2014

DEMAND SIDE MANAGEMENT ANNUAL REPORT

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ENBRIDGE®

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1. Executive Summary

In response to EB-2008-0346, the Demand Side Management Guidelines for Natural Gas Utilities (the Guidelines), published June 30, 2011 by the Ontario Energy Board, in November 2011, Enbridge Gas Distribution Inc. (Enbridge, EGD or the Company) submitted its plan outlining proposed DSM activities for the upcoming three years (EB-2011-0295). Subsequently, following an extensive consultation process in the summer of 2012, the 2013-2014 Update to the Enbridge 2012-2014 Demand Side Management (DSM) Plan (EB-2012-0394) was filed on February 28th, 2013 and reflected a comprehensive agreement reached with intervenor working groups in respect of program updates, budgets, metrics and targets.

The 2013-2014 Update to the Enbridge 2012-2014 DSM Plan continued with aggressive targets to maximize cost-effective natural gas savings. The 2012-2014 Enbridge portfolio of DSM offers was designed to allow all customer classes access to cost-effective energy efficiency offers and to optimize program results. The 2012-2014 DSM Plan uses a scorecard approach for measurement.

The Company is pleased to report that in 2014, the portfolio generated total annual natural gas savings of 43,540,237 cubic meters (m^3) or 719,842,637 lifetime (cumulative) cubic meters (CCM). These savings are a direct result of efforts in delivering the Company's Resource Acquisition and Low Income programs. Natural gas savings attributable to Market Transformation program delivery in 2014 are not captured in these totals as they are not measured on the basis of cubic meters (m^3) or lifetime (cumulative) cubic meters (CCM) saved.

In relation to its core business, as a gas distribution company, the total annual throughput of natural gas to the Company's customers in 2014 was approximately 11 billion cubic meters.[1]

Even though the current framework is based on CCM, total TRC net benefits continue to be an important indicator of the considerable positive impact that Enbridge achieves in respect of its DSM efforts.

1 This estimation is based on the total throughput for rate classes that contain 2014 DSM program participants (Rates 1, 6, 110, 115, 135, 145 and 170).

Further, as per the Guidelines, the Board calls for application of the TRC test to screen for cost-effectiveness at the program level. In 2014, the portfolio again demonstrated cost-effective program delivery based on positive TRC screening. The TRC for the Resource Acquisition program was 2.84, while the TRC for the Low Income program was 1.33 – both well above their cost-effectiveness screening thresholds.

DSM natural gas savings results for 2014 were achieved with spending of $32.51 million, 1% or $352,502 over the OEB approved budget.

Table 1. 2014 DSM Overall Results

Program	Annual Net Gas Savings (m3)	Cumulative Net Gas Savings (m3)	Budget	Spending ($)	TRC Ratio
Resource Acquistion					
Residential	5,914,881	89,690,562	$1,836,456	$8,605,657	1.96
Commercial	22,405,020	389,415,717	$8,090,102	$5,760,122	3.25
Industrial	12,474,745	185,261,718	$4,234,020	$2,214,856	3.87
Overheads			$4,638,711	$4,636,555	
Total Resource Acquisition	**40,794,646**	**664,367,997**	**$18,799,289**	**$21,217,190**	**2.84**
Low Income					
Part 9 (Single Family)	1,036,919	25,673,482	$4,564,500	$4,494,530	1.03
Part 3 (Multi Family)	1,708,673	29,801,158	$2,165,000	$1,930,180	2.03
Overheads			$507,831	$507,595	
Total Low Income	**2,745,592**	**55,474,640**	**$7,237,331**	**$6,932,305**	**1.33**
Market Transformation					
SBD Residential	n/a	n/a	$2,445,000	$1,334,035	n/a
SBD Commercial	n/a	n/a	$950,000	$739,435	n/a
Home Labelling	n/a	n/a	$1,400,000	$979,337	n/a
Overheads			$1,327,144	$1,308,965	
Total Market Transformation	**n/a**	**n/a**	**$6,122,144**	**$4,361,771**	**n/a**
Grand Total	**43,540,237**	**719,842,637**	**$32,158,764**	**$32,511,266**	

The Demand Side Management Incentive (DSMI) has been determined based on Enbridge's 2014 DSM performance results in relation to the weighted scoring approach. The 2014 DSM Incentive is calculated at $7,647,242. The maximum shareholder incentive available for the 2014 program year is $10.872 million.

Table 2. 2014 DSM Summary

2014 DSM Results Summary	
Net CCM Savings	**719,842,637 m^3**
DSMIDA amount recoverable from Ratepayers	**$7,647,242**
LRAMVA amount (to be refunded to Ratepayers)*	**($65,339)**
DSMVA amount recoverable from Ratepayers	**$352,502**

*The LRAMVA is negative, indicating that it is money owed by Enbridge to ratepayers

The Company is gratified with its accomplishments overall and was able to demonstrate solid results relative to targets for many of its customer offers.

Overall the Resource Acquisition program contributed 664 million CCM in natural gas savings. Resource Acquisition offers targeted to the Commercial and Industrial sectors did not reach savings targets established for 2014, with gas savings of 389 million and 185 million CCM for the Commercial and Industrial sectors respectively. However, the Residential home retrofit offer which has seen excellent growth since its inception in mid-2012 contributed close to 90 million CCM and reached 5,213 households.

The Low Income program delivered 55 million CCM in 2014. Results relative to target were mixed with Single Family (Part 9) offers performing well relative to targets, and Multi-Residential (Part 3) offers not reaching the 2014 target established for that segment of the program.

Market Transformation offers continued to demonstrate strong results in 2014, with results at, or exceeding weighted scorecard upper targets for all three of the Savings by Design Residential, Savings by Design Commercial and Home Labelling offers.

2. Introduction

Following a directive from the Ontario Energy Board, (EBO 169-III) in 1995, Enbridge began to offer Demand Side Management programs to help customers reduce their demand for natural gas. In 1999, Enbridge was granted Board approval to receive a financial incentive for DSM activities by way of the Shared Savings Mechanism (SSM). The continuing need for DSM efforts in the province of Ontario was outlined by the Ontario Energy Board in the Demand Side Management Guidelines for Natural Gas Utilities (the Guidelines), published June 30, 2011 (in which the Demand Side Management Incentive replaced the SSM). These Guidelines apply to the 2012-2014 Multi-Year Plan period.

"Natural gas demand side management ("DSM") is the modification of consumer demand for natural gas through various methods such as financial incentives, education and other programs. While the focus of DSM is natural gas savings and the reduction in greenhouse gases emissions, it may also result in the saving of a number of other resources such as electricity, water, propane, and heating fuel oil."[2]

The DSM Guidelines sets out three primary objectives to help guide the utilities' DSM portfolios:

- maximize cost-effective natural gas savings;
- prevent lost opportunities;
- and pursue deep savings.

The framework also outlines budget limits and affords utility performance incentives in relation to DSM activities.

Furthermore, the Guidelines also outline a Lost Revenue Adjustment Mechanism (LRAM) and Demand Side Management Variance Account (DSMVA). The LRAM "is a mechanism to adjust for margins the utility loses if its DSM Program is more (or less) successful in the period after rates are set than was planned in setting the rates."[3] The DSMVA allows the Company to exceed the DSM budget in a given year, provided that the

2 *Demand Side Management Guidelines for Natural Gas Utilities* (EB-2008-0346), OEB, June 30, 2011, page 1.

3 EBRO 495, Decision, Page 100.

Company meets the Board approved target. It also requires the repayment of any unspent budget amounts to ratepayers.

The Guidelines provide an overall framework for program design and propose a scorecard approach to measuring DSM programs, including metrics appropriate to different customer offers. The principal measurement metric for evaluating programs is cubic meters (m^3) of cumulative natural gas savings. Cumulative cubic meters (CCM) is defined as the natural gas savings over the life of an installed DSM measure.[4] Performance may however be assessed by other metrics such as number of participants.

As stated in the Guidelines, a cost-efficiency measure, such as the "$ spent per m^3 of cumulative natural gas saved", provides greater transparency to interested participants and the Board. In response, $/CCM savings calculations are included in this report. The Total Resource Cost (TRC) determination is also an important and recognized measure of cost-effectiveness for DSM purposes, and continues to be utilized for program screening, as documented in this report.

The Company's 2012-2014 DSM Plan outlines a three year strategy for the Company's DSM programs, designed to respond to customer needs and changing market conditions. The Plan encompasses Resource Acquisition, Low Income and Market Transformation programs, which reflect extensive consultation and negotiation between Enbridge and intervenors.

The Company's DSM programs are funded through distribution rates and are designed to produce a variety of measured and unmeasured societal benefits, including reduced consumer bills, economic stimulus, environmental benefits and benefits specific to low income consumers. The 2012-2014 DSM Plan (EB-2011-0295) was approved by the Board on February 9th, 2012. Later, following further negotiations with the DSM Consultative in 2012, the parties reached a Settlement Agreement to establish budget allocations, metrics and targets for 2013 and 2014. The 2013-2014 Update to the Enbridge 2012-2014 DSM Plan (EB-2012-0394) was filed on March 4th, 2013. The Board provided a Decision on the Update on July 4th, 2013:

4 Ibid, page 28.

> "The Board approves the Settlement Agreement and its rate consequences on an interim basis. In approving the Settlement Agreement, the Board expects Enbridge to proceed with the corresponding DSM activities in 2013 and 2014. The intent of this Board decision is to provide the opportunity for the 2014 DSM budget to be further reviewed."[5]

On March 13, 2014, the Board provided a further Decision on the Update:

> "The Board agrees with Enbridge that given the findings of the Board in the GTA proceeding, the Settlement Agreement containing the 2013 and 2014 DSM budgets is approved and no additional submissions are required."[6]

Report Overview

The 2014 Annual Report on Enbridge's DSM energy efficiency programs provides an overview of the results achieved over the past program year in terms of scorecard performance. The report also provides a comparison of actual to target results, and incorporates any necessary adjustments to savings outcomes.

The report provides information in support of the Company's 2014 Demand Side Management Incentive Deferral Account (DSMIDA), DSMVA and LRAM claims. Once drafted, the report is reviewed as part of a comprehensive third-party independent audit.

Approach to Natural Gas Savings Calculations

The DSM portfolio encompasses the Resource Acquisition, Low Income and Market Transformation programs which include offers directed toward residential, commercial and industrial customers. The Resource Acquisition and Low Income programs include three major categories of offers – prescriptive, quasi-prescriptive and custom.

5 EB-2012-0394, OEB - Decision and Order on Settlement Agreement, July 4, 2013, page 3.
6 EB-2012-0394, OEB - Decision and Order on Settlement Agreement, March 13, 2014, page 4.

Prescriptive and quasi-prescriptive results are calculated based on the number of units installed along with the deemed savings and related assumptions for specific DSM measures, as filed and submitted to the Board in the Company's 2012-2014 DSM Plan (EB-2011-0295). On March 27, 2015, Enbridge Gas Distribution Inc. and Union Gas Ltd. submitted a joint application that sought approval from the Ontario Energy Board for new and updated Demand Side Management measures. The Board assigned this matter file number EB-2014-0354. With endorsement of the Technical Evaluation Committee (TEC), this most recent joint submission to the Board provided an update to the assumptions for a selected number of measures.

In the case of custom projects, natural gas savings are based on detailed measure/technology related calculations for individual projects undertaken at sites where energy efficiency improvements have been made as a result of Enbridge involvement. Where applicable, Enbridge utilizes its E-Tools calculation software to establish savings estimates.

Energy savings for Community Energy Conservation (CEC), the Residential Resource Acquisition offer (formerly Community Energy Retrofit) and Home Winterproofing (formerly the Low Income Weatherization offer) are determined utilizing Natural Resources Canada (NRCan) accredited software,HOT2000, and the U.S. Department of Energy's REM/Rate software.

The Market Transformation program is assessed in terms of metrics specific to each offer.

3. 2014 DSM Portfolio Scorecard Summary

The 2014 DSM program scorecard results are presented in Table 3.

Table 3. 2014 DSM Program Scorecard Summary

	Component	Metric	Weight	Targets Lower	Targets Middle	Targets Upper	2014 Actual Result
Resource Acquisition	Volumes	*Cumulative Savings (million m³)*	***92%***	744.05	992.06	1240.08	**664.37**
	Residential Deep Savings	*Number of Houses* [1]	***8%***	560	747	934	**5,213**
Low Income	Single Family (Part 9)	*Cumulative Savings (million m³)*	***50%***	17.70	23.60	29.50	**25.67**
	Multi-residential (Part 3)	*Cumulative Savings (million m³)*	***45%***	48.15	64.20	80.25	**29.80**
	Multi-residential (Part 3) LIBPM [2]	*Percent of Part 3 Participants Enrolled* [3]	***5%***	30%	40%	50%	**74%**
Market Transformation	Residential Savings by Design	*Completed Units*	***40%***	750	1,000	1,250	**1,059**
		Previously Non-Participating Builders Enrolled [4]	***60%***	12	16	20	**23**
	Commercial Savings by Design	*New Developments Enrolled*	***100%***	8	12	19	**19**
	Home Labelling	*Number of Committed Realtors* [5, 6]	***70%***	N/A	5,000 [5]	10,000 [5]	**40,040**
		Ratings performed	***30%***	750	1,500	2,250	**662**

1. Number of houses with at least two major measures and where average annual gas savings across all participants is at least 25% of combined baseline space heating and water heating usage.
2. LIBPM - Low Income Building Performance Management is the Low Income offer complement to the Commercial Run It Right (RIR) offer.
3. Low Income Building Performance Management (LIBPM) percentage of Part 3 buildings enrolled in the current year program = (x+y)/(x+y+z):
   x = # of new LIBPM buildings in the current year that have participated in another aspect of the Low Income program in a previous year of 2012-2014 plan; y = # of new LIBPM buildings participating in current year that have not previously participated in the Low Income program; z = # of buildings in the current year that have implemented custom projects other than LIBPM.
4. Eligible builders based on a minimum of 50 homes built in the prior year.
5. Commitments to make provision for a data field to show home energy ratings for all homes listed by participating realtors (industry-wide commitment to include such a field on MLS or similar listing service and/or realtors' commitment to do so with all the homes they list on their own websites, handouts and other consumer material).
6. Commitment from realtors collectively responsible for more than 5,000 (middle target) or 10,000 (upper target) listings/year.

As outlined in the Update to the 2012 to 2014 Demand Side Management Plan (EB-2012-0394), program scorecard results are weighted (see Table 3 above). These weighted scorecards are the basis for the calculation of the Demand Side Management Incentive. DSMI amounts for the 2014 program year are outlined in Section 8 of this report.

As summarized in Table 4, in terms of CCM savings, the 2014 DSM portfolio did not reach the overall CCM savings target. Actual results totalled 719,842,637 cumulative m^3 for all offers that include CCM as a metric.

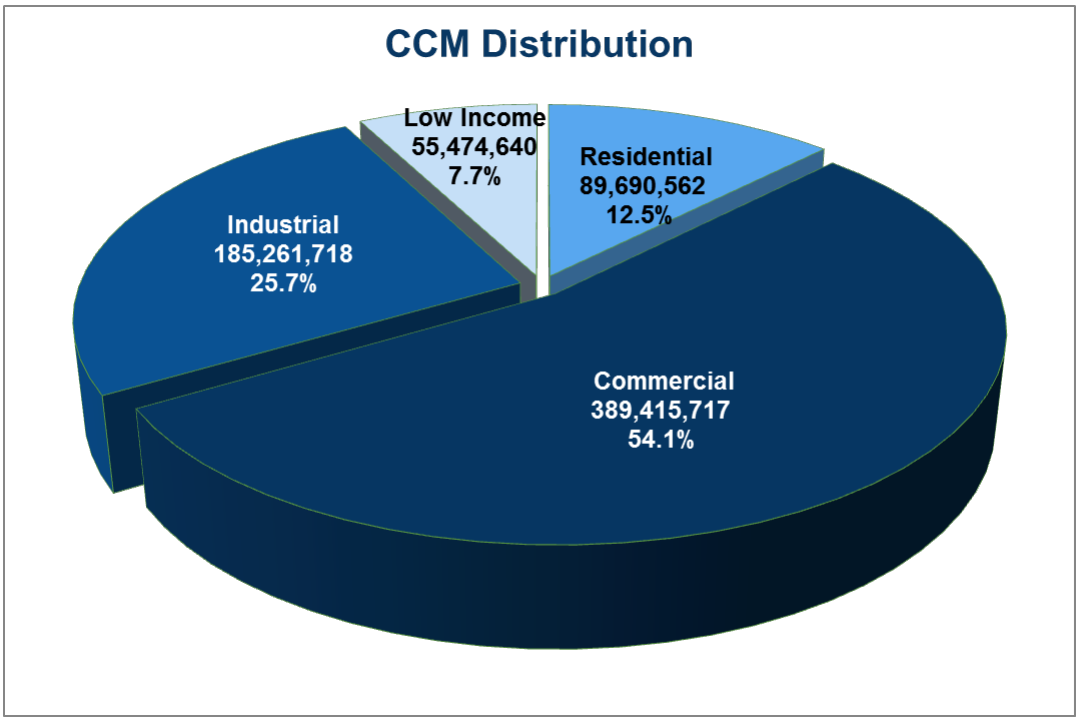
Table 4. 2014 CCM Savings Results – Target vs. Actual

Program/Sector	CCM Target (100%)	CCM Actual Results
Residential	*11,735,669*	*89,690,562*
Commercial	*633,804,658*	*389,415,717*
Industrial	*346,554,000*	*185,261,718*
Resource Aquisition	**992,094,327**	**664,367,997**
Low Income	**87,853,420**	**55,474,640**
Total	**1,079,947,747**	**719,842,637**

Results were below target in both the Commercial and Industrial sectors as well as in the Low Income sector. Conversely, results were significantly above the target originally put forth for the Residential sector due to the growing success of the Community Energy Conservation (CEC) offer. An overview of 2014 DSM spending vs. budget is provided in Section 5 of this report.

As illustrated in Table 5, in 2014 the Commercial sector was the largest overall contributor to CCM savings, accounting for 381 million CCM or 54.1% of the total CCM results. Industrial sector offers contributed 25.7% of the total CCM savings followed by the Residential sector and the Low Income program responsible for 12.5% and 7.7% of CCM, respectively.

Table 5. 2014 Distributed CCM Savings by Sector



In 2014, Enbridge delivered three Market Transformation offers, all of which performed well in relation to performance targets. As outlined previously in Table 3, on a weighted scorecard basis, all three offers approached or exceeded upper targets. Results for the Market Transformation program offers are reviewed in Section 7 of this report.

4. Annual and Cumulative 2014 Natural Gas Savings

Table 6. 2014 Annual and Cumulative Natural Gas Savings

	Program	Gross Annual Gas Savings (m^3)	Net Annual Gas Savings (m^3)	Gross CCM (m^3)	Net CCM (m^3)
Resource Acquisition	**Residential**				
	Community Energy Conservation	6,958,684	5,914,881	105,518,309	89,690,562
	Total Residential	**6,958,684**	**5,914,881**	**105,518,309**	**89,690,562**
	Commercial				
	Commercial Custom	19,708,793	16,371,408	373,800,192	307,222,026
	Commercial Prescriptive	6,573,118	5,408,523	97,136,791	79,068,251
	Run It Right	625,088	625,088	3,125,440	3,125,440
	Total Commercial	**26,906,999**	**22,405,020**	**474,062,423**	**389,415,717**
	Industrial				
	Industrial Custom	23,440,752	12,001,904	349,395,582	177,663,455
	Industrial Prescriptive	542,215	472,840	8,887,940	7,598,262
	Total Industrial	**23,982,967**	**12,474,745**	**358,283,522**	**185,261,718**
	Low Income				
	Single Family (Part 9)	1,039,428	1,036,919	25,698,580	25,673,482
	Multi-Residential (Part 3)	1,734,457	1,708,673	30,058,993	29,801,158
	Total Low Income	**2,773,885**	**2,745,592**	**55,757,573**	**55,474,640**
	Grand Total	**60,622,535**	**43,540,237**	**993,621,826**	**719,842,637**

Table 6 details the annual gas savings and cumulative lifetime natural gas savings results (in cubic meters) for each of the program components that have CCM as a performance metric. Savings results are summarized for both gross and net savings (net of applicable adjustment factors).

5. 2014 Budget and Program Spending

Budget

As stated in EB-2012-0394, "In 2012, following consultation with stakeholders, the Base Budget of $28.1 million was increased by 10% or $2.81 million (which was the allowable increase as indicated in the DSM Guidelines, Section 8.3, page 26), resulting in a total budget of $30.91 million and including a total Low Income budget of $7.025 million. Following consultation with stakeholders regarding the budget for 2013 and 2014, it was agreed that the 2013-2014 Update would propose to continue with the allowable increase to the Low Income Budget for 2013 and 2014 and a 2% annual increase based on the 2011 GDP-IPI."[7]

"For 2013, this base budget has been escalated by the GDP-IPI for 2011, which is 2%. The resulting budget for 2013 is $31.588 million. Escalating the 2013 budget by the 2011 GDP-IPI of 2%, the aggregate budget for 2014 is $32.158 million."[8]

Table 7 provides the breakdown of the 2014 budget for each of the Resource Acquisition, Low Income and Market Transformation programs as approved in the Update to the 2012 to 2014 DSM Plan (EB-2012-0394).

Table 7. 2014 DSM Plan Budget

Program	Program Budget	Overheads	Total Budget	% of Total
Resource Acquisition	$14,160,578	$4,638,711	$18,799,289	58%
Low Income	$6,729,500	$507,831	$7,237,331	23%
Market Transformation	$4,795,000	$1,327,144	$6,122,144	19%
Total	**$25,685,078**	**$6,473,686**	**$32,158,764**	**100%**

7 *Update to the 2012 to 2014 Demand Side Management ("DSM") Plan* (EB-2012-0394), Exhibit B, Tab 1, Schedule 2, Page 1 of 13.

8 Ibid, Exhibit B, Tab 2, Schedule 9, Page 8 of 28

2014 Spending

Table 8 outlines actual spending vs. budget for each program.

Table 8. 2014 OEB Approved Budget vs. Spending

Program	OEB Approved Budget	Actual	Variance	%
Resource Acquisition	**$18,799,289**	**$21,217,190**	**$2,417,901**	**13%**
Residential	*$1,836,456*	*$8,605,657*	*$6,769,201*	
Commercial	*$8,090,102*	*$5,760,122*	*-$2,329,980*	
Industrial	*$4,234,020*	*$2,214,856*	*-$2,019,164*	
Overheads	*$4,638,711*	*$4,636,555*	*-$2,156*	
Low Income	**$7,237,331**	**$6,932,305**	**-$305,026**	**-4%**
Part 9 Residential	*$4,564,500*	*$4,494,530*	*-$69,970*	
Part 3 Multi residential	*$2,165,000*	*$1,930,180*	*-$234,820*	
Overheads	*$507,831*	*$507,595*	*-$236*	
Market Transformation	**$6,122,144**	**$4,361,771**	**-$1,760,373**	**-29%**
Residential SBD	*$2,445,000*	*$1,334,035*	*-$1,110,965*	
Commercial SBD	*$950,000*	*$739,435*	*-$210,565*	
Home Labeling	*$1,400,000*	*$979,337*	*-$420,663*	
Overheads	*$1,327,144*	*$1,308,965*	*-$18,179*	
Program Cost Sub Total	**$25,685,078**	**$26,058,152**	**$373,074**	
Overhead Sub Total	**$6,473,686**	**$6,453,114**	**-$20,572**	
Total	**$32,158,764**	**$32,511,266**	**$352,502**	**1%**

Total spending in relation to EGD's DSM programming in 2014 was $32,511,266, resulting in a variance of $352,502 or 1% over budget for the year.

Within the Resource Acquisition program, spending in the Commercial and Industrial sectors was lower than 2014 plan budget amounts. As the year unfolded, forecasts of program results clearly indicated that established budgets for both of these sectors could not be fully utilized. Available program dollars were used within the RA program for the Residential Community Energy Conservation offer to support the growing energy

savings opportunities arising from the successful delivery and momentum of this offer. These funds supported gas savings results well above targets for the Residential sector and allowed the Company to expand its ability to offer energy efficiency opportunities to its largest customer segment.

As per the Guidelines, "the design of natural gas DSM programs and the overall portfolio should be guided by the following three objectives: maximization of cost effective natural gas savings; prevention of lost opportunities; and pursuit of deep energy savings."[9] The Guidelines further explain this "guidance is meant to ensure that adequate flexibility in DSM program and portfolio design is maintained, while recognizing that the natural gas utilities are ultimately responsible and accountable for their actions. This flexibility should ensure that the natural gas utilities can continuously react to and adapt to current and anticipated market developments."[10]

Further, EB-2008-0346 states that "the utilities should inform the Board, as well as their stakeholders, in the event that cumulative fund transfers among Board-approved DSM programs exceed 30% of the approved annual DSM budget for an individual natural gas DSM program."[11] Though the Company did transfer funds from the Market Transformation program to the Resource Acquisition program, the Company confirms it did not exceed 30% of the approved budget for the Market Transformation program.

In addition, as per the Guidelines, a DSMVA "over-spend" provision allows Enbridge to spend and recover funds above the approved annual DSM budget: "This option is meant to allow the natural gas utilities to aggressively pursue programs which prove to be very successful."[12] The total amount of the overspend may not exceed 15% of the total DSM budget and can only be used on scorecards once the Company has achieved the weighted scorecard target (i.e. 100%) on a pre-audit basis.

9 *Demand Side Management Guidelines for Natural Gas Utilities* (EB-2008-0346), OEB, June 30, 2011, page 4.
10 Ibid, page 4.
11 Ibid, page 4.
12 Ibid, page 26.

The Resource Acquisition program was delivered with spending 13% over the 2014 plan budget. Most of this additional spending came from funds re-allocated from the Market Transformation program.

In the Low Income program, in particular, given the challenges in achieving targets in the Multi-Residential (Part 3) offer, actual spending for this segment was below budget levels, with total spending 4% below the original budget.

Finally, the Market Transformation program ended the year with total spending 29% below budget. This underspend primarily was related to the Residential Savings by Design offer. With the offer providing a three-year time horizon to complete homes for eligible incentives, initial plan forecasts for incentives were not realized in the 2014 program year. Enbridge has proposed the establishment of a deferral account to address this challenge in the next multi-year plan.

Ultimately, the entire portfolio for 2014 was delivered with spending of $32,511,266. An amount of $352,502 (or approximately 1% of the 2014 budget) was accessed from the DSMVA to support the Residential Resource Acquisition results through the Community Energy Conservation offer and was permitted based on the RA weighted scorecard target exceeding 100% on a pre-audit basis.

6. TRC Screening

As per the Guidelines, the Board calls for application of the Total Resource Cost (TRC) test to screen for cost-effectiveness at the program level. TRC benefits include the avoided costs associated with natural gas, electricity and water savings over the life of the energy efficient equipment. TRC costs include the incremental equipment costs associated with the energy efficient equipment in relation to its less efficient equivalent, as well as any program or administrative costs attributed directly to the program.

Cost-effectiveness screening of DSM programs is valuable as a means for assessing the economic merit of a DSM program. Screening also helps with the process of prioritization among offers if budget constraint considerations need to be addressed.

As prescribed, Enbridge has utilized the TRC test to screen for cost-effectiveness of its 2014 programs. In the case of the Resource Acquisition program, if the TRC ratio (which compares the present value of the natural gas, electricity and water savings benefits to the present value of the costs) exceeds 1.0, the program is considered cost-effective.

In recognition that the Low Income program may include benefits that are not reflected in the TRC test, the Low Income program is screened using a TRC threshold of 0.7.

The Market Transformation program cannot be screened by using a systematic screening approach such as TRC, and is instead assessed on its own merits based on the objectives of the offers.

Recognizing that the current framework is based on CCM, TRC net savings nonetheless remains an important indicator of the extremely large and positive impact that Enbridge has with respect to DSM.

Table 9 summarizes the TRC screening estimates for the 2014 Enbridge DSM portfolio for illustrative purposes. The portfolio as a whole was cost-effective with an overall TRC ratio of 2.67. Further, Resource Acquisition

(2.84 TRC ratio) and Low Income (1.33 TRC ratio) were also cost-effective to deliver as individual programs.

Table 9. 2014 TRC Screening Summary

Sector/Program	NPV Total TRC Benefits	Total TRC Costs	TRC Net Benefit	TRC Ratio
Residential				
Community Energy Conservation	14,606,308	7,449,092	7,157,215	1.96
All Residential Total	**14,606,308**	**7,449,092**	**7,157,215**	**1.96**
Commercial				
Commercial Custom	69,287,837	22,384,331	46,903,506	3.10
Commercial Prescriptive	21,677,576	3,875,477	17,802,099	5.59
Run It Right	531,867	1,852,553	-1,320,686	0.29
All Commercial	**91,497,280**	**28,112,361**	**63,384,919**	**3.25**
Industrial				
Industrial Custom	28,299,123	7,265,868	21,033,256	3.89
Industrial Prescriptive	1,034,526	306,831	727,696	3.37
All Industrial	**29,333,650**	**7,572,698**	**21,760,951**	**3.87**
Overheads		4,636,555	-4,636,555	
Overall Resource Acquisition	**135,437,237**	**47,770,706**	**87,666,531**	**2.84**
Low Income				
Single Family (Part 9)	3,309,433	3,209,595	99,838	1.03
Multi-Residential (Part 3)	4,652,220	2,288,652	2,363,568	2.03
Overheads		507,595	-507,595	
Overall Low Income	**7,961,653**	**6,005,842**	**1,955,811**	**1.33**
Combined RA/Low Income *	**$ 143,398,890**	**$ 53,776,548**	**$ 89,622,342**	**2.67**

*This summary does not include TRC calcuations for the Market Transformation program.
All values are provided for illustrative purposes only.

7. 2014 DSM Program Review

This section provides an overview of Enbridge's 2014 DSM portfolio and details results for offers across all three programs: Resource Acquisition, Low Income and Market Transformation.

Resource Acquisition offers focus on achieving direct, measureable savings customer by customer and commonly involve the installation of energy efficient equipment or the implementation of operational improvements. The Resource Acquisition program is delivered across three sectors: Residential, Commercial and Industrial. Performance for the Resource Acquisition program is measured primarily in terms of net CCM of natural gas savings but also includes a residential deep savings metric based on participants.

Enbridge's current Low Income offers are similar in nature to Resource Acquisition offers in that they generally consist of the installation of energy efficient equipment or measures. However Low Income offers are set apart to recognize the unique needs of their target customer base. Though these offers may result in a lower benefit/cost ratio – Total Resource Cost (TRC) – than similar offers delivered to non-low income customers, they are designed to address the needs of these consumers and include other important societal benefits. The Low Income program comprises two segments: Single Family (Part 9) Residential buildings and Multi-Residential (Part 3) buildings. Performance in the Low Income program is measured primarily in terms of net CCM of natural gas savings but also includes a metric based on program enrolment.

The Market Transformation program includes two segments: Residential existing housing and Residential and Commercial new construction. Performance in the Market Transformation program is assessed in terms of metrics specific to each offer. Market Transformation offers are designed with the aim of influencing consumer behaviour and attitudes in support of reducing natural gas consumption. Market Transformation activities focus on enabling fundamental changes that lead toward increased market shares of energy efficient products and services.

This section of the report provides an overview of the offers within each program and summarizes the natural gas savings and related scorecard achievements for each program. This section further details the following (as applicable):

- Objectives
- Target Customer
- Metrics
- Tracking Methodology
- Offer Description
- Cost-Effectiveness
- 2014 Results
- Multi-Year 2012-2014 Result Summary
- 2014 Highlights and Lessons Learned

Resource Acquisition Program

Table 10. 2014 Resource Acquisition Scorecard

Component	Metric	Targets				2014 Actual Result
		Weight	Lower	Middle	Upper	
Volumes	*Cumulative Savings (million m³)*	***92%***	744.05	992.06	1,240.08	**664.37**
Residential Deep Savings	*Number of Houses* [1]	***8%***	560	747	934	**5,213**

1. Number of houses with at least two major measures and where average annual gas savings across all participants is at least 25% of combined baseline space heating and water heating usage.

Results for Enbridge's 2014 Resource Acquisition (RA) program were 664.37 million CCM. These results were below the lower target for this metric. The Residential Acquisition program scorecard also includes a deep savings metric specific to the Residential sector. There were 5,213 houses counted towards this metric. This result was significantly above the upper scorecard target.

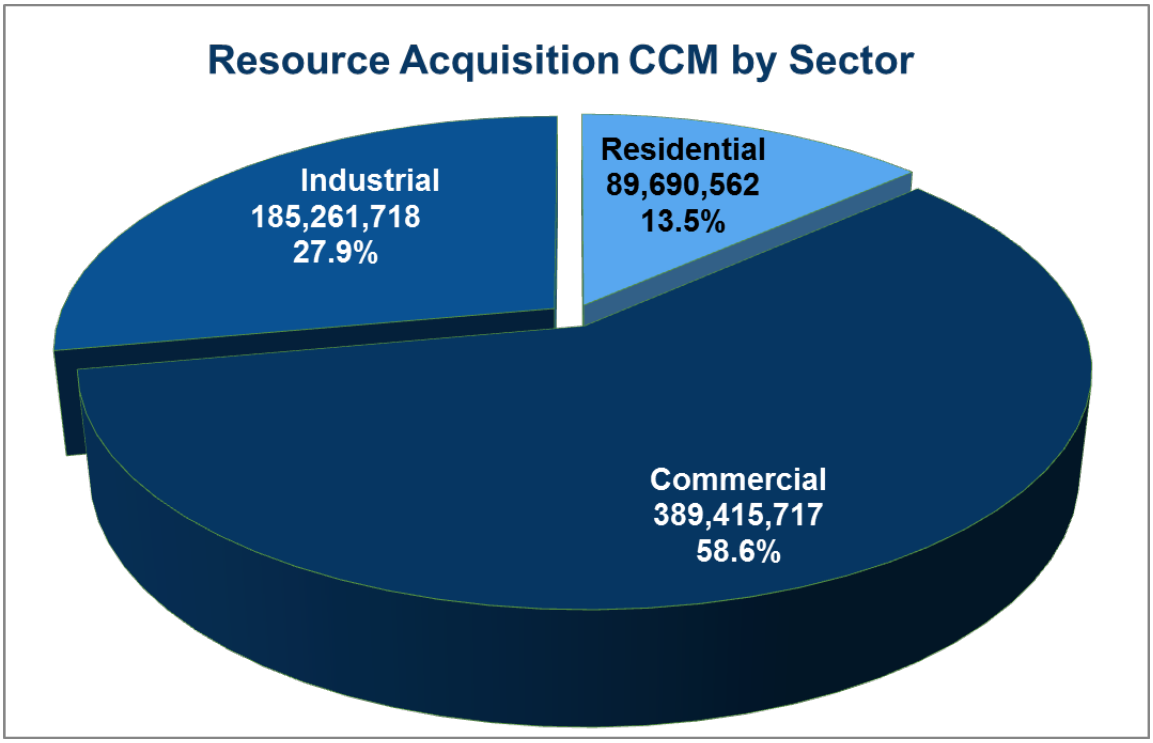
Within the RA program, each of the Residential, Commercial and Industrial sectors had specified CCM savings targets established in the plan as outlined below in Table 11. Further detail regarding the results for each of these sectors is provided in the following pages.

Table 11. 2014 Resource Acquisition Program Results

Resource Acquisition Program Sector	CCM Target (100%)	Actual CCM	$/CCM	Participants [2]	Units Installed [1]
Residential	11,735,669	89,690,562	$0.0959	5,213	---
Commercial	633,804,658	389,415,717	$0.0148	546	18,811
Industrial	346,554,000	185,261,718	$0.0120	128	108
Total/Average	**992,094,327**	**664,367,997**	**$0.0250**	**5,887**	**18,919**

1. Units installed refers to the number of units for prescriptive offers.
2. Participants refers to the number of unique addresses for custom projects and CEC (Residential).

Table 12. 2014 Resource Acquisition – CCM Results by Sector



CCM savings contributions from each sector within the RA program are illustrated in Table 12. Commercial offers were responsible for 58.6% of the total CCM savings in the RA program. Industrial and Residential offers contributed 27.9% and 13.5% of results, respectively.

Residential Resource Acquisition

Residential - Community Energy Conservation (CEC) – formerly Community Energy Retrofit (CER)

Objectives	The Residential component of the RA program focuses on the existing home sector through the marketing and delivery of a home energy conservation initiative. The goal of the CEC offer is to achieve deep energy savings in existing homes and to raise awareness of the benefits of energy efficiency. The initiative is designed to reduce gas use for space and water heating using a holistic approach, which encourages conservation through the installation of high efficiency equipment as well as thermal envelope improvements to reduce the space heating load. With financial incentives, the offer helps homeowners make their homes more energy efficient and reduces the burden of high energy costs.
Target Customer	CEC is targeted to Rate 1 residential customers.
Metrics	The first metric is cumulative cubic meter (CCM) savings generated by participants. The second metric is total number of participants – specifically, the number of houses with at least two eligible measures implemented and where average annual gas savings across all participants is at least 25% of combined baseline space heating and water heating usage.
Tracking Methodology	Gas savings are claimed based on results calculated through the use of accredited modeling software utilized by Certified Energy Auditors (CEAs). Reports summarizing participant numbers and gas savings (m^3) are maintained and tracked monthly. The number of participants (houses) with at least two major

	measures and where average annual gas savings across all participants is at least 25% of combined baseline space heating and water heating usage are tracked and counted toward the deep savings participant metric.
Offer Description	This offer was introduced in mid-2012 to encourage and support gas savings opportunities in existing residential houses and to meet the priorities outlined in the Board's DSM Guidelines, in particular, the goal of pursuing deep savings. CEC is designed to capture deep energy efficiency savings opportunities through the delivery of a holistic, "whole home" approach. Following the cancellation of the federal government funded ecoENERGY program that ran from 2007 and ended in early 2012, there has been a market need for initiatives that drive energy efficiency in the existing housing sector. The CEC offer utilizes accredited software such as Natural Resources Canada's (NRCan) HOT2000 and the US Department of Energy REM/Rate as the foundation in calculating annual gas savings for each participant. The software provides an effective building energy simulation tool to model the savings. Participants receive a pre-retrofit energy audit evaluation by a certified energy advisor before starting work and a post-retrofit energy audit to calculate gas savings. With the emphasis on deep savings, measures include home envelope improvements and mechanical system upgrades as these measures offer the greatest opportunity for "deep", long-term energy conservation through gas savings. Enbridge offers qualifying customers incentive dollars towards the pre-retrofit energy audit of their home and the opportunity for additional incentives if the participant completes at least two

	upgrades from a list of qualifying measures. The offer aims to ensure that the installation of these measures contributes to the achievement of an average 25% annual gas savings over the participant portfolio, based on pre- and post-energy audit results. The qualifying measures included for CEC are as follows: • Heating system replacement; • Foundation insulation; • Water heating system replacement; • Air sealing; • Attic insulation; • Window replacements; • Wall insulation; • Drain water heat recovery; and • Exposed floor insulation. To be eligible for the offer, customers must meet the following criteria: • Be a residential homeowner in the EGD franchise area; • Have a valid Enbridge Gas account in good standing; • Use an approved Certified Energy Evaluator/Auditor; • Install at least two measures; and • Complete a pre- and post-energy audit.
Cost-Effectiveness	The CEC offer is cost-effective as supported by the TRC screening summarized in Table 9 in Section 6. Gas savings results from the Residential CEC offer were realized at an average cost of $0.096/CCM as highlighted in Table 13 below.
2014 Results	The CEC offer contributed 89.7 million CCM in 2014. As summarized in Table 13, this result exceeded the 100% target initially established for the sector.

	As previously summarized in Table 10, which provides the 2014 Resource Acquisition Scorecard results, a total of 5,213 households participated and counted toward the Residential Deep Savings metric, well exceeding the upper target of 934 households for this metric.

Table 13. 2014 Residential Resource Acquisition Results

Resource Acquisition Program Sector	CCM Target (100%)	Actual CCM	$/CCM	Participants
Residential - CEC	11,735,669	89,690,562	$0.0959	5,213

Table 14. 2012-2014 Multi-Year Residential RA Results

Resource Acquisition Program Sector	Actual 2014	Actual 2013	Actual 2012
Residential (CCM)	89,690,562	38,980,521	5,296,300
Residential Deep Savings (participants)	5,213	1,649	271

2014 Comments and Lessons Learned:

- ★ Feedback from customers and energy advisors engaged to deliver the offer indicated that the term 'retrofit' was not well understood by the typical residential customer. Consequently, the offer was renamed Community Energy Conservation beginning in 2014 to incorporate a term and a concept more clearly understood by homeowners.

- ★ In its third year, the CEC offer has demonstrated great success. A key focus for 2014 was on expanding the offer to a much broader customer base in line with a more long term goal of making the offer accessible across the Enbridge franchise area.

- In conjunction with the Ministry of Municipal Affairs and Housing efforts to enable Ontario municipalities to use Local Improvement Charges (LICs) to finance energy retrofits on private property, in 2013, the City of Toronto established the Home Energy Loan Program (HELP) pilot to selected Toronto communities. The Home Energy Loan Program (HELP) is a financing tool to assist homeowners with improving their home's energy efficiency. Enbridge continued to work with the City of Toronto in 2014 to expand the delivery of the CEC offer in Toronto with a simultaneous expansion of the regions that could qualify for HELP.

- Close to 55% of the participants in 2014 were households in York Region (there continues to be a concentrated effort in this area since this was the initial area target when the offer was launched in mid-2012). Over 32% of the participants came from the Metropolitan Toronto area and 12% were dispersed throughout the GTA; less than 1% participants came from the Niagara and Ottawa areas.

- Ongoing engagement with energy auditors by way of training sessions and meetings ensured that procedures and processes required for tracking were understood and followed.

