as to how this program and these changes would affect the market
- lack of comparable baseline data from nonparticipating contractors
- lack of measures of statistical significance in the metric change

For these reasons, we do not support the SSM claim for this program.

Boiler Market Transformation Program

This program appears to be unchanged from the 2007 program, for which the previous auditor recommended no SSM payments. The relationship of the metrics to market transformation has not been clarified, nor has the relative weighting of the metrics. The survey of workshop participants immediately before and immediately after the workshop is not a reasonable indicator of retention of information and future action. Changes in levels of awareness were reported by percentages, but no indication of the number of participants was included in either the annual report or the Enbridge presentation of results.

For these reasons we recommend, again, that the SSM claim for this program be rejected.

Business Partner Market Transformation

This program shows substantial improvement, as it now includes follow-up surveys to verify post-workshop behavior and an implicit program theory (as indicated by the inclusion of a metric entitled "identify and target top market players/early adopters" as part of the approved metrics). Enbridge identified 248 "top HVAC design and installation firms" for the 2008 program, in addition to those identified in 2007.

Enbridge conducted follow-up surveys with 2007 workshop participants, focusing on air-doors and DCV. Surveys included information on measure recommendations since the seminars. Participant behavior was broken out by respondents who had never recommended the measures before the seminars and respondents who had recommended them previously but were now recommending them more frequently.

Results showed what appeared to be a significant increase in new recommendations for these two measures in both groups (although no statistical measures of significance were presented).

Additional workshops were held in 2008 with another set of business partner representatives. Once again, immediate pre- and immediate post-workshop surveys were implemented. We question the usefulness of these surveys by themselves, but recognize their value for future evaluations.

Because of the improvement in program and evaluation design and in the development of linkages to program and market transformation theory, we support the SSM claim for this program.

Recommendations

Based on the audit, we offer the following recommendations for Enbridge:

Change the measure life assumption for steam traps to six years for LRAM until better data are available. The six-year measure life, which is the most recent update to the California DEER database, is a number weighted for high-, medium-, and low-pressure applications. Current Enbridge documentation supporting an increase in steam trap measure life from three to 13 years is based on analysis of four sites, and it uses a straight line projection rather than the industry-standard logistic curve for survival functions. Enbridge could calculate a utility-specific steam trap Effective Useful Life (EUL) estimate by simply (1) gathering data on the age of replaced steam traps on the next 100-150 replacements, as part of the current custom programs, and (2) applying a conventional statistical package to the data (for example, SAS PROC LIFETEST). We encourage Enbridge to undertake this activity. This recommendation affects the SSM in future years.

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).

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.

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.

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.

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.

Revise ENERGY STAR® program. 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.

Document the decision rules for categorizing individual replacements versus advancements for custom projects. A total of 485 custom boiler installations were reported for 2008. Approximately 67 percent (327) were categorized as "advancement," while 158 (33 percent) were characterized as "replacements." Enbridge staff informed the auditor that that the categorization

was made as a result of discussions with the customer; however, there was no specific documentation provided for each decision.

The characterization is important because the TRC savings for the advancement case is based upon the difference between the existing equipment and the new equipment for the period representing the remaining useful life of the original equipment. At the end of the useful life estimate for the old equipment, the remaining savings are calculated as the difference between the new equipment and current practice or code. For the replacement scenario, all of the savings are the difference between the new equipment and a current practice or code baseline.

Current practice in the industry is that *only* a decision to install new equipment before the end of the assumed measure life that is *attributable to utility intervention* should be categorized as advancement. Any independent decision by a customer to install new equipment should be categorized as a replacement, regardless of equipment age. Specifically:

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.

Enbridge's approach, which bases the determination of advancement versus replacement on discussions about the project with the customer, is consistent with current industry standards, but the documentation for the decision is not. We recommend that Enbridge (1) develop formal rules for determining when a custom installation is to be characterized as an advancement or a replacement, and (2) require documentation when the decision is made to characterize a project as advancement. Ideally, this documentation would involve recording customer responses to a specific question or questions.

Evaluation and verification studies in support of annual reports need more time and should be planned and initiated earlier. Final reports were only available in April or May, and one author noted that all site visits and file reviews were performed in one month. This may account for the fact that baseline conditions were not well documented in the industrial verification report and that copies of the project files were supplied to the auditors independently by Enbridge for review.

Conduct site verification visits for commercial custom project verification studies. It is standard practice in evaluation to conduct some telephone verifications usually for simple or small projects. However, for larger custom projects, verification site visits are the standard. Site visits were implemented for the industrial sample, but not for the commercial sample. We recommend that future custom commercial verification studies require site visits.

Conduct annual free-rider surveys for custom project participants. The free-rider adjustments currently used by Enbridge custom commercial projects are based on a survey of 2007 participants. More importantly, the free-rider estimates are savings-weighted averages applied to the 2008 cohort. If the mix of measures, project verified savings, business type, and decision-maker vary from year to year, so will the free-rider estimate. Enbridge has an accepted methodology and approach for

calculating free-ridership ratios, so replication of these ratios for the 40 or 50 participants should not be a burden. Survey information could be gathered by telephone or in conjunction with verification site visits. This recommendation will affect both SSM and LRAM in future years.

Stratify savings calculations for pre-rinse spray nozzles. The savings for this technology is highly dependent on the nature of the commercial operation. CEE notes that small restaurants spray rinse approximately one hour per day; medium-sized restaurants spray rinse 1.5-2 hours per day; and large cafeteria operations spray rinse 3 to 4 hours per day.[3] The prescriptive savings for this measure is based on assumed usage of 3.75 hours per day. The daily usage was determined by a study conducted in 2003, weighted by the number of restaurants surveyed. We recommend that savings be stratified by the nature of the commercial operation in which they are installed. This approach is incorporated in the Navigant study that was adopted by the OEB for use in 2010. Alternatively, the weighted average should be updated on an annual basis based on the actual participation in the program year. This recommendation will affect both SSM and LRAM in future years.

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.

New construction measure life estimates should be savings-weighted. Currently, measure life for new construction is based on the life of the longest-lived measure. In keeping with industry current practice, this should be changed to calculate overall measure life by weighting individual component annual savings measure lives in proportion to lifetime savings. This recommendation will affect both SSM and LRAM in future years.

Develop logic models and market progress indicators for market transformation programs. This recommendation was made in the 2007 report, but has not been implemented. Consequently, it was not possible to recommend even partial SSM return for several market transformation programs, because linkages to market transformation were not established. It should be noted that the Business Partner Market Transformation Program has shown significant improvement in demonstrating an implicit model and theory. More formal program logic and metrics are still required. Future SSM returns should not be considered without these products. This recommendation will affect SSM in future years.

Develop a comprehensive third-party evaluation strategy and schedule. Program evaluations seem to be *ad hoc* and lack an overall strategy and framework. While some Enbridge administrative and support activities are exemplary and represent industry best practices (for example the QA/QC on the TAPS program), the *ad hoc* nature of the evaluation activities produces a wide range of products (some of which are, indeed, excellent). Programs do not necessarily need to be evaluated every year, but they do need an overall strategy and plan for each program cycle, including both process and impact evaluations. Third-party evaluation avoids the appearance of a conflict of interest. The reports should also be publically available for review, and future free-ridership and

[3] http://www.cee1.org/com/com-kit/prv-guides.pdf

savings should be based on the evaluated results. Best practices in program evaluation have budgets in the range of 3 to 6 percent of program expenditures. A comprehensive evaluation program for Enbridge could require a budget of $1,000,000 per year. This recommendation will affect both SSM and LRAM in future years.

Document program process flows and QA/QC procedures. Program process flows and QA/QC procedures were described in great detail, and they reflect some industry best practices; however, no back-up documentation was available. Enbridge would be well-served to develop these flows to facilitate future audits as well as to provide both internal management oversight and input to process improvement.

Review Commercial Custom Program water savings protocols. The verification report for this program found water savings for projects where no water savings were identified by Enbridge. A review of the program protocols and models related to water savings is warranted. This recommendation will affect both SSM and LRAM in future years.

EAC Comments and Recommendations

During the course of the audit analysis—and as a result of a review of the Draft Annual Report and the Draft Audit Report—the EAC offered the following comments and recommendations:

Provide a linkage between historical and current audit. We have included the Auditor, EAC and Enbridge comments and recommendations from the 2007 audit in Appendix B. This appendix also indicates the disposition of each recommendation. During the course of the current audit, we have verified the disposition of these recommendations and have noted the recommendation as appropriate in the preceding program discussion.

Include a summary table with original and audited savings, SSM and LRAM values. A summary table has been added to the introduction.

Describe rational for accepting 25-year measure lives for certain custom commercial projects. We added language describing the rational for accepting 25-year measure lives for certain custom commercial projects that include shell measures, boilers, and other measures.

Clarify program specific recommendations impacts on SSM and LRAM. We added language to indicate whether adjustments recommended by the audit affect the SSM, LRAM, or both.

Verify that the costs for all delivered measures are included in the TRC calculation, whether installed or not. We verified that (1) the TRC costs are based on all delivered measures and (2) savings are based on only those measures for which installation has been verified through program surveys or other verification methods.

Compare number of projects with negative TRCs between 2007 and 2008 program years. Each of 2007 and 2008 program years had approximately 1,000 commercial and industrial custom projects. Of the commercial and industrial custom projects, 147 projects had negative TRCs in 2007 while 76 projects had negative TRCs in 2008 (all of which were included in the TRC calculation). The decline in negative TRCs is indicative of increased pre-screening by Enbridge staff.

Apply best available information for LRAM calculation. We have assumed the Navigant study recently adopted by the OEB to be the basis for the LRAM savings calculation (with the exception of showerhead savings). Navigant adopted the results from a recent study conducted by SAS that we believe to be fundamentally flawed, as discussed above. Until a study is conducted that overcomes the flaws noted by SAS in its analysis, we do not believe the higher level of savings is warranted

The linkage between market transformation metrics and market outcomes is not clear. We agree with this general statement. As indicated above, we find that two of the market transformation program linkages are so vague as not to warrant any SSM payment. In all cases, the market transformation tracking metrics should be revisited to establish a clear linkage with market outcomes.

Individual market transformation metric performance should be capped at 150% of target. We agree that a cap on individual metric performance is important to preserve the weighting of each metric. However this is a policy issue that must ultimately be determined by Enbridge, interested parties, and the OEB.

Clarify "participant" for the Novitherm program. The Novitherm savings and participation is based on an average participating household.

SAS showerhead study suffers from serious flaws. As we noted in the body of this report, the SAS Institute indicated that the showerhead study it conducted suffers from two serious deficiencies: (1) the study period should be longer, and (2), the participant group needs to have a non-participating control group. We agree that the study is flawed and recommend that the currently approved showerhead saving values be used until a more robust study can be conducted.

