DNV·GL

ONTARIO GAS DSM EVALUATION CONTRACTOR

2018 Natural Gas Demand-Side Management Annual Verification

Ontario Energy Board

Date: March 13, 2020

Table of Contents

AUDIT OPINION

The Evaluation Contractor team[1] (DNV GL and Dunsky) provides the following opinion on the utility-achieved energy savings, lost revenue, and shareholder incentive of the demand-side management (DSM) programs offered by Enbridge Gas Distribution, Inc. and Union Gas Limited for the calendar year ending December 31, 2018.

Our opinion stems from our review of the program documentation, utility shareholder incentive calculations, and lost revenue calculations as set forth in the report that follows. It is also based on the information available at the time that this report was published.

In our opinion, the following figures are reasonable, subject to the qualifications given above.

Definition	Enbridge Gas Distribution, Inc. Results	Union Gas Limited Results
Shareholder Incentive	$3,982,872	$6,366,226
Lost Revenue	$10,827	$159,339
Verified Net Cumulative Energy Savings (m^3)	807,476,673	1,124,478,523
Total Dollars Spent (not reviewed)	$64,779,279	$68,988,161
Cost Effectiveness (TRC-plus test)	2.27	2.01

[1] DNV GL leads the Evaluation Contractor team and led the evaluation of the 2018 DSM programs, with contributions from Dunsky.

1 Executive Summary

This document has been prepared for the Ontario Energy Board (OEB) by its Evaluation Contractor (EC), DNV GL, and outlines the results of the annual verification of Enbridge Gas Distribution Inc.'s (Enbridge) and Union Gas Limited's (Union)[2] natural gas demand-side management (DSM) programs[3] delivered in 2018. The programs delivered in 2018 form part of broader six-year DSM plans that were approved by the OEB in January 2016.[4] The OEB, through independent third-party evaluation consultants, has undertaken evaluation and verification studies of DSM program results each year, beginning with the 2015 program year.[5] The graphic below provides a general depiction of the broader process that led to this evaluation report.

*The OEB's Evaluation Contractor conducts an expert, independent review to verify the program results, including natural gas savings and participants, and provides an opinion on the utility performance related to OEB-approved targets

**Eligible amounts include performance incentives the utility may be eligible to receive due to meeting or exceeding OEB-approved targets, lost revenues related to program-related natural gas savings, and changes to costs previously approved by the OEB

The verification of 2018 program year results were conducted by the EC team comprised of DNV GL and Dunsky. The EC conducted the verifications of the 2017 and 2018 program years in tandem; for the results of the 2017 verification, please review the 2017 report.

The annual verification incorporates the findings of any program-specific evaluation studies applicable to the 2018 programs and applies them to the natural gas energy savings and achieved scorecard metrics reported by the utilities. For programs or metrics where no recent studies have been performed, the EC team conducts a due diligence review to verify the savings or metrics reported by the utilities. The overall objectives are to provide an independent opinion on whether natural gas savings achieved through programs are reasonable, and that the corresponding DSM shareholder incentives and lost revenue amounts have been calculated accordingly. DNV GL also recommends future evaluation research opportunities and changes to improve input assumptions, verification procedures, and the overall verification process.

Enbridge programs offered in 2018 were verified to achieve 42,226,778 m^3 of savings in 2018, 807,476,673 cumulative m^3, and emissions reductions of 1,578,617 tons of CO_2 equivalent.[6] Union Gas programs offered in 2018 were verified to achieve 66,167,950 m^3 in 2018, 1,124,478,523 cumulative m^3, and emissions reductions of 2,198,356 tons of CO_2 equivalent.[7]

[2] Enbridge Gas Distribution Inc. and Union Gas Limited amalgamated effective January 1, 2019 to become Enbridge Gas Inc.; however, because the programs will continue to be implemented individually through the remainder of the current framework, the EC will also evaluate each program by utility.

[3] Throughout this report, the word "program" is used to reflect the OEB's understanding of a program. The utilities define it differently. See Appendix A for additional detail.

[4] The OEB issued its Decision and Order on Enbridge and Union's multi-year DSM Plans on January 20, 2016 (EB_2015-0029/EB-2015-0049)

[5] All DSM evaluation results can be found on the OEB's website.

[6] This calculation uses cumulative savings and an emission factor of 0.001955 tCO^2e/m^3 (derived based on the federal carbon price and prescribed charge rate for marketable gas in Ontario).

[7] Ibid.

In this report, we made numerous recommendations for the programs[8], focusing primarily on issues related to program data and databases, program definitions, energy modeling, and cost effectiveness. This report also reflects the only modification to the DSM framework from the OEB DSM Mid-Term Report[9] that applies to the 2018 program year, as described below. Also included in the report are recommendations from the 2017 C&I Prescriptive study, 2017/2018 Custom Savings Verification, and 2018 Free Ridership Based Attribution study, all of which are evaluations with results that contribute to the overall annual verification results contained within this report. All recommendations apply equally to both the 2017 and 2018 programs.

Table 1-1 and Table 1-3 show the verified scorecard results for Enbridge and Union, respectively. Scorecards allow the utilities to be rewarded for undertaking important activities other than strictly reducing natural gas consumption, such as increasing customer participation in programs or installing energy efficiency measures with a long life. They detail the programs delivered by each utility along with the associated metrics that are used to determine program achievement. The degree of verified achievement (relative to the metric target) determines the shareholder incentive for each utility. The shareholder incentive, or DSMSI, is paid to the utility to encourage it to deliver DSM programs, which reduce utility revenue but provide a public benefit.[10] For example, the programs delivered under the Enbridge Resource Acquisition scorecard achieved 84% of the cumulative cubic meter (CCM) savings target and 156% of the participants target in the Home Energy Conservation program. As a result, the EC is of the opinion that Enbridge should receive a shareholder incentive of approximately $2.9 million for the Resource Acquisition scorecard. Table 1-1 and Table 1-3 also show the amount of money spent by the utilities to implement the energy efficiency programs.

The OEB requires the utilities to deliver DSM programs that are cost-effective, which means the verified benefits produced by the programs outweigh the cost of their implementation. The OEB's DSM Mid-Term Report advised that carbon costs will be added to the cost-effectiveness test for 2017 onwards. The EC cost effectiveness methodology applied in 2017 and 2018 is consistent with what was done for the 2016 and 2015 analysis except for carbon costs. The cost effectiveness results (in terms of TRC benefit-cost ratio) are found in Table 1-1 and Table 1-3.

Cumulative dollar values for program costs and benefits are measured in terms of net present value, which is the calculated lump sum value in program year dollars. In the net present value calculation, future costs and benefits are discounted to account for the time value of money. The net present value for each program with a CCM savings metric is included in Table 1-1 and Table 1-3.

Table 1-2 and Table 1-4 show the verified revenue lost by Enbridge and Union, respectively, as a result of implementing demand-side management programs, called lost revenue. The lost revenue is shown by utility rate class and is only paid for revenue lost during the 2018 calendar year.[11]

[8] This report focuses primarily on savings verification, rather than evaluating the utility program design and how the programs are delivered, which is also called a process evaluation. As part of the current framework, the utility has the responsibility to evaluate the design of its programs to ensure they are as effective as possible. However, DNV GL still derived a number of program-based recommendations based on what they saw as part of the savings verification they completed.

[9] The OEB issued its DSM Mid-Term Report on November 29, 2018 (EB-2017-0127 and EB-2018-0128).

[10] The utilities are also compensated separately for lost revenues that arise from its conservation programs.

[11] The lost revenue shown in these tables are not the entire lost revenue the utility realizes from its DSM programs. A forecast DSM amount, built into natural gas rates, accounts for a large majority of lost revenues.

1.1 Enbridge

Table 1-1. Enbridge savings, spend, cost effectiveness, and incentive results*†

Program	Metric	Verified First-Year Savings (CCM)	Verified Cumulative Savings or Other Metric	Percent of Target Achieved	DSM Shareholder Incentive	OEB-Approved Program Budget	Utility Spending**	Budget/ Spending Variance	Cost Effectiveness (TRC Benefit Cost Ratio)	Net Present Value (TRC Plus)
Resource Acquisition		**36,157,056**	**677,329,382**			**$43,162,456**	**$42,551,779**	**-$610,677 (-1%)**	**2.26**	**$85,211,000**
Commercial & Industrial Custom	CCM Savings	19,799,976	352,950,627			$7,361,562	$7,696,271	$334,709	3.48	$54,562,000
Commercial & Industrial Direct Install	CCM Savings	3,785,559	56,783,392			$4,758,344	$1,726,487	-$3,031,857	5.35	$10,053,000
Commercial & Industrial Prescriptive	CCM Savings	2,132,567	36,475,770			$2,232,905	$1,164,036	-$1,068,869	2.39	$5,220,000
Comprehensive Energy Management	CCM Savings	-	-			$95,000	$0	-$95,000	-	-
Energy Leaders Initiative	CCM Savings	1,206,466	29,708,535	84.1%		$400,000	$324,138	-$75,862	4.95	$4,969,000
Residential Adaptive Thermostats	CCM Savings	2,888,131	43,321,968		$2,955,435	$2,175,000	$1,578,427	-$596,573	2.92	$10,113,000
Run-it-Right	CCM Savings	25,991	129,953			$1,584,600	$522,385	-$1,062,215	0.07	-$486,000
Small Commercial New Construction	CCM Savings	-	-			$1,305,566	$0	-$1,305,566	-	-
Home Energy Conservation	CCM Savings	6,318,365	157,959,136			$18,000,000	$24,367,955	$6,367,955	1.02	$782,000
	Participants	N/A	14,413	156.1%					N/A	N/A
Resource Acquisition Overhead	N/A		N/A	N/A		$5,249,479	$5,172,080	-$77,399		
Low Income		**6,069,722**	**130,147,292**			**$13,309,177**	**$12,988,815**	**-$320,362 (-2%)**	**2.32**	**$16,074,000**
Home Winterproofing	CCM Savings	697,146	15,978,390	56.0%		$6,477,200	$5,224,730	-$1,252,470	0.73	-$1,357,000
Multi Residential	CCM Savings	5,372,576	114,168,901	117.0%	$422,199	$3,813,296	$4,417,079	$603,783	3.42	$17,430,000
New Construction	Applications	N/A	13	92.9%		$1,400,000	$1,752,191	$352,191	N/A	N/A
Low Income Overhead	N/A		N/A	N/A		$1,618,681	$1,594,815	-$23,866		
Market Transformation		**N/A**	**N/A**			**$6,882,454**	**$7,518,569**	**$636,115 (9%)**	**N/A**	**N/A**
School Energy Competition	Schools	N/A	14	17.9%	$605,238	$500,000	$248,768	-$251,232	N/A	N/A
Run-it-Right	Participants		62	258.3%		$315,400	$608,623	$293,223		
Comprehensive Energy Management	Participants		5	23.8%		$905,000	$314,424	-$590,576		
Residential Savings by Design	Builders		35	175.0%		$3,250,000	$4,257,045	$1,007,045		
	Homes		2,956	135.7%						
Commercial Savings by Design	Developments		31	110.7%		$1,075,000	$1,264,997	$189,997		
Market Transformation Overhead	N/A		N/A	N/A		$837,054	$824,712	-$12,342		
Enbridge Program Total		**42,226,778**	**807,476,673**		**$3,982,872**	**$63,354,087**	**$63,059,163**	**$294,924 (<1%)**	**2.27**	**$101,286,000**
	Portfolio Overhead and Administrative Costs					$4,200,000	$1,720,115	-$2,479,885 (-59%)		
	Enbridge Portfolio Total					**$67,554,087**	**$64,779,279**	**-$2,774,808 (-4%)**		

*Not all values may compute exactly due to rounding.
†CCM are cumulative cubic meters of natural gas.
**The OEB's DSM Framework allows for utility spending to differ from the approved budget. Sections 6.6 and 11.2 of the Filing Guidelines provide details for acceptable spending differences.

Table 1-2. Enbridge lost revenue results*

Rate Class	Verified Lost Revenue
Rate 110	$2,073
Rate 115	$0
Rate 135	$2,902
Rate 145	$5,678
Rate 170	$173
Total	**$10,827**

*Not all values may compute exactly due to rounding.

1.2 Union

Table 1-3. Union achievement, spend, cost effectiveness, and incentive results*†

Program	Metric	Verified First-Year Savings (CCM)	Verified Cumulative Savings or Other Metric	Percent of Target Achieved	DSM Shareholder Incentive	OEB-Approved Program Budget	Utility Spending**	Budget/ Spending Variance	Cost Effectiveness (TRC Benefit Cost Ratio)	Net Present Value (TRC Plus)
Resource Acquisition		**55,433,375**	**976,937,929**			**$36,633,281**	**$46,146,906**	**$9,513,625 (26%)**	**2.05**	**$108,537,000**
Commercial & Industrial Custom	CCM Savings	33,512,717	515,872,191	119.4%	$5,809,659	$7,808,000	$8,379,370	$571,370	2.46	$59,748,000
Commercial & Industrial Direct Install	CCM Savings	3,396,747	50,951,203			$2,500,000	$1,355,104	-$1,144,896	7.02	$8,699,000
Commercial & Industrial Prescriptive	CCM Savings	10,318,033	204,967,607			$7,486,000	$4,752,739	-$2,733,261	2.64	$26,555,000
Home Reno Rebate	CCM Savings	8,205,877	205,146,928			$12,226,000	$24,194,382	$11,968,382	1.30	$13,536,000
	Homes Built	N/A	16,118	201.2%					N/A	N/A
Overhead and Administrative Costs	N/A		N/A	N/A		$6,613,281	$7,465,311	$852,030		
Low Income		**2,678,832**	**58,343,698**			**$13,570,954**	**$10,806,455**	**-$2,764,500 (-20%)**	**1.30**	**$3,090,000**
Home Weatherization	CCM Savings	1,278,504	31,815,336	78.2%	$350,811	$7,495,000	$6,872,283	-$622,717	1.04	$289,000
Furnace End-of-Life	CCM Savings	-	-			$924,000	$0	-$924,000	-	-
Indigenous	CCM Savings	9,932	237,038			$511,000	$174,604	-$336,396	0.30	-$123,000
Multi-Family - Social & Assisted	CCM Savings	1,127,472	19,718,214	84.9%		$2,984,000	$1,985,957	-$372,226	1.94	$2,925,000
Multi-Family - Market Rate	CCM Savings	262,924	6,573,109	145.5%			$625,818			
Overhead and Administrative Costs	N/A	N/A	N/A	N/A		$1,656,954	$1,147,793	-$509,161	N/A	N/A
Large Volume		**8,055,743**	**89,196,896**			**$4,000,000**	**$2,821,881**	**-$1,178,119 (-29%)**	**2.47**	**$9,955,000**
Large Volume	CCM Savings	8,055,743	89,196,896	45.6%	$0	$3,150,000	$2,341,061	-$808,939	2.47	$9,955,000
Overhead and Administrative Costs	N/A	N/A	N/A	N/A		$850,000	$480,819	-$369,181	N/A	N/A
Market Transformation		**N/A**	**N/A**			**$2,338,070**	**$2,022,149**	**-$315,921 (-14%)**	**N/A**	**N/A**
Optimum Home	Builders	N/A	8	100.0%	$205,755	$841,000	$847,194	$6,194	N/A	N/A
	Homes Built		83.33%	138.9%						
	% of Homes Built		3.97%	79.4%						
Commercial New Construction	New Developments		18	94.7%		$1,000,000	$853,788	-$146,212		
Overhead and Administrative Costs	N/A		N/A	N/A		$497,070	$321,167	-$175,903		
Performance Based		**N/A**	**N/A**			**$1,088,000**	**$694,395**	**-$393,605 (-36%)**	**N/A**	**N/A**
RunSmart	Participants	N/A	44	100.0%	$0	$193,000	$145,265	-$47,735	N/A	N/A
	% Savings		0.51%	26.0%						
Strategic Energy Management	Participants		3	100.0%		$644,000	$357,804	-$286,196		
	% Savings		3.86%	77.2%						
Overhead and Administrative Costs	N/A		N/A	N/A		$251,000	$191,326	-$59,674		
Union Program Total		**66,167,950**	**1,124,478,523**		**$6,366,226**	**$57,630,305**	**$62,491,785**	**$4,861,480 (8%)**	**2.01**	**$121,582,000**
Portfolio Overhead and Administrative Costs						$5,642,000	$6,496,375	$854,375 (15%)		
Union Portfolio Total						**$63,272,305**	**$68,988,161**	**$5,715,854 (9%)**		

*Not all values may compute exactly due to rounding.
†CCM are cumulative cubic meters of natural gas.
** The OEB's DSM Framework allows for utility spending to differ from the approved budget. Sections 6.6 and 11.2 of the Filing Guidelines provide details for acceptable spending differences.

Table 1-4. Union lost revenue results*

Rate Class	Verified Lost Revenue
M4 Industrial	$128,413
M5 Industrial	$8,297
M7 Industrial	$9,878
T1 Industrial	$1,528
T2 Industrial	$1,272
20 Industrial	$9,609
100 Industrial	$342
Total	**$159,339**

*Not all values may compute exactly due to rounding.

2 Introduction

Enbridge Gas Distribution Inc. (Enbridge) and Union Gas Limited (Union)[12] deliver demand-side management (DSM) programs[13] under the Demand Side Management Framework for Natural Gas Distributors (2015-2020)[14] developed by the Ontario Energy Board (OEB). The 2018 Natural Gas Demand Side Management Annual Verification Report has been prepared for the OEB to report the results of the annual verification of the utilities' natural gas DSM programs delivered in 2018. These verifications were conducted by the OEB's Evaluation Contractor (EC) team of DNV GL and Dunsky. The EC conducted the verifications of the 2017 and 2018 program years in tandem; for the results of the 2017 verification, please review the 2017 report.

Under the DSM framework, programs are grouped into categories, called scorecards. Each program within a scorecard is assigned at least one metric, which is used to measure utility performance. The metric for many programs is cumulative cubic meters (CCM) savings, or a reduction in natural gas consumption, while other programs have non-savings metrics such as the number of program participants. Within each scorecard, various metrics are combined to produce an overall scorecard achievement.

Each scorecard metric is assigned a target.[15] The EC uses sampling, engineering reviews, documentation verification, and other techniques to verify the utilities' performance against the target for each program year. The percentage of target achieved for each metric is combined across the scorecard and used to determine if the utility is eligible for a demand-side management shareholder incentive (DSMSI) for meeting certain performance thresholds.[16]

In addition to the shareholder incentive, the OEB compensates the utilities for the reduced revenue taken in as a result of delivering these DSM programs, called "lost revenue", which is also verified by the EC.

The OEB requires the utilities to deliver DSM programs that are cost-effective, which means the verified benefits produced by the programs outweigh the cost of their implementation.[17] Cost effectiveness results can be found in Sections 3.2, 4.2, and Appendix Q.

The OEB formed an evaluation advisory committee (EAC) to provide input and advice to the OEB and the EC on the evaluation and audit of DSM results. The EAC consists of representatives from OEB staff, the utilities, non-utility stakeholders, independent experts, staff from the Independent Electricity System Operator (IESO), and an observer from the Ministry of Energy, Northern Development and Mines. The EC received feedback and input from the EAC on the results of this annual verification. The content included in this report integrates our responses to their input. We thank them for their involvement.

[12] DNV GL is aware that Enbridge and Union are merging into a single organization; however, because the programs will continue to be implemented individually through the remainder of the current framework, the EC will also evaluate each program specified by each utility.

[13] Throughout this report, the word "program" is used to reflect the OEB's understanding of a program. The utilities define it differently. See Appendix A for additional detail.

[14] EB-2014-0134

[15] These targets, which were set in part based on 2017 performance, are described in detail in Appendix L.

[16] A minimum weighted scorecard achievement level of 75% is required to earn a portion of the available shareholder incentive for a scorecard.

[17] The cost-effectiveness methodology is described in detail in Appendix Q.

3 Enbridge Gas Distribution, Inc.

This section reports on the results of the annual verification and scorecard achievements of Enbridge's 2018 DSM programs.

3.1 Scorecard Achievements

Enbridge has three scorecards: Resource Acquisition, Low Income, and Market Transformation. Table 3-1 shows the programs included in each scorecard and the appendix that contains a detailed explanation of the verification of each program. For a discussion of the calculations behind the DSM shareholder incentive and lost revenue, see Appendix M.

Table 3-1. Overview of Enbridge 2018 programs by scorecard

Scorecard	Program	Detailed Appendix
Resource Acquisition	Home Energy Conservation Residential Adaptive Thermostats Commercial & Industrial Custom Commercial & Industrial Direct Install Commercial & Industrial Prescriptive Comprehensive Energy Management Energy Leaders Initiative Run-it-Right Small Commercial New Construction	Appendix G
Low Income	Home Winterproofing Low Income Multi-Residential Low Income New Construction	Appendix H
Market Transformation	Residential Savings by Design Commercial Savings by Design School Energy Competition	Appendix J
Market Transformation (similar to Union Performance Based)	Run-it-Right Comprehensive Energy Management	Appendix K

Table 3-2 shows the Enbridge combined scorecard for 2018, including the target metrics, verified achievement, weight, and shareholder incentive. These were the metrics reviewed as part of the annual verification. The utility achieved 95% of the incentive designated for full target achievement and 38% of the maximum possible DSMSI incentive.

Table 3-2. Enbridge's 2018 achievement target, verified achievement, weight, and shareholder incentive by scorecard

Program	Metric	2018 Target	2018 Verified Achievement	Weight	Utility Incentive
Resource Acquisition					
Commercial & Industrial Custom Commercial & Industrial Direct Install Commercial & Industrial Prescriptive Comprehensive Energy Management Energy Leaders Initiative Home Energy Conservation Residential Adaptive Thermostats Run-it-Right Small Commercial New Construction	Large Volume (CCM)	508,459,624	377,787,998	40.0%	$ 2,955,435
	Small Volume (CCM)	297,087,649	299,541,383	40.0%	
Home Energy Conservation	Participants	9,235	14,413	20.0%	
Low Income					
Home Winterproofing	CCM	28,523,764	15,978,390	45.0%	$ 422,199
Low Income Multi Residential	CCM	97,545,599	114,168,901	45.0%	
Low Income New Construction	Applications	14	13	10.0%	
Market Transformation					
School Energy Competition	Schools	78	14	10.0%	$ 605,238
Run-it-Right	Participants	24	62	20.0%	
Comprehensive Energy Management	Participants	21	5	20.0%	
Residential Savings by Design	Builders	20	35	10.0%	
	Homes	2,179	2,956	15.0%	
Commercial Savings by Design	Developments	28	31	25.0%	
Total Verified Utility Incentive					**$ 3,982,872**
Incentive if 100% of target achieved					$ 4,180,000
Maximum possible incentive (if 150% of target achieved)					$ 10,450,000

3.1.1 Resource Acquisition

This section summarizes the results of the EC's review of the Enbridge Resource Acquisition scorecard. The metrics for the Resource Acquisition scorecard include:

- Total cumulative large volume customer natural gas savings
- Total cumulative small volume customer natural gas savings
- Number of residential deep savings participants

A detailed explanation of the verification activities for all Resource Acquisition programs can be found in Appendix G. Verified program achievements are listed in Table 3-3 with DSM shareholder incentive results in Table 3-4.

Table 3-3. Enbridge 2018 Resource Acquisition verified achievements*

Programs	Metrics	Verified Achievement	
		Program-level Savings	Metric-level Savings
Commercial & Industrial Custom	Large Volume Customer - CCM	323,139,650	377,787,998
Commercial & Industrial Direct Install		9,186,763	
Commercial & Industrial Prescriptive		15,642,977	
Comprehensive Energy Management		-	
Energy Leaders		29,688,655	
Run-it-Right		129,953	
Small Commercial New Construction		-	
Home Energy Conservation	Small Volume Customer - CCM	157,959,136	299,541,383
Residential Adaptive Thermostats		43,321,968	
Commercial & Industrial Custom		29,810,977	
Commercial & Industrial Direct Install		47,596,629	
Commercial & Industrial Prescriptive		20,832,793	
Energy Leaders		19,880	
Home Energy Conservation	Participants	14,413	14,413

*Not all values may compute exactly due to rounding.

Table 3-4. Enbridge's 2018 Resource Acquisition targets, achievements, weights, and incentive*†

Metric	Target	Verified Achievement	Weight	Metric Score	Weighted Metric Score
Large Volume Customer - CCM	508,459,624	377,787,998	40.0%	74.3%	29.7%
Small Volume Customer - CCM	297,087,649	299,541,383	40.0%	100.8%	40.3%
Participants	9,235	14,413	20.0%	156.1%	31.2%
Verified Total Weighted Scorecard Achieved					101.3%
Maximum Scorecard Incentive					$7,119,472
Verified Scorecard Incentive Achieved					**$2,955,435**

*Not all values may compute exactly due to rounding.
†See Appendix M for a detailed description of the scorecard and incentive calculations.

Table 3-5 shows the net cumulative natural gas savings (CCM) by program, as verified by the EC. Unlike Table 3-3, this table shows overall program totals, not broken out by Large or Small Volume metrics.

Table 3-5. Enbridge's verified 2018 Resource Acquisition savings*

Program	Net Cumulative Savings (m3)
Home Energy Conservation	157,959,136
Residential Adaptive Thermostats	43,321,968
Commercial & Industrial Custom	352,950,627
Commercial & Industrial Direct Install	56,783,392
Commercial & Industrial Prescriptive	36,475,770
Comprehensive Energy Management	-
Energy Leaders	29,708,535
Run-it-Right	129,953
Small Commercial New Construction	-
Resource Acquisition Total	**677,329,382**

*Not all values may compute exactly due to rounding.

3.1.2 Low Income

This section summarizes the results of the EC's review of the Enbridge Low Income scorecard. The metrics for the Low Income scorecard include:

- Total cumulative natural gas savings for single family homes
- Total cumulative natural gas savings for multi-residential homes
- Total applications for Low Income New Construction

A detailed explanation of the verification activities for all Low Income programs can be found in Appendix H. Verified program achievements are listed in Table 3-6 with DSM shareholder incentive results in Table 3-7.

Table 3-6. Enbridge 2018 Low Income verified achievements

Programs	Metrics	Verified Achievement	
		Program-level Savings	Metric-level Savings
Home Winterproofing	CCM	15,978,390	15,978,390
Low Income Multi-Residential	CCM	114,168,901	114,168,901
Low Income New Construction	Applications	13	13

Table 3-7. Enbridge's 2018 Low Income scorecard targets, achievements, weights, and incentive*†

Metric	Target	Verified Achievement	Weight	Metric Score	Weighted Metric Score
Home Winterproofing CCM	28,523,764	15,978,390	45.0%	56.0%	25.2%
Low Income Multi Residential CCM	97,545,599	114,168,901	45.0%	117.0%	52.7%
Low Income New Construction Applications	14	13	10.0%	91.7%	9.2%
Verified Total Weighted Scorecard Achieved					87.0%
Maximum Scorecard Incentive					$2,195,295
Verified Scorecard Incentive Achieved					**$422,199**

*Not all values may compute exactly due to rounding.
†See Appendix M for a detailed description of the scorecard and incentive calculations.

3.1.3 Market Transformation

This section summarizes the results of the EC's review of the Enbridge Market Transformation scorecard. The metrics for the Market Transformation scorecard include the number of:

- Builders for Residential Savings by Design
- Homes built for Residential Savings by Design
- New developments for Commercial Savings by Design
- Participating schools for School Energy Competition
- Participants for Run-it-Right
- Participants for Comprehensive Energy Management

As some programs are similar to Union Market Transformation programs, and others similar to Union Performance Based programs, the programs are divided between Appendix J (Market Transformation Scorecards) and Appendix K (Performance Based (Union) and Market Transformation (Enbridge) Scorecards), as listed in Table 3-8.

Table 3-8. Enbridge Market Transformation program detailed evaluation, by appendix

Enbridge Program	Appendix
Commercial Savings by Design	Appendix J
Residential Savings by Design	
School Energy Competition	
Run-it-Right	Appendix K
Comprehensive Energy Management	

Verified program achievements are listed in Table 3-9 with DSM shareholder incentive results in Table 3-10.

Table 3-9. Enbridge 2018 Market Transformation verified achievements

Programs	Metrics	Verified Achievement	
		Program-level Savings	Metric-level Savings
School Energy Competition	Schools	14	14
Run-it-Right	Participants	62	62
Comprehensive Energy Management	Participants	5	5
Residential Savings by Design	Builders	35	35
	Homes Built	2,956	2,956
Commercial Savings by Design	New Developments	31	31

Table 3-10. Enbridge's 2018 Market Transformation scorecard targets, achievements, weights, and incentive*†

Metric	Target	Verified Achievement	Weight	Metric Score	Weighted Metric Score
School Energy Competition Schools	78	14	10.0%	15.8%	1.6%
Run-it-Right Participants	24	62	20.0%	200.0%	40.0%
Comprehensive Energy Management Participants	21	5	20.0%	20.0%	4.0%
Residential Savings by Design Builders	20	35	10.0%	175.0%	17.5%
Residential Savings by Design Homes	2,179	2,956	15.0%	135.6%	20.3%
Commercial Savings by Design Developments	28	31	25.0%	110.7%	27.7%
Verified Total Weighted Scorecard Achieved					111.1%
Maximum Scorecard Incentive					$1,135,233
Verified Scorecard Incentive Achieved					**$605,238**

*Not all values may compute exactly due to rounding.
†See Appendix M for a detailed description of the scorecard and incentive calculations.

3.2 Program Spending and Cost-Effectiveness

This section reports on Enbridge's program spending and cost-effectiveness.

3.2.1 Program Spending

The Enbridge tracking database included reported program spending information. The EC has reported on what was provided by Enbridge and has not verified spending figures or conducted a financial audit. Table 3-11 summarizes the spending across the portfolio. Additional spending detail is in Appendix P.

Table 3-11. Enbridge program cost summary*

Spending Area	OEB-Approved Budget	Utility Spending	Difference ($)	Difference (%)
Program Sub-total (no overhead)	$55,648,873	$55,467,556	-$181,317	<-1%
Program Overhead	$7,705,214	$7,591,607	-$113,607	-1%
Process and Program Evaluation	$1,700,000	$549,796	-$1,150,204	-68%
Other**	$2,500,000	$1,170,320	-$1,329,680	-53%
Total DSM Budget	**$67,554,087**	**$64,779,279**	**-$2,774,808**	**-4%**

*Not all values may compute exactly due to rounding.
**Other includes DSM IT Chargeback, Collaboration and Innovation, and Energy Literacy.

3.2.2 Cost Effectiveness

Table 3-12 and Table 3-13 show summary results for the TRC-Plus and PAC tests, respectively, including the cost-benefit ratio and the net present value. The EC cost effectiveness methodology applied in 2018 is consistent with what was done for the 2016 and 2015 analysis, however, new this year is the inclusion of the cost of carbon. As part of the OEB's DSM Mid-Term Report the OEB advised that carbon costs will be added to the cost-effectiveness test. Additional detail is provided in Appendix Q.

Table 3-12. Enbridge summary of cost-effectiveness ratio results, TRC-Plus Test*

Scorecard	NPV Benefits	NPV Costs	NPV Net Benefits (Benefits – Cost)	TRC-Plus Benefit Cost Ratio
Resource Acquisition	$152,598,000	$67,386,000	$85,211,000	2.26
Low Income	$28,288,000	$12,214,000	$16,074,000	2.32
Total	**$180,886,000**	**$79,600,000**	**$101,286,000**	**2.27**

*Not all values may compute exactly due to rounding.

Table 3-13. Enbridge summary of cost effectiveness ratio results, PAC Test*

Scorecard	NPV Benefits	NPV Costs	NPV Net Benefits (Benefits – Cost)	PAC Benefit Cost Ratio
Resource Acquisition	$133,012,000	$43,160,000	$89,852,000	3.08
Low Income	$25,123,000	$11,237,000	$13,886,000	2.24
Total	**$158,135,000**	**$54,397,000**	**$103,738,000**	**2.91**

*Not all values may compute exactly due to rounding.

3.3 DSM Shareholder Incentive and Lost Revenue

This section reports on the results of the DSM shareholder incentive and lost revenue calculations. The recommendations related to these activities are listed in section 5. See Appendix M for a description of the DSM shareholder incentive and lost revenue calculations and Appendix N for detailed tables.

3.3.1 DSM shareholder incentive

The EC gathered the verified scorecard achievements from section 3.1 to produce the DSM shareholder incentive by scorecard and overall, shown in Table 3-14. Detailed calculations with targets, weights, achievements and incentives are included in Appendix N.

Table 3-14. Enbridge DSM shareholder incentive results*

Scorecard	Verified DSMSI
Resource Acquisition	$2,955,435
Low Income	$422,199
Market Transformation	$605,238
Total	**$3,982,872**

*Not all values may compute exactly due to rounding.

3.3.2 Lost revenue

The EC summed the verified net annual savings (prorated by installation month) by rate class and estimated lost revenues. Table 3-15 shows the results for each rate class.

Table 3-15. Enbridge lost revenue results*

Rate Class	Verified Lost Revenue
Rate 110	$2,073
Rate 115	$0
Rate 135	$2,902
Rate 145	$5,678
Rate 170	$173
Total	**$10,827**

*Not all values may compute exactly due to rounding.

4 Union Gas Limited

This section reports the results of the annual verification and scorecard achievements of Union's 2018 DSM programs.

4.1 Scorecard Achievements

Union has five scorecards: Resource Acquisition, Large Volume, Low Income, Market Transformation, and Performance Based. Table 4-1 shows the programs included in each scorecard and the appendix that contains a detailed explanation of the verification of each program. For a discussion of the calculations behind the DSM shareholder incentive and lost revenue, see Appendix M.

Table 4-1. Overview of Union 2018 programs by scorecard

Scorecard	Program	Detailed Appendix
Resource Acquisition	Commercial & Industrial Custom Commercial & Industrial Direct Install Commercial & Industrial Prescriptive Home Reno Rebate	Appendix G
Low Income	Furnace End-of-Life Home Weatherization Indigenous Multifamily (Social and Assisted) Multifamily (Market Rate)	Appendix H
Large Volume	Large Volume Program	Appendix I
Market Transformation	Commercial New Construction Optimum Home	Appendix J
Performance Based	RunSmart Strategic Energy Management	Appendix K

Table 4-2 shows the Union scorecard for 2018, including the target metrics, verified achievement, weight, and shareholder incentive. These were the metrics reviewed as part of the annual verification. The utility achieved 152% of the incentive designated for full target achievement and 61% of the maximum possible DSMSI incentive.

Table 4-2. Union's 2018 achievement target, verified achievement, weight, and shareholder incentive by scorecard*

Program	Metric	2018 Target	2018 Verified Achievement	Weight	Utility Incentive
Resource Acquisition					
Commercial & Industrial Custom Commercial & Industrial Direct Install Commercial & Industrial Prescriptive Home Reno Rebate	CCM	818,345,497	976,937,929	75.0%	$ 5,809,659
Home Reno Rebate	Participants	8,010	16,118	25.0%	
Low Income					
Indigenous Furnace End-of-Life Home Weatherization	CCM	41,007,862	32,052,374	60.0%	$ 350,811
Multi-Family (Social & Assisted)	CCM	23,224,249	19,718,214	35.0%	
Multi-Family (Market Rate)	CCM	4,518,793	6,573,109	5.0%	
Large Volume					
Large Volume	CCM	195,727,318	89,196,896	100.0%	$ -
Market Transformation					
Optimum Home	Builders	8	8	10.0%	$ 205,755
	Homes	60.00%	83.33%	30.0%	
	% of Homes Built	5.00%	3.97%	10.0%	
Commercial New Construction	Developments	19	18	50.0%	
Performance Based					
RunSmart	Participants	44	44	10.0%	$ -
	Savings %	1.96%	0.51%	40.0%	
Strategic Energy Management	Participants	3	3	10.0%	
	Savings %	5.00%	3.86%	40.0%	
Total Verified Utility Incentive					**$ 6,366,226**
Incentive if 100% of target achieved					$ 4,180,000
Maximum possible incentive (if 150% of target achieved)					$ 10,450,000

*Not all values may compute exactly due to rounding.

4.1.1 Resource Acquisition

This section summarizes the results of the EC's review of the Union Resource Acquisition scorecard. The metrics for the Resource Acquisition scorecard include:

- Total cumulative natural gas savings
- Number of residential deep savings participants

A detailed explanation of the verification activities for all Resource Acquisition programs can be found in Appendix G. Verified program achievements are listed in Table 4-3 with DSM shareholder incentive results in Table 4-4.

Table 4-3. Union 2018 Resource Acquisition verified achievements*

Programs	Metrics	Verified Achievement	
		Program-level Savings	Metric-level Savings
Home Reno Rebate	CCM	205,146,928	976,937,929
Commercial & Industrial Custom		515,872,191	
Commercial & Industrial Prescriptive		204,967,607	
Commercial & Industrial Direct Install		50,951,203	
Home Reno Rebate	Homes Built	16,118	16,118

*Not all values may compute exactly due to rounding.

Table 4-4. Union's 2018 Resource Acquisition targets, achievements, weights, and incentive*†

Metric	Target	Verified Achievement	Weight	Metric Score	Weighted Metric Score
CCM	818,345,497	976,937,929	75.0%	119.4%	89.6%
Home Reno Rebate Homes Built	8,010	16,118	25.0%	200.0%	50.0%
Verified Total Weighted Scorecard Achieved					139.6%
Maximum Scorecard Incentive					$6,642,647
Verified Scorecard Incentive Achieved					**$5,809,659**

*Not all values may compute exactly due to rounding.
†See Appendix M for a detailed description of the scorecard and incentive calculations.

4.1.2 Low Income

This section summarizes the results of the EC's review of the Union Low Income scorecard. The metrics for the Low Income scorecard include:

- Total cumulative natural gas savings for single-family programs
- Total cumulative natural gas savings for "social & assisted" multifamily projects
- Total cumulative natural gas savings for "market rate" multifamily projects

A detailed explanation of the verification activities for all Low Income programs can be found in Appendix H. Verified program achievements are listed in Table 4-5 with DSM shareholder incentive results in Table 4-6.

Table 4-5. Union 2018 Low Income verified achievements*

Programs	Metrics	Verified Achievement	
		Program-level Savings	Metric-level Savings
Home Weatherization	CCM	31,815,336	32,052,374
Furnace End-of-Life		-	
Indigenous		237,038	
Multi-Family Social & Assisted	CCM	19,718,214	19,718,214
Multi-Family Market Rate	CCM	6,573,109	6,573,109

*Not all values may compute exactly due to rounding.

Table 4-6. Union's 2018 Low Income targets, achievements, weights, and incentive*†

Metric	Target	Verified Achievement	Weight	Metric Score	Weighted Metric Score
Single Family CCM	41,007,862	32,052,374	60.0%	78.2%	46.9%
Multi-Family - Social & Assisted CCM	23,224,249	19,718,214	35.0%	84.9%	29.7%
Multi-Family - Market Rate CCM	4,518,793	6,573,109	5.0%	145.5%	7.3%
Verified Total Weighted Scorecard Achieved					83.9%
Maximum Scorecard Incentive					$2,460,797
Verified Scorecard Incentive Achieved					**$350,811**

*Not all values may compute exactly due to rounding.
†See Appendix M for a detailed description of the scorecard and incentive calculations.

4.1.3 Large Volume

This section summarizes the results of the EC's review of the Union Large Volume scorecard. The metric for the Large Volume scorecard is total cumulative natural gas savings. A detailed explanation of the verification activities for the Large Volume program, broken out by prescriptive and custom savings, can be found in Appendix I. Verified program achievements are listed in Table 4-7 with DSM shareholder incentive results in Table 4-8.

Table 4-7. Union Gas 2018 Large Volume verified achievements*

Programs	Metrics	Verified Achievement	
		Program-level Savings	Metric-level Savings
Large Volume	CCM	89,196,896	89,196,896

*Not all values may compute exactly due to rounding.

Table 4-8. Union's 2018 Large Volume targets, achievements, weights, and incentive*†

Metric	Target	Verified Achievement	Weight	Metric Score	Weighted Metric Score
CCM	195,727,318	89,196,896	100.0%	45.6%	45.6%
Verified Total Weighted Scorecard Achieved**					45.6%
Maximum Scorecard Incentive					$725,313
Verified Scorecard Incentive Achieved					**$0.00**

*Not all values may compute exactly due to rounding.
**A minimum total weighted scorecard achievement level of 75% is required to earn a portion of the available shareholder incentive.
†See Appendix M for a detailed description of the scorecard and incentive calculations.

4.1.4 Market Transformation

This section summarizes the results of the EC's review of the Union Market Transformation scorecard. The metrics for the Market Transformation scorecard include:

- Number of qualified builders enrolled in the Optimum Home program
- Number of participating builders that built a prototype home
- Percentage of homes built
- Number of new developments enrolled by participating builders for Commercial New Construction

A detailed explanation of the verification activities for all Market Transformation programs can be found in Appendix J. Verified program achievements are listed in Table 4-9 with DSM shareholder incentive results in Table 4-10.

Table 4-9. Union 2018 Market Transformation verified achievements*

Programs	Metrics	Verified Achievement	
		Program-level Savings	Metric-level Savings
Optimum Home	Builders	8	8
Optimum Home	Homes Built	83.33%	83.33%
Optimum Home	Percentage of Homes Built	3.97%	3.97%
Commercial New Construction	New Developments	18	18

*Not all values may compute exactly due to rounding.

Table 4-10. Union's 2018 Market Transformation targets, achievements, weights, and incentive*†

Metric	Target	Verified Achievement	Weight	Metric Score	Weighted Metric Score
Optimum Home Builders	8	8	10.0%	100.0%	10.0%
Optimum Home Homes	60.00%	83.33%	30.0%	138.9%	41.7%
Optimum Home Percentage of Homes Built	5.00%	3.97%	10.0%	79.4%	7.9%
Commercial New Construction Developments	19	18	50.0%	95.0%	47.5%
Verified Total Weighted Scorecard Achieved					107.1%
Maximum Scorecard Incentive					$423,958
Verified Scorecard Incentive Achieved					**$205,755**

*Not all values may compute exactly due to rounding.
†See Appendix M for a detailed description of the scorecard and incentive calculations.

4.1.5 Performance Based

This section summarizes the results of the EC's review of the Union Performance Based scorecard. The metric for the Performance Based scorecard is the number of participants in the RunSmart and Strategic Energy Management programs respectively. A detailed explanation of the verification activities for all Performance programs can be found in Appendix K. Verified program achievements are listed in Table 4-11 with DSM shareholder incentive results in Table 4-12.

Table 4-11. Union 2018 Performance Based verified achievements*

Programs	Metrics	Verified Achievement	
		Program-level Savings	Metric-level Savings
RunSmart	Participants	44	44
	Savings %	0.51%	0.51%
Strategic Energy Management	Participants	3	3
	Savings %	3.86%	3.86%

*Not all values may compute exactly due to rounding.

Table 4-12. Union's 2018 Performance Based targets, achievements, weights, and incentive*†

Metric	Target	Verified Achievement	Weight	Metric Score	Weighted Metric Score
RunSmart Participants	44	44	10.0%	100.0%	10.0%
RunSmart Savings %	1.96%	0.51%	40.0%	26.0%	10.4%
Strategic Energy Management Participants	3	3	10.0%	100.0%	10.0%
Strategic Energy Management Savings %	5.00%	3.86%	40.0%	77.2%	30.9%
Verified Total Weighted Scorecard Achieved**					61.3%
Maximum Scorecard Incentive					$197,285
Verified Scorecard Incentive Achieved					**$0.00**

*Not all values may compute exactly due to rounding.
**A minimum total weighted scorecard achievement level of 75% is required to earn a portion of the available shareholder incentive.
†See Appendix M for a detailed description of the scorecard and incentive calculations.

4.2 Program Spending and Cost-Effectiveness

This section reports on Union's program spending and cost-effectiveness.

4.2.1 Program Spending

Union's tracking database included program spending by scorecard. The EC has reported on what was provided by Union and has not verified spending figures or conducted a financial audit. Table 4-13 shows the Union budget for the portfolio overall. Additional spending detail is in Appendix P.

Table 4-13. Union program cost summary*

Spending Area	OEB-Approved Budget	Utility Spending	Difference ($)	Difference (%)
Programs Sub-total (no overhead)	$47,762,000	$52,885,369	$5,123,369	11%
Program Overhead	$9,868,305	$9,606,417	-$261,888	-3%
Research	$1,000,000	$672,614	-$327,386	-33%
Evaluation	$1,300,000	$868,505	-$431,495	-33%
Administration	$2,842,000	$3,858,510	$1,016,510	36%
Other**	$500,000	$1,096,746	$596,746	119%
Total DSM Budget	**$63,272,305**	**$68,988,161**	**$5,715,856**	**9%**

*Not all values may compute exactly due to rounding.
**Other includes pilot programs, Future Infrastructure Planning Study, and Open Bill Project.

4.2.2 Cost Effectiveness

Table 4-14 and Table 4-15 show summary results for the TRC-Plus and PAC tests, respectively, including the net present value and benefit-cost ratio. The EC cost effectiveness methodology applied in 2018 is consistent with what was done for the 2016 and 2015 analysis, however, new this year is the inclusion of the cost of carbon. As part of the OEB's DSM Mid-Term Report the OEB advised that carbon costs will be added to the cost-effectiveness test. Additional detail is shown in Appendix Q.

Table 4-14. Union summary of cost-effectiveness ratio results, TRC-Plus Test*

Scorecard	NPV Benefits	NPV Costs	NPV Net Benefits (Benefits – Cost)	TRC-Plus Benefit Cost Ratio
Resource Acquisition	$211,610,000	$103,073,000	$108,537,000	2.05
Low Income	$13,411,000	$10,321,000	$3,090,000	1.30
Large Volume	$16,745,000	$6,790,000	$9,955,000	2.47
Total	**$241,766,000**	**$120,184,000**	**$121,582,000**	**2.01**

*Not all values may compute exactly due to rounding.

Table 4-15. Union summary of cost effectiveness ratio results, PAC Test*

Scorecard	NPV Benefits	NPV Costs	NPV Net Benefits (Benefits – Cost)	PAC Benefit Cost Ratio
Resource Acquisition	$177,846,000	$46,147,000	$131,700,000	3.85
Low Income	$11,110,000	$10,806,000	$303,000	1.03
Large Volume	$15,187,000	$2,822,000	$12,365,000	5.38
Total	**$204,143,000**	**$59,775,000**	**$144,368,000**	**3.42**

*Not all values may compute exactly due to rounding.

4.3 DSM Shareholder Incentive and Lost Revenue

This section reports on the results of the DSM shareholder incentive and lost revenue calculations. The recommendations related to these activities are listed in section 5. See Appendix M for a description of the DSM shareholder incentive and lost revenue calculations and Appendix N for detailed tables.

4.3.1 DSM shareholder incentive

The EC gathered the verified scorecard achievements from section 4.1 to produce the DSM shareholder incentive by scorecard and overall, shown in Table 4-16. Detailed calculations with targets, weights, achievements, and incentives are included in Appendix N.

Table 4-16. Union DSM shareholder incentive results*

Scorecard	Verified DSMSI
Resource Acquisition	$5,809,659
Large Volume	$0
Low Income	$350,811
Market Transformation	$205,755
Performance Based	$0
Total	**$6,366,226**

*Not all values may compute exactly due to rounding.

4.3.2 Lost revenue

The EC summed the verified net annual savings (prorated by installation month) by rate class and estimated lost revenues. Table 4-17 shows the results.

Table 4-17. Union lost revenue results*

Rate Class	Verified Lost Revenue
M4 Industrial	$128,413
M5 Industrial	$8,297
M7 Industrial	$9,878
T1 Industrial	$1,528
T2 Industrial	$1,272
20 Industrial	$9,609
100 Industrial	$342
Total	**$159,339**

*Not all values may compute exactly due to rounding.

5 Findings and Recommendations

The EC conducted the verifications of the 2017 and 2018 program years in tandem. Therefore, this section contains the recommendations from the 2017 and 2018 annual verification efforts and all other evaluations conducted on the 2017 and 2018 programs or completed since the 2016 report. The annual verification recommendations are in the first section. CPSV recommendations are in the second section. Free Ridership Based Attribution recommendations are in the third section. C&I Prescriptive Program NTG recommendations are in the fourth section. Some recommendations overlap the various studies and are provided in multiple sections.

5.1 2017 and 2018 Annual Verification Recommendations

The 2018 annual verification identified numerous recommendations. Many of these recommendations were previously identified in annual verification processes. While the EC appreciates that insufficient time elapsed between evaluations for implementation of the 2017 recommendations, they are nonetheless included here. In the tables below, the primary outcomes of the findings and recommendation are classified into three categories: reduce costs (evaluation or program or both), improve savings accuracy, and decrease risk (multiple types of risk are in this category including risk of adjusted savings, risk to budgets or project schedules, and others). Details of the findings, recommendations and outcomes follow the tables.

Table 5-1. Overall annual verification - summary of recommendations

#	Finding	Recommendation	Previously Recommended	Applies to 2018			Primary Outcome		
				Union	Enbridge	Evaluation	Reduce Costs	Improve Accuracy	Decrease Risk
O1	The Enbridge tracking file does not currently include information that allows the evaluator to identify all the projects installed by a single customer.	A: Enbridge should include site-level information for all measures installed through the program.	✓		✓			✓	✓
O2	The format of Enbridge's tracking data is not well suited to a combined evaluation with the Union data.	A: Enbridge should deliver tracking data in a single flat file.	✓		✓		✓	✓	✓
O3	Neither Union nor Enbridge tracking databases currently use prescriptive measure descriptions that map directly to the approved energy savings spreadsheet (TRM).	A: Develop, maintain, and use an electronic summary spreadsheet of the TRM.	✓	✓	✓	✓	✓	✓	✓
		B: Once the electronic TRM spreadsheet is developed, track prescriptive savings using unique	✓	✓	✓	✓	✓	✓	✓

		measure descriptions that map to electronic TRM.							
		C: Once the electronic TRM spreadsheet is developed, utilize the same electronic TRM for both utilities.		✓	✓	✓	✓	✓	✓
		D: OEB: develop means for consistent system.				✓	✓	✓	✓
O4	Explicit documentation was not available for all program stages, specifically for non-savings metrics	A: Document each required element and stage for non-savings metrics.		✓	✓	✓	✓		✓
		B: Data, information, and documentation is overly redacted.		✓	✓			✓	✓
O5	Programs that rely on external reference sources required additional verification to identify the appropriately used source.	A: Documentation should record and explicitly cite the external source that was used for each program.		✓	✓		✓	✓	✓
		B: Program design should strive for the most up-to-date reference source to improve and promote greater energy efficiency outcomes.		✓	✓		✓	✓	✓

Table 5-2. Whole home simulation modelling - summary of recommendations

#	Finding	Recommendation	Previously Recommended	Applies to			Primary Outcome		
				Union	Enbridge	Evaluation	Reduce Costs	Improve Accuracy	Decrease Risk
SM1	Both utilities use building simulation modeling to estimate energy savings	A: Provide both simulation file (HSE) and output file (TSV) to the evaluation team for every project.	✓		✓		✓		✓
SM2	Both utilities collect and deliver *some* photographs to support retrofit site improvements.	A: Provide more explicit support for major measure installations.	✓	✓	✓				✓

#	Finding	Recommendation	Previously Recommended	Applies to			Primary Outcome		
				Union	Enbridge	Evaluation	Reduce Costs	Improve Accuracy	Decrease Risk
SM3	There were some inaccurate savings entries.	A: Consider reviewing and modifying program processes to avoid data entry or outdated simulation result errors.		✓			✓		✓
		B: Provide more explicit support for major measure installations.	✓	✓	✓		✓		✓
SM4	Air sealing as a savings measure is present in a high percentage of single-family home retro-fit projects.	A: Evaluation: distribute before and after equivalent leakage area and energy savings attributable to reduced air leakage (if possible).				✓		✓	✓
SM5	The energy savings from the home retrofit programs rely exclusively on the simulations provided by the delivery agents.	A: Consider funding a study to verify the models produced by the utility agents.	✓			✓		✓	

Table 5-3. Cost-effectiveness - summary of recommendations

#	Finding	Recommendation	Previously Recommended	Applies to			Primary Outcome		
				Union	Enbridge	Evaluation	Reduce Costs	Improve Accuracy	Decrease Risk
CE1	All overhead is still applied at the sector level rather than the program level.	A: Allocate "sector"-level administrative cost and overhead to each individual program.	✓	✓	✓			✓	✓
CE2	The utilities continue to use different nominal discount rates due to different inflation rates selected	A: Increase transparency around the inflation rates selected and why.	✓	✓	✓	✓	✓		✓
CE3	The avoided costs provided by the utilities are not clearly labelled as being real or nominal dollars.	A: For all components of streams of avoided costs clearly identify whether they are real or nominal.		✓	✓			✓	
CE4	EUL is inconsistently applied for accelerated projects.	A: Include separate fields in the tracking data to explicitly communicate accelerated, annual and cumulative savings.			✓			✓	

5.1.1 Overall Annual Verification Recommendations

O1. Finding: The Enbridge tracking file does not currently include information that allows the evaluator to identify all the projects installed by a single customer. While Enbridge does provide IDs, these may or may not be consistent across programs or metrics, or from year to year.

Recommendation A: Enbridge should include a unique site-level or customer-level identifier for every measure installed in the program to allow the evaluator to identify all projects installed at a single customer, regardless of program.

Outcome: Confirmation that each installation is unique and assessment of interactive effects.

O2. Finding: The format of Enbridge's tracking data is not well suited to a combined evaluation with the Union data, meaning that the format requires a significant investment of time to extract the necessary data for verifying each program's savings. In addition to increased time and thus verification cost, the need for manual extraction of data introduces many opportunities for error, which potentially decreases savings accuracy and increases risk.

Recommendation A: Deliver to evaluators a single, flat file of tracking data.[18] Each record should have measure-level information which includes the information listed below:

- Program identification information, such as scorecard, and program name
- Customer identification information, such as a unique customer ID, rate class, and location
- Measure identification information, such as measure description, unique measure identification, measure group, measure life, free rider rate, and savings per unit for prescriptive measures
- Savings information, such as annual gross and net savings, cumulative gross and net savings, and non-gas savings
- Additional information as needed to allow the evaluator to verify lost revenue and cost-effectiveness

A "verification ready" flat file would not require summary rows, hidden rows or columns, links or formulas but would include all necessary variables in a single tab or table for all projects and measures, regardless of type.

Outcome: Reduced burden on program staff, more flexibility for evaluators.

O3. Finding: Both Union and Enbridge tracking databases currently use prescriptive measure descriptions that map directly to *internally* consistent measure names. However, there remains a lack of a universally accessible (i.e. public) dataset that is fully transparent and comprehensive for all prescriptive and quasi-prescriptive measures. New versions of the Technical Reference Manual (TRM) provide full documentation for new or updated measures; this limited update does not provide a comprehensive resource for all currently accepted measures nor does it provide a concise location for all items that can impact gross or net savings such as detailed accounting of free ridership.

Recommendation A: Develop, maintain, and use an electronic summary of the TRM, such as an Excel file. Each measure (identified as a unique savings value) should have an assigned measure ID number, and new ID numbers should be assigned when a measure is updated with a new savings value. This allows for a historical record of the changes in the TRM and allows the evaluation to identify outdated

[18] In this context, a flat file is a table with one record per line and no summary information.

values. Once developed or agreed to, both utilities should utilize this system for simplification and transparency.

Recommendation B: Once the electronic TRM is developed, track prescriptive savings using unique measure descriptions that clearly map to the electronic TRM.

Recommendation C: Once the electronic TRM is developed, utilize the same electronic summary file for both utilities.

Recommendation D: As the entity with primary ownership of the TRM, the OEB should develop the references for parties to directly refer to specific measures in a consistent way which accounts for variations in energy savings due to capacity or other characteristics.

Outcome: Reduced burden on utility staff and reduced evaluation costs. Fewer errors in the tracking data.

O4. Finding: Explicit documentation was not available for all program stages for programs such as Enbridge's Market Transformation Run-it-Right program. In that program, there was no documentation for participants moving to step 4 of the program (see Appendix J), only documentation that the participants had completed step 3 and utility confirmation that this is equivalent to engagement in step 4. Similar recommendations are included in section 5.1.2 for whole home simulation modeling programs.
Recommendation A: Documentation for each required element and stage for non-savings metrics should be recorded. The majority of these elements for future years have been identified in this evaluation, in the scorecard and program-relevant appendix sections.

Outcome: Reduced burden on utility staff and reduced evaluation costs.

O5. Finding: Programs that rely on external reference sources required additional verification to identify the appropriately used source. One such program is Union's Optimum Home program. In that program, additional verification was needed to identify which building code was required for program qualification.
Recommendation A: Documentation should record and explicitly cite the external source that was used for each program.
Recommendation B: Program design should strive for the most up-to-date reference source to improve and promote greater energy efficiency outcomes.

Outcome: Reduced burden on utility staff and reduced evaluation costs. Improve program implementation and goals.

5.1.2 Whole Home Simulation Modeling Recommendations

SM1. Finding: Both utilities use building simulation modeling to estimate energy savings for their home retrofit programs, including the Home Energy Conservation, Home Reno Rebate, Winterproofing, Home Weatherization and Indigenous Programs. HOT2000 is the program used for those simulations, which is a program developed and released by NRCan for certified energy advisors. Because of the restrictions on the program, the evaluator could not consistently run the simulation files and produce the same result reported by the program. Because of a previous round of evaluation, Enbridge and Union provided TSV files for all sites that improved the accuracy of verification. However, it would be useful to include full supporting documentation for all claimed project measures.

Recommendation A: Provide the building simulation file (HSE), the program output file (TSV), and full supporting documentation for *all* claimed project measures for every sampled project.

Outcome: Reduced burden on utility staff and reduced evaluation costs.

SM2. Finding: Both utilities collect and deliver *some* photographs to support many of the changes made at a home retrofit site as well as additional documentation for installed equipment and performed measures. However, the evaluator could not consistently confirm the number or type of major measures installed based on the photographs or other documentation provided.

Recommendation A: Consider providing more explicit support for each measure to eliminate uncertainty around project savings and participation. Full project documentation (pre/post photos, documentation of all installations or actions such as invoices and/or photos of each measure, data collection reports, pre-and post blower door tests for all sites) to the evaluation team. By delivering all documentation, the evaluation team would not have to follow up with the utility to obtain output for models that could not be run but could still verify the output for models that can be run.

Outcome: Greater certainty around scorecard achievements.

SM3. Finding: The evaluator identified a number of inaccurate savings entries due to data entry errors or outdated Union home retrofit simulation results. Many of these errors could be avoided through changes in program processes.

Recommendation A: Consider reviewing and modifying program processes to avoid similar errors in the future.

Recommendation B: Consider providing more explicit support for each measure to eliminate uncertainty around project savings and participation. Full project documentation (pre/post photos, documentation of all installations or actions such as invoices and/or photos of each measure, data collection reports, pre-and post blower door tests for all sites) to the evaluation team. By delivering all documentation, the evaluation team would not have to follow up with the utility to obtain output for models that could not be run but could still verify the output for models that can be run.

Outcome: Reduced burden on utility staff and reduced evaluation costs.

SM4. Finding: Air sealing as a savings measure is present in a high percentage of single-family home retro-fit projects, over 90% of projects in some programs. With such a high percentage of projects relying on a single measure, it is more important to ensure the savings validity of that measure.

Recommendation A: If possible, the evaluation team should evaluate the before and after leakage area and attributable energy savings.

Outcome: Greater certainty around savings estimates.

SM5. Finding: The energy savings from the home retrofit programs rely exclusively on the simulations provided by the delivery agents. Those simulations likely rely on a number of assumptions or standard modeling practices which may or may not follow industry standards. A detailed review of the models was outside the scope of the annual audit.

Recommendation A: Consider funding a study to verify the models produced by the utility agents to ensure they conform to standard industry practice.

Outcome: Greater certainty around savings estimates.

SM6. **Finding:** Site-level documentation confirmed that an auditor was involved, it does not signal that the auditor was an approved Certified Energy Evaluator.

Recommendation A: Tracking certifications for all energy evaluators and/or auditors submitting records.

Outcome: Ensuring proper credentials for all auditors decreases risk to program.

SM7. **Finding:** Number of projects for residential retrofit programs remains very large. Other programs required a second data request to verify metrics.

Recommendation A: Increase sample to include more project files in following verification cycles.

Outcome: Increased sample, along with improved documentation recommended earlier, increases the accuracy of savings estimates for the applicable programs.

5.1.3 Cost-effectiveness Recommendations

CE1. **Finding:** For 2018, administrative and overhead costs are still being allocated differently by each utility. For example, Union identifies administration and evaluation costs at the scorecard level whereas Enbridge details spending as direct and indirect at the OEB-defined program level and then has an explicit 'overhead' spend at the scorecard level. In the absence of clear direction from the utilities, the EC apportioned costs based on the distribution of savings, but that is not likely accurate. To facilitate the analysis, ensure that program costs are properly allocated and cost-effectiveness results reflect the true costs of each program, the EC recommends that the utilities report spending in a consistent format and apportion all overhead costs to individual programs rather than the scorecard level. This issue was also identified in 2015 and 2016.

Recommendation A: Allocate "sector"-level administrative cost and overhead to each individual program and report program-level cost-effectiveness results. Explicit allocation of general administration and evaluation costs will allow for easier cost-effectiveness calculations at the program level and ensure that cost-effectiveness results properly reflect true program costs.

Outcome: Allocating "sector" level administrative costs will ensure all costs are properly accounted for and that cost-effectiveness results better reflect the true program costs.

CE2. **Finding:** The utilities are using different inflation rates to calculate discount rates for 2018. While Enbridge calculated the 2018 inflation rate using the five-year average Consumer Price Index (2018-2022) Ontario CPI (updated January 19, 2018)[19], it is unclear how Union's inflation rates were selected. The table below compares inflation rates used by the two utilities in 2018.

[19] http://www.conferenceboard.ca/e-data/data/consumerpriceindex.aspx

	Enbridge	Union
Real Discount Rate	4.00	4.00
2018 Inflation Rate	2.11	1.27
Nominal Discount Rate	6.20	5.32

A scenario analysis using the different rates selected by the two utilities reveals a difference of +/- 6% to 8% in the TRC and PAC results.

Enbridge	TRC			PAC		
Discount Rate	**6.20%**	**5.32**	**% Diff**	**6.20%**	**5.32%**	**% Diff**
Resource Acquisition	2.26	2.43	7%	3.08	3.32	8%
Low Income	2.32	2.51	8%	2.24	2.42	8%
Total	**2.27**	**2.45**	**8%**	**2.91**	**3.13**	**8%**

Union	TRC			PAC		
Discount Rate	**5.32%**	**6.20%**	**% Diff**	**5.32%**	**6.20%**	**% Diff**
Resource Acquisition	2.05	1.91	-7%	3.85	3.59	-7%
Large Volume	2.47	2.33	-6%	5.38	5.08	-6%
Low Income	1.30	1.20	-8%	1.03	0.95	-8%
Total	**2.01**	**1.88**	**-7%**	**3.42**	**3.19**	**-7%**

It is unclear why the values would vary in the same year for the two utilities. Using two different inflation rates limits the ability to directly compare each utility's cost-effectiveness results.

Recommendation A: The utilities should increase transparency around the inflation rates selected and why and should align inflation rates to allow direct comparison of the two utility cost-effectiveness results.

Outcome: Increasing the transparency of inflation rates used will ensure alignment between the two utilities and allow the EC to directly compare cost-effectiveness results.

CE3. Finding: The avoided costs provided by the utilities are not clearly labelled as being real or nominal dollars. The rule in a cost-effectiveness analysis is that both costs and discount rates must either both be nominal, or both be real. By including nominal costs and real discount rates, the cost-effectiveness analysis will exaggerate benefits. Just the opposite (nominal discount rate, real costs) will underestimate benefits. For the cost-effectiveness analysis, the EC treated everything as nominal.

Recommendation A: For all components of streams of avoided costs, clearly state whether they are real or nominal.

Outcome: Clearly labelling all avoided costs as being either real or nominal will ensure all streams of avoided costs are treated as nominal for the cost-effectiveness analysis.

CE4. **Finding:** In 2016 the EC found that the EUL and cumulative gross savings were not provided in a consistent manner in the Enbridge program tracking database. This occurred again in 2018. The EUL inconsistency is the result of a work-around for advanced (Accelerated) projects used by Enbridge to allow the LRAM first year savings and the CCM to align. To perform the cost-effectiveness analysis correctly, the EC requires the EUL of the upgrade measure, the RUL (Remaining Useful Life) of the equipment being replaced, as well as the differing savings amounts for the two differing baselines. Given the lack of data, the EC calculated the annualized saving by taking the full lifetime resource savings and spreading it equally across each year of the measure. The equipment EUL for Advancement measures was not provided, but it appears that all the Advanced measures are boilers. Thus, the EC assumed a boiler EUL of 25.

Recommendation A: Include separate fields in the program tracking database for EUL, RUL, gross first year annual savings, gross post-RUL annual savings, NTG, gross cumulative savings, net cumulative savings, and net first year savings.

Outcome: Including separate fields will ensure that the EC has all required information to calculate the annualized savings.

5.2 CPSV Recommendations

The following recommendations are summarized from the 2017-2018 Custom Project Savings Verification study finalized in 2020. The entire report is included **Error! Reference source not found.**.

Table 5-4. Energy savings and program performance recommendations

#	Energy Savings and Program Performance		Applies to			Primary Outcome			
	Finding	Recommendation	Union	Enbridge	Evaluation	Reduce Costs	Increase Savings	Customer Satisfaction	Decrease Risk
1	Both utilities exhibit a strong commitment to accurate energy savings estimate	The utilities should continue in their commitment to accuracy.	✓	✓				✓	✓
2	The CPSV effort found realization rates for market segments that were between 90 and 125% and identified adjustments for most projects.	Continue performing custom savings verification on a regular basis.			✓				✓
3	Relative precision targets were not met for all programs, nor for all segments	Use error ratio assumptions from the results provided in this report in future evaluation years, possibly with more conservative bounding than performed this year.			✓	✓			✓
4	Some measures have difficult-to-define baseline technologies.	Establish a policy to define rules around energy savings calculation for fuel switching and district heating/cooling measures.	✓	✓	✓				✓
5	Some measures in each utility program are routine maintenance, periodic repairs, or like for like replacements that are considered standard care in other jurisdictions.	Establish a clear policy regarding eligibility of maintenance repair and like for like replacement measures for the programs.	✓	✓	✓	✓			✓

#	Energy Savings and Program Performance		Applies to			Primary Outcome			
	Finding	Recommendation	Union	Enbridge	Evaluation	Reduce Costs	Increase Savings	Customer Satisfaction	Decrease Risk
6	Multiple heat sources and third-party purchases of heat require more documentation than typical measures	Document the gas demand in the pre-period that will be offset Document the volume of heat/steam/biogas available, the seasonality of supply and its alternative usage.	✓	✓					✓

Table 5-5. Verification process recommendations

#	Verification Process		Applies to			Primary Outcome			
	Finding	Recommendation	Union	Enbridge	Evaluation	Reduce Costs	Increase Savings	Customer Satisfaction	Decrease Risk
7	DNV GL was unable to obtain access to all the equipment at all the sites selected for verification.	Modify contracts to require participants to agree to comply with EM&V as part of the requirements for participation in the program.	✓	✓		✓			✓

Table 5-6. Documentation and Support recommendations

#	Documentation and Support		Applies to			Primary Outcome			
	Finding	Recommendation	Union	Enbridge	Evaluation	Reduce Costs	Increase Savings	Customer Satisfaction	Decrease Risk
8	Incremental improvement in project documentation by both utilities was again observed in the 2017-2018 CPSV. However, project documentation could still be improved.	Implement an electronic tracking system that archives all materials Include explicit sources for all inputs and assumptions in the project documentation. Store background studies and information sources with the project files and make them available to evaluators. Provide evaluators full access to customer data. Provide pre- and post-installation photos, where available. Institute a checklist as part of project closeout to ensure all relevant project documentation is assembled and ready for verification	✓	✓			✓		✓
9	Utility savings estimates based on annual energy consumption for industrial sites did not always include sufficient information documenting production.	Include site production totals in relevant years in the savings estimates based on annual energy consumption for industrial sites	✓	✓					✓
10	Enbridge Boilers use a 73% assumed thermal efficiency for in situ boilers that have been in place for more than 10 years.	Estimate boiler degradation from name plate efficiency to determine the baseline boiler efficiency rather than use a flat number	✓	✓					✓

#	Documentation and Support		Applies to			Primary Outcome			
	Finding	Recommendation	Union	Enbridge	Evaluation	Reduce Costs	Increase Savings	Customer Satisfaction	Decrease Risk
11	Pipe insulation is a significant source of savings for the Union programs. Documentation supporting the assumptions used in calculations, in situ conditions, and location of incentivized pipe insulation was not consistently provided.	Document baseline conditions of pipe insulation (and other measures) using photos and text descriptions to provide context. Explicitly tie the documentation of baseline condition to the heat loss assumption in the savings calculation. Documentation should clearly identify location of pipe insulation installed under the program, as well as associated equipment, especially in large facilities.	✓	✓					✓
12	Documentation did not always include explanation and supporting documentation for baseline types (ROB, ER) and remaining useful life (RUL).	Always provide a complete description of the base case. The description should reference included emails and photos to document in situ conditions and features that are carried over into the baseline system.		✓					✓
13	The utilities should use longer duration data in program savings estimates when possible.	Use longer duration data in program savings estimates. When time periods less than a year are used, utilities should document why the period used is applicable to a full year and why a full year was not able to be used.	✓	✓		✓			✓
14	In situ boiler name plate information, age and operating condition were not always recorded or described.	Document in situ boiler name plate information, age and operating condition for all projects where boiler efficiency affects savings.	✓	✓					✓

#	Documentation and Support		Applies to			Primary Outcome			
	Finding	Recommendation	Union	Enbridge	Evaluation	Reduce Costs	Increase Savings	Customer Satisfaction	Decrease Risk
15	At large sites with multiple spaces containing similar equipment, program documentation did not always identify which space or piece of equipment was affected by the project.	Include additional descriptions of spaces and equipment affected to differentiate among similar spaces and equipment at the site.	✓	✓					✓
16	Invoices were not always included with documentation, and sources for incremental costs were not always clear.	Ensure that incremental costs are supported by invoices or other documentation, especially for add-on and optimization measures where the total cost and incremental cost are likely to be the same.	✓	✓				✓	✓
17	Larger projects appeared to fall under the same documentation standards as smaller projects.	Increase the amount of documentation and source material for projects that have greater energy savings.	✓	✓					✓
18	Union's custom project summary workbook is a good approach to documentation. The workbook is not used in a consistent manner across all projects.	Consider providing more training or adding quality control steps to ensure the summary workbook front page is completed and stored in a consistent manner. Identify a common approach for common measures and, if applicable, document deviations and the reasons for the deviations in a clearly labelled field on the summary sheet.	✓			✓			✓
19	Enbridge Etools does not sufficiently document sources of inputs and assumptions.	Provide details used in Etools in the application along with supporting documentation.		✓		✓			✓

Table 5-7 Data management recommendations

#	Data Management		Applies to			Primary Outcome			
	Finding	Recommendation	Union	Enbridge	Evaluation	Reduce Costs	Increase Savings	Increase Customer Satisfaction	Decrease Risk
20A	Neither Union nor Enbridge currently track participating customer or participating vendor contact information in their program tracking database. Providing the information to the evaluation puts significant burden on utility staff.	Track contacts associated with projects in the program tracking database.	✓	✓		✓		✓	✓
20B		Strongly consider investing in relational program tracking databases.	✓	✓		✓	✓	✓	✓
20C		Continue to use improved structure for data integrity in the evaluator request for contact information for the 2019 savings verification and evaluation.			✓	✓		✓	
21	The extracts from the utility program tracking database do not include dates for key project milestones.	Track and provide to evaluators dates for key milestones in the project.	✓	✓		✓			✓
22	EUL and cumulative gross savings were not provided in a consistent manner in the Enbridge program tracking database extract	Include separate fields in the program tracking database for all components of gross and net cumulative and first year savings.	✓	✓			✓		✓

5.2.1 Energy Savings and Program Performance

1. **Finding:** Both utilities exhibit a strong commitment to accurate energy savings estimates. Each has made significant investments in developing calculation tools which model savings accurately. For example, Union's dock door seal calculator is well considered and designed, and Enbridge's Etools calculator is very thorough in attempting to model savings for key measures.