- As outlined previously in Section 5 of this report, to support the growing savings opportunities arising from the expanding delivery and growing momentum of this offer in 2014, and in line with provisions set out in the Guidelines, available funds from within the Resource Acquisition program were accessed to support the opportunity for additional contributions to gas savings within the Residential sector. Budget dollars also were reallocated from the Market Transformation program to further support the Residential RA efforts.

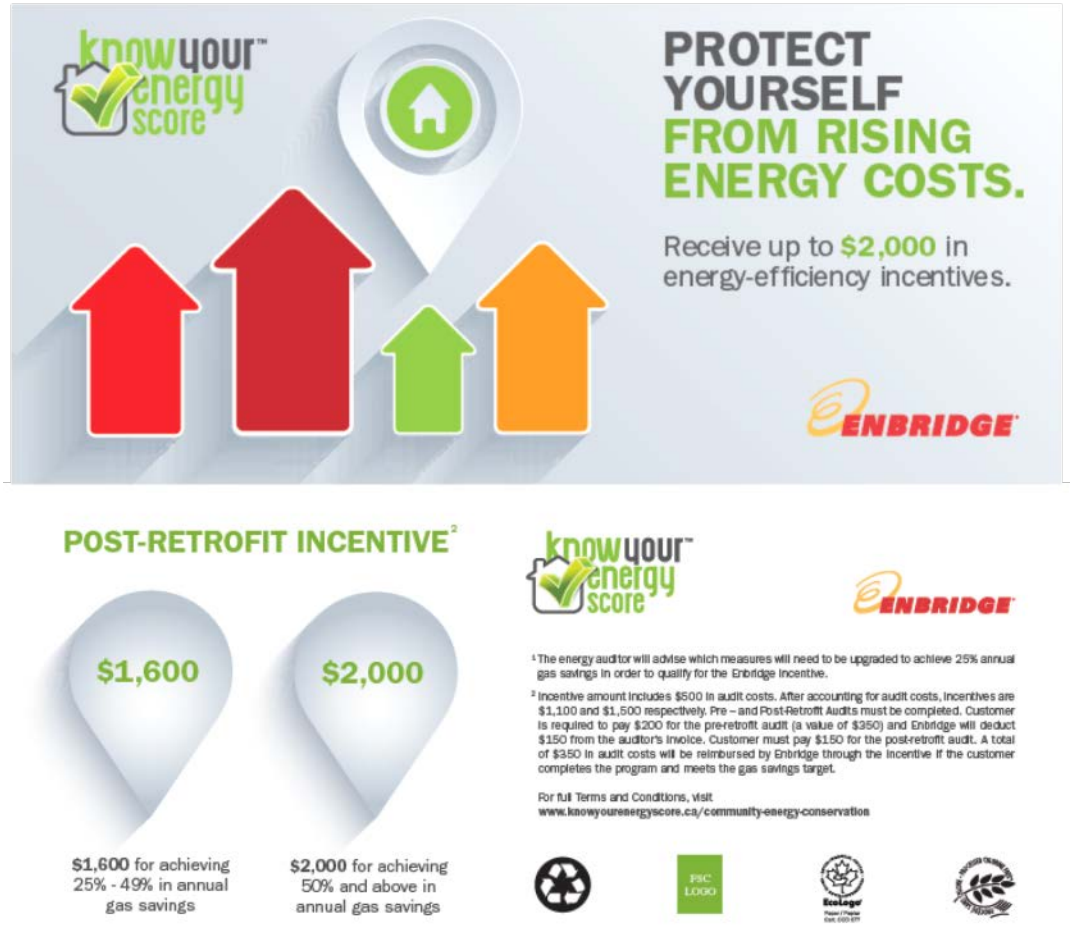
- On average in 2014, CEC participants installed more than two (2.3) eligible measures. The majority of participants installed heating system replacements; the next most common measures installed were air sealing and attic insulation. On average, annual gas savings per project were calculated to be 1,335 m^3.

- CCM savings from the offer were calculated based on an updated dual measure life input assumption as a result of a 2012 audit recommendation negotiated with the AC.[13] These values were subsequently endorsed by the TEC. Specifically, for participants where projects included a furnace replacement as one of the measures – a deemed 15 year measure life was utilized to calculate CCM; for participants where projects did not include a furnace as one of the measures – a deemed 25 year measure life was utilized to calculate CCM.

- Marketing efforts for CEC have been well received and included the following activities:

    - Enhancement and promotion of Enbridge's online Residential energy efficiency microsite - www.knowyourenergyscore.ca.

13 2012 DSM Clearance of Variance Accounts (EB-2013-0352), Exhibit B, Tab 3, Schedule 1, Page 19 of 41



- Engagement via EGD Channel Consultants in communicating and managing marketing approaches to contractors and business partners including e-blasts to the HVAC and insulation contractor community regarding program updates and expansion.

- Local print advertising in selected community newspapers and lifestyle magazines to highlight the offer and gas savings opportunities directly with homeowners.

To maximize opportunities to draw attention to the CEC offer, the offer was also promoted along with Home Labelling communication and marketing efforts to realtors.

Commercial Resource Acquisition

Offers designed for commercial customers include incentives to invest in energy efficient technologies in commercial buildings, such as the purchase and installation of efficient heating, ventilation and air conditioning (HVAC) systems as well as custom solutions specific to a customer's particular building or facility. Commercial RA offers in 2014 also included audit incentives as well as energy management offers focusing on operational improvements to support savings opportunities.

Enbridge provides service to over 150,000 Commercial sector customers across the Company's franchise area. These customers are segmented across widely diverse sub-sectors, which include: Multi-Residential (not including social housing), Commercial Office Buildings, Schools/Universities, Hotels/Motels, Warehouses, Retail, Food Services, Hospitals/Health-Care Facilities and Government/Municipal.

Energy efficiency initiatives available to commercial customers are delivered directly both by Enbridge's Energy Solutions Consultants (ESCs) to customers and building owners/operators and through supply chain channels and business partners, including HVAC contractors, engineering firms and energy service advisors.

Table 15. 2014 Commercial Resource Acquisition Results

Commercial Sector	Actual CCM	$/CCM	Participants [2]	Units Installed [1]
Custom	307,222,026	$0.0116	501	---
Prescriptive	79,068,251	$0.0088	---	18,811
Run It Right	3,125,440	$0.4763	45	---
Total/Average	**389,415,717**	**$0.0148**	**546**	**18,811**

1. Units installed refers to the number of units for prescriptive offers.
2. Participants refers to the number of unique addresses for custom projects and RIR.

Table 16. 2012-2014 Multi-Year Commercial RA Results

Resource Acquisition Program Sector	Actual CCM 2014	Actual CCM 2013	Actual CCM 2012
Commercial	389,415,717	505,133,591	658,836,828

Commercial – Custom and Prescriptive Fixed Incentive Offers

Objectives	The goal of the Commercial Custom offer is to reduce natural gas use through the capture of energy efficiency opportunities in commercial buildings, including retrofits of building components and upgrades at the time of replacement. The offer aims to promote the highest level of energy efficiency. The Commercial Prescriptive offer is designed to capture energy savings in the Commercial sector associated with the installation of prescriptive and quasi-prescriptive technologies.
Target Customer	Both the Custom and Prescriptive offers target commercial customers who are primarily in Rate 6 as well as commercial customers in Rates 135, 145, 110, 115 and 170.
Metrics	As part of the Resource Acquisition program, the primary metric for the Commercial Custom and the Prescriptive offer is lifetime natural gas savings - cumulative cubic meters (CCM) savings.
Tracking Methodology	Savings for each custom project are calculated on an individual basis and then tracked monthly by the Tracking and Reporting team, utilizing EGD's sales tracking software.

	Data is compiled for Prescriptive offer participants and tracked on a monthly basis by the Tracking and Reporting team, utilizing EGD's sales tracking software.
Offer Description	The Custom Commercial offer provides incentives for customers undertaking capital and operational improvements. Typical measures include boiler and HVAC retrofits, controls and building automation systems, heat recovery projects and building envelope improvements. The offer is primarily promoted and delivered by ESCs who are active in the marketplace. ESCs are trusted energy advisors; their technical and energy efficiency sales experience is fundamental to the successful execution of custom projects. ESCs work directly with customers, meeting with building operators and facility managers to conduct site visits and make custom recommendations based on each building's unique systems. ESCs provide advice for customized energy solutions to suit customers' energy efficiency goals in consideration of their budget and business needs. ESCs work with national chain and large property management firms to introduce savings strategies and align DSM offers with the customers' long term energy plans. ESCs use their technical expertise to work with smaller firms and managers of standalone buildings by educating them on savings concepts and providing recommendations and savings estimations for potential projects. The Commercial Prescriptive offer for 2014 included fixed incentives for various prescriptive and quasi-prescriptive

	energy efficiency measures impacting space heating, water heating and food service energy requirements. Measures included:[14] • Demand Control Ventilation (DCV); • Condensing Boilers <300MBH; • High Efficiency Boilers; • Air Doors; • Energy Recovery Ventilation (ERV); • Heat Recovery Ventilation (HRV); • Infrared Heaters; • Condensing Make-Up Air Units; • Ozone Laundry System; • Low-Flow Showerheads; • Demand Control Kitchen Ventilation System (DCKV); • Energy Star Qualified Dishwashers; • Energy Star Qualified Natural Gas Convection Ovens; • Energy Star Qualified Natural Gas Fryers; • Energy Star steam cookers; and • High efficiency under-fired broilers.
Cost-Effectiveness	Both the Commercial Custom and Prescriptive offers were cost-effective, as supported by the TRC screening summarized in Table 9 in Section 6. Gas Savings from the Commercial Custom offer were realized at an average cost of $0.0116/CCM, as highlighted in Table 15. Prescriptive savings were delivered at an average cost of $0.0088/CCM.
Evaluation Activities	Savings for each project are determined with project-specific savings calculations. Where applicable, ESCs utilize standardized engineering calculators developed by

14 Specific details regarding measures included can be found at enbridgegas.com/commercial

	Enbridge's technical engineering team. Projects are screened for an additional internal technical review to verify savings calculations as appropriate. An independent third-party engineering review, the Commercial Custom Project Savings Verification (CPSV), is conducted annually. The scope of work for this review is set out in a Terms of Reference established by the TEC. This verification study consists of a detailed review of the savings calculations for a statistically representative sample of Commercial sector custom projects claimed in 2014. The Commercial CPSV is summarized in Appendix A, and the prescribed sampling methodology followed to establish the selected projects is referenced in Appendix I. Reported results include adjustments recommended by the engineering review in conjunction with the application of determined realization rates as outlined in Appendix C.
2014 Results	As summarized in Table 15, 501 commercial custom projects were completed in 2014; these projects accounted for more than 307 million CCM in natural gas savings. Custom projects traditionally drive the highest percentage of Commercial results. This trend continued in 2014, with custom projects contributing 78.9% of Commercial results. As per Table 15, Commercial Prescriptive measures contributed over 79 million CCM, or 20.3% of the overall Commercial RA results. Overall, Commercial results were below target with savings of 389.4 million CCM (see Table 11).

2014 Highlights and Lessons Learned:

★ The Commercial Custom offer continues to be the largest contributor to the overall Resource Acquisition gas savings result. Commercial custom projects accounted for 307 million (or 46%) of the 664.4 million RA CCM results. The Commercial Prescriptive offer contributed 79 million CCM to the RA CCM total.

★ The Multi-Residential sector, followed by the University and Health-Care sectors, was the largest contributor to 2014 Commercial project results.

★ The Commercial and Prescriptive offers remained largely unchanged in 2014. Of note, condensing make-up air units (MUAs) and demand control ventilation (DCV) for single-zone retail and office locations were added to the suite of Prescriptive offers promoted in 2014. Incentives remained the same as 2013 at $0.10/m^3 of gas saved.

★ The strategy of implementing targeted campaigns to promote specific technologies to applicable sectors continued in 2014. These campaigns are often best-suited for less complex projects with relatively simple project execution.

- Several time-limited campaigns were promoted to commercial customers to drive greater participation and uptake of certain technologies. Campaigns focused on selected measures and included destratification fans, air doors, demand control kitchen ventilation (DCKV) and infrared heaters. For a period of three months, doubled incentives were offered to support the purchase and installation of each of these technologies.

- Infrared heaters, high-efficiency boilers, DCKVs, ozone laundry systems and Energy Star dishwashers were the technologies that had the largest contribution to the Commercial Prescriptive results in 2014.

- Where appropriate, resources were directed to developing focused key account relationships within specific commercial sectors. In 2014, efforts to increase sector penetration concentrated on institutional customers (e.g. universities/ colleges and hospitals). There was also a focused effort on the Multi-Residential building sector; leveraging communication through industry associations -- i.e. the Federation of Rental Providers of Ontario (FRPO) and the Building Owners and Managers Association (BOMA), to complete projects with these customers, including direct install low flow showerhead upgrades. Enbridge has seen success with this focused key account approach and will continue to build on it's efforts.

- Relatively low natural gas prices in 2014 continued to impact customers' decisions regarding implementation of natural gas efficiency projects. Competing offers from LDCs in support of electricity efficiency improvement projects are often a priority for limited capital spending, given the prospect for higher electricity cost savings.

- The Commercial DSM team has been undergoing significant rebuilding following the retirement of three ESCs in 2014 as well as staff changes on the marketing team. The process of training new staff and transferring/building relationships with customers has had an impact on results from this sector.

- Looking forward, ESCs will continue to focus on directly supporting commercial customers by providing education, helping to identify capital and operational improvements and assisting with the development of energy efficiency plans. In addition, dedicated efforts to maintain engagement with service organizations and industry contractors will continue to be an important element in identifying opportunities and realizing commercial gas savings.

Commercial – Run it Right and Energy Compass

Objectives	The goal of Run it Right (RiR) and Energy Compass is to encourage building owners to improve the energy performance of their buildings through operational improvements and benchmarking. These offers promote the awareness / visibility of building consumption patterns through energy monitoring information services (EMIS), low cost/no cost re-commissioning measures and energy savings opportunity assessments. Ultimately, these offers aim to lead commercial customers toward data-driven decision-making.
Target Customer	These offers are targeted to commercial customers in Rate 6, 110, 115, 135, 145 and 170 (with most commercial customers falling in the Rate 6 category). More specifically, the offers are designed for energy managers and building operators of commercial, multi-family and institutional buildings where daily consumption data is accessible. The Energy Compass initiative is marketed to commercial customers that have a portfolio of buildings.
Metrics	As part of the Resource Acquisition program, the primary metric for RiR is lifetime natural gas savings - cumulative cubic meters (CCM) savings. The Energy Compass initiative does not have a defined scorecard metric.
Tracking Methodology	The 2014 results are based on participants that registered for the RiR program and completed the implementation of the agreed-upon operational measures in 2013. For these participants, gas consumption data for the 12 months prior to implementation (the base year) was used as the base case gas usage. Gas consumption then was

	monitored for 12 months following implementation (the reference year). The monitoring for 2014 participants was completed in 2014. Program savings results are based on a regression analysis of actual consumption data. The participant's base year natural gas consumption is compared to the weather normalized consumption of the post-implementation reference year.
Offer Description	The RiR offer, as well as the Energy Compass initiative, is designed to motivate commercial customers towards performance-based conservation. The provision and analysis of detailed energy data aims to allow building operators and managers to make strategic data-driven decisions regarding energy savings and capital investments. Through Energy Compass and RiR, the Company helps commercial customers better manage their buildings, implement operational improvements to achieve energy savings and identify future cost-effective capital improvements. Savings that result from operational improvements implemented in any given year are recorded in the next year, following monitoring and verification.
Cost-Effectiveness	The RiR offer is not cost-effective in 2014, as illustrated by the TRC screening summarized in Table 9 in section 6. However, the Resource Acquisition program as a whole screens at 2.84.
Evaluation Activities	Further to an audit recommendation made in 2013, a third-party firm was retained by Enbridge to conduct a survey of all 2014 RiR participants to confirm savings attributed to the offer. The survey was conducted during

	Q2 of 2015, with input from the 2014 Auditor and Audit Committee. Due to a low survey response rate, the results of the survey were inconclusive and no quantitative adjustment was recommended. However, qualitative insights were gained and will be considered going forward.
2014 Results	In 2014, volumetric savings of 3 million CCM were achieved, whereas in 2013 savings of 11 million CCM were realized. Although 217 participants signed up for the program in 2013, only 53 implemented measures during the monitoring period. For 2014, the results are based on 45 claimed participants. The savings of seven participants were removed from the results due to the inclusion of capital measures.

2014 Highlights and Lessons Learned:

- ★ In comparison to 2013, the number of participants that signed up for the program in 2014 was similar – 202 compared to 217, respectively. However, the number of participants that implemented measures in 2014 compared to 2013 saw a significant decrease – 192 compared to 53, respectively. This decrease was partly due to a new standardized approach implemented by Enbridge in the building investigation phase of the offer. A further review of this process revealed a need to increase the level of engagement between the investigation agents and the customers after Enbridge issued savings reports to customers. Enbridge has implemented improvements to the process as a result of this finding.

- ★ In 2014, some customers were not able to participate in the offer because they did not meet the minimum threshold of 5% estimated operational savings. In an effort to improve participation in 2015, Enbridge is removing this criteria.

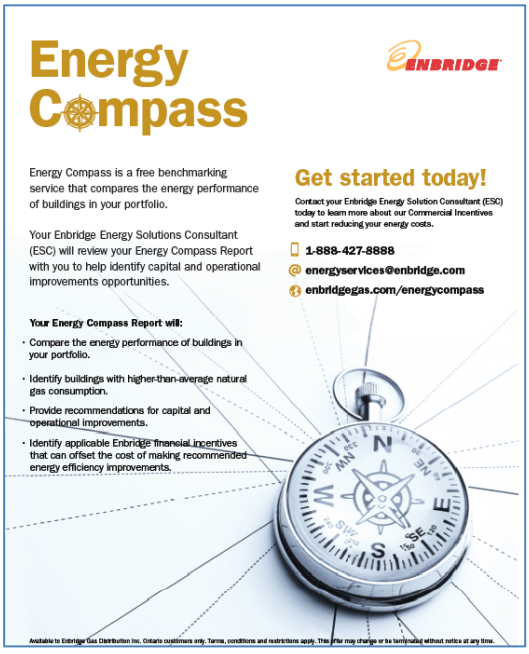
- As was the case in 2013, an analysis of RiR participant results continues to show that average savings levels are significantly lower than the initial targets, which were based on anticipated savings of greater than 10%. The average savings are 2.8% and 2.5% for 2014 and 2013, respectively. It should be noted that, as a result of the 2013 Audit, the average savings of 2.8% and 2.5% includes projects for which an increase in consumption, rather than a reduction, was observed. Consequently, potential savings derived from implemented operational measures for these projects could not be quantified.

- Adequately assessing and interpreting actual results remains a challenge. Although metered data reflects building consumption, it does not accurately reflect the building conditions that can change year-over-year. An increase in consumption has a negative impact on the savings realized through the building's participation in the RiR offer.

- There are programs in other jurisdictions, such as BC Hydro Continuous Optimization Program, that use deemed savings for each of the operational improvement measures that commercial customers implement in their buildings. This methodology overcomes the challenges in normalizing

consumption year-over-year to accurately reflect the savings achieved by implementing operational improvement measures.

★ As noted in 2013, RiR savings results are generated through operational improvements and do not involve implementation of capital measures. Many other utility re-commissioning/retro-commissioning programs, as well as local initiatives such as Greening Healthcare and Race to Reduce, take a broader approach and include both capital and operational measures. For the RiR offer, there are cases where customers have declined to participate due to the offer parameters stating that customers cannot implement capital equipment. Inclusion of capital measures would allow for a more holistic approach and result in an increase in participation as well as potentially additional savings for customers.



Industrial Resource Acquisition

Industrial – Custom Solutions and Prescriptive Fixed Incentives Offers

Objectives	The Industrial Custom Solutions offer is designed to capture cost-effective energy savings within the Industrial sector by delivering customized energy solutions aimed at supporting customers through a continuous improvement approach. Industrial Energy Solutions Consultants (ESCs) focus on assisting customers with the adoption of energy efficient technologies by overcoming financial, knowledge or technical barriers. The Industrial Prescriptive offer aims to capture energy savings in the Industrial sector by installing applicable prescriptive and quasi-prescriptive technologies, with a focus on increasing the adoption of energy efficient technologies among small industrial customers.
Target Customer	Both the Custom Solutions and Prescriptive offers are available to industrial customers (including Agricultural customers) in Rates 6, 110, 115, 135, 145 and 170. Custom projects encompass opportunities where savings are linked to unique building specifications, uses, technologies and industrial processes. With the Custom Solutions offer, Enbridge is primarily targeting industrial customers (both large and small) with significant process loads and high annual consumption. The target market for the Prescriptive offer is smaller industrial customers.
Metrics	As part of the Resource Acquisition program, the primary metric for the Industrial Custom and the Prescriptive offer is lifetime natural gas savings - cumulative cubic meter (CCM) savings.

Tracking Methodology	Savings for each custom project are calculated on an individual basis and then tracked monthly by the Tracking and Reporting team, utilizing EGD's sales tracking software. Data is compiled for Prescriptive offer participants and tracked on a monthly basis by the Tracking and Reporting team, utilizing EGD's sales tracking software.
Offer Description	In the Industrial sector, the Continuous Energy Improvement (CEI) approach includes the Industrial Custom Solutions offer and the Prescriptive offer together with a number of enabling initiatives, such as support for industrial customers in identifying energy-saving opportunities through to assistance with project implementation. These offers are primarily promoted and delivered by ESCs (professional engineers) who are active in the marketplace. ESCs are trusted energy advisors that work with customer to determine solutions to address multiple objectives – production, energy efficiency and budgetary considerations. Work involves addressing technical barriers to energy efficiency adoption as well as financial barriers that may hinder business justification and implementation. Enabling initiatives allow ESCs to work with the customers to identify potential opportunities, quantify benefits, and justify action. Such initiatives include: ESCs leveraging their skills and tools to identify efficiency opportunities; involvement of third-party vendors to conduct specific types of audit or assessments of facilities; and/or ESCs assisting with the development of project implementation plans.

	Due to the unique nature of industrial customers, custom solutions developed by ESCs are designed and engineered to meet the specific requirements of each particular customer's facility. Five core components are common to the Custom offer in 2014: • **Knowledge Development**: Technical publications, quarterly updates and themed workshops are offered to provide customers with the knowledge to make informed decisions through education. • **Opportunity Identification:** ESCs provide support to assist customers in the identification of efficiency opportunities, such as equipment testing and assessment and thermal imaging. • **Measurement**: ESCs assist customers in selecting appropriate means of measurement to quantify key energy inputs. • **Engineering Analysis**: ESCs assist customers who do not have the resources needed to conduct financial, technical and enterprise risk evaluations for potential projects. • **Implementation Support**: ESCs work with customers on an implementation plan and connect them with business partners to complete the project. The Industrial Prescriptive offer evolved by leveraging existing Commercial offers applicable to the industrial customer base. The Industrial Prescriptive offer incorporates a fixed incentive approach and includes incentives designed to help offset the cost of energy efficiency upgrades specifically relevant to industrial facilities such as Air Doors, Heat Recovery Ventilators, Energy Recovery Ventilators and Infrared Heaters.
Cost-Effectiveness	Enbridge continues to demonstrate a high level of cost-effectiveness for Industrial sector offers as supported by

	the TRC screening summarized in Table 9 in Section 6. Savings delivered from the Industrial Custom offer were realized at an average cost of $0.0121/CCM as highlighted in Table 17. Prescriptive savings were delivered at an average cost of $0.0095/CCM.
Evaluation Activities	In the case of custom projects, each project is assessed individually for inclusion in the offer. Subsequent to project-specific savings calculations being completed by ESCs, an internal technical review of project applications and savings calculations is conducted. ESCs utilize standardized engineering calculators developed by EGD's technical engineering team. Where required, savings calculations are specialized based on project-specific engineering analysis. Where applicable and appropriate, consumption information is reviewed to confirm expectations. An independent third-party engineering review, the Industrial Custom Project Savings Verification (CPSV), is conducted annually. The scope of work for this review is set out in a Terms of Reference established by the Technical Evaluation Committee (included as Appendix A). This verification study consists of a detailed review of the savings calculations for a statistically representative sample of Industrial sector custom projects. The Industrial CPSV is summarized in Appendix C and the prescribed sampling methodology followed to establish the selected projects is referenced in Appendix I. Reported results incorporate adjustments, as recommended by the engineering review following the determination of a realization rate adjustment as outlined in Appendix D.
2014 Results	There were 128 Industrial custom projects completed in 2014 contributing 177.7 million CCM. Prescriptive results

	totalled 7.6 million CCM and included 108 separate installations.

Table 17. 2014 Industrial Resource Acquisition Results

Industrial Sector	Actual CCM	$/CCM	Participants [2]	Units Installed [1]
Custom - Industrial	177,663,455	$0.0121	128	---
Prescriptive - Industrial	7,598,262	$0.0095	---	108
Total/Average	**185,261,718**	**$0.0120**	**128**	**108**

1. Units installed refers to the number of units for prescriptive offers.
2. Participants refers to the number of unique addresses for custom projects.

Table 18. 2012-2014 Multi-Year Industrial Results

Resource Acquisition Program Sector	Actual CCM 2014	Actual CCM 2013	Actual CCM 2012
Industrial	185,261,718	222,575,355	305,915,406

2014 Highlights and Lessons Learned:

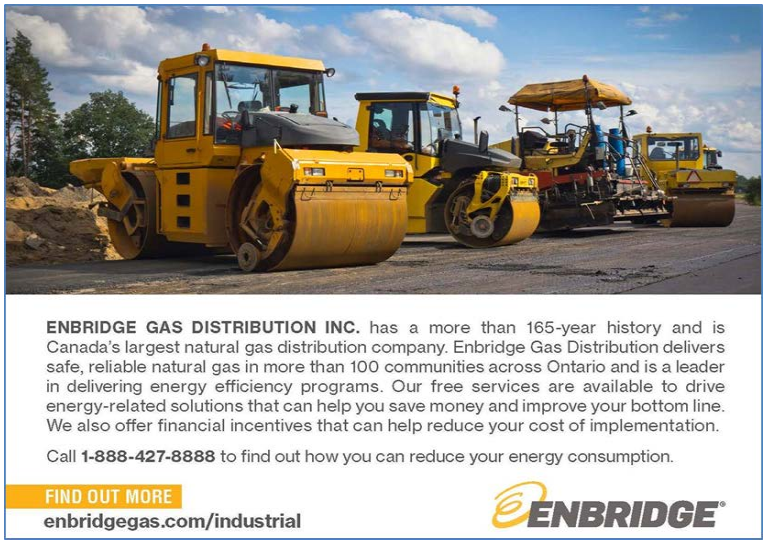
- Overall, the Custom Solutions offer remained largely unchanged from 2013 to 2014. However, a revised incentive structure was introduced – the flat rate of $0.07/m^3 offered previously was revised as follows:
  - $0.20/m^3 for first 50,000 m^3 gas saved
  - $0.05/m^3 for gas savings above 50,000m^3

  This revision was considered as a result of missed opportunities and was intended to provide additional support to customers (both large and small) to implement smaller projects.

- There is a developing trend of opportunities shifting from capital-intensive projects such as equipment upgrades to opportunities focusing on process improvements – projects which tend to yield good annual savings but lower CCM.

- Projects completed in 2014 yielded lower average per project savings in comparison to previous years. As noted above, there were 128 custom projects completed in 2014 with a combined 177 million CCM saved. In comparison, in 2013, there were 118 Industrial custom projects completed, contributing almost 222 million CCM. In other words, in 2014, the number of projects increased by 8%, the associated annual savings decreased by approximately 10% and the associated CCM decreased by 25%. Going back another year, there were 91 custom projects completed in 2012 with 306 million CCM saved. Though the Company has been able to grow the number of projects completed year-over-year, results for the overall savings are decreasing in terms of annual savings and, more significantly, in terms of cumulative gas savings.

- Custom projects can be highly resource intensive and require extensive technical expertise and data analysis; conversely Prescriptive, fixed incentive projects are less complex to execute, making them well-suited for smaller customers. An established distribution network of business partners and service providers was leveraged as a key means of promoting the Prescriptive offer. In 2014, two technologies in particular were marketed to the industrial market. Industrial customers benefitted from financial incentive support tied to the installation of Infrared Heaters as well as Industrial Air Curtains; in all, 108 projects were completed.



- In 2014, as in prior years and as outlined in the DSM plan, budget spending on programs and activities for rate classes 110, 115 and 170 is capped. As stated in EB-2012-0394:

> "In general, Enbridge will have the right, in the manner described in the Guidelines, to re-allocate budget between customer classes and groups to optimize the effectiveness of its DSM Plan. However, the Parties agree, for …2014 …that the total budget spent on programs and activities (including allocated overheads but excluding Low Income Allocations) for all customers in rate classes 110, 115, and 170 shall not exceed the following annual limits:"[15]

Table 19. Rate Class 110, 115 and 170 Spending Limits vs. 2014 Actual Spending

Rate Class	2014 Spending Limit	2014 Actual Spending*
110	$1,687,000	$902,696
115	$1,307,000	$423,423
170	$2,220,000	$352,414

- Table 19 details the actual spending (including allocated overheads but excluding Low Income Allocations) relative to prescribed spending limits for each rate class and shows that spending is below the limits set out for all three rate classes.

- In an attempt to reach a wide market of customers regardless of size while maintaining cost-effectiveness, Enbridge offered a variety of materials and forums aimed at increasing awareness of energy efficiency opportunities and benefits, educating customers and providing resources to research and evaluate potential improvement solutions. Enbridge focused efforts on a number of initiatives which included:
  - Energy efficiency workshops and webinars;
  - Quarterly newsletters (via email blasts);

15 *Update to the 2012 to 2014 Demand Side Management ("DSM") Plan* (EB-2012-0394), Exhibit B, Tab 1, Schedule 3, page 5 of 20.

- Audits and Assessments (including targeted assessment campaigns);
- Telemarketing Campaigns; and
- Industrial Energy Solutions Portal.

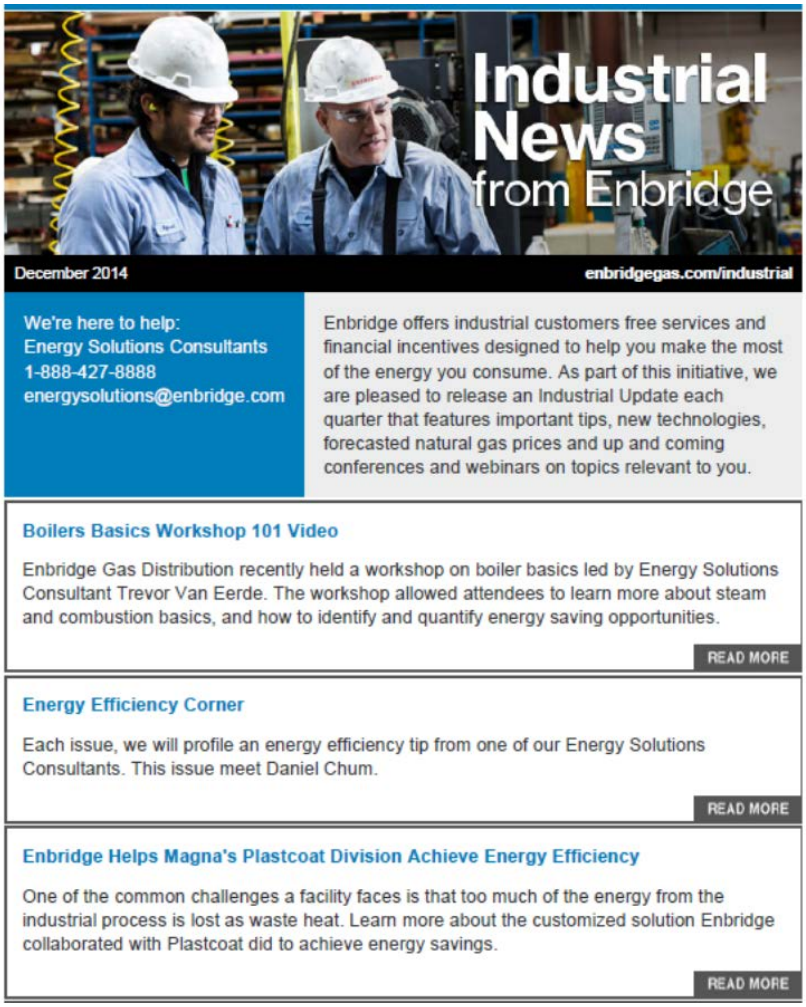
★ Throughout the year, the industrial team hosted one-day workshops aimed at building awareness for energy efficiency in the customer's facility. The focus of these efforts was on educating the customer and their employees on identifying energy conservation opportunities and providing information to help evaluate potential projects. The workshops included the following:

- **Energy Management 101:** Attendees were shown how to begin to map the energy profile for their facilities, explore ways of building and integrating an energy management system and evaluate industry recognized energy management standards.
- **Combustion Equipment Maintenance Safety Workshop:** Industrial customers were educated on maintaining the integrity of combustion equipment to prevent equipment failure while enhancing safety.
- **HVAC Audit Workshop:** Through a case study analysis, attendees learned about heat recovery and how they can apply these principles to their facilities.

- **Boiler Basics Workshop:** Attendees learned about steam and combustion basics and how to identify and quantify energy saving opportunities.

Over 100 participants took part in these workshops. Feedback survey responses indicated that 83% of participants rated the workshops as excellent in providing relevant and useful content.

★ The Company also published quarterly newsletters which were distributed through e-mail blasts to over 1000 industrial customers. These publications feature information regarding upcoming conferences, webinars and Enbridge workshops, highlight energy efficiency technologies, spotlight case studies, and provide natural gas price forecasts.



- Although the Company has developed strong relationships with many of the larger industrial customers, Enbridge recognizes there is more work to do in building engagement and developing contacts with the smaller industrial customer base. In 2014, two telemarketing campaigns targeting this customer segment were conducted. The campaigns were designed to enhance the Company's customer contact and customer information database for the smaller industrial segment. Efforts also focused on building awareness of the DSM program and increasing the newsletter audience.

- Enbridge launched the Industrial Energy Solutions Portal in April of 2014. The portal is designed to help engage industrial customers and make it possible for customers and service providers to secure the information they require to make an informed decision online – anytime – as needed.

- The portal provides industrial customers, contractors and business partners with the tools to:

  - Help evaluate efficiency opportunities;
  - Review energy savings and payback period estimates;
  - Request Enbridge incentive quotes;

- Access technical resources such as calculators, brochures and articles;
- Learn about upcoming training workshops and events; and
- Request support from an Enbridge Energy Solutions Consultant.

Interest and traffic to the site has been encouraging and several opportunities for the Company to assist customers with uncovering energy efficiency improvements were generated through the portal.

★ Ontario's industrial/manufacturing sector continues to face numerous challenges in the face of global competition which include the high cost of electricity. Enbridge expects electricity energy efficiency considerations will continue to be a higher priority to customers relative to gas savings. For the majority of Enbridge's customers however, an individualized, customer-focused approach to education will help increase awareness of the opportunities and benefits associated with gas savings solutions.

★ The industrial sector utilizes most of its energy for process related consumption as opposed to heating and ventilation purposes. Consequently energy efficiency opportunities focused on the improvement and optimization of these processes would benefit these customers. Many industrial customers lack technical knowledge regarding energy efficient technologies that may help improve these processes and reduce overall energy consumption.

★ Enbridge continues to look for ways to improve and build on current offers including examining approaches to support operational improvements through energy monitoring and targeting. The Company plans to launch a Comprehensive Energy Management offer as part of the next Multi-Year DSM plan. The proposed offer will aim to encourage customers to incorporate operational efficiency as part of their culture to ensure improvements and investments are sustainable.

Low Income Program

Enbridge is a recognized leader in the area of energy efficiency programs specifically designed for low income consumers and has been particularly effective in building collaborative partnerships in the marketplace with LDCs, municipalities and community service providers. Programming has evolved considerably since DSM activities for this market were initially offered in 2004.The Low Income program focuses on helping to reduce the energy costs facing low income consumers and housing providers through thermal envelope improvements as well as the installation of measures to achieve water and space heating savings.

Specifically, the Company's program delivery strategy focuses on leveraging available tools and resources, community-based organizations (CBOs) and local community channels. These groups have established relationships with trusted organizations that support the social service needs (housing affordability and environmental sustainability) of low income consumers. Enbridge has recognized the benefits of collaboration with these partners, including social and assisted housing support networks, in helping to inform and improve program delivery.

There are two primary streams in the Low Income program targeting distinct segments of this market: Single Family Buildings (Part 9) and Multi-Residential Social Housing Buildings (Part 3). Programming for the low income sector requires design and delivery considerations that are in many ways unique from traditional approaches in the manner they reach out to these vulnerable customers, encourage customer awareness and, in turn, build participation. This community includes seniors, low wage households, recent immigrants to Canada and people with special needs.

The Low Income program produced mixed results in 2014 relative to scorecard performance targets. Results in the Single Family (Part 9) segment were strong, totaling 25.67 million CCM, surpassing the middle (100%) target. Results in the Multi-Residential (Part 3) segment, however,

continued as in 2013 to be significantly below expectations with 29.80 million CCM[16], which is under the lower target.

Table 20. 2014 Low Income Scorecard

Component	Metric	Targets				2014 Actual Result
		Weight	Lower	Middle	Upper	
Single Family (Part 9)	*Cumulative Savings (million m³)*	***50%***	17.7	23.6	29.5	**25.67**
Multi-residential (Part 3)	*Cumulative Savings (million m³)*	***45%***	48.15	64.2	80.25	**29.80**
Multi-residential (Part 3) LIBPM [1]	*Percent of Part 3 Participants Enrolled* [2]	***5%***	30%	40%	50%	**74%**

1. LIBPM - Low Income Building Performance Management is the Low Income offer complement to the Commercial Run It Right (RIR) offer.
2. Low Income Building Performance Management (LIBPM) percentage of Part 3 buildings enrolled in current year program = (x+y)/(x+y+z):
x = # of new LIBPM buildings in the current year that have participated in another aspect of the Low Income program in a previous year of 2012-2014 plan; y = # of new LIBPM buildings in the current year that have not previously participated in the Low Income program; z = # of buildings in the current year that have implemented custom projects other than LIBPM.

Participation in the low income benchmarking initiative, LIBPM, continued to be excellent in 2014 resulting in an achievement of 74% for this metric, exceeding the upper target of 50%.

As outlined in Table 21, overall cumulative natural gas savings totalled 55.47 million CCM for the Low Income program.

16 This value is net of CPSV adjustment. Low Income Part 3 custom projects results are subject to the Commercial CPSV realization rate adjustment as they are included in that verification study.

Table 21. 2014 Low Income Results

Low Income Component	CCM Target (100%)	Actual CCM	$/CCM	Participants [2]	Units Installed [1]
Single Family (Part 9)	23,598,260	25,673,482	$0.1751	1,107	557
Multi-Residential (Part 3)	64,255,160	29,801,158	$0.0648	66	3,043
Total/Average	**87,853,420**	**55,474,640**	**$0.1158**	**1,173**	**3,600**

1. Units installed refers to the number of units for prescriptive offers.
2. Participants refers to the number of unique addresses for custom projects.

In the social housing space, a key partner in the Enbridge franchise area is Toronto Community Housing (TCH). As the largest social housing provider in Canada and the second largest in North America, this group provides homes to almost 59,000 low income households.

A significant number of projects from TCH were anticipated and taken into account in the 2013-2014 DSM Plan Update. These projects were expected to have substantial savings contributions. However, these projects have been delayed due to funding cutbacks, increased analysis requirements and additional approvals necessary for implementation. Management and decision-making process changes within TCH over the last two years continue to have an impact on Low Income DSM program results in both the single family and multi-residential segments. The need for additional reviews prior to project execution and the finalization of decisions and implementation across the TCH housing portfolio have significantly slowed results. Specifically, TCH has currently suspended capital improvement projects in Part 3 buildings. In addition, no Part 9 buildings participated in the 2014 Winterproofing offer.

An announcement from the OPA regarding the early termination of the "social housing adder", where LDCs are providing financial incentives of up to 50% of the project cost for social housing CDM projects, left housing providers prioritizing CDM-related projects over natural gas energy efficiency measures. Projects were required to be submitted for a mandatory pre-approval in July 2014 for completion by the end of 2015 to access this rich incentive offer.

GLOBE/Housing Services Corporation, as Enbridge's program delivery agent for the social housing sector, experienced significant internal organizational and operational challenges that impacted its ability to deliver on its performance targets for the year. New staff came on board, and new processes were introduced during the year. With changes in strategic direction and with a change in program focus on behalf of Enbridge to pursue the private market, the partnership with GLOBE has evolved from being a program delivery agent to a strategic communication channel partner for Enbridge.

Single Family (Part 9)

Home Winterproofing (formerly Low Income Weatherization) and Prescriptive Measures

Objectives	The goal of the Single Family Low Income offer is to capture energy savings through the reduction of hot water use and space heating demand in low income single family households through the installation of thermal envelope improvements, space heating and water saving measures.
Target Customer	This offer targets Rate 1 homeowners and tenants living in low-rise homes within the Enbridge franchise area who need assistance with their energy costs. Eligible customers must meet the following criteria: • Income is at or below 135% of Statistics Canada's Low Income Cut-Off (LICO); • Occupants of single detached and low-rise multi-family (3 stories or less); • Private homeowner or tenant who pays their own gas bills; or • Tenants residing in social and assisted housing, regardless of who pays the gas bills. Income verification is required to participate in this offer.

Metrics	The primary metric is cumulative cubic meter (CCM) savings.
Tracking Methodology	In the case of Home Winterproofing, reports are submitted from delivery agents summarizing installation site information (e.g., address, ownership, housing type) and natural gas savings (m^3) calculated based on the results of customized energy audits conducted by energy auditors. Participation also is tracked by type of tenancy (i.e., social housing or privately-owned dwellings). Similarly, monthly reporting is provided by delivery agents and summarizes savings per unit installed for each prescriptive measures installed, if any. Monthly reports are compiled by the Tracking and Reporting team, utilizing EGD's sales tracking software.
Offer Description	The Low Income Home Winterproofing offer is available for: • qualified Part 9 buildings (three stories or less); • private homeowners and residential tenants within the EGD franchise who meet the established income eligibility criteria; • residents of social housing; and • recipients of social assistance benefits. For each Part 9 single family home, Enbridge aims to comprehensively treat all cost-effective opportunities, provided that the customer accepts all such measures. Basic prescriptive measures including showerheads, aerators, programmable thermostats and heat reflector panels are offered. The Winterproofing offer provides low income customers with a free home energy audit and upgrades that may include: attic, wall and/or basement insulation, door and window caulking and draft-proofing.