Appendix A: Documents Reviewed

OEB Documents

Decision in Docket EB-2006-0021 (August 2006)
DSM Handbook – EB-2006-0021 (April 2006)
Enbridge 2008 DSM Variance Clearance Application in – EB-2008-0271 (August 2008)
Decision Phase III EB-2006-0021 - January 2007
Market Transformation Revision – February 2007
2008 Approved Assumptions EB-2008-0384 (January 2009)
Draft DSM Guidelines - EB-2008-0346 (January 2009)
2010 Approved Assumptions – EB-2008-0346 (April 2009)
- Navigant Report
- GEC comments on Navigant Report

2007 Annual Report and Audit

2007 Audit Comments

2008 DSM Draft Annual Report

2008 Draft Annual Report Comments received from GEC

Research Studies

Energy Efficient Boiler Systems Market Place – Agviro
Comparison of ENERGY STAR and Ontario Building Code - Bowser Report
Custom Projects Attribution – Summit Blue
Residential Attribution – Summit Blue
Residential Measure Savings – Summit Blue

Verification Studies

Industrial project sample – Genivar
Commercial project sample – BII
2008 Boiler Market Transformation – Enbridge
2008 Business Partner Market Transformation – Enbridge
2008 Energuide for Natural Gas Fireplaces – Enbridge
2008 Home Performance Contractor Baseline Study – Enbridge
2008 Home Performance Contractor Followup Survey – Enbridge
2008 MultiRes Showerhead – GFK
2008 Novitherm Study – Enbridge
Impact of low-flow showerheads – SAS
GEC comments on SAS low-flow showerhead study
2008 TAPS survey – Quadra Research

Custom Project Sampling Methodology

Report on the Process of the Evaluation and Audit Committee of Enbridge Gas Distribution for the 2007 Year

Appendix B: 2007 Audit Recommendations

Status Report: 2007 Audit Recommendations

Prepared for the 2008 Audit

April, 2009

Introduction

This report follows the Audit Summary Report from the 2007 audit. For each audit recommendation a status update re: 2008 has been added.

A. Auditor Recommendations

ECONorthwest obtained the SSM calculations from Enbridge 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)

This resulted in one recommended correction to the Novitherm free rider rate as noted below.

1. **Recommendation:**

   Adjust the Res. **Novitherm free rider** rate from 1% to zero (value approved by OEB).

   Enbridge Response:

   Enbridge recalculated the program results to correct this clerical error.

   2008 Status: This correction was included with Enbridge's 2008 Assumption Update which was subsequently approved by the Ontario Energy Board (the Board). This

   Resolved

The balance of this section records the Auditor's recommendations re: adjustments to TRC Results based on application of evaluation study findings.

2. **Recommendation:**

   Reduce the Res. **Novitherm installation** adjustment from 85% to 76% based on the rate of completed installations as determined from the Enbridge Novitherm installation survey.

   Enbridge Response:

   Enbridge recalculated the program results as recommended to discount participants who indicated that they would install the panels within the next six months and to only count those participants who had actually installed the panels.

   2008 Status: Enbridge followed this methodology in calculating the installation rate for 2008 participants.

Implemented

3. **Recommendation:**

   Adjust the **low income TAPS installations** using the same installation adjustment factors used for the other residential programs.

   Enbridge Response:

   Enbridge recalculated the program results for 2007 to apply the general TAPS installation rate to low income participants. The number of low income participants in 2007 was too small to ascertain a separate installation rate through the follow-up survey. As participation in the Low Income TAPS program increases, Enbridge will consider administering a separate Follow-up survey to this group of participants.

   2008 Status: In 2008 Enbridge conducted a follow-up survey of low income participants and applied a separate installation rate.

   Implemented

4. **Recommendation:**

   Reduce the total **custom commercial gas savings values** by 2.3 percent and the **Custom industrial gas savings values** by 3.6 percent based on the findings from the evaluation studies.

   Enbridge Response:

   See item #5 below

5. **Recommendation:**

   Subsequent to the Final Audit Report (July 23, 2008), a memorandum was distributed to the 2007 EAC with a recommendation that the results of an **additional detailed custom file review** be applied to all custom projects.

   Enbridge Response:

   Enbridge proposed by way of compromise an overall blended reduction factor for gas savings in the Commercial and Industrial sectors to include results of the auditor's custom project review as well as the engineering review (5.3% for Commercial and 5.5% for Industrial). This method would help maintain the statistical significance used in selecting the original sample. The EAC agreed to this on the basis, as recommended by the Auditor, that this is a transitional solution for 2007 only, and that improvements in the process for 2008 should be implemented. In the auditor memo of July 23rd, the auditor agreed that this approach would yield an appropriate adjustment factor for 2007, subject to its comments about future applicability of the compromise approach. Enbridge subsequently worked with the auditor to adjust the Commercial and Industrial gas savings accordingly.

   2008 Status: This recommendation is specific to 2007 and not applicable to 2008 results.

   Not Applicable

6. **Recommendation:**

   Use the **prescriptive schools boiler savings values** from the Agviro reports for 2007 only for those sites that are considered to be part of the prescriptive schools program.

   Enbridge Response:

Enbridge included the prescriptive boiler savings for selected elementary and secondary school projects in the 2007 DSM Annual Report results.

2008 Status: In 2008, Enbridge continued to apply prescriptive boiler savings only to those projects that are part of the prescriptive schools program.

Implemented

7. Recommendation:

Reduce the SSM incentive amounts for the market transformation programs to $178,151.

Enbridge Response:

The Company pointed out that the Ontario Energy Board may assign SSM incentives for milestones in market transformation programs beyond market effects. "The Board remains satisfied that market outcomes should not be the exclusive metric for shareholder incentives."[4] Enbridge expressed concern that where the Company has met the performance of an approved metric, the SSM should apply. Changes to market transformation SSM metrics should only apply going forward. To expedite resolution of the 2007 results, Enbridge recalculated the Market Transformation SSM calculation for 2007 as recommended.

Enbridge acknowledged the Board's "... expectation that continuous improvement can be achieved within the new long term collaborative framework."[5] Further to the auditor's report, Enbridge intends to work to improve evaluation methods for the market transformation programs in consultation with the EAC. Further, Enbridge will investigate the application of the program theory and logic model approach to at least one market transformation program for 2009 and submit any resulting proposed change in program metrics to the Board for approval.

2008 Status: Enbridge has consulted with the EAC re: market transformation programs, investigated the program theory and logic model approach and submitted revised 2009 program metrics to the Board for approval. Enbridge is continuing to investigate the program theory and logic model approach for application to market transformation programs in 2010 and beyond.

In Progress

B. EAC Recommendations

8. Recommendation:

Adjustments re: **non-installs resulting from the TAPS Follow-up Survey** should be reflected only in the savings of those participants. There should be no change to the incremental costs.

Enbridge Response:

Enbridge reviewed the treatment of the non-install adjustment for TAPS showerheads, TAPS aerators and Novitherm panels and revised the TRC calculation where necessary to ensure that all incremental costs remain in the TRC calculation for programs with non-install adjustments.

2008 Status: This recommendation was implemented in the calculation of 2008 TRC results.

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[4] EB2006-0021,Ontario Energy Board, Decision and Order Phase III, page 5.

[5] EB2006-0021, Ontario Energy Board, Decision and Order, Enbridge Gas Distribution Inc. – Market Transformation Incentive Metrics, page 4.

Implemented

9. Recommendation:

Calculation of savings for custom projects in **Large New Construction** should reflect the introduction of the new Building Code effective April, 2007.

Enbridge Response:

Enbridge reviewed the documentation for all Large New Construction projects included in the 2007 Annual Report and determined that there was one project where the building permit was issued after April 2007. Enbridge adjusted the savings claim for this one project.

2008 Status: In 2008 Enbridge continued to monitor the date of building permit issue and adjust project savings as necessary.

Implemented

10. Recommendation:

The wording in the Board Decision from the Generic Proceeding is ambiguous re: treatment of **negative projects** in results. Negative projects should be either entirely on the books OR entirely off the books. If removed, the project spending should be removed entirely from the DSM budget and DSMVA. Alternatively, the negative projects may be left entirely in the TRC calculation.

Enbridge Response:

In the Annual Report, Enbridge interpreted the Board's Decision to mean that all aspects of the project should be removed from the TRC calculation except for the incentive costs which should be treated as direct cost with a negative impact on the TRC. Following the EAC's recommendation, Enbridge included all aspects of the negative projects in the TRC calculation, budget and DSMVA.

2008 Status: This recommendation was implemented in the calculation of 2008 TRC results.

Implemented

IV LRAM

A. Auditor Recommendations

11. Recommendation :

ECONorthwest recommended that the adjustments based on changes in water temperature and throttling be omitted from the **savings estimates for low flow showerheads** outlined in the Summit Blue Savings Values for Residential Prescriptive Programs Study.

ECONorthwest recommended the following savings values for showerheads: 51m^3, 78m^3 and 117 m^3 for replacement of showerheads at 2, at 2.1 to 2.5 and over 2.6 gallons per minute flow rate. The EAC recommended applying the Summit Blue recommendation instead EcoNorthwest recommendation.

Enbridge Response:

The Company is willing to accept the application of Summit Blue recommended Deemed Savings study results for 2007 LRAM. Enbridge recalculated the showerhead savings accordingly.

The Company's agreement is based on the understanding that these adjustments for 2007 LRAM (with the exception of the item discussed in Recommendation #15 below) are used for setting the 2008 target and for tracking 2008 actual results. Given that we are half way through 2008, this will enable Enbridge to finalize the 2008 target and make 2008 decisions based on this information. Any changes to these values in 2008 will be used for 2008 LRAM purposes only and will not affect the 2008 target or actual.

2008 Status: Enbridge included the Summit Blue recommended savings values in the 2008 Assumption Update which was subsequently approved by the Board.

Implemented (EAC recommendation)

12. Recommendation:

ECONorthwest recommended that the Summit Blue estimates for **programmable thermostats and aerators** be adopted until a study can be conducted by Enbridge to develop savings estimates that are tailored to its own customers.

Enbridge Response:

The Company is willing to accept the application of Summit Blue recommended Deemed Savings study results for 2007 LRAM. Enbridge recalculated the volumetric savings for programmable thermostats and aerators using the Deemed Savings as recommended by Summit Blue and the auditor.

See Recommendation #11 re: application of these adjustments to the 2008 target and tracking of actual results.

2008 Status: Enbridge included the Summit Blue recommended savings values in the 2008 Assumption Update which was subsequently approved by the Board. Enbridge has not pursued a new study for thermostats and aerators.

Implemented (for 2008)

13. Recommendation:

ECONorthwest recommended that the **free ridership rates from the Summit Blue Free Ridership Study** not be used for the 2007 (or future) programs. Until a different free ridership estimate can be completed, ECONorthwest recommended that the previous free ridership values be used for these measures.