   Both utilities chose to retain engineers with a strong understanding of their customers' building and process systems and showed a commitment to finding accurate savings estimates. On several occasions, both on the phone and in writing, the evaluation team suggested a value that would have increased

savings in a way that the utility program engineer did not think was valid. When this happened, neither utility was shy in suggesting that we may want to make a more conservative choice.

Recommendation: The utilities should continue in their commitment to accuracy.

Outcome: Accurate energy savings.

2. **Finding:** The CPSV effort this year found realization rates between 90 and 125% for each market segment and identified adjustments for most projects. Across the programs, adjustments increased savings on for 41 measures and decreased savings on 56 measures. 57 measures had a large adjustment (verified savings more than 20% different from tracked), which was an increase from the 2016 verification.

   Recommendation: Continue performing custom savings verification on a regular basis. Even a study that results in an adjustment of near 100% is still valuable because the programs know that their savings estimates will be reviewed. Knowing a review will be conducted improves the quality of pre-verification estimates. The review itself also results in information that improves future program savings estimates.

   Outcome: Accurate energy savings.

3. **Finding:** Relative precision targets were met or close to met for each program. The sample design incorporated the final 2016 error ratios (ERs) and averaged them with the assumption used in the 2016 sample design. ERs were further bounded (minimum ER was 0.25, maximum 0.60) to limit the risk of over- or under- collecting data. Several segments did not achieve the precision targets sought. In some cases, the precision target was not met due to lack of data from very large measures in the sample, while in others the variability in the gross realization rate for projects was simply greater than the error ratio assumption that was used.

   Recommendation: In future years, continue the process used to develop error ratios assumptions from the results provided in this report, possibly with more conservative bounding (potentially increasing the maximum ER) to avoid under-collection of data for any segments.

   Outcome: Realistic estimates of error ratios result in an appropriate amount of data collected to meet targets.

4. **Finding:** Some measures (e.g., geothermal heat pumps, combined heat and power, and those that save district heating energy) have difficult-to-define baseline technologies. Multiple different baselines are possible for these projects, depending on how one looks at the scope of the project. Two challenging aspects include how non-gas energy changes and offsite gas use are considered in savings estimates.

   Recommendation: Consider establishing a policy to define rules around energy savings calculations and baselines for fuel switching and district heating/cooling measures.

   Outcome: Less risk of adjustment and a better alignment between provincial energy efficiency goals and program implementation.

5. **Finding:** Some measures in each utility program are routine maintenance, periodic repairs or like for like replacements that are considered standard care in other jurisdictions.

Recommendation: Establish a clear policy regarding the eligibility of maintenance, repair and like for like replacement measures for the programs.

Outcome: Reduced free ridership risk.

6. **Finding:** The technical estimates of potential savings from a measure need to match the achievable potential at the site. In 2017-2018, projects included measures that saved heat, but translating the heat savings into gas savings was challenging due to multiple heat sources and fuels. Other projects included the purchase of heat or landfill gas where the sufficiency and seasonality of supply affected the achievable gas savings. Also important in third-party purchase measures is to document whether and how the purchased product is and would be used in the absence of the purchase.

   Recommendation: In situations with multiple heat sources, document the gas demand that is affected by the measure in order to establish whether gas is saved in all periods. For measures where heat, steam or biogas is purchased from a third-party where it is a by-product, document the sufficiency, seasonality and baseline use of the product without the purchase.

Outcome: Accurate energy savings.

5.2.2 Verifications Processes

7. **Finding:** DNV GL was unable to obtain access to all the equipment at all the sites selected for verification. Both Enbridge and Union have several large projects with industrial companies, including food processing, refineries, and other industries. In several cases, the customer refused to provide the necessary trend data to allow a reasonable verification of the project. This means we were unable to do more than a reasonableness check on the savings.

   A review of the Enbridge contract shows that the customer is not required to provide the information that is necessary for EM&V. The most relevant sections are:

   - Item 6: Payment of the Incentive Payment is subject to the completion of a satisfactory site inspection of the improvements, including the installed equipment by an authorized representative of Enbridge.
   - Item 9: Upon request within eighteen months of the commissioning date of the Project, and with reasonable notice, the Customer agrees to provide authorized representatives of Enbridge with access to the Project, and with required information or data relating to the project for the purposes of the Application and these General Terms and Conditions.

   Neither of these are sufficient for EM&V.

   Recommendation: Modify contracts to require participants to agree to comply with EM&V as well as utility representatives as part of the requirements for participation in the program.

   Outcome: Reduced evaluation costs and risks. Participant non-compliance requires evaluators to request documentation for a large backup sample, and to survey and/or visit additional sites to obtain sufficient data for the evaluation. The process of contacting a site and getting a refusal costs time and money, as does the substitution of an additional site to make up for the unobtained data. In some cases, there might not be additional sites to sample, in which case the evaluation estimates will have lower precision than they would with full compliance.

5.2.3 Documentation and support

8. **Finding:** Incremental improvement in project documentation by both utilities was again observed in the 2017-2018 CPSV. However, project documentation could still be improved. Specific issues included:

   - Project data or details missing
   - Insufficient measure-level details to fully describe what was installed
   - Descriptions that were difficult to understand
   - Use of black box tools
   - Hardcoded information in calculation spreadsheets
   - Undocumented assumptions
   - Input adjustments that approximate other effects, but are not explained
   - Insufficient access to customer data (by customers).
   - Adjustments to savings estimates for safety or influence that were not clearly marked, sourced, or carried out in a consistent fashion

   Recommendation: Improve data quality. Possible steps include:

   - Implement an electronic tracking system that archives all materials
   - Include explicit sources for all inputs and assumptions in the project documentation.
   - Store background studies and information sources with the project files and make them available to evaluators.
   - Provide evaluators with full access to customer data.
   - Provide pre- and post-installation photos, where available.
   - Institute a checklist as part of project closeout to ensure all relevant project documentation is assembled as ready for verification

   Outcome: Properly explaining and sourcing the savings calculation method and assumptions allows the evaluating engineer to more easily identify what needs to be verified. It also makes it easier to determine whether the methods and assumptions are reasonable and use program assumptions rather than seek documented values elsewhere.

9. **Finding:** Utility savings estimates based on annual energy consumption for industrial sites did not always include sufficient information to document production. The change in energy use pre- and post-measure is often sensitive to changes in production.

   Recommendation: Savings estimates based on annual energy consumption for industrial sites should include information from the site on the amount of production in the years used. If detailed production data are not available, the utilities should get percentage differences year to year (e.g.: if year 1=100%; is year 2 exactly the same or is it 95% or 110% of production the previous year).

   Outcome: Documenting production changes and using them in savings estimates will improve accuracy and reduce evaluation risk.

10. **Finding:** Enbridge boiler calculations use a 73% assumed thermal efficiency for in situ boilers that have been in place for more than 10 years. This value likely overstates energy savings with a baseline boiler that is 20 years or less in age. The value is based on a 2% de-rate of a 2007 combustion efficiency study that found an average combustion efficiency of 74.6% for 39 boilers aged 12-38 years (average

24.5). The study, which Enbridge provided to the evaluation team, did not attempt to tie the degraded combustion efficiency to the original rated efficiency of the boilers. The study is also now more than 10 years old, so its findings are likely out of date and should only at most apply to 20-year-old or more boilers. For 2017-2018, the evaluation used the 73% value since a better option was unavailable at the time.

Recommendation: Use a degradation from name plate efficiency to determine the baseline boiler efficiency rather than use a flat number. The 2019 CPSV effort should include in the scope secondary research to determine a degradation factor or curve to be used for the 2019 CPSV and incorporated by the utilities for the 2020 program year until primary research is completed or a better approach is developed.

Outcome: Improving this key assumption will improve savings estimates for a significant portion of savings in the Enbridge portfolio and the process would also be applicable to Union sites where baseline boiler efficiencies are required and not based on site tests of boiler performance.

11. **Finding:** Pipe insulation is a significant source of savings for the Union programs. Documentation supporting the assumptions used in the calculation and the condition of the existing pipe insulation (via photos and/or a description) was not consistently provided. In large facilities, it was often difficult to determine the location of the pipe insulation that was installed for the particular project being evaluated, especially if they had multiple similar incentivized projects installed through the facility.

    Recommendation: Document baseline conditions using photos and text descriptions to provide context. Tie the documentation of the baseline condition to the heat loss assumption in a clear way. Include maps, drawings and/or descriptions that clearly identify the location of the installed pipe insulation for each measure and its associated equipment, especially in large facilities.

    Outcome: Improving documentation of baseline conditions and clarity in calculations will reduce evaluation risk and improve consistency of approach among the Union engineering team.

12. **Finding:** Enbridge documentation did not always include an explanation and supporting documentation for baseline types (replace on burnout, early replacement) and remaining useful life (RUL). "See Etools for base case" is not sufficient: Etools[20] is not designed to provide context and sources to support the values included.

    Recommendation: Always complete the "Base Case Overview" with a detailed description of the base case. The description should reference included emails and photos to document in situ conditions and features that are carried over into the baseline system.

    Outcome: Improved descriptions and documentation will reduce evaluation risk and help Enbridge ensure that accurate information has been entered into Etools.

13. **Finding:** The duration of pre- and/or post-data (energy consumption, production output, raw material consumption, etc.) used by the utilities for savings estimates was too brief in several instances.

[20] Etools is a suite of energy savings calculators that Enbridge has developed to document projects and provide savings estimates to contractors and customers.

Recommendation: The utilities should use data that encompasses a longer period of time in savings estimates when possible. When time periods less than a year are used, the utilities should document why the period used is applicable to a full year and why a full year was not able to be used.

Outcome: Increased accuracy of savings estimates.

14. **Finding:** The utilities did not always gather boiler nameplate data for in situ systems. The age and operating condition were also not always recorded or described. This was a concern on boiler projects, but also for projects where boiler efficiency has an effect on savings, such as greenhouses, pipe insulation and heat recovery.

    Recommendation: In situ boiler name plate information, age and operating condition are all helpful for determining the designed performance and reasonable range of actual efficiency for the system as well as providing context to better RUL.

    Outcome: Improving documentation of the in situ boiler will reduce uncertainty in savings estimates and reduce evaluation risk.

15. **Finding:** At large sites with multiple spaces containing similar equipment, the utility documentation did not always identify which space or piece of equipment was affected by the project.

    Recommendation: Include additional descriptions of spaces and the equipment affected by the measure to differentiate among similar spaces and equipment at the site.

    Outcome: Reduced evaluation risk.

16. **Finding:** Invoices were not always included with measure documentation, and the sources for incremental costs were not always clear.

    Recommendation: Ensure that incremental costs are supported by invoices or other documentation, especially for add-on and optimization measures where the total cost and incremental cost are likely to be the same. Equipment replacement measures may require an additional standard efficiency quote to produce incremental cost.

    Outcome: Incremental cost is an important component of simple payback, which is often used to judge the economic benefit of energy efficiency projects. It is also an input to some benefit-cost tests.

17. **Finding:** Larger projects appeared to fall under the same documentation standards as smaller projects.

    Recommendation: Increase the amount of documentation and source material for projects that have greater energy savings.

    Outcome: Projects that are better documented tend to have more accurate savings estimates and receive fewer evaluation adjustments than those that are less documented. Large projects have a greater effect on overall savings adjustment factors. Therefore, large projects with better documentation are more likely to result in program-level adjustment factors closer to 100%.

18. **Finding:** Union custom projects utilized a project application summary workbook that summarizes the key project inputs, calculations, and most details. In general, this is a good approach that facilitates

internal review and evaluation. One challenge was that different projects used the workbook in different ways:

- The notes section was sometimes used to identify and highlight specific unique approaches and features in projects, but not always.
- Calculations internal to the summary page were consistent for most projects, but not all; additional factors were sometimes added.
- Sub-methods critical to the calculation were sometimes contained in hidden sheets.
- Safety and influence adjustments were inserted in different locations and not always explained.

Recommendation: Consider providing more training or adding quality control steps to ensure the summary workbook front page is completed and stored in a consistent manner. Identify a common approach for common measures and, if necessary, document deviations and the reasons for the deviations in a clearly labelled field on the summary sheet.

Outcome: A consistent summary workbook aids both internal and external quality assurance, quality control, and measurement and verification.

19. **Finding:** Enbridge Etools is used as both a calculation tool and as a communication tool with customers. While it appears to serve the needs of the program, this form of communication is difficult for the evaluation efforts.

- Etools does not easily allow for assumptions to be sourced within the record.
- Some Etools selections may be site-specific and some may be defaults; the calculator does not clearly distinguish.
- Energy savings that are calculated outside of Etools are hard-entered in Etools but not always sourced.

Recommendation: Use a consistent summary workbook. Provide details used in Etools in the application along with supporting documentation.

Outcome: A consistent summary workbook aids both internal and external quality assurance, quality control, and measurement and verification.

5.2.4 Data management

20. **Finding:** Neither Union nor Enbridge currently track participating customer or participating vendor contact information in their program tracking database. Providing the information to the evaluation puts significant burden on utility staff.

Recommendation A: Track contacts associated with projects in the program tracking database. At a minimum, the program tracking database should include:

- Project site address
- Customer mailing address
- Primary customer contact name
- Primary customer contact phone
- Primary customer contact email
- Primary customer contact mailing address
- Addresses are best tracked as multiple fields including:

- Street address line 1
- Street address line 2
- City
- Province
- Postal code

Phone number fields should include data validation to enforce a consistent format and avoid missing or extra digit errors. Phone extensions should be tracked in a field separate from the ten-digit phone number and be restricted to numeric data only.

The best practice is to maintain contacts in a table separate from specific project or customer data. This allows for a single contact to be connected to multiple accounts and/or projects as necessary without creating duplication. This structure also makes it easier to associate multiple contacts with a single project and decreases quality control costs.

Vendor contact information should also be tracked in the database, in the same table as the participating customer contact information. With a relational database, the contact ID from the table can be added to a project record in the role consistent with the contact's participation (such as vendor, decision maker, or technical expert) with a separate table that allows a single vendor contact to be associated with multiple projects.

Outcome A: Reduced burden on utility staff to seek contact information for projects, whether for internal or evaluation use. Reduced evaluation costs and improved sample design expectations.

Recommendation B: The utilities should strongly consider investing in relational program tracking databases. Relational program tracking databases and customer relationship management (CRM) systems allow for multiple contacts to be associated with a single account and/or project. The incremental cost of implementation is low if it is part of the initial database design, populated as projects are started, and updated once they are complete.

For the implementation team, a query-able one-stop shop for data provides a wealth of information that can improve delivery. For example, these databases can help programs understand how contractors work across projects, identify when projects have hit snags and need attention, and give the program team access to key customer context such as historical participation and different contacts that have worked with the program.

For evaluation, this allows programs to easily clarify aspects of projects during implementation and to provide accurate, timely, and usable contact information to evaluators and verifiers.

Outcome B: Improved customer satisfaction from better delivery, and a reduced burden on utility staff for tracking information. A relational database would also streamline aggregation of program data for scorecards and make providing data simpler for annual savings evaluation and verification.

Recommendation C: Continue to use the improved structure for data integrity in the evaluator request for contact information for the 2019 savings verification and evaluation.

Outcome C: Reduced evaluation costs due to less data cleaning and research to fill missing information. Improved data collection with less returned advance letters and more accurate connection between projects and contacts.

21. **Finding:** The extracts from the utility program tracking database do not include dates for key project milestones. Enbridge's data did not include any dates and Union's included only the "install date."

    Recommendation: Track and provide to evaluators dates for key milestones in the project. Dates for project start, installation, and those that define the program year provide useful context for interviewers that is not always easy to find in project documentation

    Outcome: Improved data collection through more informed interviewers and reduced evaluation costs through less need to search for dates in documentation.

22. **Finding:** EUL and annual gross savings in the Enbridge program tracking database extract total to the correct cumulative savings but are a work around for advanced (accelerated) projects. The data structure provides accurate cumulative savings but does not store and report the underlying dual-baseline annual saving estimates, or the actual claimed RUL and the EUL for each measure.

    Recommendation: Include separate fields in the program tracking database for:

    - EUL
    - RUL
    - gross first year annual savings
    - gross post-RUL annual savings
    - net to gross (NTG)
    - gross cumulative gross
    - net cumulative savings
    - net first year savings

    Outcome: Improved data integrity results in less evaluation risk and more accurate savings totals. Providing each of the key savings types and their components allows evaluation to confirm that the savings provided are internally consistent.

5.3 Free Ridership Based Attribution Report Recommendations

The following recommendations are summarized from the 2018 Free Ridership Based Attribution study finalized in 2020. This study pertained only to the custom programs. The entire report is included in **Error! Reference source not found.**.

Table 5-8. Energy savings and program performance recommendations

#	Energy Savings and Program Performance		Applies to			Primary Beneficial Outcome			
	Finding	Recommendation	Union	Enbridge	Evaluation	Reduce Costs	Increase Savings	Customer Satisfaction	Decrease Risk
1	FR based attribution in some segments of the utilities' programs is low and variable	Evaluate free ridership for the programs annually and couple the free ridership evaluation with process evaluation			✓		✓		
2	Relative precision targets were not met for some targeted segments.	Error ratios from this report should inform sample design for future evaluation. Response rates from this report should inform the size of the backup sample for future evaluation.			✓	✓			✓
3	FR based attribution for the programs came primarily through acceleration	Align the program design with cumulative net goals	✓	✓			✓		
4	Some customers receive funding from multiple third-party sources	Consider the potential effect of multiple third-party incentives on free ridership			✓				✓
5	Projects with very long and very short simple payback periods often have high free ridership.	Consider establishing a policy that defines an eligibility floor and cap based on simple payback period for energy efficiency projects.	✓	✓			✓		✓

#	Energy Savings and Program Performance		Applies to			Primary Beneficial Outcome			
	Finding	Recommendation	Union	Enbridge	Evaluation	Reduce Costs	Increase Savings	Customer Satisfaction	Decrease Risk
6	Union's Large Volume program has a very low FR based attribution.	Consider the high free ridership within the context of the cost effectiveness of the program. High free rider programs can still deliver meaningful cost-effective net savings.	✓				✓	✓	
		Conduct a process evaluation to improve Large Volume influence on customer projects	✓				✓	✓	✓
7	Vendor attribution increased program attribution significantly for the Enbridge Commercial and Multifamily Segments	Consider expanding approaches to market for other programs that leverage third-party vendors.	✓	✓		✓	✓		
8	Union Agriculture FR based attribution is the highest among the Union programs.	Continue the proactive approach to DSM marketing in this sector.	✓				✓	✓	✓
9	The assumption for "never would have implemented" has a significant effect on free ridership based attribution.	Consider studying the typical planning horizons for each of the customer segments.			✓				✓
10	The treatment of efficiency in the scoring has a relatively small effect free ridership based attribution.	Consider simplifying the efficiency question sequence in future research to reduce survey length.			✓			✓	

#	Energy Savings and Program Performance		Applies to			Primary Beneficial Outcome			
	Finding	Recommendation	Union	Enbridge	Evaluation	Reduce Costs	Increase Savings	Customer Satisfaction	Decrease Risk
11	The current Lifecycle Net Savings method of free ridership based attribution has a large effect on free ridership based attribution	Continue to use the Lifecycle Net Savings method as long as the primary metrics for the program are based on Cumulative gas savings.			✓				✓

5.3.1 Energy Savings and Program Performance

1. **Finding:** FR based attribution in some segments of the utilities' programs is low and variable.

   Recommendation: Consistent annual evaluation of free ridership coupled with process evaluation will help identify specific ways for each program to manage and reduce free ridership. Consistent measurement of free ridership early in the next DSM framework can help Enbridge and stakeholders to understand what is working to drive net savings and provide lessons for continuous improvement.

   Outcome: Effective free ridership management will allow the programs to increase their net savings significantly in future years.

2. **Finding:** Relative precision targets were not met for some targeted segments. Error ratios from the evaluation were as high or higher than in the 2015 study and response rate was lower.

   Recommendation 1: Error ratios from the results provided in this report should be used to inform sample design for future evaluation years.

   Outcome 1: Better defined error ratios for the measures in the programs will allow more efficient sample design for future evaluations, improving precisions and reducing costs.

   Recommendation 2: Response rates from this evaluation should be considered in planning the amount of backup sample required for future studies.

   Outcome 2: A larger backup sample will provide more assurance of meeting sampling targets if response rates continue to be lower than in previous years. Approaches to increase response rates should be considered.

3. **Finding:** FR based attribution for the programs came primarily through acceleration rather than changes in efficiency or quantity. Acceleration is less valuable to programs that are seeking to meet cumulative net goals, because savings often drop after the acceleration period is over. Acceleration periods tend to

be considerably shorter than the estimated useful life (EUL) of a measure and thus the partial FR based attribution that results is low relative to cumulative gross savings.

Recommendation: To align the programs with cumulative net goals, the utilities should seek to:

- Continue promoting long life measures and consider discontinuing promotion of short-lived measures
- Proactively upsell equipment purchases from standard to efficient products
- Stop providing incentives for standard efficiency products even in non-replace on burnout situations
- Target hard to reach customers who have not participated in the past
- Continue to identify unique solutions that save energy at customer plants
- Expand promotion of energy efficiency measures with low market penetration (such as heat reflector panels)
- motivate customers to increase the scope of their projects. Some options include multi-measure bonuses or escalating incentive structures that pay more for doing more.
- Adopt lessons learned from the Enbridge Commercial and Multifamily approach to market, working proactively with vendors
- Increase focus on promoting novel energy saving solutions to industrial customer problems. Several customers indicated that the project would not have happened without the utility because Union or Enbridge identified a solution that they had not considered

Outcome 1: Focusing on proactive sales rather than reactive will help increase FR based attribution.

Outcome 2: Effective free ridership management will allow the program to increase net savings significantly in future years.

4. **Finding:** Some customers receive funding from multiple third-party sources (eg. IESO, municipalities, national and provincial carbon abatement programs/cap and trade), to complete the same energy efficiency measure. Both parties may claim the same changes in energy use, resulting in overlap when aggregated across fuels at the provincial level.

   Recommendation: Develop policies to collaborate across electric and gas projects to avoid double-counting fuel savings and increases from energy efficiency measures.

   Outcome: More accurate energy and carbon savings estimates across the province.

5. **Finding:** Projects with very long and very short simple payback periods often have low FR based attribution. However, from a customer service standpoint, it may be difficult for utilities to deny incentives to customers unless they have pre-established rules to point to.

   Recommendation: Consider establishing a policy that defines an eligibility floor and cap based on simple payback period for energy efficiency projects.

   Outcome: The rule will give utilities a guideline to restrict the program to projects that are more likely to result in FR based attribution. It will also allow the utilities to reject potentially poor projects without a large effect on customer satisfaction.

6. **Finding:** Union's Large Volume program has a very low FR based attribution.

Recommendation 1: FR based attribution is one metric with which to judge a program, but low-cost programs with high savings totals and high free ridership can still deliver significant volumes of cost-effective savings. The Union Large Volume has low program costs relative to the net CCM saved. The program still provides cost effective net savings despite having low FR based attribution.

Recommendation 2: This evaluation did not include a process evaluation. Union should consider conducting a process evaluation focused on how to reduce the rate of free ridership. Three options that the Union might consider are:

- Consider the benefit-cost of eliminating maintenance and like-for-like measure replacements, as they are associated with high free ridership.
- Use an application process that includes a committee review that can reject free rider projects. This option has been successful for government run programs, but would likely prove hard for utilities to manage as it can negatively affect customer satisfaction
- Develop clear payback criteria such as "initial payback must be longer than X years and the incentive paid must reduce payback below Y years." This has the advantage of being a rule that account representatives can explain when talking to customers.
- Consider the non-energy benefits realized by the customer when approving projects under a FR based attribution criterion. The non-energy benefits of many projects in the large industrial segment often large compared to the energy saving benefits, so simple payback criteria will not eliminate all free rider projects. Promote awareness of this issue among the implementation team.

Outcome: Effective free ridership management may allow the program to increase its net savings significantly in future years.

7. **Finding:** Vendor attribution increased attribution significantly for the Enbridge multifamily program and moderately for the Enbridge commercial program. Participants of all programs indicated vendor involvement at key decision-making junctures, suggesting that if Enbridge and Union are able to influence vendor recommendations, there may be an opportunity to increase indirect influence on participants in all segments.

   Recommendation: The utilities should consider what lessons can be learned from the Enbridge multifamily approach to market that is applicable to other segments. All segments may have opportunities to leverage third-party vendors. A process evaluation that includes vendor interviews might uncover specific opportunities and approaches that would help in transferring the Enbridge multifamily lessons to other segments.

   Outcome: Effective leveraging of vendors could both increase FR based attribution and program uptake.

8. **Finding:** Union Agriculture FR based attribution is the highest among the Union programs. Customers reported that Union account representatives recommended novel solutions for specific problems and appear to be a conduit for disseminating information on best practices.

   Recommendation: Continue the proactive approach to DSM marketing in this sector. Union appears to be playing a role in reducing information barriers which is leading to increased uptake of energy efficiency measures in this growing sector.

   Outcome: Effective leveraging of vendors could both increase FR based attribution and program uptake.

9. **Finding:** The sensitivity testing shows that the assumption for "never would have implemented" has a significant effect on free ridership based attribution.

   Recommendation: Consider studying the typical planning horizons for each of the customer segments to verify if the 2 year or 4 year assumptions are consistent with participating Ontario businesses in each segment.

   Outcome: More accuracy and confidence in free ridership based attribution results.

10. **Finding:** The sensitivity testing shows that the treatment of efficiency in the scoring has a relatively small effect free ridership based attribution.

    Recommendation: Consider simplifying the efficiency question sequence in future research to reduce survey length.

    Outcome: Reduced customer burden during interviews.

11. **Finding:** The sensitivity testing shows that the current Lifecycle Net Savings method of free ridership based attribution has a large effect on free ridership based attribution relative to the simpler Year 1 Net Savings method.

    Recommendation: Continue to use the Lifecycle Net Savings method as long as the primary metrics for the program are based on Cumulative gas savings.

    Outcome: More accurate estimates of cumulative net savings for the programs.

5.4 Commercial & Industrial Prescriptive Program NTG Verification Recommendations

The following recommendations are summarized from the 2017 C&I Prescriptive study finalized in 2019. The entire report is included in Appendix S.

Table 5-9. 2017 C&I Prescriptive Program Verification: Findings & Recommendations

Finding	Recommendation	Applicable Entity
Free ridership levels for Enbridge ranged from 38% to 92% and from 50% to 93% for Union.	The utilities should consider evaluating free ridership for the programs annually and consider coupling the free ridership evaluation with process evaluation to better understand how the utilities are influencing the vendors and their outreach to the end-users.	Enbridge & Union
Both utilities had high ex-post gross realization rates, implying that the utilities are accurately estimating the ex-ante savings based on the measure sub-docs and/or the TRM.	GRRs were close to 100.00% for all evaluated Priority Measure Groups; ***no action recommended.***	Enbridge & Union
There was no participant spillover for either utility.	The utilities should work with the vendors to find out their protocol on recommending the installation of program measures at customers' facilities. This would enable the utilities to better understand the influence the programs have on the customers' behavior, especially in the context of spillover.	Enbridge & Union
	The utilities should also consider conducting a market study to quantify any nonparticipant spillover, contingent on EAC and EC consideration.	
Union could benefit from investing in a modern program tracking database with document storage capabilities as most of the participant and vendor contact information had to be extracted by the verification team.	Digitize and file project documentation for all projects as they are completed and paid during project closeout.	Union; however, it must be noted that Union has indicated the presence of an online tracking database for their 2018 programs
	Track contacts associated with projects in the program tracking database.	
	Strongly consider investing in relational program tracking databases.	

Finding	Recommendation	Applicable Entity
Vendor surveys had very low response rates	Incentives to complete survey Recommendation for Utility to communicate with vendors regarding the importance of this evaluation step during future NTG studies	Enbridge & Union and Verification Team
Participants were generally receptive in responding to surveys. The response rate for participants was around 50% for the first few months. After the first wave of customers were contacted, the more difficult corporate customers and unresponsive customers were attempted to be reached. By the end, after many attempts and exhausting the sample, the overall response rate was about 30% overall for participants.	Incentives to complete survey Recommendation for utilities to communicate with customers about the importance of this evaluation steps during future NTG studies	Enbridge & Union and Verification Team
Scoring methodology for participant's responses to efficiency questions "between standard and high" was sometimes not clear.	This item should be re-visited during subsequent NTG studies contingent on EAC and EC discussion. One alternative is that if a respondent indicates that they would have used an efficiency between standard and high without the program, but cannot answer the follow up question of the efficiency level they would use, instead of taking the average "between standard and high" responses for the measure, use the scoring for "standard efficiency" instead. The logic behind this is that if the customer does not know the efficiency level, it is likely that they may not have equipment at this efficiency.	Verification Team

6 APPENDICES

Appendix A Glossary of Terms and Key Concepts

Adjustment factor	The adjustment factors are ratios of savings that allow evaluation findings from a sample of projects to be applied to and "adjust" the population of program savings. Realization rates and ratios are other common terms.
Attribution	The portion of a program's verified energy savings that the utility influenced, including the effects of free ridership and spillover. When multiplied by the utility's claimed savings, the attribution ratio produces the volume of energy saved as a result of program implementation.
Baseline, base case	Energy use or equipment in place if the program measure had not been done
Building envelope	Exterior surfaces (e.g., walls, windows, roof, and floor) of a building that separate the conditioned space from the outdoors.
Capacity expansion (CE)	Measure that allows the customer to increase production or productivity
CCM	Cumulative Cubic meters (cumulative m^3)
Code	Measure required by regulations for safety, environmental, or other reasons
C&I	Commercial and Industrial
Cost Effectiveness	Ratio of the net present value of the stream of benefits to the stream of costs for a given set of measures, programs, or portfolios. Two primary cost effectiveness ratios are calculated, PAC and TRC+.
Custom Project Savings Verification (CPSV)	Activities related to the collection, analysis, and reporting of data for purposes of verifying gross custom program savings impacts.
Customer - Enbridge	Unique customers can be identified based on the account number and the contact information provided by Enbridge. A customer may have multiple site addresses, decision makers, account numbers, and utilities. Customers can only be identified for records for which we received contact information (i.e. records associated with account number that have measures in the sample or backup sample).
Customer - Union	Unique customers can be identified based on the customer ID and the contact information provided by Union. A customer may have multiple site addresses, decision makers, customer IDs, and utilities. Customers can only be identified for records for which we received contact information (i.e. records associated with customer ID that have measures in the sample or backup sample).
Demand side management (DSM)	Modification of customer demand for a product (in this case, energy) through various methods such as financial incentives, education, and other programs
Early replacement (ER)	Measure that replaces a piece of equipment that is not past its expected useful life and is in good operating condition
Domain	Grouping of like projects. A domain may be defined as projects within a specific sector or a category of measure types, end uses or other criteria.
Dual Baseline	Savings calculation approach which addresses or combines the savings associated with early replacement and the savings after the early replacement period.
Early replacement Period (ER Period)	Years that the existing equipment would have continued to be in use. This is the same as remaining useful life, or RUL.
Energy Advisors	Energy Advisors are utility and/or program staff who provide information to customers about energy saving opportunities and program participation. This

	term includes, but is not limited to, Enbridge's Energy Solutions Consultants and Union's Account Managers
Expected useful life (EUL)	The length of time that a measure is expected to provide its estimated annual savings. EUL is a function of equipment life and measure persistence.
Ex ante	Program claimed or reported inputs, assumptions, savings, etc.
Ex post	Program inputs, assumptions, savings, etc. which are verified after the claimed savings are finalized. Does not include assessment of program influence. Synonym for verified gross savings.
Free rider	A customer who would install the same energy efficiency measure without intervention from the utility.
Free ridership	The portion of a program's verified energy savings that would naturally occur without intervention from the utility.
Free ridership based attribution	The portion of a program's verified energy savings that the utility influenced if one only considers free ridership and not spillover. Free ridership based attribution is the complement of free ridership. (free ridership based attribution = 100% - free ridership)
Gross savings	Gross savings are changes in energy consumption and/or demand directly associated with projects incented by the utilities, regardless of reasons for participation (savings relative to baseline, defined above)
In situ	Existing measure, conditions, and settings
Incentive	An incentive is a transfer payment from the utility to participants of a DSM program. Incentives can be paid to customers, vendors or other parties.
Incremental cost	The difference in purchase price (and any differences in related installation or implementation costs), at the time of purchase, between the efficient measure and the base case measure. In some early retirements and retrofits, the full cost of the efficient technology is the incremental cost.
Industry standard practice (ISP)	Common measure implemented within the industry
Input assumptions	Assumptions such as operating characteristics and associated units of resource savings for DSM technologies and measures
Lifetime cumulative savings	Total natural gas savings (CCM) over the life of a DSM measure. Can be claimed, gross, or net. Sometimes referred to as just "cumulative" or "lifetime."
Maintenance (Maint.)	Repair or maintain, restore to prior efficiency
Measure	A technology, practice, or behavior that, once installed or operational, results in a reduction in energy use.
Measure – Enbridge	Measures are identified in the tracking data as a unique combination of project ID and measure ID. Multiple measures may belong to the same project.
Measure – Union	Measure refers to a project ID and line ID in the tracking data. Multiple measures may belong to the same project.
Measurement and Verification (M&V)	Verification of savings using methods not including attribution/free ridership assessment.
Metric	Metrics used within OEB Order and Decision to describe program achievement units.
MF	Multifamily (multi-residential).
New construction (NC)	New buildings or spaces
Non-early replacement period (non-ER period)	Years after the ER period up to the EUL

<table>
<tr><td>Normal replacement (NR)</td><td>Measure that replaces a piece of equipment that has reached or is past its EUL and not in good operating condition</td></tr>
<tr><td>Persistence</td><td>The extent to which a DSM measure remains installed, and performing as originally predicted, in relation to its EUL</td></tr>
<tr><td>Program</td><td>Programs as listed within the OEB Decision and Order. Generally sub-units of Scorecards; for example, Commercial and Industrial Prescriptive Program within the Resource Acquisition Scorecard.</td></tr>
<tr><td>Program evaluation</td><td>Activities related to the collection, analysis, and reporting of data for purposes of measuring program impacts from past, existing, or potential program impacts</td></tr>
<tr><td>Program spending</td><td>Amount spent for implementation of programs, not including portfolio overhead. This value can be divided into spending for program measures and incentives, as well as program specific overhead.</td></tr>
<tr><td>Project - Enbridge</td><td>Projects are identified in the tracking data based on the project ID. A project may have multiple measures as indicated by measure IDs in the current data tracking system.</td></tr>
<tr><td>Project – Union</td><td>Projects are identified in the tracking data based on project ID. A project may have multiple measures as indicated by line IDs in the current data tracking system.</td></tr>
<tr><td>Remaining useful life (RUL)</td><td>The number of years that the existing equipment would have remained in service and in good operating condition. This is the same as ER Period.</td></tr>
<tr><td>Realization Rate</td><td>A combination of adjustment factors, which represents ratios between two savings values. For example, the final realization rate is the ratio between evaluated savings and program claimed savings.</td></tr>
<tr><td>Replace on burnout (ROB)</td><td>Measure that replaces a failed or failing piece of equipment</td></tr>
<tr><td>Retrofit add-on (REA)</td><td>Measure reduces energy use through modification of an existing piece of equipment</td></tr>
<tr><td>Rounding guidelines</td><td>The EC used the following rules for rounding values in terms of achievements, spending and budgets, targets, and adjustments.
<table>
<tr><th>Variable</th><th>Rule</th><th>Example</th></tr>
<tr><td>PY Achievement - large numbers</td><td>Rounded to 0 digits beyond decimal.</td><td>π*1000=3141.00000</td></tr>
<tr><td>PY Achievement - percentages</td><td>Rounded to 4 significant digits</td><td>2/3 = 66.66% or .66660000</td></tr>
<tr><td>Spend and budget</td><td>Rounded to dollar</td><td>$100.66 = $101.00</td></tr>
<tr><td>Target</td><td>Rounded same as inputs (large numbers or percentages)</td><td>See above</td></tr>
<tr><td>Adjustments</td><td>Rounded same as inputs (large numbers or percentages)</td><td>See above</td></tr>
</table></td></tr>
<tr><td>Scorecard</td><td>A scorecard allows for multiple different kinds of metrics such as cumulative natural gas savings and/or participants enrolled to be used simultaneously to measure annual utility performance. Each utility has a scorecard identified for each program year, which can be found in the Ontario Energy Board Decision and Order EB-2015-0029/EB-2015-0049.</td></tr>
<tr><td>Scorecard Achievement</td><td>The verified value for program-specific metric targets (CCM, applications, etc.) of each scorecard identified by the Annual Scorecard. This is the value that is verified as the achieved value by the Annual Verification report and used for calculation of the shareholder incentive.</td></tr>
</table>

Shareholder Incentive	As part of the current DSM Framework, an annual performance incentive is available to the gas utilities in the event program performance is at or above 75% of the OEB-approved targets. The shareholder incentive is in place to motivate the gas utilities to pursue natural gas savings and recognize exemplary performance as DSM program delivery is not mandatory. Each gas utility is eligible to receive a total annual maximum shareholder incentive of $10.45M; 40% of the shareholder incentive (or $4.2M) is available if the utility achieves a scorecard weighted score of 100%; the remaining 60% (or $6.3M) is available for performance beyond 100% up to 150%.
Site	Sites are identified based on unique site addresses provided by Union and Enbridge through the contact information data request. A site may have multiple units of analysis, measures, and projects. Sites can be identified by the evaluation only for records for which we receive contact information – i.e. records associated with account number (EGD) or customer ID (Union) that have projects in the sample or backup sample.
Spillover	Energy savings that occur as a result of the utility's intervention, but are not part of the utility's verified savings.
System optimization (OPT)	Improve system or system settings to exceed prior efficiency
TRM	"Technical Reference Manual" – Generally accepted acronym and term for document that identifies standard methodologies and inputs for calculating energy savings.
TSER	Telephone Supported Engineering Review
Unit of Analysis – Enbridge	The level at which the data are analyzed, which in 2017 is a "measure" or sub-project level for Enbridge.
Union Influence Factor	Factor applied by Union to a small number of projects. The factor reduces ex ante (claimed) savings to account for anticipated partial free ridership.
Unit of Analysis - Union	The level at which the data are analyzed, which in 2017 is a project for Union. A project is equivalent to a measure for Union as the database did not have a sub-project level.
Vendors	Program trade allies, business partners, contractors and suppliers who work with program participants to implement energy saving measures

Appendix B Evaluation Background

Enbridge and Union deliver energy efficiency programs under the Demand Side Management Framework for Natural Gas Distributors (2015-2020)[21] developed by the OEB. For the 2015 program year, both utilities "rolled-over" their 2014 plans into 2015 to allow them a smooth evolution into the new DSM framework. For the 2016 program year, (and continuing through 2018), the new framework was implemented, resulting in changes to the programs offered, as shown in Table 6-1. Programs included in the plan and offered by the utilities are marked with a check, those in the plan but not offered by the utilities are marked with an X.

Table 6-1. DSM programs offered 2015-2018

Scorecard	Program Name	2015	2016	2017	2018
Enbridge					
Resource Acquisition	C&I Custom	✓	✓	✓	✓
	C&I Direct Install		✓	✓	✓
	C&I Prescriptive	✓	✓	✓	✓
	Comprehensive Energy Management		✗	✗	✗
	Energy Leaders Initiative		✓	✓	✓
	Home Energy Conservation	✓	✓	✓	✓
	Residential Adaptive Thermostats		✓	✓	✓
	Run-it-Right (CCM)	✓	✓	✓	✓
	Small Commercial New Construction		✗	✗	✗
Low Income	Low Income Multi-Residential	✓	✓	✓	✓
	Low Income Single Family	✓	✓	✓	✓
	Home Winterproofing		✓	✓	✓
Market Transformation	Commercial Savings by Design	✓	✓	✓	✓
	Residential Savings by Design	✓	✓	✓	✓
	School Energy Competition	✓	✓	✓	✓
	Run-it-Right (Participants)		✓	✓	✓
	Comprehensive Energy Management		✓	✓	✓
Home Labelling	Home Labelling	✓			
Union					
Resource Acquisition	C&I Custom	✓	✓	✓	✓
	C&I Direct Install			✓	✓
	C&I Prescriptive	✓	✓	✓	✓
	Energy Savings Kit	✓			
	Home Reno Rebate	✓	✓	✓	✓
Low Income	Home Weatherization	✓	✓	✓	✓
	Furnace End-of-Life		✓	✓	✗
	Multifamily (Social and Assisted)		✓	✓	✓
	Multifamily (Market Rate)		✓	✓	✓
	Indigenous			✓	✓
	Affordable Housing Conservation	✓			
Large Volume	Large Volume	✓	✓	✓	✓
Market Transformation	Optimum Home	✓	✓	✓	✓
	Commercial New Construction		✗	✓	✓
Performance Based	RunSmart		✓	✓	✓
	Strategic Energy Management		✓	✗	✓

* ✓=Offered and reported ✗=Offered but no metrics reported

[21] EB-2014-0134

While the program mix remained stable from 2016-2018, there were changes in the scorecards in 2018 which resulted in changes to the metrics evaluated, as shown in Table 6-2.

Table 6-2. Energy efficiency metrics – 2016 through 2018

Scorecard	Metric	2016	2017	2018
Enbridge				
Resource Acquisition	Large Volume Customer Savings (CCM)	✓	✓	✓
	Small Volume Customer Savings (CCM)	✓	✓	✓
	Deep Savings Participants (Homes)	✓	✓	✓
Low Income	Home Winterproofing (CCM)	✓	✓	✓
	Low Income Multi-Residential (CCM)	✓	✓	✓
	Low Income New Construction – Project Applications	✓	✓	✓
Market Transformation	Commercial Savings by Design – Sites Built	✓	✓	✓
	Commercial Savings by Design – New Developments	✓	✓	✓
	Comprehensive Energy Management – Participants	✓	✓	✓
	Residential Savings by Design – Builders	✓	✓	✓
	Run-it-Right – Participants	✓	✓	✓
	School Energy Competition - Schools	✓	✓	✓
Union				
Resource Acquisition	CCM	✓	✓	✓
	Home Reno Rebate - Participants	✓	✓	✓
Large Volume	CCM	✓	✓	✓
Low Income	Single Family CCM	✓	✓	✓
	Multifamily Social & Assisted CCM	✓	✓	✓
	Multifamily Market Rate CCM	✓	✓	✓
Market Transformation	Commercial New Construction - New Enrolled Developments	✓	✓	✓
	Optimum Home - % of Homes Built	✓		✓
	Optimum Home - Participating Builders		✓	✓
	Optimum Home - Homes		✓	✓
Performance Based	RunSmart - Participants	✓	✓	✓
	RunSmart - Savings %		✓	✓
	Strategic Energy Management - Participants	✓	✓	✓
	Strategic Energy - Savings %			✓

The OEB hired the EC team to develop an overall evaluation, measurement, and verification (EM&V) plan and lead an annual verification of the reported utility DSM savings and scorecard achievements. This report is a result of that annual verification.

Under the 2017-2018 EM&V plan, a DNV GL-led team of DNV GL and Dunsky completed:

- A study measuring the free ridership within the custom projects[22] implemented in the 2018 program year[23]
- A study verifying the custom project savings (CPSV) during the 2017 and 2018 program years[24]
- A study verifying the prescriptive project savings from prescriptive projects implemented in the 2017 program year[25]

This report includes or applies the results of those studies. It also applies the results of the following, previously completed studies:

- Michaels' Energy study of custom measure lives, completed in May 2018.[26]
- DNV GL's study of the spillover resulting from the implementation of custom projects during the 2013-2014 program years, completed in May 2018.[27]

All three previously-completed studies affect the lost revenue or DSM shareholder incentive for the 2018 program year.

The prescriptive project savings verification also measured the free ridership within and spillover resulting from prescriptive projects implemented in the 2017 program year.[28] Per the OEB Decision and Order, the free ridership and spillover adjustments only apply prospectively from the time the study was completed. As the study was finalized in 2019, those adjustments will apply to the 2019 LRAM results and the 2020 program results but will not apply to the 2018 program.

[22] Low Income custom projects were not included in the NTG study.

[23] 2018 Natural Gas Demand Side Management Free-ridership Evaluation, DNV GL for the Ontario Energy Board, December 27, 2019

[24] 2017-2018 Natural Gas Demand Side Management Custom Savings Verification, DNV GL for the Ontario Energy Board, December 26, 2019

[25] 2017 C&I Prescriptive Verification: Final Report – Measurement of NTG Factors and Gross Savings Verification, Itron for the Ontario Energy Board, June 7, 2019

[26] Final Report: Custom Measure Life Review, Michaels Energy for the Ontario Energy Board, May 10, 2018

[27] CPSV Participant Spillover Results, DNV GL for the Ontario Energy Board, May 23, 2018

[28] 2017 C&I Prescriptive Verification: Final Report – Measurement of NTG Factors and Gross Savings Verification, Itron for the Ontario Energy Board, June 7, 2019

Appendix C Metric Verification Activities

To verify the metric achievements, the EC conducted the activities outlined in Table 6-3 and Table 6-4. The utilization of each activity depends on the "type" of measure being reviewed. DNV GL defined four different types of measures, listed below. A single program or scorecard metric may have more than one type of measure.

- **Prescriptive (P):** Prescriptive gas savings measures are those where all savings inputs can be identified in the technical resource manual (TRM). This includes not only the prescribed savings but also additional prescribed inputs such as expected useful life (EUL) and free ridership rates.
- **Custom (C):** Custom gas savings measures are those gas measures of equipment or actions (tune up, process) which are not prescribed by the TRM. Examples include measures verified as part of the CPSV process as well as non-prescribed programs like Run-it-Right or Energy Leaders.
- **Whole Home (W):** Whole home savings are savings calculated using home modelling software (HOT2000).
- **Other (O):** In addition to direct gas savings measures, the scorecards recognize additional metrics, such as the number of enrolled participants, new developments, or schools in a program or the percentage of homes built by a participating builder achieving certain efficiency levels.

Activities to verify the measures fall into three general categories. As previously stated, the utilization of each method is determined by the measure type.

- **Tracking Confirmation:** Confirmation that the data and calculations within the submitted tracking data accurately contribute to scorecard metrics.
  - *Prescriptive measures:* For prescriptive savings measures, the EC confirmed measure-level inputs were appropriately applied from the TRM where appropriate (such as free ridership ratio and savings per unit), then recalculated gross and net savings based on those inputs to verify the recorded net savings for a census of measures.
  - *Custom measures:* The EC used the results of the custom project savings verification, free ridership, and spillover studies conducted through separate processes.
  - *Whole Home and Other measures:* The EC confirmed that tracking records matched utility-reported achievement. Additional verification took place in other activities.
- **Desk Review:** File review of utility-provided documentation to verify whether the achievements in the tracking data were actually realized. Unless specifically mentioned otherwise, desk review methods were similar to those used in the prior verification.
  - *Whole Home:* Desk review included tasks such as review of energy software (HOT2000) modelling records for whole home programs.
  - *Other:* For scorecards with Other metrics, program achievements such as customer participation, eligibility for participation, and developer homes were evaluated using program records specific to each scorecard, program, and metric.

Table 6-3 and Table 6-4 identify the measure types within each scorecard and program as well as the method used to evaluate that program, corresponding with the measure type.

Table 6-3. 2018 Annual verification activities by program: Enbridge

Program		Measure Types	Confirm Tracking	Apply Factors	Desk Review
Resource Acquisition	C&I Custom	C		✓	
	C&I Direct Install	P	✓	✓	
	C&I Prescriptive	P	✓	✓	
	Comprehensive Energy Management	No 2018 activity reported			
	Energy Leaders Initiative*	C	✓	✓	✓
	Home Energy Conservation	P W O	✓	✓	✓
	Residential Adaptive Thermostats	P	✓	✓	
	Run-it-Right	C	✓	✓	✓
	Small Commercial New Construction	No 2018 activity reported			
Low Income	Home Winterproofing	P W	✓	✓	✓
	Multi-Residential	P C	✓	✓	
	New Construction	O	✓		✓
Market Transformation	Commercial Savings by Design	O	✓		✓
	Comprehensive Energy Management	O	✓		✓
	Residential Savings by Design	O	✓		✓
	Run-it-Right	O	✓		✓
	School's Energy Competition	O	✓		✓

*Energy Leaders measures in 2018 were custom (non-prescriptive CCM savings) measures *not* evaluated by the CPSV evaluation, but through the AV process.

Table 6-4. 2018 Annual verification activities by program: Union

Program		Measure Types	Confirm Tracking	Apply Factors	Desk Review
Resource Acquisition	C&I Custom	C		✓	
	C&I Direct Install	P C	✓	✓	
	C&I Prescriptive	P	✓	✓	
	Home Reno Rebate	P W O	✓	✓	✓
Large Volume	Large Volume	P C	✓	✓	
Low Income	Indigenous	P W O	✓	✓	✓
	Furnace End-of-Life	No 2018 activity reported			
	Home Weatherization	P W O	✓	✓	✓
	Multifamily Social & Assisted	P C	✓	✓	
	Multifamily Market Rate	P C	✓	✓	
Market Transformation	Commercial New Construction	O	✓		✓
	Optimum Home	O	✓		✓
Performance-Based	RunSmart	O	✓		✓
	Strategic Energy Management	O	✓		✓

Desk reviews required for Whole Home and Other measures require additional information, beyond what is provided in tracking documents. For example, the EC requested HOT2000 files and other documentation to confirm participation and eligibility for a sample of relevant participants in the Home Energy Conservation, Home Reno Rebate, Winterproofing, and Home Weatherization programs. Table 6-5 and Table 6-6 show the number of records for which the EC requested additional documentation.

Table 6-5. Desk Review Sample: Enbridge

	Program	Additional Sample for Desk Review
Resource Acquisition	Energy Leaders Initiative	Census
	Home Energy Conservation	30 Randomly Selected Homes
	Run-it-Right	10 Randomly Selected Projects
Low Income	Home Winterproofing	30 Randomly Selected Homes
	New Construction	Census
Market Transformation	Commercial Savings by Design	5 Randomly Selected Sites
	Comprehensive Energy Management	Census
	Residential Savings by Design	5 Randomly Selected Builders 5 Randomly Selected Homes
	Run-it-Right	30 Randomly Selected Projects
	School's Energy Competition	Census

Table 6-6. Desk Review Sample: Union

	Program	Additional Sample
Resource Acquisition	Home Reno Rebate	157 Randomly Selected Homes
Low Income	Home Weatherization	30 Randomly Selected Homes
	Indigenous	Census
Market Transformation	Optimum Home	Census of Builders Census of Homes Built
	Commercial New Construction	Census
Performance-Based	RunSmart	Census
	Strategic Energy Management	Census

Appendix D Changes from 2017 Evaluation

Changes between the 2017 and 2018 program year verifications include:

- **Programs not previously executed**: One, Union's Strategic Energy Management program, was implemented/executed in 2018 and had not been in 2017. This program was evaluated for the first time in this verification:[29]
- Union Strategic Energy Management
- **New scorecard metrics:** There were two new metrics in 2018 that were not part of the 2017 Scorecards.
  - **Union's Performance-Based:** The 2017 Strategic Energy Management (SEM) metric measured the participants. This metric was included, and another metric was added which measure the savings (%) of the program, as shown in Figure 6-1.

Figure 6-1. Union Gas 2017 and 2018 Strategic Energy Management Metrics

Union Gas 2017 Performance-Based Scorecard					
Programs	Metrics	Metric Target			Weight
		Lower Band	Target	Upper Band	
RunSmart	Participants	75% of Target	2016 metric achievement / 2016 actual program spend without overheads x 2017 program budget without overheads x 1.1	150% of Target	20%
	Savings (%)	8%	10%	15%	60%
Strategic Energy Management (SEM)	Participants	75% of Target	2016 metric achievement / 2016 actual program spend without overheads x 2017 program budget without overheads x 1.1	150% of Target	20%

Union Gas 2018 Performance-Based Scorecard					
Programs	Metrics	Metric Target			Weight
		Lower Band	Target	Upper Band	
RunSmart	Participants	75% of Target	2017 metric achievement / 2017 actual program spend without overheads x 2018 program budget without overheads x 1.1	150% of Target	10%
	Savings (%)	75% of Target	2017 metric achievement / 2017 actual program spend without overheads x 2018 program budget without overheads x 1.1	150% of Target	40%
Strategic Energy Management (SEM)	Participants	75% of Target	2017 metric achievement / 2017 actual program spend without overheads x 2018 program budget without overheads x 1.1	150% of Target	10%
	Savings (%)	4%	5%	8%	40%

  - **Union's Market Transformation:** The Optimum Home program added an additional metric in the 2018 evaluation that was previously evaluated in 2016 but not in 2017. The metric measures the percentage of Homes Built (>20% above OBC 2012) by Participating Builders as shown in Figure 6-2.

[29] Enbridge's Small Commercial New Constriction and Enbridge's Comprehensive Energy Management programs under the Resource Acquisition Scorecard, and Union's Furnace End-of-Life program under the Low Income Scorecard did not have any activity in 2018. As such, no evaluation 2018 activities were conducted for those programs

Figure 6-2. Union Gas 2017 and 2018 Optimum Home Metrics

Union Gas 2017 Market Transformation Scorecard					
Programs	Metrics	Metric Target			Weight
		Lower Band	Target	Upper Band	
Optimum Home	Participating Builders (Regional Top 10)	8	10	15	20%
	Prototype Homes Built	22.5%	30%	45%	30%

Union Gas 2018 Market Transformation Scorecard					
Programs	Metrics	Metric Target			Weight
		Lower Band	Target	Upper Band	
Optimum Home	Participating Builders (Regional Top 10)	6	8	12	10%
	Prototype Homes Built	45%	60%	90%	30%
	Percentage of Homes Built (>20% above OBC 2012) by Participating Builders	3.75%	5%	7.5%	10%

- **Changes to sample sizes**
  - **Whole home programs**: Union's Home Reno Rebate program required a sample of 157 total homes for 2018 to achieve approved precision targets and mirror a finding in the 2017 evaluation that required a second sample request.
  - **"Run-it-Right" or "Commercial New Construction" programs:** The sample size for Run-it-Right changed from a census to 30 randomly selected projects due to increased program participation and population size. The sample size for Commercial New Construction changed from 5 randomly selected sites to a census after the initial verification required additional verification at the EAC's direction.

Appendix E Summary of Verification Adjustments

Table 6-7 and Table 6-8 provide a combined summary of metrics for Enbridge and Union, respectively. These tables show where the EC made adjustments of greater than 1% from the values identified in *tracking data*.

Table 6-7. Enbridge Metrics with Verified Value Greater than 1% Different from Reported

Programs	Metrics	>1% Difference?
Resource Acquisition		
Home Energy Conservation (HEC)	Large Volume Customers CCM	☐
Residential Adaptive Thermostats		☐
Commercial & Industrial Custom		✓
Commercial & Industrial Direct Install		☐
Commercial & Industrial Prescriptive		✓
Comprehensive Energy Management		☐
Energy Leaders (Pilot)		☐
Run-it-Right		☐
Small Commercial New Construction		☐
Home Energy Conservation (HEC)	Small Volume Customers CCM	✓
Residential Adaptive Thermostats		☐
Commercial & Industrial Custom		✓
Commercial & Industrial Direct Install		☐
Commercial & Industrial Prescriptive		✓
Comprehensive Energy Management		☐
Energy Leaders (Pilot)		☐
Run-it-Right		☐
Small Commercial New Construction		☐
Home Energy Conservation (HEC)	HEC Participants	☐
Low Income		
Home Winterproofing	LISF (CCM)	☐
Low Income Multi Residential	LIMR (CCM)	✓
Low Income New Construction	LINC Applications	☐
Market Transformation		
School Energy Competition	SEC Schools	☐
Run-it-Right	RiR Participants	☐
Comprehensive Energy Management	CEM Participants	☐
Residential Building by Design	RSBD Builders	☐
	RSBD Homes	☐
Commercial Building by Design	CSBD Developments	☐

Table 6-8. Union Metrics with Verified Value Greater than 1% Different from Reported

Programs	Metrics	>1% Difference?
Resource Acquisition		
C&I Custom	RA (CCM)	✓
C&I Direct Install		☐
C&I Prescriptive		✓
Home Reno Rebate	HRR Participants	✓
Low Income		
Home Weatherization	LISF (CCM)	✓
Furnace End-of-Life		
Indigenous		☐
Multi-Family	LIMF-SA (CCM)	✓
	LIMF-MR (CCM)	
Large Volume		
Large Volume	LV (CCM)	✓
Market Transformation		
Optimum Home	Participating Builders	
	Prototype Homes Built	
	Percentage of Homes Built	
Commercial New Construction	CNC Developments	✓
Performance Based		
RunSmart	RS Participants	☐
	RS Savings %	✓
Strategic Energy Management	SEM Participants	☐
	SEM Savings %	✓

Appendix F Data and Documentation Requests

There were officially two data and documentation requests sent during the 2018 annual verification; a third formal request was planned but the formality was unnecessary. In practice, there was repeated back-and-forth between the EC and the utility teams with questions and follow-up information which functioned as a third request. Any back-and-forth is described in the individual program verification sections later in these appendices. This appendix shows the formal documentation request sent as a memo on June 3, 2019.

First Documentation Request

Memo to:
Utility staff

Date: June 3, 2019

Copied to:
DNV GL and OEB staff

Prep. By: DNV GL employee

Ontario Gas Portfolio Data Request

This memo formally requests anonymized program tracking data for all Enbridge and Union DSM programs. Documentation that individually lists all projects/sites/builders/etc not included in tracking data (e.g. list of Residential Savings by Design Homes), and any available operational and quality documentation, is requested to be delivered by **Monday, June 10, 2019**

Non-tracking data requested

The EC team is requesting the following items in association with the tracking data:

- Tracking database including all individual measures and projects, for all programs.
- Where program records are not included with tracking data, a copy of the spreadsheets or other documentation that confirms all 'Other' (non-CCM) metrics for Year 2018,
    - Spreadsheet documentation should include listing of *all individual* projects/homes/builders/etc so that a random sample can be drawn and verifiably requested. In previous years, initial documentation sometimes included a summary of projects instead of a listing of all individual projects/measures; this is intended to clarify that a full listing is needed for selecting sample.
- Any available documentation of operational and quality assurance associated with the tracking database

The programs/projects for which we are requesting 2018 tracking data are shown in Data Request Table 1. Please provide all **anonymized** records associated with the measures installed through these programs as part of the 2018 program year.

Data Request Table 1: 2018 programs requested

Union Programs	Enbridge Programs
Resource Acquisition Requested	
Home Reno Rebate	Residential Home Energy Conservation
Commercial & Industrial Prescriptive	Residential Adaptive Thermostats
Commercial & Industrial Direct Install	Commercial & Industrial Prescriptive
Commercial & Industrial Custom	Commercial & Industrial Direct Install
	Commercial & Industrial Custom
	Run-It-Right
	Comprehensive Energy Management
	Small Commercial New Construction
Large Volume Requested	
Large Volume	
Low Income Requested	
Home Weatherization	Low Income Home Winterproofing
Low Income Multi-Residential Housing	Low Income Multi-Residential Housing
Furnace End-of-Life	Low Income New Construction
Indigenous[30]	
Market Transformation Requested	
Optimum Home	Residential Savings by Design
Commercial New Construction	Commercial Savings by Design
	School Energy Competition
	Comprehensive Energy Management (CEM)
	Run It Right
Performance-Based Requested	
Run Smart	
Strategic Energy Management (SEM)	

The first step in the verification is to confirm that the provided tracking data matches the participant/measure counts and savings reported in the 2018 filings. To perform step one, the evaluation requires the database fields shown in Data Request Table 2. The names of the fields are indicative of the content and do not reflect the names that the utilities use in their tracking systems.

[30] Originally named the Aboriginal Program in the Decision and Order EB-2015-0029 / EB-2015-0049

Data Request Table 2: Minimum Database Fields Required for Matching Database to Utility Filings

Required Database Field	Field Description
Measure ID	Unique Identifier – smallest grain of analysis, a measure is a unique calculation within a project. For example, 2 identical boilers at a single site would be one measure with a quantity of 2, while 2 different boilers would be two separate measures
Project ID	Unique Identifier - project can include multiple measures at one site and at one time; typically projects affect a single account
Account ID	Unique Identifier - billing account
Site ID	Unique Identifier - unique to a facility or group of facilities at a location
Customer ID	Unique Identifier - customer may have multiple sites, multiple accounts
Annual gross savings	Gross savings per year for natural gas, electricity, and water (where applicable)
Annual net savings	Net savings per year for natural gas, electricity, and water (where applicable)
Cumulative gross gas savings	Gross savings over the lifetime of the measure for natural gas, electricity, and water (where applicable)
Cumulative net gas savings	Net savings over the lifetime of the measure for natural gas, electricity, and water (where applicable)
Estimated useful life	Lifetime of the measure
Incentive amount	Amount of financial incentive paid (may be multiple fields if more than one party received a financial incentive)
Incentive type	Participant Rebate, Grant, Vendor Rebate/Spiff, participant loan
Program Year	The program year in which the measure impacts are claimed
Program	The program under which the measure impacts are claimed
Market segment	Business type or rate class for C&I (both in separate fields are best) 4-way single/multifamily by low income/market rate for residential
Measure	Measure name, specific to and identifiable in the TRM
Applied factors	Factors such as the net-to-gross (NTG) or removal rates used for the program /measure in calculating net savings for the filing

For prescriptive measures, the next step is to confirm the inputs and assumptions used in the savings estimates versus those required by the technical resource manual (TRM) or agreed-on prescriptive savings documentation applicable to the 2018 program year. This step is best completed on a measure level dataset, where each row in the tracking data conforms to a single measure defined in the TRM. The information required for this task depends on the measures covered by the TRM and implemented by the programs. For the verification, the EC needs a tracking database which includes all of the site specific inputs required to estimate savings using the TRM. An example of the type of information required in the database for this process is shown in Data Request Table 3. This list is not comprehensive; please provide all necessary fields for calculating the prescriptive measure savings.

Data Request Table 3: Example of the type of information required to verify prescriptive savings

Example Database Field	Verification Purpose
Measure description	Connects the tracking measure to the TRM measure to determine the per-unit savings.
Quantity	Identifies the number of units installed to produce the total measure savings.
New or existing installation	Connects the tracking measure to the appropriate savings value in the TRM.
Measure TRM	TRM descriptor used as basis for gross and net savings calculations
Measure Capacity	Capacity value necessary for determining savings (e.g. MBH for high efficiency boilers)
Details of efficient equipment	Connects the tracking measure to the appropriate savings value in the TRM.
Base equipment	Connects the tracking measure to the appropriate savings value in the TRM.

Please provide tracking data for the programs identified in Data Request Table 1 which includes the fields listed in Data Request Tables 2 and 3, in addition to any similar or relevant fields that will aid in the verification.

Data Recommendations

In previous Natural Gas Demand Side Management Annual Verification Reports, the EC provided summary and program specific recommendations. Most relevant to this request are those regarding data, including:

- Deliver tracking data in a single flat file.
- Include site-level information for all measures installed through the program.

In addition, the EC again emphasizes the importance of **anonymized** records.

Notice for future requests

After receiving and reviewing the data and documentation requested in this memo, the EC will follow up with a second documentation request for a sample of program participants in some programs. The final details will be established after the EC reviews the tracking data requested in this memo.

Second Documentation Request

A second, follow-up request was sent via email. This request consisted of an excel file listing the sample of program participants selected for detailed desk review, taken from the data received following the first request.

Appendix G Resource Acquisition Scorecards

This appendix describes the detailed process used to verify the metrics for the Resource Acquisition Scorecard programs for Enbridge (Table 6-9) and Union Gas (Table 6-10). The programs addressed in this appendix are:

- Residential Home Retrofit - Home Energy Conservation – Enbridge
- Residential Home Retrofit - Home Reno Rebate – Union
- Residential Adaptive Thermostats – Enbridge
- Commercial & Industrial – Prescriptive – Enbridge
- Commercial & Industrial – Prescriptive – Union
- Commercial & Industrial – Direct Install – Enbridge
- Commercial & Industrial – Direct Install – Union
- Commercial & Industrial – Custom – Enbridge
- Commercial & Industrial – Custom – Union
- Small Commercial New Construction - Enbridge
- Energy Leaders Initiative – Enbridge
- Comprehensive Energy Management – Enbridge
- Run-it-Right – Enbridge

Table 6-9. Enbridge 2018 Resource Acquisition scorecard*[31]

Programs	Metrics	Verified Achievement		Metric Target			Weight
		Program-level Savings	Metric-level Savings	Lower Band	Target	Upper Band	
Commercial & Industrial Custom	Large Volume Customer - CCM	323,139,650	377,787,998	381,344,718	508,459,624	762,689,436	40.00%
Commercial & Industrial Direct Install		9,186,763					
Commercial & Industrial Prescriptive		15,642,977					
Comprehensive Energy Management		-					
Energy Leaders		29,688,655					
Run-it-Right		129,953					
Small Commercial New Construction		-					
Home Energy Conservation	Small Volume Customer - CCM	157,959,136	299,541,383	222,815,737	297,087,649	445,631,474	40.00%
Residential Adaptive Thermostats		43,321,968					
Commercial & Industrial Custom		29,810,977					
Commercial & Industrial Direct Install		47,596,629					
Commercial & Industrial Prescriptive		20,832,793					
Energy Leaders		19,880					
Home Energy Conservation	Participants	14,413	14,413	6,926	9,235	13,853	20.00%

*Not all values may compute exactly due to rounding.

Table 6-10. Union Gas 2018 Resource Acquisition scorecard*[32]

Programs	Metrics	Verified Achievement		Metric Target			Weight
		Program-level Savings	Metric-level Savings	Lower Band	Target	Upper Band	
Home Reno Rebate	CCM	205,146,928	976,937,929	613,759,123	818,345,497	1,227,518,246	75.00%
Commercial & Industrial Custom		515,872,191					
Commercial & Industrial Prescriptive		204,967,607					
Commercial & Industrial Direct Install		50,951,203					
Home Reno Rebate	Homes Built	16,118	16,118	6,008	8,010	12,015	25.00%

*Not all values may compute exactly due to rounding.

[31] Ontario Energy Board Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016, Schedule C

[32] Ibid.

Residential Home Retrofit - Home Energy Conservation – Enbridge

Overview

Table 6-11 shows the reported, tracked, and verified scorecard achievements for the 2018 Enbridge Home Energy Conservation Program, with the metrics of CCM savings for small volume customers and the number of deep savings participants. As a result of this review, the EC verifies 157,959,136 CCM for small volume customers (101.75% of tracked savings) and 14,413 participants (99.90%). Each metric is discussed separately in this section, starting with the participant metric. Table 6-11 contains the following variables:

- Reported: In past evaluations, this value has been included for both consistency and as a cross-check to validate tracking data. For 2018, a draft report was not created or provided to the EC. This column remains included for consistency in reporting with previous years, and in anticipation that draft reporting will resume with the 2019 program year.
- Tracked: Metric value identified in Tracking File
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documents section.
- Savings Ratio: Ratio of verified to tracked savings. A value of 100.00% indicates that verified values match tracked values.

Table 6-11. Enbridge Resource Acquisition scorecard achievement: Home Energy Conservation metrics*

Metric	Achievement			Ratio
	Reported	Tracked	Verified	
Large Volume Customer - CCM	N/A	-	-	-
Small Volume Customer - CCM		155,247,717	157,959,136	101.75%
Participants (Homes)	N/A	14,428	14,413	99.90%

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 6-12 to verify the metrics for the Home Energy Conservation (HEC) program.