	Enbridge's main approach to delivering the Winterproofing offer is to work with experienced and reliable delivery agents who perform the energy audits and install measures. Upgrades are determined by a free home energy audit performed by a Certified Energy Auditor to determine which cost-effective measures are most appropriate for each home. Basic measures, as defined above, are offered as part of the screening process. Once the measures are installed, a second home energy audit is conducted to verify the gas savings realized. EnviroCentre, Green Communities, GLOBE (Green Light on a Better Environment) and GreenSaver continued as the four primary service providers contracted by Enbridge to market and deliver the offer. These delivery agents have extensive experience in energy efficiency audit and retrofit delivery activities and are well established in their communities with recognized connections to low income constituents throughout the franchise area. The strategy of delivering the offer in partnership with community-based organizations with strong links to social service agencies has continued throughout the three-year multi-year plan. It has proven to be an effective way of connecting with a hard-to-reach customer segment. Where possible, delivery agents also refer participants to the local electric utility's conservation weatherization program.
Cost-Effectiveness	Low Income programs are often among the most expensive to deliver. As per the Guidelines, the Low Income program screening threshold is 0.70, the Low Income program was cost-effective as supported by the TRC screening above 1.0 (see Table 9 in Section 6). Gas savings for the Part 9 sector were achieved at a cost of $0.1751/CCM, as summarized in Table 22.

2014 Results	Single Family (Part 9) results were solid in 2014. Actual cumulative savings were 25.67 million CCM, as outlined in Table 22 below. These results exceeded the middle (100%) target 23.6 million CCM set out in the DSM Plan. The Enbridge Home Winterproofing offer reached 1,107 low income households in 2014. Many of these homes also received basic prescriptive measures including showerheads and aerators. An additional 147 homes benefitted from the installation of heat reflector panels (included in the prescriptive measures available in 2014).

Table 22. 2014 Single Family (Part 9) Low Income Results

Low Income Component	CCM Target (100%)	Actual CCM	$/CCM	Participants [2]	Units Installed [1]
Single Family (Part 9)	23,598,260	25,673,482	$0.1751	1,107	557

1. Units Installed refers to the number of units for prescriptive offers.
2. Participants refers to the number of unique addresses for Home Winterproofing.

Table 23. 2012-2014 Multi-Year Part 9 Results

Low Income Component	Actual CCM 2014	Actual CCM 2013	Actual CCM 2012
Single Family (Part 9)	25,673,482	32,904,684	24,708,220

2014 Highlights and Lessons Learned:

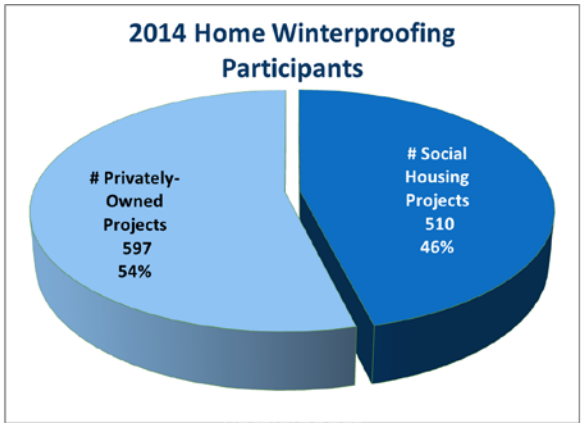
★ As summarized in Table 24, the analysis of projects completed in 2014 shows that average annual gas savings from the 510 social housing properties completed were 903 m^3 and the 597 privately-owned homes had an average annual gas savings of 918 m^3.

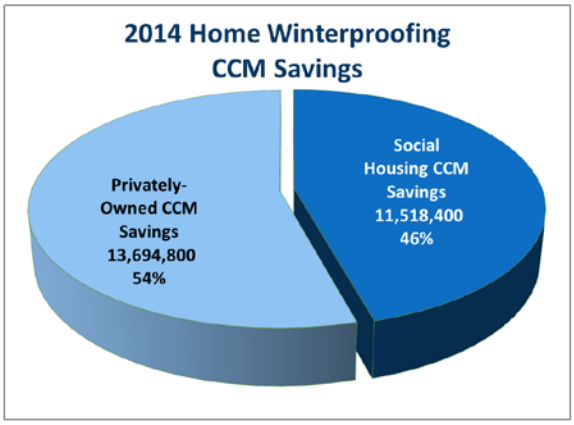
Table 24. Home Winterproofing – Average Project Savings

2014 Home Winterproofing Average Project Savings	Average Annual Gas Savings (m3)	Total Participants
Average Annual Gas Savings/Home - Social Housing	903	510
Average Annual Gas Savings/Home - Privately-Owned	918	597
Average/Total - All Projects	**911**	**1107**

- In terms of both the number of projects completed and the CCM savings, social housing projects accounted for 46% of results and privately-owned projects accounted for 54%.

Table 25. Home Winterproofing–Social Housing and Privately-Owned





- Notwithstanding the lack of gas savings expected from the Toronto social housing sector, significant savings were driven by the participation of other social housing providers as well as through delivery efforts to the privately-owned low income housing customer base.

- Following a series of comprehensive interviews with key external stakeholders of the program, it became apparent that the lack of understanding regarding the service and the terminology being used was posing a significant barrier to participation in the offer. Customers in this market simply do not understand what “weatherization” is or what it means.

- As a result, there was a significant improvement made to the Single Family Low Income effort in 2014, with the complete rebranding of the former Weatherization offer. Home Winterproofing was introduced early in 2014 and involved a full repositioning of outreach, marketing support materials and communication campaigns. Obvious financial barriers, challenging housing conditions, competing priorities and core needs as well as low customer awareness require customized outreach activities and well-designed marketing approaches.

- The new name, brand and materials were developed to focus messaging on “warmth and comfort”. A logo was developed to deliver a recognizable and welcoming image for the offer. The logo depicts the home enveloped with a toque on the roof and a scarf to support the concept and goal of warming and increasing comfort in the home.

HOME WINTERPROOFING PROGRAM

- Specific new marketing efforts in 2014 included:

    - A new brochure including fresh illustration-style graphics to represent homes “avoiding” the cold in a simple and memorable way. The brochure also incorporated the customer application form in one document for simplicity.

- Campaigns encouraged customers to sign up for the program ahead of the heating season and have the Winterproofing measures installed in preparation for the cold weather.

- Transit ads were included on buses travelling in and around Toronto/GTA, Niagara, Simcoe, Durham, Peterborough and Ottawa areas.

- Two seasonal campaigns – “Spring into Winter” and “Fall into Winter” were run in June and September. Campaigns encouraged customers to complete the free Home Winterproofing pre-audit with the additional incentive of $20 gift cards.

- A social media campaign was developed to promote awareness across various channels.

- Posters were developed for use within various social agencies, in particular for the Low Income Energy Assistance Program (LEAP)

in-take agencies and Member of Provincial Parliament (MPP) constituency office to post on their bulletin boards in key locations. An acrylic pocket was attached to hold brochures.

- Enbridge facilitated webinars and information sessions targeted to audiences of social agencies and community groups at a local level to promote program awareness, introduce the new program concept and outline updated marketing materials.

- Feedback from delivery agents supported the observation that an increased number of participants in 2014 came from low income home owners who responded to the new marketing/advertising by inquiring about the offer.

  A revised LEAP outbound calling campaign was new for 2014. Enbridge developed a scripted outreach approach for the Enbridge Call Center. The script supported outbound calls to LEAP participants for the purpose of providing information regarding the offer and directing them to the appropriate delivery agent to determine offer eligibility. An estimated 7% of LEAP participants who Enbridge attempted to contact were ultimately transferred to a delivery agent in their area to discuss the Home Winterproofing opportunity. Moving forward, Enbridge LEAP intake is being centralized to a single agency and efforts are underway to streamline LEAP and Home Winterproofing applications. This effort should improve the uptake for the offer resulting from follow up calls to LEAP participants.

- The Low Income offer included the small-scale introduction of an additional prescriptive measure for the Single Family segment to improve energy savings results and/or program delivery efficiencies. In collaboration with PEEL Living, heat reflector panels were incorporated into the screening process and, where applicable, were offered to customers for installation. GreenSaver was trained on the installation of the measure. The heat reflector panels are PVC panels with an aluminized surface designed to reflect radiant heat. They are installed in between the hot water heating units (radiator/convector) and the wall to reduce heat loss and reflect heat back into a room. In 2015, Enbridge will facilitate further training sessions with the manufacturer and other delivery agents to expand this effort.

- With a focus on ongoing program improvement efforts, training and quality control improvements directed to delivery agents continued in 2014. Data collection protocols, outlines and checklists to support work plan documentation and reporting requirements were reviewed to support continuous improvement for effective tracking and reporting.

- Enbridge continues to encourage delivery agents to cross-promote Ontario Power Authority's (OPA) funded saveONenergy Home Assistance Program (HAP) aimed at electricity focused energy efficiency while concurrently delivering the Home Winterproofing offer. This approach serves to benefit the customer by encouraging participation in both offers and maximizing potential energy savings. Enbridge will continue to explore opportunities for collaboration with electric utilities for efficiencies in delivering offers for low income customers.

- Enbridge will expand its work with the Ontario Non-Profit Housing Association (ONPHA) in 2015 to create increased awareness, visibility and education about the Company's Low Income initiatives in addition to its usual participation at ONPHA's regional meetings and annual conference.

- The Low Income program will continue to be a priority for Enbridge in 2015. The program will focus on uncovering energy savings in a market that benefits from resulting cost savings as well as through other non-energy related societal benefits. Obvious financial barriers, challenging housing conditions, competing priorities and core needs as well as low customer awareness will continue to require customized outreach activities.

Multi-Residential (Part 3)

Custom Projects and Prescriptive Measures

Objectives	The goal of the Multi-Residential Low Income offer is to capture energy savings through the reduction of space heating demand and hot water use in low income multi-residential buildings through the installation of thermal envelope improvements, space heating and water saving measures.

Target Customer	This offer targets Rate 6 multi-residential social housing providers and managers. In addition, the offer was extended in 2014 to include Rate 6 eligible owners and property managers of privately-owned multi-unit residential buildings (MURBs), which provide housing to a market that includes low income customers and families based on screening criteria established in collaboration with Enbridge's Low Income Consultative Working Group.
Metrics	The primary metric is cumulative cubic meter (CCM) savings.
Tracking Methodology	As with Commercial custom projects, the savings for each custom project are calculated on an individual basis. Additionally, savings per unit installed for each type of prescriptive measure are tracked and totalled. Results are recorded and summarized through a monthly tracking process utilizing EGD's sales tracking software.
Offer Description	Low Income Multi-Residential (Part 3) efforts help social housing providers and MURB managers improve the energy efficiency of aging buildings by offering the direct installation of basic energy savings measures. The offer alos provides financial support for custom retrofit and operational improvement projects - equipment replacement, thermal envelope improvements and controls. The Low Income Multi-Residential Custom offer takes a "building as a system approach" to energy efficiency. It targets housing providers, building operators and tenants with a range of measures and includes enhanced financial incentives, technical information services, building assessments/audits, education and project facilitation. Financial barriers inherent in the Low Income sector related to limited capital availability are addressed by

	providing an increased financial incentive relative to the standard custom offer, which provides \$0.10/ m^3 saved. Retrofits targeted at the Low Income sector are incented based on \$0.40/m^3 of gas saved (up from \$0.30 in 2013) for custom measures including building envelope, fans, boilers, heat recovery/economizers and make-up air units. Incentives are based on annual natural gas savings up to 50% of project cost. Prescriptive equipment replacement is incented at a set dollar amount depending on efficiency levels. These measures include specific condensing/high efficiency boilers, energy recovery ventilation systems and heat recovery ventilation systems. A free direct install showerhead installation program is also available. Technical issues are addressed by engaging sector experts to provide a suite of services including benchmarking, energy audits, technical assistance and project facilitation. Energy audits are incented as follows: 50% off up to \$5,000 per building or \$0.01 per m^3 gas consumed. For 2014, GLOBE, a subsidiary of the Housing Services Corporation (HSC), was engaged to provide program management and delivery services for the social housing Multi-Residential Low Income offers. The one exception is Toronto Community Housing, which is the largest single social housing provider in the country. TCH requires dedicated account management services from Enbridge, therefore the Company works directly with TCH on its multi-residential energy efficiency projects. Low-flow showerheads and heat reflector panels are provided on a direct install basis to eligible buildings.

Cost-Effectiveness	As per the Guidelines, the Low Income program TRC screening threshold is 0.70. The Low Income program was cost-effective as supported by the TRC screening above 1.0 (see Table 9 in Section 6). Gas savings for the Part 3 sector were achieved at a cost of $0.0648/CCM, as summarized in Table 26 below.
Evaluation Activities	Following internal verification review of all Low Income Multi-Residential custom projects by the DSM technical group, a further verification of Low Income custom projects is undertaken as part of the Commercial Custom Project Savings Verification (CPSV) process. An independent third-party engineering review, the Commercial Custom Project Savings Verification (CPSV), is conducted annually. The scope of work for this review is set out in a Terms of Reference established by the Technical Evaluation Committee (included as Appendix A). This verification study consists of a detailed review of the savings calculations for a statistically representative sample of Commercial sector custom projects (including Low Income Multi-Residential) claimed in 2014. The Commercial CPSV is summarized in Appendix B, and the prescribed sampling methodology followed to establish the selected projects is referenced in Appendix I. Reported results incorporate adjustments recommended by the engineering review followed by the determination of a realization rate adjustment as outlined in Appendix D.
2014 Results	The Multi-Residential offer faced significant challenges in meeting aggressive savings targets established for 2014. CCM natural gas savings were 29.8 million CCM, below the lower target metric.

Table 26. 2014 Multi-Residential (Part 3) Low Income Results

Low Income Component	CCM Target (100%)	Actual CCM	$/CCM	Participants [2]	Units Installed [1]
Multi-Residential (Part 3)	64,255,160	29,801,158	$0.0648	66	3,043

1. Units installed refers to the number of units for prescriptive offers.
2. Participants refers to the number of unique addresses for custom projects.

Table 27. 2012-2014 Multi-Year Part 3 Results

Low Income Component	Actual CCM 2014	Actual CCM 2013	Actual CCM 2012
Multi-Residential (Part 3)	29,801,158	27,314,154	43,407,789

2014 Highlights and Lessons Learned:

★ As the largest social housing provider in the country, TCH is a significantly large customer in Enbridge's low income customer group. Internal management changes, operational challenges and funding shortfalls as well as changing representation in the municipal government following elections have meant no resolution regarding the re-evaluation of initiatives and the re-prioritization of multi-residential energy efficiency projects. This scenario has continued in 2014, as in 2013, to have a significant negative impact on Part 3 results. Enbridge remains committed to assisting TCH by providing the much-needed technical support to better understand their portfolio and provide the direction to identify the opportunities that align with their priorities.

★ As in 2013, the offer continued to be directed to social housing providers elsewhere in the Enbridge franchise area. The offer involved direct engagement between EGD and social housing management groups as well as third-party delivery channels. No significant changes were made in 2014 to the process for capturing, calculating and tracking savings.

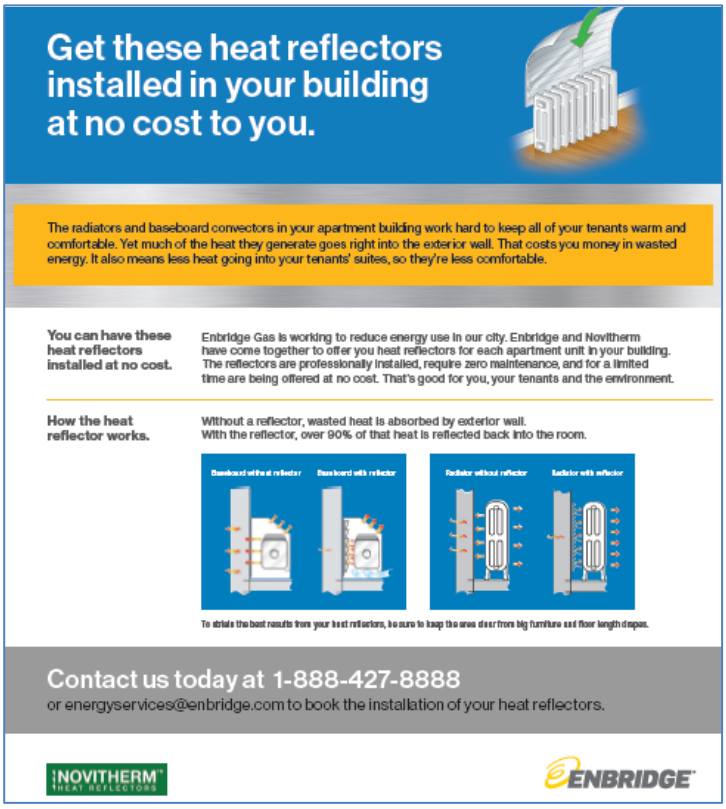
★ Retrofit fatigue in the social housing sector persists with the lingering effects of the Social Housing Renovation and Retrofit Program (SHRRP)

and the Renewable Energy Initiative (REI) in the past five years and, most recently, with the accelerated application deadline for social housing projects under saveONenergy. These concurrent programs have created an additional challenge to engage housing providers to work with Enbridge for additional or deeper energy saving opportunities.

- Enbridge and the Low Income Consultative Working Group continued to work collaboratively in 2014, with additional resources as necessary, to develop protocols for including privately-owned multi-residential buildings in the Low Income program within the City of Toronto based on available data specific to this municipality. The protocols are based on the following established principles:

    - Eligibility: To be eligible to participate in the Low Income program, it should be established that privately-owned multi-residential buildings have a high proportion of low income tenants.
    - Screening for eligibility: Screening will be based on the data available within a given region in consultation with the Low Income Consultation subgroup.
    - Impact on Rents: Participation of privately-owned multi-residential buildings through building owner or management participation should not result in a rent increase to building tenants.
    - Benefits to Tenants: Participation of multi-residential privately-owned buildings in the Low Income program should include measures that will result in direct benefit to tenants, e.g., in-suite measures that increase comfort and health.

- As a result of the efforts mentioned above, the Low Income Part 3 offer was expanded in the fall of 2014 to include privately-owned Part 3 multi-residential buildings in the City of Toronto. Delivery to this target group of customers involved the assistance of EGD ESCs in identifying projects. The offer included the direct install of heat reflector panels targeted to privately-owned multi-residential buildings in Toronto.



- Moving forward, Enbridge will work with the Low Income Consultative sub-group to develop protocols for additional municipalities based on the data and information available in those areas on a case-by-case basis.

- In partnership with the City of Toronto's Tower Renewal Office, Enbridge's campaign leveraged the extensive work the City has done to understand the building towers, residents and social planning needs of communities. These efforts are part of the continuing collaborative work Enbridge undertook with the United Way Toronto (UWT) in the 2013 private multi-residential demonstration program. Enbridge utilized the City of Toronto Tower Renewal Office where census tract information showed 40% and above of residents are low income persons (using the Low Income Measure (LIM) as the primary indicator) living in buildings eight stories or greater and where the buildings are located in City-determined communities with high social needs, i.e. Neighborhood Improvement Areas.

- With the Federation of Rental Property Owners (FRPO) as part of the Low Income Working Group, Enbridge is engaging FRPO as the largest organization representing private rental housing providers to promote the program to its membership.

- The Company will continue to engage multiple levels of management within municipal housing providers – from operational, "on-the-ground" staff to senior strategic-level management – to help in addressing barriers and facilitate decisions. This engagement will be particularly important in propelling efforts to implement energy efficiency projects for housing providers such as Toronto Community Housing.

- In the affordable housing building community, resident engagement has become a critical and influential factor in decision-making, successful project implementation and ensuring the sustainability of savings. Therefore, Enbridge will need to continue to co-ordinate its efforts with the understanding that resident input to the budgeting considerations of housing providers is commonplace in the project planning process.

Low Income Building Performance Management (LIBPM) [17]

Objectives	This initiative is designed to provide participants with detailed energy and water consumption information and benchmarking reports at no cost. The goal is to raise the level of awareness on energy usage. In addition, coaching is provided on possible areas of improvement, energy efficiency tips and energy efficiency opportunities.
Target Customer	Rate 6 multi-residential social housing providers and managers.
Metrics	The metric for this offer is based on the percentage of Part 3 buildings enrolled in the current year. Building owners or managers who have "enrolled" in Low Income Building Performance Management are counted towards the metric. The formula for calculating the percentage of Part 3 buildings enrolled in the current-year Low Income Building Performance Management offer is as follows: $\%\ \text{LIBPM} = \frac{(x + y)}{(x + y + z)}$ where: x = Number of new LIBPM buildings in the current year that have participated in another aspect of the Low Income program in a previous year of the 2012-2014 plan; y = Number of new LIBPM buildings participating in current year that have not previously participated in the Low Income program; and, z = Number of buildings in the current year that have implemented custom projects other than LIBPM.
Tracking Methodology	Participating buildings are required to complete an Enrollment and Participation form. Copies of these forms

17 Low Income Building Performance Management is the Low Income offering complement to the Commercial Run it Right (RiR) offering.

	are tracked along with copies of quarterly reports delivered by GLOBE and sent to participants as well as annual reports summarizing natural gas savings for each participant. The offer undergoes monthly tracking by the Tracking and Reporting team, utilizing EGD's sales tracking software.
Offer Description	As outlined in the 2013-2014 Update (EB-2012-0394) and in recognition of the need for a Building Performance Management offer directed at the Low Income sector, the concept of the Commercial Run it Right activity was modified to reflect the needs of social housing providers and the characteristics of social housing buildings. The Low Income Building Performance Management initiative (LIBPM) has been simplified to include: • benchmarking specifically developed for the social housing sector; • analysis of historical consumption data; • development of recommendations for reducing consumption; and • assessment of resulting changes in consumption 12 months later based on changes in actual gas usage. In line with the Low Income delivery strategy of leveraging and/or enhancing existing sector and delivery agents' networks, Enbridge entered into an agreement with GLOBE/HSC. Initially developed as a one-year trial program, GLOBE secured funding from the OPA to pilot an electricity-focused benchmarking initiative. Enbridge engaged GLOBE to enhance and expand the building subscription of its Utility Management Program (UMP) to include gas benchmarking and consumption analysis.

	Through this initiative, the energy consumption of participating buildings is tracked over a twelve-month period. Quarterly reports are generated for each building. Follow-up calls are made by GLOBE/HSC to "underperformers" based on the benchmarks established, to provide coaching and identify pathways to energy savings – from improved operational practices to energy savings incentives. The quarterly report is also used to generate program awareness and as a means to identify potential projects for custom or prescriptive offers.
2014 Results	The 2014 year saw continued good interest in the marketplace for this offer, and Enbridge reached a significant number of buildings. There were 183 properties that participated in the LIBPM offer in 2014. Based on the calculation outlined for the metric, this resulted in a score of 74% for this metric, well above the upper target for this initiative.

2014 Highlights and Lessons Learned:

★ The partnership with Enbridge has allowed GLOBE to continue expanding the UMP initiative well beyond its initial efforts in 2012 and make the necessary enhancements to improve usability and functionality of the tool for housing providers.

Social housing providers in Enbridge's Multi-Residential program are also eligible for additional ways to reduce costs:

Utility Management Program

Improve building performance via HSC's Utility Management Program (UMP)

UMP provides personalized quarterly reports on your building's utility performance over time. You also get access to services to help you reduce your utility costs and maximize your investments in energy-saving capital projects. The UMP program is offered by HSC to social housing providers independent of Enbridge. However, as a participant in the Enbridge multi-residential program, you can choose to receive reports for one year.

ENBRIDGE

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- ★ Enbridge's will continue its support for UMP as it serves as a lead generator for retrofit and other energy savings opportunities.

- ★ The initiative has been well-received by housing providers and service managers over the last two years; Enbridge will continue its partnership with HSC in supporting UMP through the LIBPM initiative into 2015.

Market Transformation Program

As defined in the Board's DSM Guidelines, "market transformation programs are focused on facilitating fundamental changes that lead to greater market shares of energy efficient products and services, and on influencing consumer behaviour and attitudes that support reduction in natural gas consumption. They are designed to make a permanent change in the marketplace over a long period of time."[18] Enbridge's Market Transformation program comprises offers for both new construction sectors (Commercial and Residential) as well as an offer directed to the existing residential sector.

Enbridge is pleased to report that 2014 was a successful year with respect to the performance of the Market Transformation (MT) program. Each of the Company's three offers in this program has seen increasing recognition in the marketplace from the respective target market groups that each was intended to educate and influence in support of reducing natural gas consumption. On a weighted scorecard basis, all three of the offers met or exceeded their upper performance targets.

Savings by Design Residential and Savings by Design Commercial are designed to influence the new construction sector and were introduced in 2012 in conjunction with the current multi-year plan. These offers were developed to play a role, both through education and influence, in demonstrating to builders/developers ways of building to standards above the current building code requirements and achieve energy performance savings.

The Home Labelling (Rating) offer was developed to influence the home re-sale marketplace by helping individuals to understand what a home rating represents and the value it brings to homebuyers and sellers.

18 "*Demand Side Management Guidelines for Natural Gas Utilities*" (EB-2008-0346), OEB, June 30, 2011, page 10.

New Construction

Residential Savings by Design (SBD)

SBD Residential Charrette

Objectives	The goal of the Residential Savings by Design program is to use the Integrated Design Process (IDP) to demonstrate to builders the potential for achieving higher levels of energy and environmental performance through the application of alternative design approaches. In order to realize the potential that the IDP demonstrates to the builder, performance incentives are provided. These incentives encourage the construction of new homes to an energy efficiency standard 25% above the level prescribed in the 2012 Ontario Building Code, ("OBC"). EGD expects that Residential SBD will help builders see the value of the IDP approach, striving to encourage adoption on an ongoing basis.
Target Customer	The offer targets builders and designers of new, Part 9 residential low-rise houses (towns, semis and detached homes) in the Enbridge franchise territory. The intent is to engage builders who construct multiple homes in any given year.

Metrics	There were two metrics for SBD Residential in 2014. The first metric tracks the number of previously non-participating eligible builders that enroll and take part in the IDP; the second metric tracks the number of homes built to the SBD specifications over the course of the year.
Tracking Methodology	This offer requires a commitment from builders to construct within a three-year time frame following the completion of the IDP. In order to follow up on the builder commitment, the Channel Consultants maintain regular contact with builders to ensure proper submission procedures are followed for the builders to receive incentives.
Offer Description	The SBD Residential offer has been developed to address lost opportunities in the Residential new construction sector. The offer focuses on engaging building industry stakeholders and leveraging industry capabilities to encourage builders to make informed decisions that realize potential energy savings. By educating builders on how to build more energy efficient buildings, along with providing a building incentive, the Company influences these builders to first “design it right”, then “build it right” and, finally, “sell it right”. SBD is designed to provide a variety of support activities for builders of new homes from the early design phase through to construction. Savings by Design is a process-based approach involving: • Visioning Session – to define the builder’s sustainability priorities and opportunities; • Integrated Design Process Session – to identify and evaluate strategies to meet the builder’s sustainability goals and the SBD energy reduction target of 25% beyond code through application of energy modelling; • Building Energy Modelling – to evaluate energy performance baselines and proposed improvements.

	This consultation involves connecting participating design teams with leading industry experts and other stakeholders as they consider alternative approaches to energy and environmental performance. Through this process, the team works with the builder to explore opportunities to achieve higher energy performance. Starting with the building envelope (windows, wall structure, insulation) and moving inward with HVAC mechanicals and lighting, the Savings by Design team guides the builder through a design process to achieve a modelled building that performs to at least 25% better than 2012 OBC. In addition, depending on the specific priorities identified during the visioning session, experts from fields such as lighting, storm water management, sustainable land-use planning or renewable energy can be engaged to provide further value to the IDP. In order to receive the incentive, builders must agree to allow a third-party service provider to provide testing and verification services to ensure that constructed homes are built with 25% greater energy efficiency than required under the current OBC.
2014 Results	As illustrated in Table 28, in the third year for this offer, Residential SBD was successful in enrolling 23 new builders who completed the IDP process in 2014. The result exceeds the upper target for this metric. In addition, there were 1,059 new homes built in relation to the completed units metric. In other words, for builders who have enrolled and completed the IDP process since 2012, these were the homes constructed through the initiative that had features consistent with SBD standards of 25% above OBC (as illustrated in the builder's IDP). This result exceeded the middle target for completed units in 2014.

Table 28. 2014 Residential Savings by Design Scorecard

Component	Metric	Targets				2014 Actual Result
		Weight	Lower	Middle	Upper	
Residential Savings by Design	*Completed Units*	***40%***	750	1000	1,250	**1059**
	Previously Non-Participating Builders Enrolled [1]	***60%***	12	16	20	**23**

1. Eligible builders based on a minimum of 50 homes built in the prior year.

Table 29. SBD Residential 2012-2014 Results

Component	Metric	2014 Actual Results	2013 Actual Results	2012 Actual Results
Residential Savings by Design	*Completed Units* [1]	**1,059**	**967**	**N/A**
	Previously Non-Participating Builders Enrolled [2]	**23**	**18**	**12**

1. Metric not applicable in 2012.
2. Eligible builders based on a minimum of 50 homes built in the prior year.

2014 Highlights and Lessons Learned:

- ★ In 2014, SBD Residential has continued to successfully expose additional builders to the IDP initiative while also working with previous attendees to assist them in building homes to the improved standards set out in the offer.

- ★ SBD Residential is a relationship-based effort. Success with the offer is reliant on the efforts of EGD Channel Consultants in recruiting key decision makers of building companies to reassess their approach to building design as it relates to their energy efficiency considerations; and as a means of preventing lost opportunities and realizing deep energy savings.

- Feedback from builders that have participated in an IDP indicates that they recognize the potential of alternative planning and design approaches as a means to achieving improved energy and environmental performance in their projects.

- Drawing on the experience, expertise and interests of all stakeholders, the offer has provided a forum for enhanced relationship development between Enbridge, builders, municipalities and other industry participants.

- Enbridge ensured that participants were made aware of other energy efficiency programs available, including the Ontario Power Authority (OPA) funded saveONenergy Residential New Construction program aimed at electricity focused energy efficiency, in an effort to ensure the builder could take advantage of other potential energy savings.

- Enbridge has gained further insight into the sales and marketing challenges facing builders, and is continuing to develop and evolve consumer-facing marketing collateral to support builder efforts to sell energy efficiency. These materials will be enhanced on a regular basis as

more learning from builders and their customers continue to drive marketing innovation.

Your Guide to SBD Sales Collateral

Live SAVINGS BY DESIGN

Use these marketing materials to help educate homebuyers on the advantages of owning a Savings by Design (SBD) home. All pieces will be co-branded with your own company logo (see reverse for how to supply your logo to us).

1 live.savingsbydesign.ca Website

This website has detailed information on what makes a Savings by Design home a smart choice. The URL appears on all collateral, along with a QR code that consumers can scan with their smartphone to be brought to the site immediately. Your team can also refer to the site on screen to help explain the SBD home features.

2 Consumer Benefits Banner

This self-supporting banner should be displayed somewhere near the entrance of your sales centre. Its purpose is to quickly educate consumers on the four main benefits of owning a Savings by Design home, and drive them to visit the website or scan the QR code to learn more.

Size: 31.5"x78"
Quantity: 1 of your choice of 3 versions
Price: $350 (first supply is courtesy of Enbridge)

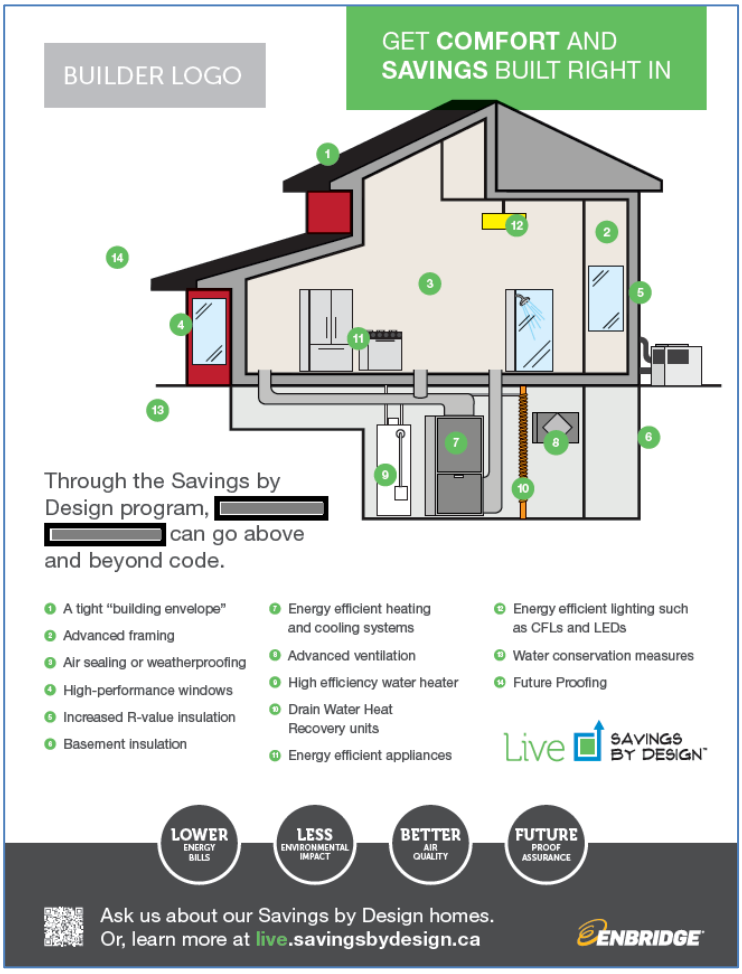
3 SBD Home Features Poster

This poster should be displayed prominently in your sales centre. Its purpose is to show consumers the key energy efficient upgrades that would be included in a Savings by Design home, and also to work as a reference for your team as they explain some of the upgrades.

Size: 18"x24"
Quantity: 1
Price: $50 (first supply is courtesy of Enbridge)

- ★ As part of the IDP charrette, a sales and marketing module was added to address a builder-identified barrier in upselling energy efficiency homes to prospective buyers.

- ★ Builders continue to face external challenges to achieving their targets for construction of new energy efficient homes due to lack of consumer demand, land access issues and market fluctuations.



- Builders continue to express a desire to participate in multiple charrettes due to the heterogeneous nature of the disparate developments. EGD has recognized the value in this idea, specifically as it relates to the impact that multiple IDP participations could have on builder culture.

- Builders have responded that, given the opportunity, they would benefit from going through the design process for subsequent projects since each development is unique in terms of housing and environmental impacts.

- Participation in the offer includes a commitment from builders to construct within a three-year time frame following the completion of the IDP. The number of incentivized homes built and the associated incentive payable was not realized in the 2014 offer year. The offer continues to have an

outstanding incentive commitment to these participants over the multi-year period.

- The current DSM framework and planning process, including the budget timeframe, is structured to address programs in one-year “windows”. The SBD Residential offer currently provides builders a three-year horizon in which to complete the homes that are eligible to be incented through the offer. Enbridge has identified some concerns from a forecasting perspective such that managing commitments made to participants over a multi-year period is proving challenging with annual (one-year) budgets. In Enbridge’s 2015-2020 Multi-Year DSM Plan (EB-2015-0049), the Company has proposed the use of a deferral account to address this challenge.

Commercial Savings by Design (SBD)

SBD Commercial Charrette

Objectives	The goal of the Commercial Savings by Design offer is to use the Integrated Design Process to demonstrate to builders the potential for achieving higher levels of energy and environmental performance through the application of alternative design approaches. The offer is intended to support this demonstration and awareness with incentives that encourage builders to use the knowledge gained in the IDP to design and build buildings that are more energy efficient. EGD expects that Commercial SBD will help builders see the value of the IDP approach, striving to encourage adoption on an ongoing basis.
Target Customer	This offer is targeted at builders and designers of new, Part 3 commercial buildings in the Enbridge franchise territory. Enbridge targets its promotional activity to owners, builders and developers, design teams including architects, design engineers and energy modelers.

Metrics	Builders and developers who enroll in the offer and complete the IDP process are eligible to be counted towards performance targets. As per EB-2012-0394, metrics are based on the number of projects to which a developer commits, i.e. "the same developer with different clients and different kinds of projects may be counted multiple times. A minimum 100,000 square feet requirement applies to each project. A project is defined as either a single building or multiples of the same building by the same company that add up to 100,000 square feet."[19]
Tracking Methodology	Enrollment entails a signed memorandum of understanding with a builder or developer containing a commitment to participate in the Commercial Savings by Design offer and participate in the IDP process. The builder commits to constructing building(s) to the IDP standard within five years in order to receive performance incentives. EGD Channel Consultants maintain regular contact with builders to track project status to project completion. Charrette reports for each IDP are maintained to provide a record of information on preliminary estimated savings for each project.
Offer Description	Enbridge has provided commercial new construction programming since 1999, beginning with the Design Assistance Program ("DAP"), which was developed to engage the new building design community to design and model new construction buildings to higher levels of energy efficiency. The Commercial Savings by Design offer was designed and developed for delivery beginning in 2012 to encourage developers to build/construct Part 3 buildings to 25% above 2012 OBC. The offer includes the following

19 EB-2012-0394, Exhibit B, Tab 1, Schedule 3, page 17 of 20.

	types of activities: • Improving sizing and design; • Optimization of passive solar, day lighting and natural ventilation; • Integration of high efficiency lighting and HVAC systems; • Integration of lighting and HVAC controls in response to occupant loads; • Reduction and/or optimization of internal loads; • Improving thermal characteristics of the building envelope; and • Managing environmental impacts. In addition to the facilitation of the IDP, which brings together industry experts, conservation authorities, and municipalities, the offer provides incentives that include financial support to cover costs associated with the IDP and additional incentives tied to the achievement of gas savings above code.
2014 Results	Enbridge was successful in enrolling 19 new developments in 2014 that met the eligibility requirements and completed the IDP process. This result reached the upper scorecard target.

Table 30. 2014 Commercial Savings by Design Scorecard

Component	Metric	Targets				2014 Actual Result
		Weight	Lower	Middle	Upper	
Commercial Savings by Design	*New Developments Enrolled*	***100%***	8	12	19	**19**

Table 31. SBD Commercial 2012-2014 Results

Component	Metric	2014 Actual Results	2013 Actual Results	2012 Actual Results
Commercial Savings by Design	*New Developments Enrolled*	19	16	9

2014 Highlights and Lessons Learned:

- ★ As with the Residential offer, SBD Commercial continues to receive positive reviews from those taking part in the process. In addition to the primary focus of influencing builders to construct their building(s) to 25% above the current OBC in the new construction market, the overall education component of the design charrette is also helping to prepare builders for the upcoming building code update in 2017.

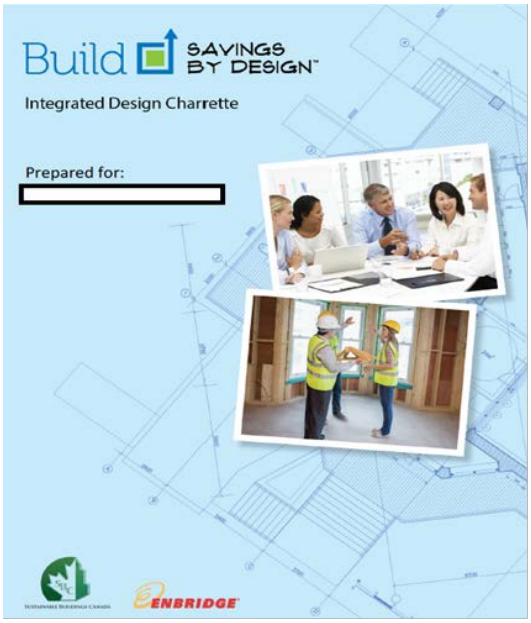
- ★ The 2014 year saw increased enrollments following good success in 2012 and 2013 in engaging builders to participate in the design charrettes.

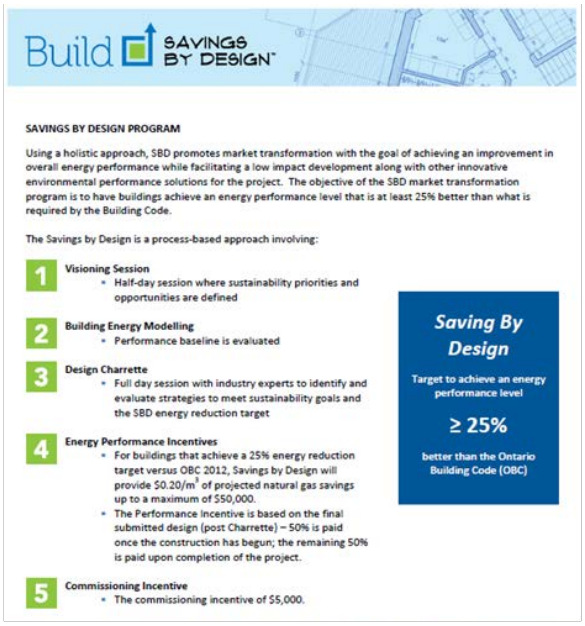
- ★ In some cases, participants continue to wrestle with the view that building "green" is an expense rather than an investment. The commercial builder is price sensitive, and an additional cost for energy efficiency considerations is not always viewed as providing enough of a positive differentiator to offset a price increase to the end customer. With this in mind, Enbridge explored how to incorporate a cost estimation element to the IDP process to provide additional value in consideration of the client's cost/benefit analysis.