Enbridge Response:

In Enbridge's view the study was developed by a firm with acknowledged expertise in the field of free ridership and spillover, the study results are reasonable and the net to gross ratio should be applied. The EAC expressed several concerns with using the spillover results and recommended that only the free rider values from the study be applied to the 2007 LRAM and that the spillover issue be referred to future policy discussion with the Consultative.

The Company is willing to accept the application of Summit Blue recommended free ridership rates (ie. excluding spillover) for 2007 LRAM settlement. Enbridge recalculated the savings for showerheads, aerators, programmable thermostats and furnaces using the free ridership values recommended in the Summit Blue study.

See Recommendation #11 re: application of these adjustments to 2008 target and tracking of actual results.

2008 Status: In the 2008 Assumption Update Enbridge submitted the Summit Blue free ridership values; these were subsequently approved by the Board.

Resolved

14. Recommendation:

Use a gross savings estimate of 28.3 therms for **multi-family clothes washer replacements**. This assumes a new, standard efficiency clothes washer as the baseline rather than the existing machine.

Enbridge Response:

Enbridge has concerns about assuming a new, standard efficiency clothes washer as the baseline since this assumes that the program is directed to capturing scheduled replacements rather than discretionary retrofits. For the 2007 LRAM Enbridge calculated the multi-residential washer savings using the recommended deemed savings. Enbridge has added this item to the list of 2008 research priorities.

2008 Status: Enbridge investigated savings for multi-residential clothes washers but did not have results available for the 2008 Assumption Update. The Board approved continued use of the original assumption of 342m^3 savings for 2008. Enbridge submitted a revised savings value in the 2009 Assumption Update.

Resolved

B. EAC Recommendations

15. Recommendation:

The EAC reviewed the Summit Blue Draft Report for Custom Project Free Ridership and Spillover. The EAC acknowledged that **spillover** was included in the study Terms of Reference and recommended that the net to gross values recommended by Summit Blue be applied to the 2007 LRAM but with no precedent value for use in 2008. The Committee further recommended that the issue of spillover for 2008, TRC and SSM purposes be referred to the Consultative for policy discussion.

Enbridge Response:

In Enbridge's view the study was developed by a firm with acknowledged expertise in the field of free ridership and spillover, the study results are reasonable and the net to gross ratio should be applied.

The Company accepts the application of the Summit Blue recommended net to gross values (including spillover) for 2007 LRAM. Enbridge recalculated custom project volumetric savings using the program-by-program values from the draft Summit Blue study.

Re: application of these adjustments to the 2008 target and tracking of actual results, the Company intends to continue discussion around the issue of spillover with the DSM Consultative at the policy level. Following this discussion, the Company may submit notice to the Board and the parties that the 2008 target is proposed to be adjusted to reflect a 2007 LRAM calculation including the spillover results for custom projects. If approved by the Board, the same net-to-gross value will be applied to 2008 actual results as used for the 2008 target. In the interim the 2008 target will be calculated without spillover included using the program-by-program values from the draft Summit Blue study.

2008 Status: In the 2008 Assumption Update, Enbridge submitted net to gross values (including spillover) for the custom projects. The Board Decision directed Enbridge to apply only the free rider rate to custom projects for 2008. The Company then circulated to all parties a revised Assumption Table reflecting the Board's Decision. In the 2009 Assumption Update Enbridge submitted spillover values for all measures where the information was available. It is expected that the Board will invite comments from intervenors on the 2009 Assumption Update.

In Progress

VI Future Research and Savings Calculations

A. Auditor Recommendations

ECONorthwest recommended that the following adjustments be made to future DSM claims (2008 onward).

16. Recommendation:

Adjust **showerhead and thermostat per unit savings** based on the Summit Blue studies using adjustment discussed in this audit report.

Enbridge Response:

Enbridge is undertaking a load research study of showerhead savings in consultation with the 2008 EAC. Enbridge will also discuss the application of the Summit Blue results for thermostats with the EAC.

2008 Status: In the 2008 Assumption Update Enbridge submitted the showerhead and thermostat savings as recommended by Summit Blue; these values were subsequently approved by the Board. Enbridge began load a load research study of showerhead savings in 2008 but the results were not available for the Update submission. Enbridge included the showerhead load research results in the 2009 Assumption Update which is currently before the Board. Enbridge has not as yet discussed the Summit Blue results for thermostats with the EAC.

In Progress

17. Recommendation:

Apply TAPS installation adjustments to **multi-residential showerhead and aerator installations** until a study can be conducted addressing the multi-family sector.

Enbridge Response:

Enbridge has begun work to design an appropriate non-install study for multi-residential showerheads and will consult with the 2008 EAC.

2008 Status: Enbridge completed a third party study of 2008 multi-residential showerhead installations and incorporated the findings in the 2008 TRC calculation.

Implemented

18. **Recommendation:**

Revise as needed the **prescriptive school savings values** based on new information on the base case conditions.

Enbridge Response:

Enbridge will review the Agviro Report and the auditor's comments with the 2008 EAC.

2008 Status: Enbridge has not yet reviewed the Agviro Report or the auditor's comments with the 2008 EAC. In their review of the 2010 Assumptions, the Board's consultant, (Navigant Consulting) endorsed the Enbridge savings values.

Follow-up needed

19. **Recommendation:**

For **Novitherm panels**, only use survey results for customers that have actually installed the panel to calculate the installation adjustment factor.

Enbridge Response:

This issue was addressed in the SSM recommendations. For 2008 forward, Enbridge agreed to exclude the responses of those participants who intend to install the panels within six months and only use responses from customers who actually installed the panels.

2008 Status: As indicated, in calculating 2008 results, Enbridge used only responses from customers who actually installed the panels.

Implemented

20. **Recommendation:**

All projects in the sample included natural gas savings. There were only a handful of **projects with electrical savings** reviewed by third party engineers and no projects were reviewed with **water savings**. Given the very small sample sizes, ECONorthwest indicated there was no basis for auditing or adjusting the electricity and water savings claims and that these samples must be increased in future years so that the kWh and water savings estimates can receive an adequate review.

Enbridge Response:

Sample used for review by the third party independent engineering firms met OEB requirements and was statistically significant. In conjunction with the EAC, Enbridge will review the sampling methodology for application to the 2008 custom project evaluation work.

2008 Status: Enbridge, together with Union Gas, worked with their respective EACs to develop a sampling methodology for 2008 which included electricity and water savings. This sampling methodology was then used to select the custom projects for the engineering review.

Implemented

EcoNorthwest made the following recommendations regarding future evaluation research.

21. Recommendation:

Conduct a new **residential free ridership study** 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 to the savings estimates. EcoNorthwest also recommended 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.

Enbridge Response:

Study was conducted by a qualified independent consultant. RFP and consultant selection was completed with input from EAC. Enbridge will discuss the application of the Summit Blue residential free ridership study results and any subsequent new residential free ridership study with the 2008 EAC.

2008 Status: Enbridge has not discussed the application of the Summit Blue residential free ridership study results with the EAC or initiated a new residential free ridership study.

Follow-up needed

22. Recommendation:

Develop **savings values for showerheads** using a sample of metered Enbridge customers. Meter tests for showers. Enbridge should conduct a study on low-flow showerheads that involves metering a randomly selected sample of participants before and after the new showerhead is installed. The sample should be large enough and cover enough housing types (single family and multi-family at a minimum) so that the results can be extrapolated to the population.

Enbridge Response:

Enbridge has begun work to develop such a study and has circulated a study proposal to the 2008 EAC for comment.

2008 Status: Enbridge initiated a showerhead load research study for single family homes in 2008. Following consultation with the EAC Enbridge engaged a third party firm to conduct the statistical analysis of the load research findings. Results were not available for the 2008 Assumption Update submission. The study was completed in 2009 and results included in the 2009 Assumption Update submission. In the 2009 Update Enbridge adapted the work of Summit Blue from the single family sector to develop savings estimates for the multi residential sector.

Implemented

23. Recommendation:

For future program years we strongly suggest that new metrics be established for **market transformation programs.** Create formal logic models and program theory documents for these programs. For the market transformation programs, it is important to develop program logic models and associated program theory to articulate what each program is attempting to achieve. These logic models will clearly show the program activities, the associated direct outputs, and how these outputs will result in short-term, mid-term, and long-term market outcomes. NYSERDA has done extensive work developing these models for their programs and these will serve as a good template for what is needed for the Enbridge market transformation programs.

Progress on the various market transformation metrics should also be calculated using confidence ranges (i.e., 90 percent confidence level with an error of +/-10%). Incentives should only be paid on those metrics that show improvement that is statistically significant.

Enbridge Response:

Enbridge will review the market transformation program evaluation methods and metrics for 2009 (see item #7 above) and the next Multi-year plan.

2008 Status: Enbridge has consulted with the EAC re: market transformation programs, investigated the program theory and logic model approach and submitted revised 2009 program metrics to the Board for approval. Enbridge is continuing to investigate the program theory and logic model approach for application to market transformation programs in 2010 and beyond.

In Progress

24. Recommendation:

Use the logic models and program theory to develop performance metrics for **market transformation programs**. Once the logic models and program theory have been developed, specific metrics should be developed that measure the various links between program activities, outputs, and outcomes. Progress on these metrics will then serve as the basis for all evaluation activities for these programs. As discussed previously, activities performed by the program should not be considered as metrics of market transformation (although these were the metrics set for the current programs).

Enbridge Response:

As above, Enbridge will review the market transformation program evaluation methods and metrics.

2008 Status: see above item #23

25. Recommendation:

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.

Enbridge Response:

Enbridge will review this recommendation and discuss with the 2008 EAC.

2008 Status: Enbridge has not as yet discussed this recommendation with the EAC.

Follow-up needed

26. Recommendation:

Create separate samples to cover **projects with electricity and water savings.** A separate and larger sampling method and file review should be done for projects that involve electricity and water savings as these are savings amounts that can contribute to net benefits. The 2007 samples had only a few electricity projects and no water projects. Consequently, the savings calculations received very little review by the 3rd party engineers and no review by the auditor.

Enbridge Response:

Enbridge will review this recommendation and discuss with the 2008 EAC.

2008 Status: Enbridge, together with Union Gas, worked with their respective EACs to develop a sampling methodology for 2008 which included electricity and water savings. This sampling methodology was then used to select the custom projects for the engineering review.

Implemented

27. Recommendation:

More project detail needed in the **engineering review report.** For the projects reviewed by the 3rd 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, printouts from e tools, and any other information that is necessary for an auditor to see how savings are calculated.

Enbridge Response:

Enbridge will review this recommendation and discuss with the 2008 EAC with a view to more clearly defining the respective roles of the engineering review evaluation studies and the auditor.

2008 Status: Enbridge discussed requirements re: the engineering review reports with the 2008 auditor prior to the completion of the reports to ensure that all needed information would be available for the auditor's review.