Table 6-12. Documentation used to verify the Home Energy Conservation program

Report Language	Description or Citation
Enbridge-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2018 Enbridge DSM programs
Project Files	Various documents for each requested participant, supporting program metrics
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016 and OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016
Enbridge Plan	Enbridge Gas Multi-Year DSM Plan (2015-2020), EB-2015-0049

Participant Selection

Enbridge provided the Tracking File listing 14,428 individual participants in the HEC program. To certify the scorecard metrics, the EC randomly selected 30 participants for review, requested additional documentation, confirmed receipt of the correct files, and reviewed documents to verify participation and eligibility.

Received Files

The typical file folder had the following information:

- Photographs of pre- and post-installation conditions
- Participation form with personally identifiable information redacted
- Invoice information (PDF scans or photo of receipts)
- HOT2000 Model input or "Simulation" Files (.HSE)
- HOT2000 Model Output Files (.TSV)

Participants Metric

Table 6-13 shows the reported, tracked, and verified scorecard achievements for the 2018 Enbridge HEC program with the metric of participant homes.

Table 6-13. Enbridge Resource Acquisition achievement: HEC Program participants metric*

Metric	Achievement			Ratio
	Reported	Tracked	Verified	
Participants (Homes)	N/A	14,428	14,413	99.90%

*Not all values may compute exactly due to rounding.

Verify Participation and Eligibility

The Resource Acquisition Scorecard identifies one metric for the program as "Residential Deep Savings Participants (Homes)". To determine the definition of "participants," the EC looked first to the OEB Decision, which identified approval of the Enbridge Home Energy Conservation program.[33] The EC next looked to Enbridge's plan, which identified the following criteria:[34] [35]

1. Be a residential homeowner in the EGD franchise area
2. Have a valid Enbridge Gas account in good standing
3. Use an approved Certified Energy Evaluator ("CEE")
4. Install at least two measures
5. Complete a pre- and post-energy audit
6. Achieve an average of at least 15% gas savings across all participants[36]

The EC evaluated the sampled participant files against the criteria above and determined:

- **Criterion 1:** Enbridge appropriately redacted Personally Identifiable Information (PII) in all of the project files, including customer name and address. However, each file contained an Enbridge account number, providing confirmation that the records were for Enbridge customers and thus within the service territory.
- **Criterion 2:** Each file contained an Enbridge account number, providing confirmation that the records were for Enbridge customers in good standing at the time of the project.

[33] Ontario Energy Board Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016, Page 13

[34] Enbridge's Proposed 2015-2020 DSM Plan, EB-2015-0049, Exhibit B, Tab 2, Schedule 2, Page 19 of 55

[35] Enbridge's Proposed 2015-2020 DSM Plan, EB-2015-0049, Exhibit B, Tab 2, Schedule 1, Page 25 of 100

[36] Enbridge's plan is internally inconsistent on this point. In some areas, each house must achieve at least 15% savings. In others, the program must achieve 15% average across all homes. After deliberation, the EAC chose to use the second (average) criteria for evaluation.

- **Criterion 3**: Each of the sampled 30 files contained a participant form. Each form was signed by the owner/participant (redacted) and the Energy Auditor, confirming customer enrollment in the program and involvement of an auditor. However, while the documentation confirmed that an auditor was involved, it does not signal that the auditor was an approved Certified Energy Evaluator.[37] Therefore, we did not use this requirement as a qualification for project eligibility for this round of evaluation.
- **Criterion 4**: The tracking data for all 14,428 records (including the 30 sampled) indicated that at least two measure types were installed at each location, with four homes receiving as many as eight.[38]
- **Criterion 5:** Each project contained *some* pre- and post- project photos. As mentioned for criterion #4, photo documentation was not comprehensive for all measures, but did partially exist for each sampled project, confirming inspections did occur. In combination with submitted modelling files, the EC found that all projects satisfied this requirement.
- **Criterion 6:** In reviewing and confirming CCM savings, the EC identified that 24 of the 30 records recorded savings greater than 15% of the original whole-house energy use. Tracking data, corroborated by HOT2000 model files, showed six houses with fewer than 15% in savings, with an average of 25.5% for the 30 sample projects reviewed. The EC observed that while all *sampled* records demonstrated savings greater than 15%, 4,410 projects listed in the Tracking File (out of 14,428) did not show savings greater than 15%.[39] Gas savings for these projects ranged from 0.1% to 15% of baseline usage. As decided by the EAC in 2016, the EC would not use this criterion for individual sites but use the same criterion applied to the Union program, which is a 15% *average* across all homes. Since the program saved 21.6% natural gas on average across all participants, the EC verified 14,428 as eligible participants.

In addition to these six criteria, the EAC identified one additional criterion for homes that installed air sealing.

- **Criterion 7**: For air sealing to qualify as a measure, the EAC determined that a reduction of at least 10% of cubic feet per minute of air leakage (as measured by a documented blower-door test) must occur. Tracking data for most projects that claimed air sealing as an installed measure identified a reduction of 10% or more, but 68 homes had a reduction that was less than 10%. Therefore, the air sealing measure did not qualify for these 68 homes. Of these 68 homes, 53 had at least two measures in addition to air sealing and thus still met Criterion 4. However, 15 homes only had one additional measure installed, and no longer met Criterion 4. This left 14,413 verified participating homes out of the original 14,428.

Table 6-14 shows the measure types installed by the verified participants in the program, broken out by the number of total measure types installed per customer. The most common measure type was a furnace upgrade, with 13,335 total installations. A Furnace Upgrade was most common in homes with only two measures; of the 9,949 homes with two measures, 9,259 (93.1%) installed a new furnace.

[37] In future evaluation cycles, the EC recommends tracking certifications for all energy evaluators and/or auditors submitting records. NRCan requires certification for all auditors permitted to use EnerGuide mode, however the EC is unable to verify this without supporting documentation or records.

[38] Numerous records included photos of blower door tests, but without photos or invoices for specific air sealing measures. For future verifications, the EC recommends improving and standardizing verification records to include direct evidence of all claimed measures, but as Enbridge had little time since the previous evaluation to update requirements and procedures, the EC identifies this requirement as satisfied.

[39] Enbridge's tracking spreadsheet included a separate tab for detailed HEC records, including variables for Base Case (m3), Upgraded Case (M3), Actual Gas Savings, and Actual Gas Savings %. To determine project qualification, the EC utilized the Actual Gas Savings % to identify projects with savings less than 15.0%

Table 6-14. Count of individual measure types among verified projects and types per home*

Measure Type	Number of Measure Types by Customer							Total	% of Total Homes
	Two	Three	Four	Five	Six	Seven	Eight		
Furnace upgraded	9,259	3,053	773	172	50	24	4	13,335	93%
Air Sealing	7,812	3,581	1,167	282	89	34	7	12,972	90%
Water Heater upgraded	693	1,200	356	92	36	18	4	2,399	17%
Basement upgraded	1,034	585	300	94	48	22	4	2,087	14%
Attic upgraded	688	796	330	119	36	24	4	1,997	14%
Windows	392	690	413	143	54	25	4	1,721	12%
Wall upgraded	29	62	71	52	28	24	4	270	2%
Exposed Floor Upgraded	5	24	6	6	-	3	1	45	<1%
Drain Water Heat Recovery System	1	2	4	-	1	1	-	9	<1%
Total Measure Types	**19,913**	**9,993**	**3,420**	**960**	**342**	**175**	**32**	**34,835**	**N/A**
Total Homes	**9,949**	**3,331**	**855**	**192**	**57**	**25**	**4**	**14,413**	**N/A**

*Not all values may compute exactly due to rounding.

Verification Result

As a result of this review, the EC verifies that 14,413 homes satisfy the requirements deep savings participants.

CCM Savings Metric

Table 6-15 shows the reported, tracked, and verified scorecard achievements for the 2018 Enbridge HEC program with the metric of CCM savings.

Table 6-15. Enbridge Resource Acquisition scorecard achievements: HEC Program CCM metric*

Metric	Achievement			Ratio
	Reported	Tracked	Verified	
Large Volume Customer - CCM	N/A	-	-	-
Small Volume Customer - CCM		155,247,717	157,959,136	101.75%
TOTAL	**N/A**	**155,247,717**	**157,959,136**	**101.75%**

*Not all values may compute exactly due to rounding.

Verify Tracked Savings

In calculating Net Cumulative Cubic Meters (CCM) savings, the EC first utilized Enbridge tracking data to identify the savings for each of the tracked projects. The EC confirmed that the measure life and free ridership multipliers were correctly applied and reviewed the documentation for the sample of 30 program participants to identify whether the gross energy savings in the project files matched the gross energy savings in the tracking data. If any of the 30 projects did not match, an average savings-weighted realization rate was calculated and applied to the tracking savings to produce verified savings.

Calculate Realization Rate

The EC used a multi-step process to verify tracked energy savings for the 30 sampled homes, shown in Figure 6-3. for the 2018 HEC verification. The process was necessary because the simulation mode

(EnerGuide or Expert[40]) used by program delivery agents is not available to non-certified professionals. While the EC can attempt to run the Expert simulations in General mode, the runs may produce error warnings or result in a savings differential between the Expert result and General result. Therefore, this multi-step process was developed to verify savings:

- EC requested simulation (HSE) and output (TSV) files from the program
- Where possible, the simulation file was re-run and the results used to verify the tracking savings. If different simulation versions or modes were used, the savings could be slightly different; therefore, simulation savings were considered "verified" if they were within 2% of the tracking savings; in this case, the tracked savings value was accepted as the verified savings.
- If a simulation file was not provided, the file inputs were incompatible with General mode and would not run, the file ran but produced an error due to version or mode differences, or the file produced a difference in savings greater than 2%, the output file was used to verify the tracking savings. As with the simulation file, the EC accepted tracking savings values within 2% of the output file value as the verified savings.
- If the EC was unable to verify the tracking savings against the output file, the EC would have requested additional documentation from the program (utility) to explain the discrepancy. This verification step was not necessary for this program in this round of evaluation.
- If no additional documentation or explanation was available, the EC would have compared the output file values to the project documentation to determine whether they were consistent. This verification step was not necessary for this program in this round of evaluation.

Figure 6-3. Overview of Gross Savings Verification for 2018 HEC Verification

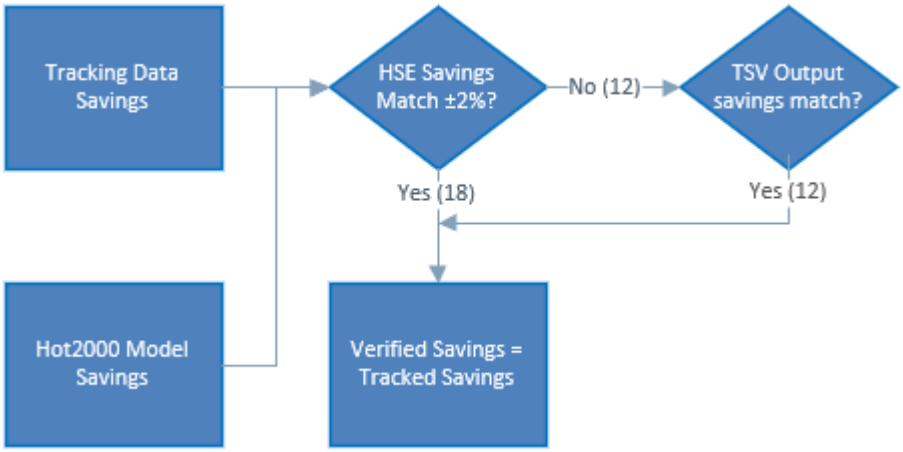


Table 6-16 shows how many customers were verified against the simulation (HSE) and output (TSV) file.

[40] "Expert" is the mode listed in the output files. This mode is also labelled as "EnerGuide" in simulation files. The EC uses both terms.

Table 6-16. Overview of gross savings verification

Evaluation Step	# Verified
Simulation re-run (HSE) and compared to tracking, verified if ± 2%	18
Output files for (TSV) compared to tracking, verified if ± 2%	12
Additional Explanation request	0
Comparison to output file values	0
Total Verified	30

The gross savings realization rate (RR) is 101.75%, shown in Table 6-17.

Table 6-17. Enbridge HEC Realization Rate*

Numbers of Houses	Realization Rate	90% Confidence Interval			
		Absolute Precision	Lower Bound	Upper Bound	Relative Precision
30	101.75%	1.75%	99.99%	103.50%	2.78%

*Not all values may compute exactly due to rounding.

Verification Result

As a result of this review, the EC confirms the total savings of 157,959,136 CCM for Enbridge's Home Energy Conservation small volume customer CCM savings metric (101.75% of tracked savings).

Residential Home Retrofit - Home Reno Rebate – Union

Overview

Table 6-18 shows the reported, tracked, and verified scorecard achievements for the 2018 Union Gas Home Reno Rebate (HRR) program, with the metrics of CCM savings and the number of deep savings participants. As a result of this review, the EC verifies 205,146,928 CCM savings (98.36% of tracked savings) and 16,118 program participants (100.00%). Each metric is discussed separately in this section, starting with the participant metric. Table 6-18 contains the following variables:

- Reported: In past evaluations, this value has been included for both consistency and as a cross-check to validate tracking data. For 2018, a draft report was not created or provided to the EC. This column remains included for consistency in reporting with previous years, and in anticipation that draft reporting will resume with the 2019 program year.
- Tracked: Metric value identified in Tracking File
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documents section.
- Savings Ratio: Ratio of verified to tracked savings. A value of 100.00% indicates that verified values match tracked values.

Table 6-18. Union Resource Acquisition scorecard achievement: Home Reno Rebate metrics*

Metric	Achievement			Ratio
	Reported	Tracked	Verified	
CCM	N/A	208,563,119	205,146,928	98.36%
Homes Built	N/A	16,118	16,118	100.00%

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 6-19 to verify the metrics for the Home Reno Rebate program.

Table 6-19. Documentation used to verify the Home Reno Rebate program

Report Language	Description or Citation
Union-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2018 Union DSM programs
Project Files	Various documents for each requested participant, supporting program metrics
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016 and OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016
Union Plan	Union's 2015-2020 DSM Plan, EB-2015-0029

Participant Selection

Union provided the Tracking File listing 16,118 individual participants in the HRR program. To certify the scorecard metric, the EC randomly selected 157 participants for review, requested additional documentation, confirmed receipt of the correct files, and reviewed documents to verify participation and eligibility.

Received Files

The typical file folder had the following information:

- HOT2000 Model simulation or "Simulation" Files (.HSE)
- HOT2000 Model Output Files (.TSV)

Participants Metric

Table 6-20 shows the reported, tracked, and verified scorecard achievements for the 2018 Union HRR program with the metric of participant homes.

Table 6-20. Union Gas Resource Acquisition achievement: HRR Program participants metric*

Metric	Achievement			Ratio
	Reported	Tracked	Verified	
Homes Built	N/A	16,118	16,118	100.0%

*Not all values may compute exactly due to rounding.

Verify Participation and Eligibility

The Resource Acquisition Scorecard identifies one metric for the program as "Home Reno Rebate Participants (Homes)". To determine the definition of "participants," the EC looked first to the OEB Decision, which approved the Union HRR program[41]. The EC looked next to Union's plan, which identified the following criteria:[42]

> *Homes that count as a participant towards the Home Reno Rebate ("HRR") Participant (Homes) metric must meet the following two requirements:*
>
> *1. A homeowner must complete at least two eligible renovations as outlined at Exhibit A, Tab 3, Appendix A, Section 1.0, Table 1.*
>
> *2. The aggregate of all of the homes counted towards the metric must achieve, on average, at least a 15% reduction in annual natural gas use as determined through comparing a pre and post energy assessment.*

The EC evaluated the sampled participant files against the criteria above and determined:

- **Criterion 1:** The EC confirmed that the project files documented at least two eligible measures for all homes, not only those sampled. Upon first review, all but one home (16,117 of 16,118) met this requirement. Enbridge indicated that the one home not meeting the criterion did in fact complete two eligible measures. After providing sufficient documentation for the home, the EC verified this requirement met for the home. As a result, all homes met the requirement. Table 6-21 shows the measure types and number of measures in the homes that met this requirement.
- **Criterion 2:** Of the 157 homes randomly sampled, tracking files allowed the EC to calculate average savings of 17.48%. The EC further calculated from tracking data that the population of homes satisfied the 15% requirement.

Table 6-21 shows the measure types installed by the program, broken out by the number of total measure types installed per customer. The most common measure type was furnace upgrade, with 14,152 total

[41] Ontario Energy Board Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016, Page 13

[42] Union's Proposed 2015-2020 DSM Plan, EB-2015-0029, Exhibit A, Tab 3, Page 24 of 73

installations. Furnace Upgrade was most common in homes with only two measures; of the 9,725 homes with two measures, 8,943 (91.93%) installed furnace upgrade.

Table 6-21. Count of individual measure types among verified projects and types per home*

Measure Type	Number of Measure Types by Customer						Total	% of Total Homes
	Two	Three	Four	Five	Six	Seven		
Furnace upgraded	8,943	3,727	988	400	88	6	14,152	88%
Air Sealing	6,980	3,972	1,229	480	88	6	12,755	79%
Windows	1,385	2,280	982	455	90	6	5,198	32%
Basement upgraded	994	1,194	687	370	89	6	3,340	21%
Attic upgraded	412	1,112	732	414	84	6	2,760	17%
Water Heater upgraded	546	711	329	193	49	6	1,834	11%
Wall upgraded	88	267	370	275	80	6	1,086	7%
Boiler Upgraded	102	51	19	13	2	-	187	1%
Total Measure Types	**19,450**	**13,314**	**5,336**	**2,600**	**570**	**42**	**41,312**	**N/A**
Total Homes	**9,725**	**4,438**	**1,334**	**520**	**95**	**6**	**16,118**	**N/A**

*Not all values may compute exactly due to rounding.

Verification Result

As a result of this review, the EC verifies that all 16,118 Homes (100.00%) satisfy the requirement for participant.

CCM Savings Metric

Table 6-22 shows the reported, tracked, and verified scorecard achievements for the 2018 Union HRR program with the metric of CCM.

Table 6-22. Union Gas Resource Acquisition scorecard achievements: HRR Program savings metric*

Metric	Achievement			Ratio
	Reported	Tracked	Verified	
CCM	N/A	208,563,119	205,146,928	98.36%

*Not all values may compute exactly due to rounding.

Verify Tracked Savings

In calculating Net Cumulative Cubic Meters (CCM) savings, the EC first utilized Union Tracking Data to identify the savings for each of the tracked projects, confirming that the measure life and free ridership multipliers were correctly applied. Union Tracking data includes all projects as individual records within tracking data, allowing for a simple summing of tracked savings. The EC reviewed the documentation for the sample of 157 program participants to identify whether the gross energy savings in the project files matched the gross energy savings in the tracking data. The sample size was increased for this program due to the program related findings reviewed in the 2017 verification and evaluation. If any of the 157 projects did not match, an average savings-weighted realization rate was calculated and applied to the tracking savings to produce verified savings. Tracking Files savings values are shown Table 6-23.

Table 6-23. Union Home Reno Rebate projects and savings: verified net savings*

Gross Annual Savings	# of Projects	Measure Life	Free Ridership Rate	Verified Tracked Net Savings (CCM)
8,781,605	16,118	25	5.00%	205,146,928

*Not all values may compute exactly due to rounding.

Calculate Realization Rate

The EC used a multi-step process to verify tracked energy savings for the sampled homes, shown in Figure 6-4. for the 2018 HRR verification. The process was necessary because the simulation mode (EnerGuide or Expert[43]) used by program delivery agents is not available to non-certified professionals. While the EC can attempt to run the Expert simulations in General mode, the runs may produce error warnings or result in a savings differential between the Expert result and General result. Therefore, this multi-step process was developed to verify savings:

- EC requested simulation (HSE) and output (TSV) files from the program
- Where possible, the simulation file was re-run and the results used to verify the tracking savings. If different simulation versions or modes were used, the savings could be slightly different; therefore, simulation savings were considered "verified" if they were within 2% of the tracking savings; in this case, the tracked savings value was accepted as the verified savings.
- If a simulation file was not provided, the file inputs were incompatible with General mode and would not run, the file ran but produced an error due to version or mode differences, or the file produced a difference in savings greater than 2%, the output file was used to verify the tracking savings. As with the simulation file, the EC accepted tracking savings values within 2% of the output file value as the verified savings.
- If the EC was unable to verify the tracking savings against the output file, the EC requested additional documentation from the program (utility) to explain the discrepancy.
- If no additional documentation or explanation was available, the EC would have compared the output file values to the project documentation to determine whether they were consistent. This verification step was not necessary for this program in this round of evaluation.

[43] "Expert" is the mode listed in the output files. This mode is also labelled as "EnerGuide" in simulation files. The EC uses both terms.

Figure 6-4. Overview of gross savings verification for 2018 HRR verification

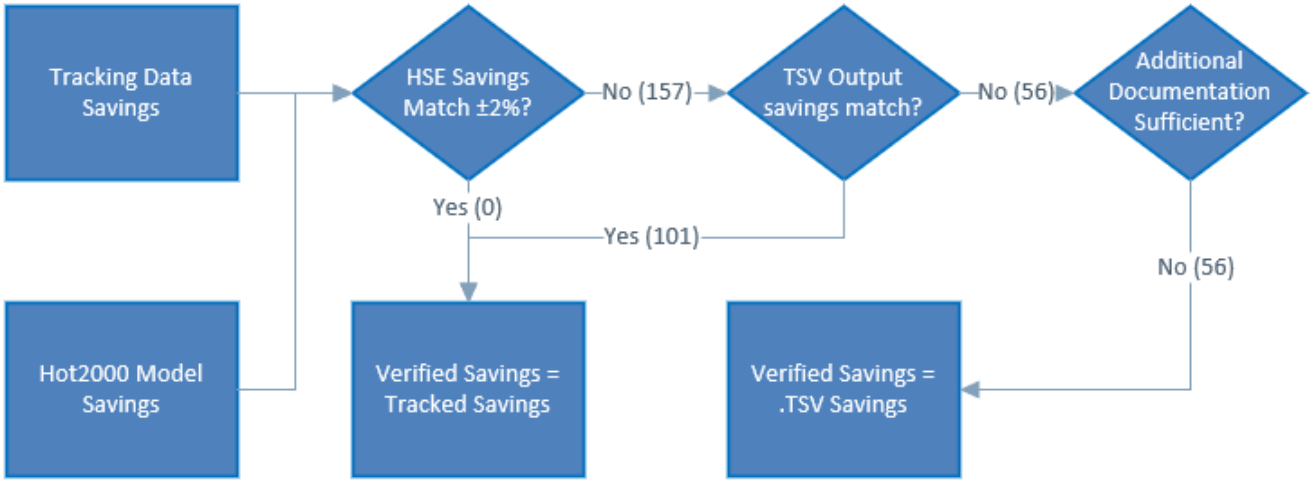


Table 6-24 shows how many customers were verified in each evaluation step. Savings for 19 homes were verified with comparison of tracking data against either simulation (HSE) or output (TSV) files.

Table 6-24. Overview of gross savings verification

Evaluation Step	# Verified
Simulation re-run (HSE) and compared to tracking, verified if ± 2%	0
Output files for (TSV) compared to tracking, verified if ± 2%	101
Additional Explanation request	0
Comparison to output file values	56
Total Verified	157

The EC produced verified savings for all 157 homes in the sample, shown in Table 6-25. The table shows the tracking and verified annual savings for each home that were not within the plus/minus two percent variation. The EC used these values to calculate the savings ratio and standard deviation.

Table 6-25. Tracked and verified savings with savings ratio and standard deviation*

Home	Tracked Savings	Verified Savings	Savings Ratio
A	51	21.7	43%
B	279	230.5	83%
C	197	135.1	69%
D	698	630.2	90%
E	327	252.9	77%
F	38	6.4	17%
G	963	933.6	97%
H	962	1394.4	70%
I	840	282.1	34%
J	459	273.2	60%
K	81	502.2	620%
L	178	211.8	119%
M	19	229.1	122%
N	1463	826.5	56%
O	1280	1603.3	78%
P	380	324.2	85%
Q	932	1041.9	112%
R	834	787.5	94%
S	471	772.8	164%
T	126	687.5	68%
U	1136	1103.5	97%
V	4538	5527.9	95%
W	1292	1907.2	84%
X	980	836	85%
Y	1256	604.7	48%
Z	614	718.2	106%
AA	94	226.3	47%
BB	384	296	77%
CC	1730	1682.2	97%
DD	612	1605.5	91%
EE	11	10.6	96%
FF	719	1509.9	95%
GG	36	317.4	325%
HH	169	695.1	88%
II	357	1009	92%
JJ	148	641.7	434%
KK	1704	2497.3	98%

Home	Tracked Savings	Verified Savings	Savings Ratio
LL	703	1351.1	96%
MM	100	431.6	103%
NN	46	132.1	287%
OO	809	1921.7	92%
PP	100	135.8	136%
QQ	439	350.1	80%
RR	163	134.6	83%
SS	-58	42.8	-74%
TT	576	507.1	88%
UU	571	374.4	66%
VV	601	562.6	94%
WW	124	89.5	72%
XX	214	158	74%
YY	656	529.5	81%
ZZ	90	94.7	105%
AAA	1119	1286.3	115%
BBB	2879	3629.9	126%
CCC	598	678.7	113%
DDD	1998	2443.3	122%
EEE	516	240.5	47%
FFF	1286	586.7	46%
GGG	1663	2219.4	85%
HHH	27	45.2	167%
III	85	98.7	116%
JJJ	689	1248.1	98%
KKK	232	786.2	97%
LLL	-198	828.4	-418%
MMM	487	410.3	84%
NNN	133	369	187%
OOO	301	293.9	98%
PPP	80	462.9	87%
QQQ	270	187.1	69%
RRR	267	333.1	125%
SSS	287	877.3	306%
TTT	940	1041.5	111%
UUU	1183	1529	129%
VVV	1183	1529	49%

*Not all values may compute exactly due to rounding.

The gross savings realization rate (RR) is 98.36%, shown in Table 6-26.

Table 6-26. Union HRR realization rate*

Numbers of Houses	Realization Rate	90% Confidence Interval			
		Absolute Precision	Lower Bound	Upper Bound	Relative Precision
157	98.36%	2.53%	95.84%	100.89%	4.29%

*Not all values may compute exactly due to rounding.

Verification Result

As a result of this review, the EC confirms the total savings of 205,146,928 CCM for Union's Home Reno Rebate CCM savings metric (98.36% of tracked savings).

Residential Adaptive Thermostats - Enbridge

Overview

Table 6-27 shows the reported, tracked, and verified scorecard achievements for the 2018 Enbridge Residential Adaptive Thermostat Program, with the metric of CCM savings for small volume customers. As a result of this review, the EC verifies 43,321,968 CCM for small volume customers (100.00% of tracked savings). Table 6-27 contains the following variables:

- Reported: In past evaluations, this value has been included for both consistency and as a cross-check to validate tracking data. For 2018, a draft report was not created or provided to the EC. This column remains included for consistency in reporting with previous years, and in anticipation that draft reporting will resume with the 2019 program year.
- Tracked: Metric value identified in Tracking File.
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documents section.
- Savings Ratio: Ratio of verified to tracked savings. A value of 100.00% indicates verified values match tracked values.

Table 6-27. Enbridge Resource Acquisition Achievements: Residential Adaptive Thermostats CCM metric*

Metric	Achievement			Ratio
	Reported	Tracked	Verified	
Large Volume Customer - CCM	N/A	-	-	-
Small Volume Customer - CCM		43,321,968	43,321,968	100.00%
TOTAL	**N/A**	**43,321,968**	**43,321,968**	**100.00%**

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 6-28 to verify the metrics for the Residential Adaptive Thermostat program.

Table 6-28. Documentation used to verify the Residential Adaptive Thermostat program

Report Language	Description or Citation
Enbridge-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2018 Enbridge DSM programs
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016 and OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016
Enbridge Plan	Enbridge Gas Multi-Year DSM Plan (2015-2020), EB-2015-0049
TRM 2.0	Natural Gas Demand Side Management Technical Resource Manual, Version 2.0

Verify Cumulative Natural Gas Savings

The EC reviewed natural gas savings for prescriptive measures from the Tracking File, using the procedures identified in Appendix O.

In calculating gas savings, the EC used:

- Tracking File data, which reported 13,729 units
- TRM 2.0

The EC certified the tracked savings, for a savings ratio of 100.00% of tracked savings.

Verification Result

As a result of this review, the EC confirms the savings of 43,321,968 CCM for Enbridge's Residential Adaptive Thermostat small volume customer CCM metric (100.00% of tracked savings).

Commercial & Industrial - Prescriptive – Enbridge

Overview

Table 6-29 shows the reported, tracked, and verified scorecard achievements for the 2018 Enbridge Commercial & Industrial Prescriptive program, with the metric of CCM savings. As a result of this review, the EC verifies total savings of 36,475,770 CCM for large and small volume customers (175.82% of tracked savings). Table 6-29 contains the following variables:

- Reported: In past evaluations, this value has been included for both consistency and as a cross-check to validate tracking data. For 2018, a draft report was not created or provided to the EC. This column remains included for consistency in reporting with previous years, and in anticipation that draft reporting will resume with the 2019 program year.
- Tracked: Metric value identified in Tracking File
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documents section.
- Savings Ratio: Ratio of verified to tracked savings. A value of 100.00% indicates that verified values match tracked values.

Table 6-29. Enbridge Resource Acquisition achievement. C&I Prescriptive CCM metric*

Metric	Achievement			Ratio
	Reported	Tracked	Verified	
Large Volume Customer - CCM	N/A	9,543,478	15,642,977	163.91%
Small Volume Customer - CCM		11,203,063	20,832,793	185.96%
TOTAL	**N/A**	**20,746,541**	**36,475,770**	**175.82%**

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 6-30 to verify the metrics for the C&I Prescriptive program.

Table 6-30. Documentation used to verify the C&I Prescriptive program

Report Language	Description or Citation
Enbridge-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2018 Enbridge DSM programs
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016 and OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016
Enbridge Plan	Enbridge Gas Multi-Year DSM Plan (2015-2020), EB-2015-0049
TRM 2.0	Natural Gas Demand Side Management Technical Resource Manual, Version 2.0
TRM 3.0	Natural Gas Demand Side Management Technical Resource Manual, Version 3.0
Showerhead Verification Among Rental Buildings	Showerhead Verification Among Rental Buildings, Ipsos Research, 2012[44]

[44] Showerhead Verification Among Rental Buildings, Ipsos Research for Enbridge Gas, March 29, 2012

Verify Cumulative Natural Gas Savings

In calculating net CCM, the EC reviewed natural gas savings for prescriptive measures from the Tracking File, using the procedures identified in Appendix O. Table 6-31 and Table 6-32 show the results of the analysis.

Table 6-31. Enbridge Resource Acquisition achievement by measure group: small volume customers*

Measure Group	Installed Measures	Tracked Achievement (CCM)	Verified Achievement (CCM)	Savings Ratio
Air Curtain	30	4,295,094	4,295,093	100.00%
Boiler - Space Heating	18	1,902,878	5,388,912	283.20%
Boiler - Water Heating	0	-	-	0.00%
Condensing Boiler - Space Heating	5	88,653	280,735	316.67%
Condensing Boiler - Water Heating	17	277,115	877,527	316.67%
Condensing Storage Water Heater	22	120,563	120,565	100.00%
Condensing Tankless Water Heater	7	66,258	66,257	100.00%
Demand Control Kitchen Ventilator	18	1,467,129	2,309,619	157.42%
Demand Control Ventilator	71	133,049	1,518,117	1141.02%
Destratification Fan	10	234,090	234,090	100.00%
Dishwasher	0	-	-	0.00%
Energy Recovery Ventilator	11	493,942	493,942	100.00%
Fryer	73	986,726	986,726	100.00%
Furnace	12	59,392	59,392	100.00%
Heat Recovery Ventilator	2	5,682	5,682	100.00%
Infrared Heater	222	594,521	3,718,166	625.41%
Ozone Washer Extractor	2	437,246	437,247	100.00%
Showerhead	175	40,725	40,725	100.00%
Unit Heater	0	-	-	0.00%
Total	**695**	**11,203,063**	**20,832,793**	**185.96%**

*Not all values may compute exactly due to rounding.

Table 6-32. Enbridge Resource Acquisition achievement by measure group: large volume customers*

Measure Group	Installed Measures	Tracked Achievement (CCM)	Verified Achievement (CCM)	Savings Ratio
Air Curtain	17	1,743,246	1,743,245	100.00%
Boiler - Space Heating	6	1,235,731	3,555,464	287.72%
Boiler - Water Heating	5	168,338	448,900	266.67%
Condensing Boiler - Space Heating	2	43,562	137,947	316.67%
Condensing Boiler - Water Heating	1	20,543	65,051	316.66%
Condensing Storage Water Heater	7	60,764	60,764	100.00%
Condensing Tankless Water Heater	10	99,794	99,794	100.00%
Demand Control Kitchen Ventilator	9	828,118	1,303,659	157.42%
Demand Control Ventilator	7	15,556	192,357	1236.55%
Destratification Fan	67	1,366,403	1,366,403	100.00%
Dishwasher	6	4,932	4,932	100.00%
Energy Recovery Ventilator	3	422,621	422,621	100.00%
Fryer	6	81,101	81,101	100.00%
Furnace	0	-	-	0.00%
Heat Recovery Ventilator	1	351,253	351,253	100.00%
Infrared Heater	137	515,400	3,223,369	625.41%
Ozone Washer Extractor	10	2,149,606	2,149,606	100.00%
Showerhead	1119	260,405	260,406	100.00%
Unit Heater	4	176,105	176,105	100.00%
Total	**1,417**	**9,543,478**	**15,642,977**	**163.91%**

*Not all values may compute exactly due to rounding.

Verification Result

As a result of this review, the EC confirms the savings of 20,832,793 CCM for small volume customers (185.96% savings ratio) and 15,642,977 CCM for large volume customers (163.91% savings ratio) for Enbridge's C&I Prescriptive Program.

Commercial & Industrial - Prescriptive – Union

Overview

Table 6-33 shows the shows the reported, tracked, and verified scorecard achievements for the 2018 Union Commercial & Industrial Prescriptive program, with the metric of CCM savings. As a result of this review, the EC has verified 204,967,607 CCM savings (265.24% of tracked). Table 6-33 contains the following variables:

- Reported: In past evaluations, this value has been included for both consistency and as a cross-check to validate tracking data. For 2018, a draft report was not created or provided to the EC. This column remains included for consistency in reporting with previous years, and in anticipation that draft reporting will resume with the 2019 program year.
- Tracked: Metric value identified in Tracking File
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified above.
- Savings Ratio: Ratio of verified to tracked savings. A value of 100.00% indicates that verified values match tracked values.

Table 6-33. Union Resource Acquisition scorecard achievement: Commercial & Industrial Prescriptive CCM metric*

Metric	Achievement			Ratio
	Reported	Tracked	Verified	
CCM	N/A	77,275,911	204,967,607	265.24%

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 6-34 to verify the metrics for the C&I Prescriptive program.

Table 6-34. Documentation used to verify the C&I Prescriptive program

Report Language	Description or Citation
Union-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2018 Union DSM programs
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016 and OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016
Union Plan	Union's 2015-2020 DSM Plan, EB-2015-0029
TRM 2.0	Natural Gas Demand Side Management Technical Resource Manual, Version 2.0
TRM 3.0	Natural Gas Demand Side Management Technical Resource Manual, Version 3.0

Verify Cumulative Natural Gas Savings

In calculating net CCM, the EC reviewed natural gas savings for prescriptive measures from the Tracking File, using the procedures identified in Appendix O. Table 6-35 shows the results of the analysis.

Table 6-35. Union Resource Acquisition Achievement by measure group*

Measure Group	Installed Measures	Tracked Achievement (CCM)	Verified Achievement (CCM)	Savings Ratio
Air Curtain	132	9,726,773	18,480,868	190.00%
Boiler - Space Heating	654	29,796,868	119,903,839	402.40%
Boiler - Water Heating	113	2,769,017	11,142,638	402.40%
Condensing Storage Water Heater	106	949,128	949,127	100.00%
Condensing Tankless Water Heater	73	708,660	708,660	100.00%
Demand Control Kitchen Ventilator	59	5,794,976	5,794,976	100.00%
Demand Control Ventilator	421	5,497,840	5,533,862	100.66%
Dishwasher	23	74,375	74,375	100.00%
Energy Recovery Ventilator	540	5,520,911	17,404,212	315.24%
Fryer	95	1,284,096	1,284,096	100.00%
Furnace	173	606,427	606,427	100.00%
Heat Recovery Ventilator	99	4,105,507	4,105,507	100.00%
Infrared Heater	662	970,763	9,539,671	982.70%
Make-Up Air Unit	24	3,996,726	3,996,726	100.00%
Ozone Washer Extractor	18	5,430,525	5,399,301	99.43%
Unit Heater	3	43,322	43,322	100.00%
Total	**3,195**	**77,275,911**	**204,967,607**	**265.24%**

*Not all values may compute exactly due to rounding.

Verification Result

As a result of this review, the EC confirms the savings of 204,967,607 CCM savings (265.24% savings ratio) for Union's C&I Prescriptive Program.

Commercial & Industrial – Direct Install – Enbridge

Overview

Table 6-36 shows the reported, tracked, and verified scorecard achievements for the 2018 Enbridge Commercial & Industrial Direct Install Program. As a result of this review, the EC verifies total savings of 56,783,392 CCM for large and small volume customers (100.00% of tracked savings). Table 6-36 contains the following variables:

- Reported: In past evaluations, this value has been included for both consistency and as a cross-check to validate tracking data. For 2018, a draft report was not created or provided to the EC. This column remains included for consistency in reporting with previous years, and in anticipation that draft reporting will resume with the 2019 program year.
- Tracked: Metric value identified in Tracking File
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documents section.
- Savings Ratio: Ratio of verified to tracked savings. A value of 100.00% indicates that verified values match tracked values.

Table 6-36. Enbridge Resource Acquisition scorecard achievement: C&I Direct Install CCM metric*

Metric	Achievement			Ratio
	Reported	Tracked	Verified	
Large Volume Customer - CCM	N/A	9,186,763	9,186,763	100.00%
Small Volume Customer - CCM		47,596,647	47,596,629	100.00%
TOTAL	**N/A**	**56,783,410**	**56,783,392**	**100.00%**

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 6-37 to verify the metrics for the C&I Direct Install program.

Table 6-37. Documentation used to verify the C&I Direct Install program

Report Language	Description or Citation
Enbridge-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2018 Enbridge DSM programs
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016 and OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016
Enbridge Plan	Enbridge Gas Multi-Year DSM Plan (2015-2020), EB-2015-0049
TRM 2.0	Natural Gas Demand Side Management Technical Resource Manual, Version 2.0

Verify Cumulative Natural Gas Savings

In calculating net CCM, the EC reviewed natural gas savings for prescriptive measures from the Tracking File, using the procedures identified in Appendix O. Three measures were installed, with 49 individual installations with large volume customers and 304 with small volume customers. The EC verified the tracked savings which resulted in a (rounded) savings ratio of 100.00%.

Table 6-38. Enbridge C&I Direct Installation measure groups: large volume customers

Measure Group	Installed Measures	Tracked Achievement (CCM)	Verified Achievement (CCM)	Savings Ratio
Air Curtain	37	7,758,656	7,758,655	100.00%
Demand Control Ventilator	7	279,088	279,088	100.00%
Demand Control Kitchen Ventilator	5	1,149,019	1,149,020	100.00%
TOTAL	**49**	**9,186,763**	**9,186,763**	**100.00%**

Table 6-39. Enbridge C&I Direct Installation measure groups: small volume customers

Measure Group	Installed Measures	Tracked Achievement (CCM)	Verified Achievement (CCM)	Savings Ratio
Air Curtain	224	44,593,715	44,593,694	100.00%
Demand Control Ventilator	71	1,554,208	1,554,210	100.00%
Demand Control Kitchen Ventilator	9	1,448,724	1,448,726	100.00%
TOTAL	**304**	**47,596,647**	**47,596,629**	**100.00%**

Verification Result

As a result of this review, the EC confirms the savings of 9,186,763 CCM for large volume customers (100.00% savings ratio) and 47,596,629 CCM for small volume customers (100.00% savings ratio) of Enbridge's C&I Direct Install Program.

Commercial & Industrial – Direct Install – Union

Table 6-36 shows the reported, tracked, and verified scorecard achievements for the 2018 Union Commercial & Industrial Direct Install Program. As a result of this review, the EC verifies total savings of 50,951,203 CCM for large and small volume customers (100.00% of tracked savings). Table 6-40 contains the following variables:

- Reported: In past evaluations, this value has been included for both consistency and as a cross-check to validate tracking data. For 2018, a draft report was not created or provided to the EC. This column remains included for consistency in reporting with previous years, and in anticipation that draft reporting will resume with the 2019 program year.
- Tracked: Metric value identified in Tracking File
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documents section.
- Savings Ratio: Ratio of verified to tracked savings. A value of 100.00% indicates that verified values match tracked values.

Table 6-40. Union Resource Acquisition scorecard achievement: C&I Direct Install CCM metric*

Metric	Achievement			Ratio
	Reported	Tracked	Verified	
CCM	N/A	50,951,203	50,951,203	100.00%

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 6-37 to verify the metrics for the C&I Direct Install program.

Table 6-41. Documentation used to verify the C&I Direct Install program

Report Language	Description or Citation
Enbridge-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2018 Enbridge DSM programs
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016 and OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016
Union Plan	Union's 2015-2020 DSM Plan, EB-2015-0029
TRM 2.0	Natural Gas Demand Side Management Technical Resource Manual, Version 2.0

Verify Cumulative Natural Gas Savings

In calculating net CCM, the EC reviewed natural gas savings for prescriptive measures from the Tracking File, using the procedures identified in Appendix O. One measure was installed, with 222 individual installations. The EC verified the tracked savings which resulted in a savings ratio of 100.00%.

Table 6-42. Union C&I Direct Installation measure groups

Measure Group	Installed Measures	Tracked Achievement (CCM)	Verified Achievement (CCM)	Savings Ratio
Air Curtain	222	50,951,203	50,951,203	100.00%

Verification Result

As a result of this review, the EC confirms the savings of 50,951,203 (100.00% savings ratio) of Union's C&I Direct Install Program.

Commercial & Industrial - Custom – Enbridge

Overview

Table 6-43 shows the shows the reported, tracked, and verified scorecard achievements for the 2018 Enbridge Commercial & Industrial Custom program. As a result of this review, the EC verifies total savings of 352,950,627 CCM (165.33% of tracked savings). Table 6-43 contains the following variables:

- Reported: In past evaluations, this value has been included for both consistency and as a cross-check to validate tracking data. For 2018, a draft report was not created or provided to the EC. This column remains included for consistency in reporting with previous years, and in anticipation that draft reporting will resume with the 2019 program year.
- Tracked: Metric value identified in Tracking File
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documents section.
- Savings Ratio: Ratio of verified to tracked savings. A value of 100.00% indicates that verified values match tracked values.

Table 6-43. Enbridge Resource Acquisition scorecard achievement: C&I Custom CCM metric*

Metric	Achievement			Ratio
	Reported	Tracked	Verified	
Large Volume Customer - CCM	N/A	195,307,930	323,139,650	165.45%
Small Volume Customer - CCM		18,170,408	29,810,977	164.06%
TOTAL	**N/A**	**213,478,338**	**352,950,627**	**165.33%**

*Not all values may compute exactly due to rounding.

Table 6-44 includes these variables:

- Cumulative Gross Savings – Tracking: Gross cumulative tracking savings for all customers in the Enbridge C&I Custom program.
- RR: Gross realization rate from the 2017-2018 CSPV report.
- Att: Attribution ratio (the complement of free ridership) from the 2018 NTG report.
- Spillover: Spillover ratio from the 2013-2014 Spillover Study.
- Adj: Adjustment Ratio, the product of the RR and the sum of the Att ratio and Spillover ratio

Equation 1: Adjustment Ratio

$$\boldsymbol{Adjustment\ Ratio} = \boldsymbol{RR} * (\boldsymbol{Att} + \boldsymbol{Spillover})$$

- Verified Net Savings: Cumulative gross savings multiplied by the Adjustment Ratio

Equation 2: Verified Net Savings

$$Verified\ Net\ Savings = Adjustment\ Ratio * (Cumulative\ Gross)$$

Table 6-44. Adjustment factors applied to Enbridge C&I Custom Program cumulative gross savings*

Attribution Group	Tracking GROSS Savings (CCM)	RR (%)	Att (%)	Spillover (%)	Adj (%)	Verified Net Savings (CCM)
Commercial - Other	35,315,552	94.99%	25.65%	1.36%	25.66%	9,060,840
Commercial - Ventilation	28,854,855	94.99%	14.12%	1.36%	14.70%	4,242,948
Commercial - Boilers	60,672,478	94.99%	42.37%	1.36%	41.54%	25,202,818
Multi-Residential - Heating	114,449,741	121.09%	57.67%	8.24%	79.81%	91,342,819
Multi-Residential - Other	63,506,532	121.09%	69.73%	8.24%	94.41%	59,958,977
Industrial	282,799,242	110.79%	50.62%	1.45%	57.69%	163,142,225
TOTAL	**585,598,400**				**60.27%**	**352,950,627**

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 6-45 to verify the metrics for the C&I Custom program.

Table 6-45. Documentation used to verify the C&I Custom program

Report Language	Description or Citation
Enbridge-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2018 Enbridge DSM programs
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016 and OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016
Enbridge Plan	Enbridge Gas Multi-Year DSM Plan (2015-2020), EB-2015-0049
2017-2018 CPSV Report	2018 Natural Gas Demand Side Management Custom Savings Verification[45]
2018 NTG Report	2018 Natural Gas Demand Side Management Free-ridership Evaluation[46]
2013-2014 Spillover Study	CPSV Participant Spillover Results[47]

Verify Savings

Adjustment Values – RR

The 2017-2018 CPSV Report conveyed gross realization rate by sector, as shown in Table 6-46. The EC used the same sectors to apply the relevant rates at the measure level.

Table 6-46. Verified gross savings rates for the Enbridge Custom C&I program

Sector	RR (%)
Commercial	94.99%
Low Income & Multi Residential	121.09%
Industrial	110.79%

[45] 2017-2018 Natural Gas Demand Side Management Custom Savings Verification, DNV GL for the Ontario Energy Board, December 26, 2019

[46] 2018 Natural Gas Demand Side Management Free-ridership Evaluation, DNV GL for the Ontario Energy Board, December 27, 2019

[47] CPSV Participant Spillover Results, DNV GL for the Ontario Energy Board, May 23, 2018

Adjustment Values – Att Ratios

The 2018 NTG Report conveyed attribution ratios using a combination of sector and measure group, as shown in Table 6-47.

Table 6-47. Attribution ratios for the Enbridge Custom C&I program

Attribution Group	Att (%)
Commercial - Other	25.65%
Commercial - Ventilation	14.12%
Commercial - Boilers	42.37%
Multi-Residential - Heating	57.67%
Multi-Residential - Other	69.73%
Industrial	50.62%

Adjustment Values – Spillover Ratios

The 2013-2014 Spillover Study conveyed spillover ratios at the sector level, as shown in Table 6-48. The EC used the same sectors to apply the relevant rates at the measure level.

Table 6-48. Spillover ratios for the Enbridge Custom C&I program

Sector	Spillover (%)
Custom Commercial	1.36%
Multi-Residential	8.24%
Custom Industrial	1.45%

Verify Cumulative Natural Gas Savings

The program-level adjustment factors shown in Table 6-44 were built up from a measure-level application of the RR, Att, and Spillover ratios. Each measure was assigned a RR or Spillover ratio based on its sector, and an Att ratio based on the combination of sector and measure group. The EC calculated the measure-level net savings using Equation 1 and Equation 2, then summed the measure-level savings to produce program-level savings. The EC calculated the program-level adjustment ratio by dividing the program-level net savings by the program-level gross savings.

Verification Result

As a result of this review, the EC confirms the savings of 352,950,627 CCM (165.33% of tracked savings) for Enbridge's C&I Custom Program.

Commercial & Industrial - Custom – Union

Overview

Table 6-49 shows the shows the reported, tracked, and verified scorecard achievements for the 2018 Union C&I Custom program. As a result of this review, the EC verifies total savings of 515,872,191 CCM (101.24% of tracked savings). Table 6-49 contains the following variables:

- Reported: In past evaluations, this value has been included for both consistency and as a cross-check to validate tracking data. For 2018, a draft report was not created or provided to the EC. This column remains included for consistency in reporting with previous years, and in anticipation that draft reporting will resume with the 2019 program year.
- Tracked: Metric value identified in Tracking File
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in Documents section.
- Savings Ratio: Ratio of verified to tracked savings. A value of 100.00% indicates that verified values match tracked values.

Table 6-49. Union Resource Acquisition scorecard achievement: Custom C&I CCM metric*

Metric	Achievement			Ratio
	Reported	Tracked	Verified	
CCM	N/A	509,540,281	515,872,191	101.24%

*Not all values may compute exactly due to rounding.

Table 6-50 includes these variables:

- Cumulative Gross Savings – Tracking: Gross cumulative tracking savings for all customers in the Enbridge C&I Custom program
- RR: Gross realization rate from the 2017-2018 CSPV report
- Att: Attribution ratio (the complement of free ridership) from the 2018 NTG Report
- Spillover: Spillover ratio from 2013-2014 Spillover Study
- Adj: Adjustment Ratio, the product of the RR and the sum of the Att ratio and Spillover ratio

Equation 3: Adjustment Ratio

$$\boldsymbol{Adjustment\ Ratio} = \boldsymbol{RR} * (\boldsymbol{Att} + \boldsymbol{Spillover})$$

- Verified Net Savings: Cumulative gross savings multiplied by the Adjustment Ratio

Equation 4: Verified Net Savings

$$Verified\ Net\ Savings = Adjustment\ Ratio * (Cumulative\ Gross)$$

Table 6-50.Adjustment factors applied to Union C&I Custom Program cumulative gross savings*

Attribution Group	Tracking GROSS Savings (CCM)	RR (%)	Att (%)	Spillover (%)	Adj (%)	Verified Net Savings (CCM)
Agricultural	707,932,787	91.17%	50.16%	0.89%	46.54%	329,488,095
Commercial and Multi-Family	120,228,342	90.57%	28.62%	0.00%	25.92%	31,164,550
Industrial - Steam or Hot Water System	152,680,320	91.17%	4.11%	0.89%	4.56%	6,959,932
Industrial - HVAC	213,589,410	91.17%	39.88%	0.89%	37.17%	79,391,203
Industrial - Steam or Hot Water System	252,890,716	91.17%	28.98%	0.89%	27.23%	68,868,411
TOTAL	**1,447,321,574**				**35.64%**	**515,872,191**

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 6-51 to verify the metrics for the C&I Custom program.

Table 6-51. Documentation used to verify the C&I Custom program

Report Language	Description or Citation
Union-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2018 Union DSM programs
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016 and OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016
Union Plan	Union's 2015-2020 DSM Plan, EB-2015-0029
2017-2018 CPSV Report	2018 Natural Gas Demand Side Management Custom Savings Verification[48]
2018 NTG Report	2018 Natural Gas Demand Side Management Free-ridership Evaluation[49]
2013-2014 Spillover Study	CPSV Participant Spillover Results[50]

Verify Savings

Adjustment Values – RR

The 2017-2018 CPSV Report conveyed gross realization rate by sector, as shown in Table 6-52. The EC used the same sectors to apply the relevant rates at the measure level.

Table 6-52. Verified gross savings rates for the Union Custom C&I program

Sector	RR (%)
Agricultural & Industrial	91.17%
Commercial and Multi-Family	90.57%

Adjustment Values – Att Ratios

The 2018 NTG Report conveyed attribution ratios using a combination of sector and measure group, as shown in Table 6-53.

[48] 2017-2018 Natural Gas Demand Side Management Custom Savings Verification, DNV GL for the Ontario Energy Board, December 26, 2019
[49] 2018 Natural Gas Demand Side Management Free-ridership Evaluation, DNV GL for the Ontario Energy Board, December 27, 2019
[50] CPSV Participant Spillover Results, DNV GL for the Ontario Energy Board, May 23, 2018

Table 6-53. Attribution ratios for the Union Custom C&I program

Attribution Group	Att (%)
Agricultural	50.16%
Commercial and Multi-Family	28.62%
Industrial - Steam or Hot Water System	4.11%
Industrial - HVAC	39.88%
Industrial - Steam or Hot Water System	28.98%

Adjustment Values – Spillover Ratios

The 2013-2014 Spillover Study conveyed spillover ratios at the sector level, as shown in Table 6-54. The EC used the same sectors to apply the relevant rates at the measure level.

Table 6-54. Spillover ratios for the Union Custom C&I program

Sector	Spillover (%)
Industrial	0.89%
Commercial and Multi-Family	0.00%

Verify Cumulative Natural Gas Savings

The program-level adjustment factors shown in Table 6-50 were built up from a measure-level application of the RR, Att, and Spillover ratios. Each measure was assigned a RR or Spillover ratio based on its sector, and a Att ratio based on the combination of sector and measure group. The EC calculated the measure-level net savings using Equation 3 and Equation 4, then summed the measure-level savings to produce program-level savings. The EC calculated the program-level adjustment ratio by dividing the program-level net savings by the program-level gross savings.

Verification Result

As a result of this review, the EC verifies the total savings of 515,872,191 CCM for Union's C&I Custom Program, an overall savings ratio of 101.24%.

Small Commercial New Construction – Enbridge

No savings or activity were reported for this program in 2018.

Energy Leaders Initiative – Enbridge

Overview

Table 6-55 shows the reported, tracked, and verified scorecard achievements for the 2018 Enbridge Energy Leaders Initiative, with the metric of CCM savings. As a result of this review, the EC verifies total savings of 29,708,545 CCM for large and small volume customers (100.00% of tracked savings). Table 6-55 contains the following variables:

- Reported: In past evaluations, this value has been included for both consistency and as a cross-check to validate tracking data. For 2018, a draft report was not created or provided to the EC. This column remains included for consistency in reporting with previous years, and in anticipation that draft reporting will resume with the 2019 program year.
- Tracked: Metric value identified in Tracking File.
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documents section.
- Savings Ratio: Ratio of verified to tracked savings. A value of 100.00% indicates that verified values match tracked values.

Table 6-55. Enbridge Resource Acquisition scorecard achievement: Energy Leaders Initiative CCM metric*

Metric	Achievement			Ratio
	Reported	Tracked	Verified	
Large Volume Customer - CCM	N/A	29,688,665	29,688,665	100.00%
Small Volume Customer - CCM		19,880	19,880	100.00%
TOTAL	**N/A**	**29,708,545**	**29,708,545**	**100.00%**

*Not all values may compute exactly due to rounding.

Table 6-56 includes these variables:

- Cumulative Gross Savings – Tracking: Gross cumulative tracking savings for all customers in the Enbridge Energy Leaders Initiative.
- RR: Gross realization rate based on engineering reviews.
- Att: Attribution ratio (the complement of free ridership), deemed based on EAC consensus.
- Spillover: Spillover ratio, deemed based on EAC consensus.
- Adj: Adjustment Ratio, the product of the RR and the sum of the Att ratio and Spillover ratio

Equation 5: Adjustment Ratio

$$\boldsymbol{Adjustment\ Ratio} = \boldsymbol{RR} * (\boldsymbol{Att} + \boldsymbol{Spillover})$$

- Verified Net Savings: Cumulative gross savings multiplied by the Adjustment Ratio

Equation 6: Verified Net Savings

$$Verified\ Net\ Savings = Adjustment\ Ratio * (Cumulative\ Gross)$$

Table 6-56. Adjustment factors applied to Enbridge Energy Leaders Initiative cumulative gross savings*

Measure Type	Tracking Gross Savings (CCM)	RR (%)	Att (%)	Spillover (%)	Adj* (%)	Verified Net Savings (CCM)
Large Volume Customer - CCM	29,688,665	100.00%	100.00%	0.00%	100.00%	29,688,665
Small Volume Customer - CCM	19,880	100.00%	100.00%	0.00%	100.00%	19,880

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 6-57 to verify the metrics for the Energy Leaders Initiative.

Table 6-57. Documentation used to verify the Energy Leaders Initiative

Report Language	Description or Citation
Enbridge-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2018 Union DSM programs
Project Files	PDF document for each requested participant, supporting program metrics
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016 and OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016
Enbridge Plan	Enbridge Gas Multi-Year DSM Plan (2015-2020), EB-2015-0049

Participant Selection

Enbridge first provided the Tracking File listing the Enbridge Account (number) and Project Code (unique ID). The spreadsheet identified three participants. The EC requested full documentation for all participants.

Received Files

The EC received pdf files for each project listed in the Tracking File. PDF files generally included:

- Project summary
- Customer invoice for project incentive
- Custom Project Documentation Review Checklist
- Program Application Form
- Custom project documentation (ETools)
- Site evaluation/audit documentation
- Manufacturer invoice
- Installation invoice

Verify Gross Savings

This program consists of two vortex ice resurfacing projects and one hydronic high efficiency boiler.

Vortex Ice Resurfacing Projects

The EC reviewed the calculations to determine whether the savings estimates for the vortex ice resurfacing projects were reasonable. The program calculated savings using the following equation, which the EC deems appropriate.

$$energy\ savings = \left(\frac{gallons\ of\ water}{year}\right)(specific\ heat\ of\ water)(change\ in\ water\ temperature)$$

The Etools custom project documentation shows the inputs used in the equation. In all cases, the Etools inputs match the information on the customer application.

Hydronic High Efficiency Boiler Project

Enbridge used the Etools Industrial Boiler suite to complete pre- and post-modeling of natural gas consumption at the site in question. The EC also uses ETools to calculate boiler savings for the CPSV analysis and deems its use appropriate for this application.

The Etools custom project documentation shows the inputs used in the pre- and post- models. These inputs match the information provided by the participant in both the application and in correspondence between the participant and Enbridge. EC deems the inputs appropriate.

Adjustment Values

In evaluation of the 2016 programs, the EAC agreed to deem the Att and Spillover ratios at 100.00% and 0%, respectively. These deemed values continued into 2018. Therefore, the adjustment factor is equal to the realization rate.

Verification Result

As a result of this review, the EC confirms the savings of 19,880 CCM (100.00% of tracked) for small volume customers and 29,688,665 CCM (100.00% of tracked) for large volume customers of the Energy Leaders Initiative.

Comprehensive Energy Management – Enbridge

No activity was reported for this program in 2018 under the Resource Acquisition Scorecard.

Run-it-Right – Enbridge

Overview

Table 6-58 shows the reported, tracked, and verified scorecard achievements for the 2018 Enbridge Run-it-Right (RIR) Program, with the metric of CCM savings. The RIR Program has two metrics under separate scorecards, CCM Savings (Resource Acquisition) and Participants (Market Transformation). CCM Savings are discussed here, while the Participants metric is discussed in Appendix K.

As a result of this review, the EC verifies total savings of 129,953 CCM (100.00% of tracked savings) for large volume customers of the 2018 Run-it-Right program. Table 6-58 contains the following variables:

- Reported: In past evaluations, this value has been included for both consistency and as a cross-check to validate tracking data. For 2018, a draft report was not created or provided to the EC. This column remains included for consistency in reporting with previous years, and in anticipation that draft reporting will resume with the 2019 program year.
- Tracked: Metric value identified in Tracking File
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documents section.
- Savings Ratio: Ratio of verified to tracked savings. A value of 100.00% indicates that verified values match tracked values.

Table 6-58. Enbridge Resource Acquisition scorecard achievement: Run-it-Right CCM metric*

Metric	Achievement			Ratio
	Reported	Tracked	Verified	
Large Volume Customer - CCM	N/A	129,953	129,953	100.00%
Small Volume Customer - CCM		-	-	-
TOTAL	**N/A**	**129,953**	**129,953**	**100.00%**

*Not all values may compute exactly due to rounding.

Table 6-59 includes these variables:

- Tracking Gross Savings Tracking: Gross cumulative tracking savings for all customers in the Enbridge 2018 Run-it-Right program.
- RR: Gross realization rate based on engineering reviews.
- Att: Attribution ratio (the complement of free ridership) from the 2015 CPSV report.
- Spillover: Spillover ratio from 2013-2014 Spillover Study.
- Adj: Adjustment Ratio, the product of the RR and the sum of the Att ratio and Spillover ratio

Equation 7: Adjustment Ratio

$$\boldsymbol{Adjustment\ Ratio} = \boldsymbol{RR} * (\boldsymbol{Att} + \boldsymbol{Spillover})$$

- Verified Net Savings: Cumulative gross savings multiplied by the Adjustment Ratio

Equation 8: Verified Net Savings

$$Verified\ Net\ Savings = Adjustment\ Ratio * (Cumulative\ Gross)$$

Table 6-59. Adjustment Factors Applied to Run-it-Right Program cumulative gross savings*

Measure Type	Tracking Gross Savings (CCM)	RR (%)	Att (%)	Spillover (%)	Adj* (%)	Verified Net Savings (CCM)
Large Volume Customers CCM	259,595	100.00%	50.06%	0.00%	50.06%	129,953

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 6-60 to verify the metrics for the Run-it-Right program.

Table 6-60. Documentation used to verify the Run-it-Right Program

Report Language	Description or Citation
Enbridge-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2018 Union DSM programs
Project Files	PDF document for each requested participant, supporting program metrics
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016 and OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016
Enbridge Plan	Enbridge Gas Multi-Year DSM Plan (2015-2020), EB-2015-0049
2015 CPSV Report	2015 Natural Gas Demand Side Management Custom Savings Verification and Free-ridership Evaluation[51]
2013-2014 Spillover Study	CPSV Participant Spillover Results[52]

Participant Selection

Enbridge first provided the Tracking File listing RIR participants with anonymized Program, Customer, and Site IDs, listing 29 individual projects with 22 included in savings results (the remainder removed by Enbridge because the participants undertook capital projects or the consumption data dd not provide the statistical confidence required for egression analysis). The EC randomly selected 10 of the 29 projects, requesting full documentation by Project ID.

Methodology Review

The program methodology did not change for the 2018 program year. For the certification, a senior engineer reviewed the calculation methods for each selected site. The following conclusion from the 2015 certification[53] remains valid:

> *The methodology used by the RIR program to estimate savings is appropriate for the application. No significant concerns were identified by the team; however, the RIR tool does not allow observation of all of the calculations performed.*

Verify Gross Savings

For 2018, evaluation engineers reviewed the supporting documentation provided in the Project Files (pdf) for the sample of sites to identify the answers to the following questions:

- Is the building type correctly identified?

[51] 2016 Natural Gas Demand Side Management Custom Savings Verification, DNV GL for the Ontario Energy Board, June 31, 2018

[52] CPSV Participant Spillover Results, DNV GL for the Ontario Energy Board, May 23, 2018

[53] 2015 Natural Gas Demand Side Management Annual Verification, DNV GL for the Ontario Energy Board, December 20, 2018, Appendix F

- How many months were used in the baseline, improvement, and reference periods?
- What type of model was used?
- What independent variables were used?
- What R-squared values were used for the baseline and reference models?
- What are the estimated savings during the reference period?
- Were capital project savings deducted?
- What percentage of consumption do the savings represent?
- What is driving the positive or negative savings claimed?
- Should a new baseline model be created?

The EC senior engineer used these questions (above) to review the calculations completed, the consumption pattern at the facility, and the baseline model. The EC senior engineer then asked three primary questions to assess the risk of savings accuracy as Low, Normal, or High. Three key questions were:

- Based on experience, is the baseline model specification reasonable?
- Based on experience, is the baseline time period definition reasonable?
- What is the assessed level of risk for achieving savings?

The EC assigned six sites as low-risk, two normal-risk, and two high-risk. Based on our experience, this distribution is consistent with similar programs. The baseline model specifications and time period definitions were reasonable for all projects examined. Overall, the savings claimed are reasonable, especially because both positive and negative savings are included in the program Tracking File and Project Files.

After the risk levels were assigned, the EC senior engineers identified similarities in the high-risk facilities:

- Both high-risk facilities had less than 12 months of baseline data used in their model, introducing risk by allowing for the possibility of not accounting for all seasonal weather variation throughout the year.
- The baseline period consumption behaviors at both high-risk facilities were irregular, with one being higher and the other being lower with occasional spikes.

All savings claims were supported by actions at the facility. Clear changes in the consumption patterns occurred. The EC's review supports a savings claim for all sites.

Adjustment Values – Att and Spillover Ratios

The 2015 CPSV Report conveyed a single attribution ratio for the Run-it-Right program of 50.06%. The 2013-2014 Spillover study did not find any spillover savings for the program.[54] The two ratios (attribution and spillover) were combined with the RR to produce a program-level adjustment factor of 50.06%.

Verification Result

As a result of this review, the EC confirms the savings of 129,953 CCM (100.00% of tracked) for large volume customers of the Run-it-Right program.

[54] Neither the attribution ratio nor the spillover value have been updated in more recent iterations of these reports.

Appendix H Low Income Scorecards

This appendix describes the detailed process used to verify the metrics for the Low Income Scorecard programs for Enbridge (Table 6-61) and Union Gas (Table 6-62). The programs addressed in this appendix are:

- Winter Retrofit - Furnace End-of-Life Upgrade Program – Union
- Winter Retrofit - Home Winterproofing - Enbridge
- Winter Retrofit - Home Weatherization – Union
- Winter Retrofit - Indigenous Program – Union
- Low Income New Construction – Enbridge
- Low Income Multi-Residential – Affordable Housing Program – Enbridge
- Low Income Multi-Residential – Multifamily Program (Social Assisted) – Union
- Low Income Multi-Residential – Multifamily Program (Market Rate) – Union

Table 6-61. Enbridge 2018 Low Income scorecard*[55]

Programs	Metrics	Verified Achievement		Metric Target			Weight
		Program-level Savings	Metric-level Savings	Lower Band	Target	Upper Band	
Home Winterproofing	CCM	15,978,390	15,978,390	21,392,823	28,523,764	42,785,646	45.00%
Low Income Multi-Residential	CCM	114,168,901	114,168,901	73,159,199	97,545,599	146,318,399	45.00%
Low Income New Construction	Applications	13	13	11	14	21	10.00%

*Not all values may compute exactly due to rounding.

Table 6-62. Union Gas 2018 Low Income scorecard*[56]

Programs	Metrics	Verified Achievement		Metric Target			Weight
		Program-level Savings	Metric-level Savings	Lower Band	Target	Upper Band	
Home Weatherization	CCM	31,815,336	32,052,374	30,755,897	41,007,862	61,511,793	60.00%
Furnace End-of-Life		-					
Indigenous		237,038					
Multi-Family Social & Assisted	CCM	19,718,214	19,718,214	17,418,187	23,224,249	34,836,374	35.00%
Multi-Family Market Rate	CCM	6,573,109	6,573,109	3,389,095	4,518,793	6,778,190	5.00%

*Not all values may compute exactly due to rounding.

[55] Ontario Energy Board Decision and Order, EB-2015-0029/EB-2015-0049, FINAL REVISED February 24, 2016, Schedule C

[56] Ibid

Winter Retrofit - Furnace End-of-Life Upgrade Program – Union

No savings were reported for this program in 2018.

Winter Retrofit – Home Winterproofing – Enbridge

Overview

Table 6-63 shows the reported, tracked, and verified scorecard achievements for the 2018 Enbridge Home Winterproofing program, with the metric of CCM savings. As a result of this review, the EC verifies 15,978,390 CCM (100.00% of tracked savings). Table 6-63 contains the following variables:

- Reported: In past evaluations, this value has been included for both consistency and as a cross-check to validate tracking data. For 2018, a draft report was not created or provided to the EC. This column remains included for consistency in reporting with previous years, and in anticipation that draft reporting will resume with the 2019 program year.
- Tracked: Metric value identified in Tracking File
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documents section.
- Savings Ratio: Ratio of verified to tracked savings. A value of 100.00% indicates that verified values match tracked values.

Table 6-63. Enbridge Low Income Scorecard Achievements: Home Winterproofing program*

Metric	Achievement			Ratio
	Reported	Tracked	Verified	
CCM - Prescriptive	N/A	2,158,715	2,158,716	100.00%
CCM - Whole Home		13,819,674	13,819,674	100.00%
TOTAL	**N/A**	**15,978,389**	**15,978,390**	**100.00%**

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 6-64 to verify the metrics for the Home Winterproofing program.

Table 6-64. Documentation used to verify the Home Winterproofing program

Report Language	Description or Citation
Enbridge-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2018 Enbridge DSM programs
Project Files	Various documents for each requested participant, supporting program metrics
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016 and OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016
Enbridge Plan	Enbridge Gas Multi-Year DSM Plan (2015-2020), EB-2015-0049
TRM 2.0	Natural Gas Demand Side Management Technical Resource Manual, Version 2.0
TAPS Report	TAPS Verification Program 2012 Year End Research Report, Quadra Research. April 2013[57]

[57] TAPS Verification Program 2012 Year End Research Report, Study CR-604, Quadra Research, April 3, 2013

Simulation-based Savings

Participant Selection

The EC did not verify Private Homes and Social Housing savings separately, as there was no difference observed for measure life (25 years) or free ridership (0%) for any Low Income program. Enbridge provided the tracking file listing 692 individual participant homes in the Winterproofing program. To certify the scorecard metric, the EC randomly selected 30 participants for review, requested additional documentation, confirmed receipt of the correct files, and reviewed documents to verify participation and eligibility.