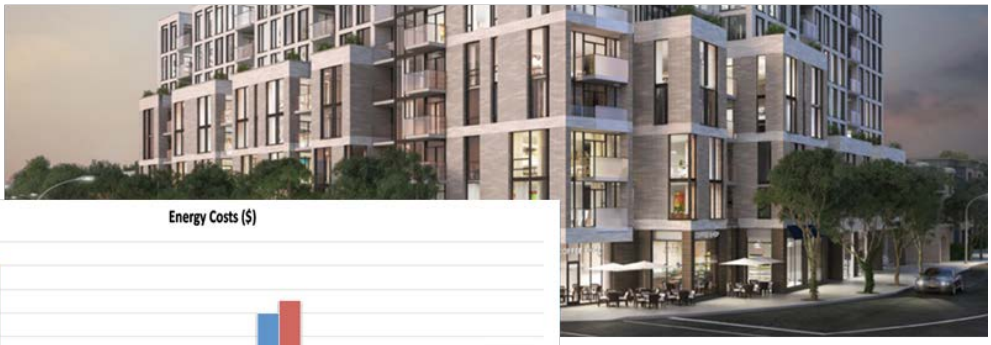
- ★ In investigating this idea, Enbridge recognized that the pricing structure for products varies from builder to builder based on such factors as relationships with suppliers or the builder's ability to benefit from bulk purchasing. As a result, Enbridge took a different approach. The IDP now incorporates guidance in estimating potential incremental costs for design considerations and improvements, by providing relative increases on a percentage basis, across the spectrum of technologies proposed.

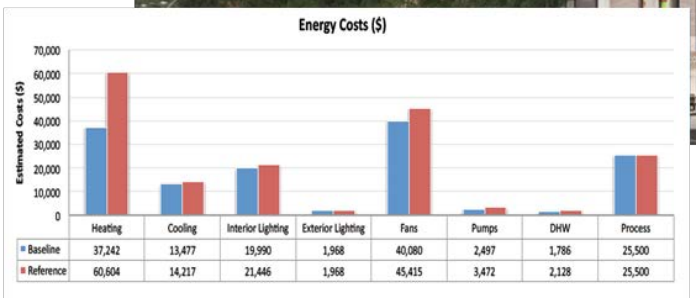
- Not surprisingly, many of the developments being reviewed in the offer have been buildings being contemplated from around the Greater Toronto and Ottawa areas, as these urban centers would be expected to be home to these larger buildings.

- Though it is anticipated that the new condo construction market will slow in Toronto over the next number of years, with the recent strength of the condo development market in Toronto in the last few years, many of the projects partaking in the process since 2012 have been condo projects.









- Savings by Design Commercial is still a relatively new offer and efforts will continue to focus on building awareness and leveraging on the success demonstrated thus far. Strategic involvement in conferences and events that provide an opportunity to showcase the offer and market the approach will be ongoing. Opportunities to engage architects, developers and construction industry manufacturers will be explored, for example the Canada Green Building Council and the Green Building Festival as well as municipal stakeholder events.

- Enbridge has developed strong relationships with builders and is now connected with some high profile buildings. Having the Savings by Design name associated with these projects will help support the value of the offer and increase the overall market acceptance of the approach. This exposure will not only help to increase awareness but will also help to demonstrate to other developers – the benefits of the offer, the value of the Savings by Design process and what can be accomplished.

- A focus for 2015 will be to explore more opportunities to impact school and long term care facilities projects as both the Ministry of Health and the

Ministry of Education have approved incremental funds from the province for building in these sectors.

- Even with changes that were made to the 2013 and 2014 offers during the consultation process to update the 2012-2014 multi-year plan that allowed for the inclusion of developments in cases where the proponent can show aggregate potential for the construction of multiple, similar buildings, to meet the square footage threshold -- there continue to be lost opportunities resulting from projects that are disallowed to participate because they do not meet the minimum aggregate size requirement. In Enbridge's 2015-2020 Multi-Year DSM Plan (EB-2015-0049), the Company has proposed a revision to the eligibility criteria to capture these opportunities.

Existing Residential

Home Labelling (Rating)

Objectives	The primary objective of the Home Labelling offer is to achieve widespread adoption of a voluntary home labelling system in the residential home resale marketplace. This initiative is aimed at educating the Residential market (realtors and homeowners) to better understand the concept of home energy rating and the value it brings in the resale market. Ultimately, the goal is to transform the re-sale market so that a home's energy performance rating becomes a standard condition of sale, similar to home inspections.
Target Customer	The immediate target market to support the deployment of a home rating system is realtors and their various real estate brokerages. To achieve this aim, collaboration with brokerages willing to commit to promoting Home Labelling and educating real estate agents is a key component for effective delivery. The ultimate market is residential (Rate 1) customers and real estate agents / brokerages who are listing homes for sale.
Metrics	The first metric requires Enbridge to secure new commitments from realtors collectively responsible for more than 5,000 (middle target) or 10,000 (upper target) home listings per year. The 2013 scorecard introduced a second metric, which counts the number of ratings performed by buyers and/or sellers. The rating must either be included in a listing or related marketing materials by the seller or made a condition of sale by the buyer.
Tracking Methodology	Track commitment letters from new realtors not counted towards a previous year's metric and home ratings included in Multiple Listing Service (MLS) listings or related marketing materials.

Offer Description	The Home Labelling offer is designed to influence the re-sale marketplace in understanding what a home rating represents and the value it can provide to both homebuyers and purchasers at the time of sale or purchase. The offer also aims to motivate realtors to include energy ratings in marketing material (e.g., MLS).
2014 Results	In 2014, 34 brokerages committed to participate. As illustrated in Table 32, these brokerages are collectively responsible for 40,040 home listings. This result exceeded the upper target established for this metric. The number of home ratings marketed in 2014 was 662. This result fell short of the lower target for the second metric specified for this offer.

Table 32. 2014 Home Labelling Scorecard

Component	Metric	Targets				2014 Actual Result
		Weight	Lower	Middle	Upper	
Home Labelling	*Number of Committed Realtors* [1, 2]	***70%***	N/A	5,000	10,000	**40,040**
	Ratings performed	***30%***	750	1500	2250	**662**

1. Commitments to make provision for a data field to show home energy ratings for all homes listed by participating realtors (industry-wide commitment to include such a field on MLS or similar listing service and/or realtors' commitment to do so with all the homes they list on their own websites, handouts and other consumer material).

2. Commitment from realtors collectively responsible for more than 5,000 (middle target) or 10,000 (upper target) listings/year.

Table 33. Home Labelling 2012-2014 Results

Component	Metric	2014 Actual Results	2013 Actual Results	2012 Actual Results
Home Labelling	*Number of Committed Realtors* [1, 2]	**40,040**	**78,000**	**8,600**
	Ratings performed [2]	**662**	**138**	**N/A**

1. Commitments to make provision for a data field to show home energy ratings for all homes listed by participating realtors (industry-wide commitment to include such a field on MLS or similar listing service and/or realtors' commitment to do so with all the homes they list on their own websites, handouts and other consumer material).

2. Metric not applicable in 2012.

2014 Highlights and Lessons Learned:

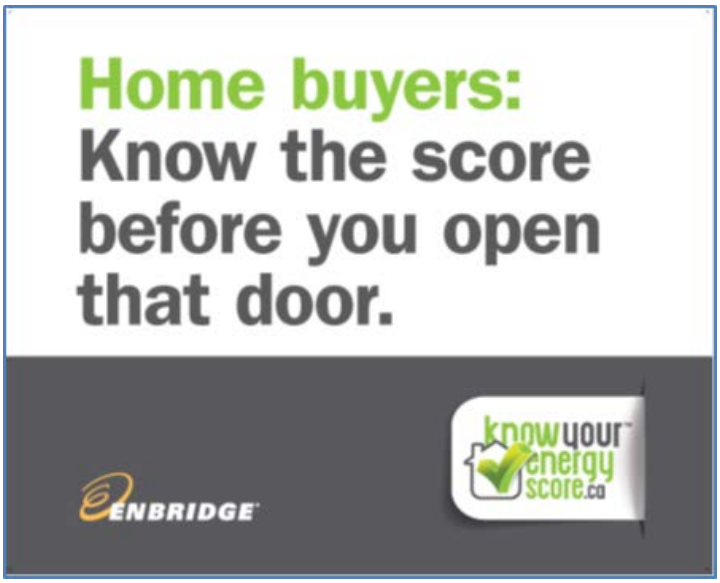
★ Though the Green Energy and Green Economy Act in 2009 originally included a proposal to mandate a home labelling system for all re-sale homes in Ontario, implementation did not follow. Given this outcome and the anticipated continuation of opposition from realtors to a government-enforced program, a voluntary system designed to gain acceptance in the marketplace continues to be suitable.

★ The approach leverages existing infrastructure to achieve voluntary adoption as a standard practice in the resale marketplace, in much the same way as offers to purchase are made under the provision of a home inspection.

- In May 2014, Channel Consultants participated in the annual Realtor Quest conference in Toronto – the largest gathering of Toronto Real Estate Board members. In the process, they presented and exhibited Enbridge's Home Labelling offer and initiated follow-up sessions to discuss the value of the offer and the benefits to potential buyers and/or sellers.

- Enbridge Channel Consultants reached out to real estate brokerages to discuss the value of understanding home labelling/rating in the resale market, explain the offer parameters as well as to provide education, training workshops and incentives.

- Efforts continued, as in the prior year, to focus on engaging individual brokerages with customized incentive support to better address the varied brokerage/realtor relationships and partnership models and maximize the value of participation.



- Current home buyers typically do not ask if a house has been energy labelled or rated although most value the importance of purchasing an energy efficient home. Challenges identified in this regard are related to a variety of contributing factors which include:

    - an overall lack of knowledge and understanding from realtors;

- a perception that energy labels are confusing and don't depict true operating costs;
- cost implications for energy audits and upgrades;
- real estate agents' focus on closing the sale of a home with minimal delays or barriers; and
- a belief that an energy rating will weaken the re-sale value and, therefore, there is no benefit for agents to promote.

★ The offer will continue in 2015. Activities focused on securing commitments from brokerages; creating awareness and educating realtors on the value of home energy ratings will not change.

★ Enbridge has had success with the offer to date as the Company has demonstrated good results in influencing realtors to participate; however, the Company is not seeing the actual number of homes labelled increase in the marketplace.

★ Beyond 2015, the Company will need to reposition given that there are a limited number of brokerages to involve with the offer and appreciating that there are a finite number of potential listings in the franchise area each year.

★ In the 2015-2020 Multi-Year DSM Plan (EB-2015-0049), Enbridge proposes to refocus efforts to promote energy audits as a means to educate homeowners and, in turn, increase demand to have home ratings performed before the purchase of a resale home is completed. Enbridge has proposed a greater emphasis on mass market outreach to homeowners and direct marketing to select realtors and home inspectors. In tandem, the Company will look at expanding marketing initiatives in the sector by working with key stakeholders including energy auditors, financial institutions, mortgage brokers, HVAC contractors and municipalities who heavily influence the sector and can promote the concept to customers.

★ Enbridge will continue to lead the market in building understanding of the value of a home energy rating with the end goal of encouraging mandatory labelling.

8. DSM Incentive Deferral Account (DSMIDA)

The Guidelines call for targets for each of the three programs: Resource Acquisition, Low Income and Market Transformation – to be included on their respective balanced scorecards. The Guidelines indicate that there should be three levels of achievement.[20] The scorecards for each program offered in 2014 were developed in consultation with the intervenors and approved by the Board in the Update to the 2012 to 2014 Demand Side Management Plan (EB-2012-0394).

The Guidelines also state that "an incentive payment should be available to the natural gas utilities to encourage them to aggressively pursue DSM savings and recognize exemplary performance."[21] The DSM Incentive (DSMI) provides that incentive to the Company for its DSM activities.

Further to approved amounts in EB-2012-0394, Table 34 summarizes how the maximum incentive available in 2014 is allocated across each program.

Table 34. 2014 DSM Maximum Incentive Allocation

Program	Program Budget	Overheads	Total Budget	% of Total	Maximum Incentive Available
Resource Acquisition	$14,160,578	$4,638,711	$18,799,289	58%	$6,355,631
Low Income	$6,729,500	$507,831	$7,237,331	23%	$2,446,785
Market Transformation	$4,795,000	$1,327,144	$6,122,144	19%	$2,069,764
Total	**$25,685,078**	**$6,473,686**	**$32,158,764**	**100%**	**$10,872,180**

The Guidelines explain that "the purpose of the DSMIDA is to record the shareholder incentive amount earned by a natural gas utility as a result of its DSM Programs." It further details that "the natural gas utilities should apply annually for disposition of the balance in their DSMIDA, together with carrying charges, after the completion of the annual third party audit," and that "incentive amounts paid to the natural gas utilities should be allocated

20 *Demand Side Management Guidelines for Natural Gas Utilities* (EB 2008-0346), OEB, June 30, 2011, page 30.
21 Ibid, page 31.

to rate classes in proportion to the amount actually spent on DSM activities on each rate class."[22]

Scorecard Targets and DSMI Calculations

Scorecard results and the corresponding DSMI earned for each program is detailed in the following tables:

Table 35. Resource Acquisition Scorecard & DSMI

Resource Acquisition						
Component	Metric	Weight	Targets Lower	Middle	Upper	Actual Result
Volumes	*Cumulative Savings (million m^3)*	**92%**	729.46	972.61	1,215.76	**664.37**
Residential Deep Savings	*Number of Houses*	**8%**	549	732	915	**5,213**
					Max. DSMIDA	$6,355,631
					DSMIDA Achieved	**$5,202,419**

Table 36. Low Income Scorecard & DSMI

Low Income						
Component	Metric	Weight	Targets Lower	Middle	Upper	Actual Result
Single Family (Part 9)	*Cumulative Savings (million m^3)*	**50%**	17.3	23.1	28.8	**25.67**
Multi-residential (Part 3)	*Cumulative Savings (million m^3)*	**45%**	45	60	75	**29.80**
Multi-residential (Part 3) LIBPM	*Percent of Part 3 Participants Enrolled*	**5%**	30%	40%	50%	**74%**
					Max. DSMIDA	$2,446,785
					DSMIDA Achieved	**$375,059**

22 *Demand Side Management Guidelines for Natural Gas Utilities* (EB-2008-0346), OEB, June 30, 2011, page 35-36.

Table 37. Market Transformation – Residential SBD Scorecard & DSMI

Market Transformation						
Component	Metric	Weight	Targets Lower	Middle	Upper	Actual Result
Residential Savings by Design	*Previously Non-Participating Builders*	**60%**	11	14	18	**23**
	Completed Units	**40%**	675	900	1,125	**1059**
					Max. DSMIDA	$1,055,385
					DSMIDA Achieved	**$1,055,385**

Table 38. Market Transformation – Commercial SBD Scorecard & DSMI

Market Transformation						
Component	Metric	Weight	Targets Lower	Middle	Upper	Actual Result
Commercial Savings by Design	*New Developments Enrolled*	**100%**	6	8	15	**19**
					Max. DSMIDA	$410,068
					DSMIDA Achieved	**$410,068**

Table 39. Market Transformation – Home Labelling Scorecard & DSMI

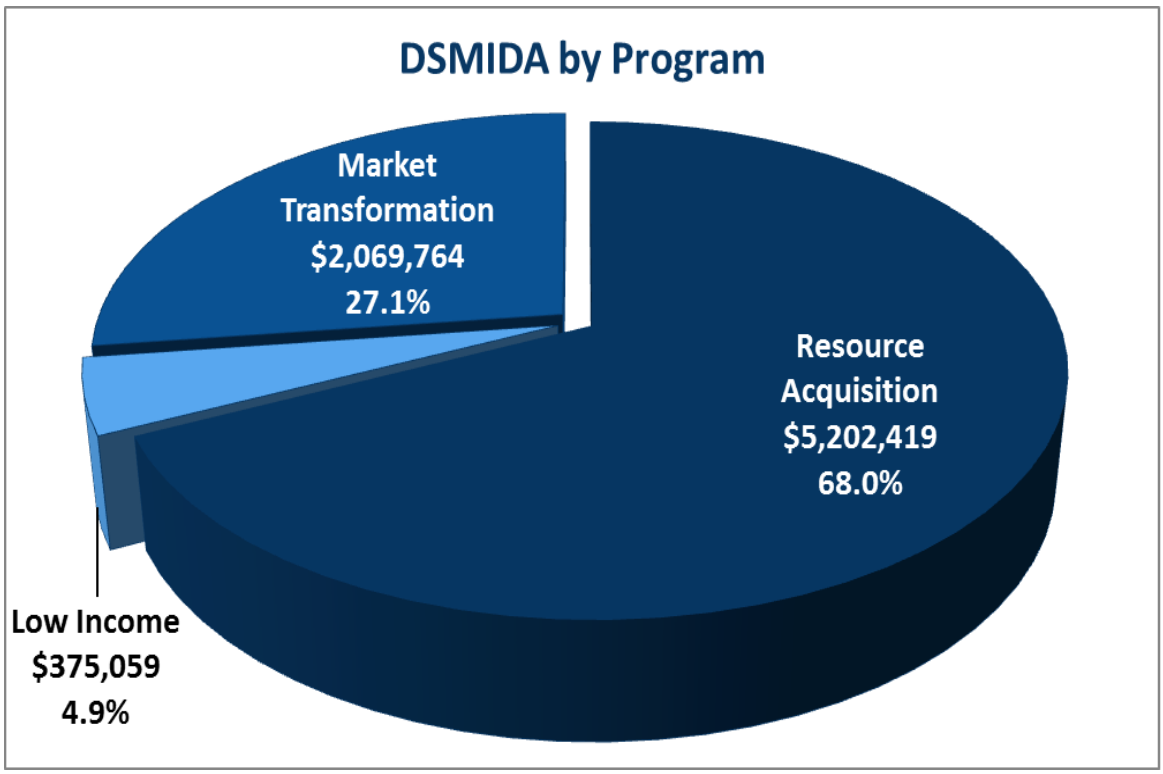
Market Transformation						
Component	Metric	Weight	Targets Lower	Middle	Upper	Actual Result
Home Labelling	*Number of Committed Realtors*	**70%**	N/A	5,000	10,000	**40,040**
	Ratings performed	**30%**	250	500	750	**662**
					Max. DSMIDA	$604,311
					DSMIDA Achieved	**$604,311**

DSMIDA Summary

Table 40. 2014 DSMIDA Summary Statement

Program	DSMIDA $	DSMIDA %
Resource Acquisition	$5,202,419	68.0%
Low Income	$375,059	4.9%
Market Transformation	$2,069,764	27.1%
TOTAL	**$7,647,242**	**100%**

Table 41. 2014 Program Contribution to DSMIDA



9. Demand Side Management Variance Account (DSMVA)

In accordance with the Guidelines, the Demand Side Management Variance Account "should be used to track the variance between actual DSM spending by rate class versus the budgeted amount included in rates by rate class. A natural gas utility may record in the DSMVA in any one year, a variance amount of no more than 15% above its DSM budget for that year."[23] Further, "if spending is less than what was built into rates, ratepayers shall be reimbursed for the full amount. If more is spent than was built into rates, the natural gas utility may be reimbursed up to a maximum of 15% of its DSM budget for the year." [24]

The OEB approved budget for 2014 is $32,158,764. The same amount of $32,158,764 was built into rates. Total spending in relation to 2014, however, is $32,511,266 resulting in a variance of $352,502 over budget, to be recovered from ratepayers. These amounts are summarized in Table 42.

Table 42. 2014 DSMVA

	OEB Approved Budget (Built Into Rates)	2014 Actual Spending	2014 Variance (DSMVA)
Total	**$32,158,764**	**$32,511,266**	**$352,502**

23 *Demand Side Management Guidelines for Natural Gas Utilities* (EB-2008-0346), OEB, June 30, 2011, page 34.
24 Ibid, page 34.

10. Lost Revenue Adjustment Mechanism Statement (LRAM)

The LRAM is a mechanism to adjust for margins the utility loses (gains) if its DSM program is more (less) successful in the period after rates are set than was planned in setting the rates. As outlined in the Guidelines, "the LRAM amount is a retrospective adjustment and may be an amount refundable to or receivable from the utility's customers, depending respectively on whether the actual natural gas savings resulting from the natural gas utility's DSM activities are less than or greater than what was included in the forecast for rate-setting purposes."[25]

Table 43. LRAM Statement

2014 LRAM Calculation

Based on 57,036,910 FE m3 built into rates

Rate Class	Budget Net Partially Effective	Actual Net Partially Effective	Volume Variance	Distribution Margin	LRAM Allocation $	LRAM Allocation %
Rate 110	2,065,678	1,237,361	(828,317)	1.4276	($11,825)	11%
Rate 115	1,314,523	846,042	(468,480)	0.7900	($3,701)	6%
Rate 135	0	51,608	51,608	1.2753	$658	-1%
Rate 145	2,428,288	467,549	(1,960,740)	1.5397	($30,189)	26%
Rate 170	4,942,907	707,329	(4,235,578)	0.4789	($20,282)	57%
Totals	10,751,396	3,309,889	-7,441,507		($65,339)	100%
			Amount to be paid back to Ratepayers		($65,339)	

** Rate 1 and Rate 6 are not included in the LRAM amount for clearance above as these rate classes are covered under the Average Use True-Up Variance Account (AUTUVA)*

25 *Demand Side Management Guidelines for Natural Gas Utilities* (EB-2008-0346), OEB, June 30, 2011, page 33.

11. DSM Rate Allocation and Impact

Table 44 illustrates the allocation to rate classes of the DSM Variance Accounts as prescribed in the Guidelines.[26]

Table 44. Rate Allocation

2014 Rate Allocation				
Rate Class	DSMIDA	LRAM	DSMVA	TOTAL
Rate 1**	$4,476,362	N/A**	$6,968,595	$11,444,957
Rate 6**	$2,647,166	N/A**	-$3,576,246	-$929,080
Rate 9*	$326	$0	-$93	$234
Rate 110	$228,800	-$11,825	-$307,460	-$90,486
Rate 115	$108,728	-$3,701	-$488,902	-$383,875
Rate 125*	$12,230	$0	-$3,488	$8,741
Rate 135	$23,438	$658	-$86,721	-$62,625
Rate 145	$54,091	-$30,189	-$934,532	-$910,629
Rate 170	$91,047	-$20,282	-$1,217,209	-$1,146,445
Rate 200*	$4,240	$0	-$1,209	$3,030
Rate 300*	$815	$0	-$233	$582
Total	$7,647,242	-$65,339	$352,502	$7,934,405

Rates 9, 125, 200 & 300 will not have any LRAM component included in the rate allocation since customers in these rates classes are not eligible for DSM programs. These rate classes will however, be subject to rate allocations for DSMVA and applicable DSMIDA related to the Low Income Program.

** Rate 1 and Rate 6 are not included in the LRAM amount for clearance above as these rate classes are covered under the Average Use True-Up Variance Account (AUTUVA)

Note: Numbers may not add up due to rounding

26 Page 26 of the *Guidelines*, Section 8.3 Budget for Low Income Programs states that: "The Board is of the view that the low-income DSM budget should be funded from all rate classes, to be consistent with the electricity conservation and demand management framework, as well as the LEAP Emergency Financial Assistance program." Allocation for the LEAP fund was outlined in EB-2008-0150 Report of the Board: Low Income Energy Assistance Program on page 11 Section 5.1.1 Funding LEAP.

Table 45 provides the estimated impact of the 2014 Clearance of DSM Variance Accounts on a typical customer's bill in each of the rate classes affected.

Table 45. Estimated Impact of DSM Clearance on a Typical Customer

Rate Class	Annual Volume for Typical Customer (m^3)	Annual Bill for Typical Customer[1] ($)	DSM Amount for Recovery[2] ($)	Estimated % of Annual Bill
Rate 1 - Heating & Water Heating	3,064	$871	$7	0.7%
Rate 6 - Commercial, Heating & Other Uses	22,606	$6,543	($4)	-0.1%
Rate 9 - Container Service[3,5]			$233	0.0%
Rate 100 - Industrial, small size	339,188	$81,601	$0	0.0%
Rate 110 - Industrial, small size, 50% Load Factor	598,568	$131,614	($103)	-0.1%
Rate 110 - Industrial, avg. size, 75% Load Factor	9,976,120	$2,032,402	($1,708)	-0.1%
Rate 115 - Industrial, small size, 80% Load Factor	4,471,609	$895,944	($3,182)	-0.4%
Rate 125 - Extra Large Firm Distribution[4,5]			$1,748	
Rate 135 - Industrial, Seasonal firm	598,567	$115,351	($598)	-0.5%
Rate 145 - Commercial, avg. size	598,568	$125,734	($3,848)	-3.2%
Rate 170 - Industrial, avg. size, 75% LF	9,976,120	$1,814,358	($25,145)	-1.4%
Rate 200 - Wholesale Service[3,5]			$3,031	
Rate 300 - Firm or Interruptible Distribution[4,5]			$291	

1. Annual bills based on October 1, 2015 rates.
2. DSM amounts for Recovery do not include interest amounts that will apply at the time of clearing.
3. Information is for the total amount for DSM recovery
4. DSM amounts for recovery for Rate 125 and Rate 300 are for average customers in each rate class
5. Rates 9, 125, 200, & 300 do not have any LRAM Allocations since customers are not eligible for DSM programs

12. Status Update –2013 Auditor and Audit Committee Recommendations

The following is an overview of the recommendations made by the Auditor in the 2013 DSM Audit.

Also summarized are the responses to each recommendation put forward by Enbridge and in turn, the 2013 Audit Committee (Intervenor Members) respectively. Finally, the current status pertaining to each recommendation where applicable is provided[27].

1. Recommendation:

Select an independent third-party engineering firm to review the ETools software for consistency with acceptable engineering practice. The CPSV TEs are directed to perform independent analyses to confirm or revise the saving estimates calculated by Enbridge or engineering contractors. In many cases, these savings estimates are generated by Enbridge's proprietary ETools analysis software. Instead of performing independent savings estimates each year, Optimal recommends that a third-party engineering contractor--one with significant experience with Excel and the VBA-based tools used to develop ETools—be retained to perform a thorough audit of all of the ETools software modules. Once the validity of the methodologies embedded in the ETools software is independently verified, the CPSV TE review of projects employing ETools can focus on determining:

- Whether the methodology used by ETools is appropriate for the specific project.
- Whether the inputs used in the ETools calculations are reasonable. As ETools is typically updated on a semi-annual basis, an independent annual review of any modifications to the ETools software should be incorporated in the annual audit process.

27 Unless otherwise indicated, the Audit Committee (AC) refers to the entire Audit Committee - which includes three intervenor members and one utility representative - as outlined in the *Joint Terms of Reference for Stakeholder Engagement*, Exhibit B, Tab 2, Schedule 9, Appendix A, Page 13 of 21.

Enbridge Response:
Enbridge agrees with selecting an independent third-party firm to review the Commercial boiler seasonal efficiency module of the Etools software for consistency with acceptable engineering practice, as soon as feasible. Enbridge's agreement is contingent on the TEC's endorsement to update the CPSV TOR to reflect that the CPSV firms can utilize the utilities' software for project reviews. Enbridge's agreement is also based on the AC's support that, barring a change in the market, in industry understanding of savings estimation, in the OEB's DSM guidelines or other factors that might affect commercial boiler savings estimates, such a change in the CPSV TOR should remain in place until at least the mid-term review of the next multi-year plan.

AC (Intervenor Members) Response:
The AC (Intervenors Members) endorses this response.

Status Update:
Enbridge has engaged an independent third party contractor to review the boiler component of ETools. This work will verify through inspection the ETools algorithms to ensure that there are no mathematical errors and/or Excel spreadsheet computational errors (e.g., errors with macros, links, lookups), and testing to ensure that the cascading effect of various algorithms are operating correctly. Secondly, through the TEC, Enbridge is proceeding with a joint review of commercial boiler seasonal efficiency through an RFP for a third party independent study as well as an RFP to review boiler baseline. Upon completion of these reviews, the ETools boiler module will be independently reviewed to ensure all updated findings are properly reflected in determining savings estimates.

2. Recommendation:
Develop a standardized report template for use by the CPSV TEs. Providing a report template would assist the CPSV TEs in developing more consistent reports that provide all of the information required to validate their review. The template should stress the importance of including all relevant project assumptions, inputs, and calculation methodologies. The inclusion of all relevant project information in a consistent format and level of detail will allow the Auditor to perform their task without having to

request the full project file from Enbridge. Auditor review of Enbridge project files for clarification or to obtain missing data is a redundant and inefficient effort. The template will also allow the Auditor to easily locate data and information within each CPSV TE project write-up leading to a more streamlined CPSV audit review process.

Enbridge Response:
This Audit Recommendation will be directed to the TEC, as it potentially impacts the CPSV TOR. The 2013 CPSV reports, which underwent substantial revision in response to the Auditor's feedback, could be a starting point for discussion.

AC (Intervenor Members) Response:
The AC (Intervenor Members) endorses this response.

Status Update:
The auditor provided a proposed template draft. Using this draft as a starting point, Enbridge worked with the TEC to develop a standardized CPSV coversheet template. The template was endorsed by the TEC for use in the 2014 CPSV review process and was included with the CPSV Terms of Reference.

3. Recommendation:
Request that the CPSV TEs estimate the remaining useful life of the existing equipment in cases where the energy efficiency measure is an “add-on” to existing equipment for both the commercial and industrial sectors. For example, if the measure is an efficiency control on an existing boiler, the CPSV TE should determine if the existing boiler will be in place for the entire measure life of the efficiency control. If not, then a baseline (or measure life) adjustment should be made to account for the existing boiler being replaced with a more efficient boiler prior to the end of the measure life. Alternatively, develop one or more deemed measure lives for these types of projects, which are not currently included in the OEB measure life tables.

Enbridge Response:
This Audit Recommendation will be directed to the TEC, as it potentially impacts the CPSV TOR.

AC (Intervenor Members) Response:
The AC (Intervenor Members) endorse this response.

Status Update:
Language was introduced into the updated CPSV Terms of Reference to address this recommendation. The CPSV Terms of Reference was reviewed and endorsed by the TEC.

4. Recommendation:
Document the custom project realization rate calculation methodology. The 2012 Audit provided guidance on the correct process to calculate realization rates, but there is no formal stand-alone document that lists all the agreed upon steps. The method employed by Enbridge's realization rate contractor for 2013 contained process errors that Optimal needed to correct as part of its audit review.

Enbridge Response:
This Audit Recommendation will be directed to the TEC as it potentially impacts the current, TEC endorsed, sampling methodology.

AC (Intervenor Members) Response:
The AC (Intervenor Members) endorses this response.

Status Update:
The TEC reviewed the Sampling Methodology and updated language to make clear the realization rate methodology. The Sampling Methodology reference document was revised accordingly by Navigant Consulting (referenced in Appendix I). The revised document was endorsed by the TEC in November 2014.

5. Recommendation:
Undertake a baseline boiler study. For replacement projects, the base case is a code compliant boiler with 80.5% thermal efficiency. In many other

jurisdictions, higher efficiency boilers are often code or standard practice. Standard practice might also include additional boiler control efficiency measures. A boiler baseline study was completed three years ago. However, given the importance of this measure and the reality that these markets change quickly, it is important to update this work. An updated study will determine if the standard practice in Enbridge's service area is actually above code, which would indicate a need for a revised baseline.

Enbridge Response:
This Audit Recommendation will be directed to the TEC for completion in 2015. Further to the Auditor's report, this study will focus on the commercial sector.

AC (Intervenor Members) Response:
The AC (Intervenor Members) endorses this response.

Status Update:
A boiler baseline study is currently underway through the TEC.

6. Recommendation:
Provide clear instructions to the CPSV TEs to focus on evaluation of annual gas savings and measure lives, the inputs used to determine CCM. The sole DSMIDA metric for custom projects is CCM. Given tight timelines and the need to use ratepayer funds efficiently, the CPSV TEs should not spend time reviewing non-gas savings values or measure cost data.

Enbridge Response:
This Audit Recommendation will be directed to the TEC, as it potentially impacts the CPSV TOR.

AC (Intervenor Members) Response:
The AC (Intervenor Members) endorses this response.

Status Update:
Language was introduced into the updated CPSV Terms of Reference to address this recommendation. The CPSV Terms of Reference was reviewed and endorsed by the TEC.

7. Recommendation:

For projects modeled using eQUEST, consider using IPMVP protocols for New Construction projects with adequate calibration of both the baseline and as-built models. In addition, each project file should contain the final model used to support the project savings claim. If necessary, any secondary calculations to overcome shortcomings of the modeling tools should also be saved in the file.

Enbridge Response:

As was the case during discussions and agreement in the 2012 Audit process last year, it is anticipated that the 2014 CCM results for legacy projects (captured under Resource Acquisition) will be minimal, therefore this recommendation would not be an effective use of resources and budget dollars. For additional clarity, with the exception of legacy projects, all 2014 Commercial New Construction projects will be claimed via the Savings by Design Market Transformation offer, which is not based on CCM.

AC (Intervenor Members) Response:

Requiring calibration of simulation models, as required by IMPVP is undoubtedly industry best practice. However, such calibration would require waiting perhaps 18 months after the building was completed before claiming savings (perhaps 6 months to allow for transition to full occupancy and another 12 months of consumption data across all seasons of the year). That is consistent with a recommendation by the 2012 Auditor. If Enbridge was to continue to claim savings from commercial new construction projects in the future, the AC would endorse such recommendations from both Auditors. However, given that (1) any new construction projects on which the Company began work since 2012 are being addressed only through its market transformation program (i.e. no resource acquisition savings claims), (2) there are no more than a few pre-2012 "legacy" projects for which the Company is expected to claim savings in 2014,and (3) savings goals for the 2012-2014 period were set without the expectation that the Company would have to wait 18 months after completion to claim savings from legacy new construction projects, the AC can accept not changing practices for 2014.

8. Recommendation:

Proper IPMVP protocols should be followed to verify project savings. While most projects employ sound measurement and verification methodologies, it was not always clear that CPSV contractors followed proper IPMVP protocols. Access and schedule issues as well as budget limitations may prevent CPSV contractors from performing the level of on-site measurement necessary to comply with IPMVP guidelines. Future CPSV contractors should endeavor to clearly identify which IPMVP option was employed and provide a thorough description of how that option was implemented. For example, if "Option A. Retrofit Isolation: Key Parameter Measurement" is determined to be the best option for a given project, the contractor should clearly establish which parameters are measured, which are estimated, and the methodology used to calculate savings. Presenting the verification results within the framework of IPMVP would lead to more justifiable savings estimates and facilitate review by future Auditors.

Enbridge Response:

This Audit Recommendation will be directed to the TEC, as it potentially impacts the CPSV TOR.

AC (Intervenor Members) Response:

The AC (Intervenor Members) endorses this response.

Status Update:

Language was introduced into the updated CPSV Terms of Reference to address this recommendation. The CPSV Terms of Reference was reviewed and endorsed by the TEC.

9. Recommendation:

Enbridge should develop site-specific destratification factors based on the building site, ceiling height, fan diameter, and speed. For custom industrial destratification fan projects, Enbridge assumes that the contractor/vendor will design and install the project to destratify the entire space. Enbridge then applies a blanket factor of 0.85 to de-rate the destratification savings to be conservative. Developing site-specific destratification would result in a more rigorous savings estimate.

Enbridge Response:
Enbridge will calculate the actual percentage of destratified coverage area for a specific project, based on best available information.

AC (Intervenor Members) Response:
The AC (Intervenor Members) endorses this response.

Run It Right

10. Recommendation:
Establish a free rider rate for the Run It Right program. Currently, there is no OEB approved free rider rate for this program. As part of this audit process, Enbridge proposed a free rider rate. Optimal conducted an informal review of free rider rates for gas retro-commissioning programs in other jurisdictions and recommended adoption of Enbridge's requested rate for purposes of this audit. Enbridge should formally establish a free rider rate that is subsequently filed and approved by the OEB.

Enbridge Response:
This Audit Recommendation will be directed to the TEC, as Union has indicated that they have a similar program. As such, there may be value in developing a free ridership rate for both utilities through the TEC. If it is determined that this is not the case, Enbridge will proceed with establishing its own free ridership rate for the RIR offer.

AC (Intervenor Members) Response:
The AC (Intervenor Members) endorses this response.

Status Update:
The 2014 AC agreed that Enbridge would proceed on its own to undertake work to confirm the free ridership rate for 2014 RIR results. The AC further agreed that a free ridership rate for the RiR offer should be included as part of the Net-to-Gross Study through the TEC.

11. Recommendation:

Survey Run It Right participants. Ideally, Enbridge or its evaluator should survey participants prior to any billing regression analysis. This would ensure better data and avoid noted problems with ex-post adjustments to the sample that resulted from exogenous factors affecting gas usage. The importance of conducting a survey prior to the analysis is that all data is treated equally, and any obvious outliers or other problem data can be removed or adjusted without bias. In addition, this process will allow for removal of any obviously bad or incomplete data. Surveys should accomplish the following:

- Determine whether the participant implemented the measures recommended in the timeframe indicated.
- Determine whether the participant made any significant changes to the facility, its operations, or equipment outside of the Run It Right Program. If changes were made, determine whether changes can be attributed to Run It Right spillover savings, are completely independent of the Program, or were already counted in another Enbridge program.
- Collect basic participant characteristics, including building type, occupancy load, usage, and size.

Based on this information, the analyst can remove or adjust all data in a consistent fashion. For example, if a major piece of equipment was replaced with a more efficient one, it may be appropriate to adjust the ex-post data to subtract the expected additional savings. Further, if building usage or operations have changed significantly, the data can be adjusted if the impacts of these changes can be estimated with relative certainty. In some cases, it may be more appropriate to simply remove a participant from the sample.

Enbridge Response:

Enbridge agrees that completing a survey with a random sample of participants would be more appropriate in order to gain further insight into results. The random sample would be conducted in a manner similar to the CPSV process. A survey of all participants would be cost prohibitive (this is in line with recommendation #13).

AC (Intervenor Members) Response:
The AC (Intervenor Members) endorses this response.

Status Update:
Enbridge discussed this recommendation with the 2014 AC and the Auditor and proceeded to engage a third party consultant to complete a survey of participants included in 2014 results with input from the AC and the Auditor.

12. Recommendation:
Include a “comparison group” of similar customers that did not participate in the Run It Right program. A comparison group of customers that are matched to the participant group (in terms of building type, major end-uses, size, and consumption) should be included in the analysis. Typically this would be done with a “dummy variable” that indicates whether the customer was a participant or not. The biggest benefit of including a comparison group is that it can more explicitly control for weather and other variations over time. Because all sites will have been exposed to the same weather, the analysis inherently controls for weather without the need to identify balance temperature points for each facility. It also avoids introducing uncertainty from determining a building specific relationship between weather and gas usage. This will significantly simplify the analysis and result in a more accurate isolation of weather effects. A comparison group also can adjust for unknown variables that may be important but are difficult to identify and control for. For example, there may be natural growth in existing buildings’ gas usage that would mask some of the true program savings. Comparing participants with similarly situated non-participants would automatically control for any such effects.

Enbridge Response:
Enbridge's proposal for recommendation #11 appropriately addresses the need for increased accuracy and information, without unduly increasing the cost and complexity of the offer.

AC (Intervenor Members) Response:
The AC agrees that the revisions associated with Auditor recommendation #11 are a good next step in the evolution of the evaluation of this program,

and that the addition of a control group is not necessary at this point in time. However, that decision should be revisited in the future as more experience with the program (and its evaluation) is gained, particularly if the program grows substantially in size.

13. Recommendation:

Consider sampling approaches that balance required resources with level of importance. When performing the analysis and incorporating the two previous recommendations, we recognize that this approach may add additional program costs related to surveying participants and using comparison groups. We also understand that Enbridge intends for this program to expand and hopefully have more participants in the future. As a result, it may be appropriate to analyze a sample of participants rather than a full census of participants. This is appropriate, particularly if the number of participants grows significantly. We recommend that the sample of participants first be stratified by size. The largest usage customers will tend to have a disproportionately high impact on overall savings. As a result, we recommend developing size strata and oversampling the largest stratum (depending on range of usage and number of participants, it may make sense to oversample more than one large stratum). Often, the very largest stratum might only have a few participants, who would all be included in the sample. This approach of devoting more resources to the largest projects will enhance the overall precision of the sample without the need to actually increase the numbers of participants sampled. Once the strata cut points are selected, the samples should be drawn in a randomized way (except for any strata where a full census is used). Similarly, the comparison group should align with the same strata and also be randomly selected.

Enbridge Response:

Please refer to the response to recommendation #11.

AC (Intervenor Members) Response:

The AC (Intervenor Members) endorses this response.

Audit Process

14. Recommendation:
Produce an audit guidelines document for the Auditor. Currently, each Auditor establishes its own detailed process to meet the overall requirements stated in the audit RFP. This can lead to inconsistencies over time. A clear, detailed set of guidelines would result in more consistent audit results from year-to-year.

Enbridge Response:
Although this recommendation may result in consistency, it may impact the level of independence that exists for each Audit year, therefore the Auditor should independently establish their own detailed process to meet the overall requirements. To aid in this activity, Enbridge will engage the 2014 AC to ensure that the Auditor is provided with a reasonable level of orientation to the process as a whole.

AC (Intervenor Members) Response:
The AC (Intervenor Members) endorses this response.

Status Update:
The 2014 AC and the Auditor discussed this recommendation and agreed that there was no need to implement this recommendation at this time.

15. Recommendation:
Clarify Audit Committee role. The AC should have a written charter that spells out its decision-making process, purpose, duties, and powers. While the "Union Gas Limited – 2012-2014 Demand Side Management Plan Settlement Agreement on Terms of Reference for Stakeholder Engagement" provides high level guidance on the function and operation of the AC, it would be useful to have a more detailed, stand-alone charter that is provided to the Auditor. This would add clarity to the AC role for the Auditor and generally make for a more efficient audit process.

Enbridge Response:
Enbridge notes that the document the Auditor is referring to is the "Joint Terms of Reference on Stakeholder Engagement for DSM Activities by Enbridge Gas Distribution Inc. and Union Gas Limited". Enbridge will discuss this recommendation with the 2014 AC early in the Audit process.