In Progress

28. Recommendation:

Revise savings estimates for **clothes washers for multi-family units.** We recommend that savings be estimated based on a comparison with a new, standard efficiency model rather than the current practice of comparing the high efficiency model with the existing equipment. A placeholder savings value was recommended for 2007 until research into a new value can be completed.

Enbridge Response:

Enbridge has added this item to the list of 2008 research priorities. Research will be prioritized relative to the other items on the list.

2008 Status: Enbridge investigated savings for multi-residential clothes washers but did not have results available for the 2008 Assumption Update. The Board approved continued use of the original assumption of 342m^3 savings for 2008. Enbridge submitted a revised savings value in the 2009 Assumption Update.

Implemented

29. Recommendation:

Conduct research on effectiveness of **EnerGuide and ENERGY STAR new home** construction rebates. It seems unlikely that these rebates are having any affect on the new construction market. Research demonstrating the incremental benefits of these rebates on builder behavior should be conducted for future program years.

Enbridge Response:

Enbridge will discuss this recommendation on reviewing the list of research priorities with the 2008 EAC.

2008 Status: The EnerGuide for New Homes program was discontinued in 2008. Enbridge has not, as yet, discussed research re: the effectiveness of builder rebates with the EAC.

Follow-up needed

30. Recommendation:

Adopt recommendations provided in the 3rd party engineering review studies. Each of the engineering studies provided a list of recommendations for future evaluation work. The audit supports each of the recommendations made by the engineers regarding future evaluation activities and encourages Enbridge to adopt them as soon as possible.

Enbridge Response:

Enbridge will discuss the research recommendations from the Engineering Review studies with the 2008 EAC. Research priorities in each year have to be set in relation to a review of the full list.

2008 Status: Enbridge is systematically reviewing the recommendations from the 3rd party engineering review studies with the internal DSM engineering committee prior to discussing the recommendations with the EAC.

In Progress

B. EAC Recommendations

31. Recommendation:

Develop research to substantiate prescriptive savings of Novitherm panels in the residential sector for application to 2008 results.

Enbridge Response:

Enbridge has undertaken load research on Novitherm panel installations in the residential sector and will bring forward the study results to the 2008 EAC.

2008 Status: Enbridge circulated the study results to 2008 EAC members in the fall of 2008. The results were submitted in the 2008 Assumption Update and subsequently approved by the Board.

Resolved

32. Recommendation:

For Low Income Weatherization Program, develop approach to savings calculation and evaluation for 2008 following discussion with program manager re: program delivery.

Enbridge Response:

Enbridge will consider with input from the 2008 EAC regarding the 2008 savings calculation and evaluation.

2008 Status: Enbridge has not, as yet, discussed this issue with the EAC. In the 2009 Assumption Update Enbridge submitted revised prescriptive savings and incremental costs per participant based on two years of program results.

Follow-up needed

33. Recommendation:

For greater transparency, report TAPS showerhead and aerator savings separately.

Enbridge Response:

Enbridge will revise TAPS reporting method to separate showerhead and aerator results in 2008 DSM Annual Report.

2008 Status: This recommendation was implemented in 2008 tracking and is reflected in the 2008 Annual Report.

Implemented

34. Recommendation:

In 2008 Energy Star for New Homes, separate results into two groups. For homes where permits were issued under the old building code, apply the prescriptive savings values as approved for 2007. Bring forward new program assumptions for the savings values for Energy Star Homes constructed under the new code.

Enbridge Response:

Enbridge will bring forward new program assumptions for Energy Star Homes constructed under the new code.

2008 Status: In the 2008 Assumption Update, Enbridge submitted program assumptions to be used under the current Ontario Building Code and these were approved by the Board. In the 2009 Assumption Update, Enbridge submitted an additional set of program assumptions for Energy Star Homes constructed under the new code.

Implemented

35. Recommendation:

Put all program assumptions included in Phase III of the Generic Proceeding at the top of the priority list for review and research.

Enbridge Response:

Enbridge will review the 2008 evaluation research priorities with the 2008 EAC following completion of the 2007 audit. These items will be added to the list. Research priorities in each year have to be set in relation to a review of the full list.

2008 Status: Late in 2008 the Board announced the process for approval of assumptions for 2010 and beyond; this process addressed the above recommendation. The Board engaged a consultant (Navigant Consulting) to develop updated assumptions for all measures. This included all measures approved in Phase III of the Generic Proceeding.

Resolved

36. Recommendation:

The TAPS Follow-up Study should clearly indicate whether one or both aerators were installed.

Enbridge Response:

Enbridge will review the survey for the TAPS Follow-up Study and revise as appropriate to address this issue.

2008 Status: The TAPS Follow-up Study was revised in 2008 to capture more detailed information on the number of kitchen and bathroom aerators installed.

Implemented

37. Recommendation:

Enbridge should refer the issue of a change in Steam Trap Measure life to the 2008 EAC for review.

Enbridge Response:

Enbridge has circulated the background study on Steam Trap Measure life to the 2008 EAC for comment.

2008 Status: Enbridge received some comments from the EAC on the Steam Trap Measure life study. The updated measure life value was approved by the Board as part of the 2008 Assumption Update.

Resolved

38. Recommendation:

Bring the issue of spillover and net to gross calculation to the DSM Consultative for policy discussion.

Enbridge Response:

Enbridge will arrange for a discussion of spillover at the DSM Consultative.

2008 Status: Enbridge submitted net to gross values (including spillover) for custom projects in the 2008 Assumption Update. Enbridge's proposed updates were circulated to the Consultative by the Board for comment. Enbridge has not, as yet, included spillover as an agenda item at a Consultative meeting.

Follow-up needed

Appendix C: Questions and Responses

Date	Question	Response	Response Date
4/20/2009	Can you tell me where the backup for the Reduction Factor in the TRC/SSM spreadsheet is? I was expecting it to be in the verification reports but I'm not finding it (or not recognizing it). The reduction factor tab divides a net savings number by a gross savings adjusted for free-ridership number to derive the reduction factor, but I don't see where the net and gross savings numbers come from in the reduction factor tab.	The reduction factors in the reduction factor tab were calculated to ensure gas savings in the actuals tab match what is in DARTS. The reduction factors are calculated using raw data gathered from the TAPs surveys. The attached spreadsheet presents findings from the surveys and calculates the weighted average reduction factor for different measures.	4/21/2009
4/20/2009	I'm having trouble finding the source for the savings estimates and free-ridership for the multi-residential showerheads. Can you point me in the right direction?	The multi-residential showerhead program is a prescriptive program. For source information, you can look at the 2008 OEB approved assumptions. Within our submission are sub-documents that present our source and back-up data.	4/21/2009

Date	Question	Response	Response Date
4/20/2009	The Genivar report calculates separate adjustment factors for industrial and agricultural savings. Can you tell me why the industrial factor is being applied to the agricultural savings in the SSM/TRC spreadsheet?	When Summit Blue was asked to develop a sampling methodology, they saw HVAC technology in the agricultural projects and recommended agricultural projects be placed in the commercial sector sample design. Summit Blue then developed a sampling methodology for the commercial sector that included agricultural projects. Historically, agricultural projects have been included in the industrial sector because the organizations/companies that run agricultural operations, do so to produce agricultural products—producing product is an industrial endeavor. Summit Blue identified three agricultural projects that needed to be verified as part of their recommended sample for the commercial sector. As we have historically placed agricultural projects in the Industrial sector, we asked Genivar to verify the results of the three agricultural projects identified by Summit Blue. Once the verification work was completed by Genivar, a question was raised, where do we put the results of the verification study on the three agricultural projects? Due to time constraints, we did not put the results from the three agricultural projects back into the commercial sample. You may choose to explore this 'glitch' in your audit of our 2008 DSM results. Perhaps we need to put the verification results of the three agricultural projects back into the matrix of commercial projects to be true to the original sample design recommended by Summit Blue, and apply the resulting commercial adjustment factor to both commercial and agricultural projects. This would allow us to be true to the original sample design methodology recommended by Summit Blue.	4/21/2009
4/22/2009	I cannot find any backup for the deemed savings for the multifamily showerheads. I see that the rental deemed savings is listed on the OEB-approved summary sheet, but I have not found where that value comes from. I cannot find the value for the condo savings either on the summary sheet or in the backup sheets.	The 2008 savings assumptions were approved during the 2006 ADR Agreement (see attached document). Showerhead condo savings were adjusted to 94.3 m3 per suite, due to the 2008 GFK Study that determined there were 1.22 showerheads per suite in the Multi-Res.Condo sector. 115 m3 / 1.22 = 94.3 m3 30,966 L / 1.22 = 25,382 L	4/23/2009
4/22/2009	Also, it looks like you uploaded a PowerPoint presentation of the installation rates for Novitherm, but I don't see any savings calculations in the PowerPoint. Item 31 of the 2007 audit recommendations indicates that there was a 2008 study that concluded that the panels saved 4.1%. Do you have that study?	Savings study provided.	4/23/2009

Date	Question	Response	Response Date
4/22/2009	Marco, the 2007 audit recommendations document indicates that the showerhead study was completed this year (Item 22). Do you have that report (it looks like you have uploaded the project description, terms of reference and some interim analysis so far)?	Current study provided.	
4/23/2009	Can you provide documentation for your decision to use the sector-specific free-ridership estimates for C&I projects?	It was settled with the EAC to use sector-specific results. I have asked Judith Ramsay to provide meeting minutes that recorded the EAC recommending the use of sector specific results. Also, please note the OEB approved the use of sector-specific free-ride-ship results for 2008.	4/27/2009
5/4/2009	BII and Genivar Final Report	Delivered.	5/4/2009
5/4/2009	Overview of how participant data are tracked from the time of participation through to the production of the annual report and what kind of controls are in place to assure its accuracy.	Discussed at Enbridge offices.	5/5/2009
5/5/2009	How are homes designated as ENERGY STAR?	1. The builder registers addresses it wants to have ENERGY STAR labeled to a company called Enerquality. Enerquality is a service organization appointed by NRCAN. 2. The builder hires an evaluator to conduct the inspection/audit of the registered addresses to confirm the homes meet ENERGY STAR standards. 3. The evaluator sends its survey/inspection reports to both NRCAN and Enerquality. 4. Enerquality issues the ENERGY STAR label to home addresses that pass the evaluators inspection. 5. Enerquality sends Enbridge monthly summary reports of all addresses that received an ENERGY STAR label. 6. In 2008, Enbridge matched the invoice from the builders to the addresses in the monthly reports. Incentive amounts were paid only for addresses found on monthly reports from Enerquality. 7. Monthly reports from Enerquality are stored and used to track participation and paid-out incentive amounts.	5/6/2009

Date	Question	Response	Response Date
5/8/2009	Do you know how much it costs the builder to hire the evaluator?	This varies, depending on the volume of homes and which company they are using. The average cost ranges from $300–$600. We have considered this to be a marketing expense as a builder needs to do this in order for him to advertise the house as an ENERGY STAR home. It is possible to buy two different homes from two different builders that both meet ENERGY STAR guidelines, yet one has been labeled and one has not. Also, some contractors use the services of Certified Energy Evaluators (evaluator) to help them better design their homes. One example of a better design is an evaluator consulting on the design that requires less timber and meets ENERGY STAR requirements. In this case, the consulting efforts of the evaluator reduced the material cost of the home.	5/14/2009
5/8/2009	Regarding the report, can you tell me what the ESNH and EGNH column titles indicate? Also, what is the distinction between enrollments and labels?	ESNH indicates ENERGY STAR for New Homes, EGNH indicates EnerGuide for New Homes but now is called EnerGuide Rating System. Enrollments are the homes that have sighed up to become ENERGY STAR or EnerGuide, and Labels are the home has been finalized and received the ESNH Label.	5/14/2009
5/13/2009	How does EGD decide whether a boiler is a simple replacement or advancement? What criteria are used?	If the owner or operator of a building indicates a piece of equipment is scheduled for replacement or for removal, the EMC decides the project is a replacement. If the owner or operator of the building indicates the piece of equipment is functioning, and there is no plan to replace or remove it, the EMC decides the project is an advancement. Most building owners prefer to repair an existing boiler because a repair is tax deductible (it is an expense, not a capital investment), requires a lower cash outlay, and is relatively immediate compared to an equipment replacement.	5/20/2009
5/13/2009	How is the base case for an advancement presented? Is it the same for all advancements? Is it tailored to the specific site? How?		