Received Files

The typical file folder had the following information:

- Photographs of pre- and post-installation conditions
- Invoice information (PDF scans or photo of receipts)
- HOT2000 Model simulation Files (.HSE)
- HOT2000 Model Output Files (.TSV)
- HOT2000 Model Output Summary (PDF)

Calculate Realization Rate

The EC used a multi-step process to verify tracked energy savings for the 30 sampled homes, shown Figure 6-5. for the 2018 Winterproofing verification. The process was necessary because the simulation mode (EnerGuide or Expert[58]) used by program delivery agents is not available to non-certified professionals. While the EC can attempt to run the Expert simulations in General mode, the runs may produce error warnings or result in a savings differential between the Expert result and General result. Therefore, this multi-step process was developed to verify savings:

- EC requested simulation (HSE) and output (TSV) files from the program
- Where possible, the simulation file was re-run and the results used to verify the tracking savings. If different simulation versions or modes were used, the savings could be slightly different; therefore, simulation savings were considered "verified" if they were within 2% of the tracking savings; in this case, the tracked savings value was accepted as the verified savings.
- If a simulation file was not provided, the file inputs were incompatible with General mode and would not run, the file ran but produced an error due to version or mode differences, or the file produced a difference in savings greater than 2%, the output file was used to verify the tracking savings. As with the simulation file, the EC accepted tracking savings values within 2% of the output file value as the verified savings.
- If no additional documentation or explanation was available, the EC would have compared the output file values to the project documentation PDF summary to determine whether they were consistent.

[58] "Expert" is the mode listed in the output files. This mode is also labelled as "EnerGuide" in simulation files. The EC uses both terms.

Figure 6-5. Overview of gross simulation savings verification for 2018 Winterproofing

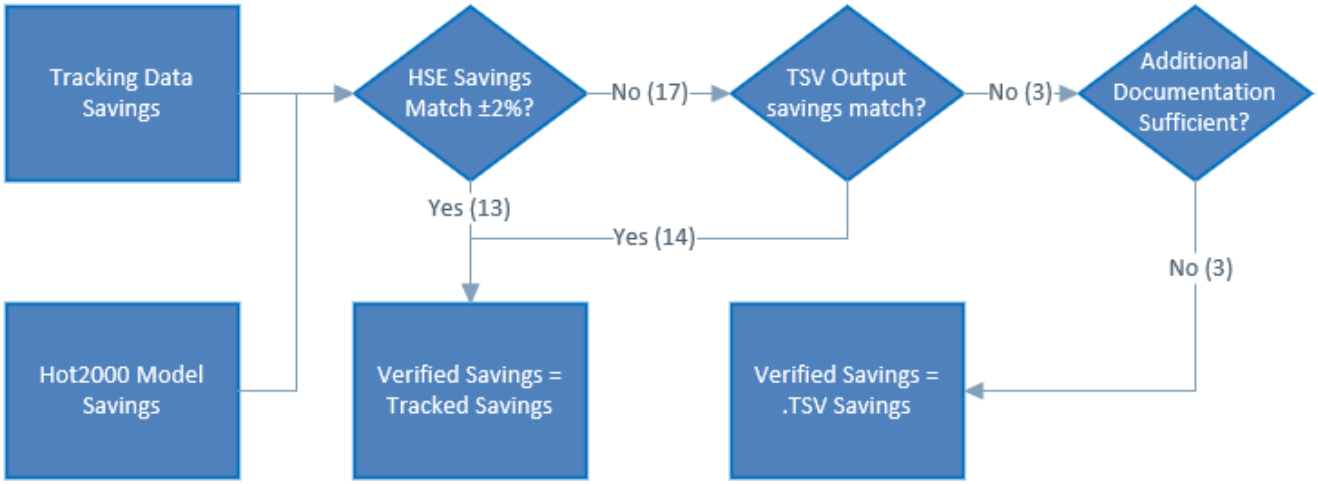


Table 6-65 shows how many customers were verified in each evaluation step.

Table 6-65. Overview of gross simulation savings verification

Evaluation Step	# Verified
Simulation re-run (HSE) and compared to tracking, verified if ± 2%	13
Output files for (TSV) compared to tracking, verified if ± 2%	14
Additional Explanation request	0
Comparison to output file values	3
Total Verified	30

The gross savings realization rate is 100.00%, shown in Table 6-66.

Table 6-66. Enbridge Home Winterproofing realization rate*

Numbers of Houses	Realization Rate	90% Confidence Interval			
		Absolute Precision	Lower Bound	Upper Bound	Relative Precision
30	100%	0%	100%	100%	0%

*Not all values may compute exactly due to rounding.

Prescriptive Savings

In calculating net CCM, the EC reviewed natural gas savings for prescriptive measures from the Tracking File, using the procedures identified in Appendix O. The EC made some minor changes to the tracked savings which resulted in a (rounded) savings ratio of 100.00%, as shown in Table 6-67.

Table 6-67. Enbridge scorecard achievements (cumulative savings) by measure group*

Measure Group	Installed Measures	Tracked Achievement (CCM)	Verified Achievement (CCM)	Savings Ratio
Aerator	227	4,655	4,655	100.01%
Showerhead	39	8,670	8,670	100.01%
Thermostat	849	2,145,390	2,145,390	100.00%
TOTAL	**1,115**	**2,158,715**	**2,158,716**	**100.00%**

*Not all values may compute exactly due to rounding.

Verification Result

As a result of this review, the EC confirms the savings of 15,978,390 CCM (100.00% of tracked savings) for Enbridge's Home Winterproofing program.

Winter Retrofit – Home Weatherization – Union

Overview

Table 6-68 shows the reported, tracked, and verified scorecard achievements for the 2018 Union Home Weatherization Program, with the metric of CCM savings. As a result of this review, the EC verifies 31,815,336 CCM (98.72% of reported and tracked savings). Table 6-68 includes the following variables:

- Reported: In past evaluations, this value has been included for both consistency and as a cross-check to validate tracking data. For 2018, a draft report was not created or provided to the EC. This column remains included for consistency in reporting with previous years, and in anticipation that draft reporting will resume with the 2019 program year.
- Tracked: Metric value identified in Tracking File
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified above.
- Savings Ratio: Ratio of verified to tracked savings. A value of 100.00% indicates that verified values match tracked values.

Table 6-68. Union Low Income scorecard achievements: Home Weatherization program*

Metric	Achievement			Ratio
	Reported	Tracked	Verified	
CCM - Prescriptive	N/A	146,816	146,813	100.00%
CCM - Whole Home		32,081,575	31,668,522	98.71%
TOTAL	**N/A**	**32,228,391**	**31,815,336**	**98.72%**

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 6-69 to verify the metrics for the Home Weatherization program.

Table 6-69. Documentation used to verify the Home Weatherization program

Report Language	Description or Citation
Union-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2018 Union DSM programs
Project Files	Various documents for each requested participant, supporting program metrics
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016 and OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016
Union Plan	Union's 2015-2020 DSM Plan, EB-2015-0029
TRM 2.0	Natural Gas Demand Side Management Technical Resource Manual, Version 2.0

Simulation-based Savings

Participant Selection

The EC did not verify Private Homes and Social Housing savings separately, as there was no difference observed for measure life (25 years) or free ridership (0%) for any Low Income program. Union provided the tracking file, listing 1,325 prescriptive measures and measures installed in Private Homes and Social

Housing. The EC identified individual sites within Private and Social Housing and randomly selected 30 participants for review, requested additional documentation, confirmed receipt of the correct files, and reviewed documents to verify participation and eligibility.

Received Files

The typical file folder had the following information:

- Photographs of pre- and post-installation conditions
- HOT2000 Model simulation Files (.HSE)
- HOT2000 Model Output Files (.TSV)

Calculate Realization Rate

The EC used a multi-step process to verify tracked energy savings for the 30 sampled homes, shown in Figure 6-6. for the Home Weatherization program. The process was necessary because the simulation mode (EnerGuide or Expert[59]) used by program delivery agents is not available to non-certified professionals. While the EC can attempt to run the Expert simulations in General mode, the runs may produce error warnings or result in a savings differential between the Expert result and General result. Therefore, this multi-step process was developed to verify savings:

- EC requested simulation (HSE) and output (TSV) files from the program
- Where possible, the simulation file was re-run and the results used to verify the tracking savings. If different simulation versions or modes were used, the savings could be slightly different; therefore, simulation savings were considered "verified" if they were within 2% of the tracking savings; in this case, the tracked savings value was accepted as the verified savings.
- If a simulation file was not provided, the file inputs were incompatible with General mode and would not run, the file ran but produced an error due to version or mode differences, or the file produced a difference in savings greater than 2%, the output file was used to verify the tracking savings. As with the simulation file, the EC accepted tracking savings values within 2% of the output file value as the verified savings.
- If the EC was unable to verify the tracking savings against the output file, the EC requested additional documentation from the program (utility) to explain the discrepancy.
- If no additional documentation or explanation was available, the EC compared output file values to project documentation to determine if the calculated model values were consistent with documentation. For this program, we found the project photos to be in agreement with the simulation file, so the verified savings were set equal to the TSV file value.

[59] "Expert" is the mode listed in the output files. This mode is also labelled as "EnerGuide" in simulation files. The EC uses both terms.

Figure 6-6. Overview of gross savings verification for 2018 Home Weatherization program

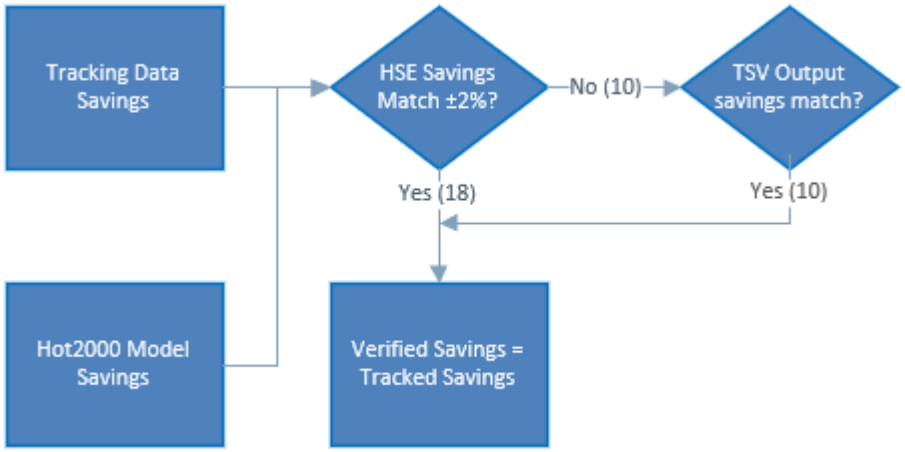


Table 6-70 shows how many customers were verified in each evaluation step. Savings for 28 homes were verified with comparison of tracking data against either simulation (HSE) or output (TSV) files. The files from 2 homes did not have complete records to verify but this did not affect the precision target.

Table 6-70. Overview of gross simulation savings verification

Evaluation Step	# Verified
Simulation re-run (HSE) and compared to tracking, verified if ± 2%	18
Output files for (TSV) compared to tracking, verified if ± 2%	10
Additional Explanation request	0
Comparison to output file values	0
Total Verified	28

The gross savings realization rate (RR) is 98.9%, shown in Table 6-71.

Table 6-71. Union Home Weatherization realization rate*

Numbers of Houses	Realization Rate	90% Confidence Interval			
		Absolute Precision	Lower Bound	Upper Bound	Relative Precision
28	98.71%	0.22%	98.49%	98.94%	0.38%

*Not all values may compute exactly due to rounding.

Prescriptive Savings

In calculating net CCM, the EC reviewed natural gas savings for prescriptive measures from the Tracking File, using the procedures identified in Appendix O. The EC certified the tracked savings which resulted in a savings ratio of 98.72%, as shown in Table 6-72.

Table 6-72. Union scorecard achievements by measure group*

Measure Group	Installed Measures	Tracked Achievement (CCM)	Verified Achievement (CCM)	Savings Ratio
Aerator	261	22,974	22,974	100.00%
Pipe Wrap	873	45,880	45,877	99.99%
Showerhead	130	36,293	36,293	100.00%
Thermostat	61	41,669	41,669	100.00%
TOTAL	**1,325**	**146,816**	**146,813**	**100.00%**

*Not all values may compute exactly due to rounding.

Verification Result

As a result of this review, the EC confirms the savings of 31,815,336 CCM (98.72% of tracked savings) for Union's Home Weatherization program.

Winter Retrofit – Indigenous Program – Union

Overview

Table 6-73 shows the reported, tracked, and verified scorecard achievements for the 2018 Indigenous Program, with the metric of CCM savings. As a result of this review, the EC verifies 237,038 CCM (100.00% of reported and tracked savings). Table 6-73 includes the following variables:

- Reported: In past evaluations, this value has been included for both consistency and as a cross-check to validate tracking data. For 2018, a draft report was not created or provided to the EC. This column remains included for consistency in reporting with previous years, and in anticipation that draft reporting will resume with the 2019 program year.
- Tracked: Metric value identified in Tracking File
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documents section.
- Savings Ratio: Ratio of verified to tracked savings. A value of 100.00% indicates that verified values match tracked values.

Table 6-73. Union Low Income scorecard achievements: Indigenous program*

Metric	Achievement			Ratio
	Reported	Tracked	Verified	
CCM - Prescriptive	N/A	10,571	10,571	100.00%
CCM - Whole Home		226,468	226,468	100.00%
TOTAL	**N/A**	**237,039**	**237,038**	**100.00%**

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 6-74 to verify the metrics for the Indigenous program.

Table 6-74. Documentation used to verify the Indigenous program

Report Language	Description or Citation
Union-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2018 Union DSM programs
Project Files	Various documents for each requested participant, supporting program metrics
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016 and OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016
Union Plan	Union's 2015-2020 DSM Plan, EB-2015-0029
TRM 2.0	Natural Gas Demand Side Management Technical Resource Manual, Version 2.0

Simulation-based Savings

Participant Selection

Union provided the tracking file, listing 45 prescriptive measures installed in 16 single family homes. The EC requested documentation for a census of participants for review, requested additional documentation, confirmed receipt of the correct files, and reviewed documents to verify participation and eligibility.

Received Files

The typical file folder had the following information:

- HOT2000 Model Output Files (PDF)

Calculate Realization Rate

The EC used a multi-step process to verify tracked energy savings for the 16 sampled homes, shown in Figure 6-6. for the Indigenous program. The process was necessary because the simulation mode (EnerGuide or Expert[60]) used by program delivery agents is not available to non-certified professionals. While the EC can attempt to run the Expert simulations in General mode, the runs may produce error warnings or result in a savings differential between the Expert result and General result. Therefore, this multi-step process was developed to verify savings:

- EC requested simulation (HSE) and output (TSV) files from the program
- Where possible, the simulation file was re-run and the results used to verify the tracking savings. If different simulation versions or modes were used, the savings could be slightly different; therefore, simulation savings were considered "verified" if they were within 2% of the tracking savings; in this case, the tracked savings value was accepted as the verified savings.
- If a simulation file was not provided, the file inputs were incompatible with General mode and would not run, the file ran but produced an error due to version or mode differences, or the file produced a difference in savings greater than 2%, the output file was used to verify the tracking savings. As with the simulation file, the EC accepted tracking savings values within 2% of the output file value as the verified savings.
- If the EC was unable to verify the tracking savings against the output file, the EC requested additional documentation from the program (utility) to explain the discrepancy.
- If no additional documentation or explanation was available, the EC compared output file values to project documentation to determine if the calculated model values were consistent with documentation. For this program, we found the project photos to be in agreement with the simulation file, so the verified savings were set equal to the PDF file value.

Table 6-75 shows how many customers were verified in each evaluation step. Savings for 16 homes were verified with comparison of tracking data against either simulation (HSE) or output (TSV) files.

Table 6-75. Overview of gross simulation savings verification

Evaluation Step	# Verified
Simulation re-run (HSE) and compared to tracking, verified if ± 2%	N/A
Output files for (TSV) compared to tracking, verified if ± 2%	N/A
Additional Explanation request	16
Comparison to output file values	0
Total Verified	16

[60] "Expert" is the mode listed in the output files. This mode is also labelled as "EnerGuide" in simulation files. The EC uses both terms.

The gross savings realization rate (RR) is 100.00%, shown in Table 6-76.

Table 6-76. Union Home Indigenous realization rate*

Numbers of Houses	Realization Rate	90% Confidence Interval			
		Absolute Precision	Lower Bound	Upper Bound	Relative Precision
16	100.00%	0.00%	100.00%	100.00%	0.00%

*Not all values may compute exactly due to rounding.

Prescriptive Savings

In calculating net CCM, the EC reviewed natural gas savings for prescriptive measures from the Tracking File, using the procedures identified in Appendix O. The EC certified the tracked savings which resulted in a savings ratio of 100%, as shown in Table 6-77.

Table 6-77. Union scorecard achievements by measure group*

Measure Group	Installed Measures	Tracked Achievement (CCM)	Verified Achievement (CCM)	Savings Ratio
Aerator	16	1,422	1,422	100.00%
Pipe Wrap	105	5,519	5,519	99.99%
Showerhead	13	3,629	3,629	100.00%
TOTAL	**134**	**10,571**	**10,571**	**100.00%**

*Not all values may compute exactly due to rounding.

Verification Result

As a result of this review, the EC confirms savings of 237,038 CCM (100% of tracked savings) for Union's Indigenous program.

Low Income New Construction – Enbridge

Overview

Table 6-78 shows the reported, tracked, and verified scorecard achievements for the 2018 Enbridge Low Income New Construction Program, with the metric of participants. As a result of this review, the EC verifies the 2018 achievement of 13 participants (100.00% of tracked). Table 6-78 contains the following variables:

- Reported: In past evaluations, this value has been included for both consistency and as a cross-check to validate tracking data. For 2018, a draft report was not created or provided to the EC. This column remains included for consistency in reporting with previous years, and in anticipation that draft reporting will resume with the 2019 program year.
- Tracked: Metric value identified in Tracking File
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documents section.
- Ratio: Ratio of verified to tracked savings. A value of 100.00% indicates that verified values match tracked values.

Table 6-78. Enbridge Low Income scorecard achievement: Low Income New Construction program*

Metric	Achievement			Ratio
	Reported	Tracked	Verified	
Participants	13	13	13	100.00%

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 6-79 to verify the metrics for the Low Income New Construction (LINC) program.

Table 6-79. Documentation used to verify the Low Income New Construction program

Report Language	Description or Citation
Enbridge-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2018 Union DSM programs
Project Files	PDF document for each requested participant, supporting program metrics
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016 and OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016
Enbridge Plan	Enbridge Gas Multi-Year DSM Plan (2015-2020), EB-2015-0049

Participant Selection

Enbridge first provided the Tracking file listing Program Year, Project Code (unique ID), Participant Status, Application Date, Charrette Date, and DCP Report Receipt. The spreadsheet listed thirteen individual participants. The EC requested full documentation for all participants.

Received Files

Enbridge provided the EC with document folders, titled by LINC Project number, containing project PDF documents. The EC first confirmed the titles received matched the IDs requested from the Tracking file.

Project Files were properly redacted with name, address, and other information unavailable, as requested. The EC confirmed that documents for all participants had been received.

Verify Participation

The metric for the program is participants. To determine the definition of participant, the EC looked first to the OEB Decision, which identified a participant as someone who submits a Project Application.[61]

The OEB Decision also includes the Enbridge proposed metric of "New Construction Program Participants.[62]" This label differs slightly from "Number of Project Applications," and implies a second or additional definition for the metric. To identify if a record with a submitted a project application qualifies as a participant, the EC also reviewed the program description:[63]

> *"Enbridge's proposed low-income new construction program will provide home builders with workshops, energy efficiency modeling tools, design options, energy efficiency education and financial incentives related to new affordable housing new construction developments."*

From this, the EC determined that to demonstrate *participation*, Project Files should also provide documentation for *any* of the following:

- Workshop participation
- Energy efficiency modeling tools
- Design options
- Energy efficiency education
- Financial incentives

The EC evaluated the sampled participant files against the criteria above and determined that all eleven projects qualify as participants.

Verify Eligibility

The OEB Decision does not provide a clear definition for participant eligibility, instead pointing to approval of Enbridge's Plan. From the Plan, the EC found the following eligibility requirements:

- Submitted project application
- New affordable housing qualified by a municipal, provincial and/or federal housing program.
- Application identifies the project is specifically directed to affordable building developments, either single family (Part 9) or multi-residential (Part 3)

These criteria were based on an examination of the 2016-2020 offer descriptions and Enbridge's Plan (Table 6-80).

[61] Ontario Energy Board Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016, p. 64-65, 67, 78, and Schedule C
[62] Ontario Energy Board Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016, Schedule B
[63] Ibid, p. 30

Table 6-80. Eligibility requirements documentation

Document	Relevant Contents
2016-2020 OFFER DESCRIPTIONS[64]	*"The offer is specifically directed to residential and multi-residential affordable building developments and efforts will focus on working with and through municipal governments, private and non-profit local housing corporations."*
EVALUATION PLAN[65]	▪ Developers and builders of new "affordable housing" as qualified by a municipal, provincial and/or federal housing program. ▪ Developers and builders of both singe (sic) family Part 9 houses and multi-residential Part 3 buildings are eligible to participate.
DRAFT 2017 Report[66]	*"The offer is specifically directed to Residential and Multi-Residential building affordable developments, and will be focused on working with and through municipal governments, private and non-profit sector local housing corporations.* *Eligibility participants must meet the following criteria:* • *Developers and builders of new "affordable housing" as qualified by a municipal, provincial and/or federal housing program.* • *Developers and builders of both single family Part 9 houses and multi residential Part 3 buildings are eligible to participate"*

To confirm eligibility, the EC looked for documentation that indicates the development or project is specifically directed to affordable building developments, either single family (Part 9) or multi-residential (Part 3). Project Files contain identification of projects as Part 3 or Part 9 projects. During the previous evaluation, the EC requested that Project Files include confirmation by the utility of whether projects were qualified by any municipal, provincial and/or federal housing program. This confirmation was provided for the evaluation.

Verification Result

As a result of this review, the EC confirms that all thirteen projects meet the definition and eligibility requirements, resulting in a scorecard achievement of 13 participants.

[64] Enbridge's Proposed 2015-2020 DSM Plan, EB-2015-0049, Exhibit B, Tab 2, Schedule 1, page 45 of 100
[65] Enbridge's Proposed 2015-2020 DSM Plan, EB-2015-0049, Exhibit B, Tab 2, Schedule 2, page 31 of 55
[66] Enbridge 2017 Demand Side Management Draft Annual Report, November 16, 2017, page 90

Low Income Multi-Residential – Affordable Housing Program – Enbridge

Table 6-81 shows the reported, tracked, and verified scorecard achievements for the 2018 Enbridge Gas Affordable Housing Program, with the metric of CCM savings. The EC verifies the 2018 achievement of 114,168,901 CCM for all program measures (119.99% of tracked savings). Table 6-81 contains the following variables:

- Reported: In past evaluations, this value has been included for both consistency and as a cross-check to validate tracking data. For 2018, a draft report was not created or provided to the EC. This column remains included for consistency in reporting with previous years, and in anticipation that draft reporting will resume with the 2019 program year.
- Tracked: Metric value identified in Tracking File
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documents section.
- Savings Ratio: Ratio of verified to tracked savings. A value of 100.00% indicates that verified values match tracked values.

Table 6-81. Enbridge Low Income Scorecard achievements: Affordable Housing Program*

Metric	Achievement			Ratio
	Reported	Tracked	Verified	
Prescriptive CCM	N/A	4,969,351	4,969,350	100.00%
Custom CCM		90,180,487	109,199,552	121.09%
TOTAL	**N/A**	**95,149,838**	**114,168,901**	**119.99%**

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 6-82 to verify the metrics for the Affordable Housing program.

Table 6-82. Documentation used to verify the Affordable Housing Program

Report Language	Description or Citation
Enbridge-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2018 Enbridge DSM programs
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016 and OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016
Enbridge Plan	Enbridge Gas Multi-Year DSM Plan (2015-2020), EB-2015-0049
TRM 2.0	Natural Gas Demand Side Management Technical Resource Manual, Version 2.0
Multi-Residential Low-Income Showerhead Verification	Multi-Residential Low-Income Showerhead Verification, Ipsos Research[67]

[67] Multi-Residential Low-Income Showerhead Verification, Ipsos Research, March 28, 2013

Report Language	Description or Citation
2017-2018 CPSV Report	2018 Natural Gas Demand Side Management Custom Savings Verification[68]

Verify Prescriptive Savings

In calculating net CCM, the EC reviewed natural gas savings for prescriptive measures from the Tracking File, using the procedures identified in Appendix O. The EC made some minor changes to the tracked savings which resulted in a (rounded) savings ratio of 100.00%, as shown in Table 6-83.

Table 6-83. Enbridge - prescriptive measures - scorecard achievements by measure group*

Measure Group	Installed Measures	Tracked Achievement (CCM)	Verified Achievement (CCM)	Savings Ratio
Showerhead	847	227,302	227,303	100.00%
Condensing Boiler - Water Heating	5	366,279	366,279	100.00%
Condensing Boiler - Space Heating	2	152,341	152,341	100.00%
Make-Up Air Unit	6	1,861,069	1,861,069	100.00%
Condensing Storage Water Heater	14	93,860	93,859	100.00%
Boiler - Space Heating	8	2,268,500	2,268,500	100.00%
TOTAL	**882**	**4,969,351**	**4,969,350**	**100.00%**

*Not all values may compute exactly due to rounding.

Verify Custom Savings

The EC identified the custom savings totals from Enbridge Tracking Files shown in Table 6-84. The EC applied a realization rate from the 2017-2018 CPSV report for Multi-Residential of 121.09%.

Table 6-84. Enbridge - custom measures - scorecard achievements*

Measure Group	Installed Measures	Tracked Achievement (CCM)	Verified Achievement (CCM)	Savings Ratio
Air Handling Unit	1	65,490	79,302	121.09%
Boiler - Hydronic Condensing - Advancement	10	4,532,872	5,488,855	121.09%
Boiler - Hydronic Condensing - Replacement	43	21,178,125	25,644,592	121.09%
Boiler - Hydronic High Efficiency - Replacement	34	43,635,075	52,837,712	121.09%
Controls	1	450,075	544,996	121.09%
ERV	3	5,775,126	6,993,100	121.09%
HRV	3	4,263,420	5,162,575	121.09%
Make Up Air Unit	9	3,529,695	4,274,108	121.09%
Pipe Insulation	3	1,216,404	1,472,944	121.09%
Reflective Panel	9	3,436,605	4,161,385	121.09%
Tank Type Water Heater	4	467,220	565,757	121.09%
VFD	5	1,630,380	1,974,227	121.09%
TOTAL	**125**	**90,180,487**	**109,199,552**	**121.09%**

*Not all values may compute exactly due to rounding.

[68] 2017-2018 Natural Gas Demand Side Management Custom Savings Verification, DNV GL for the Ontario Energy Board, December 26, 2019

Verification Result

As a result of this review, the EC confirms the total savings of 114,168,901 CCM for all program measures (119.99% of tracked) for Enbridge's Affordable Housing Program.

Low Income Multi-Residential – Multifamily Program (SA) – Union

Overview

Table 6-85 shows the reported, tracked, and verified scorecard achievements for the 2018 Union Gas Multifamily (Social and Assisted) Program, with the metric of CCM savings. As a result of this review, the EC verifies 19,718,214 CCM for all program measures (96.56% of tracked). Table 6-85 contains the following variables:

- Reported: In past evaluations, this value has been included for both consistency and as a cross-check to validate tracking data. For 2018, a draft report was not created or provided to the EC. This column remains included for consistency in reporting with previous years, and in anticipation that draft reporting will resume with the 2019 program year.
- Tracked: Metric value identified in Tracking File
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documents section.
- Savings Ratio: Ratio of verified to tracked savings. A value of 100.00% indicates that verified values match tracked values.

Table 6-85. Union Low Income scorecard achievements: Multifamily Program (SA)*

Metric	Achievement			Ratio
	Reported	Tracked	Verified	
CCM - Prescriptive	N/A	12,972,488	12,972,487	100.00%
CCM - Custom		7,448,081	6,745,727	90.57%
TOTAL	**N/A**	**20,420,568**	**19,718,214**	**96.56%**

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 6-86 to verify the metrics for the Multifamily (Social and Assisted) program.

Table 6-86. Documentation used to verify the Multifamily (Social and Assisted) program

Report Language	Description or Citation
Union-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2018 Union DSM programs
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016 and OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016
Union Plan	Union's 2015-2020 DSM Plan, EB-2015-0029
TRM 2.0	Natural Gas Demand Side Management Technical Resource Manual, Version 2.0
2017-2018 CPSV Report	2018 Natural Gas Demand Side Management Custom Savings Verification[69]

[69] 2017-2018 Natural Gas Demand Side Management Custom Savings Verification, DNV GL for the Ontario Energy Board, December 26, 2019

Verify Prescriptive Savings

In calculating net CCM, the EC reviewed natural gas savings for prescriptive measures from the Tracking File, using the procedures identified in Appendix O. The EC certified the tracked savings which resulted in a savings ratio of 108%, as shown in Table 6-87.

Table 6-87. Union - prescriptive measures - scorecard achievements by measure group*

Measure Group	Installed Measures	Tracked Achievement (CCM)	Verified Achievement (CCM)	Savings Ratio
Air Curtain	3	517,617	517,617	100.00%
Boiler - Space Heating	25	3,073,603	3,073,603	100.00%
Boiler - Water Heating	17	1,215,123	1,215,123	100.00%
Condensing Storage Water Heater	13	182,105	182,105	100.00%
Energy Recovery Ventilator	98	2,733,745	2,733,745	100.00%
Furnace	1	2,127	2,127	100.00%
Heat Recovery Ventilator	77	499,349	499,349	100.00%
Make-Up Air Unit	16	4,574,098	4,574,098	100.00%
Unit Heater	5	174,720	174,720	100.00%
TOTAL	**255**	**12,972,488**	**12,972,487**	**100.00%**

*Not all values may compute exactly due to rounding.

Verify Custom Savings

The EC identified the custom savings totals from Union Tracking. The EC applied a realization rate (gross savings adjustment) of 90.57%, attribution of 95.00%, and zero spillover, identifying net cumulative savings of 6,745,727 CCM.

Verification Result

As a result of this review, the EC confirms total savings of 19,718,214 CCM (96.56% of tracked) for Union's Multifamily (Social and Assisted) Program.

Low Income Multi-Residential – Multifamily Program (MR) – Union

Overview

Table 6-88 shows the reported, tracked, and verified scorecard achievements for the 2018 Union Gas Multifamily (Market Rate) Program, with the metric of CCM savings. The EC verifies 6,573,109 CCM for all program measures (100.00% of tracked savings). Table 6-88 contains the following variables:

- Reported: In past evaluations, this value has been included for both consistency and as a cross-check to validate tracking data. For 2018, a draft report was not created or provided to the EC. This column remains included for consistency in reporting with previous years, and in anticipation that draft reporting will resume with the 2019 program year.
- Tracked: Metric value identified in Tracking File
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documents section.
- Savings Ratio: Ratio of verified to tracked savings. A value of 100.00% indicates that verified values match tracked values.

Table 6-88. Union Low Income Scorecard achievement: Multifamily (MR) Program*

Metric	Achievement			Ratio
	Reported	Tracked	Verified	
CCM - Prescriptive	N/A	6,573,109	6,573,109	100.00%
CCM - Custom		-	-	-
TOTAL	**N/A**	**6,573,109**	**6,573,109**	**100.00%**

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 6-89 to verify the metrics for the Multifamily (Social and Assisted) program.

Table 6-89. Documentation used to verify the Multifamily (Social and Assisted) program

Report Language	Description or Citation
Union-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2018 Union DSM programs
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016 and OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016
Union Plan	Union's 2015-2020 DSM Plan, EB-2015-0029
TRM 2.0	Natural Gas Demand Side Management Technical Resource Manual, Version 2.0

Verify Prescriptive Savings

In calculating net CCM, the EC reviewed natural gas savings for prescriptive measures from the Tracking File, using the procedures identified in Appendix O. The EC certified the tracked savings which resulted in a savings ratio of 100.00%, as shown in Table 6-90.

Table 6-90. Union – prescriptive measures – scorecard achievements by measure group*

Measure Group	Installed Measures	Tracked Achievement (CCM)	Verified Achievement (CCM)	Savings Ratio
Condensing Boiler - Space Heating	31	5,853,406	5,853,406	100.00%
Condensing Boiler - Water Heating	10	719,703	719,703	100.00%
TOTAL	**41**	**6,573,109**	**6,573,109**	**100.00%**

*Not all values may compute exactly due to rounding.

Verify Custom Savings

Union reported no custom projects under the Low Income Multifamily (Market Rate) Program in 2018.

Verification Result

As a result of this review, the EC confirms total savings of 6,573,109 CCM (100.00% of tracked) for Union's Multifamily (Market Rate) Program.

Appendix I Large Volume Scorecards

This appendix describes the detailed process used to verify the metrics for the Large Volume Scorecard programs for Union, shown in Table 6-91. The program addressed in this appendix is the Large Volume program.

Table 6-91. Union Gas 2018 Large Volume (Rate T2/Rate 100) program scorecard*

Programs	Metrics	Verified Achievement		Metric Target			Weight
		Program-level Savings	Metric-level Savings	Lower Band	Target	Upper Band	
Large Volume	CCM	89,196,896	89,196,896	146,795,489	195,727,318	293,590,977	100.00%

*Not all values may compute exactly due to rounding.

Overview

Table 6-92 shows the reported, tracked, and verified scorecard achievements for the 2018 Union Large Volume program, with the metric of CCM savings. As a result of this review, the EC verifies total savings of 89,196,896 CCM for all program measures (153.84% of tracked). Table 6-92 contains the following variables:

- Reported: In past evaluations, this value has been included for both consistency and as a cross-check to validate tracking data. For 2018, a draft report was not created or provided to the EC. This column remains included for consistency in reporting with previous years, and in anticipation that draft reporting will resume with the 2019 program year.
- Tracked: Metric value identified in Tracking File
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documents section.
- Savings Ratio: Ratio of verified to tracked savings. A value of 100.00% indicates that verified values match tracked values.

Table 6-92. Union Gas Large Volume scorecard achievements: large volume CCM Metrics by type*

Metric	Achievement			Ratio
	Reported	Tracked	Verified	
CCM - Prescriptive	N/A	44,763	44,763	100.00%
CCM - Custom		57,935,195	89,152,133	153.88%
Total	**N/A**	**57,979,958**	**89,196,896**	**153.84%**

*Not all values may compute exactly due to rounding.

Table 6-93 includes these variables:

- Cumulative Gross Savings – Tracking: Gross cumulative tracking savings for all customers in the Union Large Volume program.
- RR: Gross realization rate from the 2017-2018 CSPV report.
- Att: Attribution ratio (the complement of free ridership) from the 2018 NTG report.
- Spillover: Spillover ratio from 2013-2014 Spillover Study.
- Adj: Adjustment Ratio, the product of the RR and the sum of the Att ratio and Spillover ratio

Equation 9: Adjustment Ratio

$$Adjustment\ Ratio = RR * (Att + Spillover)$$

- Verified Net Savings: Cumulative gross savings multiplied by the Adjustment Ratio

Equation 10: Verified Net Savings

$$Verified\ Net\ Savings = Adjustment\ Ratio * (Cumulative\ Gross)$$

Table 6-93. Adjustment factors applied to Large Volume Program cumulative gross savings*

Measure Type	Tracking Gross Savings (CCM)	RR (%)	Att (%)	Spillover (%)	Adj* (%)	Verified Net Savings (CCM)
Prescriptive	66,810	100.00%	33.00%	0.00%	67.00%	44,763
Custom	643,724,391	90.46%	14.49%	0.82%	13.85%	89,152,133
TOTAL	**643,791,201**				**13.85%**	**89,196,896**

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 6-94 to verify the metrics for the Large Volume program.

Table 6-94. Documentation used to verify the Large Volume program

Report Language	Description or Citation
Union-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2018 Union DSM programs
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016 and OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016
Union Plan	Union's 2015-2020 DSM Plan, EB-2015-0029
Union's Draft 2018 Report	Union Gas 2018 Demand Side Management Draft Annual Report[70]
TRM 2.0	Natural Gas Demand Side Management Technical Resource Manual, Version 3.0
2017-2018 CPSV Report	2018 Natural Gas Demand Side Management Custom Savings Verification[71]
2018 NTG Report	2018 Natural Gas Demand Side Management Free-ridership Evaluation[72]
2013-2014 Spillover Study	CPSV Participant Spillover Results[73]

Prescriptive Savings

In calculating net CCM, the EC reviewed natural gas savings for prescriptive measures from the Tracking File, using the procedures identified in Appendix O. The EC certified the tracked savings which resulted in a savings ratio of 100.00%, as shown in Table 6-95.

[70] While the EC recognizes and understands that the draft report will be updated and finalized, the final was not available at the time of this evaluation, thus the draft is cited for reference.

[71] 2017-2018 Natural Gas Demand Side Management Custom Savings Verification, DNV GL for the Ontario Energy Board, December 26, 2019

[72] 2018 Natural Gas Demand Side Management Free-ridership Evaluation, DNV GL for the Ontario Energy Board, December 27, 2019

[73] CPSV Participant Spillover Results, DNV GL for the Ontario Energy Board, May 23, 2018

Table 6-95. Union – prescriptive measures – tracked and verified cumulative net savings (CCM) and ratio by measure group*

Measure Group	Installed Measures	Tracked Achievement (CCM)	Verified Achievement (CCM)	Savings Ratio
Infrared Heater	3	44,763	44,763	100.00%

*Not all values may compute exactly due to rounding.

Custom Savings

The EC identified 40 tracked custom measures with tracked cumulative gross savings of 89,152,133 CCM. These projects are grouped by measure in Table 6-96.

Table 6-96. Union - custom measures – verified cumulative gross savings by measure group*

Measure Group	Installed Measures	Tracking Gross Savings (CCM)
Furnace or Dryer	7	15,815,772
HVAC	11	36,738,365
Steam or Hot Water System	17	15,680,624
Productivity Improvement	5	20,917,372
TOTAL	**40**	**89,152,133**

*Not all values may compute exactly due to rounding.

Adjustment Values – RR

The 2017-2018 CPSV Report conveyed one gross realization rate for the program, 90.46%.

Adjustment Values – Att Ratios

The 2017-2018 CPSV Report conveyed one attribution ratio for the program, 14.49%.

Adjustment Values – Spillover Ratios

The 2013-2014 Spillover Study conveyed one spillover ratios for the program, 0.82%.

Verify Cumulative Natural Gas Savings

The EC calculated the measure-level net savings using Equation 9 and Equation 10, then summed the measure-level savings to produce program-level savings. The EC calculated the program-level adjustment ratio by dividing the program-level net savings by the program-level gross savings.

Table 6-97. 2018 Large Volume measure groups adjustment values and cumulative net savings*

Measure Type	Tracking Gross Savings (CCM)	RR (%)	Att (%)	Spillover (%)	Adj* (%)	Verified Net Savings (CCM)
Custom	643,724,391	90.46%	14.49%	0.82%	13.85%	89,152,133

*Not all values may compute exactly due to rounding.
†Adjustment value displayed is truncated (2 digit) average based on sum of all individual adjustments by measure. Individual adjustment factors (RR, ATT, Spillover) are utilized for calculations at the 2 digit level, as displayed.

Verification Result

As a result of this review, the EC confirms total savings of 89,196,896 CCM (13.85% of gross tracked, and 153.84% of net tracked) for Union's Large Volume (Rate T2/Rate 100) Program.

Appendix J Market Transformation Scorecards

This appendix describes the detailed process used to verify the metrics for the Market Transformation Scorecard programs for Enbridge (Table 6-98) and Union Gas (Table 6-99). The programs addressed in this appendix are:

- Commercial New Construction – Commercial Savings by Design – Enbridge
- Commercial New Construction – Union
- Residential New Construction – Residential Savings by Design – Enbridge
- Residential New Construction – Optimum Home Program – Union
- School Energy Competition – Enbridge

Table 6-98. Enbridge 2018 market transformation & energy management scorecard[74]*†

Programs	Metrics	Verified Achievement		Metric Target			Weight
		Program-level Savings	Metric-level Savings	Lower Band	Target	Upper Band	
School Energy Competition	Schools	14	14	59	78	117	10.00%
Run-it-Right	Participants	62	62	18	24	36	20.00%
Comprehensive Energy Management	Participants	5	5	16	21	32	20.00%
Residential Savings by Design	Builders	35	35	15	20	30	10.00%
Residential Savings by Design	Homes Built	2,956	2,956	1,634	2,179	3,269	15.00%
Commercial Savings by Design	New Developments	31	31	21	28	42	25.00%

*Not all values may compute exactly due to rounding.
†Programs in grey text are not similar to Union programs under the Market Transformation Scorecard, and not discussed in this Appendix. For these programs please refer to Appendix G.

Table 6-99. Union Gas 2018 market transformation scorecard*[75]

Programs	Metrics	Verified Achievement		Metric Target			Weight
		Program-level Savings	Metric-level Savings	Lower Band	Target	Upper Band	
Optimum Home	Builders	8	8	6	8	12	10.00%
Optimum Home	Homes Built	83.33%	83.33%	45.00%	60.00%	90.00%	30.00%
Optimum Home	Percentage of Homes Built	3.97%	3.97%	3.75%	5.00%	7.50%	10.00%
Commercial New Construction	New Developments	18	18	14	19	29	50.00%

*Not all values may compute exactly due to rounding.

[74] Ontario Energy Board Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016, Schedule C
[75] Ibid

Commercial New Construction – Commercial Savings by Design – Enbridge

Overview

Table 6-100 shows the reported, tracked, and verified scorecard achievements for the 2018 Enbridge Market Transformation Commercial Savings by Design (SBD) Program, with the metric of New Developments. As a result of this review, the EC verifies the 2018 achievement metric of 31 New Developments (100.00% ratio).

- Reported: In past evaluations, this value has been included for both consistency and as a cross-check to validate tracking data. For 2018, a draft report was not created or provided to the EC. This column remains included for consistency in reporting with previous years, and in anticipation that draft reporting will resume with the 2019 program year.
- Tracked: Metric value identified in Tracking File
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documents section.
- Ratio: Ratio of verified to tracked savings. A value of 100.00% indicates that verified values match tracked values

Table 6-100. Enbridge market transformation scorecard achievement: Commercial SBD Program developments metric*

Metric	Achievement			Ratio
	Reported	Tracked	Verified	
New Developments	N/A	31	31	100.00%

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 6-101 to verify the metrics for the Commercial Savings by Design program.

Table 6-101. Documentation used to verify the Commercial Savings by Design program

Report Language	Description or Citation
Enbridge-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2018 Enbridge DSM programs
Project Files	PDF documents
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016 and OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016
Enbridge Plan	Enbridge Gas Multi-Year DSM Plan (2015-2020), EB-2015-0049

Participant Selection

Enbridge provided the Tracking File listing Project Code (unique ID), program year, commitment date, a variable indicating the project "meets sq ft threshold", IDP date, and a variable indicating if the "Final IDP Report Received". The spreadsheet identified 31 participants, all with 2018 dates and 'Yes' marked in for both the threshold and report received variables. As tracking data indicated that all the 31 listed participants were equally qualified, the EC randomly selected 5 records from the full list for document review. The EC

requested all supporting documentation, including documentation that supports eligibility and participation criteria.

Received Files

The EC received three types of documents in response to this request:

- Commitment form
- Terms and Conditions
- IDP report

The EC first confirmed the titles received matched the IDs requested. Enbridge redacted name, address, and other identifying information. The EC confirmed the signature dates on the commitment form matched the commitment date in the tracking file, and that the date on the IDP report matched the date recorded in the IDP date field of the tracking file.

Verify Participation

To determine the definition of New Developments, the EC looked first to the OEB Decision, which approved the Enbridge ESC Plan:[76]

Decisions
The OEB approves Enbridge's Commercial Savings by Design program. This program is similar to Enbridge's Residential Savings by Design, with the difference being the target market is commercial and industrial buildings as opposed to residential new construction. For the same reasons as the Residential Savings by Design program, the OEB finds that this program is consistent with guiding principles of the DSM Framework and drives integrated conservation savings prior to building construction.

Relevant criteria for "new development" are described in Enbridge's Plan "Budgets, Metrics and Targets,"[77] paragraph 46:

- *For the purpose of assessing the "new developments enrolled" metric for SBD Commercial:*

  i. *Only builders and developers who have "enrolled" in the program and completed the IDP process are eligible to be counted towards the target.*

  ii. "Enrolment" is defined as a signed MOU with a builder or developer containing a commitment to participate in the Enbridge Commercial Savings by Design offer for a 5-year period which will include undertaking an IDP adhering to an Enbridge approved IDP process (such as IEA Task 23 or the iiSBE developed IDP Tool) which also includes the requisite energy model, demonstrating how to achieve at least 15% total energy savings relative to the yet to be completed 2017 Ontario Building Code. The builder must also commit to constructing buildings or a building to the IDP standard within 5 years.

  iii. The metric in the Commercial Savings by Design scorecard is 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 50,000 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 50,000 square feet.

From these definitions, the EC observed the following criteria:

[76] Ontario Energy Board Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016, Page 39
[77] Enbridge's Proposed 2015-2020 DSM Plan, EB-2015-0049, Exhibit B, Tab 1, Schedule 4, 37 of 41

- Only projects from enrolled builders/developers count towards the metric. Enrollment is defined as:
  - A builder or developer committed to the CSBD offer for five years via an MOU
  - And undertaking the Enbridge approved IDP process for each development, which requires:
    - Energy model
    - Demonstration of how to achieve 15% energy savings over anticipated 2017 code
    - Project must be at least 50,000 ft^2
    - And a project is a single building or multiples of same building which sum to at least 50,000 ft^2

The EC noted that the IDPs submitted for the 5 participants cited an average savings of 22.2% improvement against the 2017 OBC code, with a range of 15.4% to 28.8% in savings. All projects were greater than 50,000 ft^2 with an average of 212,671 ft^2 and a range of 77,894 ft^2 to 417,802 ft^2.

Table 6-102. Enbridge Commercial Savings by Design participation criteria, project satisfaction, and explanation

Identified Criteria	Satisfied?	Explanation
Only projects from enrolled builders/developers count towards the metric	Yes	Following criteria meet definition for enrolment
Enrolment is defined as builder or developer committed to the CSBD offer for five years	Yes	Terms and Conditions establishes that project must be completed within 5 years
Undertaking Enbridge approved IDP process for each development	Yes	IDP Reports included in documentation
IDP includes energy model	Yes	IDP Reports identifies eQuest v3.64[78]
Sufficient energy savings achieved	Yes	See below
- IDP demonstrates how to achieve 15% energy savings over anticipated 2017 code	N/A	All IPD reports states savings 15% over 2017 OBC
Project must be at least 50,000 ft^2	Yes	Commitment Form
Project is a single building or multiples of same building which sum to at least 50,000 ft^2	Yes	Projects of one or multiple buildings all greater than 50,000 ft^2

As a result, the EC confirms that the submitted projects met the criteria for participation as a New Development for the Enbridge Commercial Savings by Design program.

Eligibility

Enbridge's Plan, approved by the OEB, further identifies eligibility criteria. As stated in Enbridge's Plan:[79]

> *The SBD Commercial offer is direct-to-builder/developer delivered by an internal sales team. Eligibility criteria include the following:*
> - *Commercial, multi-residential or industrial buildings covered under the Ontario Building Code Part 3;*

[78] ASHRAE 90.1-2010 section 11 as modified by Supplementary Standard SB-10 Division 3, Chapter 2 for generating reference and baseline models

[79] Enbridge's Proposed 2015-2020 DSM Plan, EB-2015-0049, Exhibit B, Tab 2, Schedule 1, 61 of 100

- *A minimum threshold of 50,000 square feet per project (including aggregate multi-location projects);*
- *Building(s) must be within Enbridge's franchise area, or for aggregate projects 75% of the project square footage must be in the franchise area;*
- *Building(s) must be in the design phase or earlier in the process;*
- *Building construction must be completed within five years of signing the agreement, and commissioning must be completed no more than one year after that; and,*
- *Builders will be eligible to participate in the offer multiple times for different projects*

These defined eligibility requirements overlap with the criteria Enbridge laid out for assessing enrolments. The EC used the Commitment Forms and IDP Reports to determine if the projects met these criteria.

Table 6-103. Enbridge Commercial Savings by Design eligibility criteria, project satisfaction, and explanation

Identified Criteria	Satisfied?	Explanation
Commercial, multi-residential or industrial buildings	Yes	IDP Reports
50,000 ft^2 minimum project size	Yes	Commitment Form
Within Enbridge territory	Yes	Application terms and conditions
Design phase or earlier	Yes	IDPs performed to prior to construction.
Construction within 5 years	N/A	Eligibility for fuller program participation, not applicable for new enrollment.
Commissioning within 1 year of construction	N/A	

After reviewing these stated eligibility criteria and Project Files, the EC confirms the 5 projects meet the eligibility criteria.

Verification Result

As a result of this review:

- The EC confirms proper documentation for the requested projects
- Project files for the submitted project meet all requirements for a participant
- Project files for the submitted project meet further criteria for eligibility

The EC confirms the scorecard metric of 31 projects for the Enbridge Commercial Savings by Design Program.

Commercial New Construction – Union

Overview

Table 6-104 shows the reported, tracked, and verified scorecard achievements for the 2018 Union Market Transformation Commercial New Construction Program (also referred to as the Commercial Savings by Design Program), with the metric of New Developments. As a result of this review, the EC verifies the 2018 achievement metric of 18 New Developments Enrolled by Participating builders (75.00% ratio).

- Reported: In past evaluations, this value has been included for both consistency and as a cross-check to validate tracking data. For 2018, a draft report was not created or provided to the EC. This column remains included for consistency in reporting with previous years, and in anticipation that draft reporting will resume with the 2019 program year.
- Tracked: Metric value identified in Tracking File
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documents section.
- Ratio: Ratio of verified to tracked savings. A value of 100.00% indicates that verified values match tracked values

Table 6-104. Union market transformation scorecard achievement: Commercial New Construction Program developments metric*

Metric	Achievement			Ratio
	Reported	Tracked	Verified	
New Developments	N/A	24	18	100.00%

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 6-105 to verify the metrics for the Commercial New Construction program.

Table 6-105. Documentation used to verify the Commercial New Construction program

Report Language	Description or Citation
Union-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2018 Union DSM programs
Project Files	Various documents for each requested participant, supporting program metrics
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016 and OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016
Union Plan	Union's 2015-2020 DSM Plan, EB-2015-0029

Participant Selection and Initial Verification

Union provided the Tracking File listing Project Code (unique ID), program year, application date, Visioning Date and IDP date. The spreadsheet identified 24 participants, all with 2018 dates. As tracking data indicated that all the 24 listed participants were equally qualified, the EC randomly selected 5 records from the full list for document review. The EC requested all supporting documentation, including documentation that supports eligibility and participation criteria.

Second Verification

During the initial verification, the EC reviewed one record that was significantly below the square foot requirement. The EAC and Union agreed to a full census of the remaining 19 project records after further discussion.

Received Files

The EC received three types of documents in response to this request:

- Commitment form
- Terms and Conditions
- IDP report

The EC first confirmed the titles received matched the IDs requested. Union redacted name, address, and other identifying information. The EC confirmed the signature dates on the commitment form matched the commitment date in the tracking file, and that the date on the IDP report matched the date recorded in the IDP date field of the tracking file.

Verify Participation

To determine the definition of New Developments, the EC looked first to the OEB Decision, which approved Union's Plan:[80]

Decisions
The OEB approves Enbridge's Commercial Savings by Design program. This program is similar to Enbridge's Residential Savings by Design, with the difference being the target market is commercial and industrial buildings as opposed to residential new construction. For the same reasons as the Residential Savings by Design program, the OEB finds that this program is consistent with guiding principles of the DSM Framework and drives integrated conservation savings prior to building construction.

The OEB directs Union to establish a similar program targeting commercial and industrial buildings in its service area. The OEB finds commercial and industrial customers would expect consistency in the market, especially for province-wide chains, franchises and companies.

Relevant criteria for "new development" are described in Union's Draft report "8.1.2 Commercial/Industrial Savings by Design ("CSBD") Offering:"[81]

Eligibility criteria include the following:

- *Construction projects must have a minimum threshold of 50,000 square feet. A project is defined as either a single building or multiples of the same building by the same company, i.e. "same construction", that add up to 50,000 square feet or more.*
- *Building(s) must be in the design phase or earlier in the process; and,*
    - *Building construction must be completed within five years of the IDP session, and commissioning must be completed no more than one year after that.*

From these definitions, the EC observed the following criteria:

[80] Ontario Energy Board Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016, Page 39
[81] Union's Draft 2018 Demand Side Management Evaluation Report, Page 93

- Only projects from enrolled builders/developers count towards the metric. Enrolment is defined as:
  - A builder or developer committed to the program offer for five years via an MOU
  - And undertaking the Union approved IDP process for each development, which requires:
    - Energy model
    - Demonstration of how to achieve 15% energy savings over anticipated 2017 code
    - Project must be at least 50,000 ft^2
    - And a project is a single building or multiples of same building which sum to at least 50,000 ft^2

The EC noted that the IDPs submitted for the 24 participants cited an average savings of 31% improvement against the 2017 OBC code, with a range of 16.3% to 51.3% in savings. 18 of the 24 projects were greater than 50,000 ft^2 with an average of 166,473 ft^2 and a range of 23,071 ft^2 to 1,100,833 ft^2.

Table 6-106. Union Commercial New Construction participation criteria, project satisfaction, and explanation

Identified Criteria	Satisfied?	Explanation
Only projects from enrolled builders/developers count towards the metric	Yes	Following criteria meet definition for enrolment
Enrolment is defined as builder or developer committed to the CSBD offer for five years:	Yes	Terms and Conditions establishes that project must be completed within 5 years
Undertaking IDP process for each development	Yes	IDP Reports included in documentation
IDP includes energy model	Yes	IDP Reports identify eQuest v3.64[82]
Sufficient energy savings achieved	Yes	See below
- IDP demonstrates how to achieve 15% energy savings over anticipated 2017 code	N/A	All IPD reports states savings 15% over 2017 OBC
Project must be at least 50,000 ft^2	Yes	Commitment Forms
Project is a single building or multiples of same building which sum to at least 50,000 ft^2	Yes	Projects of one or multiple buildings all greater than 50,000 ft^2

As a result, the EC confirms that 18 of the 24 submitted projects met the criteria for participation as a New Development for the Union Commercial New Construction program.

Eligibility

Since Union's plan was submitted before the Decision and Order that instructed Union to create a similar program to Enbridge's, the earlier referenced draft report served as the primary reference for eligibility. The EC used the Commitment Forms and IDP Reports to determine if the projects met these criteria.

[82] ASHRAE 90.1-2010 section 11 as modified by Supplementary Standard SB-10 Division 3, Chapter 2 for generating reference and baseline models

Table 6-107. Union Commercial New Construction eligibility criteria, project satisfaction, and explanation

Identified Criteria	Satisfied?	Explanation
Commercial, multi-residential or industrial buildings	Yes	IDP Reports
50,000 ft^2 minimum project size	Yes	Commitment Form
Design phase or earlier	Yes	IDPs performed to prior to construction.
Construction within 5 years	N/A	Eligibility for fuller program participation, not applicable for new enrollment.
Commissioning within 1 year of construction	N/A	

After reviewing these stated eligibility criteria and Project Files, the EC confirms the 18 projects meet the eligibility criteria.

Verification Result

As a result of this review:

- The EC confirms proper documentation for the requested projects
- Project files for 18 of the 24 submitted projects meet all requirements for a participant
- Project files for all 18 of those projects meet further criteria for eligibility

The EC verifies the scorecard metric of 18 of 24 projects for the Enbridge Commercial Savings by Design Program for a realization rate of 75.00%.

Residential New Construction – Residential Savings by Design – Enbridge

Overview

Table 6-108 shows the scorecard achievements for the 2018 Enbridge Residential Savings by Design (SBD) Program, with the metrics of enrolled builders and number of homes built. To limit confusion of discussing two separate measures within the same space, each metric will be discussed separately. Table 6-108 shows the reported, tracked, and verified scorecard achievements for the 2018 Enbridge Residential SBD program.

- Reported: In past evaluations, this value has been included for both consistency and as a cross-check to validate tracking data. For 2018, a draft report was not created or provided to the EC. This column remains included for consistency in reporting with previous years, and in anticipation that draft reporting will resume with the 2019 program year.
- Tracked: Metric value identified in Tracking File
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in Documents section
- Ratio: Ratio of verified to tracked savings. A value of 100.00% indicates that verified values match tracked values

Table 6-108. Enbridge Market Transformation scorecard achievement: Residential Savings by Design*

Program	Metric	Achievement			Ratio
		Reported	Tracked	Verified	
Residential Savings by Design	Builders	N/A	35	35	100.00%
	Homes Built		2,956	2,956	100.00%

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 6-109 to verify the metrics for the Residential Savings by Design program.

Table 6-109. Documentation used to verify the Residential Savings by Design program

Report Language	Description or Citation
Enbridge-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2018 Enbridge DSM programs
Project Files	Files documenting participation and eligibility for selected builder/project
Confirmation Emails	PDF copies of email correspondence with builders verifying aspects of their housing developments
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016 and OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016
Enbridge Plan	Enbridge Gas Multi-Year DSM Plan (2015-2020), EB-2015-0049

Builders Metric

Participant Selection

Enbridge first provided the Tracking File listing Project Code (unique ID), Enrolment Year, IDP date, Signed Commitment (date), and a variable indicating whether the "Final IDP Report Received". The spreadsheet identified 35 builders, all with 2018 IDP dates and 'Yes' populated for both the threshold and report received variables. As tracking data indicated that all the 35 listed builders were equally qualified, the EC randomly selected five from the full list for document review. The EC requested all supporting documentation, including documentation that supports eligibility and participation criteria.

Received Files

Enbridge provided two files to support each project:

- "Project Application"
- "IDP Report"

Enbridge also provided copies of email correspondence between representatives from Enbridge and some builders that, upon first review, appeared to not meet the requirements for participation.

Verify Participation

To determine the definition of Enrolled Builders, the EC looked first to the OEB Decision, which approved the Enbridge ESC Plan[83] stating: "*The OEB approves Enbridge's Residential Savings by Design program as proposed."* For further detail on criteria, the EC looked to Enbridge's Plan which identified:[84]

> *"For the purpose of assessing whether a builder is "enrolled" in SBD Residential:*
>
> *i. The builder must have signed a Memorandum of Understanding ("MOU") containing a commitment to participate in the Residential SBD program for a 3-year period*
>
> *ii. The builder must have completed a program-approved Integrated Design Process ("IDP"), such as IEA Task 23 or the iiSBE developed IDP tool, including requisite energy modeling for homes the builder plans to construct in a new development. Homes to be completed in 2016 must demonstrate at least 25% total energy savings relative to the 2012 Ontario Building Code. Homes to be completed in 2018 and beyond must demonstrate total energy savings of at least 15% relative to the yet to be developed 2018 Ontario Building Code.*
>
> *iii. Builders will be permitted to enroll in Enbridge's Residential SBD offer more than once to avoid lost opportunities. In order to increase the scale of energy efficiency amongst participating builders, repeat builders will be offered progressively smaller incentives per home, but shall be permitted to collect these reduced incentives for a larger number of units.*
>
> *iv. In order for a builder's development to qualify as significant enough in size to participate in Enbridge's SBD Residential offer, the development must include no less than 50 homes."*

The EC evaluated the sampled participant files against the criteria above and determined:

- Requirement i:

[83] Ontario Energy Board Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016, Page 34

[84] Enbridge's Proposed 2015-2020 DSM Plan, EB-2015-0049, Exhibit B, Tab 1, Schedule 4, Page 35-36 of 41

- Section 2c. of the Enbridge-provided Terms & Conditions included in the application contains the following: "…Applicant must design and construct the residential homes…by no later than three (3) calendar years from the date of the IDP."
- This identifies an agreement to complete a project within three years, but does not indicate the commitment of a builder to participate in the Residential SBD program for three years.

- Requirement ii:
  - Section 2c. of the Enbridge-provided Terms & Conditions includes the following: "In order to apply for the Program and be eligible for financial incentives, the Applicant must design and construct the residential homes…in Enbridge franchise areas which meet or exceed the Target Energy Performance", which is established in Section 1.ii as exceeding "the 2017 Ontario Building Code's ("OBC") energy performance requirements by at least 15% or greater."
  - The five submitted IDP Reports identified at least 15% energy savings above 2017 OBC using the HOT2000 simulation program.
- Requirement iii:
  - The EC does not find that this requirement is applicable to validating participation, only that it permits further participation.
- Requirement iv:
  - The Project Applications of two of the initial five builders identified the total development size of 50 homes or more, satisfying the requirement for no less than 50. Three applications indicated that the development would include fewer than 50 homes, which did not meet the requirement.

Initial Verification

The initial verification review determined that two of the five randomly-selected homes met the participation and eligibility criteria.

Second Verification

The program application states that the applicant must complete the components of the program within three years of the application date (see above). As a result, the EC determined that the three builders in question could meet the 50 homes threshold by confirming that at least 50 homes will be constructed in the development by the end of 2020. Enbridge provided DNV GL copies of email correspondence with the three builders, all of which confirmed at least 50 homes. This meant that all five builders met all of the requirements.

Verification Result

As a result, the EC confirms:

- Builders do not have MOUs identifying agreement to participate "in the Residential SBD program for three years," only that projects would be completed before three years are over
  - While the EC does not find this significant enough to deny verification of the metric, this is an item for future clarification and/or correction
- All selected builders meet the participation criteria for IDP submission with sufficient savings
- All submitted builders meet the participation criteria for project size

As a result, the EC confirms the scorecard metric of 35 enrolled builders.

Homes Built Metric

Participant Selection

Enbridge first provided the Tracking File listing Project Code and House ID (unique ID) for program homes. The spreadsheet identified 446 program rebated homes, separate from the 2,510 additional homes built to program requirements but not receiving program rebates. The EC randomly selected five homes from the 446 program homes for document review. The EC requested all supporting documentation, including documentation that supports eligibility and participation criteria.

Received Files

Enbridge provided the following files to support the sampled homes:

- "IDP Workshop Summary" – PDF document outlining qualification documentation
- "ES Report" – PDF of ENERGY STAR for New Homes Report, BOP 12
- "HOT2000 screenshot" – JPG showing the Total Annual Fuel Consumption in megajoules (MJ) of the sampled house
- "Savings Summary" – Excel file which outlines the calculations that were made summarizing the HOT2000 calculation of energy savings and indicates the NRCan credits

In addition to these documents to support program homes, Enbridge also confirmed that supporting letters were receive for additional non-rebated homes, verifying that they were built to the same IDP standard as program homes.

Verify Participation

To determine the definition criteria for Homes Built, the EC looked first to the OEB Decision, which approved the Enbridge ESC Plan stating[85] "*The OEB approves Enbridge's Residential Savings by Design program as proposed."* For further detail on criteria, the EC looked to Enbridge's Plan which identified:[86]

> *For the purpose of assessing the "homes built" metric for SBD Residential:*
>
> *i. A home must be completed by a participating builder who has completed the IDP process for the development.*
>
> *ii. A home which, as constructed, has features consistent with the builder's IDP and that make it 25% more efficient than a new home built to the 2012 Ontario Building Code if constructed in 2016, and 15% more efficient than a new home built to the yet to be completed 2018 Ontario Building Code.*
>
> *iii. Builders may apply the outcomes of the IDP to additional developments if the outcomes are applicable. The homes built in additional developments may be counted as homes built. However, the maximum number of homes for which a builder may receive incentives shall not increase.*
>
> *iv. All homes constructed to the standard in a builder's development shall count towards the "homes built" metric even if rebates were not paid for all of them. Non-rebated units will be verified by a confirmation letter from the builder acknowledging that the homes were built to the IDP standard. Enbridge rebated units will be verified using the blower door test.*

[85] Ontario Energy Board Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016, Page 34

[86] Enbridge's Proposed 2015-2020 DSM Plan, EB-2015-0049, Exhibit B, Tab 1, Schedule 4, Page 36-37 of 41

From this definition and submitted documentation, the EC determined participation for the randomly-selected homes:

- Requirement i:
  - The EC did not evaluate whether the homes selected were completed by participating builders who had completed the IDP process for this development. Evaluation of the builders was done through verifying the Enrolled Builder metric (see above). The EC assumed that portion of the requirements was met because the previous section confirmed builder participation.
- Requirement ii:
  - The Summary documentation as well as the Savings Summary worksheets and the HOT2000 screenshots for all five randomly-selected homes demonstrated modelled as-built energy consumption 25% or greater above 2012 OBC.
  - The EC identified that this result did not speak to the requirements, which states that homes built in 2017 and thereafter must meet a threshold of 15% or greater energy performance above 2017 OBC.
  - After review, the EAC determined that homes constructed from 'Design Charrettes' that occurred prior to Jan. 1, 2017 would be allowed to be modelled against the 2012 OBC. Homes constructed from 'Design Charrettes' occurring after December 31, 2016 would be required to benchmark savings against the updated 2017 building code.
  - All five sampled homes were constructed from 'Design Charrettes' that occurred in 2016. Therefore, the 2012 OBC benchmark applies and all sampled homes meet the requirement.
- Requirement iii:
  - The EC does not find that this requirement is applicable to validating participation, only that it permits further participation.
- Requirement iv:
  - Enbridge confirmed that supporting letters were received for all developments that included additional homes beyond those incented. The EC finds that this satisfies the requirement for non-rebated units.

The EC finds that all five randomly-selected homes meet the eligibility and efficiency qualifications.

Verification Result

As a result, the EC confirms 446 rebated program homes and 2,510 non-rebated homes, and thus the scorecard metric of 2,956 Homes Built.

Residential New Construction – Optimum Home Program – Union

Table 6-110 shows the scorecard achievements for the 2018 Union Gas Market Transformation Optimum Home Program, with the metrics of enrolled builders, prototype homes built, and percentage of homes built (>20% above OBC 2012) by participating builders. To limit confusion of discussing three separate measures within the same space, each metric will be discussed separately. Table 6-110 shows the reported, tracked, and verified scorecard achievements for the 2018 program:

- Reported: In past evaluations, this value has been included for both consistency and as a cross-check to validate tracking data. For 2018, a draft report was not created or provided to the EC. This column remains included for consistency in reporting with previous years, and in anticipation that draft reporting will resume with the 2019 program year.
- Tracked: Metric value identified in Tracking File.
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documents section
- Ratio: Ratio of verified to tracked savings. A value of 100.00% indicates that verified values match tracked values

Table 6-110. Union Market Transformation Scorecard Achievement: Optimum Home*

Program	Metric	Achievement			Ratio
		Reported	Tracked	Verified	
Optimum Home	Builders	N/A	8	8	100.00%
	Prototype Homes Built		83.33%	83.33%	100.00%
	Percentage of Homes Built		3.97%	3.97%	100.00%

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 6-111 to verify the metrics for the Optimum Home program.

Table 6-111. Documentation used to verify the Optimum Home program

Report Language	Description or Citation
Union-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2018 Enbridge DSM programs
2018 Optimum Homes	Excel spreadsheet listing all participating homes
Top Builder Reports	Excel spreadsheet listing builders in each region by housing starts
Project Files	Various documents for each requested participant, supporting program metrics
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016 and OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016
Union Plan	Union's 2015-2020 DSM Plan, EB-2015-0029
Union's Draft 2017 Report	Union Gas 2017 Demand Side Management Draft Annual Report[87]

[87] While the EC recognizes and understands that the draft report will be updated and finalized, the final was not available at the time of this evaluation, thus the draft is cited for reference.

Participating Builders Metric

Participant Selection

Union first provided the Tracking File listing Builder (unique ID) and Discovery Home file number. The spreadsheet identified 18 total builders in 2018, 8 of which enrolled in 2018 and 10 of which enrolled in 2017 and remained enrolled. The EC requested documentation for the full census of "new" builders (those enrolled in 2018), including documentation that supports eligibility and participation criteria.

Received Files

Union provided two types of files to support the eligibility of each participating builder:

- One "Builder Agreement" (program application) for each builder
- A Top Builder Reports spreadsheet listing the builders in each region by housing starts in 2017

Verify Participation

Union relaunched the Optimum Home program in 2017 in response to the introduction of the new Ontario Building Code (OBC). To determine the definition of Participating Builders under this relaunched program, the EC looked to the Union 2017 Draft Annual Report. The draft report stated that participation in a given year required each builder to sign a participation contract for the Optimum Home offering in that year.

The EC confirmed that participation agreements were provided by Union for each of the 8 builders, and they were all signed in calendar year 2018.

Verify Eligibility

To determine eligibility under this relaunched program, the EC looked to the Union 2017 Draft Annual Report. The draft report stated: "Eligible builders are the top ten builders in each region based on number of housing starts in Union's franchise area in the prior calendar year." The report also listed the seven regions as Halton, Hamilton, London, Waterloo, Windsor, Kingston, and North.

The EC examined the Recruitment Tracking spreadsheet and confirmed that all 8 builders were a "top 10" builder in one of the seven regions based on housing starts in 2017.

Verification Result

The EC confirms that all builders meet both the participation and eligibility criteria. As a result, the EC confirms 8 of 8 Participating Builders for a 100.00% realization rate.

Prototype Homes Built Metric

Participant Selection

Union first provided the Tracking File listing Builder (unique ID) and Discovery Home file number. The spreadsheet identified 9 prototype homes built in 2018. The EC requested documentation for the full census of homes built, including documentation that supports the energy performance criteria.