AC (Intervenor Members) Response:
The AC (Intervenor Members) endorses this response.

Status Update:
The role of the AC was discussed with the Auditor at the audit kick-off meeting on December 8th, 2014.

16. Recommendation:
Award the audit contract earlier in the process. Optimal received its audit contract on March 5, 2014. OEB rules require that the final audit report be submitted by June 30 of each year. Optimal was able to quickly shift its other workloads to allow its audit staff to devote the necessary effort needed to produce rigorous audit results over this short timeframe. For example, in order to provide timely feedback on the CPSV draft Wave 1 reports, Optimal staff had to devote more than a full time effort at the outset of its contract period. Fortunately, Optimal was able to shift other work to accommodate this initial, quick turn-around. Because subsequent Auditors may not be able to adjust so rapidly, issuing the audit contract earlier will better ensure a robust and thorough audit report within the necessary timeframe. This recommendation is not intended to suggest that Optimal did not have sufficient time to produce a high quality and rigorous audit. Optimal did indeed have ample time. Rather, it is meant to address potential challenges that may arise if future audit firms are unable to re-deploy staff resources as readily.

Enbridge Response:
Enbridge agrees that it would be beneficial to have the Auditor's contract awarded earlier. This recommendation will be brought forward to the 2014 AC.

AC (Intervenor Members) Response:
The AC (Intervenor Members) endorses this response.

Status Update:
This recommendation was discussed with the 2014 AC and the Auditor was retained on November 12th, 2014.

17. Recommendation:
Seek written comments and feedback from the Audit Committee as one unified document as opposed to individual documents from each AC member. Currently, the Auditor has to respond to and sort through multiple documents. Having a single document from the AC for each set of comments would simplify the Auditor's work flow.

Enbridge Response:
Enbridge will support the decision made by the 2013 AC on this issue.

AC (Intervenor Members) Response:
The AC appreciates that compliance with the Auditor's recommendation would make life a little simpler for the Auditor. However, the most that we could say is that the AC should do this whenever possible, with the understanding that it often won't be. Given the very tight timelines for review of draft materials, there often just isn't enough time to get everyone together, explain and discuss each comment, debate conflicting comments, document a consolidated set of comments, send it to everyone so that they agree the consolidated document represents everyone's perspective accurately and then send to the Auditor.

Other Recommendations

18. Recommendation:
Produce a single document that pulls in all of the current year final OEB approved metrics, DSMIDA amounts and calculation procedures with appropriate citations back to the OEB regulatory filings. This document would be provided to the Auditor at the start of their work plan. Currently,

all of this data is buried in hundreds of pages of OEB regulatory filings and exhibits. For someone not familiar with these proceedings, it is time consuming and not efficient to dig through all of these documents. In addition, it is sometimes difficult to determine the final approved values given the various revisions and updates.

Enbridge Response:
Enbridge will work with the 2014 AC and Auditor to determine what is useful and appropriate.

AC (Intervenor Members) Response:
The AC (Intervenor Members) endorses this response.

Status Update:
At the audit kick-off meeting on December 8th, 2014, it was agreed that this audit recommendation need not be implemented.

19. Recommendation:
Provide enhanced quality control procedures for the data provided to the CPSV TE and the CPSV sampling and realization rate firm(s). In its audit review, Optimal identified minor data entry errors in data sets provided by Enbridge to its sampling and realization rate contractor and the CPSV TEs. Project level savings data were not always consistent between the realization rate contractor and the CPSV TEs. We suspect that as Enbridge records and updates the data in its DSM tracking system, it is not also ensuring that all the various firms performing audit and verification tasks receive updated data sets.

Enbridge Response:
Enbridge will review current processes to ensure accuracy of data not only internally, but with external contractors. Subsequent process changes will be shared with the 2014 AC.

AC (Intervenor Members) Response:
The AC (Intervenor Members) endorses this response.

13. Other Evaluation Research

As outlined in the Joint Terms of Reference for Stakeholder Engagement on DSM Activities, "the goal of the TEC is to establish DSM technical and evaluation standards for natural gas utilities in Ontario." [28] Further, the Joint Terms of Reference outlines the TEC's work as follows:

- The TEC will make recommendations to the OEB on the annual Technical Reference Manual (TRM) Update.
- The TEC has accountability to:
  - produce and maintain a prioritized annual work list (by consensus);
  - establish evaluation priorities and specify future evaluation studies to be undertaken – execution of all work defined by the TEC is subject to the utilities' resource constraints (such as funding, personnel resources, time limitations); and
  - review and reach consensus on the design and implementation of evaluation studies to be carried out including determination of whether the work is done by utility staff, the TEC technical consultant or third party firms.

In 2014, the TEC pursued evaluation priorities set out in the prior year, focusing on responding to recommendations made by the utilities' respective auditors and two evaluation projects – a Custom Net-to-Gross (Free Ridership and Participant Spillover) Research Study and a Technical Reference Manual (TRM).

Technical Reference Manual

Throughout 2014, the TEC continued to work with a third-party consultant (ERS Inc.) to update existing measure assumptions and create substantiation documents for new technologies using best available information. The TRM is intended to provide an up-to-date reference for

28 *Joint Terms of Reference on Stakeholder Engagement for DSM Activities by Enbridge Gas Distribution and Union Gas Limited*, November 4, 2011, page 9.

both utilities and the public, providing transparency and clarity regarding measure assumptions.

Net-to-Gross Study

In February of 2014, DNV GL was selected by consensus by the TEC to develop and implement a survey of a sample group of Enbridge and Union Gas commercial and industrial customers in order to assist the TEC in developing Net-to-Gross factors to be applied to each utility's Custom Commercial and Industrial offers.

The TEC worked with DNV GL to identify and resolve a number of methodological questions relating to the survey process and scoring of responses. The project was temporarily postponed in mid-2014 due to unresolved discussions involving the type of Net-to-Gross ratio measured by the study. Additional clarity was not provided as anticipated in the draft OEB guidelines released in September 2014, and the project remained on hold for the remainder of 2014 pending the final DSM Framework and Guidelines.

Appendix A: CPSV Terms of Reference

The following pages include the CPSV Terms of Reference and the CPSV Project Cover Sheet Template. These documents were reviewed and endorsed by the TEC in November 2014 to outline the scope of work for the CPSV engineering firms in their review of the 2014 program year custom projects.

2014 Custom Project Savings Verification
Terms of Reference

A. Background

Utility Specific

B. Requirements / Scope of Work

This verification study will consist of a detailed estimate of gas savings, for comparison to the utility's estimates, for a representative sample of custom projects in 2014.

a) Sampling

A random sample of custom projects will be selected by an independent third party (other than the proponent selected). The 2014 CPSV will be conducted in two parts. Wave 1 will be selected from custom projects tracked during Q1-Q3 of 2014. These projects will be reviewed immediately. Wave 2 will be selected from custom projects completed during Q1-Q4 of 2014. These projects will be reviewed during Q1 of 2015.

b) Environment Health & Safety

Utility Specific

c) Assessment Methodology

The consultant will conduct on-site visits that will involve:

1. **An interview with the customer to validate installation of equipment and confirm operating conditions**. The consultant should provide to the customer the list of the data that they would like to see as well as an overview of the types of questions that will be asked of the customer prior to the interview. In addition, this information will also be provided to the Audit Committee, the Auditor, and the utility.

2. **Direct measurement of key site, equipment and/or operating characteristics whenever such measurements could be expected to appreciably improve the accuracy of the savings verification and does not overly burden the customer**. Direct measurement could involve both instantaneous measurement and short duration measurement that might require revisiting the site to collect data and devices left on-site. In cases in which the consultant determines that either adequate onsite measurement has already been conducted, or there would be an undue burden on the customer, or the cost of additional onsite measurement would be disproportionately high relative to the benefits, the consultant could choose not to conduct the measurement but is expected to provide the rationale for not doing so.

The utility's 2014 DSM incentive is based on the achievement of a targeted level of cumulative gas savings (CCM). CCM is calculated by multiplying the net annual gas savings of a measure and its measure life (the consultant is not tasked with addressing free ridership assumptions). The consultant should focus on gas savings, but provide an assessment of the reasonableness of non-gas savings estimates found to be noteworthy (water savings, electric savings, maintenance savings, space savings, time savings, etc.).

There may be cases in which the consultant believes that no increase in the accuracy/confidence of its savings estimates would reasonably be expected from a site visit. In such cases (which are

expected to be rare), the consultant may complete the assessment without a site visit provided that it clearly documents the rationale for not having a site visit.

In addition to conducting site visits, the consultant will interview vendors whenever useful for informing the savings verification process.

Using information collected during site-visits and interviews as well as its own expertise, the consultant will develop its own independent estimate of the savings for the project. The independent estimate should be based on the consultant's own tools, calculations and assumptions. Note that the utility's savings goals are expressed as total lifetime savings. Thus, the consultant's work must address both the reasonableness of estimates of annual savings and the reasonableness of estimates of the life of those savings. The consultant's basis for assumptions made in developing the independent estimates of lifetime savings (both first year savings and measure life) must be, to the extent practical, documented with appropriate references and/or other forms of substantiation. If the consultant cannot identify a reference, the consultant must provide a rationale for their assumption.

During the review, the consultant will work with the respective utility to address any issues requiring clarification or additional documentation. The consultant will also be expected to work with an independent auditor that will be hired by the utility's 2014 "Audit Committee", a body comprised of several stakeholders to assess the reasonableness of the Company's 2014 savings claim (looking at all savings, of which custom project savings are just a part). The auditor will be charged, among other things, with providing input to and ultimately passing judgment on the reasonableness of the consultant's work and conclusions.

The consultant is encouraged to propose, either in their initial proposal, or during the review process, alternative or additional methods of verification of results that are expected to increase the accuracy level or confidence of the review results. Any such proposal should include an analysis of the additional benefits versus the incremental costs and any impact on both the customer and project schedule.

C. Deliverables

The project deliverables include the following:

- A Draft Report: In addition to the points outlined below, the Draft Report will also note the date of the interview and the names of individual(s) interviewed.
- A report showing the findings for each custom project review undertaken. A coversheet template will be provided by the Utility to ensure consistency and the inclusion of all relevant project assumptions, inputs, and calculation methodologies for each project addressed in the report. The consultant should also indicate which IPMVP Option it followed in its review of each CPSV project. Where the consultant deviates from the Option it selected, it should provide an explanation.
- The review of savings will include the following items in the report for each project:
  - Description of the project
  - Date of installation of equipment;
  - Type of building, building segment or process;
  - Description of the base case scenario used in utility's savings estimate; the reasonableness of the designation of advancement where applicable (i.e. did the utility's program cause old inefficient equipment to be replaced before it otherwise would have been) or replacement (i.e. should savings be based on the efficiency of new standard equipment because the equipment would have been replaced even in the absence of the utility's program) of the claimed base case used in the savings calculation – both for annual savings and measure life;

- Discussion of any base case adjustments applied by the consultant, if applicable;
- Description of on-site data collection or measurement that was used in developing savings estimates;
- Description of other aspects of the approach used by the consultant to estimate savings for the project, including references;
- Discussion of the difference between the utility's savings estimate and the consultant's estimate, including a discussion of the relative merits of the methodologies used by both the utility and the consultant and differences in key assumptions used by each;
- Regarding measure life, commentary on the reasonableness of the measure life applied to the specific project. Also provide commentary on the reasonableness of the remaining useful life of the existing equipment in cases where the energy efficiency measure is an "add-on" to the existing equipment. Where appropriate, comment on future changes to the OEB filed measure lives for custom projects. Where the project has multiple measures, the measure life should be a savings weighted average of the lives of the measures;
- Discussion of the reasonableness of the results (i.e. gas m^3/yr.);
- Where proprietary modeling software is used, the consultant must identify the model and provide support to demonstrate its use as an appropriate and accurate tool for this application. When possible, the consultant should make available to the utility and the auditor for review, the underlying algorithms for any proprietary models used by the consultant to validate the savings calculation. When not possible, the consultant should supply model inputs and assumptions, so that if desired by others, they can compare the proprietary model results to other models or approaches; and
- Complete documentation of the reviewer's calculations.

The report will also include:

- Any additional data or information collected through the verification process;
- Report on any discrepancies between the equipment as described in the utility's savings estimates and the equipment as installed;
- Discussion of changes in the size or use of the building or process that alter the baseline model; and the assumptions that were made to account for these changes;
- Total claimed and evaluated lifetime gas savings;
- Recommendations on steps which could be taken to provide higher level of accuracy/confidence for future reviews;
- Recommendations on what could have been done earlier in the process to improve the confidence and accuracy of verification results;
- To the extent that any measurements were taken on-site, list what was actually measured. (The raw data will be made available to the Auditor, Audit Committee and the utility. Any raw data that is commercially sensitive will be identified as having been used but will be kept confidential and not included in the report.); and
- Identify areas of greatest confidence and areas with the greatest level of uncertainty.

The report will also include a section recommending any refinements for future savings calculations for custom projects.

For privacy reasons, the names and addresses of the customers and any specific data or information indicating the type of industry, which could allow the reader to infer the identity of customer, must not be published in any of the reports. Therefore, the consultant will be required to provide their report with that information included, for internal use, and with that information redacted for public use.

The consultant will be involved in discussions with an Auditor regarding the report during their investigations and after the release of their final report.

D. Schedule

Deadlines for deliverables will be strictly adhered to. The utility may impose penalties for failure to meet deadlines, up to 10% of the total cost of the project.

E. Proposal Requirements

Utility Specific

F. Proposal Deadline

Utility Specific

G. **Project Contact**

Utility Specific

2014 Custom Project Savings Verification Coversheet Template

Date:
Wave:
Utility Project Number:

#	Required Information	Value to be entered
Project Basics		
1	Sector	text
2	Type of building, building segment or process	text
3	Efficiency Measure(s) Description	text
4	Date Measure(s) Operational	Date, text
5	Site Visit	yes/no + text
6	Justification of why site visit not required	text
7	Advancement Project?	yes/no
8	Agreement with Advancement Designation?	text
Baseline		
9	Utility Claimed Base Case	text
10	Agreement with Base Case	yes/no
11	Where item 10 is 'no': CPSV Recommended Base Case	text
Annual Savings Estimate		
12	Utility Claimed Gross Natural Gas Savings (for each measure)	m^3
13	Agreement with Utility Claimed Gross Natural Gas Savings (for each measure)	yes/no
14	Where item 13 is 'no': CPSV Recommended Gross Natural Gas Savings (for each measure)	m^3
15	Utility Claimed Gross Electricity Savings	kWh
16	Utility Claimed Gross Water Savings	L
Measure Life		
17	CPSV Recommended Measure Life (for each measure)	years
18	Measure Life as per OEB Measure Life Guide	years
19	Measure Life Conforms with filed OEB Measure Life Guide?	yes/no
20	Justification of CPSV Firm's alternate measure life being used	text
Results		
21	Proprietary modelling software	yes/no + text
22	Were any measures add-ons?	yes/no
23	Where item 22 applies, provide commentary of reasonableness of remaining useful life.	text
24	% Difference Between CPSV Independently Calculated Gross Natural Gas Savings vs. Utility Gross Natural Gas Savings	%
25	CPSV Firm Independently Calculated Annual Gross Natural Gas Savings	m^3
26	CPSV Firm Final Recommended Gross Cumulative Cubic Meters (CCM)	m^3
27	CPSV Justification for Final Recommendation	text
28	CPSV Firm IPMVP option identified	yes/no + text
29	CPSV Firm Final Assessed Electricity Savings (if noteworthy)	kWh
30	CPSV Firm Final Assessed Water Savings (if noteworthy)	L

Appendix B: Commercial / Low Income Custom Project Savings Verification Study (CPSV) Summary

As part of its annual evaluation and DSM audit process, a third-party firm is selected to undertake engineering reviews of a random sample of custom projects in each of the Commercial and Industrial sectors.

In consultation with the 2014 Audit Committee, in November 2014, EGD retained MMM Group Limited (MMM) to conduct the engineering review (Custom Project Savings Verification Study (CPSV)) [29] of the savings claim for the 2014 Commercial custom projects.

Purpose of the Study

The purpose of the CPSV is to provide an independent opinion of the reasonableness of the energy savings claimed by the Commercial sector and Low Income Multi-Residential sector custom projects in 2014 through a review of a statistically representative sample of projects.

Methodology

Using a sampling methodology developed for Enbridge and Union Gas by Navigant Consulting in 2012, revised in 2014 and endorsed by the TEC (attached as Appendix I), Ipsos Loyalty was contracted as an independent third party to randomly select a representative sample of Commercial custom and Low Income Multi-Residential custom projects claimed in 2014. In 2014, there were 567 Commercial custom and Low Income Multi-Residential custom projects completed, of which 27 were randomly selected by Ipsos Loyalty for the CPSV.

A detailed Terms of Reference for the CPSV was updated and endorsed by the TEC and provided to the CPSV consultant at the outset of the review.

29 The Commercial CPSV includes both the Commercial custom and the Low Income Multi-Residential custom projects.

Specific details regarding the scope of work and deliverables associated with the study are outlined in the CPSV Terms of Reference (included in Appendix A).

Results of the engineering review are shown in the next table, with the claimed and revised CCM savings as recommended by MMM.

2014 Commercial Custom Project Verification Results

Table 46. Commercial CPSV Result

2014 Commercial Engineering Review Results	Enbridge Claim	CPSV Recommendation	% Difference
Total CCM Savings	74,412,932	65,185,597	-12.4%

Appendix C. Industrial Custom Project Savings Verification Study (CPSV) Summary

As part of its annual evaluation and DSM audit process, a third-party firm is selected to undertake engineering reviews of a random sample of custom projects in each of the Commercial and Industrial sectors.

In consultation with the 2014 Audit Committee, in November 2014, EGD retained Cole Engineering (Cole) to conduct the engineering review (Custom Project Savings Verification Study (CPSV)) of the savings claim for the 2014 Industrial custom projects.

Purpose of the Study

The purpose of the CPSV is to provide an independent opinion of the reasonableness of the energy savings claimed by the Industrial sector custom projects in 2014, through a review of a statistically representative sample of projects.

Methodology

Using a sampling methodology developed for Enbridge and Union Gas by Navigant Consulting in 2012, revised in 2014 and endorsed by the TEC (attached as Appendix I), Ipsos Loyalty was contracted as an independent third party to randomly select a representative sample of Industrial custom projects claimed in 2014. In 2014, there were 128 Industrial custom projects completed, of which 19 were randomly selected by Ipsos Loyalty for the CPSV.

A detailed Terms of Reference for the CPSV was updated and endorsed by the TEC and provided to the CPSV consultant at the outset of the review. Specific details regarding the scope of work and deliverables associated with the study are outlined in the CPSV Terms of Reference (included in Appendix A).

Results of the engineering review are summarized below, with the Enbridge claimed and CPSV revised CCM as recommended by Cole Engineering.

2014 Industrial Custom Project Verification Results

Table 47. Industrial CPSV Result

2014 Industrial Engineering Review Results	Enbridge Claim	CPSV Recommendation	% Difference
Total CCM Savings	8,279,071	9,001,386	+8.7%

Appendix D. CPSV Realization Rates

The Custom Project Savings Verification ("CPSV") process ultimately facilitates the determination of project and portfolio specific realization rates. The realization rate is the ratio that compares the CPSV firm recommended savings to the savings originally claimed by Enbridge.

The realization rate extrapolates verified savings from a sample of projects representative of the project portfolio and applies this calculation to the underlying project portfolio. More specifically, realization rates are calculated for each stratum sample, and a weighted realization rate is determined.

The methodology for determining the random sample and calculating realization rates was established by Navigant Consulting in 2012, revised in 2014 and endorsed by the TEC (see Appendix I). This approach ensures the sample of projects to be verified is statistically representative of the custom project population for each of the Commercial/Low Income (Multi-Residential) and Industrial custom project portfolios.

As detailed below, two separate realization rates were calculated by the Auditor (Optimal Energy, Inc.) for cumulative gas savings results.

Commercial/Low Income CPSV

Ipsos Loyalty was retained to select a statistically relevant set of sample projects, following the prescribed methodology, representative of Enbridge's 2014 Commercial custom & Low Income Multi-Residential custom projects to be reviewed in the Custom Project Savings Verification (CPSV).

For the purposes of the 2014 Commercial/Low Income CPSV, 27 projects were independently selected for verification.

The CCM values recommended by MMM in their Final CPSV Report were utilized to calculate a Realization Rate. This calculation was completed by the 2014 auditor, Optimal Energy, Inc. This adjustment factor was applied to

all 2014 Commercial custom and Low Income Multi-Residential custom project results.

The Realization Rate for the 2014 Commercial/Low income Multi-Residential custom projects is 80.8%. based on the CPSV firm recommended adjustments.

The CCM values recommended by MMM in their Final CPSV Report were reviewed by the auditor through the audit process and final auditor recommended values were then utilized to determine the audit adjusted Realization Rate. This calculation was completed by the 2014 auditor, Optimal Energy, Inc.

The final post-audit Realization Rate for the Commercial/Low income Multi-Residential custom projects is 83.7%.

Industrial CPSV

Ipsos Loyalty was retained to select a statistically relevant set of sample projects, following the prescribed methodology, representative of Enbridge's 2014 Industrial custom projects to be reviewed in the Custom Project Savings Verification (CPSV).

For the purposes of the 2014 Industrial CPSV, 19 projects were independently selected for verification.

The CCM values recommended by Cole Engineering in their Final CPSV Report were utilized to calculate a Realization Rate. This calculation was completed by the 2014 auditor, Optimal Energy, Inc. This adjustment factor was then applied to all 2014 Industrial custom project results.

The Realization Rate for the 2014 Industrial custom projects is 103.3% based on the CPSV firm recommended adjustments..

The CCM values recommended by Genivar in their Final CPSV Report were reviewed by the auditor through the audit process and final auditor

recommended values were then utilized to determine the audit adjusted Realization Rate. This calculation was completed by the 2014 auditor, Optimal Energy, Inc.

The final post-audit Realization Rate for the Industrial custom projects is 103.5%.

Appendix E. Breakdown of 2014 Results

This appendix provides additional detail regarding the 2014 DSM results. Separate tables are presented for prescriptive and custom technologies.

The following three tables summarize results as follows:

- by technology for prescriptive offers
- summarized by type of custom project
- custom projects by sub-sector.

These tables are presented for illustrative purposes only.

Table 48. Overview by Prescriptive Technology

Summary Overview by Prescriptive Technology	Net Annual Gas Savings (m3)	Net Cumulative Cubic Metres (CCM)	Total Incentive Amount $	Net Gas Saved per Incentive $ spent (m3)	Total Net Incremental Costs	Net Gas Saved per Incremental $ spent (m3)
Commercial						
Air Curtains	125,999	1,889,978	$26,200	4.81	$99,608	1.26
Boiler - Hydronic Condensing	62,300	1,557,501	$11,200	5.56	$90,960	0.68
Boiler - Hydronic High Efficiency	1,279,960	18,064,040	$98,450	13.00	$555,541	2.30
Condensing Make Up Air Unit	62,749	941,241	$10,365	6.05	$27,320	2.30
Demand Control Kitchen Vent (DCKV)	670,528	10,057,921	$134,500	4.99	$893,000	0.75
Demand Control Vent (DCV)	180,262	2,703,923	$19,407	9.29	$32,918	5.48
Energy Recovery Ventilators (ERV)	299,378	4,191,296	$33,831	8.85	$364,399	0.82
Energy Star Convection Ovens	2,076	24,912	$300	6.92	$2,100	0.99
Energy Star Dishwasher	430,903	6,524,358	$44,900	9.60	$107,036	4.03
Energy Star Fryer	203,878	2,446,541	$17,800	11.45	$493,044	0.41
Energy Star Steam Cooker	7,111	85,334	$100	71.11	$828	8.59
Heat Recovery Ventilator (HRV)	11,564	161,901	$1,434	8.06	$18,451	0.63
Infrared Heaters	781,998	15,639,957	$70,800	11.05	$587,671	1.33
Ozone Laundry	376,236	5,643,538	$66,859	5.63	$411,240	0.91
Showerheads	913,581	9,135,810	$162,087	5.64	$195,863	4.66
Commercial Total	**5,408,523**	**79,068,251**	**$698,233**	**7.75**	**$3,879,977**	**1.39**
Industrial						
Air Curtains	371,708	5,575,626	$63,500	5.85	$222,957	1.67
Infrared Heaters	101,132	2,022,636	$8,400	12.04	$83,873	1.21
Industrial Total	**472,840**	**7,598,262**	**$71,900**	**6.58**	**$306,831**	**1.54**
Low Income						
Boiler - Hydronic Condensing	3,496	87,400	$1,000	3.50	$4,500	0.78
Boiler - Hydronic High Efficiency	53,506	1,337,650	$10,000	5.35	$23,450	2.28
Low Income Showerheads	183,838	1,838,385	$0	0.00	$37,975	4.84
Low Income TAPS	28,391	460,293	$0	0.00	$62,802	0.45
Weatherization	1,008,528	25,213,188	$4,494,530	0.22	$2,954,408	0.34
Low Income Total	**1,277,759**	**28,936,917**	**$4,505,530**	**0.28**	**$3,083,135**	**0.41**
Grand Total	**7,159,123**	**115,603,430**	**$5,275,663**	**1.36**	**$7,269,942**	**0.98**

Table 49. Overview by Custom Technology

Summary Overview by Custom Technology	Net Annual Gas Savings (m3)	Net Cumulative Cubic Metres (CCM)	Total Incentive Amount $	Net Gas Saved per Incentive $ spent (m3)	Total Net Incremental Costs	Net Gas Saved per Incremental $ spent (m3)
Commercial						
20 Year Space	328,588	6,571,750	$44,611	7.37	$2,215,286	0.15
5 Year Space	44,570	222,850	$5,923	7.53	$23,544	1.89
Air Curtain	123,107	1,846,599	$17,399	7.08	$66,475	1.85
Air Handling Unit	28,957	434,357	$7,506	3.86	$2,259	12.82
Boiler - Hydronic Condensing	2,882,421	71,632,301	$685,940	4.20	$2,885,112	1.00
Boiler - Hydronic High Efficiency	4,899,115	119,864,650	$791,595	6.19	$7,505,274	0.65
Boiler - Steam	55,193	1,379,816	$7,494	7.36	$224,177	0.25
Building Envelope	49,334	1,233,351	$6,698	7.37	$324,433	0.15
Controls	4,556,468	68,347,026	$634,395	7.18	$5,221,898	0.87
DCV 15 yr	310,291	4,654,371	$42,127	7.37	$300,626	1.03
Dehumidification	35,799	536,985	$4,860	7.37	$69,960	0.51
Destratification	798,144	11,972,157	$181,362	4.40	$785,647	1.02
Drain Water Heat Recovery	5,924	148,104	$804	7.37	$6,325	0.94
Heat Recovery/Economizer	279,988	4,199,817	$38,990	7.18	$554,266	0.51
High Extraction Washer	59,081	590,810	$8,610	6.86	$212,634	0.28
Insulation/Caulking/Sealing	134,473	2,017,094	$18,477	7.28	$93,310	1.44
Operational Improvements	693,551	3,467,754	$89,820	7.72	$300,467	2.31
Pipe Insulation	11,390	170,855	$1,682	6.77	$9,804	1.16
Re-Commissioning	166,659	833,296	$22,627	7.37	$48,664	3.42
Reflective Panel	87,843	1,317,642	$14,289	6.15	$108,575	0.81
Roof Top Unit	8,499	127,487	$1,154	7.36	$19,888	0.43
Steam Condensate Recovery	28,450	426,755	$3,862	7.37	$34,685	0.82
Steam Pipe Insulation	43,099	646,486	$6,103	7.06	$70,048	0.62
Steam Trap	658,358	3,291,790	$53,261	12.36	$107,865	6.10
Tank Less/Instantaneous	18,778	338,001	$2,549	7.37	$21,816	0.86
VFD	63,328	949,920	$8,988	7.05	$368,265	0.17
Commercial Total	**16,371,408**	**307,222,026**	**$2,701,126**	**6.06**	**$21,581,305**	**0.76**
Industrial						
10 Year Industrial	1,098,718	10,987,182	$85,520	12.85	$88,983	12.35
5 Year Industrial	482,979	2,414,893	$2,801	172.41	$2,801	172.41
Air Handling Unit	8,499	127,484	$3,285	2.59	$5,596	1.52
Boiler - Hydronic Condensing	103,936	2,598,399	$23,803	4.37	$185,406	0.56
Boiler - Steam	96,814	2,420,360	$24,354	3.98	$249,164	0.39
Boiler - Watertube	30,472	457,079	$10,444	2.92	$26,750	1.14
Building Envelope	498,185	12,454,634	$119,239	4.18	$233,079	2.14
Condensate Recovery	140,939	2,114,078	$21,117	6.67	$27,575	5.11
Condensing Economizer	308,628	4,629,415	$48,845	6.32	$142,482	2.17
Controls	387,620	5,814,307	$54,328	7.13	$236,043	1.64
Furnace	232,303	4,181,448	$48,993	4.74	$280,661	0.83
Greenhouse Curtains	1,617,741	16,177,405	$200,274	8.08	$1,171,791	1.38
Heat Recovery	222,047	3,330,702	$21,674	10.25	$298,732	0.74
Heat Recovery/Economizer	116,202	1,743,029	$40,522	2.87	$65,452	1.78
Industrial Equipment	4,234,975	84,699,494	$693,159	6.11	$2,783,301	1.52
Infrared	269,149	5,382,973	$48,505	5.55	$542,041	0.50
Insulation	576,518	8,647,767	$90,770	6.35	$119,103	4.84
Linkageless Control	97,871	1,468,067	$8,550	11.45	$12,150	8.06
Oven	28,410	426,146	$9,750	2.91	$9,750	2.91
Pipe Insulation	24,851	372,763	$1,916	12.97	$1,916	12.97
Roof Insulation	4,529	113,229	$1,750	2.59	$2,350	1.93
Steam Trap	1,420,520	7,102,602	$116,621	12.18	$119,967	11.84
Industrial Total	**12,001,904**	**177,663,455**	**$1,676,219**	**7.16**	**$6,605,094**	**1.82**
Low Income						
Boiler - Hydronic Condensing	198,069	4,951,734	$118,498	1.67	$423,632	0.47
Boiler - Hydronic High Efficiency	291,113	6,906,231	$145,544	2.00	$410,779	0.71
Controls	36,685	550,273	$22,886	1.60	$66,983	0.55
Heat Recovery/Economizer	9,129	136,937	$5,249	1.74	$43,200	0.21
Make Up Air Unit	263,929	3,958,930	$164,968	1.60	$439,299	0.60
Reflective Panel	667,685	10,015,274	$0	0.00	$668,945	1.00
Tank Type Water Heater	1,223	18,343	$584	2.09	$19,000	0.06
Low Income Total	**1,467,833**	**26,537,723**	**$457,729**	**3.21**	**$2,071,838**	**0.71**
Grand Total	**29,841,145**	**511,423,205**	**$4,835,075**	**6.17**	**$30,258,236**	**0.99**

Table 50. Custom Project Overview by Sub-Sector

Summary Overview by Sub-Sector for Custom Projects	Net Annual Gas Savings (m3)	Net Cumulative Cubic Metres (CCM)	Total Incentive Amount $	Net Gas Saved per Incentive $ spent (m3)	Total Net Incremental Costs	Net Gas Saved per Incremental $ spent (m3)
Commercial						
Accommodation	247,484	4,782,830	$48,091	5.15	$351,357	0.70
Food Services	6,460	161,491	$1,635	3.95	$21,197	0.30
Government	139,847	3,378,464	$30,652	4.56	$113,619	1.23
Health Care	2,059,164	23,776,605	$292,943	7.03	$2,005,469	1.03
Large New Construction	1,637,147	40,928,677	$100,221	16.34	$5,115,874	0.32
Logistics	878,617	13,715,307	$175,712	5.00	$944,999	0.93
Multi - Residential Private	6,625,991	139,788,792	$1,332,213	4.97	$4,472,537	1.48
Other Commercial	489,560	9,233,597	$64,084	7.64	$544,731	0.90
Professional	989,851	18,325,443	$155,393	6.37	$1,373,907	0.72
Recreational Non-Government	299,735	4,647,005	$56,885	5.27	$399,896	0.75
Retail	560,449	9,581,379	$96,311	5.82	$1,128,002	0.50
Schools	335,348	8,270,582	$73,645	4.55	$683,515	0.49
Universities	2,101,755	30,631,855	$273,342	7.69	$4,426,202	0.47
Commercial Total	**16,371,408**	**307,222,026**	**$2,701,126**	**6.06**	**$21,581,305**	**0.76**
Industrial						
Agriculture	1,689,169	17,793,988	$220,896	7.65	$1,241,715	1.36
Industrial Custom	10,312,735	159,869,467	$1,455,324	7.09	$5,363,379	1.92
Industrial Total	**12,001,904**	**177,663,455**	**$1,676,219**	**7.16**	**$6,605,094**	**1.82**
Low Income						
Multi Residential - Part 3	1,467,833	26,537,723	$457,729	3.21	$2,071,838	0.71
Low Income Total	**1,467,833**	**26,537,723**	**$457,729**	**3.21**	**$2,071,838**	**0.71**

Appendix F. 2012-2014 DSM Plan – Multi-Year Results

Table 51. 2012-2014 DSM Plan Multi-Year Results

	Component	Metric	2014 Actual Results	2013 Actual Results	2012 Actual Results
Resource Acquisition	Volumes	*Cumulative Savings (million m³)*	664.37	766.69	970.05
	Residential Deep Savings	*Number of Houses* [1]	5,213	1,649	271
Low Income	Single Family (Part 9)	*Cumulative Savings (million m³)*	25.7	32.9	24.7
	Multi-residential (Part 3)	*Cumulative Savings (million m³)*	29.8	27.3	43.4
	Multi-residential (Part 3) LIBPM [2]	*Percent of Part 3 Participants Enrolled* [3]	74%	85%	N/A[7]
Market Transformation	Drain Water Heat Recovery	*# of Units Installed*	N/A[8]	6,465	5,047
	Residential Savings by Design	*Completed Units*	1,059	967	N/A[7]
		Builders Enrolled [4]	23	18	12
	Commercial Savings by Design	*New Developments Enrolled*	19	16	9
	Home Labelling	*Number Committed Realtors* [5, 6]	40,040	78,000	8,600
		Ratings performed	662	138	N/A[7]

1. Number of houses with at least two major measures and where average annual gas savings across all participants is at least 25% of combined baseline space heating and water heating usage.
2. LIBPM - Low Income Building Performance Management is the Low Income offer complement to the Commercial Run It Right (RIR) offer.
3. Low Income Building Performance Management (LIBPM) percentage of Part 3 buildings enrolled in current year program = (x+y)/(x+y+z):

   x = # of new LIBPM buildings in the current year that have participated in another aspect of the Low Income program in a previous year of 2012-2014 plan; y = # of new LIBPM buildings participating in current year that have not previously participated in the Low Income program; z = # of buildings in the current year that have implemented custom projects other than LIBPM.
4. Eligible builders based on a minimum of 50 homes built in the prior year.
5. Commitments to make provision for a data field to show home energy ratings for all homes listed by participating realtors (industry-wide commitment to include such a field on MLS or similar listing service and/or realtors' commitment to do so with all the homes they list on their own websites, handouts and other consumer material).
6. Commitment from realtors collectively responsible for more than 5,000 (middle target) or 10,000 (upper target) listings/year.
7. Metric did not apply in this year.
8. Program ended in 2013.

Appendix G. New and Updated DSM Measures

On March 27, 2015, Enbridge Gas Distribution Inc. and Union Gas Ltd. submitted a joint application which sought approval from the Ontario Energy Board for new and updated Demand Side Management measures. The Board assigned this matter file number EB-2014-0354. On July 23, 2015 Enbridge and Union Gas were granted approval of the new and updated DSM measures and input assumptions as set out in the joint application, EB-2014-0354.

Below is the link to the OEB website to access the filing:

http://www.rds.ontarioenergyboard.ca/webdrawer/webdrawer.dll/webdrawer/search/rec&sm_udf10=eb-2014-0354&sortd1=rs_dateregistered&rows=200

Appendix H. Avoided Costs

Year	2014 Gas Avoided Costs							
	Water Heating		Space Heating		Combined Space & Water Heating		Industrial	
	Baseload ($/m3)		Baseload ($/m3)		Baseload ($/m3)		Baseload ($/m3)	
	Rate	NPV	Rate	NPV	Rate	NPV	Rate	NPV
1	0.15488	$0.15	0.16267	$0.16	0.16145	$0.16	0.15536	$0.16
2	0.16264	$0.31	0.17227	$0.32	0.17071	$0.32	0.16339	$0.31
3	0.18316	$0.47	0.19229	$0.49	0.19061	$0.49	0.18428	$0.47
4	0.20437	$0.63	0.21450	$0.67	0.21262	$0.66	0.20578	$0.64
5	0.22945	$0.81	0.24138	$0.85	0.23906	$0.84	0.23083	$0.81
6	0.25834	$0.99	0.29654	$1.06	0.29129	$1.05	0.26060	$1.00
7	0.25101	$1.16	0.26761	$1.24	0.26470	$1.23	0.25280	$1.17
8	0.24938	$1.32	0.26588	$1.41	0.26299	$1.39	0.25116	$1.32
9	0.25036	$1.46	0.26692	$1.56	0.26402	$1.54	0.25214	$1.47
10	0.24321	$1.59	0.25930	$1.70	0.25648	$1.68	0.24495	$1.60
11	0.24807	$1.72	0.26448	$1.84	0.26161	$1.82	0.24984	$1.73
12	0.25303	$1.84	0.26977	$1.97	0.26684	$1.94	0.25484	$1.85
13	0.25810	$1.95	0.27517	$2.09	0.27218	$2.07	0.25994	$1.97
14	0.26326	$2.06	0.28067	$2.20	0.27762	$2.18	0.26514	$2.08
15	0.26852	$2.17	0.28628	$2.31	0.28317	$2.29	0.27044	$2.18
16	0.27389	$2.27	0.29201	$2.42	0.28884	$2.39	0.27585	$2.28
17	0.27937	$2.36	0.29785	$2.52	0.29461	$2.49	0.28137	$2.38
18	0.28496	$2.45	0.30381	$2.62	0.30051	$2.59	0.28699	$2.47
19	0.29066	$2.54	0.30988	$2.71	0.30652	$2.68	0.29273	$2.55
20	0.29647	$2.62	0.31608	$2.80	0.31265	$2.77	0.29859	$2.64
21	0.30240	$2.70	0.32240	$2.88	0.31890	$2.85	0.30456	$2.72
22	0.30845	$2.77	0.32885	$2.96	0.32528	$2.93	0.31065	$2.79
23	0.31462	$2.84	0.33543	$3.04	0.33178	$3.00	0.31686	$2.86
24	0.32091	$2.91	0.34214	$3.11	0.33842	$3.07	0.32320	$2.93
25	0.32733	$2.98	0.34898	$3.18	0.34519	$3.14	0.32966	$3.00
26	0.33387	$3.04	0.35596	$3.24	0.35209	$3.21	0.33626	$3.06
27	0.34055	$3.10	0.36308	$3.30	0.35913	$3.27	0.34298	$3.12
28	0.34736	$3.15	0.37034	$3.36	0.36631	$3.33	0.34984	$3.17
29	0.35431	$3.21	0.37775	$3.42	0.37364	$3.38	0.35684	$3.23
30	0.36140	$3.26	0.38530	$3.47	0.38111	$3.44	0.36398	$3.28

The Nominal Inflation Rate used in the table is 2.0%
The Discount factor used in the table is 7.0%

2014 Water and Electricity Avoided Costs

Year	Water Heating				Space Heating				Combined Space & Water Heating				Industrial			
	Electricity (¢/Kwh)		Water ($/1000 litre)		Electricity (¢/Kwh)		Water ($/1000 litre)		Electricity (¢/Kwh)		Water ($/1000 litre)		Electricity (¢/Kwh)		Water ($/1000 litre)	
	Rate	NPV	Rate	NPV	Rate	NPV	Rate	NPV	Rate	NPV	Rate	NPV	Rate	NPV	Rate	NPV
1	0.10770	$0.11	2.59480	$2.59	0.10770	$0.11	2.59480	$2.59	0.10770	$0.11	2.59480	$2.59	0.10770	$0.11	2.59480	$2.59
2	0.11000	$0.21	2.65017	$5.07	0.11000	$0.21	2.65017	$5.07	0.11000	$0.21	2.65017	$5.07	0.11000	$0.21	2.65017	$5.07
3	0.11221	$0.31	2.70347	$7.43	0.11221	$0.31	2.70347	$7.43	0.11221	$0.31	2.70347	$7.43	0.11221	$0.31	2.70347	$7.43
4	0.11446	$0.40	2.75772	$9.68	0.11446	$0.40	2.75772	$9.68	0.11446	$0.40	2.75772	$9.68	0.11446	$0.40	2.75772	$9.68
5	0.11677	$0.49	2.81335	$11.83	0.11677	$0.49	2.81335	$11.83	0.11677	$0.49	2.81335	$11.83	0.11677	$0.49	2.81335	$11.83
6	0.11916	$0.58	2.87101	$13.88	0.11916	$0.58	2.87101	$13.88	0.11916	$0.58	2.87101	$13.88	0.11916	$0.58	2.87101	$13.88
7	0.12161	$0.66	2.92995	$15.83	0.12161	$0.66	2.92995	$15.83	0.12161	$0.66	2.92995	$15.83	0.12161	$0.66	2.92995	$15.83
8	0.12403	$0.73	2.98829	$17.69	0.12403	$0.73	2.98829	$17.69	0.12403	$0.73	2.98829	$17.69	0.12403	$0.73	2.98829	$17.69
9	0.12644	$0.81	3.04640	$19.46	0.12644	$0.81	3.04640	$19.46	0.12644	$0.81	3.04640	$19.46	0.12644	$0.81	3.04640	$19.46
10	0.12897	$0.88	3.10728	$21.15	0.12897	$0.88	3.10728	$21.15	0.12897	$0.88	3.10728	$21.15	0.12897	$0.88	3.10728	$21.15
11	0.13153	$0.94	3.16899	$22.76	0.13153	$0.94	3.16899	$22.76	0.13153	$0.94	3.16899	$22.76	0.13153	$0.94	3.16899	$22.76
12	0.13416	$1.01	3.23224	$24.30	0.13416	$1.01	3.23224	$24.30	0.13416	$1.01	3.23224	$24.30	0.13416	$1.01	3.23224	$24.30
13	0.13684	$1.07	3.29678	$25.76	0.13684	$1.07	3.29678	$25.76	0.13684	$1.07	3.29678	$25.76	0.13684	$1.07	3.29678	$25.76
14	0.13956	$1.13	3.36228	$27.16	0.13956	$1.13	3.36228	$27.16	0.13956	$1.13	3.36228	$27.16	0.13956	$1.13	3.36228	$27.16
15	0.14233	$1.18	3.42923	$28.49	0.14233	$1.18	3.42923	$28.49	0.14233	$1.18	3.42923	$28.49	0.14233	$1.18	3.42923	$28.49
16	0.14518	$1.24	3.49788	$29.76	0.14518	$1.24	3.49788	$29.76	0.14518	$1.24	3.49788	$29.76	0.14518	$1.24	3.49788	$29.76
17	0.14808	$1.29	3.56777	$30.97	0.14808	$1.29	3.56777	$30.97	0.14808	$1.29	3.56777	$30.97	0.14808	$1.29	3.56777	$30.97
18	0.15105	$1.33	3.63924	$32.12	0.15105	$1.33	3.63924	$32.12	0.15105	$1.33	3.63924	$32.12	0.15105	$1.33	3.63924	$32.12
19	0.15406	$1.38	3.71167	$33.22	0.15406	$1.38	3.71167	$33.22	0.15406	$1.38	3.71167	$33.22	0.15406	$1.38	3.71167	$33.22
20	0.15712	$1.42	3.78553	$34.26	0.15712	$1.42	3.78553	$34.26	0.15712	$1.42	3.78553	$34.26	0.15712	$1.42	3.78553	$34.26
21	0.16025	$1.46	3.86086	$35.26	0.16025	$1.46	3.86086	$35.26	0.16025	$1.46	3.86086	$35.26	0.16025	$1.46	3.86086	$35.26
22	0.16345	$1.50	3.93807	$36.21	0.16345	$1.50	3.93807	$36.21	0.16345	$1.50	3.93807	$36.21	0.16345	$1.50	3.93807	$36.21
23	0.16672	$1.54	4.01683	$37.12	0.16672	$1.54	4.01683	$37.12	0.16672	$1.54	4.01683	$37.12	0.16672	$1.54	4.01683	$37.12
24	0.17006	$1.58	4.09717	$37.98	0.17006	$1.58	4.09717	$37.98	0.17006	$1.58	4.09717	$37.98	0.17006	$1.58	4.09717	$37.98
25	0.17346	$1.61	4.17911	$38.81	0.17346	$1.61	4.17911	$38.81	0.17346	$1.61	4.17911	$38.81	0.17346	$1.61	4.17911	$38.81
26	0.17693	$1.64	4.26270	$39.59	0.17693	$1.64	4.26270	$39.59	0.17693	$1.64	4.26270	$39.59	0.17693	$1.64	4.26270	$39.59
27	0.18047	$1.67	4.34795	$40.34	0.18047	$1.67	4.34795	$40.34	0.18047	$1.67	4.34795	$40.34	0.18047	$1.67	4.34795	$40.34
28	0.18408	$1.70	4.43491	$41.05	0.18408	$1.70	4.43491	$41.05	0.18408	$1.70	4.43491	$41.05	0.18408	$1.70	4.43491	$41.05
29	0.18776	$1.73	4.52361	$41.73	0.18776	$1.73	4.52361	$41.73	0.18776	$1.73	4.52361	$41.73	0.18776	$1.73	4.52361	$41.73
30	0.19151	$1.76	4.61408	$42.38	0.19151	$1.76	4.61408	$42.38	0.19151	$1.76	4.61408	$42.38	0.19151	$1.76	4.61408	$42.38

The Nominal Inflation Rate used in the table is 2.0%
The Discount factor used in the table is 7.0%

Appendix I. Sampling Methodology for Custom C&I Programs

NAVIGANT

A Sampling Methodology for Custom C&I Programs

Prepared for:
Sub-Committee of the
Technical Evaluation Committee

November 12, 2012
Revised: October 28, 2014

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Table of Contents

1. Introduction

This report presents a sampling methodology intended for use in the evaluation of custom demand side management (DSM) programs delivered in commercial and industrial (C&I) sectors. The report provides a technical explanation of issues that have been raised in the evaluation processes. It also provides justification for the approaches recommended herein.