Date	Question	Response	Response Date
5/13/2009	On another related topic: I was struck by what was said at the eTools demonstration regarding ease of use. It seems counter to the EGD position that the process is too complex for the schools sector. Can you explain?	Although eTools is quick to use once the user has been trained and run through a number of examples, this ease of use did not enter into the decision to develop a prescriptive schools boiler program. The primary purpose of the prescriptive schools program was to reduce the administration typically required for custom programs. When the program was being developed, it was observed many schools had similar gas consumption profiles and used boilers of similar efficiency. These similarities suggested the process could be streamlined. By taking advantage of the similarities, a prescriptive program was developed that streamlined the process for the schools and for Enbridge. Not only does this reduce the time required to run E-Tools, but it saves substantial time trying to obtain incremental costs on a case-by-case basis for boilers, which are typically not an individual line item when a school awards a large tender.	5/20/2009
5/15/2009	Are Novitherm values number of participants or number of panels?	Number of participants.	5/19/2009
5/15/2009	Are avoided costs approved by OEB?	Tab 9 of the OEB approved three-year plan outlines the methodology for establishing avoided costs. Enbridge has been following the approved methodology. Also, 2008 avoided costs where filed with the 2007 Audit Summary Report in the Application for Clearance of Accounts (Filed: 2008-08-14, EB-2008-0271, Exhibit B, Tab 5, Schedule 1, Page 19 of 21).	5/19/2009
5/15/2009	The note below Table 2 on page 7 of the Annual Report indicates that the term "participant" in Table 2 refers to the number of measures rather than the number of households. Can you confirm that this is the case?	In 2008 we assumed one device per household in our TRC calculations. Participants in Table 2 truly represent the number of households, and, because we assumed one device per household, participants also presents number of devices. [Cadmus note: Enbridge later provided the TAPS summary information that indicated that the number of installed showerheads was 1.27 per household which is consistent with the deemed savings estimate.]	5/20/2009
5/15/2009	The savings in the TRC calculator for the TAPS showerhead measures appears to be the "per household" savings as calculated by the Summit Blue report, for example 68 cubic meters for "showerheads over 2.5". Is that correct?	The savings in the TRC calculator for the TAPS showerhead measures appears to be the "per household" savings, as calculated by the Summit Blue report; for example, 68 cubic meters for "showerheads over 2.5." Is that correct?	5/20/2009

Date	Question	Response	Response Date
5/15/2009	The savings in the TRC calculator for TAPS showerhead measures is based on installing a 1.25 gpm showerhead. Can you confirm that all of the 2008 showerheads were 1.25 gpm?	Yes, this is correct. Keep in mind that in 2008, we assumed one device per household; so using per household savings is appropriate when estimating savings. [Cadmus note: Enbridge later provided the TAPS summary information that indicated that the number of installed showerheads was 1.27 per household which is consistent with the deemed savings estimate.]	
5/18/2009	Is 150% a cap on market transformation metrics?	No.	5/19/2009
5/18/2009	Are there program costs beyond the costs included in the TRC spreadsheet?	No. Regarding the Energuide for new homes program, if you look at the comments attached to cells AB25 & AC25 (highlighted in green) on tab Actuals of the TRC spreadsheet, you will find an explanation of how the incentive payments where handled.	5/19/2009
5/18/2009	It appears that the total incremental costs are calculated based on the gross number of participants, i.e. before the reduction factor is applied, so I believe that all measure costs whether installed or not have been included. Can you confirm this?	Confirmed. Please refer to Section 8 of the 2007 Audit Recommendation Status summary. Enbridge followed this recommendation in our 2008 programs and results.	5/19/2009
5/18/2009	2) Project S.BM.CM.HOS.016.08 is a steam trap replacement. Can you find out why 15 years was used as the measure life?	Please refer to the attached document (Custom Resource Acquisition Programs, Measure Life Assumptions October 31, 2008). Fifteen years was pulled from this chart under industrial heat recovery. (BKH-Note: BII report indicates pump trap replacement, BII detail indicates steam trap replacement.)	5/20/2009
5/18/2009	3) Project S.BM.CM.SCH.002.08 is also a replacement of boilers. Can you find out why 11 years was used as the measure life?	This project is an advancement. As in question #1, we use 11 years in advancement scenarios.	5/20/2009
5/18/2009	4) Projects S.BM.CM.SCH.007.08 through S.BM.CM.SCH.012.08 are also replacement of boilers. Can you find out why 25 years was used as the measure life and how these differ from the replacement of boiler projects where 11 years was used?	Twenty-five years was pulled from the approved list (see attached document); 25 years was pulled from the boiler line items found in the attached chart.	5/20/2009
5/18/2009	5) Project S.BM.CM.SCH.016.08 is also a replacement of boilers. Can you find out why 11 years was used as the measure life?	This is an advancement. Same as in question 1.	5/20/2009

Date	Question	Response	Response Date
5/18/2009	6) Project S.BM.CM.NC.034.08 is described as "High Efficiency Improvements." A 25 year measure life was used in the TRC spreadsheet. Can you confirm that these were shell improvements? Also, the project file indicates that the incentive was not paid because the customer did not agree to the terms of the EEP. Can you explain what this means and why the project is included in the TRC calculations?	Answer Part 1: Bell Creekbank was an Archetype Calculated project, where the savings were recalculated using the revised A.C. from BII. The project had a measure life of 25 years since it had both shell and HVAC improvements. Answer Part 2: These projects typically have two incentives: one as part of the Design Advisory Program, the second for installation/ implementation. A payment was made for the modeling included in the DAP program. In the agreement for the installation/implementation incentive, EGD asks for access into the building for 18 months. The customer did not agree to this condition, and, as a result, the contract was not signed. EGD was prepared to sign and pay out the incentive if the customer had agreed to all conditions in the contact.	5/27/2009
5/18/2009	7) Project S.BM.IND.ALL.052.08 is an upgrade of an electric furnace. I did not find an approved measure life for electric furnaces. Can you tell me the source of the 18 year measure life?	Please refer to the attached document; 18 years comes from Industrial Equipment, Furnaces (gas-fired). We assumed the same life for an electric furnace.	5/20/2009
5/18/2009	1) Project S.BM.CM.HOS.001.08 is a replacement of boilers. Can you find out why 11 years was used as the measure life?	This project is an advancement. Through previous audits and agreements with the EAC, we have reached agreement to use 11 years in advancement scenarios.	5/20/2009
5/20/2009	Does the EGD note the age of the existing boiler?	We do not collect the age of the boiler as that is not always available and not critical for savings calculations.	5/27/2009
5/27/2009	Project S.BM.CM.NC.038.08 also appears to have HVAC equipment. The measure life assumption for HVAC equipment appears to be 15 years. Do you know the proportion of savings attributable to the shell versus HVAC equipment for these projects? If it is typical that the new construction projects have a mix of HVAC and shell improvements, has the Company considered a weighted measure life?	Historically, for new construction custom projects, we have taken the measure life of shell improvements. We have looked into the application of different measure lives, such as a weighted approach, but have found it difficult to develop a methodology that is acceptable. The table below presents possible values for savings and incremental costs under different scenarios. Challenges with an average weighted approach include the following: 1. How do we best generate all these numbers? 2. How do we use these numbers to generate a weighted average measure life? Is the weighted average based on savings? Based on incremental cost?	5/27/2009

Date	Question	Response	Response Date
5/27/2009	I'm going under the assumption that the new construction projects consist of some combination of shell measures, HVAC, lighting, controls and other energy efficient technologies. Does Archetype model the building with and without these enhancements to create a total savings for the project? If so, does it calculate the savings by measure?	The Archetype calculator was developed because the federal government (NRCAN) was no longer supporting the EE4 calculator, which is the base calculator to determine the savings from base case to high-efficiency case. The EE4 calculator was generating a base case based on the 1998 MNECB (Model National Energy Code of Canada for Buildings); however, when the OBC (Ontario Building Code) was updated in 2006, the EE4 Calculator was not updated. Therefore, the Archetype calculator was developed to adjust the results of the EE4 calculator for the new updated OBC 2006 requirements. It does so in the following measure buckets: • Lighting • Auxiliary Equipment • Space Heating • Space Cooling • Heat Rejection • Pumps and Miscellaneous • Vent Fans • Water Heating • Refrigeration Savings for each bucket are generated. In 2009, Enbridge will no longer be using the Archetype calculator. Base cases will be developed based on the current OBC, not the EE4 calculator.	5/28/2009

Audit Report on Union Gas 2008 Annual Report

A Report to the Audit Subcommittee of the DSM Consultative

Final Report

June 24, 2009

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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. Logan Van Ert, Jessica Smith, and Ted Helvoigt at ECONorthwest assisted with this analysis. Mike Kennedy also provided a review of the engineering studies and other supporting research reports.

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1. INTRODUCTION

ECONorthwest was asked by Union Gas Limited (Union) in consultation with the Evaluation and Audit Committee (EAC) to conduct an audit of the Union Gas DSM 2008 Annual Report. The structure of this audit is different than those that ECONorthwest has conducted in prior years in that there was no detailed review of project files by the auditor for a sample of custom projects. A review of project files was conducted by third party engineering firms as part of Union Gas' 2008 DSM evaluation. Consequently, the audit was limited to a more general review of the 2008 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 2008 audit include the following:

- Audited the draft 2008 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 and participant tracking procedures.
- 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 2008 Annual Report.
- Considered and responded to EAC comments on earlier draft versions of the 2008 Audit 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 the DSMVA calculations.
- 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 a Navigant report that provides savings values for various measures that have been adopted for 2010 as planning assumptions.
- Reviewed the sampling methodology for custom projects developed by Summit Blue
- Reviewed Union Gas survey results used for 2008 market transformation activities
- Assessed the underlying assumptions used in savings estimates
- Reviewed Beslin studies used to determine installation rates for ESK measures.