Received Files

Union provided the following files to support each prototype home:

- "ESNH Compliance Report" – PDF of ENERGY STAR for New Homes v17 Compliance Report

- "BOP" – Balance-of-Plant summary completed by third-party consultant verifying building energy performance to ESNH v17

Verify Participation

Union relaunched the Optimum Home program in 2017 in response to the introduction of the new Ontario Building Code (OBC) in 2017. To determine the specifics of the Prototype Homes Built metric under this relaunched program, the EC looked to the Union 2017 Draft Annual Report. The report states:

> *"The Optimum Home Prototype Homes Built Metric is the percentage of participating builders who construct a prototype home 15% greater than OBC 2017 based on the total number of builders who remain enrolled in the Optimum Home offering."*

The EC deconstructed the metric into the following components:

- Requirement of 15% greater than OBC 2017
  - Union's 2017 Draft Annual Report makes clear that, while "the performance standard is set against current OBC 2017", the program is aligned with ENERGY STAR. Therefore, qualifying homes must "achieve ENERGY STAR® for New Homes v17 ("ESNH v17")." The stated rationale for using the ENERGY STAR standard is that the "ESNH v17 standard is, on average, 20% more energy-efficient than OBC 2017" which is greater than the program metric of 15% above OBC 2017.[88]
  - The EC independently confirmed that ESNH v17 qualifying homes are, on average, 20% more energy efficient than those built to OBC 2017.[89]
  - The EC concurs that using ESNH v17 is consistent with the metric.
- Whether constructed homes meet the energy requirement
  - The metric language makes clear that it is based on "the total number of builders who remain enrolled in the Optimum Home offering," and thus is cumulative beginning in 2017.
  - The compliance reports and balance-of-plant summaries provided by Union for all 9 prototype homes constructed in 2018 indicate that the homes met the ESNH v17 threshold for energy performance. Additionally, the 2017 Annual Verification Report verified that all 6 prototype homes constructed in 2017 met the energy performance threshold. Thus, 15 qualifying prototype homes had been constructed at the end of 2018.
- Number of enrolled builders in 2018
  - The metric language makes clear that it is based on "the total number of builders who remain enrolled in the Optimum Home offering," and thus is cumulative beginning in 2017.
  - The Participating Builders metric (above) verified that 8 builders became enrolled in the Optimum Home offering in 2018. Additionally, the 2017 Annual Verification Report verified that 10 builders had previously enrolled in 2017. Thus, 18 builders remained enrolled in the program in 2018.

As a result, the EC finds that 15 of the 18 enrolled builders constructed a prototype home 15% greater than OBC 2017 by the end of 2018.

Verification Result

As a result of this review:

[88] Union's Draft 2017 Demand Side Management Evaluation Report, Page 89

[89] https://www.enerquality.ca/wp-content/uploads/2017/03/ESNH-Standard-Ver-12.8-and-Ver-17.0-Ontario_Effective-Feb-21-2017.pdf

- The EC confirms that requiring homes built within the program to meet the ESNH v17 standard is consistent with the target of 15% greater energy performance than OBC 2017
- Project files for each of the 9 homes built in 2018 meet the energy performance criteria in addition to each of the 6 homes built in 2017
- The EC confirms that 18 builders remained enrolled in the program at the end of 2018

The EC confirms that 15 of 18 (83.33%) enrolled builders had constructed qualifying prototype homes at the end of 2018, which constitutes a 100.00% realization rate.

Percentage of Homes Built Metric

Participant Selection

Union Gas first provided the Tracking File listing anonymized builders with the number of total homes each constructed in 2018, number of program homes, and participating homes percentage calculated. This file demonstrated the claimed metric achievement, identifying 110 of 2,773 total homes built by 18 builders, as demonstrated in Table 6-112.

Table 6-112. Optimum Home claimed total and program homes built, by builder*

Builder	Total Homes Built	Optimum Homes Built	% of Homes Built
Builder 1	83	27	33%
Builder 2	99	0	0%
Builder 3	252	1	0%
Builder 4	63	1	2%
Builder 5	55	3	5%
Builder 6	32	2	6%
Builder 7	22	9	41%
Builder 8	1,096	1	0%
Builder 9	0	0	N/A
Builder 10	53	41	77%
Builder 11	192	1	1%
Builder 12	23	2	9%
Builder 13	48	2	4%
Builder 14	26	2	8%
Builder 15	13	0	0%
Builder 16	23	1	4%
Builder 17	290	16	6%
Builder 18	403	1	0%
Total	**2,773**	**110**	**3.97%**

*Not all values may compute exactly due to rounding.

In addition, Union Gas provided the 2018 Optimum Homes Built file with individual anonymized listings for the 110 program homes, identifying builder (anonymized), file number, and enrollment type (ES BOP Version 17, e.g.). From these, the EC randomly selected one program home for review and verification.

Union Gas provided documentation to support verification of the selected program home in three files:

- Air Leakage Test Report – Word document
- Energy Star for New Homes Compliance Report – PDF
- Energy Star for New Homes Details – Excel spreadsheet

Verify Participation

This metric includes the percentage of homes built to Optimum Home energy performance standards "by participating builders." To fully verify the metric, the EC examined the specific builder of the randomly-selected home. The EC confirmed this builder (Builder 10) enrolled in the program in 2017, satisfying the requirement.

Verify Eligibility

Union relaunched the Optimum Home program in 2017 in response to the introduction of the new Ontario Building Code (OBC) in 2017. To determine the definition of participating homes, the EC looked to the Union 2017 Draft Annual Report. The report makes clear that qualifying homes constructed in 2017 and thereafter must "achieve ENERGY STAR® for New Homes v17 ("ESNH v17").[90]

The EC requested documentation for verification of site "55ES043532," randomly selected from the 2018 Optimum Homes Built spreadsheet. Files provided by Union Gas confirmed the eligibility of the home. The ESNH v17 Compliance Report demonstrated both a qualifying inspection date (2018) and the site met the ESNH v17 energy performance threshold.

As a result, the EC confirms that the submitted project meets the criteria for eligibility for the Union Gas Optimum Homes program.

Verification Result

As a result of this review:

- The EC confirms proper documentation for the requested site and builder
- Project files for the randomly selected site meet energy savings compliance criteria

The EC confirms documentation for the 2018 Optimum Home Program, with 110 Optimum Homes claimed out of 2,773 total participating builder homes for a metric result of 3.97%.

[90] Union's Draft 2017 Demand Side Management Evaluation Report, Page 89

School Energy Competition – Enbridge

Table 6-113 shows the reported, tracked, and verified scorecard achievements for the 2018 Enbridge Market Transformation School Energy Competition Program, with the metric of Participating Schools. As a result of this review, the EC verifies the 2018 achievement metric of 14 Participating Schools (100.00% ratio). Table 6-113 contains the following variables:

- Reported: In past evaluations, this value has been included for both consistency and as a cross-check to validate tracking data. For 2018, a draft report was not created or provided to the EC. This column remains included for consistency in reporting with previous years, and in anticipation that draft reporting will resume with the 2019 program year.
- Tracked: Metric value identified in Tracking File
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documents section.
- Ratio: Ratio of verified to tracked savings. A value of 100.00% indicates that verified values match tracked values.

Table 6-113. Enbridge market transformation & energy management scorecard achievement: School Energy Competition Schools metric*

Metric	Achievement			Ratio
	Reported	Tracked	Verified	
School Energy Competition Participating Schools	N/A	14	14	100.00%

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 6-114 to verify the metrics for the School Energy Competition program.

Table 6-114. Documentation used to verify the School Energy Competition program

Report Language	Description or Citation
Enbridge-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2018 Union DSM programs
Project Files	Various documents for each requested participant, supporting program metrics
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016 and OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016
Enbridge Plan	Enbridge Gas Multi-Year DSM Plan (2015-2020), EB-2015-0049

Participant Selection

Enbridge first provided the Tracking File listing the Enbridge Account (number) and Project Code (unique ID). The spreadsheet identified 14 participants. The EC requested full documentation for all participants.

Received Files

The EC received eight individual files:

- Six PDF scans of school board application "hardcopies"

- One "Online Registrations" spreadsheet listing schools registered "online" without hardcopy, listing program ID and a timestamp variable.
- One "ESC Activity Tracker" spreadsheet marking participation of all schools in various program elements and offerings

The EC first confirmed the titles received matched the IDs requested. Project Files were redacted with name, address, and other all other location, school, or site-specific information unavailable. The EC confirmed that documents were received that included all participants.

Verify Participation

To determine the definition of Participating Schools, the EC looked first to the OEB Decision which approved the Enbridge Plan:[91]

Decision
The OEB approves Enbridge's School Energy Competition program. The OEB finds this program provides both educational and energy conservation benefits. Further, this program is designed to engage a wide group of participants through a competition, which is innovative. The OEB also finds the involvement of students, potential future customers, to be consistent with the intent of the DSM Framework.

For specific definition, the EC then looked to Enbridge's Plan which identifies:[92]

"For the purpose of measuring the success of the Company's School Energy Competition, a school will be considered "enrolled" at the time that energy monitoring begins using the Energy Management Information System ("EMIS") provided via the offer. At a high level, monitoring is the third of the four steps which comprise the School Energy Competition."

Further, Enbridge's Plan identifies "Key Offer Evaluation Metrics:[93]"

"A participant is a school that registers, implements, and has access to an EMIS system to log competition activities"

From this, the EC has identified that a "Participating School" is defined as a school that has:

- Registered and 'logged in' to the EMIS system.

School application hardcopy images (PDF) do not provide evidence of having registered with or logged into any information system, including the EMIS system. The Online Registration spreadsheet identifies a list of program IDs and a "timestamp" for each. Neither registration provides evidence that the any of the 14 IDs have logged into the EMIS system. However, during the previous round of evaluation, the EC requested confirmation that ESC Activities as tracked in the spreadsheet represent EMIS registration. Enbridge staff responded with confirmation:[94]

"In order to provide the schools with their EMIS data, a website was created that contained a link to a dashboard, which showed each school their EMIS data. Enbridge was then able to track that all participating schools accessed the website."

The ESC Activity Tracker is a program tracking spreadsheet, identifying program elements completed by each school. For each ID, the spreadsheet identifies activities which that ID participated in, summarized in Table 6-115.

[91] Ontario Energy Board Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016, Page 43
[92] Enbridge's Proposed 2015-2020 DSM Plan, EB-2015-0049, Exhibit B, Tab 1, Schedule 4, 34 of 41
[93] Enbridge's Proposed 2015-2020 DSM Plan, EB-2015-0049, Exhibit B, Tab 2, Schedule 2, Page 48 of 55
[94] Enbridge Employee "RE: Follow up request - LI New Construction and MT School Energy Competition" Message to DNV GL Employee, 2/1/2018, Email

Table 6-115. Enbridge ESC activities and participant counts*

Program Element	# of Schools Participating
Team to Support & Lead SEC	14
Communication Strategy	5
Programmable or Smart Thermostats	3
Conduct a Home Energy Audit	6
Art Poster Contest	3
Ugly Sweater Day	4
Access Energy Use	7
Natural Gas Education	8
Bonus Activity	2

*Not all values may compute exactly due to rounding.

Verify Eligibility

The EC first looked to the OEB Decision to determine specific criteria for participant eligibility, then to Enbridge's Plan, which identifies:[95]

"Participating schools must be part of a board within one of the publicly funded systems (English/French/Public/Catholic) in Ontario within the Enbridge franchise area."

School application hardcopy PDFs all identify school boards for six records. The PDF email and Online Registration spreadsheet do not provide any information confirming that each record is a school. Further, none of the Project Files provided confirm that any of the IDs are within one of the publicly funded systems nor do they provide any information that would allow the EC to independently confirm school status through public records. The EC requested confirmation that claimed participants were publicly funded schools, Enbridge staff confirmed all schools belonged to public school boards.

Verification Result

As a result of this review, the EC confirms:

- Participants meet the participation criteria
- Any participants meet the eligibility requirements

As a result, the EC confirms the scorecard metric of 14 Schools.

[95] Enbridge's Proposed 2015-2020 DSM Plan, EB-2015-0049, Exhibit B, Tab 2, Schedule 2, Page 47 of 55

Appendix K Performance Based (Union) and Market Transformation (Enbridge) Scorecards

This appendix describes the detailed process used to verify the metrics for the Performance-Based Scorecard programs for Union Gas (Table 6-117) and the similar programs for Enbridge that are contained under the Market Transformation Scorecard (Table 6-116). As noted in the OEB Decision and Order, the programs listed below are similar and thus included together. The programs addressed in this appendix are:

- Commercial & Industrial Operational Efficiency Improvement – Run-it-Right – Enbridge
- Commercial & Industrial Operational Efficiency Improvement – RunSmart – Union
- Commercial & Industrial Energy Management – Comprehensive Energy Management – Enbridge
- Commercial & Industrial Energy Management – Strategic Energy Management – Union

Table 6-116. Enbridge 2018 market transformation & energy management scorecard*†

Programs	Metrics	Verified Achievement		Metric Target			Weight
		Program-level Savings	Metric-level Savings	Lower Band	Target	Upper Band	
School Energy Competition	Schools	14	14	59	78	117	10.00%
Run-it-Right	Participants	62	62	18	24	36	20.00%
Comprehensive Energy Management	Participants	5	5	16	21	32	20.00%
Residential Savings by Design	Builders	35	35	15	20	30	10.00%
Residential Savings by Design	Homes Built	2,956	2,956	1,634	2,179	3,269	15.00%
Commercial Savings by Design	New Developments	31	31	21	28	42	25.00%

*Not all values may compute exactly due to rounding.
†Programs in grey text are not similar to Union programs under the Performance Based Scorecard, and not discussed in this Appendix. For these programs please refer to Appendix F: Market Transformation Scorecard

Table 6-117. Union Gas 2018 performance-based scorecard*

Programs	Metrics	Verified Achievement		Metric Target			Weight
		Program-level Savings	Metric-level Savings	Lower Band	Target	Upper Band	
RunSmart	Participants	44	44	33	44	66	10.00%
	Savings %	0.51%	0.51%	1.47%	1.96%	2.94%	40.00%
Strategic Energy Management	Participants	3	3	2	3	5	10.00%
	Savings %	3.86%	3.86%	3.75%	5.00%	7.50%	40.00%

*Not all values may compute exactly due to rounding.

Commercial & Industrial Operational Efficiency Improvement – Run-it-Right – Enbridge

Table 6-118 shows the reported, tracked, and verified scorecard achievements for the 2018 Enbridge Run-it-Right (RIR) Program, with the metric of Participants. The RIR Program has two metrics under separate scorecards, CCM Savings (Resource Acquisition) and Participants (Performance Based). Participants are discussed here, while the CCM Savings metric is discussed in Appendix G. As a result of this review, the EC verifies the 2018 achievement metric of 62 participants (100.00% ratio). Table 6-118 contains the following variables:

- Reported: In past evaluations, this value has been included for both consistency and as a cross-check to validate tracking data. For 2018, a draft report was not created or provided to the EC. This column remains included for consistency in reporting with previous years, and in anticipation that draft reporting will resume with the 2019 program year.
- Tracked: Metric value identified in Tracking File
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documents section.
- Ratio: Ratio of verified to tracked savings. A value of 100.00% indicates that verified values match tracked values.

Table 6-118. Enbridge market transformation & energy management scorecard achievement: Run-it-Right*

Metric	Achievement			Ratio
	Reported	Tracked	Verified	
Participants	N/A	62	62	100.00%

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 6-119 to verify the metrics for the Run-it-Right program.

Table 6-119. Documentation used to verify the Run-it-Right program

Report Language	Description or Citation
Enbridge-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2018 Enbridge DSM programs
Project Files	PDF scans of program participant documentation
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016 and OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016
Enbridge Plan	Enbridge Gas Multi-Year DSM Plan (2015-2020), EB-2015-0049

Participant Selection

Enbridge first provided the Tracking File listing RIR Project Codes, Account Numbers, and Confirmation Date. The spreadsheet listed 62 individual accounts. The EC requested full documentation for a census of projects.

Received Files

The EC received three PDF documents for each project:

- One program application,
- One Investigation report, and
- Either one implementation time record or work orders for the recommended measures.

The EC also received an EMIS file detailing the monitoring start date for each project.

The EC first confirmed the document IDs received matched the IDs requested and that documents for all participants had been received. Project Files were received with name, address, and other information unavailable.

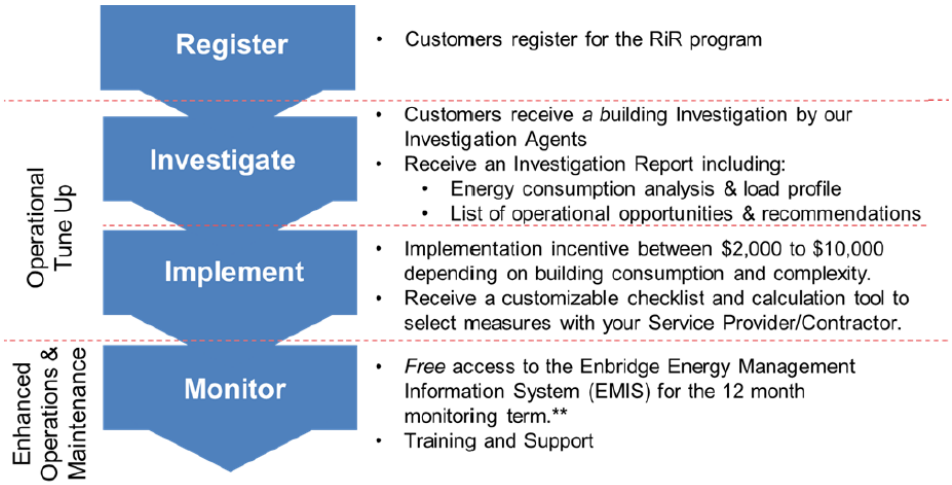
Verify Participation

Enbridge's Plan[96] states that:

> *Customers shall be deemed a "participant" in Enbridge's RiR offer for the purpose of the MTEM scorecard once they have entered the monitoring stage of the offer, which is the fourth of four steps inherent to this offer*.

Enbridge's plan further documents the four steps inherent to the offer to be: Register, Investigate, Implement, and Monitor (Figure 6-7.). Combining the definition on p. 34 of 41 with the figure, the EC interprets "participation" to require evidence of completing all four steps, including site energy use or savings monitoring that would be produced by the fourth step.

Figure 6-7. Image of RIR Process Elements from Enbridge Plan[97]



Enbridge provided redacted program applications for all 62 sites, satisfying intentional enrollment – the "register" step identified in Figure 6-7.

Enbridge provided investigation reports for all 62 sites. Investigation reports provided estimated savings (analysis) for a site, as well as estimated savings by recommended measure. This document satisfies the second step identified in Figure 6-7.

[96] Enbridge Gas Program Plan: DSM Plan Overview and Guiding Principles, EB-2015-0049, Tab 1, Schedule 4, Page 34 of 41

[97] Enbridge Gas Program Plan: DSM Plan Overview and Guiding Principles, EB-2015-0049, Tab 2, Schedule 1, Page 87 of 100

For all 62 sites, Enbridge provided either an implementation time record document or copies of work orders, either of which documented the execution of recommended work from the investigation reports. The EC considered either of these forms of documentation sufficient to satisfy the third step identified in Figure 6-7. for all projects submitted.

Enbridge provided an EMIS file that listed the starting date for monitoring of all 62 sites after project implementation, satisfying the fourth step identified in Figure 6-7.

Verification Result

As a result of this review, the EC verifies all sampled records, and verifies all 62 participants (100.00% of tracked).

Commercial & Industrial Operational Efficiency Improvement – RunSmart – Union

Overview

Table 6-120 shows the scorecard achievement for the 2018 Union RunSmart program, with the metrics of participants and percent savings. To limit confusion of discussing two separate measures within the same space, each metric will be discussed separately. Table 6-120 shows the reported, tracked, and verified scorecard achievements for the 2018 RunSmart program:

- Reported: In past evaluations, this value has been included for both consistency and as a cross-check to validate tracking data. For 2018, a draft report was not created or provided to the EC. This column remains included for consistency in reporting with previous years, and in anticipation that draft reporting will resume with the 2019 program year.
- Tracked: Metric value identified in Tracking File
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documents section.
- Ratio: Ratio of verified to tracked savings. A value of 100.00% indicates that verified values match tracked values.

Table 6-120. Union Gas 2018 performance-based scorecard achievement: RunSmart Program participants and savings percent*

Program	Metric	Achievement			Ratio
		Reported	Tracked	Verified	
RunSmart	Participants	N/A	44	44	100.00%
	Savings %		0.56%	0.51%	90.13%

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 6-121 to verify the metrics for the RunSmart program.

Table 6-121. Documentation used to verify the RunSmart program

Report Language	Description or Citation
Union-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2018 Union DSM programs
Project Files	PDF scans of program participant documentation
Activity Report	Excel spreadsheet documenting DSM activity from 2015 through 2017
RETScreen Files	Files detailing participant consumption and predicted consumption
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016 and OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016
Union Plan	Union's 2015-2020 DSM Plan, EB-2015-0029
Union's Draft 2017 Report	Union Gas 2017 Demand Side Management Draft Annual Report[98]

[98] While the EC recognizes and understands that the draft report will be updated and finalized, the final was not available at the time of this evaluation, thus the draft is cited for reference.

Participants Metric

Participant Selection

Union Gas first provided the Tracking File listing RunSmart participants with anonymized Program, Customer, and Site IDs, listing 44 individual participants. The EC requested full documentation for a census of participants.

Received Files

The EC received PDF documents for each participant, each titled by Participant ID. The EC also received an Excel spreadsheet which included, for each participant, whether they had any DSM program activity in 2016, 2017, or 2018. All files were properly redacted with name, address, and other information unavailable, as requested. The EC confirmed that the Account Numbers, Customer IDs, and Site IDs matched across all documentation.

Verify Participation

Union's Plan defines RunSmart participants[99] as the "number of customers that enter into an agreement with Union and participate in a site walk-through within a program year". The EC confirmed documentation supported participation of all 44 participants by verifying the Project Files contained for each site:

- A technical expert- (consultant) documented walk-through of the company facility
- A completed and signed walk-through checklist submitted for qualification
- All documents had required signatures of the customer, technical expert (consultant), and Union account manager

Verify Eligibility

Union's Plan defined the participant metric as the "number of customers without prior DSM participation history, consuming greater than 50,000 m^3 per year of natural gas." Union's 2017 Draft Annual Report further clarifies that "without prior DSM participation" includes participants who have not participated in the previous two years. Additionally, the 2017 Draft Annual Report states that while the program is largely directed towards mid-sized customers in excess of 50,000 m^3 per year of natural gas, other sizes may be considered if there is opportunity and interest.

As a result, verification of eligibility in 2018 came down to prior participation. The EC confirmed no documented DSM prior participation for any RunSmart participant from January 2016 through December 2018.

The EC confirmed the eligibility of all 44 participants.

As a result of this review, the EC confirms that:

- Participant records were correctly sent to the EC for all 44 participants
- All 44 participants met the participation definition
- All 44 participants met the eligibility definition

[99] Description of RunSmart Participants from Overview of Union's Proposed 2015-2020 DSM Plan, 2015EB-2015-0029, Exhibit A, Tab 3, Page 33 of 73

The EC confirms that 44 of 44 participants meet all requirements and certifies the 2018 achievement metric at 100.00%.

Savings Percent Metric

Participant Selection

Union Gas first provided the Tracking File containing a table listing RunSmart participants with Customer ID, Site ID, Existing Consumption (Baseline), Consumption Predicted from Baseline, and Actual Consumption (during participation). The EC requested a census of the previous program year's 35 participants, requesting documentation supporting the consumption values for those participants.

Received Files

The EC received RETScreen files and Excel outputs of those RETScreen files for the 35 previous program year participants.

Verify Consumption

The EC examined the provided RETScreen documents to verify each of the consumption values in the Tracking File spreadsheet. The EC confirmed the documentation supported the consumption values for all participants.

Verify Savings Calculation

Union's plan defines savings percent[100] as "the aggregate percentage of savings achieved by the program participants within a program year."

In its reported and tracked calculation, Union used the following equation for each individual participant's percent savings:

$$Union's\ Initial\ Participant\ Savings\ \% = \frac{Predicted - Actual}{Baseline}$$

Where:

- "Baseline" = Existing consumption during the year prior to program participation
- "Predicted" = A prediction of consumption during the participation period, based on the baseline consumption and heating degree days during participation
- "Actual" = Consumption during the one-year participation period

This resulted in a Savings Percent value of 0.56%. The EC disagreed with using the baseline consumption value in the denominator of the savings percentage equation because of the potential variation in weather

$$Final\ Participant\ Savings\ \% = \frac{Predicted - Actual}{Predicted}$$

between the baseline period and the participation period. Upon discussion, the EC reached a consensus with Union that the savings percentage equation for each individual participant should be as follows:

[100] Description of RunSmart Savings Percent from Overview of Union's Proposed 2015-2020 DSM Plan, 2015EB-2015-0029, Exhibit A, Tab 3, Page 35 of 73

Union's reported and tracked calculation then took the individual savings percent values for each participant and use the following equation to arrive at a program-level Savings Percent value:

The EC agrees and confirms this methodology.

$$\frac{\sum Participant\ Savings\ \%}{Count\ of\ Participants}$$

Verification Result

As a result of this review, the EC confirms a Savings Percent value of 0.51%, which results in a realization rate of 90.13%.

Commercial & Industrial Energy Management – Comprehensive Energy Management – Enbridge

Overview

Table 6-122 shows the reported, tracked, and verified scorecard achievements for the 2018 Enbridge Comprehensive Energy Management (CEM) program, with the metric of Participants. As a result of this review, the EC certifies the 2018 achievement metric of five participants (100.00% ratio). Table 6-122 contains the following variables:

- Reported: In past evaluations, this value has been included for both consistency and as a cross-check to validate tracking data. For 2018, a draft report was not created or provided to the EC. This column remains included for consistency in reporting with previous years, and in anticipation that draft reporting will resume with the 2019 program year.
- Tracked: Metric value identified in Tracking File
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documents section.
- Ratio: Ratio of verified to tracked savings. A value of 100.00% indicates that verified values match tracked values

Table 6-122. Enbridge market transformation & energy management scorecard achievement: CEM participants metric*

Metric	Achievement			Ratio
	Reported	Tracked	Verified	
Participants	N/A	5	5	100.00%

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 6-123 to verify the metrics for the Comprehensive Energy Management program.

Table 6-123. Documentation used to verify the Comprehensive Energy Management program

Report Language	Description or Citation
Enbridge-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2018 Enbridge DSM programs
Project Files	Two PDF documents
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016 and OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016
Enbridge Plan	Enbridge Gas Multi-Year DSM Plan (2015-2020), EB-2015-0049

Participant Selection

Enbridge provided the Tracking File listing CEM Project Codes, Account Numbers, and Energy Model date. The spreadsheet listed five individual participants. The EC requested full documentation for all participants.

Received Files

The EC received five PDF documents, titled by CEM Project number. The EC first confirmed the titles received matched the IDs requested. Project Files were properly redacted with name, address, and other information unavailable, as requested. The EC confirmed that the "Opportunity Code" listed in the Project Files matched Account Numbers listed in the Tracking File, and that documents for all participants had been received.

Verify Participation

Clear and specific criteria for participation in the CEM program were not readily available; rather, that the CEM program is intended to be a multi-year, 'holistic' process with ongoing and multi-year engagement resulting in energy savings. As a result, the EC understands evidence of initial engagement and a specific agreement to participate sufficient to verify participants for the purposes of the Market Transformation Scorecard metric of 'participants'.

The provided Project Files demonstrated that each participant applied for participation in the CEM program, signed by an applicant representative and Enbridge Manager. In addition, the applications include declarations that the applicant:

- Acknowledges and confirms that they will commit resources to participate and identify energy efficiency opportunities
- Will create internal energy awareness
- Share energy data with Enbridge
- Allow continued communication with Enbridge

The EC confirmed documentation supports participation of all seven participants.

Eligibility

The EC also used the Project File to confirm eligibility of each participant,[101,102] namely to verify that customers met annual gas consumption between 340,000 m^3 and 5,000,000 m^3. Project Files identified previous year gas consumption for the five customers:

- One customer with consumption below 340,000 m^3
- Three customers with consumption between 340,000 m^3 and 5,000,000 m^3
- One customer with consumption greater than 5,000,000 m^3

The EC immediately confirmed documentation supported eligibility for four of five participants. Upon further review with the EAC it was determined that inclusion of the one additional participant was permissible. Enbridge confirmed that one participant's consumption was incorrectly listed at below 340,000 m^3 and the correct consumption was supposed to be 1.2 million m^3 that is well within the eligibility requirement.

The one participant is significantly outside of the range at more than 19 million m^3. However, language in other parts of the plan make it clear that the target is large and complex commercial and industrial customers; therefore, DNV GL feels that participants with consumption larger than the stated guideline are

[101] Ontario Energy Board Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016, page 47

[102] Enbridge Gas Program Plan: DSM Plan Overview and Guiding Principles, EB-2015-0049, Exhibit B, Tab 2, Schedule 1, Page 53 of 100

reasonably close to the expectations set by the plan, while participants with consumption significantly lower would not be. Since the participant is significantly larger, the EC verifies the eligibility of this participant.

Verification Result

As a result of this review, the EC confirms that:

- Participant records were correctly sent to the EC for the census of 2018 participants
- Documentation confirmed all participants met the participation definition
- Documentation confirmed five of five participants met the eligibility definition
- Further review by EAC permitted the one participant

The EC confirms the scorecard metric of 5 participants for the Enbridge Comprehensive Energy Management Program.

Commercial & Industrial Energy Management – Strategic Energy Management – Union

Overview

Table 6-124 shows the reported, tracked, and verified scorecard achievements for the 2018 Union Strategic Energy Management (SEM) program, with the metric of Participants and Savings percent. This Savings percent metric was new for the 2018 evaluation. As a result of this review, the EC certifies the 2018 achievement metric of three participants (100.0% ratio) and 3.86% (115.93% ratio). Table 6-122 contains the following variables:

- Reported: In past evaluations, this value has been included for both consistency and as a cross-check to validate tracking data. For 2018, a draft report was not created or provided to the EC. This column remains included for consistency in reporting with previous years, and in anticipation that draft reporting will resume with the 2019 program year.
- Tracked: Metric value identified in Tracking File
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documents section.
- Ratio: Ratio of verified to tracked savings. A value of 100.00% indicates that verified values match tracked values

Table 6-124. Union performance based & energy management scorecard achievement: Strategic Energy Management*

Program	Metric	Achievement			Ratio
		Reported	Tracked	Verified	
Strategic Energy Management	Participants	N/A	3	3	100.00%
	Savings %		3.33%	3.86%	115.93%

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 6-125 to verify the metrics for the Strategic Energy Management program.

Table 6-125. Documentation used to verify the Strategic Energy Management program

Report Language	Description or Citation
Enbridge-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2018 Union DSM programs
Project Files	Two PDF documents
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016 and OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016
Union Plan	Union Gas Multi-Year DSM Plan (2015-2020), EB-2015-0049

Participant Selection

Union provided the Tracking File listing Year, SEM Project Codes, and Percent saved allocated to SEM. The spreadsheet listed three individual participants. The EC requested full documentation for all participants.

Received Files

The EC received five PDF documents, titled by Participant number, three memorandum of understanding/application forms and two savings reports. The EC first confirmed the titles received matched the IDs requested. Project Files were properly redacted with name, address, and other information unavailable, as requested. The EC confirmed that the "project code" listed in the Project Files matched project codes listed in the Tracking File, and that documents for all participants had been received.

Verify Participation

Clear and specific criteria for participation in the SEM program were not readily available, rather that the SEM program is intended to be a multi-year, 'holistic' process with ongoing and multi-year engagement resulting in energy savings. As a result, the EC understands evidence of initial engagement and a specific agreement to participate sufficient to verify participants for the purposes of the Performance Based Scorecard metric of 'participants'.

The provided Project Files demonstrated that each participant applied for participation in the SEM program, signed by an applicant representative and Union Manager. In addition, the MOUs/applications include declarations that the applicant:

- Has annual natural gas usage of or near 1,000,000 m^3;
- Does not currently have an Energy Management System in place; and,
- Has not previously participated in Union's integrated energy management system offering.

The EC confirmed documentation supports participation of all three participants.

Eligibility

The EC also used the Project application to confirm eligibility of each participant[103,104], namely to verify that customers met annual gas consumption at or near 1,000,000 m^3. Project Files identified gas consumption for the three customers:

- Two customers with consumption greater than 1,000,000 m^3
- One customer with consumption unknown consumption but MOU signed

The EC immediately confirmed documentation supported eligibility for two of three participants. The language within the signed Memorandum of Understanding was accepted as confirmation of gas consumption. Therefore, it was determined that inclusion of the one additional participant was permissible.

The two savings reports were used to determine the savings percent. The savings report utilized on-site meter data and baseline consumption to model consumption and reductions in gas usage resulting from the implementation of the SEM Program. The savings percent was calculated by taking the consumption change called the Pre Consumption (CUSUM + first half 2018 Actual) in each savings report divided by the listed

[103] Ontario Energy Board Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016

[104] Union's Draft 2017 Demand Side Management Evaluation Report, Page 105-106

Program Year Consumption listed below as Equation 11. The results of this calculation were then averaged to calculate the savings percent metric. The third participant did not enact the recommended savings and did not have a savings report to review or a savings percent to report.

Equation 11: Savings Percent Calculation

$$\textbf{Savings Percent} = \frac{\boldsymbol{Pre\ Comupstion\ Change}}{\boldsymbol{Listed\ PY\ Consumption}}$$

The EC confirmed that the three participants averaged 3.86% as the savings percent metric.

Verification Result

As a result of this review, the EC confirms that:

- Participant records were correctly sent to the EC for the census of 2018 participants
- Documentation confirmed all participants met the participation definition
- Documentation confirmed three of three participants met the eligibility definition
- Further review by EAC permitted the one participant

The EC confirms the scorecard metric of 3 participants and a savings percent of 3.86% for the Union Strategic Energy Management Program.

Appendix L Review of Metric Target Calculations

Overview

Metric Targets for 2016 were generally identified as fixed or prescribed values in the OEB decision and order, with the single exception of the Union Large Volume Program. For 2017 and 2018 (and through the rest of this framework), targets for metrics that existed in the previous year are defined based on the previous year's (PY) achievement and spend,[105] the current year (CY) budget, and a multiplier.[106] In general, metric targets follow this generic formula:

$$Metric\ Target = \frac{PY\ Achievement}{PY\ Spend} \times CY\ Budget \times Multiplier$$

The exception to the generic formula is the Union Large Volume Program, which uses the same general formula as 2016. For 2018, the formula for calculating the target uses the 3 Year cost effectiveness (CE),[107] the current year (CY) budget, and a multiplier[108] of 2% (1.02):

$$Union\ Large\ Volume\ Target = 3\ Year\ CE \times CY\ Budget \times 1.02$$

[105] Budget values for calculating metric targets do not include overhead costs

[106] 1.02 or 1.10 depending on the scorecard

[107] Three-year rolling average (2014-2016) Rate T2/T100 cost effectiveness where cost-effectiveness here is defined as "Final verified metric achievement used for MRAMVA purposes divided by final actual program spend for that year."

[108] In 2016 there were dual multipliers: 1.1 x 0.75. For 2018 the multiplier is 1.02.

Calculation Inputs

Table 6-126 and Table 6-127 provide the specific values used to calculate the 2018 metric targets.

Table 6-128 provides annual cost effectiveness (CE) ratios for the previous 3-years of the Union Large Volume Program and the average of those years, rounded to two digits past the decimal. The annual ratio is calculated via the Final verified metric achievement divided by final actual program spend for that year. This rounded 3-year average value is what DNV GL used for target calculations.

Table 6-129 and Table 6-130 provide the targets for all 2018 metrics, calculation-based and prescribed.

Table 6-126. Enbridge Metric Target Calculation Inputs – 2018

Scorecard	Metric	2017 Achievement	2017 Spend	2018 Budget	Multiplier
Resource Acquisition	LV RA (CCM)	401,222,684	$7,833,387	$9,732,410	1.02
	SV RA (CCM)	296,983,080	$27,402,852	$26,875,001	
	HEC Participants	11,390	$22,644,994	$18,000,000	
Low Income	LISF (CCM)	19,598,357	$4,539,420	$6,477,200	
	LIMR (CCM)	69,363,767	$2,765,831	$3,813,296	
	LINC Applications	11	$1,158,956	$1,400,000	
Market Transformation	CSBD Developments	30	$1,270,688	$1,075,000	1.10
	CEM Participants	5	$234,085	$905,000	
	RSBD Builders	24	$4,216,284	$3,250,000	
	RSBD Homes	2,570			
	RiR Participants	29	$421,777	$315,400	
	SEC Schools	65	$460,396	$500,000	

*HEC budget is a subset of, and not a separate line item from, the Resource Acquisition budget.

Table 6-127. Union Metric Target Calculation Inputs – 2018

Scorecard	Metric	2017 Achievement	2017 Spend	2018 Budget	Multiplier
Resource Acquisition	RA (CCM)	995,332,440	$37,242,800	$30,020,000	1.02
	HRR Participants	13,729	$21,375,224	$12,226,000	
Large Volume	LV (CCM)*	61* (see additional table)		$3,150,000	
Low Income	LISF (CCM)	30,676,937	$6,813,912	$8,930,000	
	LIMF-SA (CCM)	22,426,926	$2,503,499	$2,541,670	
	LIMF-MR (CCM)	4,363,656	$435,687	$442,330	
Market Transformation	CNC Developments	12	$706,158	$1,000,000	1.10
	OH % Built	0.00%	685,326	$841,000	
	OH Builders	10			
	OH Homes	60.00%			
Performance Based	RS Participants	35	$169,385	$193,000	
	RS Savings %	1.49%	$162,052		
	SEM Participants	0	$193,887	$644,000	
	SEM Savings %	0.00%			

*Union's Large Volume program metric target is based on different inputs; instead of the 2017 CCM metric, the formula is based off the three-year rolling average (2015-2017) Rate T2/Rate 100 cost effectiveness. This average value (61) is what is listed for the 2017 achievement.

Table 6-128. Union Large Volume Cost Effectiveness* Ratios

Year	CE Ratio*
2015	92.31
2016	31.30
2017	59.14
3-Year Average	**60.92**

*Final verified metric achievement divided by final actual program spend for that year. Annual CE Ratios and the 3-year average are rounded to 2 digits past the decimal

Table 6-129. Enbridge Metric Targets – 2018

Scorecard	Metric	2018 Target
Resource Acquisition	LV RA (CCM)	508,459,624
	SV RA (CCM)	297,087,649
	HEC Participants	9,235
Low Income	LISF (CCM)	28,523,764
	LIMR (CCM)	97,545,599
	LINC Applications	14
Market Transformation	CSBD Developments	28
	CEM Participants	21
	RSBD Builders	20
	RSBD Homes	2,179
	RiR Participants	24
	SEC Schools	78

Table 6-130. Union Metric Targets – 2018

Scorecard	Metric	2018 Target
Resource Acquisition	RA (CCM)	818,345,497
	HRR Participants	8,010
Large Volume	LV (CCM)	195,727,318
Low Income	LISF (CCM)	41,007,862
	LIMF-SA (CCM)	23,224,249
	LIMF-MR (CCM)	4,518,793
Market Transformation	CNC Developments	19
	OH % Built	5.00%
	OH Builders	8
	OH Homes	60.00%
Performance Based	RS Participants	44
	RS Savings %	1.96%
	SEM Participants	3
	SEM Savings %	5.00%

Appendix M Review of lost revenue and DSM shareholder incentive calculations

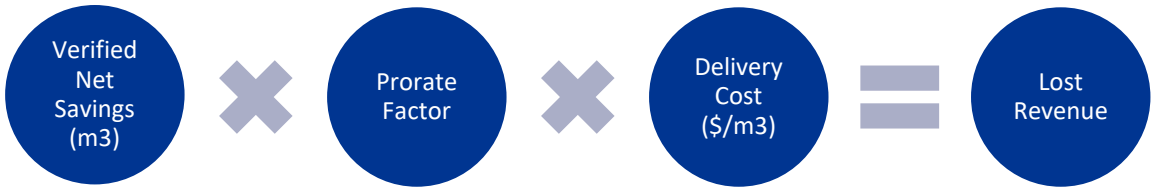
This appendix describes the EC team's review of the lost revenue and demand side management shareholder incentive calculations.

Lost revenue calculations

Figure 6-8. illustrates the basic approach to the lost revenue calculation. It is based on the following factors:

- The verified net natural gas savings (in annual cubic meters) by applicable rate class using the best available information at the time of the verification
- The delivery cost of the natural gas by rate class
- The month in which the measure was installed, represented in the equation below as a prorate factor

Figure 6-8. Lost revenue calculation



Lost revenues are summed across all measures in a rate class. Then the lost revenues for all applicable rate classes are summed to calculate total lost revenues per utility.

The applicable rate classes for Enbridge and Union are shown in Table 6-131. Values specific to these rates for the evaluated year are included in Appendix N.

Table 6-131. Rate classes for lost revenue calculation

Enbridge	Union
Rate 110	M4 Industrial
Rate 115	M5 Industrial
Rate 135	M7 Industrial
Rate 145	T1 Industrial
Rate 170	T2 Industrial
	20 Industrial
	100 Industrial

The methods to compute each of the components shown in Figure 6-8. are described in the following sections.

Lost revenue: Verified Net Savings

The lost revenue calculation first utilizes verified net savings, calculated using best available inputs and assumptions at the time of the verification. For prescriptive program savings, this is currently the December 2016 update to the TRM. This differs from the savings used for the DSM shareholder incentive calculation, which uses the energy savings at the time of program planning.

Lost revenue: Prorate Factor Calculation

The prorate factor is simply the proportion of the annual net savings that will be included in the lost revenue calculation, based on the number of months the gas-saving measure was installed. Table 6-132 shows the prorate factors for each installation month. Prorated savings are calculated by multiplying the measure's annual savings by the ratio for the month it was installed.

Table 6-132. Lost revenue installation month savings ratio*

Month	Ratio (12-Month+1)/12
January	1.0000
February	0.9167
March	0.8333
April	0.7500
May	0.6667
June	0.5833
July	0.5000
August	0.4167
September	0.3333
October	0.2500
November	0.1667
December	0.0833

*Not all values may compute exactly due to rounding.

For example, the calculation assigns 12 months of savings to measures installed in January and one month of savings to measures installed in December.

Lost revenue: Delivery Cost Calculation

Delivery rates are expressed as cost per 1000 cubic meters. Prorated energy savings are divided by 1000 to convert savings in cubic meters to savings in thousands of cubic meters, which are then multiplied by the delivery rate for the respective rate class to determine lost revenue by rate class. The delivery rate is not verified as part of this evaluation.

Lost revenue: Summing lost revenue Savings

Lost revenue for each rate class is calculated by summing the lost revenue for all measures within the rate class. Total lost revenue for each utility is calculated by summing the lost revenue across all applicable rate classes:

$$Total\ Lost\ Revenue = \sum_{Rate\ Class}^{Utility} \sum_{Measure}^{Rate\ Class} Lost\ Revenue$$

DSM shareholder incentive calculations

The DSM shareholder incentive calculations are more complex than the lost revenue calculations. DSM shareholder incentive calculations are based on:

- The verified program achievements compared to the target metrics for that scorecard

- The weight placed on each metric within each scorecard
- The maximum incentive achievable for that scorecard

Because all three of these factors vary by utility and scorecard, a simple diagram is not possible. DNV GL independently calculated DSM shareholder incentive values for both utilities. The following sections lay out the calculation methodology, as well as inputs used for each utility.

The EC confirmed the lower band, upper band, target metric, weights, maximum incentives, rate classes, and rates for both utilities with the EAC.

DSM shareholder incentive: verification savings values

Where lost revenue verified net savings uses energy savings values that represent the best available information at the time of the verification, DSM shareholder incentive verified savings are calculated using the savings values leveraged during the program planning process.

DSM shareholder incentive: metric score

DSM shareholder incentive calculations are based on the verified metric achievement identified within each scorecard compared to the target value. For each metric, DNV GL first determines the percent of metric achieved.

$$\%\ Metric\ Achieved = \frac{achieved\ metric}{target\ metric}$$

If the achieved metric is less than or equal to the 2018 Target, the Metric Score is then calculated as:

$$Metric\ Score = 1 - \frac{0.25 * (target\ metric - achieved\ metric)}{(target\ metric - lower\ band)}$$

If the achieved metric is greater than the 2018 Target, the Metric Score is then calculated as:

$$Metric\ Score = 1 + \frac{0.5 * (achieved\ metric - target\ metric)}{(upper\ band - target\ metric)}$$

DSM shareholder incentive: weighted metric score

The weighted metric score is determined by multiplying the metric score by its corresponding weight. Each metric within the scorecard is weighted, with all weights within each scorecard summing to 100.00%. Per the OEB Decision and Order, the OEB approved maximum and minimum achievement limits per metric of 200% and 0%, respectively.[109] As a result, all Metric Scores are capped at 200%, thereby limiting the influence of any one metric within the weighted scorecard achievement calculation to twice its weight.

[109] OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016, page 80

DSM shareholder incentive: weighted scorecard achievement

The weighted metrics within each scorecard are summed to calculate the weighted scorecard achievement:

$$weighted\ scorecard\ achievement = \sum_{Scorecard} (weight * Metric\ Score)$$

DSM shareholder incentive: incentive calculation

The weighted scorecard achievement (WSA) is then used to calculate the Shareholder Incentive for that Scorecard. The appropriate calculation is dependent on the WSA value, as demonstrated in Table 6-133.

Table 6-133. Calculation to determine shareholder incentive

SWS Value	Incentive
<.75	0
.75≤WSA<1	$(40\%\ x\ Max\ Incentive)\frac{(WSA - 0.75)}{.25}$
1≤WSA<1.5	$(40\%\ Max\ Incentive) + (60\%\ Max\ Incentive) * \frac{(WSA - 1)}{0.5}$
1.5≤WSA	Max Incentive

The shareholder incentives for each scorecard are summed to calculate each utility's total incentive:

$$Total\ Incentive = \sum_{Utility} Scorecard\ Incentive$$

Example Calculations

Lost revenue

As an example, a widget carries a annual lost revenue verified savings value of 500 m^3 (annual, net savings). If that unit was installed in January, 500 m^3 (500 x 1.000) would be verified for lost revenue. If that same unit were installed in July, 250 m^3 (500 x 0.500) would be verified and if installed in November, 83.33 m^3 (500 x .1667). Table 6-134 shows the prorated total savings for all widgets with one installed per month, in 1000 m^3.

Table 6-134. Example lost revenue savings total for single rate class with monthly widget installation*

Month	Ratio (12-Month+1)/12	Units Installed	Lost Revenue Net Annual Gas Savings (m^3)	Prorated Energy Savings (m^3)	Lost Revenue Energy Savings (1000 m^3)
January	1.00	1	500	500.00	0.50
February	0.92	1	500	458.33	0.46
March	0.83	1	500	416.67	0.42
April	0.75	1	500	375.00	0.38
May	0.67	1	500	333.33	0.33
June	0.58	1	500	291.67	0.29
July	0.50	1	500	250.00	0.25
August	0.42	1	500	208.33	0.21
September	0.33	1	500	166.67	0.17
October	0.25	1	500	125.00	0.13
November	0.17	1	500	83.33	0.08
December	0.08	1	500	41.67	0.04
Total					**3.25**

*Not all values may compute exactly due to rounding.

In Table 6-135, the above example savings total is represented by Rate Class II – one widget per month was the sum of all measures performed within customers in that rate class. The verified lost revenue energy savings for the class are multiplied by the rate for that class to determine the lost revenue for that rate class; lost revenue for Rate Class II totalling $48.75 from energy savings of 3.25 at a rate of $15.00 per 1000 m^3. All applicable rate class lost revenue are then summed for total lost revenue.

Table 6-135. Example total lost revenue*

Rate Class	Lost Revenue Energy Savings (1000 m^3)	Rate ($/1000 m^3)	Lost Revenue
I	25.00	$5.55	$138.75
II	**3.25**	**$15.00**	**$48.75**
III	150.00	$1.50	$225.00
IV	100.00	$4.00	$400.00
V	5.10	$25.50	$130.05
VI	1.26	$10.00	$12.60
Total Lost Revenue			$955.15

*Not all values may compute exactly due to rounding.

DSM shareholder incentive

The first step in calculating the DSM shareholder incentive is to calculate the percent of the target metric that was achieved, which is a simple ratio of the achieved metric divided by the target metric. The second step is to determine the correct formula based on whether the verified achievement for the scorecard metric was at, above, or below the annual target. In the example in Table 6-136, the verified achievement for Scorecard A CCM was below the 2018 Target, so the formula for achievement below target is used to determine the metric score. The Verified Achievement for participants was above the 2018 Target, so the alternative calculation is used. Both formulas are illustrated below.

Table 6-136. Example metric score*

Scorecard	Metric	Verified Achievement	Lower Band	2018 Target	Upper Band	Metric Score
Scorecard A	CCM	9,000,000	7,500,000	10,000,000	15,000,000	0.9
	Participants	250	150	200	300	1.25

*Not all values may compute exactly due to rounding.

$$CCM\ Metric\ Score = 1 - \frac{.25 * (10{,}000{,}000 - 9{,}000{,}000)}{(10{,}000{,}000 - 7{,}500{,}000)} = 1 - 0.1 = 0.9$$

$$Participant\ Metric\ Score = 1 + \frac{0.5 * (250 - 200)}{(300 - 200)} = 1 + .25 = 1.25$$

The metric score for each metric is then multiplied by the applicable weight. In this example, CCM savings is weighted at 75% and participants at 25%. The weighted metric scores for the scorecard are summed for the weighted scorecard achievement.

Table 6-137. Example scorecard weighted score (SWS)*

Scorecard	Metric	Metric Score	Weight	Weighted Metric Score	Weighted Scorecard Achievement
Scorecard A	CCM	0.9	75%	0.675	0.9875
	Participants	1.25	25%	0.3125	

*Not all values may compute exactly due to rounding.

For Scorecard A, if we assume a maximum incentive value of $100,000, a weighted scorecard achievement of 0.9875 would result in an incentive of $38,000, as demonstrated below.

$$(40\% \; x \; \$100{,}000)\frac{(0.9875 - .75)}{.25} = \$40{,}000 \; x \; \frac{(0.2375)}{.25} = \$40{,}000 \; x \; 0.95 = \$38{,}000$$

Appendix N Lost revenue and DSM shareholder incentive: detailed tables

Enbridge DSM shareholder incentive

Table 6-138. Enbridge's 2018 Resource Acquisition targets, achievements, and incentive*

Metric	Target	Verified Achievement	Weight	Metric Score	Weighted Metric Score
Large Volume Customer - CCM	508,459,624	377,787,998	40.00%	74.30%	29.72%
Small Volume Customer - CCM	297,087,649	299,541,383	40.00%	100.80%	40.32%
Participants	9,235	14,413	20.00%	156.10%	31.22%
Verified Total Weighted Scorecard Achieved					101.26%
Maximum Scorecard Incentive					$7,119,472
Verified Scorecard Incentive Achieved					**$2,955,435**

*Not all values may compute exactly due to rounding.

Table 6-139. Enbridge's 2018 Low Income scorecard targets, achievements, and incentive*

Metric	Target	Verified Achievement	Weight	Metric Score	Weighted Metric Score
Home Winterproofing CCM	28,523,764	15,978,390	45.00%	56.00%	25.20%
Low Income Multi Residential CCM	97,545,599	114,168,901	45.00%	117.00%	52.65%
Low Income New Construction Applications	14	13	10.00%	91.70%	9.17%
Verified Total Weighted Scorecard Achieved					87.02%
Maximum Scorecard Incentive					$2,195,295
Verified Scorecard Incentive Achieved					**$422,199**

*Not all values may compute exactly due to rounding.

Table 6-140. Enbridge's 2018 Market Transformation scorecard targets, achievements, and incentive*

Metric	Target	Verified Achievement	Weight	Metric Score	Weighted Metric Score
School Energy Competition Schools	78	14	10.00%	15.80%	1.58%
Run-it-Right Participants	24	62	20.00%	200.00%	40.00%
Comprehensive Energy Management Participants	21	5	20.00%	20.00%	4.00%
Residential Savings by Design Builders	20	35	10.00%	175.00%	17.50%
Residential Savings by Design Homes	2,179	2,956	15.00%	135.60%	20.34%
Commercial Savings by Design Developments	28	31	25.00%	110.70%	27.68%
Verified Total Weighted Scorecard Achieved					111.10%
Maximum Scorecard Incentive					$1,135,233
Verified Scorecard Incentive Achieved					**$605,238**

*Not all values may compute exactly due to rounding.

Union DSM shareholder incentive

Table 6-141. Union's 2018 Resource Acquisition targets, achievements, and incentive*

Metric	Target	Verified Achievement	Weight	Metric Score	Weighted Metric Score
CCM	818,345,497	976,937,929	75.00%	119.40%	89.55%
Home Reno Rebate Homes Built	8,010	16,118	25.00%	200.00%	50.00%
Verified Total Weighted Scorecard Achieved					139.55%
Maximum Scorecard Incentive					$6,642,647
Verified Scorecard Incentive Achieved					**$5,809,659**

*Not all values may compute exactly due to rounding.

Table 6-142. Union's 2018 Low Income targets, achievements, and incentive*

Metric	Target	Verified Achievement	Weight	Metric Score	Weighted Metric Score
Single Family CCM	41,007,862	32,052,374	60.0%	78.2%	46.9%
Multi-Family - Social & Assisted CCM	23,224,249	19,718,214	35.0%	84.9%	29.7%
Multi-Family - Market Rate CCM	4,518,793	6,573,109	5.0%	145.5%	7.3%
Verified Total Weighted Scorecard Achieved					83.9%
Maximum Scorecard Incentive					$2,460,797
Verified Scorecard Incentive Achieved					**$350,811**

*Not all values may compute exactly due to rounding.

Table 6-143. Union's 2018 Large Volume targets, achievements, and incentive*

Metric	Target	Verified Achievement	Weight	Metric Score	Weighted Metric Score
CCM	195,727,318	89,196,896	100.00%	45.60%	45.60%
Verified Total Weighted Scorecard Achieved**					45.60%
Maximum Scorecard Incentive					$725,313
Verified Scorecard Incentive Achieved					**$0.00**

*Not all values may compute exactly due to rounding.
**A minimum total weighted scorecard achievement level of 75% is required to earn a portion of the available shareholder incentive.

Table 6-144. Union's 2018 Market Transformation targets, achievements, and incentive*

Metric	Target	Verified Achievement	Weight	Metric Score	Weighted Metric Score
Optimum Home Builders	8	8	10.00%	100.00%	10.00%
Optimum Home Homes	60.00%	83.33%	30.00%	138.90%	41.67%
Optimum Home Percentage of Homes Built	5.00%	3.97%	10.00%	79.40%	7.94%
Commercial New Construction Developments	19	18	50.00%	95.00%	47.50%
Verified Total Weighted Scorecard Achieved					107.11%
Maximum Scorecard Incentive					$423,958
Verified Scorecard Incentive Achieved					**$205,755**

*Not all values may compute exactly due to rounding.

Table 6-145. Union's 2018 Performance Based targets, achievements, and incentive*

Metric	Target	Verified Achievement	Weight	Metric Score	Weighted Metric Score
RunSmart Participants	44	44	10.00%	100.00%	10.00%
RunSmart Savings %	1.96%	0.51%	40.00%	26.00%	10.40%
Strategic Energy Management Participants	3	3	10.00%	100.00%	10.00%
Strategic Energy Management Savings %	5.00%	3.86%	40.00%	77.20%	30.88%
Verified Total Weighted Scorecard Achieved					61.28%
Maximum Scorecard Incentive					$197,285
Verified Scorecard Incentive Achieved					**$0.00**

*Not all values may compute exactly due to rounding.
**A minimum total weighted scorecard achievement level of 75% is required to earn a portion of the available shareholder incentive.

Enbridge Lost Revenue

Table 6-146. Enbridge lost revenue volumes (10^3 m^3) by rate class, prorated by month*

Rate Class	Savings Volume by Month (1,000 m3)												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Rate 110	-	1	-	-	-	16	2	-	47	53	203	58	380
Rate 115	-	-	-	-	-	-	29	80	-	-	-	63	171
Rate 135	-	-	-	-	-	-	-	-	9	-	25	137	171
Rate 145	-	-	7	-	-	-	-	490	-	-	-	1	498
Rate 170	-	-	-	-	-	-	-	-	-	-	-	71	71
TOTAL	**-**	**1**	**7**	**-**	**-**	**16**	**31**	**570**	**56**	**53**	**228**	**330**	**1,292**

*Not all values may compute exactly due to rounding.

Table 6-147. Enbridge lost revenue volumes (10^3 m^3) total volume, delivery rates, and revenue impact by rate class*

Rate Class	Savings Volume (1,000 m3)	Delivery Rate ($/1,000 m3)	Revenue Impact ($)
Rate 110	380	$5.45	$2,073
Rate 115	171	$0.00	$0
Rate 135	171	$17.01	$2,902
Rate 145	498	$11.39	$5,678
Rate 170	71	$2.43	$173
TOTAL	**1,292**		**$10,827**

*Not all values may compute exactly due to rounding.

Union Lost Revenue

Table 6-148. Union lost revenue volumes (10^3 m^3) by rate class, prorated by month*

Rate Class	Savings Volume by Month (1,000 m3)												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
M4 Industrial	2,095	808	1,389	92	1,075	550	182	543	541	249	265	511	8,301
M5 Industrial	52	-	43	41	70	4	-	-	-	69	26	-	305
M7 Industrial	1,468	-	141	72	136	63	473	14	81	95	343	27	2,914
T1 Industrial	258	3	17	15	13	1,005	44	5	-	37	4	-	1,402
T2 Industrial	2,832	30	-	149	218	581	491	94	223	202	73	-	4,893
20 Industrial	809	112	-	53	38	691	1	9	13	63	1	0	1,789
100 Industrial	23	-	-	10	-	13	-	10	1	65	33	-	155
TOTAL	**7,537**	**953**	**1,591**	**431**	**1,551**	**2,908**	**1,192**	**674**	**860**	**779**	**745**	**538**	**19,759**

*Not all values may compute exactly due to rounding.

Table 6-149. Union lost revenue volumes (10^3 m^3) total volume, delivery rates, and revenue impact by rate class*

Rate Class	Savings Volume (1,000 m3)	Delivery Rate ($/1,000 m3)	Revenue Impact ($)
M4 Industrial	8,301	$15.47	$128,413
M5 Industrial	305	$27.19	$8,297
M7 Industrial	2,914	$3.39	$9,878
T1 Industrial	1,402	$1.09	$1,528
T2 Industrial	4,893	$0.26	$1,272
20 Industrial	1,789	$5.37	$9,609
100 Industrial	155	$2.20	$342
TOTAL	**19,759**		**$159,339**

*Not all values may compute exactly due to rounding.

Appendix O Prescriptive Savings Verification

This appendix describes the detailed process used to verify the reported (tracked) prescriptive and quasi-prescriptive savings for Enbridge and Union.

Data Sources

Verification of prescriptive measures relies on several data sources provided by Enbridge and Union.

Tracking Files

The EC received one tracking file each from Enbridge and Union. Both tracking files are Excel files, and include prescriptive measures and additional information for measures from non-prescriptive programs.

TRM - Joint Submissions

The EC utilized documents titled "New and Updated DSM Measures - Joint Submission from Union Gas Ltd. and Enbridge Gas Distribution," referred to in this report as TRMs. The EC used the December 2017 TRM (TRM 2.0) as the primary source for identifying prescribed values, such as energy savings and measure life, for prescriptive measures. In addition to that primary TRM, the EC also used TRM 3.0[110].

Other Supporting Documentation

The Joint Submission documents did not contain all of the necessary detail to verify the savings for all measures. Some measures were described at a level of detail that was not contained in the December 2016 Joint Submission. For example, Union Gas' C&I Prescriptive Demand Controlled Ventilation measure descriptions were expanded in the December 2017 TRM (TRM 2.0) to include additional equipment types. All prescriptive measures and corresponding verification sources are listed in the tables at the end of this appendix.

In addition to the TRMs, the EC also used the following for verification of savings for prescriptive measures, as cited in the tables at the end of this appendix.

- C&I Prescriptive Showerheads, Enbridge, "Showerhead Verification Among Rental Buildings", Ipsos Research, March, 2012
- C&I Prescriptive Boiler Cycling Controls, Union, "Boiler Cycling Controls Document": DSM Opportunities Associated with Boiler Load Controls, NGTC
- C&I Prescriptive Condensing Boilers, Union, "Condensing Boilers Document": Prescriptive Commercial Boiler Program – Prescriptive Savings Analysis, AMEC Environmental and Infrastructure, November, 8, 2012
- C&I Prescriptive Demand Controlled Ventilation, Union, "Demand Controlled Ventilation Expanded Document"
- C&I Prescriptive High Efficiency Boilers, Enbridge, "High Efficiency Boiler Document"
- Low-Income Multi-Residential Showerheads, Enbridge, "Multi-Residential Low-Income Showerhead Verification": 2012 Multi-Residential Low-Income Showerhead Verification for Enbridge Gas, Ipsos Research, March 2013

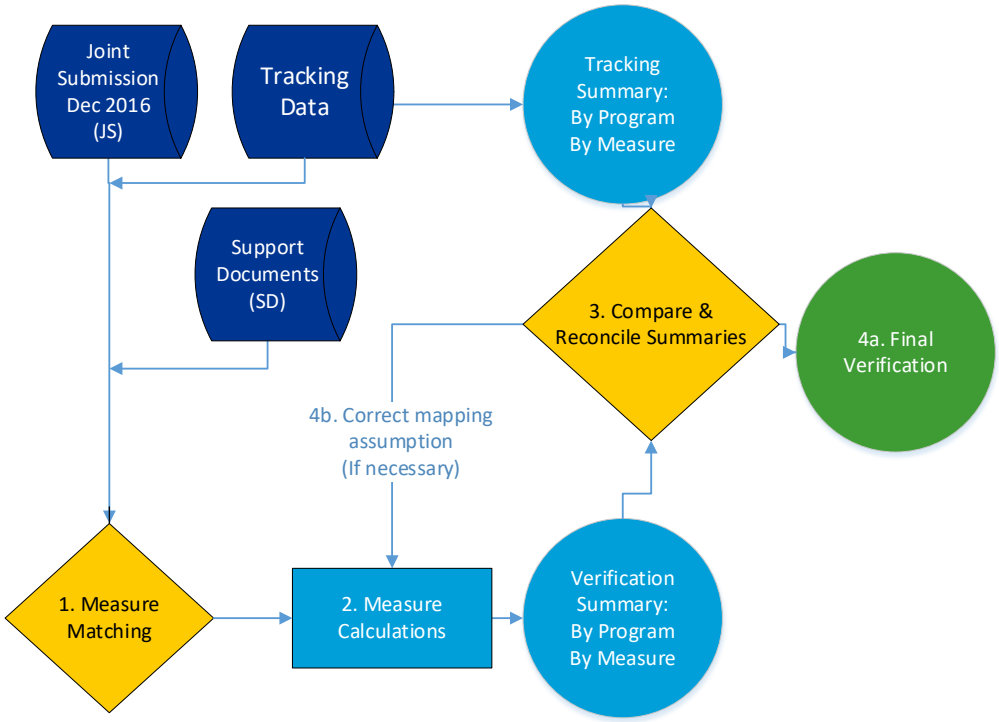
[110] Natural Gas Demand Side Management Technical Resource Manual Version 3.0

- "TAPS Report", TAPS Verification Program 2012 Year End Research Report, Study CR-604, Quadra Research, April 3, 2013

Overall Methodology

The EC used a straightforward process to consistently verify savings for both utilities, summarized in Figure 6-9.

Figure 6-9. Savings verification process



The process includes the following high-level steps. Additional detail is presented below.

1. Manually match individual project measure savings against Joint Submission (JS) and Support Documents (SD) values, based first on measure name and then on other attributes, to calculate savings.
2. Calculate gross and net annual and lifetime savings for all measures.
3. Compare the summarized calculated savings and the tracked savings to identify discrepancies or disagreements.
4. When the EC determined that a discrepancy was due to an error in assigning the correct savings value, the EC assigned a new savings value to the measure and re-compared totals (4b). Once the EC resolved the correct savings value (through continued investigation of measure or clarification with utility) the record was verified (4a).

Table 6-150 shows the variables used from the utility tracking data to verify, summarize, and reconcile savings values. While variables such as measure life or free ridership were present in the tracking data, these were not used by the EC to calculate verified savings, but to identify discrepancies between

verification and tracking summaries when comparing and reconciling savings totals. The EC used TRM or SD values for the verified savings calculations.

Table 6-150. Tracking variables used for prescriptive savings verification

Tracking Variable	Used In		
	Verification/ Summary	Tracking Summary	Compare & Reconcile Summaries
Scorecard	X		X
Program	X		X
Decision Type (Early Replace, Retrofit, etc.)	X		X
Measure Name	X		X
End Use	X		X
Building Type	X		X
Number of Units	X		X
Capacity	X		X
Measure Life			X
Free Rider			X
Adjustment Factor			X
Gross Annual Natural Gas Savings (m3)		X	X
Net Annual Natural Gas Savings (m3)		X	X
Gross Cumulative Natural Gas Savings (m3)		X	X
Net Cumulative Natural Gas Savings (m3)		X	X

1. Measure Matching

The EC manually mapped measures into groups. Measures were filtered by name to assign them to a group, then matched against the TRM and SD measures to identify the correct savings values. For each project, the EC confirmed that the savings value listed for the measure matched the value listed for that measure type in the TRM and SD. The tables at the end of this appendix lists all tracked measure groups and their corresponding savings values and JS or SC source for Enbridge and Union, respectively.

2. Measure Calculations

There are two types of prescriptive measure calculations: Pure-Prescriptive and Quasi-Prescriptive. Quasi-Prescriptive measure savings require more than the per unit savings and the number of units to determine annual gross savings. For example, some boiler measures require the capacity of the boiler. Table 6-151 summarizes the differences between the two types.

Table 6-151. Explanation of calculation inputs for two types of prescriptive measures

Savings Type	Purely Prescriptive	Quasi-Prescriptive
Annual Gross	Per Unit Savings * # of Units	Unit Capacity Savings * Unit Capacity * # of Units
Annual Net	Annual Gross * (1 - Free Ridership) * Adjustment	
Lifetime Gross	Annual Gross * Measure Life	
Lifetime Net (CCM)	Annual Net * Measure Life	

The EC used Excel macros to identity savings inputs and apply savings calculations. The use of macros ensured consistent application of savings calculations and allowed for quick and accurate savings updates. The tables at the end of this appendix lists all calculated measure totals, as verified by the EC.

3. Compare & Reconcile Summaries

The EC summed savings values from utility tracking and from EC verification calculations by program and measure type, and tabulated by Annual Gross, Annual Net, Lifetime Gross, Lifetime Net, and project measure counts. The EC did this with the Pivot Table function in Excel, creating Tracking (utility tracking data) and Verification (EC calculated) Summaries, which provided two benefits. First, the EC was able to identify discrepancies between listed measure names, because any differences would result in a different number of summary rows between the two tables. Second, the pivot tables allowed for quick and accurate updates when the EC performed adjustments to our original matches.

By reviewing differences between the two summaries, the EC identified errors in the EC matches and differences between the EC matches and the original utility tracking data, allowing us to investigate the discrepancies. The tavles at the end of this appendix lists all verification discrepancies where:

- **The tracking data did not contain sufficient information to identify savings:** In general, these measures were resolved with additional documentation and resulted in no change to savings. They are listed in this appendix to document the evaluation process and communication between the evaluator and the utility.
- **The tracking data was incorrect:** This may have been because different savings factors were identified through the verification process. The tables include the details for each measure.

4. Final Verification

Once all tracked measures were matched to TRM values, the savings calculated, and all discrepancies reconciled or explained, verified savings summaries were finalized. Final savings totals for each program are available within the appropriate appendix in this report.

Savings Calculation Values

Savings tables in this section utilize measure names and units from the TRM wherever possible. Utilities utilized different units (BTU vs kBTU) or name variations, those are not used here.