Past evaluation studies of Union Gas Limited (Union) and Enbridge Gas Distribution (Enbridge) custom programs have undergone third-party audits where the sample design and realization rate calculations are examined. The processes and judgments applied in these evaluation studies are audited to ensure that the analyses are transparent and accurate. The recommendations in this report along with the technical discussions are intended to better frame the issues for the third-party audit reviews and streamline the overall audit process.

The sample design methodology recommendations are presented in Section 5. The realization rate and achieved precision methodology recommendations are presented in Section 6. The report also contains three technical appendices discussing key issues and presenting the calculations required to develop statistical program estimates.

1.1 Background

Union and Enbridge have delivered DSM initiatives since 1997 and 1995, respectively. Union and Enbridge operate DSM programs, including programs that involve custom projects in the industrial, commercial, multi-residential, and new construction sectors. Custom projects cover opportunities where savings are linked to unique building and manufacturing specifications, end uses, and technologies. Each project is assessed individually for participation in the program. The DSM portfolio for both utilities includes several hundred custom projects annually.

Union and Enbridge DSM activities are regulated by the Ontario Energy Board (OEB) and adhere to the requirements as laid out in DSM Guidelines for Natural Gas Utilities.[1] For custom projects, the resource savings are determined through engineering calculations that are determined at the design stage of each project. There is a need to verify the resource savings through a third-party C&I engineering review.

A sampling methodology for custom projects was developed in 2008.[2,3] This methodology was intended to be used to evaluate future custom program impacts while the programs retained

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

[2] "Sampling Methodology for Engineering Review of Custom Projects." Enbridge Gas Distribution Inc. and Union Gas Limited. Prepared by Summit Blue Consulting. April 3, 2008.

roughly the same distribution of projects in terms of size and segment. There have been some changes to the custom programs and Union and Enbridge are now preparing for the engineering review of custom projects for 2012. As a result, there is a need to update the sampling methodology. Both utilities seek a harmonized approach to evaluating custom programs that involves on-site reviews of selected custom projects within a representative sample of the respective utility project populations.

In 2012, both utilities entered into a new regulatory framework in Ontario that established a new intervener process with the creation of a common Technical Evaluation Committee (TEC) for both utilities. The goal of the TEC is to establish DSM technical and evaluation standards for natural gas utilities in Ontario. The TEC will make recommendations to the OEB on annual Technical Reference Manual (TRM) updates, establish evaluation priorities, and reach consensus on the design and implementation of evaluation studies.

1.2 OEB Requirements for Evaluating Custom Projects

The OEB's DSM Guidelines for Natural Gas Utilities draws special attention to custom projects. The Guidelines define custom projects:[4]

> *Custom projects are those projects that involve customized design and engineering, and where a natural gas utility facilitates the implementation of specialized equipment or technology not identified in the Board approved list of input assumptions. Projects that simply include a combination of several measures provided in the list of input assumptions are not considered to be custom projects.* (p.5)

The Guidelines go on to prescribe an evaluation approach for custom projects:

> *For custom resource acquisition projects, which usually involve specialized equipment, savings estimates should be assessed on a case by case basis. It is expected that each custom project will incorporate a professional engineering assessment of the savings. This assessment would serve as the primary documentation for the savings claimed.*
>
> *A special assessment program should be implemented for custom projects. The assessment should be conducted on a random sample consisting of 10% of the large custom projects; and the projects should represent at least 10% of the total volume savings of all custom projects. The minimum number of projects to be assessed should be 5. Where less than 5 custom projects have been undertaken, all projects should be assessed. The assessment should focus on verifying the equipment installation, estimated savings and equipment costs.*

[3] "Update Memorandum: Proposed Sampling Method for Custom Projects." Summit Blue Consulting. October 31, 2008.

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

> *All program result evaluations should be conducted by the natural gas utilities' third-party evaluator(s). If possible, the natural gas utilities' third-party evaluator(s) should be selected from the [Ontario Power Authority's] OPA's third-party vendor of record list. The natural gas utilities' third-party evaluators should seek to follow the OPA's evaluation, measurement and verification protocols,[5] where applicable and relevant to the natural gas sector.* (p.39)

The recommended sample methodology contained in Sections 5 and 6 of this report conforms to the Guidelines for custom projects. Appendix B presents the detailed equations necessary to implement the recommended methodology.

1.3 Report Objective

The objective of this report is to develop a methodology for designing a sample and for calculating achieved realization rates and sample confidence and precision using the observed results from the sample. The recommended methodology must meet OEB requirements as well as address the technical and programmatic needs of Union and Enbridge custom programs. The steps taken to achieve this objective include the following:

- Understand the composition of Union and Enbridge custom programs (Sections 2 and 3)
- Review and analyze sample methodologies in selected jurisdictions (Section 4)
- Recommend a methodology for designing and selecting samples (Section 5)
- Recommend a methodology for calculating the achieved program realization rates and sample confidence and precision (Section 6)

The recommended statistical methodology can be described as two-stage stratified ratio estimation. A step-by-step approach to implementing the methodology for sample design is presented in Section 5.4.

The recommended sample methodology is intended to provide sufficient flexibility to allow Union and Enbridge to efficiently meet sample precision needs while the composition, participation, and impacts of their custom programs resemble the current 2011/2012 programs. If the nature of the custom programs changes, adjustments to the recommended methodology may be warranted.

[5] "EM&V Protocols and Requirements: 2011-2014." Ontario Power Authority. March 2011. (see page 129)

2. Overview of Union Custom Programs

Union's T1/R100 and commercial/industrial (C/I) custom programs are aligned under one brand platform, the *EnerSmart* program. This ensures a seamless, recognizable brand throughout Union's franchise. The program scorecards are divided based on rate class.[6] The T1/R100 program consists of T1 rate customers in Union's Southern delivery zone whose annual consumption is over 5M m^3 and R100 rate customers in Union's other delivery zones whose annual consumption is over 25.6M m^3. The C/I program consists of Union customers in all other rate classes. The methodology in this report pertains only to the custom measures in these programs. Additionally, Union is adding a new Low Income custom segment for the 2012 program year.[7]

Figure 1 outlines the rate class divisions of Union's custom projects. The number of projects in the C/I program is more than twice the number of the projects in the T1/R100 program but represents less than half of the savings of that program.

Figure 1. Union 2011 Custom Projects Overview

Union Custom Sector	# of Custom Projects	Gas Savings	% of Custom Portfolio
T1/R100	200	98,702,955	68.3%
Commercial/Industrial	459	45,472,108	31.5%
Low Income*	13	348,525	0.2%
Total	**672**	**144,523,588**	**100%**

*Low Income values are forecast for 2012 as this is a new segment for Union in 2012.
Source: Union Gas Limited

Custom projects are highly heterogeneous, with most projects tied directly to unique processes or technology requirements. Each project is validated on a stand-alone basis by a comprehensive professional engineering review and the overall programs are required to pass a Total Resource Cost (TRC) screening process. The EnerSmart program was designed to achieve savings in process-specific energy applications, as well as space heating, water heating, and the building envelope. Given the customized nature by which tracking database savings estimates are generated, Union conducts a third-party, on-site engineering study to verify the results of a representative project sample.

Account managers market the program directly to customers for T1/R100 and a combination of directly and indirectly through trade allies, channel partners, energy service companies, engineering firms, and equipment manufacturers to all other rate classes. Account managers work to cost-effectively promote energy efficiency within Union's C&I customer base.

[6] Historically, the Union custom C&I program was divided based on whether the customer purchased gas under a firm distribution contract or through a general service contract.
[7] Low income includes commercial and industrial general service customers.

3. Overview of Enbridge Custom Programs

Enbridge offers custom programs for the C&I sectors. A variety of incentive-based initiatives are offered to C&I sector customers. These initiatives include custom project incentives and a suite of prescriptive offerings aimed at promoting specific measures. Given the myriad of building types, end uses, ownership structures, and leasing arrangements, the C&I sector is a complex and variable segment in which to market and deliver energy efficiency.

Enbridge's Continuous Energy Improvement (CEI) initiative is focused on custom measures in the industrial segment. As part of ongoing modifications to this program, the industrial program will pursue greater targeting of small to mid-size operations and more flexibility in the incentives offered. As such, in 2012 Enbridge proposes to increase its custom incentive and expand its prescriptive offering to include more measures. Greater segment-focused marketing activities aimed at the mid-size facilities will augment the traditional marketing efforts for larger customers.

Figure 2 presents the commercial and industrial sector divisions of Enbridge custom projects in 2011. The number of projects in the commercial sector is more than six times the number of the projects in the industrial sector, but the average commercial sector project is only about one third the size of the average industrial sector project.

Figure 2. Enbridge 2011 Custom Projects Overview

Enbridge Custom Sector	# of Custom Projects	Gas Savings	% of Custom Portfolio
Commercial	780	37,470,116	68.2%
Industrial	127	17,482,847	31.8%
Total	**907**	**54,952,963**	**100%**

Source: Enbridge Gas Distribution Company

There are important differences in the Union and Enbridge custom programs. One difference is the average size of project. The average Enbridge commercial project is about 48K therms compared to about 99K therms for the Union C/I market projects. The average Enbridge industrial project is about 138K therms compared to the Union T1/R100 industrial projects, which average about 493K therms. In general terms, Enbridge's programs serve a market more dominated by commercial customers with smaller average project sizes, while Union's programs generally serve a market with more industrial customers, which results in larger projects in terms of savings. These factors need to be taken into account in an efficient sample design.

4. Analysis of Sampling Methodologies in Selected Jurisdictions

This section presents the findings from a review of sampling methodologies used in the evaluation of custom project programs in North America, including those described in annual evaluation reports of selected utilities as well as methodologies contained within evaluation protocols. The reviewed methodologies are all contained within publicly available documents. Because the reviewed documents contain varying degrees of detail and explanation, the Navigant Consulting, Inc. (Navigant) team applied its best interpretation of these documents to synthesize the available information in a consistent manner.

4.1 Summary of Jurisdictions Reviewed

The analysis of the reviewed methodologies accounts for factors such as fuel type, customer segment, and program design factors that might influence the design of samples for realization rate analyses.

Seventeen documents[8] were reviewed covering 12 unique jurisdictions in North America listed below:

- Illinois (Chicago) – Commonwealth Edison Company[9]
- Michigan (Detroit) – DTE Energy[10]
- Massachusetts – Massachusetts Energy Efficiency Advisory Council[11] covering NSTAR, National Grid, and Western Massachusetts Electric Company
- New Mexico – El Paso Electric Company,[12] New Mexico Gas Company,[13] and Public Service Company of New Mexico[14]
- Pennsylvania (Philadelphia) – PECO Energy Company[15,16]
- Ohio – AEP Ohio[17]

[8] Not counting the review of methodologies used by Union and Enbridge in prior evaluation cycles.

[9] "Evaluation Report: Smart Ideas for Your Business Custom Program." (Program Cycle 2010-2011.) Commonwealth Edison Company. Prepared by Navigant Consulting, Incorporated. May 16, 2012.

[10] "Reconciliation Report for DTE Energy's 2010 Energy Optimization Programs." DTE Energy Company. Prepared by Opinion Dynamics Corporation. April 15, 2011.

[11] "Impact Evaluation of 2008 and 2009 Custom CDA Installations." Massachusetts Energy Efficiency Advisory Council. Prepared by KEMA and SBW Consulting Incorporated. June 7, 2011.

[12] "Evaluation of 2011 DSM Portfolio." El Paso Electric Company. Prepared by ADM Associates Incorporated. May 2012.

[13] "Evaluation of 2011 DSM Portfolio." New Mexico Gas Company. Prepared by ADM Associates Incorporated. June 2012.

[14] "Evaluation of 2011 DSM & Demand Response Portfolio. "Public Service Company of New Mexico. Prepared by ADM Associates Incorporated. March 2012.

[15] "Annual Report to the Pennsylvania Public Utility Commission for the Period June 2010 through May 2011." PECO Energy Company. Prepared by Navigant Consulting. November 15, 2011.

[16] "Audit Plan and Evaluation Framework for Pennsylvania Act 129 Energy Efficiency and Conservation Programs. "Pennsylvania Public Utility Commission. Prepared by the PA Statewide Evaluation Team. November 4, 2011.

[17] "Program Year 2011 Evaluation Report: Business Custom Program." AEP Ohio. Prepared by Navigant Consulting, Incorporated. May 10, 2012.

- Maryland – EmPOWER Maryland[18] covering Baltimore Gas & Electric, Potomac Electric Power Company, Delmarva Power, Southern Maryland Electric Cooperative, and Potomac Edison
- California – California Public Utilities Commission,[19,20,21] covering Pacific Gas & Electric, Southern California Edison, Southern California Gas, and San Diego Gas & Electric
- Vermont – Vermont Department of Public Service[22] covering Efficiency Vermont and Burlington Electric Department
- PJM Interconnection – covering participating utilities in the Midwest and Eastern U.S.[23]
- U.S. Federally Owned Facilities – U.S. Department of Energy[24]
- International Performance Measurement and Verification Protocol (IPMVP) – Efficiency Evaluation Organization[25]

Figure 3 provides a high-level summary comparing the reviewed studies and Appendix C presents more detail on methods used in selected jurisdictions.

4.2 Key Findings – Review of Methods Used in Selected Jurisdictions

Commercial and industrial programs across North America range in type and size, and they frequently use inconsistent nomenclature. It is common to see custom C&I programs separated from prescriptive programs; however, some utilities do combine custom and prescriptive measures into a single program. Stratification approaches and confidence and precision targets are determined differently, depending on each utility's regulatory requirements and program organization.

Many publicly available evaluation reports tend not to describe sampling methodologies in much detail. These reports focus more on reporting evaluation results rather than describing methods used. Certain attributes of the sampling methodologies can be deduced from the reports, but explicit detail on the sampling approach ranges from little to none. The Navigant team applied its best interpretation in assessing utility evaluation reports.

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[18] "EmPower Maryland 2011 Evaluation Report – Chapter 4: Commercial and Industrial Custom and Re-commissioning Programs." Baltimore Gas & Electric, Potomac Electric Power Company, Delmarva Power, Southern Maryland Electric Cooperative, and Potomac Edison. Prepared by Navigant Consulting, Incorporated.

[19] "Energy Efficiency Evaluation Report for the 2009 Bridge Funding Period." California Public Utilities Commission. January 2011.

[20] "The California Evaluation Framework." California Public Utilities Commission. Prepared by TecMarket Works. June 2004.

[21] "California Energy Efficiency Evaluation Protocols: Technical, Methodological, and Reporting Requirements for Evaluation Professionals." California Public Utilities Commission. Prepared by TecMarket Works. April 2006.

[22] "Verification of Efficiency Vermont's Energy Efficiency Portfolio for the ISO-NE Forward Capacity Market." Vermont Department of Public Service. Prepared by West Hill Energy and Computing Incorporated. July 29, 2010.

[23] "PJM Manual 18B: Energy Efficiency Measurement & Verification." PJM Forward Market Operations. March 1, 2010.

[24] "M&V Guidelines: Measurement and Verification for Federal Energy Projects Version 3." U.S. Department of Energy. Prepared by Nexant Incorporated. April 2008.

[25] "International Performance Measurement and Verification Protocol: Concepts for Determining Energy and Water Savings Volume 1." Efficiency Valuation Organization. January 2012.

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Figure 3. Summary Comparison of Sample Methodologies in Selected Jurisdictions

N°	Service Territory or Jurisdiction	Organizations Reviewed	Year	Service Type	Timing	Precison Target	Stratify by Size	Stratify by Segment	Ratio Estimation
1	Illinois (Chicago)	Commonwealth Edison Company	2011	Electric	2-stage	90/08 (3yr utility program)	✓		✓
2	Michigan (Detroit)	DTE Energy	2010	Gas & Electric	1-stage	90/10 (utility program)		✓	✓
3	Massachusetts	Massachusetts Energy Efficiency Advisory Council (NSTAR, National Grid, Western Massachusetts Electric Company)	2009	Gas & Electric	1-stage	90/10 (statewide custom C&I)			✓
4	New Mexico	El Paso Electric Company, New Mexico Gas Company, Public Service Company of New Mexico	2011	Gas & Electric	1-stage	90/10 (utility total portfolio)	✓		✓
5	Pennsylvania (Philadelphia)	PECO Energy Company	2011	Gas & Electric	3-stage	85/15 (utility C&I total)	✓	✓	✓
6	Ohio	AEP Ohio	2011	Electric	2-stage	90/10 (utility program, RTO zone)	✓	✓	✓
7	Maryland	EmPower Maryland (Baltimore Gas & Electric, Potomac Electric Power Company, Delmarva Power, Southern Maryland Electric Cooperative, and Potomac Edison)	2011	Gas & Electric	1-stage	80/20 one-sided (utility program)	✓		✓
8	California	California Public Utilities Commission (Pacific Gas & Electric Company, San Diego Gas & Electric, Southern California Edison, Southern California Gas Company)	2009	Gas & Electric	flexible	90/10 (utility program)	✓	✓	✓
9	Vermont	Vermont Department of Public Service (Efficiency Vermont and Burlington Electric Department)	2010	Electric	2-stage	80/10 (utility portfolio)	✓	✓	✓
10	PJM Interconnection (Midwest & Eastern US)	PJM Interconnection	2010	Electric	flexible	90/10 one-sided (utility program, RTO zone)	✓	✓	✓
11	US Federal Facilities	US Department of Energy	2008	not applicable	flexible	not applicable		✓	
12	General International	Efficiency Valuation Organization (IPMVP)	2012	not applicable	flexible	not applicable		✓	

Source: Navigant review of previously cited documents in selected jurisdictions

Protocols for evaluating DSM projects in specific jurisdictions tend to provide a more detailed description of sampling methodologies used than the program evaluation reports. Protocols generally allow specific sampling options such as selecting between census, simple random sampling, and stratified sampling, as well as options for determining the appropriate basis for stratification. The reviewed protocols usually offer step-by-step processes for designing samples.

Meeting Precision Targets

Confidence and precision requirements vary widely across the reviewed methodologies. Both one-sided and two-sided confidence intervals are common. Confidence requirements range from 80% to 90%, and precision requirements ranged from 8% to 20%. These confidence and precision requirements frequently differ in the level at which they are applied, which could be for the program, the customer segment, the portfolio, or the transmission zone. One methodology[26] adheres to a relatively rigorous precision target of 90/08, but the target only applies to a 3-year term rather than annually.

On-site verification and evaluation is common industry practice for evaluating larger custom program impacts. There are cases where phone and engineering algorithm verifications have been used for custom programs in some years with more in-depth evaluation work performed in other years. Phone surveys are generally reserved for process evaluation and establishing free-ridership estimates. Phone surveys are less commonly used to estimate gross program impacts. The reviewed methodologies tend to contain a rather substantial description of the evaluation techniques used to estimate project savings, often describing in detail the engineering models applied and how parameters were measured and used. Several evaluation sample design methodologies apply more rigorous techniques or aim to achieve a census for large projects that represent a high concentration of savings in order to cost-effectively increase validity and accuracy of evaluation estimates at the project and program levels.[27,28]

Ratio estimation is used in nearly all of the reviewed methodologies and has now become a standard practice in the industry. Ratio estimation is a statistical technique whereby prior information from a tracking database—"tracked savings"—is employed to reduce the overall sample requirements. If stratification is used, the resulting precision is applied to the total based on applying the realization rate measured for each stratum.

An expected variance must be assumed to create an initial sample design. This assumption is made via an error ratio or coefficient of variation (CV). The CV is defined as the standard

[26] "Evaluation Report: Smart Ideas for Your Business Custom Program." (Program Cycle 2010-2011.) Commonwealth Edison Company. Prepared by Navigant Consulting, Incorporated. May 16, 2012.

[27] As a point of interest, the more rigorous evaluation approaches for selected large projects can, on occasion, produce a higher variance across the sample. This can produce the appearance of worsening sampling precision, but it is generally viewed as producing more appropriate levels of confidence and precision for the program.

[28] "EmPower Maryland 2011 Evaluation Report – Chapter 4: Commercial and Industrial Custom and Re-commissioning Programs." Prepared by Navigant Consulting, Inc.

deviation of the sample divided by the mean. In the case of ratio estimation, the CV should be based on the variance of project-specific realization rates rather than the variance of savings. Industry practice is to conservatively rely on historic evaluation results in selecting a CV for sample design. When historic data are not available, conservative assumptions are made, typically ranging from 0.5 to 1.0 depending on the expected homogeneity of the population.[29] Ratio estimation can sometimes reduce the CV to levels around 0.3; however, these levels represent "best outcomes" and should not be viewed as conservative when designing a sampling framework.

The reviewed methodologies more commonly apply Z-values[30,31] than T-values in determining sample precision. At larger sample sizes (i.e., greater than 30) the differences are insignificant. But for smaller samples, application of the Z-value fails to account for the limited degrees of freedom in the sample and can lead to overstating the confidence and precision achieved by the sample.

Use of the finite population correction (FPC) factor is not frequently discussed. However, the FPC has a valid statistical basis and should be used when evaluating smaller populations. Two of the reviewed methodologies[32,33] do not appear to use the FPC, and instead recommend a census if the calculated sample size approached or exceeded the population size. Any sample size calculation that exceeds the population is not taking into account the basic principles of sample design. This approach is not statistically valid and can lead to excessive evaluation costs. Although this topic is not frequently discussed, it is reasonable to assume that the FPC is applied whenever size-based sampling was used since application of the FPC is necessary to take advantage of the concentrations of savings in large projects.

Use of Stratification

The reviewed methodologies applied stratification in the sample design when population sizes were not sufficiently small to achieve a census. Stratification approaches vary across the reviewed methodologies and appear to be customized to fit each utility's program structure, number of projects, sizes of projects, regulatory requirements, and stakeholder concerns.

The review yielded two common approaches for stratifying based on size. The first approach defines the large stratum based on very large projects in the population. Sometimes a census is

[29] "PJM Manual 18B: Energy Efficiency Measurement & Verification." PJM Forward Market Operations. March 1, 2010. (See page 30)

[30] "Audit Plan and Evaluation Framework for Pennsylvania Act 129 Energy Efficiency and Conservation Programs." Pennsylvania Public Utility Commission. Prepared by the PA Statewide Evaluation Team. November 4, 2011.

[31] "The California Evaluation Framework." California Public Utilities Commission. Prepared by TecMarket Works. June 2004.

[32] "The California Evaluation Framework." California Public Utilities Commission. Prepared by TecMarket Works. June 2004. (See page 337)

[33] "Audit Plan and Evaluation Framework for Pennsylvania Act 129 Energy Efficiency and Conservation Programs." Pennsylvania Public Utility Commission .Prepared by the PA Statewide Evaluation Team. November 4, 2011. (see page 75)

sought when the very large stratum contains only a few projects. The second approach divides the population into strata of roughly equal contribution to total savings.[34] In some cases, this approach seemed to follow textbook examples rather than examining the program projects to see if alternate approaches to stratification could be designed to increase precision. Simply dividing the population into three roughly equal strata may overlook more appropriate stratification designs that could yield higher precision and confidence. This approach is more applicable when project size declines smoothly from large to small projects. Some of the reviewed methodologies apply more rigorous evaluation and measurement approaches to projects in the large stratum or for strata with highly heterogeneous populations in a cost-efficient effort to improve accuracy.

Many of the reviewed methodologies stratify by segment instead of or in addition to stratifying by size. Segments used for stratification included market sector (e.g., education, multi-family, manufacturing, and other customer-type segments), geography, and project types (space heating, water heating, or industrial process). Stratification by segment can be used to increase precision for a given sample size as well as make the sample more representative of the population.

Sample Staging

Schedule requirements for reporting often necessitate a rolling sample or staged approach to sampling in order to begin evaluation efforts early enough to complete the evaluation tasks in time to report results on schedule. About half of the reviewed methodologies implement staged sampling. Most of the methodologies do not require reporting intermediate results, but rather focus only on the final population results.[35]

A two-stage approach is most common[36,37,38] where a stage one sample is drawn based on either the first two or first three quarters of the year. Single-stage sampling and three-stage sampling also occur in the reviewed methodologies. Details on the rationale underlying the calendar periods for the different stages, and the allocation of sample to the different stages, were generally not explicitly stated. In general, approaches were based on "reasonable judgment" by the evaluators.

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[34] "Program Year 2011 Evaluation Report: Business Custom Program." AEP Ohio. Prepared by Navigant Consulting, Incorporated. May 10, 2012. (See appendix J, page 33)

[35] Pennsylvania has a slight exception. Reporting quarterly results is required by Act 129. Although quarterly reporting has been interpreted as applying to unverified results, verified results are reported for the full year.

[36] "Evaluation Report: Smart Ideas for Your Business Custom Program." (Program Cycle 2010-2011.) Commonwealth Edison Company. Prepared by Navigant Consulting, Incorporated. May 16, 2012.

[37] "Program Year 2011 Evaluation Report: Business Custom Program." AEP Ohio. Prepared by Navigant Consulting, Incorporated. May 10, 2012. (See appendix J, page 33)

[38] "Verification of Efficiency Vermont's Energy Efficiency Portfolio for the ISO-NE Forward Capacity Market." Vermont Department of Public Service. Prepared by West Hill Energy and Computing Incorporated. July 29, 2010.

Gas & Electric Service

Major differences in evaluating savings between electric and gas utilities were not found. Differences in evaluation methods are more likely based on program size and number of years evaluating and reporting program savings. Most jurisdictions count both electric and gas savings for custom C&I measures regardless of whether the administrating utility supplies both fuel types.

Bias in Results

Industry best practices prescribe a demonstration of effort to control for common sources of bias. Once a population of projects exists, the goal of the sample design is to estimate the gross savings resulting from that population.[39] The principal concern about bias is that certain elements of the population may be over- or underrepresented in the sample. Stratification is a good approach for reducing this potential bias. Bias can also result from non-random sample selection. Finally, bias can be introduced into the analysis by anomalous observations in the sample that for some reason are unique and not representative of other members of the population. If anomalous observations are also "influential" observations, then corrective action may be necessary to provide accurate information from the realization rate calculation, and the accompanying calculations of precision and confidence. The California Evaluation Framework notes:[40,41]

> *[If] there is substantial bias, perhaps due to self-selection, non-response, deliberate substitution of sample projects, or measurement bias, then the methods presented here can be seriously misleading. For example it is misleading and counterproductive to report that the average savings has been estimated with a relative precision of 10% at the 90% level of confidence if there is a serious risk that the results might be in error by 25% due to bias.* (p. 327)

The reviewed methodologies contain little description of efforts made to minimize bias. Additionally, there is little discussion on the composition of the sample, treatment of outliers, sample replacements, missing data points, or other sample adjustments. These discussions could be addressed in project memos rather than expanding what is often a lengthy final evaluation report. However, this is an area where standard industry practice may not be on par with evaluation practices in other fields. It is not clear whether this deficiency is related only to reporting or if it reflects limitations on current evaluation practice.

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[39] Issues such as self-selection bias in recruiting program participation are not an issue for sample designs whose purpose is to estimate the gross savings from those that did participate in the program. Once the frame of participant projects is determined, the biases of concern are typically based on ensuring random samples, ensuring representativeness, addressing extreme values, and using appropriate calculations consistent with the sample cases to produced unbiased estimates of the population parameters.

[40] "The California Evaluation Framework." California Public Utilities Commission. Prepared by TecMarket Works. June 2004.

[41] The California Evaluation Framework contains a substantive discussion on accuracy and bias in chapter 12.

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5. Recommended Sample Design Methodology

This section describes the recommended sample design methodology for DSM programs for Union and Enbridge. Sections 5.1–5.3 describe the key attributes of the recommended methodology and offer support for their use in evaluating Union and Enbridge custom programs. Section 5.4 presents steps for appropriate sample designs and sample selection. Sections 5.5–5.6 present examples for Union and Enbridge illustrating how the sample methodology might be implemented using representative tracking data.

Ratio estimation has become standard practice for the evaluation of large C&I programs, as it leverages information available on the population of projects with the sample. The sample design approaches discussed in this section are constructed to make full use of the ability to leverage sample data in combination with information on the population from the project tracking database. This is important given the relatively high cost of rigorously evaluating custom C&I projects. Ratio estimation has become a common industry practice in evaluation since it leverages information on the population to better interpret information from the sample. Stratification has also become a common industry practice, although its application varies, and its application may not result in strata that enhance the efficiency of the sample design. The methods presented in this section are aligned with these basic concepts of leveraging information to get the most out of the analysis.

The level of specification for sampling protocols observed in jurisdictions across North America ranges widely. An overly specified methodology may lead to incompatibilities in future evaluation efforts as the composition, participation, and distribution of impacts evolve. However, an overly general methodology may lead to sample designs that do not meet Union and Enbridge's confidence and precision requirements with cost-efficient methods. The recommended sample design methodology is intended to strike a balance between flexibility and specification to allow Union and Enbridge to best meet their evaluation needs now and in future program years.

5.1 Stratification

Stratification is recommended in designing samples for evaluating custom C&I programs. Stratification is the practice of disaggregating the population into sub-groups based on some criteria. Strata should be defined such that the strata sample frames are mutually exclusive (i.e., no overlap) and exhaustive (i.e., strata sample frames combine to represent the appropriate population sample frame). There are three generally accepted reasons to use stratification:

1. Sample Efficiency: To reduce the required sample size needed to achieve confidence and precision targets on an estimate. There are two common stratification practices that can increase sample efficiency:

- Stratifying by project size may reduce the overall number of required samples by taking advantage of the concentrations of savings when relatively few projects contribute to a large fraction of total impacts. This is most commonly seen in C&I evaluations, and the majority of reviewed methodologies apply this approach.
- Stratifying based on qualitative segments (e.g., project type or customer segment) can reduce the effective variance compared to combining the segments in a single stratum when segments of a population produce different results. For example, if the project-level realization rate (RR) is expected to average 0.9 for lighting projects and 0.8 for heating, ventilating, and air conditioning (HVAC) projects, then the variance of these segments combined will usually be greater than their individual variances. Separating lighting from HVAC would then allow smaller sample sizes to meet the required precision criteria for total combined savings.

  Stratification design must reduce the effective sample variance in order to produce gains in precision. The simple rule is that projects within a sample should have a smaller variance within the strata than across strata. Lohr notes:[42,]

  > *Observations within many strata tend to be more homogeneous than observations in the population as a whole, and the reduction in variance in the individual strata often leads to a reduced variance for the population estimate.* (p. 77)

- Stratification cannot make the problem worse (i.e., decrease precision). As a result, it is strongly recommended.

2. Segment Results Required: To ensure sufficient sample sizes that can answer questions pertaining to certain segments of the total population**.** For example, if stakeholders or interveners require results specifically for HVAC-related projects in order to improve program implementation in subsequent years, then creating strata for HVAC projects and establishing a minimum precision requirement for those strata would help ensure that sufficient data are collected to understand HVAC projects.
3. Reduced Potential for Bias by Improving the Representativeness of the Sample: For many evaluators, this is the most important reason for stratification as part of sample design. Stratification helps ensure that the sample appropriately represents the population. Since simple random sampling allows for the possibility of under-sampling certain segments, stratification can help ensure that the sample drawn provides the appropriate sample size for each segment. For example, stratifying by project type can ensure that each major project category is appropriately represented in the sample by explicitly drawing samples for each project type. Other frequently used dimensions for stratification include customer segments and site geographies. Representativeness quotas are sometimes used instead of strata to ensure representativeness.

[42] Lohr, S. L., "Sampling: Design and Analysis," Second Edition, 2010.

The specific stratification approach will depend on evaluation of the population data. If the distribution of project savings for a program is relatively tight[43] and there is not an easily delineated group of large projects, then stratification by project size alone may not produce sampling efficiencies. However, if the distribution of project savings is wide or there is clear group of large projects, then stratifying by project size will likely produce sampling efficiencies.

It is important to note that when sample observations are collected based on a stratified sample design, the strata weights must be applied in the estimation of the population realization rate.

The general rule for stratification is to attempt to select strata that have smaller variance within the strata than between strata. Stratifying by segment may also be appropriate when realization rates are expected to vary by segment. Judgment should be applied to segment the population on the basis of mechanisms that lead to different realization rates, rather than simply using common predefined segments used in program administration. For example, if steam projects are expected to have a different realization rate than other project types—or even more widely varied realization rates across steam projects—then a potentially useful segmentation may be by steam projects vs. other non-steam projects. It is not necessary to segment by every major project category to achieve the desired sampling efficiency, only those where this effect is believed to be sizeable and where stratification may also help increase the representativeness of the final sample across important technology categories.

5.2 Ratio Estimation

The application of a ratio estimation approach is recommended. Ratio estimation is the statistical technique whereby the *accuracy* of "prior" tracked estimates is applied from the sample rather than directly applying the *absolute* estimates of the sample. For DSM evaluation efforts, the sample estimator is the realization rate for each stratum rather than the sampled savings for each stratum. Ratio estimation is often used to increase the precision of estimated means and totals. It is motivated by the desire to use information about a known auxiliary quantity (i.e., tracked savings) to obtain a more accurate estimator of the population total or mean (i.e., verified savings). When applying ratio estimation within a stratified population, the separate ratio estimator approach should be used where strata are defined and analyzed before combining strata.[44]

Ratio estimation would not be possible without initial savings estimates for the population. This technique relies on establishing the variance based on the errors between the savings predicted by the stratum average realization rates for each project and the actual savings measured for each project. Ratio estimation effectively develops verified savings estimates based on measuring the accuracy of the tracked savings. Therefore, it is necessary to ensure that the tracked savings in the tracking database represent the best possible estimate based on the available information.

[43] A "tight" project savings distribution is generally considered to be within a single order of magnitude. Size-based stratification should be considered when the distribution of savings spans multiple orders of magnitude.

[44] Lohr, S. L., "Sampling: Design and Analysis," Second Edition, 2010. (Section 4.5)

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5.3 Sample Staging

A rolling sampling approach comprised of two sample draws (a two-stage sample approach) is recommended to ensure that spring reporting requirements can be met. Reporting schedules often do not provide sufficient time to design and evaluate a sample following the completion of the project year. This type of schedule constraint frequently occurred in the jurisdiction reviewed in Section 4. Sample staging can allow evaluation efforts to begin earlier on a preliminary sub-sample of projects completed early in the program year. Thus, staging can reduce the evaluation workload required between the end of the program year and the reporting deadline.

A two-stage sample is recommended, where the first stage takes a sample draw from projects completed in the first three quarters of the program year, and the second sample draw adds in projects completed in the fourth quarter.

The sample design for the first stage should estimate or extrapolate the numbers of projects in each stratum to the values expected at the end of the year.[45,46] Sample sizes should be determined for this preliminary sample frame as an indication of the final population. While judgment is needed to determine how much of the expected overall sample is drawn in the first stage, it is unlikely that the first stage sample would fully require three-quarters of the calculated sample sizes.[47] In general, practical considerations would support a lower split of the planned sample between the first and second stages. This would allow for a sample that adequately represents the year-end projects.

Union's and Enbridge's projects tend to come online more heavily in the fourth quarter, with roughly half to three-quarters (depending on which program) of projects completing in the last quarter. This would imply that a 50-50 split between sample stages would be reasonable, given constraints related to the calendar time needed to set up and conduct the verification studies. However, if the timing allows, Union and Enbridge might consider placing more of the sample into the fourth quarter when savings from projects completed in the fourth quarter are expected to contribute more than half of program savings. This recommendation is a compromise between the time and resources needed to perform the number of site verifications, and the need to meet program reporting deadlines. It simply is not possible for the utilities to wait until information on that year's full population of projects becomes available and then draw the sample and complete the site verifications while still meeting the program reporting deadlines.

[45] This step is important because it will reduce the effect of finite population correction that could otherwise lead to underestimating the required sample sizes.

[46] If the final quarter of the program year is known to have very large projects in disproportion to the first three quarters, the strata weighting may be adjusted to account for this information.

[47] The sample sizes may be further reduced slightly to allow for the possibility that the assumed CV is overly conservative. If upon evaluation of the first stage, the assumed CV was not overly conservative, then additional samples may be added in the second stage.

This rolling sample or two-stage approach is often used in program evaluation (see Section 4 above) to meet timely reporting deadlines.

The sample design for the second stage should consider the population of the program year in its entirety. Sample sizes should be determined for the entire population. The first stage sample is intended to fulfill about half of the overall sample. The second stage is intended to fulfill the remainder of the sample and should be selected from projects completed in the fourth quarter.[48] If analysis of the first stage sample observations indicates insufficient sample sizes, then the first stage may be reinforced in the second stage with additional projects selected at random from the full program year population. An analysis of sample data should investigate whether differences between sample stages are significant and adjustments are needed. Again, the goal is to produce good information for making decisions regarding the custom programs for both the utilities and stakeholders. Some judgment is needed in implementing this rolling two-stage sample selection approach.