Our review focused on the 2008 program areas as defined in the 2008 Annual Report:

- Residential Sector
  - New Home Construction
  - Home Retrofit
- Residential-Low Income
  - Helping Homes Conserve
- Commercial Sector
  - New Building Construction
  - Building Retrofit, Audit Programs
- 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 2008 Annual Report is shown in Table 1. (This table is consistent with Table 3.1 in the draft 2008 Annual Report).

Table 1: 2008 Program Savings and Net Benefits (TRC) From Union's 2008 Draft Annual Report

Program Area	Participants	Gas Savings (m^3 000s)	Net TRC (000s)
Residential	405,992	7,188	$25,949
Low Income	35,699	1,575	$5,949
Commercial	85,549	26,164	$79,409
Distribution Contract	189	38,884	$147,524
Market Transformation			$(347)
Other Direct Program Costs			$4,772
Indirect Program Costs			$1,700
Total All Programs	**527,429**	**73,811**	**$252,013**

2. REVIEW OF DSMVA CALCULATIONS

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 2008 Annual Report.

3. REVIEW OF SSM CALCULATIONS

As part of this audit, ECONorthwest replicated the SSM calculations as shown in the 2008 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 2008 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)

In our review, we found several minor discrepancies (typos) that we have discussed with Union during the course of this audit. Union has agreed to make these corrections in the final version of the report.

Based on our review, we recommend the following adjustments be made to the 2008 SSM claim:

- Use the average baseline efficiency estimate from the Seeline boiler study.
- For the Building Retrofit programmable thermostat program, adjust participation in the Hotel/Motel and Multifamily segments to 1 participant per address or business. Implementing this adjustment reduces participation from 3,698 to 3,307 and results in an 11 percent reduction in TRC for that program, from $6,468,874 to $5,784,902.
- Apply the audit savings adjustments to the total 2008 program savings value for the distribution contract custom projects. The audit adjustment rates are 1.05 for gas, 2.2 for electricity, and 1.22 for water. These adjustments replace the average adjustment factors recommended by the evaluator, which were 1.1 for natural gas, 0.37 for electricity, and 1.22 for water.
- Decrease the commercial custom project savings by 30 percent to account for concerns the audit has with the third party engineering review conducted for these projects. This adjustment replaces the adjustment factors recommended by the evaluators, which were 0.96 for natural gas, 0.86 for electricity, and 1.03 for water.

Additional detail on these recommended changes is provided below.

4. REVIEW OF LRAM CALCULATIONS

The LRAM calculation provided by Union was reviewed in this audit and was found to be generally calculated correctly using the same gas savings values utilized in the 2008 SSM calculation provided in the 2008 Annual Report.

Given that the LRAM calculations are to be made with best information currently available, we recommend that the following change be made for the 2008 LRAM calculation:

- Adopt the savings values from the Navigant report *Measure and Assumptions for Demand Side Management (DSM) Planning* (April 16, 2009).
- Use the average baseline efficiency estimate from the Seeline boiler study.

Note that we have not done a thorough review of the Navigant report as this was outside the scope of this audit. The recommendation is being made as a matter of convenience, as the Navigant values have already been approved by the OEB for use in Union's 2010 DSM planning.

Table 2 shows the original values for SSM, TRC, and LRAM from the 2008 Annual Report and with the changes recommended as part of the 2008 Audit. If the changes recommended by the 2008 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	2008 Annual Report	2008 Audit Value	% Change
Gas Savings SSM (m^3 000's)	73,811	73,250	-0.8%
Gas Savings LRAM (m^3 000's)	65,875	61,852	-6.1%
SSM	$8,695,500*	$8,695,500*	0%
TRC	$252,012,957	$262,754,220	+4.3%
DSMVA (Total Program Spending)	$20,258,900	$20,258,900	0%

* The SSM payout is capped at $8,695,500. The actual calculated annual report SSM was $8,737,400 and the calculated audit SSM value was $9,333,500.

The following sections present audit findings as they relate to the residential and business sector programs. In most cases, the savings estimates were consistent with the methods and values set for the 2008 programs as part of the Settlement Proposal. We have provided suggestions for evaluation research to improve the savings estimates for future years.

5. RESIDENTIAL PROGRAM AUDIT RESULTS

For the Residential programs, we reviewed the savings calculations as well as some of 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:

- New Home Construction
- 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 a previous audit for Enbridge, at the request of the EAC we will not repeat our comments here.

5.1 NEW HOME CONSTRUCTION

The Union Gas Home Construction program currently pays builders a $100 incentive for each ENERGY STAR home. There is no supporting evaluation research indicating that the $100 incentive is having any affect on the decision to build a new home to the ENERGY STAR standard.

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

Given the small rebate relative to overall home building costs and the incremental costs associated with meeting the higher standard, it seems extremely unlikely that this program is having any significant effect on the new construction market. We recommend that Union Gas conduct some evaluation research in this area to demonstrate the effectiveness of this program for future years.

We understand from Union that the ENERGY STAR program will no longer be offered in 2009. If there are plans to replace it with a similar residential new construction program, we recommend that no savings be allowed for this program in future years unless there is supporting evaluation research showing that the program activities and incentives are influencing builder behavior.

5.2 Other 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.

Showerhead savings – are savings adjusted to reflect the amount of household showering that is affected by the new showerheads installed by the program?

This issue was eventually resolved through conversations with Union and the EAC. Based on these discussions, we have determined that the savings values have been applied correctly for this measure in the Annual Report.

6. Commercial and Industrial Audit Results

The major business market program issues examined by the audit are described below, followed by a discussion of specific issues raised by the Audit Subcommittee on these programs.

As part of the audit, we reviewed the sampling process used to select projects for the engineering review. 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. Other research reports on boiler efficiency and pre-rinse spray valves were also reviewed.

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. However, we have several issues with the current sampling method and recommend that it be modified in future years. Key recommendations include the following:

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.

3. **Apply results of the evaluated sample and audit review to the entire program.** This recommendation was made as part of 2007 Audit and is reiterated in 2008. This is common evaluation practice and there is no compelling reason for evaluating a sample of projects unless the results are going to be applied to the entire population.

The remainder of our review of the sampling method focused on the changes made from the 2007 sampling method (beginning on p. 73 of the Annual Report). The relevant changes are paraphrased and then discussed below.

Change #2 (p73): *Recognizing that many projects have both electricity and gas savings, the researchers reduce the overall sample requirements (relative to drawing independent samples of projects for gas and for electricity) while maintaining required confidence and precision levels.*

This seems a reasonable approach, however the researchers apparently do not examine or even consider the statistical relationship (*i.e.*, correlation) between expected savings of gas and electric. The greater the degree of colinearity in expected gas and electric savings, the greater the ability (and necessity) to exploit this information in developing the sample design. If expected gas and electric savings are shown to be colinear (*i.e.*, not independent), then the sample should be selected in a way that jointly considers both fuels.

Change #3 (p74): *The researchers state that in addition to stratifying the sample by size of expected savings, samples would be selected respectively from the six projects with the largest gas savings and electric savings.*

This "rule" does not incorporate actual expected savings for each project. Instead, it creates a stratum based on the six largest projects by gas savings and another stratum of the six largest projects based on electricity savings. This approach ignores the relative (or absolute) size of the projects in each stratum and does not address the question "*does stratification result in a meaningful gain in precision?*"

A more statistically valid approach would be to first determine if stratification would lead to a material increase in precision. If so, then stratification should be done using a formulaic method that first orders projects in descending order by expected savings and then assigns projects to the (largest) stratum based on expected savings *relative* to the aggregate expected savings of all projects. Although the number of strata is determined by the analyst, the assignment of projects to a particular strata should be ordered based on expected savings (in addition to any stratification based on measure type, or other programmatic characteristic) such that the aggregate savings of projects in each stratum is approximately equal across the *k* strata. Such a

methodological approach has the flexibility to be applied to any universe of projects and would account for the idiosyncratic differences between groups of projects.[2]

Change #4 (p74): *In developing the joint sample of electric and gas savings, "A decision was made to trade-off a more accurate assessment of gas savings since the EAC has expressed confidence in the abilities of the utilities to estimate gas savings."*

It is not clear why such a trade-off is necessary. The sample could be optimized such that projects with both electric and gas savings would contribute to the requirements of the respective samples.

Change #5 (p74): *The researchers state that for each segment projects are first selected only on electricity TRC benefits.[3] In those instances where there are not enough electric projects to fill out the stratum, the remaining projects are based on gas.*

It is not clear why projects with gas savings would be substituted for non-existent projects with electrical savings. If the portion of the sample allocated to a particular stratum is greater than the number of projects in that stratum, then include all of the projects in the sample stratum, but do not carry-over the remaining sample size for that stratum into another stratum. Stratifying first by the four segments (NC, BR, MR, and OS) may be appropriate in this instance, but the reasoning for such stratification should be made. Further stratifying each of these four strata by size may also be appropriate—but not by assigning an arbitrary number of projects to the first sample frame and the rest to the second. No clear rational regarding the minimization of variance is made.

Change #6 (p74): *Every stratum has more projects than its target sample size (paraphrase).*

This appears to contradict (Change #5) and is unnecessary.

Two-Stage Sampling

Also addressed in Appendix H is the issue of the time required to conduct the analysis of each project selected in the sample. The 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 authors state that the first-stage portion of the sample 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

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[2] For more information on comparing the precision of simple and stratified random samples and on structuring a stratified random sample, see Cochran, 1977, Sampling Techniques.

[3] Segments refer to New Construction (NC), Building Renovation (BR), Multi-Residential (MR), and Other Sectors, such as agriculture.

[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.

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 Next Round of 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.

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).

The following two tables present the result of ECONorthwest's post-hoc evaluation of the likely confidence and precision levels associated with the samples drawn for the 2008 custom project

[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.

TRC. As shown at the bottom of the tables, both samples appear to be sufficient to provide a better than 90/10 relative precision, although the issues discussed above still remain.

Implicit in the precision calculations below is the assumption that the selection of projects for M&V evaluation was done in a way consistent with recognized statistical sampling methods. We did not attempt to replicate the Summit Blue sampling method in these two tables, as more information would be needed on each custom project and the methods used to implement the sampling strategy.