Table 6-152. Enbridge measure savings calculation values*

Program	Measure	Pure or Quasi	Source	Savings Factor (m^3)	Unit	EUL	Gross Realization Rate	Free Ridership	Adjustment Factor
Residential Adaptive Thermostats	Residential Adaptive Thermostat	Pure	TRM 2.0	185.00	unit	15	100.00%	4%	100%
C&I Prescriptive	Air Door Double 8x6 Cx Offer	Pure	TRM 2.0	3,243.00	unit	15	100.00%	5%	100%
C&I Prescriptive	Air Door Double with Vestibule 7x3 Cx Offer	Pure	TRM 2.0	909.00	unit	15	100.00%	5%	100%
C&I Prescriptive	Air Door 8x10 Cx Campaign	Pure	TRM 2.0	15,135.00	unit	15	100.00%	5%	100%
C&I Prescriptive	Air Door Single 7x6 Cx Offer	Pure	TRM 2.0	1,343.00	unit	15	100.00%	5%	100%
C&I Prescriptive	DCKV up to 5000 CFM Cx Offer	Pure	TRM 2.0, 2017 C&I Prescriptive Verification Study	4,207.00	unit	15	102.74%	5%	100%
C&I Prescriptive	DCKV 10001 - 15000 CFM Cx Offer	Pure	TRM 2.0, 2017 C&I Prescriptive Verification Study	17,529.00	unit	15	102.74%	5%	100%
C&I Prescriptive	DCKV 5001 - 10000 CFM Cx Offer	Pure	TRM 2.0, 2017 C&I Prescriptive Verification Study	10,517.00	unit	15	102.74%	5%	100%
C&I Prescriptive	Destratification Fan Cx Offer	Pure	TRM 2.0	1,734.00	unit	15	100.00%	10%	100%
C&I Prescriptive	Destratification Fan Cx Offer	Pure	TRM 2.0	583.00	unit	15	100.00%	10%	100%
C&I Prescriptive	DW Under-Counter High Temp Cx Offer	Pure	TRM 2.0	137.00	unit	10	100.00%	40%	100%
C&I Prescriptive	Fryer Cx Offer	Pure	TRM 2.0	1,408.00	unit	12	100.00%	20%	100%
C&I Prescriptive	Fryer Cx Campaign	Pure	TRM 2.0	1,408.00	unit	12	100.00%	20%	100%
C&I Prescriptive	Showerhead Offer	Pure	TRM 2.0, Showerhead Verification Study Among Rental Buildings	30.60	unit	10	100.00%	10%	85%

Program	Measure	Pure or Quasi	Source	Savings Factor (m^3)	Unit	EUL	Gross Realization Rate	Free Ridership	Adjustment Factor
C&I Prescriptive	Cond Boiler 200-299 MBH Cx Offer	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	0.00996	BTU/hour	25	100.00%	5%	100%
C&I Prescriptive	Cond Boiler 200-299 MBH Cx Campiagn	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	0.01019	BTU/hour	25	100.00%	5%	100%
C&I Prescriptive	Cond Strge W/H Low Retail 75-250 Kbtu Cx Offer	Quasi	TRM 2.0	1.36000	kBTU/hour input capacity	15	100.00%	5%	100%
C&I Prescriptive	Cond Strge W/H Low Other 75-250 Kbtu Cx Campaign	Quasi	TRM 2.0	1.36000	kBTU/hour input capacity	15	100.00%	5%	100%
C&I Prescriptive	Cond Strge W/H High Multi-Res 75-250 Kbtu Cx Campaign	Quasi	TRM 2.0	3.09000	kBTU/hour input capacity	15	100.00%	5%	100%
C&I Prescriptive	Cond Strge W/H High Multi-Res >250 Kbtu Cx Campaign	Quasi	TRM 2.0	3.09000	kBTU/hour input capacity	15	100.00%	5%	100%
C&I Prescriptive	Cond Strge W/H Med Other > 250Kbtus Cx Offer	Quasi	TRM 2.0	2.22000	kBTU/hour input capacity	15	100.00%	5%	100%
C&I Prescriptive	Cond Tankless High Other >75 and < 200Kbtu Cx Campaign	Mixed	TRM 2.0	212+1.79	unit + kBTU/hour input capacity	20	100.00%	2%	100%
C&I Prescriptive	Cond Tankless Med Other >75 and < 200Kbtu Cx Campaign	Mixed	TRM 2.0	212+1.29	unit + kBTU/hour input capacity	20	100.00%	2%	100%
C&I Prescriptive	Cond Unit Heater 225-300 Kbtu Cx Campaign	Quasi	TRM 2.0	7.89000	kBTU/hour input capacity	18	100.00%	0%	100%
C&I Prescriptive	DCV Single Zone Retail with NO Maintenance Cx Offer	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	0.39200	ft^2	10	104.14%	5%	100%
C&I Prescriptive	ERV Vent Med Stand Hotel 65% - 74% Cx Offer	Quasi	TRM 2.0	3.31000	CFM	14	100.00%	5%	100%

Program	Measure	Pure or Quasi	Source	Savings Factor (m^3)	Unit	EUL	Gross Realization Rate	Free Ridership	Adjustment Factor
C&I Prescriptive	HRV Vent Med Int Hotel 65% - 74%Cx Offer	Quasi	TRM 2.0	2.78000	CFM	14	100.00%	5%	100%
C&I Prescriptive	High Boiler 600 - 999 MBH Cx Offer	Pure	High Efficiency Boiler Subdocument, 2017 C&I Prescriptive Verification Study	3,076.00	unit	25	100.00%	20%	100%
C&I Prescriptive	High Boiler 1000-1499MBH Cx Offer	Pure	High Efficiency Boiler Subdocument, 2017 C&I Prescriptive Verification Study	12,141.00	unit	25	100.00%	12%	100%
C&I Prescriptive	High Boiler 1000-1499MBH Cx Campaign	Pure	High Efficiency Boiler Subdocument, 2017 C&I Prescriptive Verification Study	12,141.00	unit	25	100.00%	12%	100%
C&I Prescriptive	High Boiler 1500 - 1999 MBH Cx Offer	Pure	High Efficiency Boiler Subdocument, 2017 C&I Prescriptive Verification Study	19,189.00	unit	25	100.00%	12%	100%
C&I Prescriptive	High Boiler 1000-1499MBH Cx Campaign	Pure	High Efficiency Boiler Subdocument, 2017 C&I Prescriptive Verification Study	5,431.00	unit	25	100.00%	20%	100%
C&I Prescriptive	High Boiler 1000-1499MBH Cx Offer	Pure	High Efficiency Boiler Subdocument, 2017 C&I Prescriptive Verification Study	5,431.00	unit	25	100.00%	20%	100%
C&I Prescriptive	High Boiler 600-999 MBH Cx Offer	Pure	High Efficiency Boiler Subdocument, 2017 C&I Prescriptive Verification Study	3,076.00	unit	25	100.00%	20%	100%
C&I Prescriptive	Infrared 2-Stage 165,000-300,000 Cx Campaign	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	9.80000	kBTU/hour input capacity	17	102.68%	33%	100%
C&I Prescriptive	Infrared Single Stage 165,000 - 300,000 Cx Offer	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	11.50000	kBTU/hour input capacity	17	102.68%	33%	100%
C&I Prescriptive	Infrared Single Stage 165,000 - 300,000 Cx Offer	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	8.60000	kBTU/hour input capacity	17	102.68%	33%	100%
C&I Prescriptive	Infrared Single Stage 50,000-164,999 Cx Offer	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	11.50000	kBTU/hour input capacity	17	102.68%	33%	100%

Program	Measure	Pure or Quasi	Source	Savings Factor (m^3)	Unit	EUL	Gross Realization Rate	Free Ridership	Adjustment Factor
C&I Prescriptive	Infrared Single Stage 50,000-164,999 Cx Campaign	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	11.50000	kBTU/hour input capacity	17	102.68%	33%	100%
C&I Prescriptive	School Board Boiler Secondary Cx Offer	Pure	TRM 2.0, 2017 C&I Prescriptive Verification Study	49,476.00	unit	25	100.00%	12%	100%
C&I Prescriptive	School Board Boiler Secondary Cx Campaign	Pure	TRM 2.0, 2017 C&I Prescriptive Verification Study	49,476.00	unit	25	100.00%	12%	100%
C&I Prescriptive	Ozone Washer Extractor =/< 60lbs Cx Campaign	Quasi	TRM 2.0	0.03830	pounds/year	15	100.00%	8%	100%
C&I Prescriptive	Ozone Washer Extractor >60lbs and <500lbs Cx Campaign	Quasi	TRM 2.0	0.03830	pounds/year	15	100.00%	8%	100%
C&I Prescriptive	Air Door Double 7x6 Cx Offer	Pure	TRM 2.0	2,686.00	unit	15	100.00%	5%	100%
C&I Prescriptive	Air Door Double with Vestibule 7x6 Cx Offer	Pure	TRM 2.0	1,817.00	unit	15	100.00%	5%	100%
C&I Prescriptive	Air Door Single with Vestibule 7x6 Cx Offer	Pure	TRM 2.0	909.00	unit	15	100.00%	5%	100%
C&I Prescriptive	Air Door 8x10 Cx Offer	Pure	TRM 2.0	15,135.00	unit	15	100.00%	5%	100%
C&I Prescriptive	DCKV up to 5000 CFM Cx Campaign	Pure	TRM 2.0, 2017 C&I Prescriptive Verification Study	4,207.00	unit	15	102.74%	5%	100%
C&I Prescriptive	DCKV 5001 - 10000 CFM Cx Campaign	Pure	TRM 2.0, 2017 C&I Prescriptive Verification Study	10,517.00	unit	15	102.74%	5%	100%
C&I Prescriptive	Cond Boiler 100-199MBH Cx Campaign	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	0.01332	BTU/hour	25	100.00%	5%	100%
C&I Prescriptive	Cond Boiler 100-199MBH Cx Offer	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	0.01332	BTU/hour	25	100.00%	5%	100%
C&I Prescriptive	Cond Boiler 100-199MBH Cx Offer	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	0.01019	BTU/hour	25	100.00%	5%	100%

Program	Measure	Pure or Quasi	Source	Savings Factor (m^3)	Unit	EUL	Gross Realization Rate	Free Ridership	Adjustment Factor
C&I Prescriptive	Cond Boiler 100-199MBH Cx Campaign	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	0.01019	BTU/hour	25	100.00%	5%	100%
C&I Prescriptive	Cond Boiler 200-299 MBH Cx Offer	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	0.01019	BTU/hour	25	100.00%	5%	100%
C&I Prescriptive	Cond Furnace up to 74 Kbtu Cx Campaign	Quasi	TRM 2.0	3.11000	kBTU/hour	18	100.00%	18%	100%
C&I Prescriptive	Cond Furnace 75 - 149 Kbtu Cx Campaign	Quasi	TRM 2.0	3.11000	kBTU/hour	18	100.00%	18%	100%
C&I Prescriptive	Cond Furnace 75-149 Kbtu's Cx Offer	Quasi	TRM 2.0	3.11000	kBTU/hour	18	100.00%	18%	100%
C&I Prescriptive	Cond Strge W/H Low Other >250 Kbtu Cx Campaign	Quasi	TRM 2.0	1.36000	kBTU/hour input capacity	15	100.00%	5%	100%
C&I Prescriptive	Cond Strge W/H High Other >250 Kbtu Cx Campaign	Quasi	TRM 2.0	3.09000	kBTU/hour input capacity	15	100.00%	5%	100%
C&I Prescriptive	Cond Strge W/H High Other 75-250 Kbtu Cx Campaign	Quasi	TRM 2.0	3.09000	kBTU/hour input capacity	15	100.00%	5%	100%
C&I Prescriptive	Cond Strge W/H Med Other 75-250 Kbtu Cx Campaign	Quasi	TRM 2.0	2.22000	kBTU/hour input capacity	15	100.00%	5%	100%
C&I Prescriptive	Cond Tankless Low Other >75 and < 200Kbtu Cx Campaign	Mixed	TRM 2.0	212+0.79	unit + kBTU/hour input capacity	20	100.00%	2%	100%
C&I Prescriptive	Cond Tankless Low Retail >75 and < 200Kbtu Cx Campaign	Mixed	TRM 2.0	212+0.79	unit + kBTU/hour input capacity	20	100.00%	2%	100%
C&I Prescriptive	DCV Single Zone Retail with Maintenance Cx Offer	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	0.39200	ft^2	15	104.14%	5%	100%
C&I Prescriptive	DCV Single Zone Retail with Maintenance Cx Offer	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	0.39200	ft^2	15	104.14%	20%	100%

Program	Measure	Pure or Quasi	Source	Savings Factor (m^3)	Unit	EUL	Gross Realization Rate	Free Ridership	Adjustment Factor
C&I Prescriptive	ERV Vent High Stand Multi Res 75% - 84% Cx Offer	Quasi	TRM 2.0	6.90000	CFM	14	100.00%	5%	100%
C&I Prescriptive	ERV Vent Low Int Office 75% - 84% Cx Offer	Quasi	TRM 2.0	2.45000	CFM	14	100.00%	5%	100%
C&I Prescriptive	ERV Vent Low Stand Office 65% - 74% Cx Offer	Quasi	TRM 2.0	2.11000	CFM	14	100.00%	5%	100%
C&I Prescriptive	ERV Vent Low Stand Office 75% - 84% Cx Offer	Quasi	TRM 2.0	2.45000	CFM	14	100.00%	5%	100%
C&I Prescriptive	HRV Vent Low Stand Office 65% - 74% Cx Offer	Quasi	TRM 2.0	1.78000	CFM	14	100.00%	5%	100%
C&I Prescriptive	High Boiler 300 - 599 MBH Cx Offer	Pure	High Efficiency Boiler Subdocument, 2017 C&I Prescriptive Verification Study	3,496.00	unit	25	100.00%	12%	100%
C&I Prescriptive	High Boiler 1500 - 1999 MBH Cx Offer	Pure	High Efficiency Boiler Subdocument, 2017 C&I Prescriptive Verification Study	19,189.00	unit	25	100.00%	20%	100%
C&I Prescriptive	Infrared 2-Stage 50,000-164,999 Cx Campaign	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	13.10000	kBTU/hour input capacity	17	102.68%	33%	100%
C&I Prescriptive	Infrared 2-Stage 50,000-164,999 Cx Offer	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	9.80000	kBTU/hour input capacity	17	102.68%	33%	100%
C&I Prescriptive	Infrared 2-Stage 50,000-164,999 Cx Campaign	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	9.80000	kBTU/hour input capacity	17	102.68%	33%	100%
C&I Prescriptive	Infrared Single Stage 165,000 - 300,000 Cx Campaign	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	11.50000	kBTU/hour input capacity	17	102.68%	33%	100%
C&I Prescriptive	Infrared Single Stage 165,000 - 300,000 Cx Campaign	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	8.60000	kBTU/hour input capacity	17	102.68%	33%	100%

Program	Measure	Pure or Quasi	Source	Savings Factor (m^3)	Unit	EUL	Gross Realization Rate	Free Ridership	Adjustment Factor
C&I Prescriptive	Infrared Single Stage 50,000-164,999 Cx Campaign	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	8.60000	kBTU/hour input capacity	17	102.68%	33%	100%
C&I Prescriptive	Infrared Single Stage 50,000-164,999 Cx Offer	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	8.60000	kBTU/hour input capacity	17	102.68%	33%	100%
C&I Prescriptive	School Board Boiler Elementary Cx Campaign	Pure	TRM 2.0, 2017 C&I Prescriptive Verification Study	12,217.00	unit	25	100.00%	12%	100%
C&I Prescriptive	School Board Boiler Elementary Cx Offer	Pure	TRM 2.0, 2017 C&I Prescriptive Verification Study	12,217.00	unit	25	100.00%	12%	100%
C & I Direct Install	Direct Install Air Door 10x10 Cx Offer	Pure	TRM 2.0	20,796.00	unit	15	100.00%	5%	100%
C & I Direct Install	Direct Install Air Door 8x10 Cx Offer	Pure	TRM 2.0	15,135.00	unit	15	100.00%	5%	100%
C & I Direct Install	Direct Install Air Door 8x8 Cx Offer	Pure	TRM 2.0	12,108.00	unit	15	100.00%	5%	100%
C & I Direct Install	Direct Install DCV Offer	Quasi	TRM 2.0	0.39200	ft^2	15	100.00%	5%	100%
C & I Direct Install	Direct Install DCKV 10001 - 15000 CFM Cx Offer	Pure	TRM 2.0	17,529.00	unit	15	100.00%	5%	100%
C & I Direct Install	Direct Install DCKV 5001 - 10000 CFM Cx Offer	Pure	TRM 2.0	10,517.00	unit	15	100.00%	5%	100%
C & I Direct Install	Direct Install Air Door Single 7x3 Cx Offer	Pure	TRM 2.0	671.00	unit	15	100.00%	5%	100%
C & I Direct Install	Direct Install Air Door Single 7x6 Cx Offer	Pure	TRM 2.0	1,343.00	unit	15	100.00%	5%	100%
C & I Direct Install	Direct Install Air Door Single 8x6 Cx Offer	Pure	TRM 2.0	1,622.00	unit	15	100.00%	5%	100%
C & I Prescriptive	Air Door 10x10 Cx Offer	Pure	TRM 2.0	20,796.00	unit	15	100.00%	5%	100%
C & I Prescriptive	Air Door 8x8 Cx Offer	Pure	TRM 2.0	12,108.00	unit	15	100.00%	5%	100%

Program	Measure	Pure or Quasi	Source	Savings Factor (m^3)	Unit	EUL	Gross Realization Rate	Free Ridership	Adjustment Factor
C & I Prescriptive	Ind Infrared 2-Stage 165,000 -300,000 Cx Campagin	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	13.10000	kBTU/hour input capacity	17	102.68%	33%	100%
C & I Prescriptive	Ind Infrared 2-Stage 50,000 - 164,999 Cx Campaign	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	13.10000	kBTU/hour input capacity	17	102.68%	33%	100%
C & I Prescriptive	Ind Infrared Single Stage 165,000 - 300,000 Cx Offer	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	11.50000	kBTU/hour input capacity	17	102.68%	33%	100%
C & I Prescriptive	Ind Infrared Single Stage 50,000- 164,999 Cx Offer	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	11.50000	kBTU/hour input capacity	17	102.68%	33%	100%
C & I Prescriptive	Air Door 10x10 DI Campaign	Pure	TRM 2.0	20,796.00	unit	15	100.00%	5%	100%
C & I Prescriptive	Air Door 8x10 MM 20% Bonus Offer	Pure	TRM 2.0	15,135.00	unit	15	100.00%	5%	100%
C & I Prescriptive	Ind Infrared 2-Stage 50,000 - 164,999 Cx Campaign	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	9.80000	kBTU/hour input capacity	17	102.68%	33%	100%
C & I Prescriptive	Ind Infrared Single Stage 165,000 - 300,000 Cx Campaign	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	11.50000	kBTU/hour input capacity	17	102.68%	33%	100%
C & I Prescriptive	Ind Infrared Single Stage 165,000 - 300,000 Cx Offer	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	8.60000	kBTU/hour input capacity	17	102.68%	33%	100%
C & I Prescriptive	Ind Infrared Single Stage 50,000- 164,999 Cx Campaign	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	11.50000	kBTU/hour input capacity	17	102.68%	33%	100%
C & I Prescriptive	Ind Infrared Single Stage 50,000- 164,999 Cx Campaign	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	8.60000	kBTU/hour input capacity	17	102.68%	33%	100%
Home Winterproofing	LI Prescriptive - Adaptive Thermostats	Pure	TRM 2.0	185.00	unit	15	100.00%	0%	100%
Home Winterproofing	LI Prescriptive - Bathroom Aerators	Pure	TRM 2.0, TAPS Report	6.40	unit	10	100.00%	0%	23%
Home Winterproofing	LI Prescriptive - Kitchen Aerators	Pure	TRM 2.0, TAPS Report	11.56	unit	10	100.00%	0%	34%

Program	Measure	Pure or Quasi	Source	Savings Factor (m^3)	Unit	EUL	Gross Realization Rate	Free Ridership	Adjustment Factor
Home Winterproofing	LI Prescriptive - Showerheads 2.6+	Pure	TRM 2.0, Low Income Showerhead Verification Study	25.35	unit	10	100.00%	0%	88%
Home Winterproofing	LI Prescriptive - Programmable Thermostats	Pure	TRM 2.0	46.00	unit	15	100.00%	0%	100%
Low Income Multi-Residential	Low Income Showerhead Offer	Pure	TRM 2.0, Low Income Showerhead Verification Study	30.60	unit	10	100.00%	0%	88%
Low Income Multi-Residential	Low Income Showerheads Offer	Pure	TRM 2.0, Low Income Showerhead Verification Study	30.60	unit	10	100.00%	0%	88%
Low Income Multi-Residential	Low Income Condensing Boiler up to 299MBH Cx Offer	Quasi	TRM 2.0	0.00996	BTU/hour	25	100.00%	0%	100%
Low Income Multi-Residential	Low Income Condensing Boiler up to 299MBH Cx Offer	Quasi	TRM 2.0	0.01019	BTU/hour	25	100.00%	0%	100%
Low Income Multi-Residential	Low Income Condensing MUA Two Spd up to 14000 CFM Cx Offer	Quasi	TRM 2.0	2.45000	CFM	20	100.00%	0%	100%
Low Income Multi-Residential	Low Income Condensing Storage Water Heater Cx Offer	Quasi	TRM 2.0	3.09000	kBTU/hour input capacity	15	100.00%	0%	100%
Low Income Multi-Residential	Low Income Condensing Storage Water Heater Cx Offer	Quasi	TRM 2.0	3.09000	kBTU/hour input capacity	15	100.00%	0%	100%
Low Income Multi-Residential	Low Income High Eff Boiler 1501-2000MBH Seasonal Cx Offer	Pure	High Efficiency Boiler Subdocument	19,189.00	unit	25	100.00%	0%	100%
Low Income Multi-Residential	Low Income High Eff Boiler 300-599MBH Cx Offer	Pure	High Efficiency Boiler Subdocument	3,496.00	unit	25	100.00%	0%	100%

*Not all values may compute exactly due to rounding.

Table 6-153. Union Gas measures savings calculation values*

Program	Measure	Pure or Quasi	Source	Savings Factor (m^3)	Unit	EUL	Gross Realization Rate	Free Ridership	Adjustment Factor
C & I Direct Install	Air Curtain - 10 x 10	Pure	TRM 2.0	20,796.00	unit	15	100.00%	5%	100%
C & I Direct Install	Air Curtain - 8 x 10	Pure	TRM 2.0	15,135.00	unit	15	100.00%	5%	100%
C & I Direct Install	Air Curtain - 8 x 8	Pure	TRM 2.0	12,108.00	unit	15	100.00%	5%	100%
C & I Prescriptive	Air Curtain - (2) 7 x 3 Door	Pure	TRM 2.0, 2017 C&I Prescriptive Verification Study	1,343.00	unit	15	100.00%	5%	100%
C & I Prescriptive	Air Curtain - (2) 7 x 6 Door	Pure	TRM 2.0, 2017 C&I Prescriptive Verification Study	2,686.00	unit	15	100.00%	5%	100%
C & I Prescriptive	Air Curtain - (2) 8 x 6 Door	Pure	TRM 2.0, 2017 C&I Prescriptive Verification Study	3,243.00	unit	15	100.00%	5%	100%
C & I Prescriptive	Air Curtain - 10 x 10 with LTO BONUS	Pure	TRM 2.0, 2017 C&I Prescriptive Verification Study	20,796.00	unit	15	100.00%	5%	100%
C & I Prescriptive	Air Curtain - 7 x 3 Door	Pure	TRM 2.0, 2017 C&I Prescriptive Verification Study	671.00	unit	15	100.00%	5%	100%
C & I Prescriptive	Air Curtain - 7 x 6 Door	Pure	TRM 2.0, 2017 C&I Prescriptive Verification Study	1,343.00	unit	15	100.00%	5%	100%
C & I Prescriptive	Air Curtain - 8 x 10 with LTO BONUS	Pure	TRM 2.0, 2017 C&I Prescriptive Verification Study	15,135.00	unit	15	100.00%	5%	100%
C & I Prescriptive	Air Curtain - 8 x 6 Door	Pure	TRM 2.0, 2017 C&I Prescriptive Verification Study	1,622.00	unit	15	100.00%	5%	100%
C & I Prescriptive	Air Curtain - 8 x 8 with LTO BONUS	Pure	TRM 2.0, 2017 C&I Prescriptive Verification Study	12,108.00	unit	15	100.00%	5%	100%
C & I Prescriptive	Air Curtain Ambient - w/ Vestibule - 7x3	Pure	TRM 2.0, 2017 C&I Prescriptive Verification Study	454.00	unit	15	100.00%	5%	100%
C & I Prescriptive	Air Curtain Ambient - w/ Vestibule - 7x6	Pure	TRM 2.0, 2017 C&I Prescriptive Verification Study	909.00	unit	15	100.00%	5%	100%
C & I Prescriptive	Air Curtain Heated - w/ Vestibule - (2)7x3	Pure	TRM 2.0, 2017 C&I Prescriptive Verification Study	909.00	unit	15	100.00%	5%	100%

Program	Measure	Pure or Quasi	Source	Savings Factor (m^3)	Unit	EUL	Gross Realization Rate	Free Ridership	Adjustment Factor
C & I Prescriptive	Air Curtain Heated - w/ Vestibule - (2)7x6	Pure	TRM 2.0, 2017 C&I Prescriptive Verification Study	1,817.00	unit	15	100.00%	5%	100%
C & I Prescriptive	Air Curtain Heated - w/ Vestibule - (2)8x6	Pure	TRM 2.0, 2017 C&I Prescriptive Verification Study	2,194.00	unit	15	100.00%	5%	100%
C & I Prescriptive	Commercial Condensing Unit Heater	Quasi	TRM 2.0	5.92000	kBTU/hour input capacity	18	100.00%	0%	100%
C & I Prescriptive	Commercial Condensing Unit Heater	Quasi	TRM 2.0	7.89000	kBTU/hour input capacity	18	100.00%	0%	100%
C & I Prescriptive	Commercial Energy Star Fryer - INSTALLED AFTER MARCH 1st 2018	Pure	TRM 2.0	1,408.00	unit	12	100.00%	20%	100%
C & I Prescriptive	Commercial Energy Star Fryer - INSTALLED BEFORE MARCH 1st 2018	Pure	TRM 2.0	1,408.00	unit	12	100.00%	20%	100%
C & I Prescriptive	Commercial High Efficiency Furnace	Quasi	TRM 2.0	2.33000	kBTU/hour	18	100.00%	18%	100%
C & I Prescriptive	Commercial High Efficiency Furnace	Quasi	TRM 2.0	3.11000	kBTU/hour	18	100.00%	18%	100%
C & I Prescriptive	Condensing Boiler - Space Heating - 300 to 999 MBH	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	0.01040	BTU/hour	25	101.66%	5%	100%
C & I Prescriptive	Condensing Boiler - Space Heating - GTE 1000 MBH	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	0.01040	BTU/hour	25	101.66%	5%	100%
C & I Prescriptive	Condensing Boiler - Space Heating - LT 300 MBH	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	0.01019	BTU/hour	25	101.66%	5%	100%
C & I Prescriptive	Condensing Boiler - Space Heating - LT 300 MBH	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	0.01019	BTU/hour	25	101.66%	5%	100%
C & I Prescriptive	Condensing Boiler - Space Heating - LT 300 MBH	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	0.01019	BTU/hour	25	101.66%	5%	100%
C & I Prescriptive	Condensing Boiler - Space Heating - LT 300 MBH	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	0.01019	BTU/hour	25	101.66%	5%	100%

Program	Measure	Pure or Quasi	Source	Savings Factor (m^3)	Unit	EUL	Gross Realization Rate	Free Ridership	Adjustment Factor
C & I Prescriptive	Condensing Boiler - Space Heating - LT 300 MBH	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	0.01019	BTU/hour	25	101.66%	5%	100%
C & I Prescriptive	Condensing Boiler - Space Heating - LT 300 MBH	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	0.01019	BTU/hour	25	101.66%	5%	100%
C & I Prescriptive	Condensing Boiler - Water Heating - 300 to 999 MBH	Quasi	Condensing Boiler Subdocument, 2017 C&I Prescriptive Verfication Study	0.00735	BTU/hour	25	101.66%	5%	100%
C & I Prescriptive	Condensing Boiler - Water Heating - 300 to 999 MBH	Quasi	Condensing Boiler Subdocument, 2017 C&I Prescriptive Verfication Study	0.00608	BTU/hour	25	101.66%	5%	100%
C & I Prescriptive	Condensing Boiler - Water Heating - GTE 1000 MBH	Quasi	Condensing Boiler Subdocument, 2017 C&I Prescriptive Verfication Study	0.00644	BTU/hour	25	101.66%	5%	100%
C & I Prescriptive	Condensing Boiler - Water Heating - GTE 1000 MBH	Quasi	Condensing Boiler Subdocument, 2017 C&I Prescriptive Verfication Study	0.00591	BTU/hour	25	101.66%	5%	100%
C & I Prescriptive	Condensing Boiler - Water Heating - LT 300 MBH	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	0.01332	BTU/hour	25	101.66%	5%	100%
C & I Prescriptive	Condensing Boiler - Water Heating - LT 300 MBH	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	0.00996	BTU/hour	25	101.66%	5%	100%
C & I Prescriptive	Condensing Boiler - Water Heating - LT 300 MBH	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	0.01332	BTU/hour	25	101.66%	5%	100%
C & I Prescriptive	Condensing Boiler - Water Heating - LT 300 MBH	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	0.00996	BTU/hour	25	101.66%	5%	100%
C & I Prescriptive	Condensing Boiler - Water Heating - LT 300 MBH	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	0.02170	BTU/hour	25	101.66%	5%	100%
C & I Prescriptive	Condensing Storage Water Heater - GT 250 kBTU/hr	Quasi	TRM 2.0	3.09000	kBTU/hour input capacity	15	100.00%	5%	100%
C & I Prescriptive	Condensing Storage Water Heater - GT 250 kBTU/hr	Quasi	TRM 2.0	2.22000	kBTU/hour input capacity	15	100.00%	5%	100%

Program	Measure	Pure or Quasi	Source	Savings Factor (m^3)	Unit	EUL	Gross Realization Rate	Free Ridership	Adjustment Factor
C & I Prescriptive	Condensing Storage Water Heater - GT 75 & LTE 250 kBTU/Hr	Quasi	TRM 2.0	1.36000	kBTU/hour input capacity	15	100.00%	5%	100%
C & I Prescriptive	Condensing Storage Water Heater - GT 75 & LTE 250 kBTU/Hr	Quasi	TRM 2.0	2.22000	kBTU/hour input capacity	15	100.00%	5%	100%
C & I Prescriptive	Condensing Storage Water Heater - GT 75 & LTE 250 kBTU/Hr	Quasi	TRM 2.0	3.09000	kBTU/hour input capacity	15	100.00%	5%	100%
C & I Prescriptive	Condensing Tankless Water Heater - GT 75 & LT 200 kBTU/hr	Mixed	TRM 2.0	212+0.79	unit + kBTU/hour input capacity	20	100.00%	2%	100%
C & I Prescriptive	Condensing Tankless Water Heater - GT 75 & LT 200 kBTU/hr	Mixed	TRM 2.0	212+1.29	unit + kBTU/hour input capacity	20	100.00%	2%	100%
C & I Prescriptive	Condensing Tankless Water Heater - GT 75 & LT 200 kBTU/hr	Mixed	TRM 2.0	212+1.79	unit + kBTU/hour input capacity	20	100.00%	2%	100%
C & I Prescriptive	Condensing Tankless Water Heater - GTE 200 kBTU/hr	Mixed	TRM 2.0	326+0.79	unit + kBTU/hour input capacity	20	100.00%	2%	100%
C & I Prescriptive	DCKV - 5,001 to 10,000 cfm - Install After July 13 2018	Pure	TRM 2.0	10,517.00	unit	15	100.00%	5%	100%
C & I Prescriptive	DCKV - Up to 5,000 cfm - Install After July 13 2018	Pure	TRM 2.0	4,207.00	unit	15	100.00%	5%	100%
C & I Prescriptive	DCKV - Up to 5,000 cfm - Install Before July 13 2018	Pure	TRM 2.0	4,207.00	unit	15	100.00%	5%	100%
C & I Prescriptive	DCKV - Up to 5,000 cfm - Install Before July 13 2018	Pure	TRM 2.0	4,207.00	unit	15	100.00%	5%	100%
C & I Prescriptive	DCKV - 10,001 to 15,000 cfm with LTO BONUS	Pure	TRM 2.0	17,529.00	unit	15	100.00%	5%	100%
C & I Prescriptive	DCKV - 5,001 to 10,000 cfm	Pure	TRM 2.0	10,517.00	unit	15	100.00%	5%	100%

Program	Measure	Pure or Quasi	Source	Savings Factor (m^3)	Unit	EUL	Gross Realization Rate	Free Ridership	Adjustment Factor
C & I Prescriptive	DCKV - 5,001 to 10,000 cfm with LTO BONUS	Pure	TRM 2.0	10,517.00	unit	15	100.00%	5%	100%
C & I Prescriptive	DCKV - Up to 5,000 cfm	Pure	TRM 2.0	4,207.00	unit	15	100.00%	5%	100%
C & I Prescriptive	DCKV - Up to 5,000 cfm	Pure	TRM 2.0	4,207.00	unit	15	100.00%	5%	100%
C & I Prescriptive	DCKV - Up to 5,000 cfm with LTO BONUS	Pure	TRM 2.0	4,207.00	unit	15	100.00%	5%	100%
C & I Prescriptive	DCKV - Up to 5,000 cfm with LTO BONUS	Pure	TRM 2.0	4,207.00	unit	15	100.00%	5%	100%
C & I Prescriptive	DCV-Community Center Meeting Spaces-NC/TNR	Quasi	TRM 3.0	0.44100	ft^2	10	100.00%	20%	100%
C & I Prescriptive	DCV-Community Center Meeting Spaces-Retrofit	Quasi	TRM 3.0	0.44100	ft^2	10	100.00%	5%	100%
C & I Prescriptive	DCV-Exercise centers and Sports Arenas-Retrofit	Quasi	TRM 3.0	0.43500	ft^2	10	100.00%	5%	100%
C & I Prescriptive	DCV-Hotel Conference Rooms-Retrofit	Quasi	TRM 3.0	1.04300	ft^2	10	100.00%	5%	100%
C & I Prescriptive	DCV-Office-GTE 2,500 sq ft-NC/TNR	Quasi	TRM 2.0	0.11200	ft^2	10	100.00%	20%	100%
C & I Prescriptive	DCV-Office-GTE 2,500 sq ft-Retrofit	Quasi	TRM 2.0	0.11200	ft^2	10	100.00%	5%	100%
C & I Prescriptive	DCV-Office-LT 2,500 sq ft-Retrofit	Quasi	TRM 2.0	0.11200	ft^2	10	100.00%	5%	100%
C & I Prescriptive	DCV-Primary/Secondary Education Classrooms-NC/TNR	Quasi	TRM 3.0	0.60100	ft^2	10	100.00%	20%	100%
C & I Prescriptive	DCV-Primary/Secondary Education Classrooms-Retrofit	Quasi	TRM 3.0	1.48400	ft^2	10	100.00%	5%	100%
C & I Prescriptive	DCV-Retail-GTE 5,000 sq ft-NC/TNR	Quasi	TRM 2.0	0.39200	ft^2	10	100.00%	20%	100%
C & I Prescriptive	DCV-Retail-GTE 5,000 sq ft-Retrofit	Quasi	TRM 2.0	0.39200	ft^2	10	100.00%	5%	100%
C & I Prescriptive	DCV-Retail-LT 5,000 sq ft-NC/TNR	Quasi	TRM 2.0	0.39200	ft^2	10	100.00%	20%	100%

Program	Measure	Pure or Quasi	Source	Savings Factor (m^3)	Unit	EUL	Gross Realization Rate	Free Ridership	Adjustment Factor
C & I Prescriptive	DCV-Retail-LT 5,000 sq ft-Retrofit	Quasi	TRM 2.0	0.39200	ft^2	10	100.00%	5%	100%
C & I Prescriptive	Dishwasher-Multi Tank Conveyor-High Temperature	Pure	TRM 2.0	2,049.00	unit	20	100.00%	27%	100%
C & I Prescriptive	Dishwasher-Stationary Single Tank Door-High Temperature	Pure	TRM 2.0	890.00	unit	15	100.00%	20%	100%
C & I Prescriptive	Dishwasher-Under Counter-High Temperature	Pure	TRM 2.0	137.00	unit	10	100.00%	40%	100%
C & I Prescriptive	Dishwasher-Under Counter-Low Temperature	Pure	TRM 2.0	322.00	unit	10	100.00%	40%	100%
C & I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 55% Sensible Heat Recovery	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	5.01000	CFM	14	99.55%	5%	100%
C & I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 55% Sensible Heat Recovery	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	1.78000	CFM	14	99.55%	5%	100%
C & I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 55% Sensible Heat Recovery	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	1.78000	CFM	14	99.55%	5%	100%
C & I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 55% Sensible Heat Recovery	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	5.01000	CFM	14	99.55%	5%	100%
C & I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 55% Sensible Heat Recovery	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	2.78000	CFM	14	99.55%	5%	100%
C & I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 65% Sensible Heat Recovery	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	5.95000	CFM	14	99.55%	5%	100%
C & I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 65% Sensible Heat Recovery	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	2.11000	CFM	14	99.55%	5%	100%

Program	Measure	Pure or Quasi	Source	Savings Factor (m^3)	Unit	EUL	Gross Realization Rate	Free Ridership	Adjustment Factor
C & I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 65% Sensible Heat Recovery	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	2.11000	CFM	14	99.55%	5%	100%
C & I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 65% Sensible Heat Recovery	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	5.95000	CFM	14	99.55%	5%	100%
C & I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 65% SHR - In-Suite	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	5.95000	CFM	14	99.55%	5%	100%
C & I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 75% Sensible Heat Recovery	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	2.45000	CFM	14	99.55%	5%	100%
C & I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 75% Sensible Heat Recovery	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	2.45000	CFM	14	99.55%	5%	100%
C & I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 75% Sensible Heat Recovery	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	6.90000	CFM	14	99.55%	5%	100%
C & I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 75% Sensible Heat Recovery	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	3.83000	CFM	14	99.55%	5%	100%
C & I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 75% Sensible Heat Recovery	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	6.90000	CFM	14	99.55%	5%	100%
C & I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 75% Sensible Heat Recovery	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	3.83000	CFM	14	99.55%	5%	100%
C & I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 75% SHR - In-Suite	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	6.90000	CFM	14	99.55%	5%	100%
C & I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 75% SHR - In-Suite	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	6.90000	CFM	14	99.55%	5%	100%

Program	Measure	Pure or Quasi	Source	Savings Factor (m^3)	Unit	EUL	Gross Realization Rate	Free Ridership	Adjustment Factor
C & I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 85% Sensible Heat Recovery	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	2.79000	CFM	14	99.55%	5%	100%
C & I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 85% Sensible Heat Recovery	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	2.79000	CFM	14	99.55%	5%	100%
C & I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 85% Sensible Heat Recovery	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	7.84000	CFM	14	99.55%	5%	100%
C & I Prescriptive	Energy Recovery Ventilator (ERV)-Incremental-GTE 65% Sensible Heat Recovery	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	0.34000	CFM	14	99.55%	5%	100%
C & I Prescriptive	Energy Recovery Ventilator (ERV)-Incremental-GTE 65% Sensible Heat Recovery	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	0.52000	CFM	14	99.55%	5%	100%
C & I Prescriptive	Energy Recovery Ventilator (ERV)-Incremental-GTE 75% Sensible Heat Recovery	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	0.67000	CFM	14	99.55%	5%	100%
C & I Prescriptive	Energy Recovery Ventilator (ERV)-Incremental-GTE 75% Sensible Heat Recovery	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	1.05000	CFM	14	99.55%	5%	100%
C & I Prescriptive	Energy Recovery Ventilator (ERV)-Incremental-GTE 75% Sensible Heat Recovery	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	1.89000	CFM	14	99.55%	5%	100%
C & I Prescriptive	Energy Recovery Ventilator (ERV)-Incremental-GTE 85% Sensible Heat Recovery	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	1.01000	CFM	14	99.55%	5%	100%
C & I Prescriptive	Heat Recovery Ventilator (HRV)-GTE	Quasi	TRM 2.0	1.50000	CFM	14	100.00%	5%	100%

Program	Measure	Pure or Quasi	Source	Savings Factor (m^3)	Unit	EUL	Gross Realization Rate	Free Ridership	Adjustment Factor
	55% Sensible Heat Recovery								
C & I Prescriptive	Heat Recovery Ventilator (HRV)-GTE 55% Sensible Heat Recovery	Quasi	TRM 2.0	1.50000	CFM	14	100.00%	5%	100%
C & I Prescriptive	Heat Recovery Ventilator (HRV)-GTE 55% Sensible Heat Recovery	Quasi	TRM 2.0	4.23000	CFM	14	100.00%	5%	100%
C & I Prescriptive	Heat Recovery Ventilator (HRV)-GTE 55% Sensible Heat Recovery	Quasi	TRM 2.0	2.35000	CFM	14	100.00%	5%	100%
C & I Prescriptive	Heat Recovery Ventilator (HRV)-GTE 65% Sensible Heat Recovery	Quasi	TRM 2.0	1.78000	CFM	14	100.00%	5%	100%
C & I Prescriptive	Heat Recovery Ventilator (HRV)-GTE 65% Sensible Heat Recovery	Quasi	TRM 2.0	2.78000	CFM	14	100.00%	5%	100%
C & I Prescriptive	Heat Recovery Ventilator (HRV)-GTE 65% Sensible Heat Recovery	Quasi	TRM 2.0	5.00000	CFM	14	100.00%	5%	100%
C & I Prescriptive	Heat Recovery Ventilator (HRV)-GTE 65% Sensible Heat Recovery	Quasi	TRM 2.0	1.78000	CFM	14	100.00%	5%	100%
C & I Prescriptive	Heat Recovery Ventilator (HRV)-GTE 65% SHR - In-Suite	Quasi	TRM 2.0	5.00000	CFM	14	100.00%	5%	100%
C & I Prescriptive	Heat Recovery Ventilator (HRV)-GTE 75% Sensible Heat Recovery	Quasi	TRM 2.0	2.05000	CFM	14	100.00%	5%	100%
C & I Prescriptive	Heat Recovery Ventilator (HRV)-GTE 75% Sensible Heat Recovery	Quasi	TRM 2.0	2.05000	CFM	14	100.00%	5%	100%
C & I Prescriptive	Heat Recovery Ventilator (HRV)-GTE	Quasi	TRM 2.0	3.21000	CFM	14	100.00%	5%	100%

Program	Measure	Pure or Quasi	Source	Savings Factor (m^3)	Unit	EUL	Gross Realization Rate	Free Ridership	Adjustment Factor
	75% Sensible Heat Recovery								
C & I Prescriptive	Heat Recovery Ventilator (HRV)-GTE 85% Sensible Heat Recovery	Quasi	TRM 2.0	2.32000	CFM	14	100.00%	5%	100%
C & I Prescriptive	Heat Recovery Ventilator (HRV)-GTE 85% Sensible Heat Recovery	Quasi	TRM 2.0	3.64000	CFM	14	100.00%	5%	100%
C & I Prescriptive	Heat Recovery Ventilator (HRV)-GTE 85% Sensible Heat Recovery	Quasi	TRM 2.0	6.54000	CFM	14	100.00%	5%	100%
C & I Prescriptive	Heat Recovery Ventilator (HRV)-Incremental-GTE 65% Sensible Heat Recovery	Quasi	TRM 2.0	0.27000	CFM	14	100.00%	5%	100%
C & I Prescriptive	Heat Recovery Ventilator (HRV)-Incremental-GTE 65% SHR - MURB In-Suite	Quasi	TRM 2.0	0.77000	CFM	14	100.00%	5%	100%
C & I Prescriptive	Heat Recovery Ventilator (HRV)-Incremental-GTE 75% Sensible Heat Recovery	Quasi	TRM 2.0	0.55000	CFM	14	100.00%	5%	100%
C & I Prescriptive	Heat Recovery Ventilator (HRV)-Incremental-GTE 85% Sensible Heat Recovery	Quasi	TRM 2.0	0.82000	CFM	14	100.00%	5%	100%
C & I Prescriptive	Heat Recovery Ventilator (HRV)-Incremental-GTE 85% Sensible Heat Recovery	Quasi	TRM 2.0	2.31000	CFM	14	100.00%	5%	100%
C & I Prescriptive	Infrared Heater - Single Stage / High Intensity	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	8.60000	kBTU/hour input capacity	17	102.67%	33%	100%
C & I Prescriptive	Infrared Heater - Single Stage / High Intensity	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	8.60000	kBTU/hour input capacity	17	102.67%	33%	100%

Program	Measure	Pure or Quasi	Source	Savings Factor (m^3)	Unit	EUL	Gross Realization Rate	Free Ridership	Adjustment Factor
C & I Prescriptive	Infrared Heater - Single Stage / High Intensity	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	8.60000	kBTU/hour input capacity	17	102.67%	33%	100%
C & I Prescriptive	Infrared Heater - Single Stage / High Intensity	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	11.50000	kBTU/hour input capacity	17	102.67%	33%	100%
C & I Prescriptive	Infrared Heater - Single Stage / High Intensity	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	11.50000	kBTU/hour input capacity	17	102.67%	33%	100%
C & I Prescriptive	Infrared Heater - Single Stage / High Intensity	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	11.50000	kBTU/hour input capacity	17	102.67%	33%	100%
C & I Prescriptive	Infrared Heater - Two Stage	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	9.80000	kBTU/hour input capacity	17	102.67%	33%	100%
C & I Prescriptive	Infrared Heater - Two Stage	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	9.80000	kBTU/hour input capacity	17	102.67%	33%	100%
C & I Prescriptive	Infrared Heater - Two Stage	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	9.80000	kBTU/hour input capacity	17	102.67%	33%	100%
C & I Prescriptive	Infrared Heater - Two Stage	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	13.10000	kBTU/hour input capacity	17	102.67%	33%	100%
C & I Prescriptive	Infrared Heater - Two Stage	Quasi	TRM 2.0, 2017 C&I Prescriptive Verification Study	13.10000	kBTU/hour input capacity	17	102.67%	33%	100%
C & I Prescriptive	Make-Up Air Unit (MUA) - 2 Speed	Quasi	TRM 2.0	2.45000	CFM	20	100.00%	5%	100%
C & I Prescriptive	Make-Up Air Unit (MUA) - 2 Speed GTE 5000 CFM - WITH LTO BONUS	Quasi	TRM 2.0	1.22000	CFM	20	100.00%	5%	100%
C & I Prescriptive	Make-Up Air Unit (MUA) - Constant Speed	Quasi	TRM 2.0	0.40700	CFM	20	100.00%	5%	100%
C & I Prescriptive	Make-Up Air Unit (MUA) - Constant Speed	Quasi	TRM 2.0	0.91900	CFM	20	100.00%	5%	100%
C & I Prescriptive	Make-Up Air Unit (MUA) - VFD	Quasi	TRM 2.0	2.03000	CFM	20	100.00%	5%	100%
C & I Prescriptive	Make-Up Air Unit (MUA) - VFD	Quasi	TRM 2.0	3.00000	CFM	20	100.00%	5%	100%

Program	Measure	Pure or Quasi	Source	Savings Factor (m^3)	Unit	EUL	Gross Realization Rate	Free Ridership	Adjustment Factor
C & I Prescriptive	Make-Up Air Unit (MUA) - VFD - GTE 5000 CFM WITH LTO BONUS	Quasi	TRM 2.0	2.03000	CFM	20	100.00%	5%	100%
C & I Prescriptive	Ozone Laundry - Washer Extractor <= 60 Lbs Cap with LTO BONUS	Quasi	TRM 2.0	0.03830	pounds/year	15	100.00%	8%	100%
C & I Prescriptive	Ozone Laundry - Washer Extractor > 60 and < 500 Lbs Cap with LTO BONUS	Quasi	TRM 2.0	0.03830	pounds/year	15	100.00%	8%	100%
C & I Prescriptive	Ozone Laundry - Washer Extractor LTE 60 Lbs Capacity	Quasi	TRM 2.0	0.03830	pounds/year	15	100.00%	8%	100%
Large Volume	Infrared Heater - Two Stage	Quasi	TRM 2.0	13.10000	kBTU/hour input capacity	17	100.00%	33%	100%
Multi-Family	Air Curtain - Low Income - 8 x 8	Pure	TRM 2.0	12,108.00	unit	15	100.00%	5%	100%
Multi-Family	Commercial Condensing Unit Heater-LI	Quasi	TRM 2.0	7.89000	kBTU/hour input capacity	18	100.00%	5%	100%
Multi-Family	Commercial Condensing Unit Heater-LI	Quasi	TRM 2.0	7.89000	kBTU/hour input capacity	18	100.00%	5%	100%
Multi-Family	Commercial High Efficiency Furnace-LI	Quasi	TRM 2.0	3.11000	kBTU/hour	18	100.00%	5%	100%
Multi-Family	Condensing Boiler - Space Heating - 300 to 999 MBH	Quasi	TRM 2.0	0.01040	BTU/hour	25	100.00%	5%	100%
Multi-Family	Condensing Boiler - Space Heating - GTE 1000 MBH	Quasi	TRM 2.0	0.01040	BTU/hour	25	100.00%	5%	100%
Multi-Family	Condensing Boiler - Space Heating - LT 300 MBH	Quasi	TRM 2.0	0.01019	BTU/hour	25	100.00%	5%	100%
Multi-Family	Condensing Boiler - Space Heating - LT 300 MBH	Quasi	TRM 2.0	0.01019	BTU/hour	25	100.00%	5%	100%
Multi-Family	Condensing Boiler - Water Heating - 300 to 999 MBH	Quasi	Condensing Boiler Subdocument	0.00735	BTU/hour	25	100.00%	5%	100%

Program	Measure	Pure or Quasi	Source	Savings Factor (m^3)	Unit	EUL	Gross Realization Rate	Free Ridership	Adjustment Factor
Multi-Family	Condensing Boiler - Water Heating - LT 300 MBH	Quasi	TRM 2.0	0.00996	BTU/hour	25	100.00%	5%	100%
Multi-Family	Condensing Boiler - Water Heating - LT 300 MBH	Quasi	TRM 2.0	0.01332	BTU/hour	25	100.00%	5%	100%
Multi-Family	Condensing Storage Water Heater - GT 250 kBTU/hr	Quasi	TRM 2.0	3.09000	kBTU/hour input capacity	15	100.00%	5%	100%
Multi-Family	Condensing Storage Water Heater - GT 75 & LTE 250 kBTU/Hr	Quasi	TRM 2.0	3.09000	kBTU/hour input capacity	15	100.00%	5%	100%
Multi-Family	Energy Recovery Ventilator (ERV)-GTE 65% Sensible Heat Recovery-LI	Quasi	TRM 2.0	5.95000	CFM	14	100.00%	5%	100%
Multi-Family	Energy Recovery Ventilator (ERV)-GTE 65% Sensible Heat Recovery-LI	Quasi	TRM 2.0	5.95000	CFM	14	100.00%	5%	100%
Multi-Family	Energy Recovery Ventilator (ERV)-GTE 65% SHR - In-Suite-LI	Quasi	TRM 2.0	5.95000	CFM	14	100.00%	5%	100%
Multi-Family	Energy Recovery Ventilator (ERV)-GTE 75% Sensible Heat Recovery-LI	Quasi	TRM 2.0	6.90000	CFM	14	100.00%	5%	100%
Multi-Family	Energy Recovery Ventilator (ERV)-GTE 75% SHR - In-Suite-LI	Quasi	TRM 2.0	6.90000	CFM	14	100.00%	5%	100%
Multi-Family	Energy Recovery Ventilator (ERV)-Incremental-GTE 85% Sensible Heat Recovery	Quasi	TRM 2.0	2.83000	CFM	14	100.00%	5%	100%
Multi-Family	Heat Recovery Ventilator (HRV)-GTE 65% Sensible Heat Recovery-LI	Quasi	TRM 2.0	5.00000	CFM	14	100.00%	5%	100%
Multi-Family	Heat Recovery Ventilator (HRV)-GTE	Quasi	TRM 2.0	5.00000	CFM	14	100.00%	5%	100%

Program	Measure	Pure or Quasi	Source	Savings Factor (m^3)	Unit	EUL	Gross Realization Rate	Free Ridership	Adjustment Factor
	65% SHR - In-Suite-LI								
Multi-Family	Make-Up Air Unit (MUA) - 2 Speed	Quasi	TRM 2.0	2.45000	CFM	20	100.00%	5%	100%
Multi-Family	Make-Up Air Unit (MUA) - VFD	Quasi	TRM 2.0	3.00000	CFM	20	100.00%	5%	100%
Multi-Family	Condensing Boiler - Water Heating - 300 to 999 MBH	Quasi	Condensing Boiler Subdocument	0.00608	BTU/hour	25	100.00%	5%	100%
Indigenous	Bathroom Aerator	Pure	TRM 2.0	6.40	unit	10	100.00%	1%	100%
Indigenous	Kitchen Aerator	Pure	TRM 2.0	11.56	unit	10	100.00%	1%	100%
Indigenous	Pipe Insulation	Pure	TRM 2.0	3.54	unit	15	100.00%	1%	100%
Indigenous	Showerhead Replacement 1.25 GPM	Pure	TRM 2.0	28.20	unit	10	100.00%	1%	100%
Home Weatherization	Bathroom Aerator	Pure	TRM 2.0	6.40	unit	10	100.00%	1%	100%
Home Weatherization	Kitchen Aerator	Pure	TRM 2.0	11.56	unit	10	100.00%	1%	100%
Home Weatherization	Pipe Insulation	Pure	TRM 2.0	3.54	unit	15	100.00%	1%	100%
Home Weatherization	Programable Thermostat	Pure	TRM 2.0	46.00	unit	15	100.00%	1%	100%
Home Weatherization	Showerhead Replacement 1.25 GPM	Pure	TRM 2.0	28.20	unit	10	100.00%	1%	100%

*Not all values may compute exactly due to rounding.

Savings Calculation Measure Totals

Table 6-154. Enbridge Measure Savings, Tracked and Verified, by Annual and Cumulative, Gross and Net*

Program	Measure	Tracked				Verified			
		Annual		Cumulative		Annual		Cumulative	
		Gross	Net	Gross	Net	Gross	Net	Gross	Net
C & I Direct Install - Large	Direct Install Air Door 10x10 Cx Offer	20,796	19,756	311,940	296,343	20,796	19,756	311,940	296,343
C & I Direct Install - Large	Direct Install Air Door 8x10 Cx Offer	438,915	416,969	6,583,725	6,254,540	438,915	416,969	6,583,725	6,254,539
C & I Direct Install - Large	Direct Install Air Door 8x8 Cx Offer	84,756	80,518	1,271,340	1,207,773	84,756	80,518	1,271,340	1,207,773
C & I Direct Install - Large	Direct Install DCKV 10001 - 15000 CFM Cx Offer	70,116	66,610	1,051,740	999,152	70,116	66,610	1,051,740	999,153
C & I Direct Install - Large	Direct Install DCKV 5001 - 10000 CFM Cx Offer	10,517	9,991	157,755	149,867	10,517	9,991	157,755	149,867
C & I Direct Install - Large	Direct Install DCV Offer	19,585	18,606	293,777	279,088	19,585	18,606	293,777	279,088
C & I Direct Install - Small	Direct Install Air Door 10x10 Cx Offer	894,228	849,517	13,413,420	12,742,749	894,228	849,517	13,413,420	12,742,749
C & I Direct Install - Small	Direct Install Air Door 8x10 Cx Offer	2,012,955	1,912,307	30,194,325	28,684,622	2,012,955	1,912,307	30,194,325	28,684,609
C & I Direct Install - Small	Direct Install Air Door 8x8 Cx Offer	193,728	184,042	2,905,920	2,760,624	193,728	184,042	2,905,920	2,760,624
C & I Direct Install - Small	Direct Install Air Door Single 7x3 Cx Offer	14,762	14,024	221,430	210,364	14,762	14,024	221,430	210,359
C & I Direct Install - Small	Direct Install Air Door Single 7x6 Cx Offer	12,087	11,483	181,305	172,242	12,087	11,483	181,305	172,240
C & I Direct Install - Small	Direct Install Air Door Single 8x6 Cx Offer	1,622	1,541	24,330	23,114	1,622	1,541	24,330	23,114
C & I Direct Install - Small	Direct Install DCKV 10001 - 15000 CFM Cx Offer	17,529	16,653	262,935	249,788	17,529	16,653	262,935	249,788
C & I Direct Install - Small	Direct Install DCKV 5001 - 10000 CFM Cx Offer	84,136	79,929	1,262,040	1,198,936	84,136	79,929	1,262,040	1,198,938
C & I Direct Install - Small	Direct Install DCV Offer	109,067	103,614	1,636,009	1,554,208	109,067	103,614	1,636,010	1,554,210
C & I Prescriptive - Large	Air Door 10x10 Cx Offer	20,796	19,756	311,940	296,343	20,796	19,756	311,940	296,343

Program	Measure	Tracked				Verified			
		Annual		Cumulative		Annual		Cumulative	
		Gross	Net	Gross	Net	Gross	Net	Gross	Net
C & I Prescriptive - Large	Air Door 8x10 Cx Campaign	15,135	14,378	227,025	215,674	15,135	14,378	227,025	215,674
C & I Prescriptive - Large	Air Door 8x8 Cx Offer	60,540	57,513	908,100	862,695	60,540	57,513	908,100	862,695
C & I Prescriptive - Large	Air Door Double 8x6 Cx Offer	22,701	21,566	340,515	323,489	22,701	21,566	340,515	323,489
C & I Prescriptive - Large	Air Door Double with Vestibule 7x3 Cx Offer	1,818	1,727	27,270	25,907	1,818	1,727	27,270	25,907
C & I Prescriptive - Large	Air Door Single 7x6 Cx Offer	1,343	1,276	20,145	19,138	1,343	1,276	20,145	19,138
C & I Prescriptive - Large	Cond Boiler 200-299 MBH Cx Campiagn	5,808	1,742	145,208	43,562	5,808	5,518	145,208	137,947
C & I Prescriptive - Large	Cond Boiler 200-299 MBH Cx Offer	2,739	822	68,475	20,543	2,739	2,602	68,475	65,051
C & I Prescriptive - Large	Cond Strge W/H High Multi-Res >250 Kbtu Cx Campaign	927	881	13,905	13,210	927	881	13,905	13,210
C & I Prescriptive - Large	Cond Strge W/H High Multi-Res 75-250 Kbtu Cx Campaign	615	584	9,224	8,762	615	584	9,224	8,762
C & I Prescriptive - Large	Cond Strge W/H Low Other 75-250 Kbtu Cx Campaign	271	257	4,060	3,857	271	257	4,060	3,857
C & I Prescriptive - Large	Cond Strge W/H Low Retail 75-250 Kbtu Cx Offer	680	646	10,200	9,690	680	646	10,200	9,690
C & I Prescriptive - Large	Cond Strge W/H Med Other > 250Kbtus Cx Offer	1,772	1,683	26,573	25,245	1,772	1,683	26,573	25,245
C & I Prescriptive - Large	Cond Tankless High Other >75 and < 200Kbtu Cx Campaign	2,279	2,234	45,586	44,674	2,279	2,234	45,586	44,674
C & I Prescriptive - Large	Cond Tankless Med Other >75 and < 200Kbtu Cx Campaign	2,812	2,756	56,245	55,120	2,812	2,756	56,245	55,120

Program	Measure	Tracked				Verified			
		Annual		Cumulative		Annual		Cumulative	
		Gross	Net	Gross	Net	Gross	Net	Gross	Net
C & I Prescriptive - Large	Cond Unit Heater 225-300 Kbtu Cx Campaign	9,784	9,784	176,105	176,105	9,784	9,784	176,105	176,105
C & I Prescriptive - Large	DCKV 10001 - 15000 CFM Cx Offer	17,529	10,868	262,935	163,020	18,009	17,109	270,139	256,632
C & I Prescriptive - Large	DCKV 5001 - 10000 CFM Cx Offer	63,102	39,123	946,530	586,848	64,831	61,589	972,465	923,842
C & I Prescriptive - Large	DCKV up to 5000 CFM Cx Offer	8,414	5,217	126,210	78,250	8,645	8,212	129,668	123,185
C & I Prescriptive - Large	DCV Single Zone Retail with NO Maintenance Cx Offer	19,443	1,555	194,432	15,556	20,248	19,236	202,481	192,357
C & I Prescriptive - Large	Destratification Fan Cx Offer	101,215	91,094	1,518,225	1,366,403	101,215	91,094	1,518,225	1,366,403
C & I Prescriptive - Large	DW Under-Counter High Temp Cx Offer	822	493	8,220	4,932	822	493	8,220	4,932
C & I Prescriptive - Large	ERV Vent Med Stand Hotel 65% - 74% Cx Offer	31,776	30,187	444,864	422,621	31,776	30,187	444,864	422,621
C & I Prescriptive - Large	Fryer Cx Campaign	5,632	4,506	67,584	54,067	5,632	4,506	67,584	54,067
C & I Prescriptive - Large	Fryer Cx Offer	2,816	2,253	33,792	27,034	2,816	2,253	33,792	27,034
C & I Prescriptive - Large	High Boiler 1000-1499MBH Cx Campaign	23,003	6,901	575,075	172,523	23,003	19,374	575,075	484,342
C & I Prescriptive - Large	High Boiler 1000-1499MBH Cx Offer	17,572	5,272	439,300	131,791	17,572	15,029	439,300	375,722
C & I Prescriptive - Large	High Boiler 1500 - 1999 MBH Cx Offer	38,378	11,513	959,450	287,835	38,378	33,773	959,450	844,316
C & I Prescriptive - Large	High Boiler 600 - 999 MBH Cx Offer	3,076	923	76,900	23,070	3,076	2,461	76,900	61,520

Program	Measure	Tracked				Verified			
		Annual		Cumulative		Annual		Cumulative	
		Gross	Net	Gross	Net	Gross	Net	Gross	Net
C & I Prescriptive - Large	High Boiler 600-999 MBH Cx Offer	3,076	923	76,900	23,070	3,076	2,461	76,900	61,520
C & I Prescriptive - Large	HRV Vent Med Int Hotel 65% - 74%Cx Offer	26,410	25,090	369,740	351,253	26,410	25,090	369,740	351,253
C & I Prescriptive - Large	Ind Infrared 2-Stage 165,000 -300,000 Cx Campagin	2,620	288	44,540	4,899	2,690	1,802	45,734	30,642
C & I Prescriptive - Large	Ind Infrared 2-Stage 50,000 - 164,999 Cx Campaign	1,965	216	33,405	3,675	2,018	1,352	34,300	22,981
C & I Prescriptive - Large	Ind Infrared Single Stage 165,000 - 300,000 Cx Offer	4,600	506	78,200	8,602	4,723	3,165	80,296	53,798
C & I Prescriptive - Large	Ind Infrared Single Stage 50,000-164,999 Cx Offer	6,325	696	107,525	11,829	6,495	4,351	110,407	73,972
C & I Prescriptive - Large	Infrared 2-Stage 165,000-300,000 Cx Campaign	151,116	16,623	2,568,972	282,587	155,166	103,961	2,637,820	1,767,340
C & I Prescriptive - Large	Infrared Single Stage 165,000 -300,000 Cx Offer	64,943	7,144	1,104,023	121,442	66,683	44,678	1,133,610	759,519
C & I Prescriptive - Large	Infrared Single Stage 50,000-164,999 Cx Campaign	16,675	1,834	283,475	31,183	17,122	11,472	291,072	195,018
C & I Prescriptive - Large	Infrared Single Stage 50,000-164,999 Cx Offer	27,370	3,011	465,291	51,183	28,104	18,829	477,760	320,099
C & I Prescriptive - Large	Ozone Washer Extractor =/< 60lbs Cx Campaign	21,667	19,934	325,006	299,006	21,667	19,934	325,007	299,006
C & I Prescriptive - Large	Ozone Washer Extractor >60lbs and <500lbs Cx Campaign	134,101	123,373	2,011,521	1,850,600	134,101	123,373	2,011,522	1,850,600
C & I Prescriptive - Large	School Board Boiler Secondary Cx Campaign	51,052	15,316	1,276,300	382,890	49,476	43,539	1,236,900	1,088,472
C & I Prescriptive - Large	School Board Boiler Secondary Cx Offer	51,052	15,316	1,276,300	382,890	49,476	43,539	1,236,900	1,088,472

Program	Measure	Tracked				Verified			
		Annual		Cumulative		Annual		Cumulative	
		Gross	Net	Gross	Net	Gross	Net	Gross	Net
C & I Prescriptive - Large	Showerhead Offer	34,241	26,041	342,414	260,405	34,241	26,041	342,414	260,406
C & I Prescriptive - Small	Air Door 10x10 DI Campaign	20,796	19,756	311,940	296,343	20,796	19,756	311,940	296,343
C & I Prescriptive - Small	Air Door 8x10 Cx Offer	211,890	201,296	3,178,350	3,019,434	211,890	201,296	3,178,350	3,019,433
C & I Prescriptive - Small	Air Door 8x10 MM 20% Bonus Offer	45,405	43,135	681,075	647,021	45,405	43,135	681,075	647,021
C & I Prescriptive - Small	Air Door Double 7x6 Cx Offer	2,686	2,552	40,290	38,276	2,686	2,552	40,290	38,276
C & I Prescriptive - Small	Air Door Double 8x6 Cx Offer	9,729	9,243	145,935	138,638	9,729	9,243	145,935	138,638
C & I Prescriptive - Small	Air Door Double with Vestibule 7x3 Cx Offer	1,818	1,727	27,270	25,906	1,818	1,727	27,270	25,907
C & I Prescriptive - Small	Air Door Double with Vestibule 7x6 Cx Offer	7,268	6,905	109,020	103,569	7,268	6,905	109,020	103,569
C & I Prescriptive - Small	Air Door Single with Vestibule 7x6 Cx Offer	1,818	1,727	27,270	25,907	1,818	1,727	27,270	25,907
C & I Prescriptive - Small	Cond Boiler 100-199MBH Cx Campaign	15,961	4,788	399,017	119,705	15,961	15,163	399,015	379,065
C & I Prescriptive - Small	Cond Boiler 100-199MBH Cx Offer	9,793	2,938	244,822	73,446	9,793	9,303	244,821	232,580
C & I Prescriptive - Small	Cond Boiler 200-299 MBH Cx Campiagn	6,878	2,063	171,956	51,587	6,878	6,534	171,956	163,358
C & I Prescriptive - Small	Cond Boiler 200-299 MBH Cx Offer	16,137	4,841	403,430	121,030	16,137	15,330	403,430	383,258
C & I Prescriptive - Small	Cond Furnace 75 - 149 Kbtu Cx Campaign	1,493	1,232	26,870	22,168	1,493	1,232	26,870	22,168

Program	Measure	Tracked				Verified			
		Annual		Cumulative		Annual		Cumulative	
		Gross	Net	Gross	Net	Gross	Net	Gross	Net
C & I Prescriptive - Small	Cond Furnace 75-149 Kbtu's Cx Offer	2,320	1,914	41,761	34,453	2,320	1,914	41,761	34,453
C & I Prescriptive - Small	Cond Furnace up to 74 Kbtu Cx Campaign	187	154	3,359	2,771	187	154	3,359	2,771
C & I Prescriptive - Small	Cond Strge W/H High Multi-Res 75-250 Kbtu Cx Campaign	1,601	1,521	24,010	22,808	1,601	1,521	24,009	22,809
C & I Prescriptive - Small	Cond Strge W/H High Other >250 Kbtu Cx Campaign	1,236	1,174	18,535	17,609	1,236	1,174	18,535	17,609
C & I Prescriptive - Small	Cond Strge W/H High Other 75-250 Kbtu Cx Campaign	1,390	1,321	20,853	19,810	1,390	1,321	20,853	19,810
C & I Prescriptive - Small	Cond Strge W/H Low Other >250 Kbtu Cx Campaign	816	775	12,240	11,628	816	775	12,240	11,628
C & I Prescriptive - Small	Cond Strge W/H Low Other 75-250 Kbtu Cx Campaign	938	891	14,074	13,370	938	891	14,074	13,370
C & I Prescriptive - Small	Cond Strge W/H Low Retail 75-250 Kbtu Cx Offer	2,311	2,196	34,668	32,934	2,311	2,196	34,668	32,934
C & I Prescriptive - Small	Cond Strge W/H Med Other 75-250 Kbtu Cx Campaign	169	160	2,531	2,404	169	160	2,531	2,404
C & I Prescriptive - Small	Cond Tankless High Other >75 and < 200Kbtu Cx Campaign	2,273	2,227	45,457	44,548	2,273	2,227	45,457	44,548
C & I Prescriptive - Small	Cond Tankless Low Other >75 and < 200Kbtu Cx Campaign	738	724	14,768	14,473	738	724	14,768	14,473
C & I Prescriptive - Small	Cond Tankless Low Retail >75 and < 200Kbtu Cx Campaign	369	362	7,384	7,237	369	362	7,384	7,237
C & I Prescriptive - Small	DCKV 5001 - 10000 CFM Cx Campaign	73,619	45,644	1,104,285	684,656	75,636	71,854	1,134,542	1,077,815
C & I Prescriptive - Small	DCKV 5001 - 10000 CFM Cx Offer	63,102	39,123	946,530	586,848	64,831	61,589	972,465	923,842

Program	Measure	Tracked				Verified			
		Annual		Cumulative		Annual		Cumulative	
		Gross	Net	Gross	Net	Gross	Net	Gross	Net
C & I Prescriptive - Small	DCKV up to 5000 CFM Cx Campaign	4,207	2,608	63,105	39,125	4,322	4,106	64,834	61,592
C & I Prescriptive - Small	DCKV up to 5000 CFM Cx Offer	16,828	10,433	252,420	156,500	17,289	16,425	259,336	246,369
C & I Prescriptive - Small	DCV Single Zone Retail with Maintenance Cx Offer	96,744	7,740	1,451,166	116,094	100,750	87,230	1,511,245	1,308,443
C & I Prescriptive - Small	DCV Single Zone Retail with NO Maintenance Cx Offer	21,193	1,695	211,935	16,955	22,071	20,967	220,709	209,673
C & I Prescriptive - Small	Destratification Fan Cx Offer	17,340	15,606	260,100	234,090	17,340	15,606	260,100	234,090
C & I Prescriptive - Small	ERV Vent High Stand Multi Res 75% - 84% Cx Offer	19,458	18,485	272,412	258,791	19,458	18,485	272,412	258,791
C & I Prescriptive - Small	ERV Vent Low Int Office 75% - 84% Cx Offer	2,573	2,444	36,015	34,214	2,573	2,444	36,015	34,214
C & I Prescriptive - Small	ERV Vent Low Stand Office 65% - 74% Cx Offer	7,807	7,417	109,298	103,833	7,807	7,417	109,298	103,833
C & I Prescriptive - Small	ERV Vent Low Stand Office 75% - 84% Cx Offer	7,301	6,936	102,215	97,104	7,301	6,936	102,214	97,103
C & I Prescriptive - Small	Fryer Cx Campaign	46,464	37,171	557,568	446,054	46,464	37,171	557,568	446,054
C & I Prescriptive - Small	Fryer Cx Offer	56,320	45,056	675,840	540,672	56,320	45,056	675,840	540,672
C & I Prescriptive - Small	High Boiler 1500 - 1999 MBH Cx Offer	19,189	5,757	479,725	143,918	19,189	15,351	479,725	383,780
C & I Prescriptive - Small	High Boiler 300 - 599 MBH Cx Offer	6,992	2,098	174,800	52,440	6,992	6,153	174,800	153,824
C & I Prescriptive - Small	HRV Vent Low Stand Office 65% - 74% Cx Offer	427	406	5,981	5,682	427	406	5,981	5,682

Program	Measure	Tracked				Verified			
		Annual		Cumulative		Annual		Cumulative	
		Gross	Net	Gross	Net	Gross	Net	Gross	Net
C & I Prescriptive - Small	Ind Infrared 2-Stage 50,000 - 164,999 Cx Campaign	10,780	1,186	183,260	20,159	11,069	7,416	188,171	126,075
C & I Prescriptive - Small	Ind Infrared Single Stage 165,000 - 300,000 Cx Campaign	4,600	506	78,200	8,602	4,723	3,165	80,296	53,798
C & I Prescriptive - Small	Ind Infrared Single Stage 165,000 - 300,000 Cx Offer	51,903	5,709	882,343	97,058	53,293	35,707	905,989	607,013
C & I Prescriptive - Small	Ind Infrared Single Stage 50,000-164,999 Cx Campaign	28,743	3,162	488,623	53,748	29,513	19,774	501,718	336,151
C & I Prescriptive - Small	Ind Infrared Single Stage 50,000-164,999 Cx Offer	67,965	7,476	1,155,405	127,099	69,786	46,757	1,186,370	794,868
C & I Prescriptive - Small	Infrared 2-Stage 50,000-164,999 Cx Campaign	26,473	2,912	450,033	49,503	27,182	18,212	462,093	309,603
C & I Prescriptive - Small	Infrared 2-Stage 50,000-164,999 Cx Offer	15,974	1,757	271,558	29,872	16,402	10,989	278,836	186,820
C & I Prescriptive - Small	Infrared Single Stage 165,000 -300,000 Cx Campaign	22,682	2,495	385,594	42,415	23,290	15,604	395,928	265,272
C & I Prescriptive - Small	Infrared Single Stage 50,000-164,999 Cx Campaign	32,923	3,621	559,684	61,567	33,805	22,649	574,682	385,037
C & I Prescriptive - Small	Infrared Single Stage 50,000-164,999 Cx Offer	55,880	6,147	949,961	104,498	57,378	38,443	975,419	653,531
C & I Prescriptive - Small	Ozone Washer Extractor >60lbs and <500lbs Cx Campaign	31,685	29,150	475,269	437,246	31,685	29,150	475,268	437,247
C & I Prescriptive - Small	School Board Boiler Elementary Cx Campaign	113,454	34,036	2,836,350	850,905	109,953	96,759	2,748,825	2,418,966
C & I Prescriptive - Small	School Board Boiler Elementary Cx Offer	63,030	18,909	1,575,750	472,725	61,085	53,755	1,527,125	1,343,870
C & I Prescriptive - Small	School Board Boiler Secondary Cx Offer	51,052	15,316	1,276,300	382,890	49,476	43,539	1,236,900	1,088,472

Program	Measure	Tracked				Verified			
		Annual		Cumulative		Annual		Cumulative	
		Gross	Net	Gross	Net	Gross	Net	Gross	Net
C & I Prescriptive - Small	Showerhead Offer	5,355	4,072	53,550	40,725	5,355	4,072	53,550	40,725
Home Winterproofing	LI Prescriptive - Adaptive Thermostats	138,380	138,380	2,075,700	2,075,700	138,380	138,380	2,075,700	2,075,700
Home Winterproofing	LI Prescriptive - Bathroom Aerators	1,088	245	10,880	2,448	1,088	245	10,880	2,448
Home Winterproofing	LI Prescriptive - Kitchen Aerators	659	221	6,589	2,207	659	221	6,589	2,207
Home Winterproofing	LI Prescriptive - Programmable Thermostats	4,646	4,646	69,690	69,690	4,646	4,646	69,690	69,690
Home Winterproofing	LI Prescriptive - Showerheads 2.6+	989	867	9,887	8,670	989	867	9,887	8,670
Low Income Multi-Residential	Low Income Condensing Boiler up to 299MBH Cx Offer	20,745	20,745	518,620	518,620	20,745	20,745	518,620	518,620
Low Income Multi-Residential	Low Income Condensing MUA Two Spd up to 14000 CFM Cx Offer	93,053	93,053	1,861,069	1,861,069	93,053	93,053	1,861,069	1,861,069
Low Income Multi-Residential	Low Income Condensing Storage Water Heater Cx Offer	6,257	6,257	93,860	93,860	6,257	6,257	93,859	93,859
Low Income Multi-Residential	Low Income High Eff Boiler 1501-2000MBH Seasonal Cx Offer	76,756	76,756	1,918,900	1,918,900	76,756	76,756	1,918,900	1,918,900
Low Income Multi-Residential	Low Income High Eff Boiler 300-599MBH Cx Offer	13,984	13,984	349,600	349,600	13,984	13,984	349,600	349,600
Low Income Multi-Residential	Low Income Showerhead Offer	13,403	11,754	134,028	117,542	13,403	11,754	134,028	117,543
Low Income Multi-Residential	Low Income Showerheads Offer	12,515	10,976	125,154	109,760	12,515	10,976	125,154	109,760
Residential Adaptive Thermostats	Residential Adaptive Thermostat	3,008,470	2,888,131	45,127,050	43,321,968	3,008,470	2,888,131	45,127,050	43,321,968

*Not all values may compute exactly due to rounding.