5.4 Recommended Sample Design Process—Seven Steps

The sample study should be designed to estimate the impacts of the population of projects in each program year. At the time of this report, gross *cumulative* (i.e. lifetime) gas savings measured in cubic meters (m^3) is the primary impact to be studied and should serve as the basis of the sample design.[49] The sampling and the application of population-wide realization rates should all be performed using gross cumulative savings.[50] The recommended sample design methodology contains the following steps:

Step 1: Review project tracking database for accuracy and quality.
Prior to any stratification or sampling, large gains can be made in the resulting analysis and precision by reviewing the estimates in the tracking database and making sure that the best possible initial project-based engineering estimates are contained in the tracking database. It is also important to make sure that appropriate contact information is contained in the files to avoid having to replace drawn sample projects with supplemental projects held in reserve. One of the most cost-effective ways to enhance the precision and confidence in the evaluation results is to make the appropriate investment in the tracking database. A tracking database that is accurate will typically reduce the costs of the evaluation, yield project realization rates that are closer to one, and have a smaller variance across the project realization rates. Many utilities do a

[48] Although this approach is intended to achieve roughly equal proportions of projects for each quarter, disproportions by quarter should not be viewed as causing notable bias. Accordingly, if the first stage produces a small number of projects in excess of what is required in the second stage, these extra projects may be counted toward meeting the fourth quarter sample size requirements.

[49] This is a new basis for custom C&I evaluation studies beginning in program year 2012. The Technical Evaluation Committee may decide to change this basis in future years.

[50] Ultimately, adjusted gross savings can be converted to adjusted net savings (i.e. by applying a program net-to-gross ratio to the adjusted program gross savings). However, that would occur outside of (i.e. after) the application of the sampling work discussed in this report.

second check of the tracking database prior to the sample design and sample selection.

Identifying unique projects in the tracking database can help avoid outlier problems later in the analysis. Examples of unique projects may be those with the only instance of a certain efficient technology installed or even those with technologies whose impacts are difficult to predict. These unique projects may be treated separately from the primary population to produce more efficient samples for the vast majority of the population. Identification of unique projects can also help ensure the representativeness of the selected sample and help eliminate problems in the interpretation of the analysis such as bias in the realization rate.

Step 2: Evaluate the population and define strata.
Examine the population for ways to leverage the sample design to improve efficiencies in meeting target confidence and precision levels. This includes three activities:

- *Exclusion of extremely small projects* – Ratio estimation weights project realization rates according to project savings. Very small projects typically exert only negligible influence on estimates of the total realization rate, the total savings, and the total achieved precision. For many very small projects, a 100% difference in realized savings would produce a negligible impact on the total estimates. The cost of evaluating the impacts of these small projects exceeds the value of the information obtained from them. Additionally, including projects that contribute only small fractions of a percent to program savings in the sample frame might result in the random selection of projects that includes a disproportionate number of these very small projects, which could reduce the accuracy with which the overall realization rate is estimated for a given sample size and reduce the overall representativeness of the sample. It is therefore considered reasonable to exclude the very small projects (i.e., representing up to 5% of the total program savings as appropriate) from the sample frame. The savings of the population of very small projects may be adjusted by an appropriate realization rate[51] and added to the program savings total.
- *Identification of project size strata bounds* – Efficiencies can be gained by stratifying by project size when the distribution of project savings is wide or there is a clear group of large projects. Sorting the projects by savings size can allow easy identification of discontinuities in the project size distribution. If it is unclear whether natural project size groupings exist; visualization of the project savings in a histogram should provide a clearer indication. Typically, strata are set such that program savings within a stratum fall within an order of magnitude.[52] Set strata bounds first based on natural breaks in the distribution that result in easily delineated groupings. If natural groupings do not exist,

[51] If the remaining population is stratified by size, then the average small stratum realization rate should be applied. Otherwise the population total realization rate should be applied. However, the savings accounted for by these projects is so small that alternative assumptions should not affect the overall program savings estimates. Some applications simply use a realization rate of 1.0 for these very small projects.

[52] One rule of thumb is to keep the expected coefficient of variation of project savings to less than 1.0 within a stratum.

other approaches may be used such as stratifying into strata of roughly equal total savings. The number of size-based strata typically ranges from two to four, with three most commonly applied for C&I program evaluations.

- *Identification of categorical characteristic strata bounds* – Efficiencies can be gained by defining strata along categorical qualities such that the coefficient of variation of project realization rates for each stratum is lower than the resulting CV of the aggregated group without the categorical strata. This basis for stratifying may be applicable when a certain segment of the project population is expected to have different or more variable realization rates than the rest of the population. Units that are generally more alike should be grouped together in a stratum. For commercial projects, strata could be defined by building type (e.g., schools, office building, and multi-family). Similar buildings could be expected to have a lower variance in the estimated realization rate across sites (i.e., within the stratum) than when combined with other building types. Although categorical strata bounds are frequently applied in many DSM studies, they are not mandatory and should be prudently applied.

The sample designer may be required to make trade-offs between stratification approaches. Defining the appropriate strata is often the most important part of sample design; however, it requires data analysis skills, subject matter expertise on the project types, and knowledge of program administration and participation issues.

Step 3: Estimate an appropriate variance for each stratum.
In ratio estimation, the variance considered is that of the residuals on the stratum average realization rate rather than the variance of the verified savings. Accordingly, a CV or error ratio should be based on the assumed distribution of individual realization rates for the population of projects in each stratum.

The CVs should be based on the un-weighted[53] realization rates historic sample data, when such data are available. Any changes in program composition, administration, or participation from the previous year will decrease the validity of applying prior year CVs, and the assumed CVs should be adjusted upward by 0.1-0.2 to prevent under-sampling. It is not recommended to apply a coefficient of variation less than 0.30, in order to ensure sample sizes sufficient for robust results and to allow for increasing variances that may result from evolving measurement approaches and program participation.

A two-staged sample provides an opportunity to adjust the assumed CVs in the second stage to incorporate the sample data already observed in the first stage. The observed CVs in the first stage should still be slightly adjusted upward to account for variance and size unknowns in the second stage sample.

[53] The realization rates are un-weighted rather than weighted because it is assumed that any correlation between the size of a project in a stratum and its realization rate is coincidental (especially in small sample sizes). So, applying the historic correlation could result in under-sampling or over-sampling in subsequent program evaluation efforts.

A CV of 0.5 may be assumed when historic data are not available. This is a standard industry assumption and is generally conservative in ratio estimation if the population tracked savings in the tracking database are reasonably accurate. However, custom projects with poor tracking database estimates may produces CVs as large as 1.0. It is not uncommon to observe program CV's lowering over time as programs mature and tracking estimates improve. CVs can also increase if more rigorous and precise methods are used to evaluate project savings; however, this should not be viewed as a negative since rigorous methods create a more accurate understanding of project and program results.

Step 4: Allocate observations to each stratum.

The overall sample should be designed to achieve 10% precision at a 90% one-sided confidence level (i.e., 90/10 one-sided).[54, 55] This confidence and precision target is meant to be used for each custom program in each year. If changes are made to this target, these changes can be addressed in the sample size calculations and do not necessarily warrant changes in the recommended methodology. Appendix A and Figure 19 provide additional explanation and illustration for the 90/10 one-sided confidence interval and the other reporting confidence intervals.

Allocating the sample across strata to achieve target confidence and precision is not a simple exercise and can often require an iterative approach. Proportional sampling is one technique that is often applied, where the total sample size is calculated for the population and subsequently allocated to strata in proportion to some characteristic such as savings. Proportional sampling, however, fails to realize the efficiencies gained from stratifying and very frequently results in over-sampling. Lohr notes:[56]

> *If the variances are more or less equal across all the strata, proportional allocation is probably the best allocation for increasing precision. In cases where the variances vary greatly [across strata], optimal allocation can result in lower costs. In practice, when we are sampling units of different sizes, the larger units are likely to be pre variable than the smaller units [in absolute terms] and we would like to sample them with a higher fraction.*[57]

The California Evaluation Framework notes the skills required:

[54] Based on October 25, 2012 Technical Evaluation Committee decision, the sample design should be based on a 90/10 one-sided confidence interval. Reporting of achieved confidence and precision should present the precision achieved for three confidence intervals: 90% one-sided on the lower bound, 90% one-sided on the upper bound, and 90% two-sided intervals. Appendix A provides additional explanation and illustrative examples for these reporting confidence intervals.

[55] This target may be inferentially interpreted as the intent to ensure that there is a 90% likelihood that the actual savings of the program population exceeds 90% of the sample estimate of program population savings.

[56] Lohr, S. L., "Sampling: Design and Analysis," Second Edition.2010. (Section 3.4.2 discusses optimal allocation)

[57] Lohr, S. L., "Sampling: Design and Analysis," Second Edition.2010. (Section 3.4.2 discusses optimal allocation in more detail – p. 87.)

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> *Stratified ratio estimation is somewhat more complex [than simple random sampling]…it probably still requires someone to have basic training and/or experience in statistics to ensure that it is understood and applied correctly.*[58]

Given the judgment needed to develop a sample design, it is important to test the robustness of the design by simulating different scenarios. Assessing several alternative allocations of the sample across strata can usually improve sample efficiency.

Step 5: Determine criteria for assessing sample representativeness. (optional)
There are often categorical characteristics of the population that are not used in defining strata but are still desired to ensure a reasonably representative sample.[59] For example, market segment may not have been used in defining strata; however, a random sample that fails to include certain major market segments would not be viewed as a representative sample. You could establish new strata for these factors; however, it is expected that a random draw will be representative across these factors and there is a benefit for a simple stratification design.

To address this, some criteria can be defined prior to randomly selecting a sample, which can be used to assess the representativeness of the sample. Criteria should be established only for the most important characteristics, and they should only be set for high-level characteristics that, if not met, would represent an extreme sample that would not representative of the population. Failure to meet the criteria will result in discarding the full original sample and selecting an alternate full sample. Criteria can be established only for the total population or specific strata as appropriate (See example in Section 5.5). Selection of a sample that does not meet representativeness criteria should be a rare occurrence. This approach is only meant to mitigate the possibility that a randomly selected sample might result in highly inaccurate statements about the entire population. The necessity to discard the original sample should not occur in most program years.

Step 6: Select a random sample.
The sample for each stratum should be selected at random from a uniform distribution. This provides an equal opportunity for each project within a stratum to be selected.[60] This can be accomplished in Microsoft Excel using the RAND() function[61] to assign a random number between 0 and 1 to each project in a stratum. The projects should be sorted within each stratum

[58] "The California Evaluation Framework." California Public Utilities Commission. Prepared by TecMarket Works. June 2004, p. 316.

[59] These criteria are not intended to be overly restrictive in selecting a sample. Rather, they are intended to prevent the unlikely but possible case where extreme over-representation or under-representation of certain project characteristics occurs in the sample.

[60] Sampling from a savings-weighted distribution can also be valid, but it is not recommended here since size-based strata are already employed.

[61] Note that the RAND() function will continue to generate a new set of random numbers each time a cell is updated. To prevent this, the values of the RAND() function can be copied and pasted (i.e., "paste values") into a separate column.

based on the random number assigned to it, and the projects with the highest random number should be selected for the sample until the target stratum sample size is reached.

The selected sample should be analyzed and documented. If criteria are set to assess the representativeness, the selected sample should be analyzed against these criteria at this point. If the sample does not meet the criteria for representativeness, then the full population sample should be discarded and a new sample should be selected.

Recruiting the full selected sample is often not achievable since some program participants may not respond or refuse to participate in the sample. Even when agreement to participate in evaluation activities is required to participate in the program, full recruitment of the selected sample can often not be achieved. Therefore, a set of potential replacement projects may be provided to recruiters to fill in for non-recruited participants.

Potential replacements should be selected from the same random number list of the population from which the original sample was selected. Replacements should be selected in priority of assigned random number until full recruitment is achieved. The full population of a stratum should not be provided to recruiters, whose incentives are not usually aligned to follow the random prioritization of the sample, unless the full sample size is not expected to be achieved.

Step 7: Recruit the sample.
Recruitment of each stratum sample can begin once the sample has been selected and assessed. Recruitment typically occurs over the phone, and may or may not involve scheduling of the on-site evaluation visit. Ensuring the accuracy and completeness of contact information in the tracking database can streamline the recruitment task.

The list of potential replacements may be initially withheld from recruiters to ensure that the originally selected sample projects are pursued fully before being replaced by alternate projects. This can help reduce the possibility for non-response bias in the sample. The California Evaluation Framework notes:[62]

> *It is very important to use the backup sample correctly. The most efficient way to recruit a sample of the desired size may appear to be to contact both the primary and backup sample at once and to schedule those sites that are first to respond and agree. But this is generally not sound practice since this approach ensures that the response will be no better than 50%, assuming that the backup sample size is equal to the primary sample size. Instead, the initial recruiting effort should be limited to the primary sample. A backup should be used only if a primary sample site is impossible to contact or refuses to participate.* (p. 350)

[62] "The California Evaluation Framework." California Public Utilities Commission. Prepared by TecMarket Works. June 2004.

A full effort should be made to recruit the original sample before resorting to replacements, and the same effort should be made to recruit each replacement before moving on to the next.

5.5 Example Implementation of Sample Design Methodology (Union)

This section demonstrates how the sample design methodology might be implemented for an example set of Union program data. The data used for this example has been randomized and does not indicate historic program achievements that have undergone regulatory review in prior years. The data for this example is intended to be representative of a typical program year and are used in this example for illustrative purposes only. This example is for reference and does not preclude the judgment needed to understand and address the idiosyncrasies of actual program data.

This example applies the seven steps of the sample design process presented in Section 5.4 above.

Step 1 reviews the project tracking database for accuracy and quality. Of particular emphasis is a check on the processes used to produce the initial estimates for savings contained in the database and the contact information. This step is usually undertaken by the utility and is done to provide the third-party evaluator with the best information possible. As mentioned above, a more accurate tracking database will make it more likely that confidence and precision targets will be met. This example assumes that the tracking database has been reviewed.

Step 2 evaluates the population and defines strata. Gross *cumulative* gas savings measured in cubic meters (m^3) is the primary impact to be studied and should serve as the basis of the sample design. Figure 4 and Figure 5 show representative project distributions of savings[63] for Union's T1/R100 and C/I programs, respectively. Analyzing the distribution of project sizes indicates that size-based stratification should produce sampling efficiencies. Other categorical bases for stratification are not chosen for this example, although Union may consider isolating new technologies into a unique stratum for future evaluation efforts.

[63] The initial manual produced in November, 2012 used net gas savings in the examples. In this revised report, the example analyses are performed on cumulative gross savings values to correctly illustrate how the sampling and the application of population-wide realization rates for the utilities should be performed in current sampling efforts.

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Figure 4. Illustrative Distribution of Savings for Union'sT1/R100 Projects

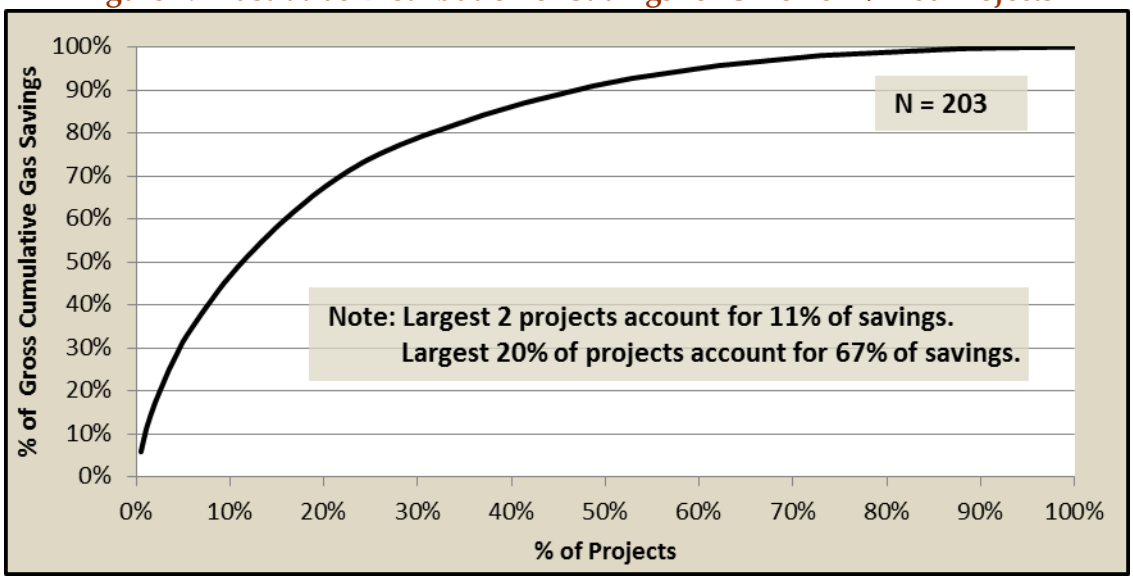
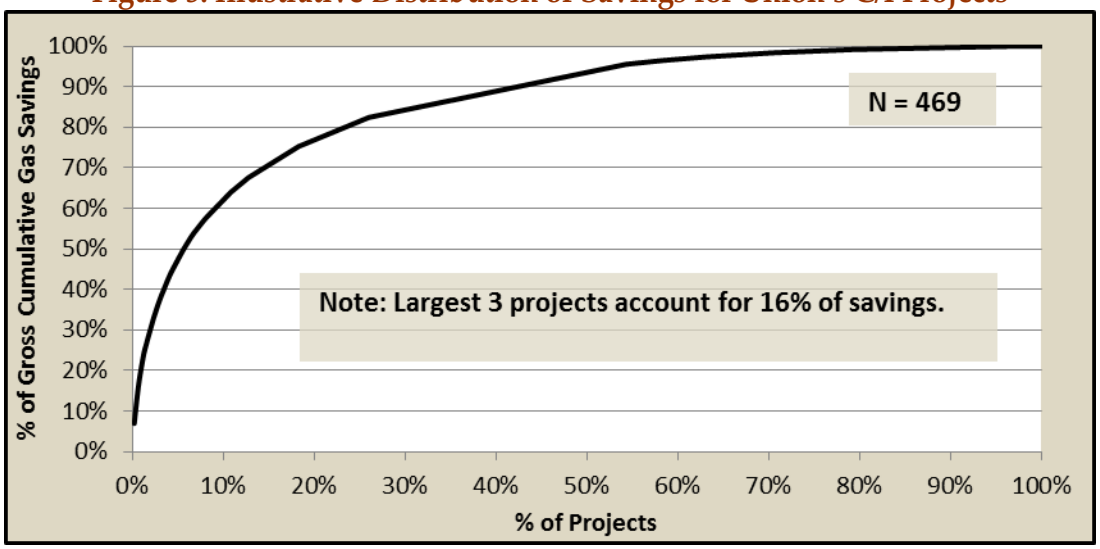


Figure 5. Illustrative Distribution of Savings for Union's C/I Projects



The sensitivity to sample sizes is investigated to determine appropriate savings thresholds for strata bounds. Figure 6 and Figure 7 show illustrative strata boundaries for Union's T1/R100 and C/I programs, respectively.

Figure 6. Illustrative Strata Boundaries for Union's T1/R100 Projects

Stratum Size	Lower Threshold of Cumulative Gross Gas Savings (m^3)	Projects	Savings Represented (%)
Large	50,000,000	10	31.4%
Medium	25,000,000	28	33.9%
Small	2,500,000	110	32.8%
Very Small	0	55	1.9%

Figure 7. Illustrative Strata Boundaries for Union's C/I Projects

Stratum Size	Lower Threshold of Cumulative Gross Gas Savings (m^3)	Projects	Savings Represented (%)
Large	25,000,000	11	33.0%
Medium	5,000,000	49	34.6%
Small	1,500,000	195	27.9%
Very Small	0	214	4.5%

The "Very Small" projects—representing the bottom 1.9% of T1/R100 program savings and the bottom 4.5% of C/I program savings—are removed from the sample frame. These projects are small enough that the value of the information gained by evaluating them is not likely to be worth the cost. These projects should be adjusted by the Small Project stratum realization rate when re-introduced in the final sample analysis.

Step 3 estimates an appropriate variance for each stratum. Historical evaluation results indicate that CVs on project realization rates have been as low as 0.20 or as high as 0.40. However, typical CVs have been near 0.25. CVs are set at 0.30 for all strata in this example.

Step 4 allocates observations to each stratum. Figure 8 and Figure 9 indicate the sample sizes[64] and the assumptions used to allocate the samples when applying the calculations presented in Appendix B.

Figure 8. Illustrative Sample Allocation for Union's T1/R100 Projects

Stratum Size	Population Size	Sample Size	CV	T - value	FPC	Mean Gross Cumulative Gas Savings	Total Gross Cumulative Gas Savings	Stratum Weight
Large	10	7	0.3	1.94	0.58	88,950,000	889,500,000	0.32
Medium	28	7	0.3	1.94	0.88	34,339,286	961,500,000	0.35
Small	110	6	0.3	2.02	0.98	8,454,545	930,000,000	0.33
	148	20		1.73				1.00

[64] In previous program cycles when Union's custom programs were differentiated based on service contract rather than rate class, the differences between program sample sizes were much greater. Sample sizes will likely be more similar for the Union programs now that the programs differentiated based on rate class.

Figure 9. Illustrative Sample Allocation for Union's C/I Projects

Stratum Size	Population Size	Sample Size	CV	T - value	FPC	Mean Gross Cumulative Gas Savings	Total Gross Cumulative Gas Savings	Stratum Weight
Large	11	6	0.3	2.02	0.71	45,545,455	501,000,000	0.35
Medium	49	7	0.3	1.94	0.94	10,744,898	526,500,000	0.36
Small	195	7	0.3	1.94	0.98	2,176,923	424,500,000	0.29
	255	20		1.73				1.00

The sample allocations are restricted to less than 75% of the total population for the two Large Project strata. This restriction allows for some backup projects to exist for the Large Project strata so that if recruitment of the original sample is unsuccessful, backup projects can be used and the sample will likely not require re-stratification or re-allocation.

Step 5 determines criteria for assessing sample representativeness. Note that this is listed as an optional step; however, it can be important for ensuring that the most appropriate information is provided from this analysis for making regulatory decisions such as payment of incentives and future program decisions. While the sample methodology applies techniques to minimize the required sample sizes, the smaller samples are at an increased risk that a given random sample is not sufficiently representative for extrapolation to the population and used to assess whether savings targets have been met. This is why ensuring representativeness is an important step.

This example establishes simple criteria to ensure representativeness of the sample across market segment in the R1/T100 and the C/I program sample.[65] Several market segments are specified in the tracking database, and their proportions are shown in Figure 10 and Figure 11.

Figure 10. Illustrative Representativeness Analysis of Project Market Segment for Union'sT1/R100 Program

Project Market Segment	Large Projects Gross			Medium Projects Gross			Small Projects Gross		
	#	Cumulative m^3	%	#	Cumulative m^3	%	#	Cumulative m^3	%
Agriculture							6	54,000,000	6%
Food Services							1	12,000,000	1%
Healthcare							5	33,000,000	4%
Manufacturing	10	889,500,000	100%	27	919,500,000	96%	86	753,000,000	81%
Resource									
Utility				1	42,000,000	4%	12	78,000,000	8%
	10	889,500,000	100%	28	961,500,000	100%	110	930,000,000	100%

The main concern is that a randomly selected sample might under-represent the most important market segments, leading to a bias in program results. In these sample designs, less than ten

[65] Union and its sampling advisor may determine that no criteria are needed or that other criteria are needed based on judgment and assessment of actual program data.

sites may be drawn in a stratum; therefore, it is not impossible that this small sample size might be quite unrepresentative in some strata due to an unlucky sample draw. Increasing the sample sizes in each stratum could help resolve this issue, but the high cost of visiting each site and gathering the verification data makes this very expensive. As a result, this representativeness check should be considered.

In the T1/R100 program, manufacturing is clearly the dominant market segment and ensuring that a representative sample from this segment across size categories is all that may be needed; however, an evaluator may want to check to see if the random project selection (in the next step) provides some projects from non-manufacturing segments such as agriculture and utility market segments. The most significant risk is likely to occur in the small projects sample where manufacturing accounts for 78% of the projects and 81% of the savings. It could be possible to have an "extreme" sample occur in a random draw where non-manufacturing sites are "overly" represented.[66] The sample for this stratum is only six projects. If five of these projects are non-manufacturing when manufacturing accounts for 81% of the savings, this sample may not provide the information desired from this verification effort. A criteria that at least three of the projects in this stratum be manufacturing projects may represent the minimum needed to consider the sample representative overall.

Figure 11. Illustrative Representativeness Analysis of Project Market Segment for Union's C/I Program

Project Market	Large Projects Gross			Medium Projects Gross			Small Projects Gross		
Segment	#	Cumulative m^3	%	#	Cumulative m^3	%	#	Cumulative m^3	%
Agriculture				17	151,500,000	29%	56	121,500,000	29%
Education	2	144,000,000	29%	1	7,500,000	1%	13	36,000,000	8%
Entertainment							2	4,500,000	1%
Healthcare							19	33,000,000	8%
Manufacturing	9	357,000,000	71%	31	367,500,000	70%	99	214,500,000	51%
Multi-Family							2	4,500,000	1%
Resource							1	4,500,000	1%
Retail							1	1,500,000	0%
Transport							1	3,000,000	1%
Utility							1	1,500,000	0%
	11	501,000,000	100%	49	526,500,000	100%	195	424,500,000	100%

In the C/I program, the most important market segment is clearly manufacturing, followed by agriculture and education. To ensure that this is a representative sample, it may be important to be sure that the projects selected in the next step (random selection) contain some projects from each of these market segments. Manufacturing represents 65% of the overall savings. The agriculture and education market segments account for 19% and 13%, respectively, or 32% of total savings when taken together. Given a sample size of 20 overall, and no more than 7 in each stratum, a sample might be drawn that could be extreme and may not be an accurate

[66] What constitutes "overly" represented simply has to be defined by judgment exercised by the evaluator.

representation of the population. Again, the concern is the high cost of conducting the site visits, which argues against simply expanding the sample size or adding new strata. To ensure that manufacturing does not entirely dominate the sample, it might be good to set representativeness criteria, for example, that at least four sites be non-manufacturing sites.

Step 6 selects a random sample. The selection of the sample should be uniformly random within each stratum. This is accomplished by applying the RAND() function in Microsoft Excel and selecting the projects with the highest randomly assigned numbers to fulfill sample size requirements. The sample is reviewed to ensure that it meets any previously established criteria. Backup projects are also selected to replace any projects from the primary sample that are not successfully recruited.

Step 7 recruits the sample. Projects from the primary sample are only replaced after four recruitment attempts on four different dates. Projects that are not successfully recruited are documented before being replaced by backup projects.

These seven steps illustrate how the sample design methodology might be implemented using representative data. Following verification and evaluation of the sample, the sample data should be analyzed according to the realization rate methodology presented in Section 6 and according to the calculations presented in Appendix B.

5.6 Example Implementation of Sample Design Methodology (Enbridge)

This section demonstrates how the sample design methodology might be implemented for an example set of Enbridge program data. The data used for this example has been randomized and does not indicate historic program achievements that have undergone regulatory review in prior years. The data for this example is intended to be representative of a typical program year for illustrative purposes only. This example is for reference and does not preclude the judgment needed to understand and address the idiosyncrasies of actual program data.

This example applies the steps of the sample design process presented in Section 5.4.

Step 1 reviews the project tracking database for accuracy and quality. Of particular emphasis is a check on the processes used to produce the initial estimates for savings contained in the database and the contact information. This step is usually undertaken by the utility and is done to provide the third-party evaluator with the best information possible. As mentioned above, a more accurate tracking database will make it more likely that confidence and precision targets will be met. This example assumes that the tracking database has been reviewed.

Step 2 evaluates the population and defines strata. Gross *cumulative* gas savings measured in cubic meters (m^3) is the primary impact to be studied and should serve as the basis of the

sample design. Figure 12 and Figure 13 show representative project distributions of savings[67] for Enbridge's commercial and industrial programs, respectively. Analyzing the distribution of project sizes indicates that size-based stratification should produce sampling efficiencies. Other categorical bases for stratification are not chosen for this example.

Figure 12. Illustrative Distribution of Savings for Enbridge Commercial Projects

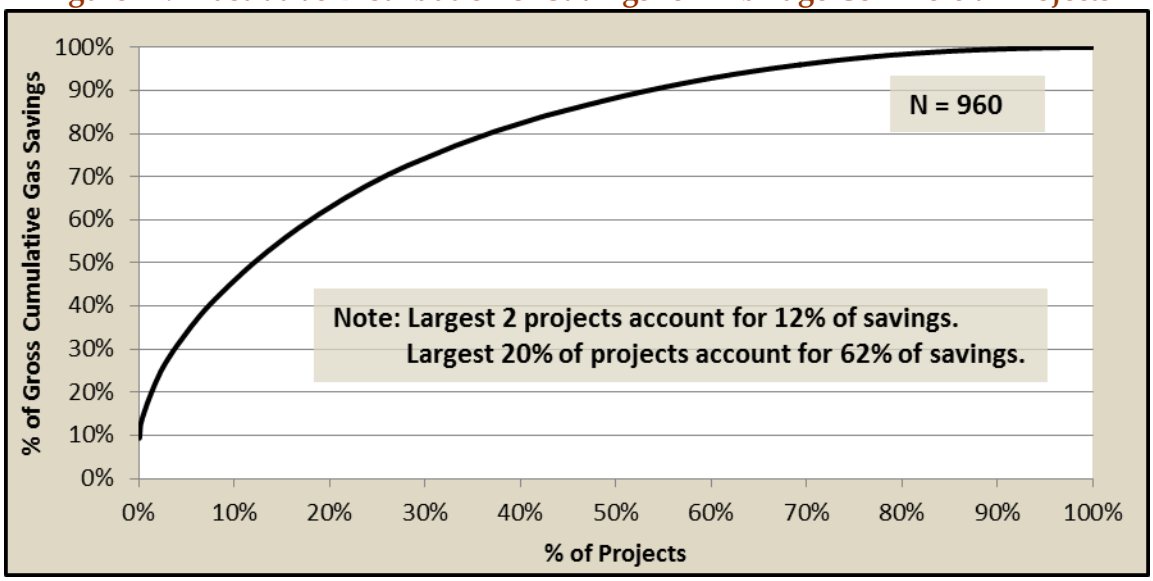
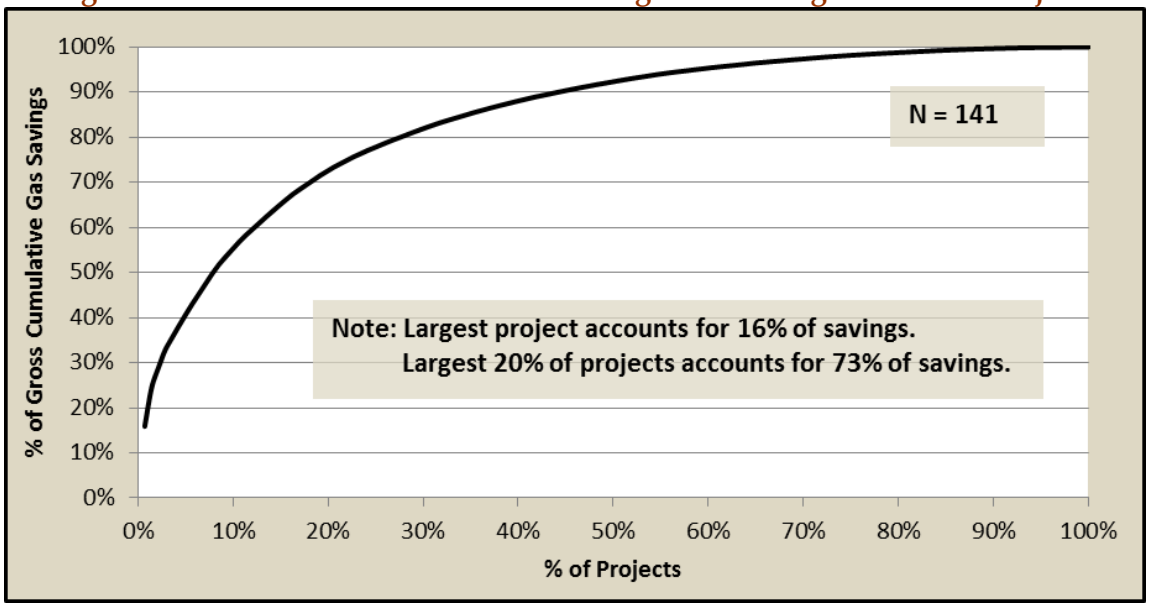


Figure 13. Illustrative Distribution of Savings for Enbridge Industrial Projects



[67] The initial manual produced in November, 2012 used net gas savings in the examples. In this revised report, the example analyses are performed on cumulative gross savings values to correctly illustrate how that the sampling and the application of population-wide realization rates for the utilities should be performed in these sampling analyses.

The sensitivity to sample sizes is investigated to determine appropriate savings thresholds for strata bounds. Since the commercial program has a relatively large number of projects, it is necessary to balance the effects of strata weight with the effects of finite population correction when determining the threshold for the Large Project stratum. Figure 14 and Figure 15 show illustrative strata boundaries for Enbridge's commercial and industrial programs, respectively.

Figure 14. Illustrative Strata Boundaries for Enbridge Commercial Projects

Stratum Size	Lower Threshold of Cumulative Gross Gas Savings (m^3)	Projects	Savings Represented (%)
Large	8,000,000	9	17.6%
Medium	2,000,000	153	40.7%
Small	400,000	479	36.9%
Very Small	0	319	4.8%

Figure 15. Illustrative Strata Boundaries for Enbridge Industrial Projects

Stratum Size	Lower Threshold of Cumulative Gross Gas Savings (m^3)	Projects	Savings Represented (%)
Large	14,000,000	8	40.5%
Medium	5,000,000	22	32.8%
Small	500,000	79	25.1%
Very Small	0	32	1.5%

The "Very Small" projects—representing the bottom 4.8% of commercial program savings and the bottom 1.5% of industrial program savings—are removed from the sample frame. These projects are small enough that the value of the information gained by evaluating them is not likely to be worth the cost. These projects should be adjusted by the Small Project stratum realization rate when re-introduced in the final sample analysis.

Step 3 estimates an appropriate variance for each stratum. Historical evaluation results indicate that CVs on project realization rates have been very low, sometimes less than 0.10. However, applying CVs less than 0.30 is not recommended in order to ensure sample sizes sufficient for robust results and to allow for increasing variances that may result from evolving measurement approaches and program participation. CVs are set at 0.30 for all strata in this example.

Step 4 allocates observations to each stratum. Figure 16 and Figure 17 indicate the sample sizes and the assumptions used to allocate the samples when applying the calculations presented in Appendix B.

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Figure 16. Illustrative Sample Allocation for Enbridge's Commercial Program

Stratum Size	Population Size	Sample Size	CV	T - value	FPC	Mean Gross Cumulative Gas Savings	Total Gross Cumulative Gas Savings	Stratum Weight
Large	9	5	0.3	2.13	0.71	751,111	6,760,000	0.18
Medium	98	8	0.3	1.89	0.97	110,384	13,798,000	0.37
Small	590	11	0.3	1.81	0.99	29,766	16,758,000	0.45
	697	24		1.71				1.00

Figure 17. Illustrative Sample Allocation for Enbridge's Industrial Program

Stratum Size	Population Size	Sample Size	CV	T - value	FPC	Mean Gross Cumulative Gas Savings	Total Gross Cumulative Gas Savings	Stratum Weight
Large	8	6	0.3	2.02	0.41	33,321,429	233,250,000	0.41
Medium	22	6	0.3	2.13	0.87	8,590,909	189,000,000	0.33
Small	79	5	0.3	2.35	0.97	1,809,938	144,795,000	0.26
	109	17		1.75				1.00

The key reason that the required sample size is smaller for the industrial program than the commercial program is that a larger fraction of the savings is concentrated in a smaller number of projects for the industrial program. The sample allocations are restricted to less than 75% of the total population for the two Large Project strata. This restriction allows for some backup projects to exist for the Large Project strata so that if recruitment of the original sample is unsuccessful, backup projects can be used and the sample will likely not require re-stratification or re-allocation.

Step 5 determines criteria for assessing sample representativeness. Note that this is listed as an optional step ; however, it can be important for ensuring that the most appropriate information is provided from this analysis for making regulatory decisions such as payment of incentives and future program decisions. While the sample methodology applies techniques to minimize the required sample sizes, the smaller samples are at an increased risk that a given random sample is not sufficiently representative for extrapolation to the population and used to assess whether savings targets have been met. This is why ensuring representativeness is an important step.

This example establishes a simple criterion to ensure representativeness of load type in the commercial program sample.[68] Three load types are specified in the tracking database, and their proportions are shown in Figure 18.

[68] Enbridge and its sampling advisor may determine that no criteria are needed or that other criteria are needed based on judgment and assessment of actual program data.

Figure 18. Illustrative Analysis of Project Load Types for Enbridge's Commercial Program

Project Market Segment	Large Projects Gross #	Large Projects Gross Cumulative m3	Large Projects Gross %	Medium Projects Gross #	Medium Projects Gross Cumulative m3	Medium Projects Gross %	Small Projects Gross #	Small Projects Gross Cumulative m3	Small Projects Gross %
Space Heating	7	202,200,000	92%	135	438,300,000	86%	416	414,660,000	89%
Water Heating	1	10,500,000	5%	5	16,500,000	3%	53	37,440,000	8%
Combined	1	8,100,000	4%	13	55,800,000	11%	10	11,670,000	3%
Grand Total	9	220,800,000	100%	153	510,600,000	100%	479	463,770,000	100%

The main concern is that a randomly selected sample might over-represent water heating to the detriment of properly representing space heating projects simply due to an unlucky draw of insufficiently representative projects. As example criteria, it might be reasonable to require that space heating projects must account for at least 70% of the savings in each stratum. A sample that does not meet these criteria would be viewed as unrepresentative and would be discarded and re-selected.

Step 6 selects a random sample. The selection of the sample should be uniformly random within each stratum. This is accomplished by applying the RAND() function in Microsoft Excel and selecting the projects with the highest randomly assigned numbers to fulfill sample size requirements. The sample is reviewed to ensure that it meets any previously established criteria. Backup projects are also selected to replace any projects from the primary sample that are not successfully recruited.

Step 7 recruits the sample. Projects from the primary sample are only replaced after four recruitment attempts on four different dates. Projects that are not successfully recruited are documented before being replaced by backup projects.

These seven steps illustrate how the sample design methodology might be implemented using representative data. Following verification and evaluation of the sample, the sample data should be analyzed according to the realization rate methodology presented in Section 6 and according to the calculations presented in Appendix B.

5.7 Summary of Sample Design Methodology

The sample design methodology described in this section is meant to apply advanced industry practices to create a cost-efficient sample by leveraging preexisting project and program information to the greatest extent possible. The methodology can be described as employing a "stratified ratio-estimation" approach. The sample is administered in two stages to make the best use of early observations that can be collected prior to completion of the program year. The methodology provides a step-by-step description of sample design tasks, but leaves flexibility to accommodate program changes in future years and cycles.

6. Recommended Realization Rate Methodology

This section describes the recommended methodology for determining realization rates and achieved confidence and precision based on sample observations of custom DSM programs for Union and Enbridge. Section 6.1 describes the approach to determine verified realization rates. Section 6.2 describes the approach to determine the precision on the realization rate and total savings achieved by the sample. Section 6.3 discusses several potential adjustments that may be needed to ensure that the results appropriately characterize the population and provide the information needed by the utilities and stakeholders.

It is important ensure the quality of sample observation data prior to calculating achieved realization rates and savings. Data quality issues can sometimes be discovered when analyzing the sample, but it can be costly to correct the data at that point. Undetected data quality issues would result in inaccuracies of total savings and precision estimates.

6.1 Determining Verified Realization Rates

Gross realization rates should be calculated for each stratum sample and applied to each respective stratum population when estimating total gross cumulative gas savings.[69]

Applying gross realization rates to population strata is more complicated than assessing the results in a simple random sample without strata, but it is necessary when efficiencies are sought through stratification.[70]Again, efficiencies are important in this application due to the high cost of gathering the verification data at each sample site. Lohr notes:

> *The population total is the [sum across all strata of the estimated stratum population mean times the stratum population size]…This is a weighted average of the sample stratum averages; the weights are the relative sizes of the strata. To use stratified sampling, the sizes or relative sizes of the strata must be known.* [71]

Also, Wadsworth notes:

> *The estimator of the total of a stratified population can be expressed as the sum of strata of estimators of the individual stratum totals. This representation suggests the valid generalization that the estimator of the total in a stratum need not be limited to the expansion estimator, but could be any appropriate estimator of the population in the stratum, including a ratio*

[69] Ultimately, adjusted gross savings can be converted to adjusted net savings (i.e. by applying a program net-to-gross ratio to the adjusted program gross savings). However, that would occur outside of (i.e. after) the application of the sampling work discussed in this report.

[70] There are examples in the evaluation literature where strata weights have not been used in the calculation of the mean realization weight. This is clearly an oversight in these evaluations as it is a simple matter to weight the mean ratios of each stratum by the appropriate stratum weight (i.e., the proportion of the population in that stratum).

[71] Lohr, S. L., "Sampling: Design and Analysis," Second Edition. 2010, p. 69.

estimator…then an estimate of the total in a stratified population may be constructed as a sum over strata. [72]

These are standard procedures for developing population estimates from a stratified sample. The methods for estimating the population parameters must take into account the strata weights when stratification is used. The calculations needed to develop a verified gross realization rate from stratified sample data are shown in Appendix B. This approach is based on widely recognized methods published by Lohr.[73]

This approach for determining gross realization rates is consistent with the recommended sample design methodology presented in Section 5.

6.2 Determining Achieved Confidence & Precision

A precision level cannot be calculated without first establishing the confidence level. The calculation for both confidence and precision comes from the same basic equation. Either confidence or precision is first established, then the other is solved for. For example, a precision of +/- 10% implies that the stated confidence level should span +/- 10% from the mean estimate. The confidence may turn out to be 90%, 82% or another value. The confidence level is more typically established and the precision is solved for. For example, the level of precision achieved at a 90% level of confidence can be calculated and may turn out to be 10%, 12%, 15% or some other number (as illustrated in Appendix A). Regardless, the calculating confidence and precision are part of the same equation and one cannot be estimated without establishing the other. Misunderstanding this basic concept frequently leads to problems in presenting and discussing evaluation results in the industry. Additional discussion on confidence and precision can be found in Appendix A.