Table 3: Evaluation of Confidence & Precision Levels of Commercial Projects

Characteristic or Factor	Natural Gas (Cubic Meters)	Water (Liters)	Electricity (kWh)
Universe of Projects	228	15	42
Expected Savings	8,393,432	36,697,914	9,695,155
Sample Size	24	3	14
Sample Projects as a Percent of Universe of Projects	29%	97%	76%
Estimated Coefficient of Variation	0.22	NA	NA
Assumed Confidence Level	0.9	NA	NA
Implicit Precision Level**	0.07	NA	NA
Comments	Sample is sufficient to provide estimates at the 90/07 level of confidence & precision	Sample represents such a large percent of universe, no need to evaluate confidence & precision levels	Sample represents such a large percent of universe, no need to evaluate confidence & precision levels

Source: ECONorthwest analysis of data provided by Union Gas

*Coefficient of variation (CV)= Standard Deviation/Mean. The CV was estimated as the weighted average of the CVs of seven strata. The strata were developed so as to approximately minimize the weighted average CV of the population.

** The "Implicit Precision Level" is the precision level one could achieve by drawing the sample that was drawn from the universe of projects and employing a stratification process that minimizes the aggregate coefficient of variation across all strata.

Table 4: Evaluation of Confidence & Precision Levels of Industrial Projects

Characteristic or Factor	Natural Gas (Cubic Meters)	Water (Liters)	Electricity (kWh)
Universe of Projects	127	17	9
Expected Savings	69,141,550	2,181,094	2,753,905
Sample Size	12	3	4
Sample Projects as a Percent of Universe of Projects	37%	98%	87%
Estimated Coefficient of Variation*	0.20	NA	NA
Assumed Confidence Level	0.9	NA	NA
Implicit Precision Level**	0.09	NA	NA
Comments	Sample is sufficient to provide estimates at the 90/07 level of confidence & precision	Sample represents such a large percent of universe, no need to evaluate confidence & precision levels	Sample represents such a large percent of universe, no need to evaluate confidence & precision levels

Source: ECONorthwest analysis of data provided by Union Gas

*Coefficient of variation (CV)= Standard Deviation/Mean. The CV was estimated as the weighted average of the CVs of seven strata. The strata were developed so as to approximately minimize the weighted average CV of the population.

** The "Implicit Precision Level" is the precision level one could achieve by drawing the sample that was drawn from the universe of projects and employing a stratification process that minimizes the aggregate coefficient of variation across all strata.

6.2 Quasi-Prescriptive Savings Calculations

Union Gas provided the audit with a spreadsheet of the quasi-prescriptive measures (ERVs, condensing boilers, and infrared heaters) that was used to establish savings and incentive levels for new and existing applications of these measures. The condensing boiler and infrared heater spreadsheet tabs rely on savings factors that incorporate all the relevant assumptions. However, there is incomplete documentation for these factors (in the materials the utility supplied) and several assumptions in this spreadsheet may need to be re-visited.

Specific comments include the following:

- The boiler tab does provide data on the base and measure efficiency levels, and while the base efficiency level is good for existing buildings, it is likely low for new construction.

- The infrared heater tab is missing data on efficiencies. In addition, 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.

- 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.

6.3 PRE-RINSE SPRAY VALVES

The report *Deemed Savings for (Low Flow) Pre-Rinse Spray Nozzles* (Energy Profiles Limited, January 30, 2009) was reviewed as part of the 2008 audit. The report is thorough and has a good summary of the measured data available and in most regards is satisfactory. The stratification of the savings estimates are likely a good development, however no criteria for how these definitions should be applied are provided in the report. This may be very well designed within the program but given the large difference in savings attributed to these different categories it is important that the report accurately reflect criteria actually used in the program with specific attention to borderline cases such as bars and delis.

Two issues were identified that if properly understood might change the savings numbers or the application of those numbers.

1. **Water Savings.** The water savings estimates are based upon standardized flow models for existing and new devices and a measurement of site pressure, but the pressure adjustment is unclear. The standardized 60psi calculation agrees fairly well with the measured data in the literature review but the report seems to imply they are adjusting the measured data to a standardized pressure. Adjustments are then made for the much higher pressures in the areas they examined. The main literature data used is the Veratec study which seems to be looking at buildings in the same area and so it seems that water pressures should be fairly similar to those found in the Union service area. Given these issues, we do not think that the additional adjustment should be made, especially since building water pressure likely varies with flow and the tests were likely done when the restaurant was not in full operation thus have somewhat elevated pressure. Throttling also does not seem to be accounted for in the savings estimate.

2. **Energy Savings.** The energy savings calculations are somewhat unclear. It appears that a seasonal efficiency using the US-DOE water heater model was developed and then applied to the change in water use. Since the energy factor is a seasonal measure this procedure would not yield the same answer as a procedure that looked at the impact of changing the usage.

6.4 BOILER EFFICIENCY STUDY

The *Boiler Base Case Efficiency Study* (Seeline Group, January 30, 2009) was also reviewed as part of the 2008 Audit. For new boilers, this report provided great detail in terms of a market review. It offers significant insight into the boiler world and is thorough. The only issue that we found is the lack of separation between program and non-program boilers in the analysis. Despite this, there is little doubt that new boiler efficiency is significantly better than the minimum available efficiency at this point. This is supported by the report finding that several boiler manufacturers only sell high efficiency products.

For existing boilers, Union should consider supplementing this study with combustion testing on a sample of boilers, as this would provide additional support for the findings in this report. Currently, the report does not include any testing but instead appears to rely primarily on the report author's general experience with these measures in the field.

The report author states that the boiler applications are so varied that it is impossible to develop a single average baseline efficiency number. The authors also calculate an error range of +/- 8 percent for their average baseline efficiency estimate of 84.3 percent, which results in a wide range of possible values. We are not sure that this confidence interval has been calculated correctly but do not have enough information from the report and supporting documents to verify this.

Despite uncertainty around how the confidence interval is calculated, we believe that the findings of this report should be used by Union for the 2008 LRAM calculations. This value should also be incorporated into the boiler quasi-prescriptive spreadsheet tool that was also reviewed as part of this audit. This tool currently assumes a baseline value of 76 percent seasonal efficiency. If a difference of 4 percent is assumed between combustion efficiency and seasonal efficiency, the boiler report estimate of 84.3 percent combustion efficiency is converted to an 80.3 percent seasonal efficiency. The assumed proposed boiler seasonal efficiency of 88% should remain the same.

There are two complicating issues surrounding the base and proposed efficiencies that should be addressed in future evaluation work. First, the proposed efficiency of 92 percent (88 percent seasonal efficiency) currently used in the boiler spreadsheet has not been evaluated. A condensing boiler efficiency is limited not only by the boiler but also by the entering water temperature. In a typical hot water heating system where the return water temperature is 140F, condensing boiler efficiency can be no better than 87 percent thermal efficiency. Controls and systems need to be designed for lower return water temperatures to achieve the higher efficiencies. A 92 percent efficiency implies an average return water temperature of 110F, which is very cool and it is unlikely that the typical condensing boiler application achieves this level of performance on average.

6.5 COMMERCIAL CUSTOM PROJECT REVIEW

The firm Jacques Whitford conducted an independent engineering review of the Commercial Custom program. Their final report *Review of 2008 DSM Commercial Sector, Custom Projects* (March 30, 2009) was reviewed as part of the 2008 Audit. The evaluation entailed a review of 23 custom energy efficiency projects and the ECONorthwest audit team reviewed this evaluation work. We also requested the backup documentation for a sample of these projects (which was provided by Union) and interviewed the engineer at Jacques Whitford.

For each project, the consultants conducted phone interviews with the business partner or owner (whoever is on application) and checked the savings calculation procedures to ensure that they were reasonable. Inputs were assessed, but in general the evaluation team appears to have accepted the project claims at face value. In some cases the evaluation team compared the custom savings values with savings from similar measures in literature. No site visits were conducted as part of the evaluation.

Due to concerns with the limited material presented in the evaluation report, ECONorthwest reviewed a sampling of the original files for the custom projects. Many of the project files have little information documenting inputs or other factors crucial to the calculations. In order to justify the savings for these projects, we recommend that Union Gas require more detailed information on the background calculations and assumptions for each custom project.

In most cases, there was not enough detail available to allow the audit to replicate the savings estimates and verify the underlying assumptions. In order for the audit to be confident in the commercial custom savings numbers, we recommend that an adjustment factor of 0.70 (*i.e.*, savings be reduced by 30 percent) be applied to all commercial custom projects to adjust for potential errors in the savings calculations. In future years we recommend that zero savings be allowed for custom projects where savings calculations are not adequately documented and evaluated.

6.6 DISTRIBUTION CONTRACT CUSTOMERS CUSTOM PROJECTS

The third Party engineering report *2008 Distribution Contract Custom Projects* by Diamond Engineering (March 22, 2009) was also reviewed as part of the 2008 Audit. We also interviewed the engineer that produced the final report.

The distribution contract customers are responsible for the majority of the commercial sector energy savings and these projects are generally quite complex and involve custom engineering. Diamond Engineering reviewed 12 projects (and four of these projects actually represent two projects that each have two applications). There are two general issues with the savings claims for the distribution contract projects.

- The first is that savings are predicated on steady production levels. Given the economic downturn many of these industrial projects are likely operating significantly below assumptions in the savings estimates. For example, one 2008 participant recently filed for bankruptcy.

- The second is that several of these claims are for repairs to equipment that is no longer functioning properly. No check exists in the system to distinguish claims for minor repairs or denies savings claims for repairs to a device whose savings are already accounted for in the program.

Despite these concerns, overall the evaluation report was fairly comprehensive and thoroughly examined the savings calculation procedures. The engineer reviewed applications, requested additional information on the base case estimates and calculations, and visited the site (for a maximum two hours) to verify installation, expenses, and review assumptions with site staff. During the site visits, the evaluator asked each customer to restate the project in their own words. The evaluator described this process as a "light touch" with no direct verification of the data given by the client. For example, in our discussions with the evaluator he indicated that he did not check the base case for validity and did not consider deferred maintenance issues in some cases where it appeared that these might be relevant. He did look at production data to verify that production levels were reasonably constant between the base case and the site visit.

In most cases, there was not enough detail in the data and project files to allow the audit to replicate the savings estimates and verify the underlying assumptions. We did review some of the project files and discuss them with the engineering firms and developed some savings adjustments. These adjustments were done to correct some errors made by the engineering firm and to remove some gas savings that are actually electricity savings that were converted to gas equivalent units as part of the engineering review.

Based on these factors, the audit adjustment factors for the Distribution Contract custom projects are 1.05 for gas, 2.2 for electricity, and 1.22 for water. As discussed above, the large rate adjustment for electricity is primarily due to changing two projects from gas savings to electricity savings.

We recommend that these adjustments be applied to all 2008 Distribution Contract custom projects for both the 2008 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. Some of the specific items we recommend including in each custom project file are discussed below.

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 third party engineers should also be provided with more direction on how the savings should be determined for evaluation purposes (*e.g.*, determining the appropriate baseline, documentation required for each project, etc.).