Table 6-155. Union Gas Measure Savings, Tracked and Verified, by Annual and Cumulative, Gross and Net*

Program	Measure	Tracked				Verified			
		Annual		Cumulative		Annual		Cumulative	
		Gross	Net	Gross	Net	Gross	Net	Gross	Net
C & I Direct Install	Air Curtain - 10 x 10	1,247,760	1,185,372	18,716,400	17,780,580	1,247,760	1,185,372	18,716,400	17,780,580
C & I Direct Install	Air Curtain - 8 x 10	1,831,335	1,739,768	27,470,025	26,096,524	1,831,335	1,739,768	27,470,025	26,096,524
C & I Direct Install	Air Curtain - 8 x 8	496,428	471,607	7,446,420	7,074,099	496,428	471,607	7,446,420	7,074,099
C & I Prescriptive	Air Curtain - (2) 7 x 3 Door	6,715	3,358	100,725	50,363	6,715	6,379	100,725	95,689
C & I Prescriptive	Air Curtain - (2) 7 x 6 Door	37,604	18,802	564,060	282,030	37,604	35,724	564,060	535,857
C & I Prescriptive	Air Curtain - (2) 8 x 6 Door	3,243	1,622	48,645	24,323	3,243	3,081	48,645	46,213
C & I Prescriptive	Air Curtain - 10 x 10 with LTO BONUS	727,860	363,930	10,917,900	5,458,950	727,860	691,467	10,917,900	10,372,005
C & I Prescriptive	Air Curtain - 7 x 3 Door	16,104	8,052	241,560	120,780	16,104	15,299	241,560	229,482
C & I Prescriptive	Air Curtain - 7 x 6 Door	6,715	3,358	100,725	50,363	6,715	6,379	100,725	95,689
C & I Prescriptive	Air Curtain - 8 x 10 with LTO BONUS	408,645	204,323	6,129,675	3,064,838	408,645	388,213	6,129,675	5,823,191
C & I Prescriptive	Air Curtain - 8 x 6 Door	1,622	811	24,330	12,165	1,622	1,541	24,330	23,114
C & I Prescriptive	Air Curtain - 8 x 8 with LTO BONUS	72,648	36,324	1,089,720	544,860	72,648	69,016	1,089,720	1,035,234
C & I Prescriptive	Air Curtain Ambient - w/ Vestibule - 7x3	1,362	681	20,430	10,215	1,362	1,294	20,430	19,409
C & I Prescriptive	Air Curtain Ambient - w/ Vestibule - 7x6	5,454	2,727	81,810	40,905	5,454	5,181	81,810	77,720
C & I Prescriptive	Air Curtain Heated - w/ Vestibule - (2)7x3	909	455	13,635	6,818	909	864	13,635	12,953
C & I Prescriptive	Air Curtain Heated - w/ Vestibule - (2)7x6	3,634	1,817	54,510	27,255	3,634	3,452	54,510	51,785
C & I Prescriptive	Air Curtain Heated - w/ Vestibule - (2)8x6	4,388	2,194	65,820	32,910	4,388	4,169	65,820	62,529
C & I Prescriptive	Commercial Condensing Unit Heater	2,407	2,407	43,322	43,322	2,407	2,407	43,322	43,322
C & I Prescriptive	Commercial Energy Star Fryer -	92,928	74,342	1,115,136	892,109	92,928	74,342	1,115,136	892,109

Program	Measure	Tracked				Verified			
		Annual		Cumulative		Annual		Cumulative	
		Gross	Net	Gross	Net	Gross	Net	Gross	Net
	INSTALLED AFTER MARCH 1st 2018								
C & I Prescriptive	Commercial Energy Star Fryer - INSTALLED BEFORE MARCH 1st 2018	40,832	32,666	489,984	391,987	40,832	32,666	489,984	391,987
C & I Prescriptive	Commercial High Efficiency Furnace	40,837	33,690	735,063	606,427	40,837	33,690	735,063	606,427
C & I Prescriptive	Condensing Boiler - Space Heating - 300 to 999 MBH	1,706,797	409,631	42,669,925	10,240,782	1,735,130	1,648,373	43,378,246	41,209,334
C & I Prescriptive	Condensing Boiler - Space Heating - GTE 1000 MBH	2,893,082	694,340	72,327,060	17,358,494	2,941,108	2,794,052	73,527,689	69,851,305
C & I Prescriptive	Condensing Boiler - Space Heating - LT 300 MBH	366,265	87,904	9,156,632	2,197,592	372,345	353,728	9,308,632	8,843,201
C & I Prescriptive	Condensing Boiler - Water Heating - 300 to 999 MBH	184,666	44,320	4,616,646	1,107,995	187,731	178,345	4,693,282	4,458,618
C & I Prescriptive	Condensing Boiler - Water Heating - GTE 1000 MBH	168,244	40,379	4,206,100	1,009,464	171,037	162,485	4,275,921	4,062,125
C & I Prescriptive	Condensing Boiler - Water Heating - LT 300 MBH	108,593	26,062	2,714,823	651,558	110,396	104,876	2,759,889	2,621,895
C & I Prescriptive	Condensing Storage Water Heater - GT 250 kBTU/hr	39,790	37,801	596,851	567,009	39,790	37,801	596,851	567,009
C & I Prescriptive	Condensing Storage Water Heater - GT 75 & LTE 250 kBTU/Hr	26,815	25,475	402,230	382,119	26,815	25,475	402,230	382,119
C & I Prescriptive	Condensing Tankless Water Heater - GT 75 & LT 200 kBTU/hr	35,188	34,484	703,762	689,687	35,188	34,484	703,762	689,687
C & I Prescriptive	Condensing Tankless Water Heater - GTE 200 kBTU/hr	968	949	19,360	18,973	968	949	19,360	18,973
C & I Prescriptive	DCKV - 10,001 to 15,000 cfm with LTO BONUS	17,529	16,653	262,935	249,788	17,529	16,653	262,935	249,788

Program	Measure	Tracked				Verified			
		Annual		Cumulative		Annual		Cumulative	
		Gross	Net	Gross	Net	Gross	Net	Gross	Net
C & I Prescriptive	DCKV - 5,001 to 10,000 cfm	10,517	9,991	157,755	149,867	10,517	9,991	157,755	149,867
C & I Prescriptive	DCKV - 5,001 to 10,000 cfm - Install After July 13 2018	10,517	9,991	157,755	149,867	10,517	9,991	157,755	149,867
C & I Prescriptive	DCKV - 5,001 to 10,000 cfm with LTO BONUS	220,857	209,814	3,312,855	3,147,212	220,857	209,814	3,312,855	3,147,212
C & I Prescriptive	DCKV - Up to 5,000 cfm	16,828	15,987	252,420	239,799	16,828	15,987	252,420	239,799
C & I Prescriptive	DCKV - Up to 5,000 cfm - Install After July 13 2018	4,207	3,997	63,105	59,950	4,207	3,997	63,105	59,950
C & I Prescriptive	DCKV - Up to 5,000 cfm - Install Before July 13 2018	12,621	11,990	189,315	179,849	12,621	11,990	189,315	179,849
C & I Prescriptive	DCKV - Up to 5,000 cfm with LTO BONUS	113,589	107,910	1,703,835	1,618,643	113,589	107,910	1,703,835	1,618,643
C & I Prescriptive	DCV-Community Center Meeting Spaces-NC/TNR	2,205	1,764	22,050	17,640	2,205	1,764	22,050	17,640
C & I Prescriptive	DCV-Community Center Meeting Spaces-Retrofit	2,496	2,371	24,961	23,713	2,496	2,371	24,961	23,713
C & I Prescriptive	DCV-Exercise centers and Sports Arenas-Retrofit	870	827	8,700	8,265	870	827	8,700	8,265
C & I Prescriptive	DCV-Hotel Conference Rooms-Retrofit	26,025	24,724	260,250	247,238	26,075	24,771	260,750	247,713
C & I Prescriptive	DCV-Office-GTE 2,500 sq ft-NC/TNR	13,350	10,680	133,504	106,803	13,350	10,680	133,504	106,803
C & I Prescriptive	DCV-Office-GTE 2,500 sq ft-Retrofit	7,709	7,324	77,094	73,239	7,709	7,324	77,094	73,239
C & I Prescriptive	DCV-Office-LT 2,500 sq ft-Retrofit	3,058	2,906	30,585	29,056	3,058	2,906	30,585	29,056
C & I Prescriptive	DCV-Primary/Secondary Education Classrooms-NC/TNR	11,642	9,313	116,415	93,132	11,720	9,376	117,195	93,756
C & I Prescriptive	DCV-Primary/Secondary	5,731	5,445	57,312	54,446	14,246	13,534	142,464	135,341

Program	Measure	Tracked				Verified			
		Annual		Cumulative		Annual		Cumulative	
		Gross	Net	Gross	Net	Gross	Net	Gross	Net
	Education Classrooms-Retrofit								
C & I Prescriptive	DCV-Retail-GTE 5,000 sq ft-NC/TNR	17,940	14,352	179,403	143,522	17,940	14,352	179,403	143,522
C & I Prescriptive	DCV-Retail-GTE 5,000 sq ft-Retrofit	265,836	252,544	2,658,356	2,525,438	265,836	252,544	2,658,356	2,525,438
C & I Prescriptive	DCV-Retail-LT 5,000 sq ft-NC/TNR	62,722	50,178	627,222	501,778	62,723	50,178	627,225	501,780
C & I Prescriptive	DCV-Retail-LT 5,000 sq ft-Retrofit	176,165	167,357	1,761,652	1,673,569	171,326	162,760	1,713,260	1,627,597
C & I Prescriptive	Dishwasher-Multi Tank Conveyor-High Temperature	2,049	1,496	40,980	29,915	2,049	1,496	40,980	29,915
C & I Prescriptive	Dishwasher-Stationary Single Tank Door-High Temperature	1,780	1,424	26,700	21,360	1,780	1,424	26,700	21,360
C & I Prescriptive	Dishwasher-Under Counter-High Temperature	1,918	1,151	19,180	11,508	1,918	1,151	19,180	11,508
C & I Prescriptive	Dishwasher-Under Counter-Low Temperature	1,932	1,159	19,320	11,592	1,932	1,159	19,320	11,592
C & I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 55% Sensible Heat Recovery	37,518	11,255	525,249	157,575	37,349	35,482	522,886	496,741
C & I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 65% Sensible Heat Recovery	539,612	161,883	7,554,562	2,266,369	537,183	510,324	7,520,567	7,144,538
C & I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 65% SHR - In-Suite	75,779	22,734	1,060,909	318,273	75,438	71,666	1,056,135	1,003,328
C & I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 75% Sensible Heat Recovery	307,872	92,362	4,310,205	1,293,061	306,486	291,162	4,290,809	4,076,268
C & I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 75% SHR - In-Suite	104,087	31,226	1,457,211	437,163	103,618	98,437	1,450,654	1,378,121

Program	Measure	Tracked				Verified			
		Annual		Cumulative		Annual		Cumulative	
		Gross	Net	Gross	Net	Gross	Net	Gross	Net
C & I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 85% Sensible Heat Recovery	202,621	60,786	2,836,698	851,010	201,710	191,624	2,823,933	2,682,737
C & I Prescriptive	Energy Recovery Ventilator (ERV)-Incremental-GTE 65% Sensible Heat Recovery	13,695	4,108	191,727	57,518	13,633	12,952	190,864	181,321
C & I Prescriptive	Energy Recovery Ventilator (ERV)-Incremental-GTE 75% Sensible Heat Recovery	27,916	8,375	390,826	117,248	27,791	26,401	389,067	369,614
C & I Prescriptive	Energy Recovery Ventilator (ERV)-Incremental-GTE 85% Sensible Heat Recovery	5,404	1,621	75,649	22,695	5,379	5,110	75,309	71,543
C & I Prescriptive	Heat Recovery Ventilator (HRV)-GTE 55% Sensible Heat Recovery	38,783	36,843	542,955	515,807	38,783	36,843	542,955	515,807
C & I Prescriptive	Heat Recovery Ventilator (HRV)-GTE 65% Sensible Heat Recovery	51,871	49,278	726,196	689,886	51,871	49,278	726,196	689,886
C & I Prescriptive	Heat Recovery Ventilator (HRV)-GTE 65% SHR - In-Suite	3,250	3,088	45,500	43,225	3,250	3,088	45,500	43,225
C & I Prescriptive	Heat Recovery Ventilator (HRV)-GTE 75% Sensible Heat Recovery	204,667	194,433	2,865,334	2,722,068	204,667	194,433	2,865,334	2,722,068
C & I Prescriptive	Heat Recovery Ventilator (HRV)-GTE 85% Sensible Heat Recovery	6,225	5,914	87,154	82,796	6,225	5,914	87,154	82,796
C & I Prescriptive	Heat Recovery Ventilator (HRV)-Incremental-GTE 65%	1,404	1,334	19,656	18,673	1,404	1,334	19,656	18,673

Program	Measure	Tracked				Verified			
		Annual		Cumulative		Annual		Cumulative	
		Gross	Net	Gross	Net	Gross	Net	Gross	Net
	Sensible Heat Recovery								
C & I Prescriptive	Heat Recovery Ventilator (HRV)-Incremental-GTE 65% SHR - MURB In-Suite	501	475	7,007	6,657	501	475	7,007	6,657
C & I Prescriptive	Heat Recovery Ventilator (HRV)-Incremental-GTE 75% Sensible Heat Recovery	116	110	1,617	1,536	116	110	1,617	1,536
C & I Prescriptive	Heat Recovery Ventilator (HRV)-Incremental-GTE 85% Sensible Heat Recovery	1,869	1,776	26,167	24,859	1,869	1,776	26,167	24,859
C & I Prescriptive	Infrared Heater - Single Stage / High Intensity	391,233	27,386	6,650,953	465,567	401,678	269,125	6,828,533	4,575,117
C & I Prescriptive	Infrared Heater - Two Stage	424,535	29,717	7,217,087	505,196	435,870	292,033	7,409,783	4,964,554
C & I Prescriptive	Make-Up Air Unit (MUA) - 2 Speed	7,840	7,448	156,800	148,960	7,840	7,448	156,800	148,960
C & I Prescriptive	Make-Up Air Unit (MUA) - 2 Speed GTE 5000 CFM - WITH LTO BONUS	9,150	8,693	183,000	173,850	9,150	8,693	183,000	173,850
C & I Prescriptive	Make-Up Air Unit (MUA) - Constant Speed	14,044	13,342	280,886	266,842	14,044	13,342	280,886	266,842
C & I Prescriptive	Make-Up Air Unit (MUA) - VFD	111,660	106,077	2,233,196	2,121,536	111,660	106,077	2,233,196	2,121,536
C & I Prescriptive	Make-Up Air Unit (MUA) - VFD - GTE 5000 CFM WITH LTO BONUS	67,660	64,277	1,353,198	1,285,538	67,660	64,277	1,353,198	1,285,538
C & I Prescriptive	Ozone Laundry - Washer Extractor <= 60 Lbs Cap with LTO BONUS	50,318	46,292	754,763	694,382	50,332	46,305	754,973	694,576
C & I Prescriptive	Ozone Laundry - Washer Extractor >	335,510	308,669	5,032,650	4,630,038	333,233	306,575	4,998,502	4,598,621

Program	Measure	Tracked				Verified			
		Annual		Cumulative		Annual		Cumulative	
		Gross	Net	Gross	Net	Gross	Net	Gross	Net
	60 and < 500 Lbs Cap with LTO BONUS								
C & I Prescriptive	Ozone Laundry - Washer Extractor LTE 60 Lbs Capacity	7,689	7,074	115,331	106,104	7,689	7,074	115,331	106,104
Home Weatherization	Bathroom Aerator	864	855	8,640	8,554	864	855	8,640	8,554
Home Weatherization	Kitchen Aerator	1,457	1,442	14,566	14,420	1,457	1,442	14,566	14,420
Home Weatherization	Pipe Insulation	3,090	3,059	46,344	45,880	3,089	3,058	46,341	45,877
Home Weatherization	Programable Thermostat	2,806	2,778	42,090	41,669	2,806	2,778	42,090	41,669
Home Weatherization	Showerhead Replacement 1.25 GPM	3,666	3,629	36,660	36,293	3,666	3,629	36,660	36,293
Indigenous	Bathroom Aerator	51	51	512	507	51	51	512	507
Indigenous	Kitchen Aerator	92	92	925	916	92	92	925	916
Indigenous	Pipe Insulation	372	368	5,575	5,519	372	368	5,575	5,519
Indigenous	Showerhead Replacement 1.25 GPM	367	363	3,666	3,629	367	363	3,666	3,629
Large Volume	Infrared Heater - Two Stage	3,930	2,633	66,810	44,763	3,930	2,633	66,810	44,763
Multi-Family	Air Curtain - Low Income - 8 x 8	36,324	34,508	544,860	517,617	36,324	34,508	544,860	517,617
Multi-Family	Commercial Condensing Unit Heater-LI	10,218	9,707	183,916	174,720	10,218	9,707	183,916	174,720
Multi-Family	Commercial High Efficiency Furnace-LI	124	118	2,239	2,127	124	118	2,239	2,127
Multi-Family	Condensing Boiler - Space Heating - 300 to 999 MBH	192,887	183,242	4,822,168	4,581,060	192,887	183,242	4,822,168	4,581,060
Multi-Family	Condensing Boiler - Space Heating - GTE 1000 MBH	163,779	155,590	4,094,480	3,889,756	163,779	155,590	4,094,480	3,889,756
Multi-Family	Condensing Boiler - Space Heating - LT 300 MBH	19,208	18,248	480,204	456,194	19,208	18,248	480,204	456,194

Program	Measure	Tracked				Verified			
		Annual		Cumulative		Annual		Cumulative	
		Gross	Net	Gross	Net	Gross	Net	Gross	Net
Multi-Family	Condensing Boiler - Water Heating - 300 to 999 MBH	68,258	64,845	1,706,453	1,621,130	68,258	64,845	1,706,453	1,621,130
Multi-Family	Condensing Boiler - Water Heating - LT 300 MBH	13,208	12,548	330,207	313,697	13,208	12,548	330,207	313,697
Multi-Family	Condensing Storage Water Heater - GT 250 kBTU/hr	9,572	9,093	143,578	136,399	9,572	9,093	143,578	136,399
Multi-Family	Condensing Storage Water Heater - GT 75 & LTE 250 kBTU/Hr	3,207	3,047	48,111	45,706	3,207	3,047	48,111	45,706
Multi-Family	Energy Recovery Ventilator (ERV)-GTE 65% Sensible Heat Recovery-LI	80,950	76,902	1,133,297	1,076,632	80,950	76,902	1,133,297	1,076,632
Multi-Family	Energy Recovery Ventilator (ERV)-GTE 65% SHR - In-Suite-LI	16,184	15,375	226,576	215,247	16,184	15,375	226,576	215,247
Multi-Family	Energy Recovery Ventilator (ERV)-GTE 75% Sensible Heat Recovery-LI	41,400	39,330	579,600	550,620	41,400	39,330	579,600	550,620
Multi-Family	Energy Recovery Ventilator (ERV)-GTE 75% SHR - In-Suite-LI	33,051	31,398	462,714	439,578	33,051	31,398	462,714	439,578
Multi-Family	Energy Recovery Ventilator (ERV)-Incremental-GTE 85% Sensible Heat Recovery	33,960	32,262	475,440	451,668	33,960	32,262	475,440	451,668
Multi-Family	Heat Recovery Ventilator (HRV)-GTE 65% Sensible Heat Recovery-LI	13,495	12,820	188,930	179,484	13,495	12,820	188,930	179,484
Multi-Family	Heat Recovery Ventilator (HRV)-GTE 65% SHR - In-Suite-LI	24,050	22,848	336,700	319,865	24,050	22,848	336,700	319,865

Program	Measure	Tracked				Verified			
		Annual		Cumulative		Annual		Cumulative	
		Gross	Net	Gross	Net	Gross	Net	Gross	Net
Multi-Family	Make-Up Air Unit (MUA) - 2 Speed	12,250	11,638	245,000	232,750	12,250	11,638	245,000	232,750
Multi-Family	Make-Up Air Unit (MUA) - VFD	228,492	217,067	4,569,840	4,341,348	228,492	217,067	4,569,840	4,341,348

*Not all values may compute exactly due to rounding.

Savings Verification Discrepancies

Table 6-156. Enbridge measure verification discrepancies

Program	Measure	Issue	Resolution	Tracked Cumulative Gross Savings	Tracked Cumulative Net Savings	Verified Cumulative Gross Savings	Verified Cumulative Net Savings
C & I Direct Install - Large	Direct Install Air Door 8x10 Cx Offer	Rounding	-	6,583,725	6,254,540	6,583,725	6,254,539
C & I Direct Install - Large	Direct Install DCKV 10001 - 15000 CFM Cx Offer	Rounding	-	1,051,740	999,152	1,051,740	999,153
C & I Direct Install - Small	Direct Install Air Door 8x10 Cx Offer	Rounding	-	30,194,325	28,684,622	30,194,325	28,684,609
C & I Direct Install - Small	Direct Install Air Door Single 7x3 Cx Offer	Rounding	-	221,430	210,364	221,430	210,359
C & I Direct Install - Small	Direct Install Air Door Single 7x6 Cx Offer	Rounding	-	181,305	172,242	181,305	172,240
C & I Direct Install - Small	Direct Install DCKV 5001 - 10000 CFM Cx Offer	Rounding	-	1,262,040	1,198,936	1,262,040	1,198,938
C & I Direct Install - Small	Direct Install DCV Offer	Rounding	-	1,636,009	1,554,208	1,636,010	1,554,210
C & I Prescriptive - Large	Cond Boiler 200-299 MBH Cx Campiagn	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	145,208	43,562	145,208	137,947
C & I Prescriptive - Large	Cond Boiler 200-299 MBH Cx Offer	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	68,475	20,543	68,475	65,051
C & I Prescriptive - Large	DCKV 10001 - 15000 CFM Cx Offer	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	262,935	163,020	270,139	256,632
C & I Prescriptive - Large	DCKV 5001 - 10000 CFM Cx Offer	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	946,530	586,848	972,465	923,842
C & I Prescriptive - Large	DCKV up to 5000 CFM Cx Offer	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	126,210	78,250	129,668	123,185

Program	Measure	Issue	Resolution	Tracked Cumulative Gross Savings	Tracked Cumulative Net Savings	Verified Cumulative Gross Savings	Verified Cumulative Net Savings
C & I Prescriptive - Large	DCV Single Zone Retail with NO Maintenance Cx Offer	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	194,432	15,556	202,481	192,357
C & I Prescriptive - Large	High Boiler 1000-1499MBH Cx Campaign	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	575,075	172,523	575,075	484,342
C & I Prescriptive - Large	High Boiler 1000-1499MBH Cx Offer	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	439,300	131,791	439,300	375,722
C & I Prescriptive - Large	High Boiler 1500 - 1999 MBH Cx Offer	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	959,450	287,835	959,450	844,316
C & I Prescriptive - Large	High Boiler 600 - 999 MBH Cx Offer	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	76,900	23,070	76,900	61,520
C & I Prescriptive - Large	High Boiler 600-999 MBH Cx Offer	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	76,900	23,070	76,900	61,520
C & I Prescriptive - Large	Ind Infrared 2-Stage 165,000 - 300,000 Cx Campagin	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	44,540	4,899	45,734	30,642
C & I Prescriptive - Large	Ind Infrared 2-Stage 50,000 - 164,999 Cx Campaign	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	33,405	3,675	34,300	22,981
C & I Prescriptive - Large	Ind Infrared Single Stage 165,000 - 300,000 Cx Offer	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	78,200	8,602	80,296	53,798
C & I Prescriptive - Large	Ind Infrared Single Stage 50,000-164,999 Cx Offer	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	107,525	11,829	110,407	73,972
C & I Prescriptive - Large	Infrared 2-Stage 165,000-300,000 Cx Campaign	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	2,568,972	282,587	2,637,820	1,767,340
C & I Prescriptive - Large	Infrared Single Stage 165,000 - 300,000 Cx Offer	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	1,104,023	121,442	1,133,610	759,519

Program	Measure	Issue	Resolution	Tracked Cumulative Gross Savings	Tracked Cumulative Net Savings	Verified Cumulative Gross Savings	Verified Cumulative Net Savings
C & I Prescriptive - Large	Infrared Single Stage 50,000-164,999 Cx Campaign	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	283,475	31,183	291,072	195,018
C & I Prescriptive - Large	Infrared Single Stage 50,000-164,999 Cx Offer	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	465,291	51,183	477,760	320,099
C & I Prescriptive - Large	School Board Boiler Secondary Cx Campaign	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	1,276,300	382,890	1,236,900	1,088,472
C & I Prescriptive - Large	School Board Boiler Secondary Cx Offer	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	1,276,300	382,890	1,236,900	1,088,472
C & I Prescriptive - Large	Showerhead Offer	Rounding	-	342,414	260,405	342,414	260,406
C & I Prescriptive - Small	Air Door Double with Vestibule 7x3 Cx Offer	Rounding	-	27,270	25,906	27,270	25,907
C & I Prescriptive - Small	Cond Boiler 100-199MBH Cx Campaign	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	399,017	119,705	399,015	379,065
C & I Prescriptive - Small	Cond Boiler 100-199MBH Cx Offer	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	244,822	73,446	244,821	232,580
C & I Prescriptive - Small	Cond Boiler 200-299 MBH Cx Campiagn	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	171,956	51,587	171,956	163,358
C & I Prescriptive - Small	Cond Boiler 200-299 MBH Cx Offer	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	403,430	121,030	403,430	383,258
C & I Prescriptive - Small	Cond Strge W/H High Multi-Res 75-250 Kbtu Cx Campaign	Rounding	-	24,010	22,808	24,009	22,809
C & I Prescriptive - Small	DCKV 5001 - 10000 CFM Cx Campaign	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	1,104,285	684,656	1,134,542	1,077,815
C & I Prescriptive - Small	DCKV 5001 - 10000 CFM Cx Offer	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	946,530	586,848	972,465	923,842

Program	Measure	Issue	Resolution	Tracked Cumulative Gross Savings	Tracked Cumulative Net Savings	Verified Cumulative Gross Savings	Verified Cumulative Net Savings
C & I Prescriptive - Small	DCKV up to 5000 CFM Cx Campaign	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	63,105	39,125	64,834	61,592
C & I Prescriptive - Small	DCKV up to 5000 CFM Cx Offer	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	252,420	156,500	259,336	246,369
C & I Prescriptive - Small	DCV Single Zone Retail with Maintenance Cx Offer	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	1,451,166	116,094	1,511,245	1,308,443
C & I Prescriptive - Small	DCV Single Zone Retail with NO Maintenance Cx Offer	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	211,935	16,955	220,709	209,673
C & I Prescriptive - Small	ERV Vent Low Stand Office 75% - 84% Cx Offer	Rounding	-	102,215	97,104	102,214	97,103
C & I Prescriptive - Small	High Boiler 1500 - 1999 MBH Cx Offer	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	479,725	143,918	479,725	383,780
C & I Prescriptive - Small	High Boiler 300 - 599 MBH Cx Offer	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	174,800	52,440	174,800	153,824
C & I Prescriptive - Small	Ind Infrared 2-Stage 50,000 - 164,999 Cx Campaign	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	183,260	20,159	188,171	126,075
C & I Prescriptive - Small	Ind Infrared Single Stage 165,000 - 300,000 Cx Campaign	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	78,200	8,602	80,296	53,798
C & I Prescriptive - Small	Ind Infrared Single Stage 165,000 - 300,000 Cx Offer	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	882,343	97,058	905,989	607,013
C & I Prescriptive - Small	Ind Infrared Single Stage 50,000-164,999 Cx Campaign	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	488,623	53,748	501,718	336,151

Program	Measure	Issue	Resolution	Tracked Cumulative Gross Savings	Tracked Cumulative Net Savings	Verified Cumulative Gross Savings	Verified Cumulative Net Savings
C & I Prescriptive - Small	Ind Infrared Single Stage 50,000-164,999 Cx Offer	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	1,155,405	127,099	1,186,370	794,868
C & I Prescriptive - Small	Infrared 2-Stage 50,000-164,999 Cx Campaign	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	450,033	49,503	462,093	309,603
C & I Prescriptive - Small	Infrared 2-Stage 50,000-164,999 Cx Offer	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	271,558	29,872	278,836	186,820
C & I Prescriptive - Small	Infrared Single Stage 165,000 - 300,000 Cx Campaign	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	385,594	42,415	395,928	265,272
C & I Prescriptive - Small	Infrared Single Stage 50,000-164,999 Cx Campaign	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	559,684	61,567	574,682	385,037
C & I Prescriptive - Small	Infrared Single Stage 50,000-164,999 Cx Offer	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	949,961	104,498	975,419	653,531
C & I Prescriptive - Small	Ozone Washer Extractor >60lbs and <500lbs Cx Campaign	Rounding	-	475,269	437,246	475,268	437,247
C & I Prescriptive - Small	School Board Boiler Elementary Cx Campaign	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	2,836,350	850,905	2,748,825	2,418,966
C & I Prescriptive - Small	School Board Boiler Elementary Cx Offer	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	1,575,750	472,725	1,527,125	1,343,870
C & I Prescriptive - Small	School Board Boiler Secondary Cx Offer	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	1,276,300	382,890	1,236,900	1,088,472
Low Income Multi-Residential	Low Income Condensing Storage Water Heater Cx Offer	Rounding	-	93,860	93,860	93,859	93,859
Low Income Multi-Residential	Low Income Showerhead Offer	Rounding	-	134,028	117,542	134,028	117,543

Table 6-157. Union measure verification discrepancies

Program	Measure	Issue	Resolution	Tracked Cumulative Gross Savings	Tracked Cumulative Net Savings	Verified Cumulative Gross Savings	Verified Cumulative Net Savings
C & I Prescriptive	Air Curtain - (2) 7 x 3 Door	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	100,725	50,363	100,725	95,689
C & I Prescriptive	Air Curtain - (2) 7 x 6 Door	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	564,060	282,030	564,060	535,857
C & I Prescriptive	Air Curtain - (2) 8 x 6 Door	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	48,645	24,323	48,645	46,213
C & I Prescriptive	Air Curtain - 10 x 10 with LTO BONUS	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	10,917,900	5,458,950	10,917,900	10,372,005
C & I Prescriptive	Air Curtain - 7 x 3 Door	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	241,560	120,780	241,560	229,482
C & I Prescriptive	Air Curtain - 7 x 6 Door	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	100,725	50,363	100,725	95,689
C & I Prescriptive	Air Curtain - 8 x 10 with LTO BONUS	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	6,129,675	3,064,838	6,129,675	5,823,191
C & I Prescriptive	Air Curtain - 8 x 6 Door	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	24,330	12,165	24,330	23,114
C & I Prescriptive	Air Curtain - 8 x 8 with LTO BONUS	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	1,089,720	544,860	1,089,720	1,035,234
C & I Prescriptive	Air Curtain Ambient - w/ Vestibule - 7x3	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	20,430	10,215	20,430	19,409
C & I Prescriptive	Air Curtain Ambient - w/ Vestibule - 7x6	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	81,810	40,905	81,810	77,720
C & I Prescriptive	Air Curtain Heated - w/ Vestibule - (2)7x3	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	13,635	6,818	13,635	12,953
C & I Prescriptive	Air Curtain Heated - w/ Vestibule - (2)7x6	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	54,510	27,255	54,510	51,785
C & I Prescriptive	Air Curtain Heated - w/ Vestibule - (2)8x6	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	65,820	32,910	65,820	62,529

Program	Measure	Issue	Resolution	Tracked Cumulative Gross Savings	Tracked Cumulative Net Savings	Verified Cumulative Gross Savings	Verified Cumulative Net Savings
C & I Prescriptive	Condensing Boiler - Space Heating - 300 to 999 MBH	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	42,669,925	10,240,782	43,378,246	41,209,334
C & I Prescriptive	Condensing Boiler - Space Heating - GTE 1000 MBH	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	72,327,060	17,358,494	73,527,689	69,851,305
C & I Prescriptive	Condensing Boiler - Space Heating - LT 300 MBH	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	9,156,632	2,197,592	9,308,632	8,843,201
C & I Prescriptive	Condensing Boiler - Water Heating - 300 to 999 MBH	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	4,616,646	1,107,995	4,693,282	4,458,618
C & I Prescriptive	Condensing Boiler - Water Heating - GTE 1000 MBH	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	4,206,100	1,009,464	4,275,921	4,062,125
C & I Prescriptive	Condensing Boiler - Water Heating - LT 300 MBH	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	2,714,823	651,558	2,759,889	2,621,895
C & I Prescriptive	DCV-Hotel Conference Rooms-Retrofit	Assumptions from Demand Control Ventilation Subdocument finalized in TRM 3.0.	-	260,250	247,238	260,750	247,713
C & I Prescriptive	DCV-Primary/Secondary Education Classrooms-NC/TNR	Assumptions from Demand Control Ventilation Subdocument finalized in TRM 3.0.	-	116,415	93,132	117,195	93,756
C & I Prescriptive	DCV-Primary/Secondary Education Classrooms-Retrofit	Assumptions from Demand Control Ventilation Subdocument finalized in TRM 3.0.	-	57,312	54,446	142,464	135,341
C & I Prescriptive	DCV-Retail-LT 5,000 sq ft-NC/TNR	Assumptions from Demand Control Ventilation Subdocument finalized in TRM 3.0.	-	627,222	501,778	627,225	501,780
C & I Prescriptive	DCV-Retail-LT 5,000 sq ft-Retrofit	Assumptions from Demand Control Ventilation Subdocument finalized in TRM 3.0.	-	1,761,652	1,673,569	1,713,260	1,627,597
C & I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 55% Sensible Heat Recovery	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	525,249	157,575	522,886	496,741

Program	Measure	Issue	Resolution	Tracked Cumulative Gross Savings	Tracked Cumulative Net Savings	Verified Cumulative Gross Savings	Verified Cumulative Net Savings
C & I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 65% Sensible Heat Recovery	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	7,554,562	2,266,369	7,520,567	7,144,538
C & I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 65% SHR - In-Suite	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	1,060,909	318,273	1,056,135	1,003,328
C & I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 75% Sensible Heat Recovery	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	4,310,205	1,293,061	4,290,809	4,076,268
C & I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 75% SHR - In-Suite	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	1,457,211	437,163	1,450,654	1,378,121
C & I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 85% Sensible Heat Recovery	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	2,836,698	851,010	2,823,933	2,682,737
C & I Prescriptive	Energy Recovery Ventilator (ERV)-Incremental-GTE 65% Sensible Heat Recovery	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	191,727	57,518	190,864	181,321
C & I Prescriptive	Energy Recovery Ventilator (ERV)-Incremental-GTE 75% Sensible Heat Recovery	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	390,826	117,248	389,067	369,614
C & I Prescriptive	Energy Recovery Ventilator (ERV)-Incremental-GTE 85% Sensible Heat Recovery	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	75,649	22,695	75,309	71,543
C & I Prescriptive	Infrared Heater - Single Stage / High Intensity	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	6,650,953	465,567	6,828,533	4,575,117
C & I Prescriptive	Infrared Heater - Two Stage	Utility applied different gross realization rate than was found in C&I Prescriptive Verification Study.	-	7,217,087	505,196	7,409,783	4,964,554
C & I Prescriptive	Ozone Laundry - Washer Extractor	Tracking data error.	-	754,763	694,382	754,973	694,576

Program	Measure	Issue	Resolution	Tracked Cumulative Gross Savings	Tracked Cumulative Net Savings	Verified Cumulative Gross Savings	Verified Cumulative Net Savings
	<= 60 Lbs Cap with LTO BONUS						
C & I Prescriptive	Ozone Laundry - Washer Extractor > 60 and < 500 Lbs Cap with LTO BONUS	Tracking data error.	-	5,032,650	4,630,038	4,998,502	4,598,621
Home Weatherization	Pipe Insulation	Rounding	-	46,344	45,880	46,341	45,877

Appendix P Program Spending Tables

Table 6-158. Enbridge 2017 approved and spent budget*

Scorecard/Program	OEB-Approved Budget	Utility Spending	Difference	
			$	%
Resource Acquisition Total	**$43,162,456**	**$42,551,779**	**-$610,677**	**-1%**
Home Energy Conservation	$18,000,000	$24,367,955	$6,367,955	35%
Residential Adaptive Thermostats	$2,175,000	$1,578,427	-$596,573	-27%
Commercial & Industrial Custom	$7,361,562	$7,696,271	$334,709	5%
Commercial & Industrial Direct Install	$4,758,344	$1,726,487	-$3,031,857	-64%
Commercial & Industrial Prescriptive	$2,232,905	$1,164,036	-$1,068,869	-48%
Energy Leaders Initiative	$400,000	$324,138	-$75,862	-19%
Run it Right (RA Portion)	$1,584,600	$522,385	-$1,062,215	-67%
Comprehensive Energy Management (RA portion)	$95,000	$0	-$95,000	-100%
Small Commercial New Construction	$1,305,566	$0	-$1,305,566	-100%
Resource Acquisition Overhead	$5,249,479	$5,172,080	-$77,399	-1%
Low Income Total	**$13,309,177**	**$12,988,815**	**-$320,362**	**-2%**
Home Winterproofing	$6,477,200	$5,224,730	-$1,252,470	-19%
Low Income Multi Residential	$3,813,296	$4,417,079	$603,783	16%
Low Income New Construction	$1,400,000	$1,752,191	$352,191	25%
Low Income Overhead	$1,618,681	$1,594,815	-$23,866	-1%
Market Transformation Total	**$6,882,454**	**$7,518,569**	**$636,115**	**9%**
Residential Savings by Design	$3,250,000	$4,257,045	$1,007,045	31%
Commercial Savings by Design	$1,075,000	$1,264,997	$189,997	18%
Run it Right (MTEM portion)	$315,400	$608,623	$293,223	93%
Comprehensive Energy Management (MTEM portion)	$905,000	$314,424	-$590,576	-65%
School Energy Competition	$500,000	$248,768	-$251,232	-50%
Market Transformation Overhead	$837,054	$824,712	-$12,342	-1%
Portfolio Overhead	**$4,200,000**	**$1,720,115**	**-$2,479,885**	**-59%**
Process and Program Evaluation	$1,700,000	$549,796	-$1,150,204	-68%
DSM IT Chargeback**	$1,000,000	$0	-$1,000,000	-100%
Collaboration and Innovation**	$1,000,000	$703,213	-$296,787	-30%
Energy Literacy**	$500,000	$467,107	-$32,893	-7%
Enbridge Total	**$67,554,087**	**$64,779,279**	**-$2,774,808**	**-4%**

*Not all values may compute exactly due to rounding.
**These line items are collapsed into the Other category in Table 3-11.

Table 6-159. Union 2017 approved and spent budget*

Scorecard/Program		OEB-Approved Budget	Utility Spending	Difference	
				$	%
Resource Acquisition Total		**$36,633,281**	**$46,146,906**	**$9,513,625**	**26%**
Resource Acquisition - Residential		$13,907,697	$27,216,207	$13,308,510	96%
Home Reno Rebate		$12,226,000	$24,194,382	$11,968,382	98%
Residential Overhead		$1,681,697	$3,021,824	$1,340,127	80%
Resource Acquisition - Commercial & Industrial		$22,725,584	$18,930,699	-$3,794,885	-17%
Commercial & Industrial Custom	Commercial	$7,808,000	$841,870	$571,370	7%
	Industrial		$3,338,982		
	Agriculture & Greenhouse		$4,198,518		
Commercial & Industrial Direct Install		$2,500,000	$1,355,104	-$1,144,896	-46%
Commercial & Industrial Prescriptive		$7,486,000	$4,752,739	-$2,733,261	-37%
Commercial & Industrial Overhead		$4,931,584	$4,443,487	-$488,097	-10%
Low Income Total		**$13,570,954**	**$10,806,455**	**-$2,764,500**	**-20%**
Home Weatherization		$7,495,000	$6,872,283	-$622,717	-8%
Furnace End-of-Life		$924,000	$0	-$924,000	-100%
Indigenous		$511,000	$174,604	-$336,396	-66%
Multi-Family	Social and Assisted - Prescriptive	$2,984,000	$1,313,594	-$372,226	-12%
	Social and Assisted - Custom		$672,362		
	Market Rate - Prescriptive		$625,818		
	Market Rate - Custom		$0		
Low Income Overhead		$1,656,954	$1,147,793	-$509,161	-31%
Large Volume Total		**$4,000,000**	**$2,821,881**	**-$1,178,119**	**-29%**
Large Volume	Rate T2 Incentives	$3,150,000	$1,897,903	-$808,939	-26%
	Rate 100 Incentives		$442,996		
	Promotion		$162		
Large Volume Overhead		$850,000	$480,819	-$369,181	-43%
Market Transformation Total		**$2,338,070**	**$2,022,149**	**-$315,921**	**-14%**
Optimum Home		$841,000	$847,194	$6,194	1%
Commercial New Construction		$1,000,000	$853,788	-$146,212	-15%
Market Transformation Overhead		$497,070	$321,167	-$175,903	-35%
Performance-Based Total		**$1,088,000**	**$694,395**	**-$393,605**	**-36%**
RunSmart		$193,000	$145,265	-$47,735	-25%
Strategic Energy Management		$644,000	$357,804	-$286,196	-44%
Performance-Based Overhead		$251,000	$191,326	-$59,674	-24%
Portfolio Overhead		**$5,642,000**	**$6,496,375**	**$854,375**	**15%**
Research		$1,000,000	$672,614	-$327,386	-33%
Evaluation		$1,300,000	$868,505	-$431,495	-33%
Administration		$2,842,000	$3,858,509	$1,016,509	36%
Pilots**		$500,000	$192,887	-$307,113	-61%
Open Bill Project**		-	$821,395	$821,395	-
Future Infrastructure Planning Study**		-	$82,464	$82,464	-
Union Total		**$63,272,305**	**$68,988,159**	**$5,715,854**	**9%**

*Not all values may compute exactly due to rounding.
**These line items are collapsed into the Other category in Table 4-13.

Appendix Q Cost Effectiveness Methodology

Overview

The OEB requires the utilities to deliver portfolios that are cost effective at the "program" level. Each utility defines "program" differently from the other utility, and both utilities define "program" differently from the OEB, as shown in Table 6-160. Throughout this report, the EC has used the OEB-Defined Programs. The relevant cost effectiveness results are based on the utilities' definition of program.

Table 6-160: 2017 "Programs" as defined by the OEB, Enbridge, and Union

Utility-Defined Programs	OEB-Defined Programs
Enbridge	
Resource Acquisition	Home Energy Conservation
	Residential Adaptive Thermostats
	Commercial and Industrial Custom
	Commercial and Industrial Direct Install
	Commercial and Industrial Prescriptive
	Energy Leaders Initiative
	Run it Right
Low Income	Single Family (Part 9)
	Multi-residential (Part 3)
Market Transformation	Residential Savings by Design
	Commercial Savings by Design
	School Energy Competition
	Run it Right
	Comprehensive Energy Management
Union	
Residential Resource Acquisition	Home Reno Rebate
C&I Resource Acquisition	Commercial and Industrial Custom
	Commercial and Industrial Prescriptive
Low Income	Home Weatherization
	Indigenous
	Furnace End of Life
	Low Income Multi-Family
Large Volume	Large Volume
Market Transformation	Residential Savings by Design
	Commercial Savings by Design
Performance Based	Run it Right
	Strategic Energy Management

To calculate cost effectiveness, the EC used the cost-effectiveness model that has been applied in previous years using the utilities' verified savings. This step had several goals, including:

- Using a comprehensive model that can be easily modified to assess the impact of changing assumptions and methodology to calculate the TRC-Plus and PAC tests

- Ensuring consistent cost-effectiveness calculations by regrouping both utilities in the same model

The EC model was then modified to adjust gross savings using realization rates and free ridership from the annual savings verification activities and the provisional spillover rate. Because the realization rates for other savings (electricity, water) were generally either not available or much less precise, the gas realization rates were used for all savings.

The EC cost effectiveness methodology applied in 2018 is consistent with what was done for the 2017, 2016 and 2015 analysis, however, new this year is the inclusion of the Cost of Carbon.

As part of the OEB's DSM Mid-Term Report the OEB advised that carbon costs will be added to the cost-effectiveness test. Following the approach used to complete the 2019 Achievable Potential Study[111] and per the OEB's direction, the EC used the utility's avoided costs with the full carbon costs applied to all customers. The 15% non-energy benefit (NEB) adder was applied to gas, electricity and water avoided costs before adding carbon costs. The cost of carbon and NEB adder was applied to the TRC-Plus. The PAC test included carbon and natural gas resources only (i.e., there are no electricity and water benefits), but it does not include the NEB adder. While the EC recognizes that the utilities receive some NEBs, it is highly unlikely that it is 15%.

Results

Table 6-161 shows summary results for Enbridge TRC-Plus and PAC tests. Table 6-162 shows the same information for Union. There are additional tables located at the end of this section with more detailed results.

All the utility-defined programs pass the Board-defined cost-effectiveness threshold of 0.7 for Low Income programs and 1.0 for all other programs using the TRC-Plus test.

Table 6-161. Enbridge summary of cost-effectiveness ratio results*

Scorecard	Final Verified Ratio		Final Verified Net Present Value (M$)	
	TRC-Plus	PAC	TRC-Plus	PAC
Resource Acquisition	2.26	3.08	85.21	89.85
Low Income	2.32	2.24	16.07	13.89
Total	**2.27**	**2.91**	**101.29**	**103.74**

*Not all values may compute exactly due to rounding.
†Values calculated from original utility tracking data, pre-verification.

Table 6-162. Union summary of cost-effectiveness ratio results*

Scorecard	Final Verified Ratio		Final Verified Net Present Value (M$)	
	TRC-Plus	PAC	TRC-Plus	PAC
Resource Acquisition	2.05	3.85	108.54	131.70
Large Volume	2.47	5.38	9.95	12.37
Low Income	1.30	1.03	3.09	0.30
Total	**2.01**	**3.42**	**121.58**	**144.37**

*Not all values may compute exactly due to rounding.
†Values calculated from original utility tracking data, pre-verification.

[111] Navigant, 2019. Integrated Ontario Electricity and Natural Gas Achievable Potential Study.

There were several OEB-defined programs that did not meet the Board-defined cost effectiveness threshold. Specifically, using the PAC and TRC-Plus tests, Enbridge's Resource Acquisition Run-It-Right program fell significantly short of 1.0. Using the TRC-Plus test, Union's Indigenous program fell short of 0.7. Using the PAC test, Enbridge's Low-Income Single-family program fell short of 0.7.

Cost effectiveness framework

The 2018 cost effectiveness analysis found the following:

- The avoided costs provided by the utilities are not clearly labelled as being real or nominal dollars. The rule in a cost-effectiveness analysis is that both costs and discount rates must either both be nominal, or both be real. By including nominal costs and real discount rates, the cost-effectiveness analysis will exaggerate benefits. Just the opposite (nominal discount rate, real costs) will underestimate benefits. For the cost-effectiveness analysis, the EC treated everything as nominal.

Recommendations made by the EC following the **2016** verification results activities, that **remain unchanged in 2018**, are noted below:

- The utilities are using different inflation rates to calculate discount rates for 2018. While Enbridge calculated the 2018 inflation rate using the five-year average Consumer Price Index (2018-2022) Ontario CPI (updated January 19, 2018)[112], it is unclear how Union's inflation rates were selected. The table below compares inflation rates used by the two utilities in 2018.

	Enbridge	Union
Real Discount Rate	4.00	4.00
2018 Inflation Rate	2.11	1.27
Nominal Discount Rate	6.20	5.32

A scenario analysis using the different rates selected by the two utilities reveals a difference of +/- 6% to 8% in the TRC and PAC results.

Enbridge	TRC			PAC		
Discount Rate	**6.20%**	**5.32**	**% Diff**	**6.20%**	**5.32%**	**% Diff**
Resource Acquisition	2.26	2.43	7%	3.08	3.32	8%
Low Income	2.32	2.51	8%	2.24	2.42	8%
Total	**2.27**	**2.45**	**8%**	**2.91**	**3.13**	**8%**

Union	TRC			PAC		
Discount Rate	**5.32%**	**6.20%**	**% Diff**	**5.32%**	**6.20%**	**% Diff**
Resource Acquisition	2.05	1.91	-7%	3.85	3.59	-7%
Large Volume	2.47	2.33	-6%	5.38	5.08	-6%
Low Income	1.30	1.20	-8%	1.03	0.95	-8%
Total	**2.01**	**1.88**	**-7%**	**3.42**	**3.19**	**-7%**

[112] http://www.conferenceboard.ca/e-data/data/consumerpriceindex.aspx

It is unclear why the values would significantly vary in the same year between the two utilities. Using two different inflation rates limits the EC's ability to directly compare each utility's cost-effectiveness results.

- In 2015 and 2016, the EC recommended that "sector"-level administrative costs and overhead be allocated to each individual program and the utilities report program-level cost-effectiveness results. For example, Union identifies administration and evaluation costs at the scorecard level whereas Enbridge details spending as direct and indirect at the OEB-defined program level and then has an explicit 'overhead' spend at the scorecard level. In the absence of clear direction from the utilities, the EC apportioned costs based on savings distribution, but that is not likely accurate. To facilitate the analysis, ensure that program costs are properly allocated to the right programs and cost-effectiveness results reflect the true costs of each program, the EC recommends that the utilities report spending in a consistent format and apportion all overhead costs to individual programs rather than the scorecard level. This issue was identified in 2015 and 2016.
- There are slight variations between the methodology applied in utility-reported cost-effectiveness calculator and that of the EC, specifically the EC and Enbridge treat the annual savings of measures with dual baselines differently, specifically hydronic condensing boilers and hydronic high efficiency boilers in Commercial Custom and Multi-Residential. The EC calculated an average annual savings based on the cumulative energy savings divided by the measure's EUL (assumed to be 25).

Recommendations

This analysis has shown the robustness of DSM results, as cost-effectiveness is generally maintained through the adjustment of claimed savings, net-to-gross factors, discount rates, and water avoided costs.

The EC has the following recommendations results from the cost-effectiveness analysis:

1. Allocate "portfolio"-level administrative cost and all overhead costs, to each individual program and report program-level cost-effectiveness results.
2. Be transparent about inflation rates used and why.
3. Clearly identify whether real and nominal rates are used.

Include separate fields in the program tracking database for EUL, RUL, gross first year annual savings, gross post-RUL annual savings, NTG, gross cumulative savings, net cumulative savings, and net first year savings

Table 6-163: Enbridge overall PAC results*†

Program	PAC Benefits ($)	PAC Costs ($)	PAC Value ($)	PAC Ratio
Resource Acquisition	133,012,000	43,160,000	89,852,000	3.08
Low Income	25,123,000	11,237,000	13,886,000	2.24
Total	**158,135,000**	**54,397,000**	**103,738,000**	**2.91**

*Not all values may compute exactly due to rounding.
†All dollar values are rounded to the nearest thousand.

Table 6-164: Enbridge Residential PAC results*†

Program	Annual net savings (m3)	Program-level Incentives ($)	Program-level general admin costs ($)	Portfolio Budget ($)	PAC Benefits ($)	PAC Costs ($)	PAC Value ($)	PAC Ratio
Residential Adaptive Thermostat	2,888,000	1,328,000	581,000	92,000	9,365,000	1,909,000	7,455,000	4.90
Home Energy Conservation	6,318,000	22,880,000	2,694,000	336,000	29,818,000	25,574,000	4,243,000	1.17
Verified Final Results	**9,206,000**	**24,208,000**	**3,275,000**	**429,000**	**39,182,000**	**27,483,000**	**11,699,000**	**1.43**

*Not all values may compute exactly due to rounding.
†All dollar values are rounded to the nearest thousand.

Table 6-165: Enbridge Commercial PAC results*†

Program	Annual net savings (m3)	Program-level Incentives ($)	Program-level general admin costs ($)	Portfolio Budget ($)	PAC Benefits ($)	PAC Costs ($)	PAC Value ($)	PAC Ratio
Run-it-Right	26,000	635,000	497,000	0	31,000	1,132,000	-1,101,000	0.03
Commercial Prescriptive	1,670,000	713,000	559,000	62,000	5,962,000	1,272,000	4,690,000	4.69
Commercial Direct Install	1,244,000	629,000	507,000	40,000	4,034,000	1,136,000	2,897,000	3.55
Energy Leaders Initiative	1,206,000	324,000	227,000	63,000	5,615,000	551,000	5,064,000	10.19
Commercial Custom	9,862,000	4,794,000	2,241,000	404,000	37,235,000	7,035,000	30,200,000	5.29
Verified Final Results	**14,008,000**	**7,094,000**	**4,031,000**	**570,000**	**52,876,000**	**11,126,000**	**41,750,000**	**4.75**

*Not all values may compute exactly due to rounding.
†All dollar values are rounded to the nearest thousand.

Table 6-166: Enbridge Industrial PAC results*†

Program	Annual net savings (m3)	Program-level Incentives ($)	Program-level general admin costs ($)	Portfolio Budget ($)	PAC Benefits ($)	PAC Costs ($)	PAC Value ($)	PAC Ratio
Industrial Direct Install	2,542,000	733,000	291,000	81,000	7,669,000	1,024,000	6,645,000	7.49
Industrial Custom	9,938,000	1,658,000	1,698,000	348,000	31,849,000	3,357,000	28,493,000	9.49
Industrial Prescriptive	463,000	81,000	90,000	15,000	1,436,000	171,000	1,265,000	8.41
Verified Final Results	**12,943,000**	**2,472,000**	**2,079,000**	**444,000**	**40,954,000**	**4,551,000**	**36,403,000**	**9.00**

*Not all values may compute exactly due to rounding.
†All dollar values are rounded to the nearest thousand.

Table 6-167: Enbridge Low Income PAC results*†

Program	Annual net savings (m3)	Program-level Incentives ($)	Program-level general admin costs ($)	Portfolio Budget ($)	PAC Benefits ($)	PAC Costs ($)	PAC Value ($)	PAC Ratio
Multi Residential	5,373,000	3,773,000	2,043,000	243,000	22,048,000	5,816,000	16,232,000	3.79
Single Family	697,000	2,406,000	3,015,000	34,000	3,075,000	5,421,000	-2,345,000	0.57
Verified Final Results	**6,070,000**	**6,179,000**	**5,058,000**	**277,000**	**25,123,000**	**11,237,000**	**13,886,000**	**2.24**

*Not all values may compute exactly due to rounding.
†All dollar values are rounded to the nearest thousand.

Table 6-168: Enbridge overall TRC-Plus results*†

Program	Annual net savings (m3)	Measure Incremental Costs ($)	TRC Plus Benefits ($)	Program Costs ($)	Overhead ($) ‡	TRC Plus Costs ($)	TRC Plus Value ($)	TRC Plus Ratio
Resource Acquisition	36,157,000	58,001,000	152,598,000	4,214,000	5,172,000	67,386,000	85,211,000	2.26
Low Income	6,070,000	7,156,000	28,288,000	3,463,000	1,595,000	12,214,000	16,074,000	2.32
Total	**42,227,000**	**65,157,000**	**180,886,000**	**7,677,000**	**6,767,000**	**79,600,000**	**101,286,000**	**2.27**

*Not all values may compute exactly due to rounding.
†All dollar values are rounded to the nearest thousand.
‡ Portfolio overhead costs for research, evaluation and administration are not being applied at the program level. Consistent with what was done in 2015, the EC calculated costs as the sum of all OEB-defined program costs, including program admin and overhead costs and spread these costs across all programs based on their weighted savings contribution. Costs do not include market transformation or portfolio overhead costs.

Table 6-169: Enbridge Residential TRC-Plus results*†

Program	Annual net savings (m3)	Measure Incremental Costs ($)	TRC Plus Benefits ($)	TRC Plus Costs (equipment) ($)	TRC Plus Value (equipment) ($)	TRC Plus Ratio (equipment)	Program Admin Costs ($)	TRC Plus Ratio (program)
Residential Adaptive Thermostat	2,888,000	4,683,000	15,377,000	4,683,000	10,693,000	3.28	581,000	2.92
Home Energy Conservation	6,318,000	29,595,000	33,071,000	29,595,000	3,476,000	1.12	2,694,000	1.02
Verified Final Results	**9,206,000**	**34,278,000**	**48,447,000**	**34,278,000**	**14,169,000**	**1.41**	**3,275,000**	**1.29**

*Not all values may compute exactly due to rounding.
†All dollar values are rounded to the nearest thousand.

Table 6-170: Enbridge Commercial TRC-Plus results*†

Program	Annual net savings (m3)	Measure Incremental Costs ($)	TRC Plus Benefits ($)	TRC Plus Costs (equipment) ($)	TRC Plus Value (equipment) ($)	TRC Plus Ratio (equipment)	Program Admin Costs ($)	TRC Plus Ratio (program)
Run-it-Right	26,000	23,000	34,000	23,000	11,000	1.47	497,000	0.07
Commercial Prescriptive	1,670,000	2,667,000	7,427,000	2,667,000	4,761,000	2.79	559,000	2.30
Commercial Direct Install	1,244,000	674,000	4,670,000	674,000	3,996,000	6.93	507,000	3.95
Energy Leaders Initiative	1,206,000	1,032,000	6,228,000	1,032,000	5,195,000	6.03	227,000	4.95
Commercial Custom	9,862,000	10,656,000	41,291,000	10,656,000	30,635,000	3.87	2,241,000	3.20
Verified Final Results	**14,008,000**	**15,052,000**	**59,650,000**	**15,052,000**	**44,599,000**	**3.96**	**4,031,000**	**3.13**

*Not all values may compute exactly due to rounding.
†All dollar values are rounded to the nearest thousand.

Table 6-171: Enbridge Industrial TRC-Plus results*†

Program	Annual net savings (m3)	Measure Incremental Costs ($)	TRC Plus Benefits ($)	TRC Plus Costs (equipment) ($)	TRC Plus Value (equipment) ($)	TRC Plus Ratio (equipment)	Program Admin Costs ($)	TRC Plus Ratio (program)
Industrial Direct Install	2,542,000	841,000	7,696,000	841,000	6,855,000	9.15	291,000	6.80
Industrial Custom	9,938,000	7,380,000	35,246,000	7,380,000	27,865,000	4.78	1,698,000	3.88
Industrial Prescriptive	463,000	449,000	1,558,000	449,000	1,109,000	3.47	90,000	2.89
Verified Final Results	**12,943,000**	**8,671,000**	**44,500,000**	**8,671,000**	**35,829,000**	**5.13**	**2,079,000**	**4.14**

*Not all values may compute exactly due to rounding.
†All dollar values are rounded to the nearest thousand.

Table 6-172: Enbridge Low Income TRC-Plus results*†

Program	Annual net savings (m3)	Measure Incremental Costs ($)	TRC Plus Benefits ($)	TRC Plus Costs (equipment) ($)	TRC Plus Value (equipment) ($)	TRC Plus Ratio (equipment)	Program Admin Costs ($)	TRC Plus Ratio (program)
Multi Residential	5,373,000	5,160,000	24,633,000	5,160,000	19,474,000	4.77	2,043,000	3.42
Single Family	697,000	1,997,000	3,655,000	1,997,000	1,658,000	1.83	3,015,000	0.73
Verified Final Results	**6,070,000**	**7,156,000**	**28,288,000**	**7,156,000**	**21,132,000**	**3.95**	**5,058,000**	**2.32**

*Not all values may compute exactly due to rounding.
†All dollar values are rounded to the nearest thousand.

Table 6-173: Union Low Income PAC results*

Program	Annual net savings (m3)	Program-level Incentives ($)	Program-level general admin costs ($)	Portfolio Budget ($)	PAC Benefits ($)	PAC Costs ($)	PAC Value ($)	PAC Ratio
Home Weatherization	1,279,000	3,881,000	3,617,000	648,000	6,052,000	7,498,000	-1,446,000	0.81
Furnace End-of-Life Upgrade	0	0	0	0	0	0	0	—
Indigenous	10,000	82,000	97,000	15,000	45,000	179,000	-134,000	0.25
LI Multi Family Custom	440,000	672,000	133,000	70,000	1,201,000	805,000	396,000	1.49
LI Multi Family Prescriptive	951,000	1,790,000	534,000	201,000	3,812,000	2,324,000	1,488,000	1.64
Verified Final Results	**2,679,000**	**6,425,000**	**4,381,000**	**934,000**	**11,110,000**	**10,806,000**	**303,000**	**1.03**

*Not all values may compute exactly due to rounding.

Table 6-174: Union Resource Acquisition PAC results*

Program	Annual net savings (m3)	Program-level Incentives ($)	Program-level general admin costs ($)	Portfolio Budget ($)	PAC Benefits ($)	PAC Costs ($)	PAC Value ($)	PAC Ratio
Home Reno Rebate	8,206,000	21,290,000	5,926,000	2,352,000	39,023,000	27,216,000	11,807,000	1.43
CI Prescriptive	10,318,000	3,868,000	2,065,000	513,000	39,082,000	5,933,000	33,149,000	6.59
Commercial & Institutional Buildings	1,827,000	833,000	188,000	88,000	5,436,000	1,021,000	4,415,000	5.32
Industrial	8,214,000	3,196,000	1,036,000	366,000	26,229,000	4,233,000	21,997,000	6.20
Agriculture & Greenhouse	23,472,000	4,199,000	1,897,000	527,000	57,941,000	6,096,000	51,846,000	9.51
CI Direct Install	3,397,000	1,339,000	309,000	142,000	10,135,000	1,648,000	8,486,000	6.15
Verified Final Results	**55,433,000**	**34,725,000**	**11,422,000**	**3,987,000**	**177,846,000**	**46,147,000**	**131,700,000**	**3.85**

*Not all values may compute exactly due to rounding.

Table 6-175: Union Large Volume PAC results*

Program	Annual net savings (m3)	Program-level Incentives ($)	Program-level general admin costs ($)	Portfolio Budget ($)	PAC Benefits ($)	PAC Costs ($)	PAC Value ($)	PAC Ratio
Large Industrial T2	7,533,000	1,898,000	422,000	200,000	13,354,000	2,320,000	11,034,000	5.76
Large Industrial R100	522,000	443,000	59,000	43,000	1,833,000	502,000	1,331,000	3.65
Verified Final Results	**8,056,000**	**2,341,000**	**481,000**	**244,000**	**15,187,000**	**2,822,000**	**12,365,000**	**5.38**

*Not all values may compute exactly due to rounding.

Table 6-176: Union Low Income TRC-Plus results*

Program	Annual net savings (m3)	Measure Incremental Costs ($)	TRC Plus Benefits ($)	TRC Plus Costs (equipment) ($)	TRC Plus Value (equipment) ($)	TRC Plus Ratio (equipment)	Program Admin Costs ($)	TRC Plus Ratio (program)
Home Weatherization	1,279,000	3,422,000	7,328,000	3,422,000	3,906,000	2.14	3,617,000	1.04
Furnace End-of-Life Upgrade	0	0	0	0	0	—	0	—
Indigenous	10,000	80,000	54,000	80,000	-26,000	0.68	97,000	0.30
LI Multi Family Custom	440,000	1,438,000	1,703,000	1,438,000	264,000	1.18	133,000	1.08
LI Multi Family Prescriptive	951,000	1,000,000	4,327,000	1,000,000	3,327,000	4.33	534,000	2.82
Verified Final Results	**2,679,000**	**5,940,000**	**13,411,000**	**5,940,000**	**7,472,000**	**2.26**	**4,381,000**	**1.30**

*Not all values may compute exactly due to rounding.

Table 6-177: Union Resource Acquisition TRC-Plus results*

Program	Annual net savings (m3)	Measure Incremental Costs ($)	TRC Plus Benefits ($)	TRC Plus Costs (equipment) ($)	TRC Plus Value (equipment) ($)	TRC Plus Ratio (equipment)	Program Admin Costs ($)	TRC Plus Ratio (program)
Home Reno Rebate	8,206,000	38,594,000	58,056,000	38,594,000	19,462,000	1.50	5,926,000	1.30
CI Prescriptive	10,318,000	14,123,000	42,743,000	14,123,000	28,620,000	3.03	2,065,000	2.64
Commercial & Institutional Buildings	1,827,000	3,111,000	7,044,000	3,111,000	3,933,000	2.26	188,000	2.13
Industrial	8,214,000	7,231,000	29,247,000	7,231,000	22,015,000	4.04	1,036,000	3.54
Agriculture & Greenhouse	23,472,000	27,456,000	64,376,000	27,456,000	36,921,000	2.34	1,897,000	2.19
CI Direct Install	3,397,000	1,136,000	10,144,000	1,136,000	9,008,000	8.93	309,000	7.02
Verified Final Results	**55,433,000**	**91,651,000**	**211,610,000**	**91,651,000**	**119,959,000**	**2.31**	**11,422,000**	**2.05**

*Not all values may compute exactly due to rounding.

Table 6-178: Union Large Volume TRC-Plus results*

Program	Annual net savings (m3)	Measure Incremental Costs ($)	TRC Plus Benefits ($)	TRC Plus Costs (equipment) ($)	TRC Plus Value (equipment) ($)	TRC Plus Ratio (equipment)	Program Admin Costs ($)	TRC Plus Ratio (program)
Large Industrial T2	7,533,000	6,107,000	14,734,000	6,107,000	8,627,000	2.41	422,000	2.26
Large Industrial R100	522,000	202,000	2,010,000	202,000	1,808,000	9.93	59,000	7.69
Verified Final Results	**8,056,000**	**6,309,000**	**16,745,000**	**6,309,000**	**10,435,000**	**2.65**	**481,000**	**2.47**

*Not all values may compute exactly due to rounding.