Confidence and precision calculations also have to take into account the fact that a stratified random sample has been used. The equations for calculating confidence and precision from a stratified sample design are shown in Appendix B. This approach for determining confidence and precision is consistent with the recommended sampling methodology in Section 5, and it is consistent with the population realization rate and savings estimates described in Section 6.1.

Communications with the TEC indicated that they were interested in both the likelihood that savings exceeds a given value and the likelihood that it falls above a given value. As a result, the recommendation is to report achieved confidence and precision in three ways:[74]

1. Achieved precision corresponding to 90% one-sided confidence on the lower bound
2. Achieved precision corresponding to 90% one-sided confidence on the upper bound[75]

[72] Wadsworth, H.M., "Handbook of Statistical Methods for Engineers and Scientists," 1990, p. 9.25.
[73] Lohr, S. L., "Sampling: Design and Analysis," Second Edition.2010. (Sections 4.1-4.5)
[74] The achieved precision is a result of analyzing the sample data, and will usually differ to some extent from the targeted precision applied in designing the sample.

3. Achieved precision corresponding to a 90% two-sided confidence interval

Appendix A provides additional explanation and illustrative examples for the reporting of confidence and precision in the estimated realization rate. The Figures in Appendix A are intended to clarify the interpretation of confidence and precision in making decisions based on the estimated realization rate.

6.3 Sample Adjustments & Related Issues

This section discusses several sampling adjustments that may be needed to accurately synthesize the total population realization rate and savings estimates. The following three types of adjustments are discussed:

1. Treatment of outliers and influential observations
2. Replacing sample projects
3. Post-stratification

Appropriately treating outliers and influential observations is important in accurately estimating the realized savings for DSM programs. Parties to a discussion of estimating program savings should understand appropriate treatment of outliers and influential observations when estimates are based on a sample of the population.

Treatment of Outliers & Influential Observations

This section first presents a conceptual discussion. Following this discussion, an example from a recent Union custom program evaluation is presented. Most statistical analyses should examine the data for outliers and test to determine whether these outliers may be "influential observations" that can skew the accuracy of a sample. Kennedy states the rationale for treating outliers:

> *The rationale for looking for outliers is that they may have a strong influence on the estimates…an influence that may not be desired.* [76]

In other words, the reason for looking for evaluating outliers is that there may be a sample case drawn that is well outside the expected bounds of the distribution and that this observation may exert undue influence on the estimates of the analysis (i.e., an influential observation). Osborne and Overbay further describe the effect of outliers:

> *The presence of outliers can lead to inflated error rates and substantial distortions of parameter and statistic estimates when using either parametric or nonparametric tests (e.g., Zimmerman,*

[75] Achieved precision of the upper bound represents a simple inversion of the confidence interval for the lower bound. Reporting on the upper bound is intended to facilitate an understanding that sampling uncertainties can just as likely lead to underestimation of the realization rate and therefore underestimating overall program savings as they are to result in overestimates.

[76] Kennedy, P. "A Guide to Econometrics." Third Edition. MIT Press, 1992, p. 279.

> *1994, 1995, 1998). Casual observation of the literature suggests that researchers rarely report checking for outliers of any sort.*[77]

The issue is whether it is appropriate for a single observation to swing the overall results in a substantial manner.[78] If such an observation is found, then further study is needed to determine the most appropriate course of action. In general, a sample of 10 from a population of 100 projects implies that each sample point represents 10 projects. However, if a selected sample point is truly a unique case and does not represent other projects in the population, then an adjustment may be warranted. Osborne and Overbay go on to state:

> *[The appropriate treatment] depends in large part on why an outlier is in the data in the first place. Where outliers are illegitimately included in the data, it is only common sense that those data points should be removed… Few should disagree with that statement.*

The sample analysis should seek to determine whether or not outliers and influential observations can be viewed as representative members of the main population upon which population estimates may be inferred. Barnett and Lewis note:[79]

> *If they are not [suitable]…they may frustrate attempts to draw inferences about the original (main) population.*

One example can be taken from the analysis of the sample observation in Union's 2011 custom program. Two outliers were identified in the Distribution Contract (DC) custom program. One verified project observed a gas savings realization rate of 3.75 and a second project observed a realization rate of 0.18. A sensitivity analysis tested for the influence of these two observations by removing[80] them and noting the changes in results.[81]

The estimated overall realization rate for gas savings when including both observations was 1.25. This is a relatively high realization rate when compared to evaluation efforts across North America, but not an unheard of result. Excluding the high observation lowered the estimated overall estimate from 1.25 to 1.05. Excluding the low observation raised the overall estimate

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[77] Osborne, J., Overbay, A. "The Power of Outliers and Why Researchers Should Always Check for Them."2004 Practical Assessment, Research & Evaluation, volume 9, section 6. Link: http://pareonline.net/getvn.asp?v=9&n=6

[78] A simple intuitive example of the impacts an outlier can have on a statistical analysis can be found in a Wikipedia contribution (8/20/2012): *Naive interpretation of statistics derived from data sets that include outliers may be misleading. For example, if one is calculating the average temperature of 10 objects in a room, and nine of them are between 20 and 25 °C, but an oven is at 175 °C, the median of the data could be between 20 and 25 °C but the mean temperature will be between 35.5 and 40 °C. In this case, the median better reflects the temperature of a randomly sampled object than the mean; however, naively interpreting the mean as "a typical sample", equivalent to the median, is incorrect. As illustrated in this case, outliers may be indicative of data points that belong to a different population than the rest of the sample set.*

[79] Barnett, V., Lewis, T., "Outliers in Statistical Data." Wiley Series in Probability & Statistics, 1998/1994.

[80] Removing or excluding an outlier entails isolating the sample point in a unique stratum such that the sample point still counts in the analysis, but it is not used for extrapolating results for the un-sampled population.

[81] Note that some observations may be identified as outliers but do not significantly influence the analysis results.

from 1.25 to 1.32. Excluding both outliers produced an overall realization rate on gas savings of 1.11.

Discussions were held with Union concerning the two outlier observations. It is important not to exclude an observation without examining the reasons that may contribute to the observation's extreme value. If the observation is representative of other projects in the population, it should be left in. If it can be shown to result from a one-time construct and is not likely to be replicated by other members of the population, then exclusion of this observation should be considered. The discussions with Union indicated that both observations were likely due to unique calculation issues and technologies involved.

The most conservative position in treating this outlier issue was taken—the high observation was removed and the low observation was retained in the sample data set. This produces the lowest overall program realization rate given the choices in addressing the identified outliers. However, removing outliers in strata with small sample sizes may also adversely affect the confidence and precision results and the sample may require augmentation to achieve confidence and precision targets.

Projects that implement new technologies—whose savings estimates have had less validation—or certain technology classes that are complex and difficult to estimate for the tracking database may be at an increased likelihood to result in outlier realization rates. Identifying such projects in the program tracking database could help isolate them and reduce their chance of skewing program estimates. These projects could be placed into a separate category with different confidence and precision targets for new technologies. Any projects that are truly unique should be identified and addressed during sample design. These steps would not eliminate these projects in terms of their contribution to overall program savings, but would allow for appropriate methods to more accurately estimate program savings. If sampled, these unique projects should not be considered representative of other projects in the main program. As a result, addressing this issue in advance could improve the sample analysis and the resulting program estimates.

Replacing Sample Projects

The final recruited sample should be analyzed and summarized, especially when replacement projects are substituted into the originally selected sample. Recruiters should document the reasons for unsuccessful recruitment of original sample members. Replacement samples should always be selected in priority based on the assigned random number, and full effort should be made to recruit selected replacements before substituting other replacements. If recruitment rates are very poor, this may introduce a significant non-response bias. Low recruitment rates should be investigated and documented, and recommendations may be made to improve recruitment in subsequent evaluation years.

Post-Stratification

If a sample did not achieve the desired confidence and precision and the stratification basis is thought to be sub-optimal, post-stratification may be used to retrospectively re-stratify a sample along more appropriate dimensions to demonstrate an improved precision achieved by the sample. Often, post-stratification will not improve achieved precision, especially at relatively small sample sizes; however, under certain circumstances this technique may be useful. The Ontario Power Authority notes that:

> *A technique known as post-stratification may be used to develop estimates about sub-populations after the study is complete and can be used if characteristics about the sub-populations are unknown at the time the study in conducted.*
>
> *This advanced technique should be reserved for special situations and utilized only after careful consideration of other options and well documented in the experimental approach of the Draft Evaluation Plan.* [82]

Post-stratification should not be used on a normal basis, and if necessary should inform subsequent program evaluation cycles to improve the sample frame and prevent the need for post-stratification in future years.

6.4 Summary of Realization Rate Methodology

This section presents the method for calculating verified ex-post realization rates as well as for appropriately calculating the confidence and precision levels for the estimated realization rate and overall program savings. It also discusses three issues that can lead to adjustments to the sample and recalculation of the realization rate along with confidence and precision levels. There are several important concepts presented in this section:

- The program realization rate is inferred from the sample observations based on the separate realization rates for each stratum.
- The realization rate calculations should apply the strata weights to accurately interpret sample observations. This adds a bit of complexity, but no alternate application of the observed data would be appropriate. This is considered standard practice in the application of a stratification approach in statistics.
- There are some important and legitimate considerations that should be examined when inferring estimates for a population from an observed sample. The following three factors are discussed in this section:
    1. Outliers and influential observations
    2. Replacement projects when data cannot be gathered from the originally sampled project

[82] "EM&V Protocols and Requirements: 2011-2014." Ontario Power Authority. March 2011, p. 130.

3. Post-stratification to provide higher precision and greater confidence in the results

The equations needed to calculate the realization rates and achieve confidence and precision from the sample data are contained in Appendix B.

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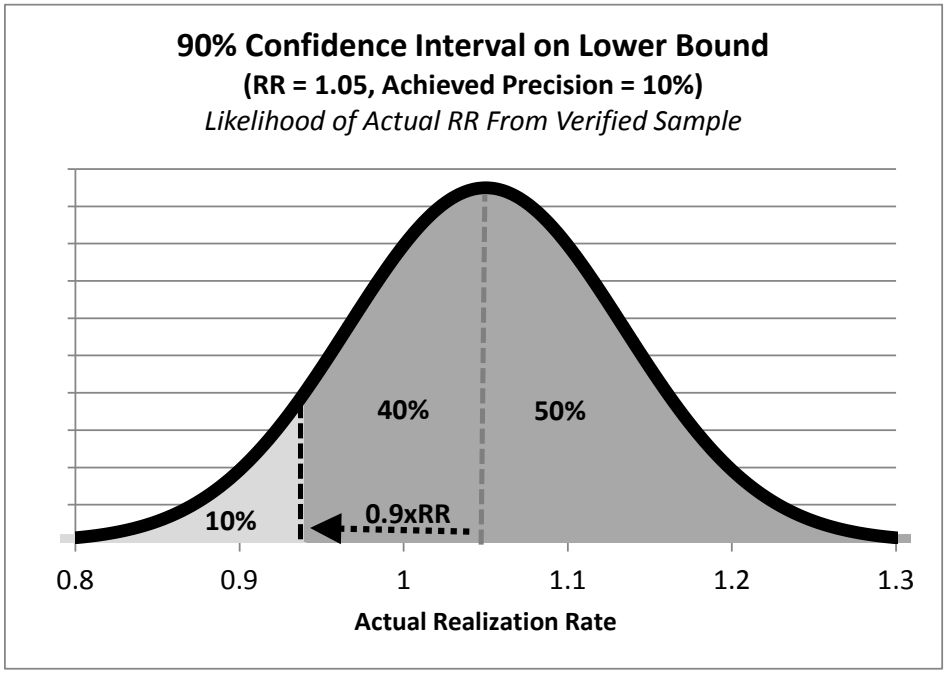
Appendix A. Explanatory Note on Confidence & Precision

The level of certainty associated with a statistical sample is most often stated in terms of a confidence interval. A confidence interval contains two components: confidence level and precision. Confidence level indicates the likelihood that an actual variable either exceeds a value (i.e., one-sided confidence) or falls within a range (i.e., two-sided confidence). Precision[83] indicates the bounding values of the corresponding confidence level. Confidence and precision are both necessary to sufficiently describe a confidence interval.[84]

At the time of this report, the target confidence interval for the design of the sample is established as 90/10 one-sided.[85] Figure 19 illustrates a 90% one-sided confidence interval with 10% precision for a sample whose realization rate (RR) is estimated to be 1.05.

Figure 19. Illustration of a 90% One-Sided Confidence Interval on the Lower Bound



[83] Relative precision (e.g., 10% of the estimate) is most often used to set the precision as a percentage of the estimated value rather than in absolute terms.

[84] Also, the shape (i.e., one-sided or two-sided) is often used to fully specify the confidence interval.

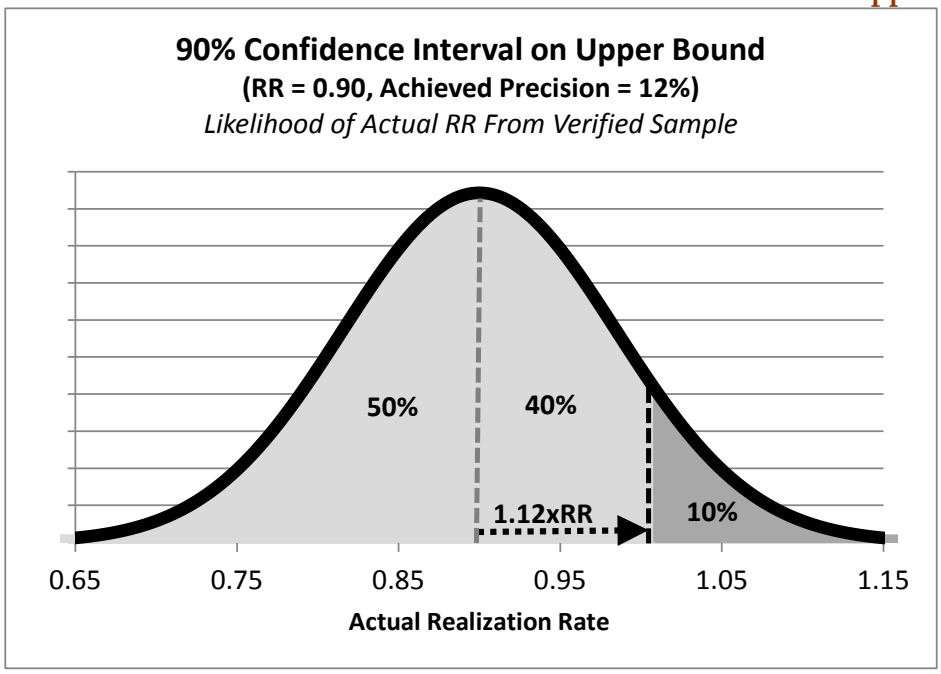
[85] Based on October 25, 2012 Technical Evaluation Committee decision the sample design should be based on a 90/10 one-sided confidence interval. Reporting of achieved confidence and precision should present the precision achieved for both the 90% one-sided and 90% two-sided intervals.

Reading off of Figure 19, this confidence interval can be interpreted as showing that:[86]

- There is a 10% likelihood that the actual value is less than 10% below the mean sample estimate of 1.05.
- There is a 40% likelihood that the actual value falls between 10% below the sample estimate and the sample estimate of 1.05.
- There is a 50% likelihood that the actual value exceeds the sample estimate of 1.05.

The reporting recommendations in Section 6.2 of the main report also call for the reporting of a one-tailed test around an upper bound and a two-tailed test at a 90% confidence level. These are illustrated in Figure 20 and Figure 21. Figure 20 illustrates a 90% one-sided confidence interval on the upper bound. For this illustration a different realization rate estimate is use that was used in Figure 19. In this case, the estimated realization rate is 0.90 and the level of precision achieved at the 90% confidence level is observed from the sample to be 12%. This confidence interval illustrates that the actual value has a 10% likelihood of exceeding the estimated realization rate of 0.90 plus 12% (i.e., exceeding a realization rate 1.01). This likelihood is illustrated by the dark shaded portion of the distribution in the Figure.

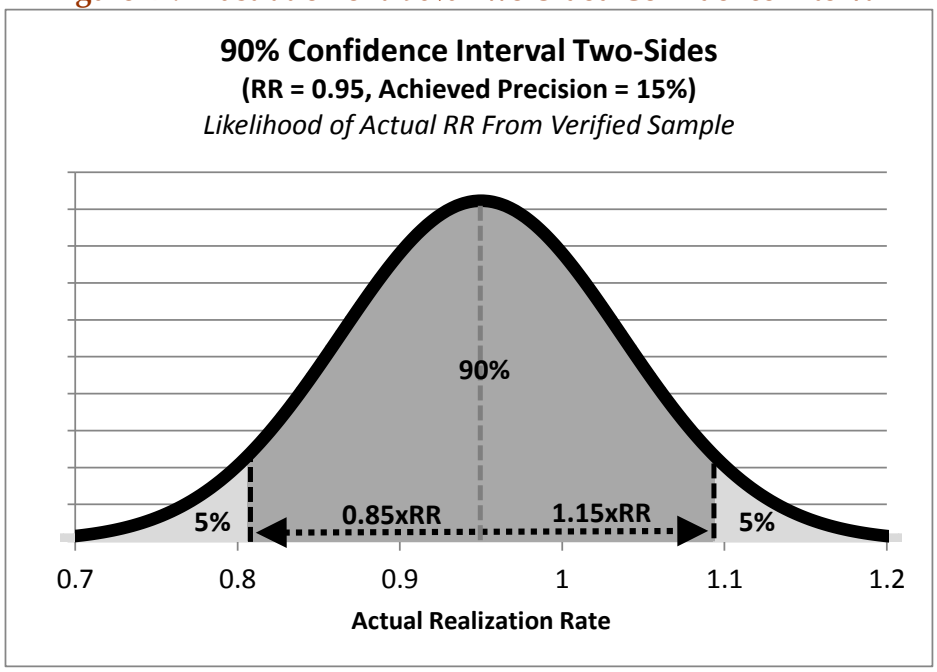
Figure 20. Illustration of a 90% One-Sided Confidence Interval on the Upper Bound



[86] This interpretation of the confidence interval is based on statistical inference, which assumes that the sample provides an adequate representation of the population.

Figure 21 illustrates a 90% two-sided confidence interval on a sample whose realization rate is observed to be 0.95 and whose achieved precision is 15%. The dark shaded area in the middle of the distribution represents the 90% confidence level that the actual value would fall between the bounds set plus or minus 15% of the observed sample estimate. There is only a 5% likelihood that the actual value would fall below the lower bound.

Figure 21. Illustration of a 90% Two-Sided Confidence Interval



Appendix B presents the detailed calculation methods for determining the confidence and precision achieved by a sample.

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Appendix B. Calculation Methods & Equations

B.1 Calculating Target Sample Confidence & Precision from Assumed CV

(Note: The formulae in this appendix are based on application of Lohr[87] and Cochran,[88] and are adapted to the vocabulary of the stratified realization rate problem of efficiency program evaluation.)

The standard error of the total savings of stratum h based on tracked ex ante savings[89] is given by,

$$SE'_h = FPC_h \times \frac{CV_h}{\sqrt{n_h}} \times TS'_h$$

Where CV_h[90] is the estimated coefficient of variation in stratum h, defined as the expected stratum standard deviation divided by the expected stratum mean.[91] Where FPC_h is the finite population correction factor of stratum h, n_h is the sample size of stratum h, and TS'_h is the tracked ex ante total savings in stratum h.[92] FPC_h is given by,

$$FPC_h = \sqrt{\frac{N_h - n_h}{N_h - 1}}$$

Where N_h is the population size of stratum h. The relative precision at the stated confidence level of stratum h is given by,

$$RP'_h = t_h \times \frac{SE'_h}{TS'_h} \times 100\%$$

Where t_h is the t-value derived from the confidence requirement and the sample size of stratum h. The overall standard error can be calculated by aggregating the sample according to each stratum's weighting (i.e., expected percent contribution to total program savings). The overall standard error of the tracked ex ante total savings of the program is given by,

[87] Lohr, S. L., "Sampling: Design and Analysis," Second Edition, 2010.
[88] Cochran, W. G., "Sampling Techniques," Third Edition, 1977.
[89] The prime symbol (apostrophe) is used to indicate that these values are based on tracked ex ante values rather than verified ex post values.
[90] In cases of ratio estimation, the error ratio is substituted for the coefficient of variation.
[91] The coefficient of variation may be based on savings or realization rate, as in the case of ratio estimation.
[92] Total tracked ex ante is not necessarily required to compute relative precision since this term is also in the denominator of the relative precision calculation.

$$SE'_P = \sqrt{\sum_h SE_h{}^2}$$

The overall relative precision at the stated confidence level is given by,

$$RP'_P = t_P \times \frac{SE'_P}{TS'_P} \times 100\%$$

Where t_P is the t-value derived from the confidence requirement and the overall sample size in the population, and TS'_P is the estimated total savings across all strata based on verified ex post savings.

B.2 Calculating Achieved Realization Rates

Defining $x_{i,h}$ as the tracked ex ante estimate and $y_{i,h}$ as the verified ex post estimate of a single sample point i in stratum h, the effective realization rate of a single sample point i in stratum h is given by,

$$RR_{i,h} = \frac{y_{i,h}}{x_{i,h}}$$

The stratum sample realization rate of stratum h is the sum of all verified ex post savings in the sample of stratum h divided by the sum of all tracked ex ante savings in the sample of stratum h, given by,

$$RR_h = \frac{\sum_{i \in h} y_{i,h}}{\sum_{i \in h} x_{i,h}}$$

In stratified ratio estimation, the stratum realization rate should be applied to the tracked ex ante estimates of each member j[93] of the full population of stratum h to produce the total savings estimate for stratum h. The verified total savings estimate for stratum h is the sum of all tracked ex ante estimates in stratum h multiplied by the stratum realization rate, given by,

$$TS_h = RR_h \times \sum_{j \in h} x_{j,h}$$

[93] Note that i members of the sample are a subset of j total members of the applicable population.

The verified total savings of the program can be calculated by aggregating strata results. The program verified total savings estimate is given by,

$$TS_P = \sum_h TS_h$$

The overall realization rate across all strata is the verified total savings of the program divided by the tracked ex ante total savings of the program, given by,

$$RR_P = \frac{TS_P}{TS'_P}$$

B.3 Calculating Achieved Sample Confidence & Precision

A predicted estimate can be made for each member of stratum h based on the stratum realization rate, where the predicted estimate is the tracked ex ante estimate of each member of the stratum multiplied by the stratum realization rate. A residual error can be calculated for each sample point in stratum h based on the difference between the verified ex post savings of the sample point and the predicted estimate. The residual of each sampled point is given by,

$$e_{i,h} = y_{i,h} - RR_h \times x_{i,h}$$

The sample variance[94] of the verified total savings in stratum h is derived from the stratum residuals, given by:

$$V_h = \frac{1}{n_h - 1} \sum_{i \in h} e_{i,h}^2$$

The standard error of the sample of stratum h can be calculated using the stratum sample variance and the finite population correction factor. The standard error of the verified total savings of stratum h is given by,

$$SE_h = FPC_h \times \frac{\sqrt{V_h}}{\sqrt{n_h}} \times N_h$$

[94] Sample variance is based on residuals of the verified measurement compared to the predicted estimate using the stratum realization rate when applying ratio estimation.

The relative precision for the stated confidence level of the verified estimate of stratum h is given by,

$$RP_h = t_h \times \frac{SE_h}{TS_h} \times 100\%$$

The resulting confidence interval can be stated in terms of the realization rate or the total estimate. The absolute two-sided confidence interval for the stratum realization rate and verified total savings of stratum h is given by,

$$RR_h \pm (RR_h \times RP_h) \quad and \quad TS_h \pm (TS_h \times RP_h)$$

The absolute one-sided confidence interval for the stratum realization rate and verified total savings of stratum h is given by,

$$> RR_h - (RR_h \times RP_h) \quad and \quad > TS_h - (TS_h \times RP_h)$$

The standard error of the verified total savings of the program is given by,

$$SE_P = \sqrt{\sum_h SE_h^2}$$

The overall relative precision at the stated confidence level is given by,

$$RP_P = t_P \times \frac{SE_P}{TS_P} \times 100\%$$

The absolute two-sided confidence interval for the overall program realization rate and verified total savings of the program is given by,

$$RR_P \pm (RR_P \times RP_P) \quad and \quad TS_P \pm (TS_P \times RP_P)$$

The absolute one-sided confidence interval for the overall program realization rate and verified total savings of the program is given by,

$$> RR_P - (RR_P \times RP_P) \quad and \quad > TS_P - (TS_P \times RP_P)$$

Appendix C. Summaries of Custom C&I Samples in Selected Jurisdictions

This appendix presents brief summaries of the sampling approaches used in custom commercial and industrial (C&I) programs in selected jurisdictions. The reviewed approaches are all contained within publicly available documents. Because the reviewed documents contain varying degrees of detail and explanation, the Navigant team applied its best interpretation of these documents to synthesize the available information in a consistent manner. Eight jurisdictions are discussed below. Published information on the sampling procedures allowed for a useful summary to be produced.

C.1 Summary from Illinois (ComEd)

The Commonwealth Edison Company (ComEd) Smart Ideas for Your Business program offers all eligible commercial and industrial customers financial incentives for upgrading their facilities with energy-efficient equipment. The program offers prescriptive incentives, available for qualified equipment commonly installed as part of retrofit and equipment replacement projects, or custom incentives, available for less common and more complex energy-saving measures. Examples of custom projects include heating, ventilating, and air conditioning (HVAC) measures (such as chiller upgrades and centralized thermostat control systems), large commercial refrigeration measures, air compressor system upgrades, high-rise building domestic water pumping systems, industrial process renovations, and non-prescriptive lighting measures. In 2011, the custom incentive levels were $0.03/kilowatt-hour (kWh) for equipment with less than a five-year life and $0.07/kWh for equipment with a five-year life or greater.[95] These incentive levels were applied for the first $100,000 in incentives and then reduced by half for the next $100,000, up to the project cost cap. In 2011, ComEd provided financial incentives to 887 projects. Of these, 32 projects were selected for evaluation to achieve confidence and precision targets of 90% and 8% over the three-year program.[96]

A two-stage sampling methodology was implemented, with the first projects being sampled in April of 2011 and the remaining projects sampled in July. The sampling approach stratified the population of projects by project size. All custom projects were sorted into three strata based on *ex ante* energy (kWh) savings, such that each stratum contained one-third of the total claimed energy savings.[97] The evaluation sample was drawn to represent the population distribution by stratum. Figure 22 shows the total number of projects and the evaluation sample by stratum. This sample represents 100% of the population's claimed energy savings in the first stratum,

[95] Any project involving Energy Management System programming is eligible for the $0.03/kWh incentive. To receive the $0.07/kWh custom incentive, equipment must have a minimum payback of one year and a maximum payback of seven years.

[96] A thirty-third project had been selected but after the site-visit it was moved into the following program year (PY4).

[97] Note that ComEd's custom program application does not require that applicants submit an estimate of savings, suggesting that the claimed savings may be underestimated. In addition, more projects may be assigned to stratum 3, resulting in a less precise estimation of *ex post* gross impacts.

59% in the second, and 5% in the third. In total, the 32 projects represent 45% of the program's custom projects' *ex ante* energy savings.

Figure 22. ComEd 2011 C&I Sample Summary

Sampling Stratum	Total Number of Projects	Evaluation Sample
1	2	2
2	27	15
3	858	15
Total	**887**	**32**

Source: Navigant Review of Evaluation Report[98]

C.2 Summary from Michigan (DTE Energy)

The DTE Energy C&I non-prescriptive program offers business customers financial incentives for the installation of "innovative and unique" energy efficiency equipment and controls. Examples of custom measures include energy management system controls, variable-speed air compressors, and ultrasonic HVAC humidification systems. Ineligible customer measures include on-site electricity generation, renewable energy, peak-shifting, fuel switching, or changes in operational/maintenance practices that do not involve capital costs. The custom incentive levels are $0.08/kWh, based on the first year of estimated energy savings, up to 50% of the project cost. Projects require a one-year minimum payback and an eight- year maximum payback.

In 2010, DTE Energy provided financial incentives for 515 energy efficiency measures associated with 381 unique projects. Of these projects, 56 were selected for evaluation to achieve confidence and precision targets of 90% and 10%, respectively, at the program level. This sample of 56 was based on a proportional sampling of measures from each of the three major technology groups: custom lighting, custom electric and custom gas.[99] Figure 23 shows the number of energy efficiency measures, unique projects, and evaluation sample size by group. The sample of custom lighting measures, custom electric measures, and custom gas measures represents 60%, 45%, and 90% of *ex ante* gross energy savings, respectively, for the population.

[98] "Evaluation Report: Smart Ideas for Your Business Custom Program." (Program Cycle 2010-2011.) Commonwealth Edison Company. Prepared by Navigant Consulting, Incorporated. May 16, 2012.

[99] Due to the small sample of "custom electric", several additional measure types were consolidated into this group to avoid a potential distortion in the realization rate. For example, custom HVAC, custom motors, and measures installed through a grocery RFP are included in the "custom electric" category.

Figure 23. DTE Energy 2010 Custom C&I Sample Summary

Sampling Stratum	Total Number of Measures	Total Number of Projects	Evaluation Sample
Custom Lighting	321	252	27
Custom Electric	150	93	9
Custom Gas	44	36	20
Total	**515**	**381**	**56**

Source: Navigant Review of Evaluation Report[100]

C.3 Summary from Massachusetts (National Grid, NSTAR, and Western Massachusetts Electric Company)

The C&I energy efficiency program run by the Massachusetts Program Administrators offers financial incentives to business customers for installing energy-efficient equipment. Custom projects are categorized as either a comprehensive design (CD) project or a comprehensive chiller (CC) project. CD projects typically involve the new construction of commercial, industrial, or municipal buildings that include at least four energy conservation measures (ECMs) that achieve a minimum of 20% energy savings relative to code.[101] CC projects typically involve the installation of a new chiller and multiple other ECMs in an existing building that achieve a minimum of 20% savings.

In 2008 and 2009, 25 custom projects were installed in National Grid, NSTAR, and Western Massachusetts Electric Company (WMECO) service territories.[102] Custom projects were stratified for National Grid, NSTAR, and WMECO separately, resulting in three strata for National Grid and one stratum for both NSTAR and WMECO. Although not specified in the evaluation report, it appears that stratification was based on project size. Figure 24 lists the number of projects and evaluation sample in each stratum by program administrator. Of these projects, five were selected for evaluation to achieve confidence and precision targets of 90% and 10%, respectively, three from National Grid and one each from NSTAR and WMECO.

[100] "Reconciliation Report for DTE Energy's 2010 Energy Optimization Programs." DTE Energy Company. Prepared by Opinion Dynamics Corporation. April 15, 2011.

[101] Examples of ECMs are building envelope upgrades, lighting fixtures and controls, cooling system upgrades, and Energy Management System controls.

[102] Twenty-two custom projects occurred in National Grid service territory, 2 in NSTAR, and 1 in WMECO.

Figure 24. Massachusetts 2008-2010 Custom C&I Sample Summary

Sampling Stratum	Total Number of Projects	Maximum Gross Savings (kWh)	Evaluation Sample
National Grid, 1	12	332,480	1
National Grid, 2	6	608,237	1
National Grid, 3	4	1,108,409	1
NSTAR, 1	2	3,352,840	1
WMECO, 1	1	496,579	1

Source: Navigant Review of Evaluation Report[103]

C.4 Summary from New Mexico (New Mexico Public Service Company and New Mexico Gas Company)

New Mexico Gas Company and the Public Service Company of New Mexico have programs that offer financial incentives to commercial and industrial customers for custom energy efficiency projects.[104] The custom C&I program offered by the New Mexico Gas Company is called "Commercial Solutions" and provides low-flow faucet aerators and pre-rinse spray valves at no cost, as well as a $0.75/therm incentive for custom measures (e.g., water heating, HVAC, building envelope, and industrial process improvements). The custom C&I program offered by the Public Service Company of New Mexico is called the "Commercial Comprehensive Program" and provides rebates for a range of prescriptive and custom measures. Projects are classified as either retrofit, new construction, or QuickSaver direct-install.

The sampling methodology to evaluate C&I programs utilizes stratified random sampling to achieve 90% confidence and 10% precision levels. Projects are stratified by project size. New Mexico Gas Company stratified into three strata. The Public Service Company of New Mexico implemented the sampling strategy for retrofit, new construction, and quick-saver projects separately. Due to the large population of projects for retrofit and QuickSaver, projects were stratified into five strata, while new construction projects were stratified into three strata. Figure 25 and Figure 26 show the number of projects and evaluation sample by stratum.

[103] "Impact Evaluation of 2008 and 2009 Custom CDA Installations." Massachusetts Energy Efficiency Advisory Council. Prepared by KEMA and SBW Consulting Incorporated. June 7, 2011.

[104] El Paso Electric Company also offers a custom C&I program. However, during 2010 and 2011 there were no participants and as a result an evaluation of the program was not conducted.

Figure 25. New Mexico Gas Company 2011 Custom C&I Sample Summary

Sampling Stratum	Total Number of Projects	Evaluation Sample
< 1,000 therms	16	3
1,000 – 5,000 therms	7	3
> 4,000 therms	5	5
Total	**28**	**11**

Source: Navigant Review of Evaluation Report[105]

Figure 26. Public Service Company of New Mexico 2011 Custom C&I Sample Summary

Retrofit		
Sampling Stratum	**Total Number of Projects**	**Evaluation Sample**
< 26.5 MWh	95	5
26.5-50 MWh	38	4
50-150 MWh	48	4
150-500MWh	29	5
>500 MWh	9	9
Total	**224**	**27**

QuickSaver		
Sampling Stratum	**Total Number of Projects**	**Evaluation Sample**
< 10 MWh	192	4
10-20 MWh	150	4
20-40 MWh	88	4
40-95 MWh	44	4
> 95 MWh	10	10
Total	**484**	**26**

New Construction		
Sampling Stratum	**Total Number of Projects**	**Evaluation Sample**
< 70 MWh	12	3
70-250 MWh	9	4
> 250 MWh	2	2
Total	**23**	**9**

Source: Navigant Review of Evaluation Report[106]

C.5 Summary from Pennsylvania (PECO Energy)

The PECO Energy Company Smart Equipment Incentives program offers financial incentives for installing energy-efficient equipment in commercial and industrial facilities and in master-metered multifamily residential buildings. The program offers incentives for both prescriptive and custom measures. Examples of custom projects include energy management systems,

[105]"Evaluation of 2011 DSM Portfolio." New Mexico Gas Company. Prepared by ADM Associates Incorporated. June 2012.

[106]"Evaluation of 2011 DSM & Demand Response Portfolio." Public Service Company of New Mexico. Prepared by ADM Associates Incorporated. March 2012.

compressed air systems, process equipment and chillers, industrial systems, whole building systems, and outdoor lighting. Custom incentive levels are $0.12/kWh for estimated on-peak energy savings and $0.08/kWh for estimated off-peak energy savings, up to 100% of project costs.[107]

In 2010, PECO provided financial incentives to 1,085 non-multi-tenant projects and 490 multi-tenant projects. Of these projects, 39 were selected for evaluation to achieve confidence and precision targets of 85% and 10%, respectively, at the program level.[108] The sample is stratified by project size, based on *ex ante* energy savings, and by project-type (lighting, non-lighting, custom). A three-stage sampling strategy was implemented, with the first stage occurring after the end of Q2, the second stage after Q3, and the third stage after Q4.[109,110] Within the sample, custom projects make up the majority of stratum 1, accounting for 49% of *ex ante* energy savings for the sample population.[111]

C.6 Summary from Ohio (AEP Ohio)

AEP Ohio offers commercial and industrial customers energy efficiency incentives through a number of programs. The custom program provides financial incentives for "less common or more complex energy-saving measures" that are installed as part of a qualified retrofit project or equipment replacement project. Examples of custom measures include lighting retrofits, HVAC measures such as VFDs, equipment controls, and process efficiency improvements. Custom incentive levels are based on both energy (kWh) and demand (kW) savings in the first year. Specifically, the incentive levels are $0.08/kWh, $100/kW, up to 50% of the project cost. In 2011, AEP Ohio provided financial incentives to 220 custom projects. Of these, 54 projects were selected for evaluation.

The sampling methodology stratified projects both by geography and by project size. At the time, AEP Ohio had gone through a merger of two regional operating companies so that participants in the custom program were distributed across two rate zone territories. The sample design was conducted separately for each rate zone, targeting confidence and precision levels of 90% and 10%, respectively, for each zone. A two-stage sampling methodology was implemented, with the first wave of projects sampled in November of 2011 and the second wave sampled in February of 2012. Projects were first separated by zone, then stratified based on *ex ante* energy (kWh) savings. Projects were assigned to one of three strata such that there

[107] On-peak hours include 12pm-8pm, June 1 – September 30 (excluding holiday weekdays). Off-peak hours include 8:01pm-11:59am, June 1-September 30, and all hours from October 1-May 31. https://peco.icfi.com/sites/peco/files/2011_PECO_CUSTOM_Incentive_Levels.pdf

[108] The evaluation plan targeted confidence and precision levels of 85% and 15%, respectively. However, the final sample design allowed for 85/10 confidence and precision targets.

[109] The first stage included projects implemented in both Q1 and Q2 due to low levels of participation in the program during Q1.

[110] Note that PECO reports unverified savings quarterly.

[111] Lighting and non-lighting measures account for 19% and 32%, respectively.

was a relatively even distribution of cumulative standard deviation in energy savings between strata. Figure 27 shows the number of total projects and the number of projects in the evaluation sample for each zone and stratum. In total, the evaluation sample represents 62% of *ex ante* gross energy savings for the population.

Figure 27. AEP Ohio 2011 Custom C&I Sample Summary

Sampling Stratum	Total Number of Projects	Evaluation Sample
Zone 1, Stratum 1	5	5
Zone 1, Stratum 2	19	7
Zone 1, Stratum 3	85	12
Zone 2, Stratum 1	8	5
Zone 2, Stratum 2	18	11
Zone 2, Stratum 3	85	14
Total	**220**	**54**

Source: Navigant Review of Evaluation Report[112]

C.7 Summary from Maryland (covers five Maryland utilities)

The five EmPOWER Maryland utilities (Baltimore Gas and Electric, Potomac Electric Power Company, Delmarva Power, Southern Maryland Electric Cooperative, and Potomac Edison) offer large commercial and industrial customers financial incentives for the installation of efficiency measures that are complex and/or unique, such as commercial HVAC and industrial process improvements. Baltimore Gas and Electric (BGE) and Southern Maryland Electric Cooperative (SMECO) offer rebates for up to 50% of retrofit projects and up to 75% of the incremental cost of new construction projects. Potomac Electric Power Company (PEPCO) and Delmarva Power (DPL) programs were implemented jointly and offer $0.16/kWh for energy savings in the first year.[113] Potomac Edison (PE) offers $0.05/kWh of *ex ante* energy savings. The target evaluation sample for each utility was 12 projects to achieve confidence and precision levels of 80% and 20%, respectively. At the time the evaluation samples were drawn, only BGE had enough participants to reach the targeted sample of 12. PEPCO/DPL had 10 custom projects completed, SMECO had 7, and PE had 11. For these utilities, the entire population was used as the evaluation sample.[114]

For BGE, the sampling strategy calculated the percentage of population energy (kWh) and demand (kW) savings for each project using equal weights. These percentages were used to sort the population of projects into three strata such that each stratum represented approximately one-third of population savings. Random numbers were then assigned to projects within each

[112] "Program Year 2011 Evaluation Report: Business Custom Program." AEP Ohio. Prepared by Navigant Consulting, Incorporated. May 10, 2012.

[113] As a result, participants in PEPCO and DPL's programs were combined into a single sample.

[114] The final evaluation sample for PEPCO/DPL was reduced to eight due to barriers in doing on-site verification for two custom projects.

stratum. Sample projects from each stratum were selected based on the random number designation. For BGE, the evaluation sample represents 58% of *ex ante* energy savings for the population.

C.8 Summary from Vermont (Efficiency Vermont)

Efficiency Vermont offers financial incentives for installing energy-efficient equipment in commercial and industrial facilities as well as multi-family buildings. The evaluation was conducted for two program years, 2007 and 2008. The sample size was chosen to achieve an 80% confidence level and 10% precision level for the entire portfolio of Efficiency Vermont programs.

Sampling occurred in two stages, with the first wave including projects completed by April 30, 2008, and the second wave including projects completed during the remainder of 2008. The sampling methodology categorizes projects by market type (retrofit or new construction/market opportunities) and end use (lighting, HVAC, and other).

The sample of retrofit projects includes projects of all end uses, whereas the evaluation sample of new construction/market opportunities projects only includes lighting projects. Projects were stratified into three strata based on *ex ante* peak demand savings. Because demand reductions are claimed separately for winter and summer, the population of projects/end uses was further stratified by season. In particular, if the estimated peak reduction was higher during winter, projects/end uses were assigned to "winter." If the estimated peak reduction was higher during summer or was roughly equivalent during winter and summer, projects/end uses were assigned to "summer/non-seasonal." Within each stratum, a random number was assigned to each project/end use and ordered. The evaluation sample was then selected from the top of each group. Figure 28 shows the total number of retrofit and NC/MOP projects, as well as the evaluation samples stratified by project size and seasonality.

Figure 28. Efficiency Vermont 2007-2008 Custom C&I Sample Summary

	Total Number of Projects		Evaluation Sample			
Sampling Stratum	**Retrofit**	**NC/MOP**	**Retrofit, Winter**	**Retrofit, Summer**	**NC/MOP, Winter**	**NC/MOP, Summer**
0.8-5 kW	263	652	8	8	15	15
5-35 kW	244	315	16	17	23	26
> 35 kW	64	35	49	49	21	23
Total	**571**	**1,002**	**73**	**74**	**59**	**64**

Source: Navigant Review of Evaluation Report[115]

[115]"Verification of Efficiency Vermont's Energy Efficiency Portfolio for the ISO-NE Forward Capacity Market." Vermont Department of Public Service. Prepared by West Hill Energy and Computing Incorporated. July 29, 2010.