There are a few projects in which electrical generation is added where the added generator (with its hypothetical gas use) is used as a base case to calculate savings. Gas savings is claimed in these cases even though gas usage does not change or even increases. It is unclear if these are appropriate projects for claiming savings if consumption increases; they certainly should receive a higher level of scrutiny in the evaluation.

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.

Given the diverse nature of the custom projects, it is difficult to generalize on what type of information should be collected and maintained by Union in each project file. The overall goal is to keep enough information on each project so that a third party reviewer (evaluation or auditor) can come in and clearly see how the savings were calculated and (more importantly) understand the source for all the key savings calculation inputs.

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.

Finally, we 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 very general guidance was provided as to how the savings should be verified and evaluated for the custom projects.

6.8 Other Business Market Issues Raised by the Audit Subcommittee

Clarify what is meant by text in Annual Report regarding "uniqueness" of IR installations.

Union confirmed that the term "uniqueness" was meant to communicate that they did not double count any IR installations.

Commercial Programmable Thermostats—savings are deemed on a per building basis (not per thermostat). Are savings numbers adjusted appropriately to account for this?

This issue was discussed with Union during the audit and it was confirmed that Union makes no additional adjustment on the savings values for buildings receiving multiple thermostats. We have recommended that the savings values for thermostats be limited to one thermostat per building in the hotel and multi-family installations. There are likely adjustments that should be made for other building types (*e.g.*, office, institutional, etc.) but it appears that the hotel and multi-family installations likely overstate the savings the most. Future work should be done by Union to develop an adjustment factor for other building types. The Navigant report does provide thermostat savings for different segments, which will be an improvement if these estimates are adopted.

Commercial / Institutional / Multi-family showerheads—was the verification sample for these large enough to provide reliable results?

Union provided information on showerhead tracking and verification to the audit team for review. This included a description of the verification procedure plus documentation for some of the installations. It appears that the process used (involving either a phone or site visit for each customer) is adequate for verifying these installations. We did not attempt to independently verify any of these installations as part of this audit.

TRC calculations for individual custom projects—do any individual projects fail the TRC test?

Union provided the audit team with a spreadsheet containing the individual custom project TRC calculations. There were no individual projects that failed the TRC test.

Steam traps—are savings claimed for audits or just replacements? What measure life is assumed?

This issue was discussed with Union as part of the audit and it was determined that savings are claimed only for steam trap replacements and not just the steam trap audit. Union claims a measure life of 7-10 years for steam traps in 2008. During the course of the audit, it was agreed to by Union and the EAC that a measure life of 7 to 10 years would be used for 2008.

We reviewed the Enbridge study used to justify the 13-year measure life and concluded that this study is flawed and does not provide adequate support for the measure life assumption. This study uses a sample of only four sites and uses a linear extrapolation to estimate measure life. Both of these are inappropriate, as the sample size is far too small to result in a reliable estimate. The linear approximation is also not an appropriate method to estimate measure life, as the failure process is unlikely to be linear in nature. A more traditional approach such as a using a discrete choice model to estimate the failure rate should be used with a much larger sample.

Due to time and budget constraints, we did not come up with an alternative suggestion for the steam trap measure life as part of this audit.

Navigant study of savings values for 2010—should these be used for LRAM in 2008?

The report was given a general review, but we were not able to provide measure-level recommendations for the 2008 LRAM given time and budget constraints for this audit. Given that the Navigant study appears to be the latest information available, we recommend that they

be used for the 2008 LRAM as a matter of convenience given the timing of the audit and the fact that these values have already been approved for use in the 2010 Union program planning. This should not be construed as an endorsement by the audit to use these values in future years, as we have not reviewed the underlying calculations.

A general comment is that most of the measures covered by the Navigant report are for a certain group or class of buildings. Care must be taken that they are applied within the programs appropriately. For example, many of the residential and non-residential measures save gas and electric. Often these savings seem to be assuming that cooling is present. When applied, will the savings estimates be clearly modified for this when cooling is not present? The existing residential ceiling insulation assumes buildings built prior to 1980 with R10 insulation. Are these savings numbers to be used everywhere, both in places with no insulation and places with more insulation?

Additionally, many of the heating equipment measures have savings expressed as annual gas use per unit capacity per hour. Given the very wide range of interior heat loads in commercial buildings this is a number that is sensitive to lots of variables. The methodology and case weights for this generalized number should be reviewed.

2009 Targets – verify that this calculation has been done correctly

We have reviewed the 2009 target savings values with Union and confirm that these have been calculated correctly.

7. MARKET TRANSFORMATION

We reviewed the work completed by Union to show progress on its market transformation programs. In general, the surveys that Union fielded are adequate for measuring progress on the various metrics that have been established for these programs. We also want to emphasize that progress on these metrics should be considered valid only when the increase in the metrics is statistically significant. The 2008 results were all statistically significant from the baseline, but we recommend that statistical significance be adopted as a formal policy for all market transformation metrics. We also recommend that some additional survey question responses be used to collect more detail on the various progress metrics.

The Union Gas market transformation program targeted the Drain Water Heat Recovery (DWHR) technology to the residential new construction sector in 2007 and 2008. Union Gas developed several market transformation metrics to assess progress toward its goals. According to the Union Gas 2008 Demand Side Management Annual Report, the metrics are:

- Number of builders enrolled in the program
- Overall number of units installed
- Both customer & builder awareness of technology
- Builders' level of promotion

Union Gas utilizes internal program tracking data and customer and builder surveys to measure the market status. Figure 1 shows the program's Market Transformation Scorecard from the

Union Gas 2008 Annual Report, which records progress toward each metric. The metrics are divided between ultimate outcomes and market effects. We assume the program's ultimate outcomes—the number of builders enrolled and number of units installed—are tracked by internal program databases, as there is no survey instrument designation within the Scorecard.

Figure 1. 2008 Market Transformation Scorecard Results

Element	Indicator (weighting)	Metric Levels			Actual	Result	Score
		50%	100%	150%			
ULTIMATE OUTCOMES	Builder's Enrolled (25)	25	30	35	51	150%	84.75 / 70
	Units Installed New Build (45)	1000	1500	1800	1575	105%	
MARKET EFFECTS (Research)	Customer Awareness Survey (10) Baseline – 15%	17%	21%	25%	32%	150%	43 / 30
	Builder Knowledge Survey (10) Baseline – 58%	62%	70%	78%	75%	131%	
	Builder Promotion Survey (10) Baseline – 23%	29%	33%	37%	42%	150%	
Total Score							**127.75/100**

We reviewed the survey results for the customer awareness, builder knowledge, and builder promotion metrics and found that they were consistent with what was reported in the Annual Report. The builder knowledge survey results were not statistically significant from the prior survey at the 95 percent level.[7] The other metrics did have significantly different survey results from the prior survey.

While the survey questions technically measure progress toward the associated market transformation metrics, in some cases there may be ways to improve the question design. We offer the following suggestions:

- **Define the various levels of familiarity.** Currently, the Customer and Builder Surveys ask how familiar the respondent is with the DWHR technology. However, various respondents may have different interpretations of what it means to be "very familiar" with a technology versus other levels of familiarity. For greater consistency and transparency of survey results, Union Gas may want to consider offering definitions for each answer category. For example, for the Customer Survey, "very familiar" = thoroughly understand how the technology works and its benefits; "somewhat familiar" = know somewhat how the technology works and its benefits; not very familiar = have heard of the technology but don't know much about it, etc.

[7] The combined 95 percent confidence interval has a range of 17.2 percent, which exceeds the 17 percent difference between the average values from each survey (58 percent and 75 percent). At the 90 percent level of confidence, the survey results are significantly different. Since the 95 percent confidence level was reported by Union in 2007 and 2008, that is the standard applied in the 2008 Audit. In future years, the confidence level should be set by Union and the EAC prior to beginning any evaluation work.

For builders, the definitions might be slightly different, *i.e.*, very familiar = thoroughly understand how to install the equipment, how to maintain it, how it works, and its benefits; somewhat familiar = know somewhat how install the equipment, how to maintain it, how it works, and its benefits; not very familiar = have heard of the technology but don't know much about it, etc.

- **Expand the answer categories for builder promotion of the technology.** In the Builder Survey, the answer categories to question A4 could be revised in order to provide more information about the builder's level of promotion of the DWHR technology. Specifically, the second answer category "we offer it as an optional installation to home buyers" does not reveal how much the builder advocates the technology to their customers. We suggest that this second answer category be expanded into several answer choices so that the survey instrument can better appraise the builder's degree of endorsement. For example: 1) We offer it as an optional installation to homebuyers, but do not recommend it more than other options, and, 2) We offer it as an optional installation to homebuyers and recommend it.

- **Accept progress on market transformation metrics only in cases where there is a statistically significant change.** This was a recommendation from the 2007 audit and is reiterated again for 2008. We recommend in the future that progress on each metric only be counted if there are statistically significant differences across survey years at the 95 confidence level. We also recommend that the confidence bounds for the specific questions used to measure market transformation progress be included in the Annual Report.

8. AUDIT RECOMMENDATIONS

We found that the 2008 Annual Report generally conformed to the methods agreed upon for these programs. As discussed above, we were unable to conduct a detailed review of the custom savings estimates due to the limited information available in the third party engineering reports completed for the 2008 evaluation.

We recommend the following adjustments be applied to the 2008 DSM results:

- Adjust commercial thermostat savings values for hotels and multi-family to include only one thermostat per site.

- Savings for commercial custom projects be reduced by 30 percent for gas, water, and electricity.

- For the Distribution Contract custom projects, apply an adjustment factor of 1.05 for gas savings, 2.2 for electricity savings, and 1.22 for water savings.

- Use the boiler efficiency baseline estimate from the Seeline study.

We recommend that the following adjustments be made to future DSM claims (2009 onward):

- Do not claim savings for ENERGY STAR homes under the current program design.
- 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 2 shows the original values for SSM, TRC, and LRAM from the 2008 Annual Report and with the changes recommended as part of the 2008 Audit. If the changes recommended by the 2008 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 5: Audit Adjustments to SSM, TRC, LRAM, and DSMVA

Account	2008 Annual Report	2008 Audit Value	% Change
Gas Savings SSM (m^3 000's)	73,811	73,250	-0.8%
Gas Savings LRAM (m^3 000's)	65,875	61,852	-6.1%
SSM	$8,695,500*	$8,695,500*	0%
TRC	$252,012,957	$262,754,220	+4.3%
DSMVA (Total Program Spending)	$20,258,900	$20,258,900	0%

* The SSM payout is capped at $8,695,500. The actual calculated annual report SSM was $8,737,400 and the calculated audit SSM value was $9,333,500.

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.

- **Conduct research on effectiveness of ENERGY STAR new home construction rebates.** It seems unlikely that these rebates are having any effect on the new construction market. Research demonstrating the incremental benefits of these rebates on builder behavior should be conducted for future program years. No savings claims should be allowed in future years if a similar program is implemented without supporting evaluation research that has been thoroughly vetted.