Appendix R Custom Project Savings Verification and Free Ridership Based Attribution Reports

These reports have been prepared for the OEB. These studies, which only pertain to custom projects, contain:

1) Results from Custom Project Savings Verification (CPSV) of the Enbridge and Union natural gas DSM projects completed in 2017 and 2018.
2) Results from a Free Ridership Based Attribution study of the Enbridge and Union natural gas DSM programs delivered in 2018.

2017-18 Natural Gas Demand Side Management Custom Studies Executive Summary

Ontario Gas DSM Evaluation Contractor

Ontario Energy Board

March 13, 2020

SAFER, SMARTER, GREENER

To verify the impacts of the Enbridge Gas Distribution, Inc. (Enbridge) and Union Gas Limited (Union) demand side management (DSM) programs, the Ontario Energy Board (OEB) undertakes various annual evaluation studies.[1] The 2017-2018 Natural Gas Demand Side Management Custom Savings Verification report and 2018 Natural Gas Demand Side Management Free Ridership Based Attribution Evaluation report are two such studies.[2] The results of the studies are summarized in this document.

In the 2017 and 2018 calendar years, Enbridge and Union delivered ratepayer funded DSM programs to residential, multifamily, low income, commercial, and industrial customers. [3] Included within the programs offered throughout 2017 and 2018 were custom programs available to commercial and industrial customers that encouraged them to reduce their energy consumption by providing customer-specific energy efficiency and conservation solutions.

The custom commercial and industrial DSM programs offered by the utilities provide financial incentives, technical expertise, and guidance with respect to energy-related decision-making and business justification to help customers prioritize energy efficiency projects against their own internal competing factors. Multi-residential buildings — other than low-income buildings, which are dealt with separately — are eligible to participate in both Union and Enbridge's custom commercial programs.

The OEB evaluates the custom commercial and industrial program results annually as the programs have significant OEB-approved savings targets. Based on the results of the utilities' programs, the utilities may be eligible for performance incentives. The portion of shareholder incentives that come from the custom commercial and industrial programs is based on the amount of verified net natural gas savings achieved by each utility relative to the OEB-approved targets.

- **Verified savings** are utility draft program savings that are audited and confirmed by an independent third party. The process and results of the verification are described in the 2017-2018 Natural Gas Demand Side Management Custom Savings Verification report. The result of the analysis is a ratio that represents the percentage of utility-draft energy savings that are verified by the auditor.
- **Net savings** are those that are caused, or influenced, by the utility. The process and results of the net savings assessment are described in the 2018 Natural Gas Demand Side Management Free Ridership Based Attribution Evaluation report. The result of the analysis is a ratio that represents the percentage of verified savings that were caused by the utility.

The two ratios are applied to the utility draft savings to produce final verified net natural gas savings according to the equation in the following figure.

[1] Enbridge Gas Distribution Inc. and Union Gas Limited amalgamated effective January 1, 2019 to become Enbridge Gas Inc.; however, because the programs will continue to be implemented individually through the remainder of the current framework, the EC will also evaluate each program by utility.

[2] All DSM evaluation results can be found on the OEB's website.

[3] The OEB issued its Decision and Order on Enbridge and Union's multi-year DSM Plans on January 20, 2016 (EB_2015-0029/EB-2015-0049)

Equation to determine verified net savings

This summary reports the verification ratio and net savings ratio. The two ratios are applied to the utility draft savings to produce final verified net savings in the annual verification report for each program year. The custom program results are combined with the results from other utility programs in a "scorecard". The utilities' scorecard results determine overall performance and if the utility is eligible for a shareholder incentive.

The following table shows the verification ratio and the net savings ratio from these studies.

Results from the 2017-18 custom DSM evaluation studies[4]

Program	Verification Ratio	Net Savings Ratio
Enbridge Commercial and Industrial Custom	105%	38%
Union Commercial and Industrial Custom	91%	50%
Union Large Volume	90%	14%

1.1 Findings

Key findings from the 2017-2018 Natural Gas Demand Side Management Custom Savings Verification study include:

- Both utilities generally calculate sound draft savings estimates, resulting in high verification ratios, largely using engineering approaches. None of the three program verification ratios were statistically different from 100%. Much of the variation in verification ratios among projects is driven by factors that the utilities only partially control, such as changes in operating conditions, changes in operating hours and changes in production levels. In some cases, the utility can control these types of discrepancies with more thorough documentation, but some changes can be difficult to anticipate when calculating savings before the project is installed.
- Both utilities could provide better supporting documentation of assumptions and inputs in their savings estimates and each could benefit from investing in a modern program tracking database with document storage capabilities

Key findings from the 2018 Natural Gas Demand Side Management Free Ridership Based Attribution Evaluation study include:

- Overall the study found somewhat higher net savings ratios than the last study, which was conducted in 2015.
- Enbridge has been successful in influencing vendors to recommend more energy efficient options to their commercial and multi-residential customers.

[4] This table presents the sample weighted overall results which differ slightly from the official domain results in the 2017 and 201818 Annual Verification Reports. The official domain results are the ones that are applied to determine shareholder incentive.

- Union has been successful in influencing agricultural customers to adopt energy efficiency upgrades in greenhouses.
- Enbridge has been successful in increasing net savings for industrial customers.
- The net savings ratio for the Large Volume programs is low, though the program remains cost effective, meaning the benefits resulting from the program outweigh the cost of implementing it even with low net savings ratios.
- The primary source of influence for both utilities is in convincing customers to install energy efficiency measures sooner than they would have without the program.

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2017-2018 Natural Gas Demand Side Management Custom Savings Verification

CUSTOM SAVINGS VERIFICATION FOR ONTARIO'S NATURAL GAS CUSTOM COMMERCIAL AND INDUSTRIAL DSM PROGRAMS

Ontario Energy Board

March 13, 2020

SAFER, SMARTER, GREENER

Table of contents

1 INTRODUCTION

To encourage Enbridge Gas Distribution, Inc. (Enbridge) and Union Gas Limited (Union) to implement public benefits programs designed to reduce overall energy use, called conservation demand-side management (DSM) programs, the Ontario Energy Board (OEB) reimburses them for the cost of program implementation and provides an incentive, called the shareholder incentive, that reflects the utilities' performance against pre-determined targets. The OEB also compensates the utilities for the revenue lost as a result of the lower natural gas sales.

In the 2017 and 2018 calendar years, programs delivered by Enbridge and Union targeted all natural gas ratepayers, including residential, multifamily, low income, commercial, and industrial customers. This study is part of an overall conservation program cycle as shown in the following figure. This study is part of step 4.

Figure 1-1. Conservation Program Cycle

To verify the impacts of the Enbridge and Union DSM programs, the OEB sponsors studies to verify the energy savings achieved. Specifically, this study verifies the engineering calculations, inputs and assumptions that produce the utilities' claimed gas savings. The results of this study are combined with the results of two other studies[1] to produce verified net cumulative gas savings for the utilities' 2017 and 2018 C&I Custom and Custom Large Volume programs.

1.1 Findings

Key findings from the study include:

- Both utilities generally calculate sound claimed savings estimates, largely using engineering approaches. None of the three program overall realization rates were statistically different from 100%. Much of the variation in gross realization rates is driven by factors that the utilities only partially control, such as changes in operating conditions, changes in operating hours and changes in production levels. In some cases, the utility can control these types of discrepancies, but they can be difficult to anticipate when calculating savings before the project is installed.
- Both utilities could provide better supporting documentation of assumptions and inputs in their savings estimates and each could benefit from investing in a modern program tracking database with document storage capabilities

Additional recommendations are found in section 5.

[1] *2018 Natural Gas Demand Side Management Free Ridership Based Attribution Evaluation.* Prepared for The Ontario Energy Board by DNV GL, August 15, 2017.
CPSV Participant Spillover Results. Prepared for The Ontario Energy Board by DNV GL, May 23, 2018.

2 ENBRIDGE COMMERCIAL AND INDUSTRIAL CUSTOM PROGRAMS

Enbridge's custom DSM programs for commercial and industrial (C&I) customers encourage customers to reduce their natural gas consumption by recommending and incentivizing energy saving projects and actions.

These custom programs differ from the prescriptive programs by providing additional technical support for projects. They also provide financial incentives based on overall natural gas savings realized by the customer rather than a per-unit incentive.[2]

A subset of the projects in this program is part of the multi-residential segment. The custom project savings verification (CPSV) included custom projects from both the Market-Rate Multifamily (MR MF) and the low income multifamily (LI MF) subsets of the multi-residential segment.

All projects implemented as part of these programs and claimed in 2017-2018 are custom projects and are included in the scope of the CPSV study.

2.1 Gross Savings Realization Rate

The gross realization rate (GRR) represents the ratio of the savings verified by the evaluation to the savings claimed (or reported) by the utility, as shown in the following equation. A 90% GRR means the verified gross savings for the project or program were 90% of the claimed savings. Differences between claimed and verified savings for each project can arise for a number of reasons, usually related to differences in forecast assumptions, differences in underlying facts, or differences in calculation approaches or parameters.

$$gross\ realization\ rate = \frac{Evaluation\ verified\ savings}{Utility\ reported\ savings}$$

Table 2-1 shows the cumulative gross savings realization rate by customer segment for the Enbridge C&I Custom program. The table shows the gross realization rate, statistical precision at the 90% confidence interval, the program-claimed population cumulative cubic meters of natural gas (CCM) savings, and percent of program savings for each customer segment. The percent of program savings represents the relative contribution that each customer segment makes to the overall result.

Enbridge's custom program overall achieved a 111% gross realization rate. The customer segment gross realization rates varied from 95% to 121%. The largest segment was Industrial with 46% of the population energy savings. Relative precision for the program overall was 7% at 90% confidence.

[2] Enbridge's 2016 Annual Report provides a more detailed description of the program and can be found here: https://www.oeb.ca/sites/default/files/2016-EGDI-DSM-Annual-Report_20181117.pdf

Table 2-1. Cumulative gross savings realization rate for the Enbridge C&I Custom program

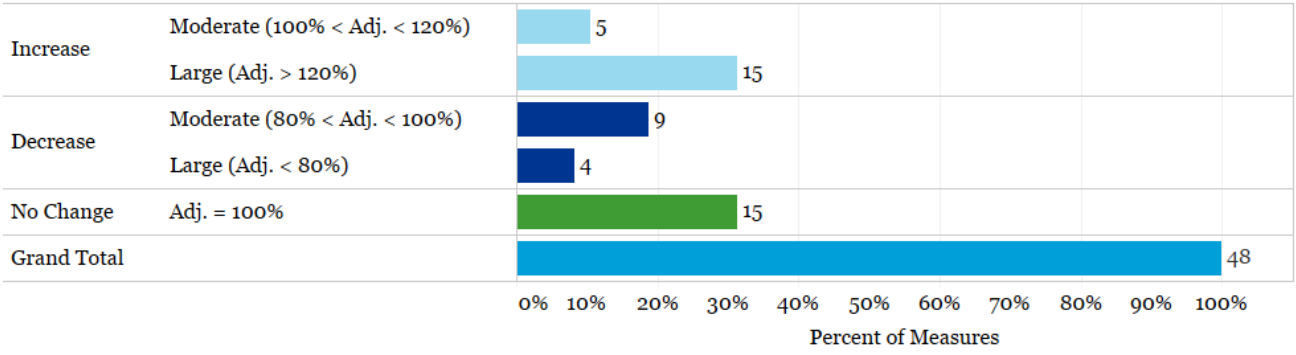
Segment	Gross Realization Rate	+/- at 90% Confidence	Population CCM Savings	Percent Population CCM Savings
Commercial	94.99%	9%	318,342,995	22%
Industrial	110.79%	8%	671,703,718	46%
LI & MR Multi-Residential	121.09%	16%	471,312,210	32%
Enbridge C&I Custom - Overall	110.51%	7%	1,461,358,923	100%

2.2 Discrepancy Summary

This section presents detailed results of the various project-level discrepancies between program claimed and evaluation verified savings. The verification found discrepancies in 69% of the projects reviewed.

Table 2-2 shows that 15 of the 48 measures had no adjustment from program claimed to evaluation verified savings, while 33 measures were adjusted based on verification findings. For custom savings verification, we consider verified savings that differ more than 20% from utility tracking savings to be a "large" discrepancy. Moderate adjustments within 20% of utility tracking savings are expected given the level of uncertainty in forecasting energy savings. Fourteen of the 33 adjusted measures had verified savings within 20% of utility tracked savings. Of the 19 measures with adjustments greater than 20%, 15 had adjustments increasing savings (adjustment greater than 120%) and four (4) had adjustments decreasing savings (adjustment less than 80%).

Table 2-2. Adjustment Summary – Enbridge C&I Custom



Four randomly selected measures with large adjustments are described below. They are included here in order to provide readers with examples of the types of discrepancies that can be identified through the CPSV process. The examples reference the site ID, which is also used in Figure 2-1 in this section and the appendix section 6.6.

- The sampled measure identified as ES159-2 was one of two measures at site ES159. The measure included steam trap jackets on several hundred steam traps. The realization rate for the measure was 76%. The verification *annual* savings are higher than the program savings because the verification site

visit found that the operating hours of the system on which the jackets were installed were greater than the program assumed. However, *cumulative (lifetime)* savings were lower due to an adjustment to the effective useful life (EUL) of the measure from 20 years to 14 years based on the updated measure life guide.

- The sampled measure identified as ET239-1 consisted of the replacement of seven steam traps. The program savings estimate was based on all seven traps being part of a seasonal space heating loop. The realization rate was 146%. The verification received the steam trap survey report and found that four of the seven traps were actually on a year-round steam loop, which increased the operating hours for those traps.
- The sampled measure identified as ET103-1 was Demand-Controlled Ventilation (DCV) controls on a laboratory ventilation system. The realization was 56%. The verification found that, after measure installation, the site had commissioned an airflow study. The study showed a significant reduction in outside airflow. In addition, supporting documentation for the program-assumed annual heating hours and outdoor air temperature could not be confirmed, so the verification re-calculated these inputs.
- The sampled measure identified as ES125-1 was the installation of two new boilers in a multi-residential housing building. The realization rate was 131%. The verification found differences from program claims for both the in situ (pre-existing) boiler system and the efficient system installed. For the in situ system, the differences were in the capacity, supply and return water temperatures, and controls in place. The measure was a replace on burnout, so these updates to the in situ system primarily impacted the estimate of heating load. The verification also found that the efficient system was installed in a lead-lag configuration, which was different from the program assumption.

Figure 2-1 plots the claimed cumulative savings and the realization rate for each measure in the sample. The plot is sorted with the smallest measure on the bottom and largest on the top. The left plot shows the relative size of each measure. The right plot shows the gross realization rate for each measure. In both plots, measures with light blue bars have a realization rate greater than 100% (verified savings greater than utility claimed savings). Measures with dark blue bars represent a gross realization rate less than 100% (verified savings lower than utility claimed savings). Measures with green bars represent a gross realization rate of 100%.

Figure 2-1. Sample Measure Realization Rates sorted by size – Enbridge C&I Custom Program

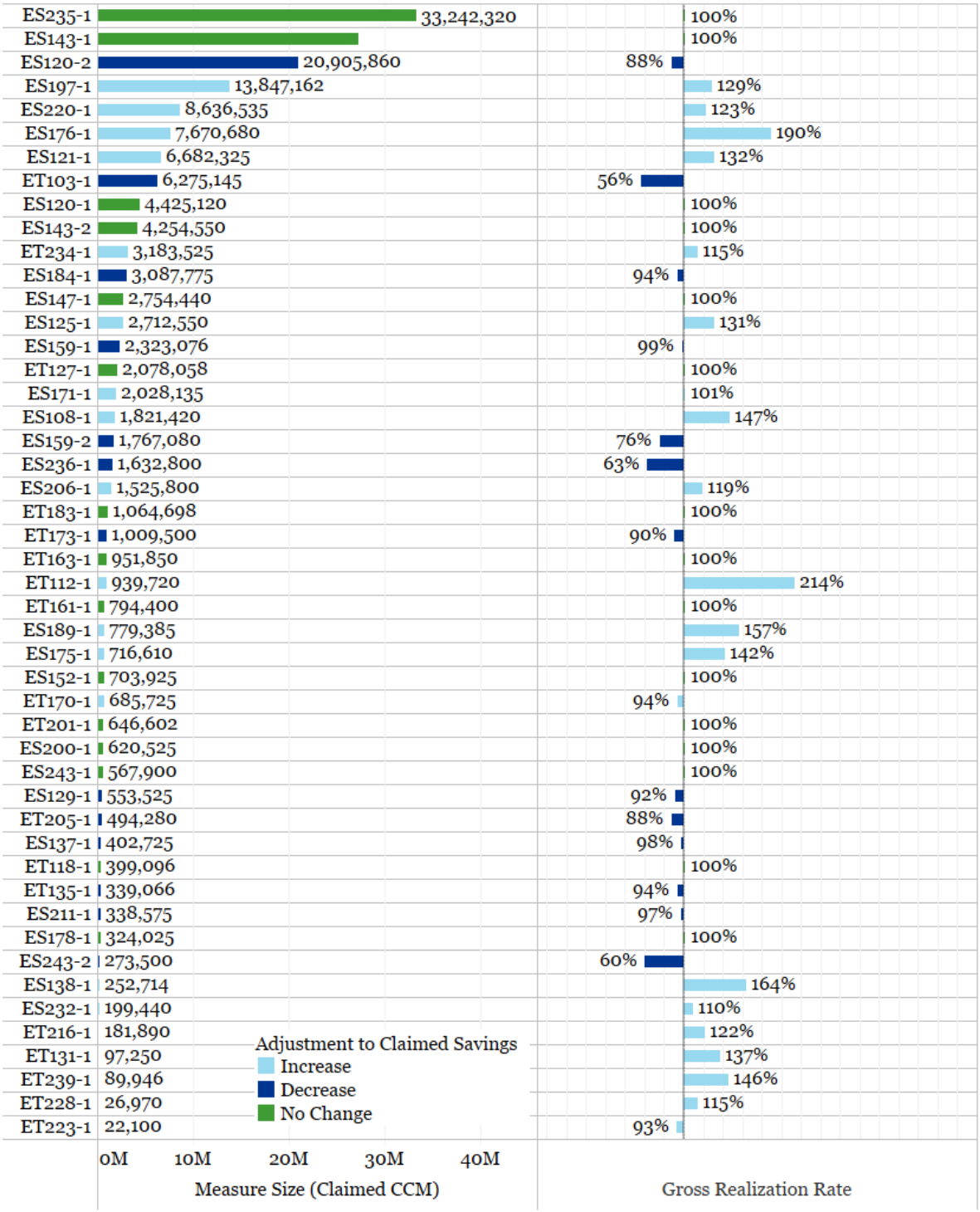
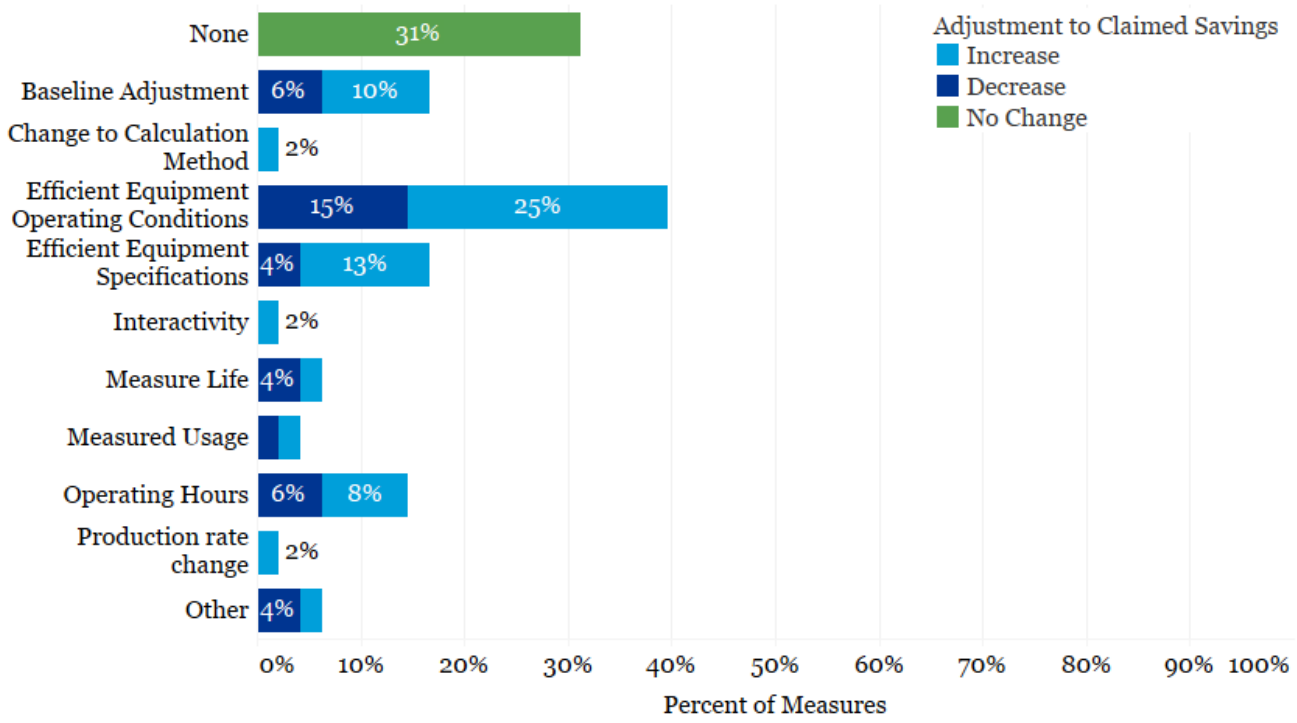


Figure 2-2 shows the types of discrepancies found by the verification. The verification found no discrepancies for 31% of sampled measures. Operating conditions were the only type of discrepancy found for more than 20% of measures. The utility can reduce this type of discrepancy by documenting projects more thoroughly with sources for the assumptions used and more complete descriptions of conditions found at the time of installation (see recommendations in section 5); however, this type of discrepancy is partially outside of utility control.

Figure 2-2. Savings discrepancies – Enbridge C&I Custom Program



3 UNION COMMERCIAL AND INDUSTRIAL CUSTOM PROGRAMS

Union's custom DSM programs for C&I customers encourage customers within this sector to reduce their natural gas consumption by recommending and incentivizing energy saving projects and actions.

These custom programs differ from the prescriptive programs by providing additional technical support for projects. They also provide financial incentives based on overall natural gas savings realized by the customer rather than a per-unit incentive.[3]

A subset of the projects in this program is part of the multifamily segment. The CPSV included custom projects from both the market-rate multifamily (MR MF) and the low income multifamily (LI MF) subsets of the multifamily segment.

All projects implemented as part of this program and claimed in 2017-2018 as custom projects are included in the scope of the CPSV study, including those from MR MF and LIMF segments.

3.1 Gross Savings Realization Rate

The GRR represents the ratio of the savings verified by the evaluation to the savings claimed (or reported) by the utility, as shown in the following equation. A 90% GRR means the verified gross savings for the project or program were 90% of the claimed savings. Differences between claimed and verified savings for each project can arise for a number of reasons, usually related to differences in forecast assumptions, differences in underlying facts, or differences in calculation approaches or parameters.

$$gross\ realization\ rate = \frac{Evaluation\ verified\ savings}{Utility\ reported\ savings}$$

Table 3-1 shows the cumulative gross savings realization rate by customer segment for the Union C&I Custom program. The table shows the gross realization rate, statistical precision at the 90% confidence interval, the program-claimed population CCM savings, and percent of program savings for each customer segment. The percent of program savings represents the relative contribution that each customer segment makes to the overall result.

[3] Union's 2016 Draft Annual Report provides a more detailed description of the program and can be found here: https://www.oeb.ca/sites/default/files/2016-Union-DSM-Annual-Report-20181130.pdf

Union's C&I programs overall achieved a 91% gross realization rate, which was also the value for each customer segment. The Agricultural and Industrial segments were combined into a single domain for reporting and verified savings estimation because the Agricultural segment did not meet the 15% absolute precision threshold (as described in the Scope of Work attached in the appendix section 6.5). Relative precision for the program overall was 11% at 90% confidence.

Table 3-1. Cumulative gross savings realization rate for the Union C&I Custom program

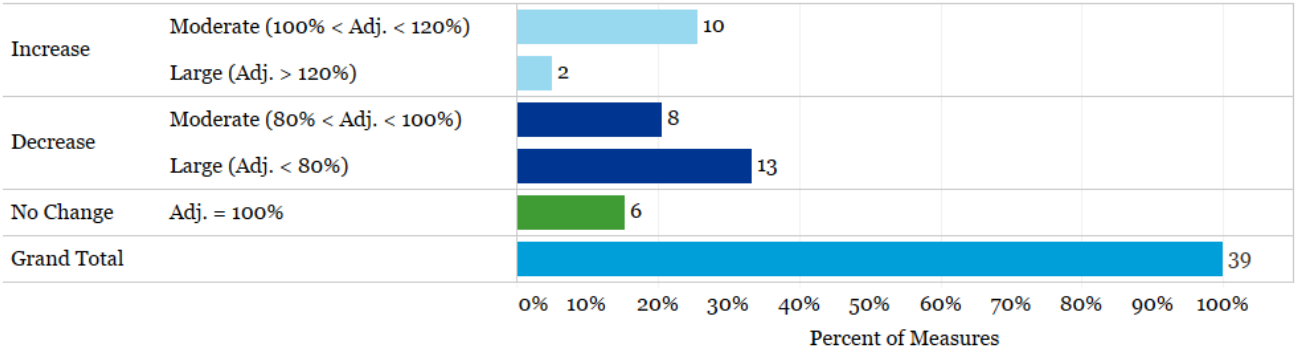
Segment	Gross Realization Rate	+/- at 90% Confidence	Population CCM Savings	Percent Population CCM Savings
Agricultural & Industrial	91.17%	13%	2,911,956,371	92%
Commercial & Multifamily	90.57%	6%	259,606,580	8%
Union C&I Custom - Overall	91.10%	11%	3,171,562,951	100%

3.2 Discrepancy Summary

This section presents detailed results of the various project-level discrepancies between program claimed and evaluation verified savings. The final realization rate for the program was close to 91%, but the verification found discrepancies for 85% of the measures reviewed.

Table 3-2 shows that 6 of the 39 measures had no adjustment from program claimed to evaluation verified savings, while 33 measures were adjusted based on verification findings. For custom savings verification, we consider verified savings that differ more than 20% from utility tracking savings to be a "large" discrepancy. Moderate adjustments within 20% of utility tracking savings are expected given the level of uncertainty in forecasting energy savings. Eighteen of the 33 adjusted measures had verified savings within 20% of utility tracked savings. Of the 15 measures with adjustments greater than 20%, 2 had adjustments increasing savings (adjustment greater than 120%) and 13 had adjustments decreasing savings (adjustment less than 80%).

Table 3-2. Adjustment Summary – Union C&I Custom



Four randomly selected measures with large adjustments are described below. They are included here in order to provide readers with examples of the types of discrepancies that can be identified through the CPSV

process. The examples reference the site ID, which is also used in Figure 2 in this section and the appendix section 6.6.

- The sampled measure at site US146 was a water to water pre-heat and recovery heat exchanger on a pasteurizing system. The realization rate for the measure was 44%. The verification updated key inputs to the savings calculation based on the site contact's reports. The updates included a reduction in annual operating days from the program-assumed 365 to the site contact's reported 267 days. Additional changes that reduced the savings estimate included those to system flow rate and three key operational water temperatures. The verification also increased the EUL for the system from 15 years to 17 years based on the updated custom measure life guide.
- The sampled measure at site US191 consisted of variable frequency drive (VFD) exhaust fans and automated control systems in the welding production area of a manufacturing facility. The realization rate for the measure was 74%. The verification found that the energy management system (EMS) was controlling 22 fans versus the 24 in the program estimate. The verification also made a correction to the calculation methodology used to estimate airflow.
- The sampled measure at site US217 installed an advanced climate control system in a greenhouse. The realization rate for the measure was 317%. The verification used the same calculation approach as the program, with updates to two inputs verified onsite that increased the savings estimate. The most significant change was the observed temperature setpoint which was found to be lower than assumed in the program estimate. An additional small increase in savings resulted from the newly installed controls system which increased the efficiency of the heating system
- The sampled measure at site UT168 added heat recovery to a rooftop heating, ventilation, and air conditioning (HVAC) unit. The measure realization rate was 73%. The program estimate of savings did not separate occupied and unoccupied hours in the bin analysis used to estimate savings. Based on information provided by the site contact, the verification was able to separate the hours. Since heating outside air is a significant portion of the heating load, accounting for lower thermostat settings during unoccupied hours produced a better estimate of savings.

Figure 2 plots the claimed cumulative savings and the realization rate for each measure in the sample. The plot is sorted with the smallest measure on the bottom and largest on the top. The left plot shows the relative size of each measure. The right plot shows the gross realization rate for each measure. In both plots, measures with light blue bars have a realization rate greater than 100% (verified savings greater than utility claimed savings). Measures with dark blue bars represent a gross realization rate less than 100% (verified savings lower than utility claimed savings). Measures with green bars represent a gross realization rate of 100%.

Figure 2. Sample Measure Realization Rates sorted by size – Union C&I Custom program

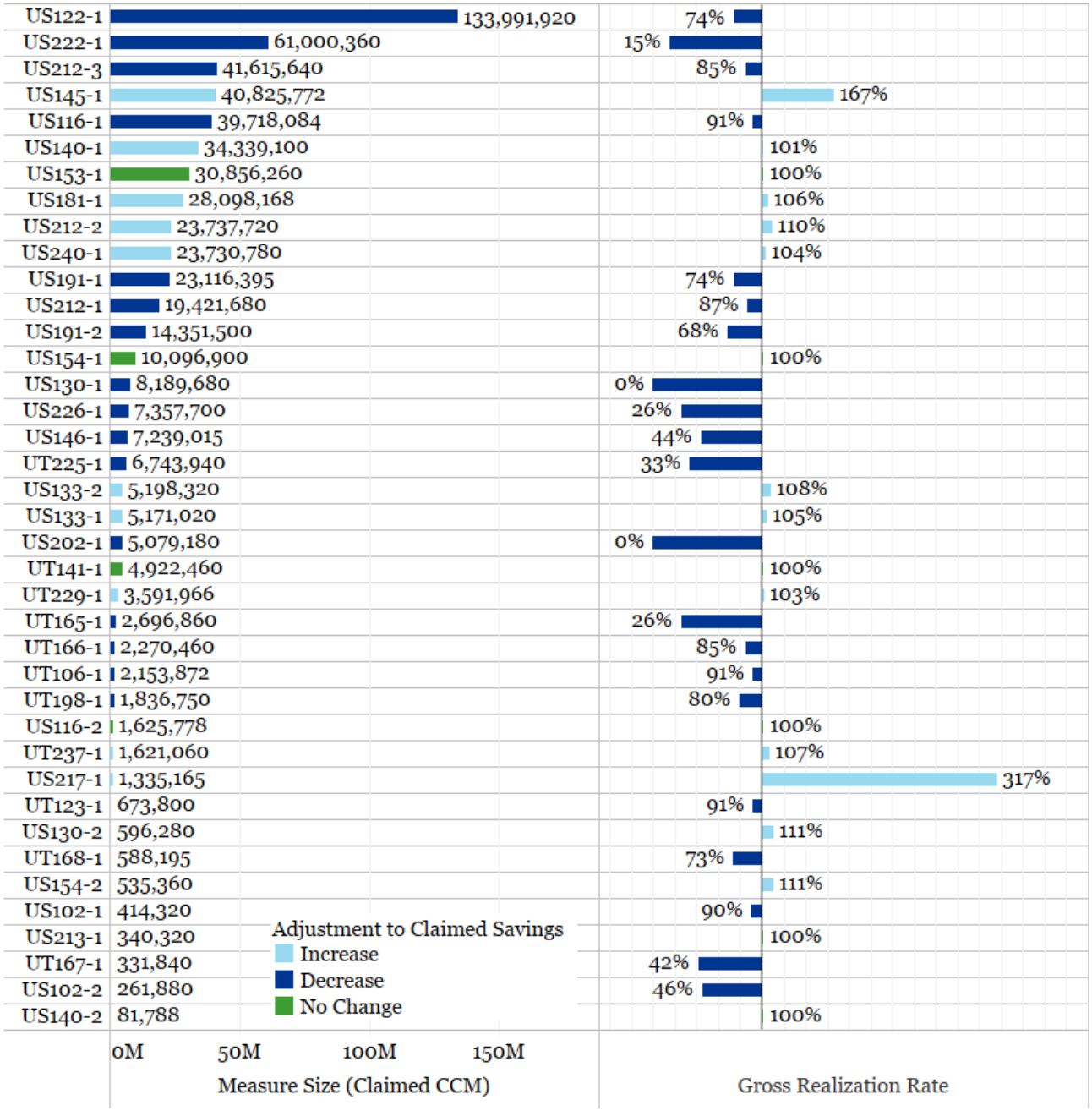


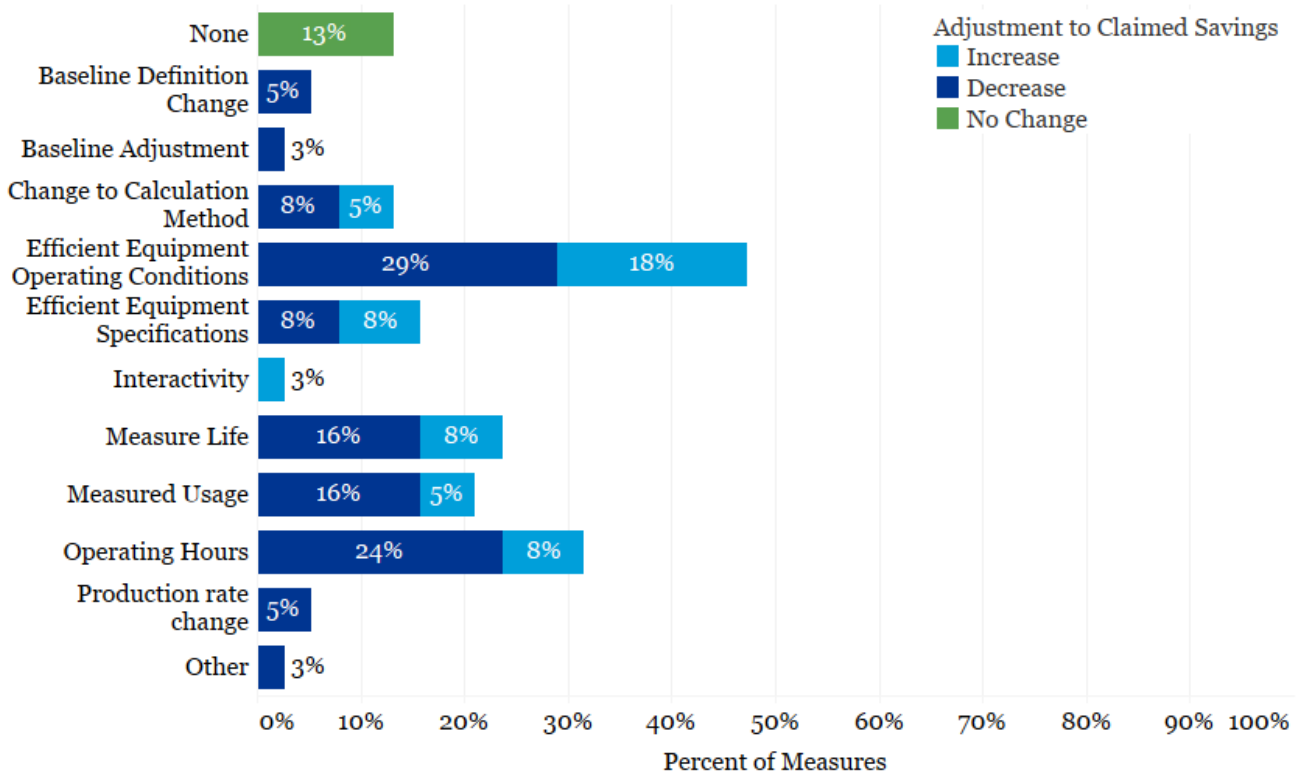
Figure 3-1 shows the types of discrepancies found by the verification. The verification found no discrepancies for 13% of sampled measures. The major categories of discrepancies between claimed savings and verified savings were different assumptions for operating conditions (47% of measures), operating hours (32%), measure life (24%), and differences in measured usage (21%).

The utility could reduce the frequency of operating condition discrepancies by improving its documentation, but changing operating conditions are partially outside the utility's control. The same is true for measured

usage and operating hours. In many cases, improving documentation and using pre-period measurements can mitigate these discrepancies, but there will be sites where operations change in unanticipated ways.

There wasn't a consistent single reason for measure life adjustments in this round of evaluation; however, two were more frequent. In some cases, the program claimed a standard EUL for measures where a site-specific value was more appropriate based on the customer report. In other cases, the measure life was updated to be consistent with the custom measure life guide.

Figure 3-1. Savings discrepancies - Union C&I Custom



4 UNION LARGE VOLUME

Union encourages the adoption of energy efficient equipment, technologies, and actions via its Large Volume program. In 2018, the Large Volume program was applicable to customers in Rate T2/Rate 100.

The program uses a direct access budget mechanism for the customer incentive budget process. This mechanism collects funds from each customer through rates. Customers must use these funds to identify and implement energy efficiency projects, or the funds become available for use by other customers in the same rate class. This "use it or lose it" approach ensures each customer has first access to the amount of incentive budget funded by their rates. The Large Volume program is the only "direct access" program offered in Ontario. [4]

Custom projects implemented as part of this program and claimed in 2017-2018 were included in the CPSV study. There was one (1) prescriptive project in the 2017 and 2018 Large Volume programs that is not included in CPSV.

4.1 Gross Savings Realization Rate

The GRR represents the ratio of the savings verified by the evaluation to the savings claimed (or reported) by the utility, as shown in the following equation. A 90% GRR means the verified gross savings for the project or program were 90% of the claimed savings. Differences between claimed and verified savings for each project can arise for a number of reasons, usually related to differences in forecast assumptions, differences in underlying facts, or differences in calculation approaches or parameters.

$$gross\ realization\ rate = \frac{Evaluation\ verified\ savings}{Utility\ reported\ savings}$$

Table 4-1 shows the cumulative gross savings realization rate for the Union Large Volume program. The table shows the gross realization rate, statistical precision at the 90% confidence interval, the program-claimed population CCM savings, and percent of program savings.

The Union Large Volume program overall had a 90% cumulative gross realization rate. The absolute precision (+/-) for the program was 13% at 90% confidence.

Table 4-1. Cumulative gross savings realization rate for the Union Large Volume program

Segment	Gross Realization Rate	+/- at 90% Confidence	Population CCM Savings	Percent Population CCM Savings
Union - Large Volume	90.46%	13%	1,552,094,997	100%

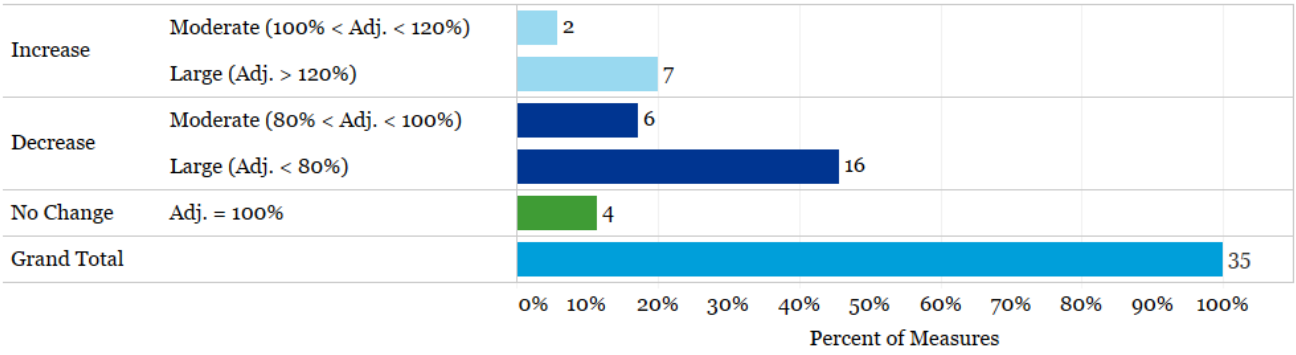
[4] Union's 2017 Draft Annual Report provides a more detailed description of the program and can be found here: https://www.oeb.ca/sites/default/files/UNION-2017-Draft-Annual-Report-20181130.pdf

4.2 Discrepancy Summary

This section presents detailed results of the various project-level discrepancies between program claimed and evaluation verified savings. The final realization rate for the program was 90% and the verification found discrepancies for 89% of the projects reviewed.

Table 4-2 shows that 4 out of 35 measures had no adjustment from program claimed to evaluation verified savings, while 31 measures were adjusted based on verification findings. For custom savings verification, we consider verified savings that differ more than 20% from utility tracking savings to be a "large" discrepancy. Moderate adjustments within 20% of utility tracking savings are expected given the level of uncertainty in forecasting energy savings. Eight of the 31 adjustments had verified savings within 20% of utility tracked savings. Of the 23 measures with adjustments greater than 20%, 7 had adjustments increasing savings (adjustments greater than 120%) and 16 had adjustments decreasing savings (adjustment less than 80%).

Table 4-2. Adjustment Summary – Union Large Volume



Four randomly selected measures with large adjustments are described below. They are included here in order to provide readers with examples of the types of discrepancies that can be identified through the CPSV process. The examples reference the site ID, which is also used in Figure 4-1 in this section and the appendix section 6.6.

- The sampled measure identified as US215-2 consisted of a recuperator replacement. The realization rate for the measure was 254%. The verification treated this measure and a reheat furnace operations optimization measure (US215-1) as one measure and estimated *annual* savings based on facility data in the common post-project period. This resulted in an overall decrease in *annual* savings. *Annual* savings were then allocated to the individual tracked measures based on the proportion of program savings claimed for each measure. For US215-2, *cumulative* savings increased due to a change to measure life consistent with the custom measure life guide for heat recovery.
- The sampled measure identified as US203-1 involved replacement of gas-fired unit heaters with high efficiency units. The realization rate for the measure was 2%. The verification learned that the replaced heaters were at the end of their life (they had been red tagged as no longer safe to operate). This changed the baseline from early replacement (in situ equipment) to replace on burnout (minimum viable replacement). The verification based the efficiency of the minimum viable replacement on ASHRAE 90.1 minimum efficiency for warm-air unit heaters, which was only slightly less efficient than those installed.
- The sampled measure identified as US214-3 replaced leaking valves in a heat recovery system. The realization rate for the measure was 46%. The verification updated the program claimed assumptions for

operating hours based on four years of production data that was fit to a typical meteorological year (TMY) weather pattern and used separate hours for each of the two systems on which the valves were installed. The EUL for the measure was also adjusted from 10 years in the program calculation to 6 years in the verification calculation as the site contact indicated that the facility puts high stress on the valves and they "hope" the valves last 5-7 years.

- The sampled measure identified as US192-3 was one of seven measures completed at this site through the Large Volume program during the evaluation period. The realization rate for the measure was 19%. The measure consisted of disassembly & removal of asphaltene and scale deposits on select heat exchanger surfaces in a preheat heat exchanger train. The verification used more extensive pre- and post-measure data than that used by the program, which reduced annual savings by 10%. The major reduction to cumulative savings resulted from a reduction in EUL from 14 years to 3 years based on the site contact's understanding of how often these heat exchangers undergo similar maintenance.

Figure 4-1 plots the claimed cumulative savings and the realization rate for each measure in the sample. The plot is sorted with the smallest measure on the bottom and largest on the top. The left plot shows the relative size of each measure. The right plot shows the gross realization rate for each measure. In both plots, measures with light blue bars have a realization rate greater than 100% (verified savings greater than utility claimed savings). Measures with dark blue bars represent a gross realization rate less than 100% (verified savings lower than utility claimed savings). Measures with green bars represent a gross realization rate of 100%.

Figure 4-1. Sample Measure Realization Rates sorted by size –Union Large Volume

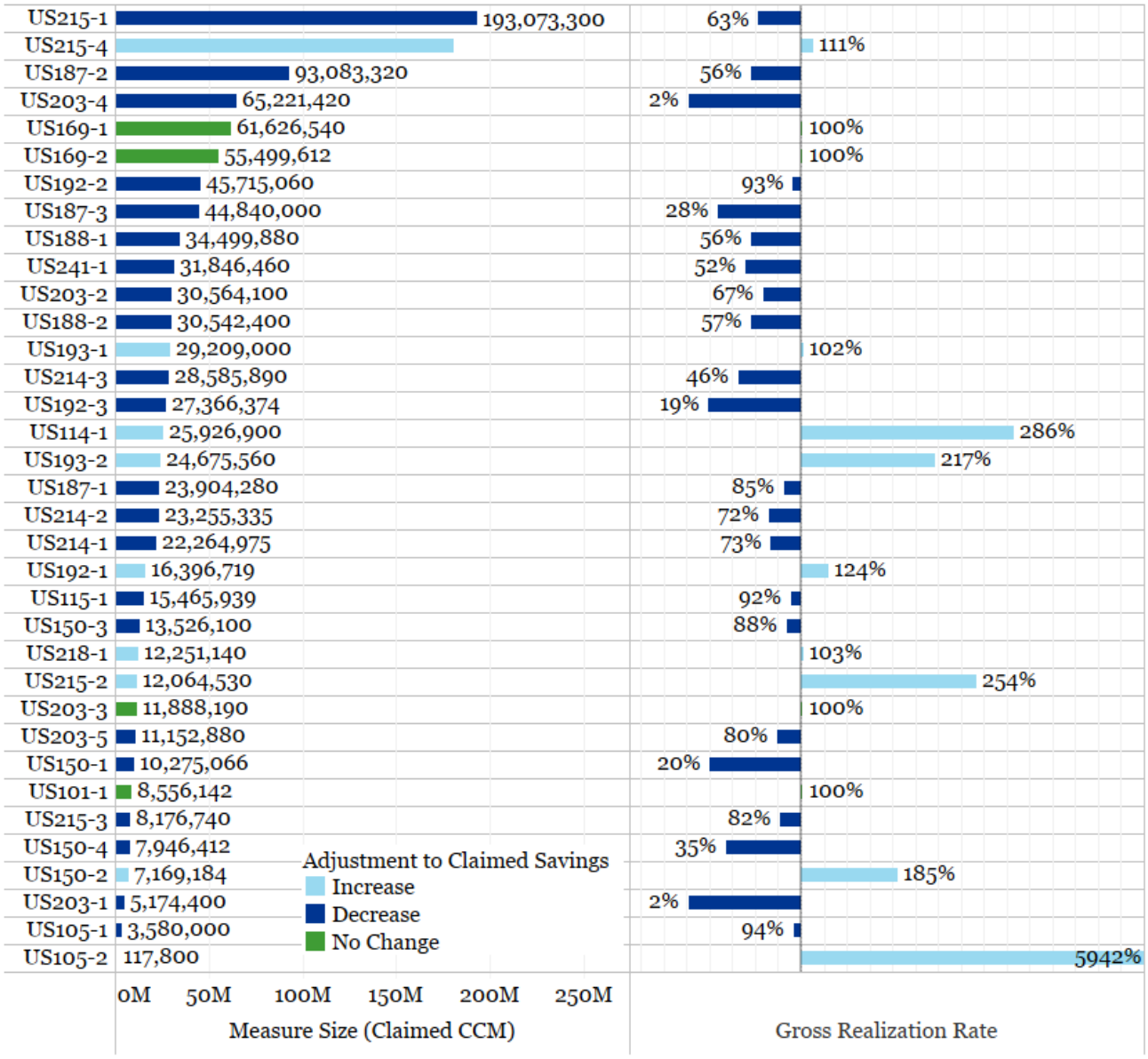
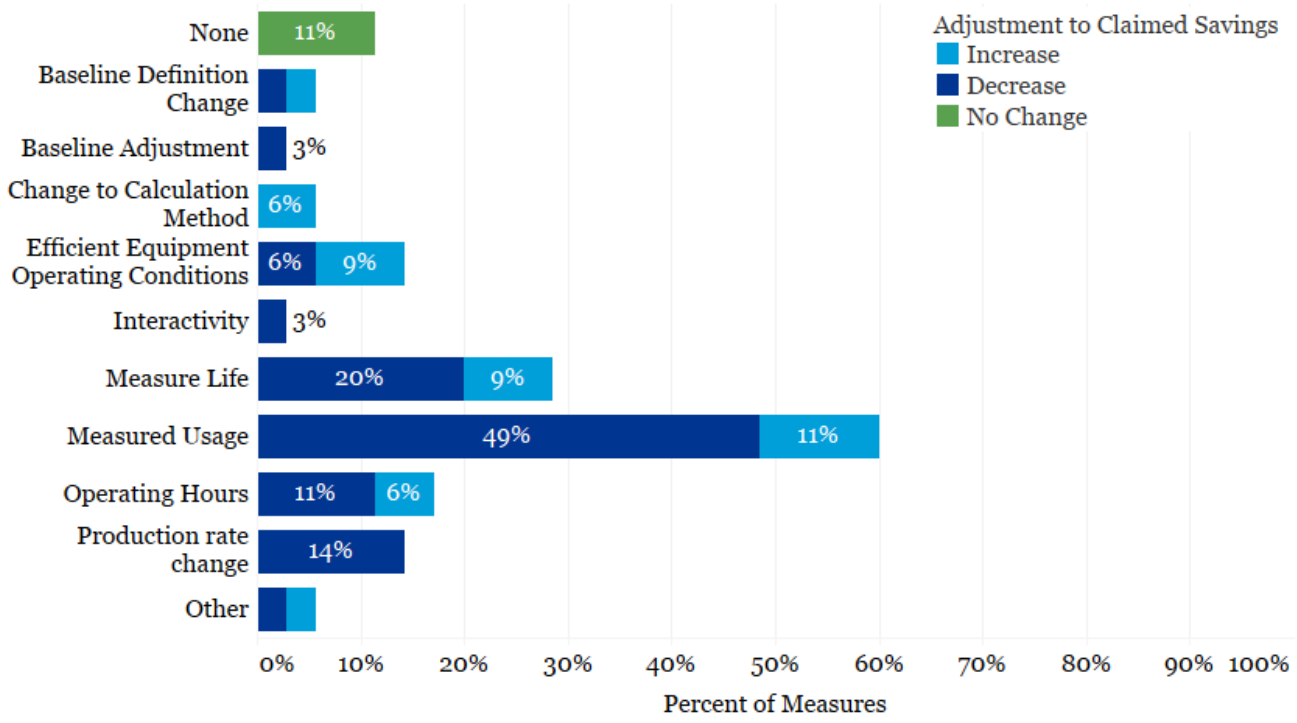


Figure 4-2 shows the types of discrepancies found by the verification. The verification found no discrepancies for 11% of sampled measures. The most common discrepancy between claimed savings and verified savings (60% of measures) was updates to measured energy usage data provided by customers to the verification team. Savings based on measured energy usage are expected to result in some discrepancy during verification because the verification has access to a longer time period of post-installation data than the implementation team. In several cases the implementation team was working with very limited post-installation period data to model savings, which increases the risk of a large adjustment in verification.

Measure life was the only other discrepancy type that occurred for more than 20% of measures. In most cases, measure lives were adjusted primarily for site specific conditions. The program can reduce these

adjustments by deviating from the measure life guide defaults where site-specific situations warrant. When determining the measure life to use, consider the age of the replaced equipment and the specifics of the environment in which the equipment will operate, and provide clear documentation of the reasoning for the measure life chosen, especially when it differs from the measure life guide.

Figure 4-2. Savings discrepancies - Union Large Volume



5 FINDINGS AND RECOMMENDATIONS

The tables in this section present the key findings and recommendations from the study. The tables show the party to whom the recommendation applies and the primary beneficial outcome of the recommendation. We classified outcomes into four categories: reduce costs, increase savings, increase (or maintain) customer satisfaction and decrease risk (multiple types of risk are in this category including risk of adjusted savings, risk to budgets or project schedules, and others). Details of the findings, recommendations and outcomes follow the tables.

Table 5-1. Energy savings and program performance recommendations

#	Energy Savings and Program Performance		Applies to			Primary Beneficial Outcome			
	Finding	Recommendation	Union	Enbridge	Evaluation	Reduce Costs	Increase Savings	Customer Satisfaction	Decrease Risk
1	Both utilities exhibit a strong commitment to accurate energy savings estimate	The utilities should continue in their commitment to accuracy.	✓	✓				✓	✓
2	The CPSV effort found realization rates for market segments that were between 90 and 125% and identified adjustments for most projects.	Continue performing custom savings verification on a regular basis.			✓				✓
3	Relative precision targets were not met for all programs, nor for all segments	Use error ratio assumptions from the results provided in this report in future evaluation years, possibly with more conservative bounding than performed this year.			✓	✓			✓
4	Some measures have difficult-to-define baseline technologies.	Establish a policy to define rules around energy savings calculation for fuel switching and district heating/cooling measures.	✓	✓	✓				✓

#	Energy Savings and Program Performance		Applies to			Primary Beneficial Outcome			
	Finding	Recommendation	Union	Enbridge	Evaluation	Reduce Costs	Increase Savings	Customer Satisfaction	Decrease Risk
5	Some measures in each utility program are routine maintenance, periodic repairs, or like for like replacements that are considered standard care in other jurisdictions.	Establish a clear policy regarding eligibility of maintenance repair and like for like replacement measures for the programs.	✓	✓	✓	✓			✓
6	Multiple heat sources and third-party purchases of heat require more documentation than typical measures	Document the gas demand in the pre-period that will be offset Document the volume of heat/steam/biogas available, the seasonality of supply and its alternative usage.	✓	✓					✓

Table 5-2. Verification process recommendations

#	Verification Process		Applies to			Primary Outcome			
	Finding	Recommendation	Union	Enbridge	Evaluation	Reduce Costs	Increase Savings	Customer Satisfaction	Decrease Risk
7	DNV GL was unable to obtain access to all the equipment at all the sites selected for verification.	Modify contracts to require participants to agree to comply with EM&V as part of the requirements for participation in the program.	✓	✓		✓			✓

Table 5-3. Documentation and Support recommendations

#	Documentation and Support		Applies to			Primary Outcome			
	Finding	Recommendation	Union	Enbridge	Evaluation	Reduce Costs	Increase Savings	Customer Satisfaction	Decrease Risk
8	Incremental improvement in project documentation by both utilities was again observed in the 2017-2018 CPSV. However, project documentation could still be improved.	Implement an electronic tracking system that archives all materials Include explicit sources for all inputs and assumptions in the project documentation. Store background studies and information sources with the project files and make them available to evaluators. Provide evaluators full access to customer data. Provide pre- and post-installation photos, where available. Institute a checklist as part of project closeout to ensure all relevant project documentation is assembled and ready for verification	✓	✓			✓		✓
9	Utility savings estimates based on annual energy consumption for industrial sites did not always include sufficient information documenting production.	Include site production totals in relevant years in the savings estimates based on annual energy consumption for industrial sites	✓	✓					✓
10	Enbridge Boilers use a 73% assumed thermal efficiency for in situ boilers that have been in place for more than 10 years.	Estimate boiler degradation from name plate efficiency to determine the baseline boiler efficiency rather than use a flat number	✓	✓					✓

#	Documentation and Support		Applies to			Primary Outcome			
	Finding	Recommendation	Union	Enbridge	Evaluation	Reduce Costs	Increase Savings	Customer Satisfaction	Decrease Risk
11	Pipe insulation is a significant source of savings for the Union programs. Documentation supporting the assumptions used in calculations, in situ conditions, and location of incentivized pipe insulation was not consistently provided.	Document baseline conditions of pipe insulation (and other measures) using photos and text descriptions to provide context. Explicitly tie the documentation of baseline condition to the heat loss assumption in the savings calculation. Documentation should clearly identify location of pipe insulation installed under the program, as well as associated equipment, especially in large facilities.	✓	✓					✓
12	Documentation did not always include explanation and supporting documentation for baseline types (ROB, ER) and remaining useful life (RUL).	Always provide a complete description of the base case. The description should reference included emails and photos to document in situ conditions and features that are carried over into the baseline system.		✓					✓
13	The utilities should use longer duration data in program savings estimates when possible.	Use longer duration data in program savings estimates. When time periods less than a year are used, utilities should document why the period used is applicable to a full year and why a full year was not able to be used.	✓	✓		✓			✓
14	In situ boiler name plate information, age and operating condition were not always recorded or described.	Document in situ boiler name plate information, age and operating condition for all projects where boiler efficiency affects savings.	✓	✓					✓

#	Documentation and Support		Applies to			Primary Outcome			
	Finding	Recommendation	Union	Enbridge	Evaluation	Reduce Costs	Increase Savings	Customer Satisfaction	Decrease Risk
15	At large sites with multiple spaces containing similar equipment, program documentation did not always identify which space or piece of equipment was affected by the project.	Include additional descriptions of spaces and equipment affected to differentiate among similar spaces and equipment at the site.	✓	✓					✓
16	Invoices were not always included with documentation, and sources for incremental costs were not always clear.	Ensure that incremental costs are supported by invoices or other documentation, especially for add-on and optimization measures where the total cost and incremental cost are likely to be the same.	✓	✓				✓	✓
17	Larger projects appeared to fall under the same documentation standards as smaller projects.	Increase the amount of documentation and source material for projects that have greater energy savings.	✓	✓					✓
18	Union's custom project summary workbook is a good approach to documentation. The workbook is not used in a consistent manner across all projects.	Consider providing more training or adding quality control steps to ensure the summary workbook front page is completed and stored in a consistent manner. Identify a common approach for common measures and, if applicable, document deviations and the reasons for the deviations in a clearly labelled field on the summary sheet.	✓			✓			✓
19	Enbridge Etools does not sufficiently document sources of inputs and assumptions.	Provide details used in Etools in the application along with supporting documentation.		✓		✓			✓

Table 5-4. Data management recommendations

#	Data Management		Applies to			Primary Outcome			
	Finding	Recommendation	Union	Enbridge	Evaluation	Reduce Costs	Increase Savings	Increase Customer Satisfaction	Decrease Risk
20A	Neither Union nor Enbridge currently track participating customer or participating vendor contact information in their program tracking database. Providing the information to the evaluation puts significant burden on utility staff.	Track contacts associated with projects in the program tracking database.	✓	✓		✓		✓	✓
20B		Strongly consider investing in relational program tracking databases.	✓	✓		✓	✓	✓	✓
20C		Continue to use improved structure for data integrity in the evaluator request for contact information for the 2019 savings verification and evaluation.			✓	✓		✓	
21	The extracts from the utility program tracking database do not include dates for key project milestones.	Track and provide to evaluators dates for key milestones in the project.	✓	✓		✓			✓
22	EUL and cumulative gross savings were not provided in a consistent manner in the Enbridge program tracking database extract	Include separate fields in the program tracking database for all components of gross and net cumulative and first year savings.	✓	✓			✓		✓

5.1 Energy Savings and Program Performance

1. **Finding:** Both utilities exhibit a strong commitment to accurate energy savings estimates. Each has made significant investments in developing calculation tools which model savings accurately. For example, Union's dock door seal calculator is well considered and designed, and Enbridge's Etools calculator is very thorough in attempting to model savings for key measures.

   Both utilities chose to retain engineers with a strong understanding of their customers' building and process systems and showed a commitment to finding accurate savings estimates. On several occasions,

both on the phone and in writing, the evaluation team suggested a value that would have increased savings in a way that the utility program engineer did not think was valid. When this happened, neither utility was shy in suggesting that we may want to make a more conservative choice.

Recommendation: The utilities should continue in their commitment to accuracy.

Outcome: Accurate energy savings.

2. **Finding:** The CPSV effort this year found realization rates between 90 and 125% for each market segment and identified adjustments for most projects. Across the programs, adjustments increased savings on for 41 measures and decreased savings on 56 measures. 57 measures had a large adjustment (verified savings more than 20% different from tracked), which was an increase from the 2016 verification.

   Recommendation: Continue performing custom savings verification on a regular basis. Even a study that results in an adjustment of near 100% is still valuable because the programs know that their savings estimates will be reviewed. Knowing a review will be conducted improves the quality of pre-verification estimates. The review itself also results in information that improves future program savings estimates.

   Outcome: Accurate energy savings.

3. **Finding:** Relative precision targets were met or close to met for each program. The sample design incorporated the final 2016 error ratios (ERs) and averaged them with the assumption used in the 2016 sample design. ERs were further bounded (minimum ER was 0.25, maximum 0.60) to limit the risk of over- or under- collecting data. Several segments did not achieve the precision targets sought. In some cases, the precision target was not met due to lack of data from very large measures in the sample, while in others the variability in the gross realization rate for projects was simply greater than the error ratio assumption that was used.

   Recommendation: In future years, continue the process used to develop error ratios assumptions from the results provided in this report, possibly with more conservative bounding (potentially increasing the maximum ER) to avoid under-collection of data for any segments.

   Outcome: Realistic estimates of error ratios result in an appropriate amount of data collected to meet targets.

4. **Finding:** Some measures (e.g., geothermal heat pumps, combined heat and power, and those that save district heating energy) have difficult-to-define baseline technologies. Multiple different baselines are possible for these projects, depending on how one looks at the scope of the project. Two challenging aspects include how non-gas energy changes and offsite gas use are considered in savings estimates.

   Recommendation: Consider establishing a policy to define rules around energy savings calculations and baselines for fuel switching and district heating/cooling measures.

   Outcome: Less risk of adjustment and a better alignment between provincial energy efficiency goals and program implementation.

5. **Finding:** Some measures in each utility program are routine maintenance, periodic repairs or like for like replacements that are considered standard care in other jurisdictions.

   Recommendation: Establish a clear policy regarding the eligibility of maintenance, repair and like for like replacement measures for the programs.

   Outcome: Reduced free ridership risk.

6. **Finding:** The technical estimates of potential savings from a measure need to match the achievable potential at the site. In 2017-2018, projects included measures that saved heat, but translating the heat savings into gas savings was challenging due to multiple heat sources and fuels. Other projects included the purchase of heat or landfill gas where the sufficiency and seasonality of supply affected the achievable gas savings. Also important in third-party purchase measures is to document whether and how the purchased product is and would be used in the absence of the purchase.

   Recommendation: In situations with multiple heat sources, document the gas demand that is affected by the measure in order to establish whether gas is saved in all periods. For measures where heat, steam or biogas is purchased from a third-party where it is a by-product, document the sufficiency, seasonality and baseline use of the product without the purchase.

   Outcome: Accurate energy savings.

5.2 Verification Processes

7. **Finding:** DNV GL was unable to obtain access to all the equipment at all the sites selected for verification. Both Enbridge and Union have several large projects with industrial companies, including food processing, refineries, and other industries. In several cases, the customer refused to provide the necessary trend data to allow a reasonable verification of the project. This means we were unable to do more than a reasonableness check on the savings.

   A review of the Enbridge contract shows that the customer is not required to provide the information that is necessary for EM&V. The most relevant sections are:

   - Item 6: Payment of the Incentive Payment is subject to the completion of a satisfactory site inspection of the improvements, including the installed equipment by an authorized representative of Enbridge.
   - Item 9: Upon request within eighteen months of the commissioning date of the Project, and with reasonable notice, the Customer agrees to provide authorized representatives of Enbridge with access to the Project, and with required information or data relating to the project for the purposes of the Application and these General Terms and Conditions.

   Neither of these are sufficient for EM&V.

   Recommendation: Modify contracts to require participants to agree to comply with EM&V as well as utility representatives as part of the requirements for participation in the program.

   Outcome: Reduced evaluation costs and risks. Participant non-compliance requires evaluators to request documentation for a large backup sample, and to survey and/or visit additional sites to obtain sufficient data for the evaluation. The process of contacting a site and getting a refusal costs time and

money, as does the substitution of an additional site to make up for the unobtained data. In some cases, there might not be additional sites to sample, in which case the evaluation estimates will have lower precision than they would with full compliance.

5.3 Documentation and support

8. **Finding:** Incremental improvement in project documentation by both utilities was again observed in the 2017-2018 CPSV. However, project documentation could still be improved. Specific issues included:

   - Project data or details missing
   - Insufficient measure-level details to fully describe what was installed
   - Descriptions that were difficult to understand
   - Use of black box tools
   - Hardcoded information in calculation spreadsheets
   - Undocumented assumptions
   - Input adjustments that approximate other effects, but are not explained
   - Insufficient access to customer data (by customers).
   - Adjustments to savings estimates for safety or influence that were not clearly marked, sourced, or carried out in a consistent fashion

   Recommendation: Improve data quality. Possible steps include:

   - Implement an electronic tracking system that archives all materials
   - Include explicit sources for all inputs and assumptions in the project documentation.
   - Store background studies and information sources with the project files and make them available to evaluators.
   - Provide evaluators with full access to customer data.
   - Provide pre- and post-installation photos, where available.
   - Institute a checklist as part of project closeout to ensure all relevant project documentation is assembled as ready for verification

   Outcome: Properly explaining and sourcing the savings calculation method and assumptions allows the evaluating engineer to more easily identify what needs to be verified. It also makes it easier to determine whether the methods and assumptions are reasonable and use program assumptions rather than seek documented values elsewhere.

9. **Finding:** Utility savings estimates based on annual energy consumption for industrial sites did not always include sufficient information to document production. The change in energy use pre- and post-measure is often sensitive to changes in production.

   Recommendation: Savings estimates based on annual energy consumption for industrial sites should include information from the site on the amount of production in the years used. If detailed production data are not available, the utilities should get percentage differences year to year (e.g.: if year 1=100%; is year 2 exactly the same or is it 95% or 110% of production the previous year).

   Outcome: Documenting production changes and using them in savings estimates will improve accuracy and reduce evaluation risk.

10. **Finding:** Enbridge boiler calculations use a 73% assumed thermal efficiency for in situ boilers that have been in place for more than 10 years. This value likely overstates energy savings with a baseline boiler that is 20 years or less in age. The value is based on a 2% de-rate of a 2007 combustion efficiency study that found an average combustion efficiency of 74.6% for 39 boilers aged 12-38 years (average 24.5). The study, which Enbridge provided to the evaluation team, did not attempt to tie the degraded combustion efficiency to the original rated efficiency of the boilers. The study is also now more than 10 years old, so its findings are likely out of date and should only at most apply to 20-year-old or more boilers. For 2017-2018, the evaluation used the 73% value since a better option was unavailable at the time.

    Recommendation: Use a degradation from name plate efficiency to determine the baseline boiler efficiency rather than use a flat number. The 2019 CPSV effort should include in the scope secondary research to determine a degradation factor or curve to be used for the 2019 CPSV and incorporated by the utilities for the 2020 program year until primary research is completed or a better approach is developed.

    Outcome: Improving this key assumption will improve savings estimates for a significant portion of savings in the Enbridge portfolio and the process would also be applicable to Union sites where baseline boiler efficiencies are required and not based on site tests of boiler performance.

11. **Finding:** Pipe insulation is a significant source of savings for the Union programs. Documentation supporting the assumptions used in the calculation and the condition of the existing pipe insulation (via photos and/or a description) was not consistently provided. In large facilities, it was often difficult to determine the location of the pipe insulation that was installed for the particular project being evaluated, especially if they had multiple similar incentivized projects installed through the facility.

    Recommendation: Document baseline conditions using photos and text descriptions to provide context. Tie the documentation of the baseline condition to the heat loss assumption in a clear way. Include maps, drawings and/or descriptions that clearly identify the location of the installed pipe insulation for each measure and its associated equipment, especially in large facilities.

    Outcome: Improving documentation of baseline conditions and clarity in calculations will reduce evaluation risk and improve consistency of approach among the Union engineering team.

12. **Finding:** Enbridge documentation did not always include an explanation and supporting documentation for baseline types (replace on burnout, early replacement) and remaining useful life (RUL). "See Etools for base case" is not sufficient: Etools[5] is not designed to provide context and sources to support the values included.

    Recommendation: Always complete the "Base Case Overview" with a detailed description of the base case. The description should reference included emails and photos to document in situ conditions and features that are carried over into the baseline system.

[5] Etools is a suite of energy savings calculators that Enbridge has developed to document projects and provide savings estimates to contractors and customers.

Outcome: Improved descriptions and documentation will reduce evaluation risk and help Enbridge ensure that accurate information has been entered into Etools.

13. **Finding:** The duration of pre- and/or post-data (energy consumption, production output, raw material consumption, etc.) used by the utilities for savings estimates was too brief in several instances.

    Recommendation: The utilities should use data that encompasses a longer period of time in savings estimates when possible. When time periods less than a year are used, the utilities should document why the period used is applicable to a full year and why a full year was not able to be used.

    Outcome: Increased accuracy of savings estimates.

14. **Finding:** The utilities did not always gather boiler nameplate data for in situ systems. The age and operating condition were also not always recorded or described. This was a concern on boiler projects, but also for projects where boiler efficiency has an effect on savings, such as greenhouses, pipe insulation and heat recovery.

    Recommendation: In situ boiler name plate information, age and operating condition are all helpful for determining the designed performance and reasonable range of actual efficiency for the system as well as providing context to better RUL.

    Outcome: Improving documentation of the in situ boiler will reduce uncertainty in savings estimates and reduce evaluation risk.

15. **Finding:** At large sites with multiple spaces containing similar equipment, the utility documentation did not always identify which space or piece of equipment was affected by the project.

    Recommendation: Include additional descriptions of spaces and the equipment affected by the measure to differentiate among similar spaces and equipment at the site.

    Outcome: Reduced evaluation risk.

16. **Finding:** Invoices were not always included with measure documentation, and the sources for incremental costs were not always clear.

    Recommendation: Ensure that incremental costs are supported by invoices or other documentation, especially for add-on and optimization measures where the total cost and incremental cost are likely to be the same. Equipment replacement measures may require an additional standard efficiency quote to produce incremental cost.

    Outcome: Incremental cost is an important component of simple payback, which is often used to judge the economic benefit of energy efficiency projects. It is also an input to some benefit-cost tests.

17. **Finding:** Larger projects appeared to fall under the same documentation standards as smaller projects.

    Recommendation: Increase the amount of documentation and source material for projects that have greater energy savings.

Outcome: Projects that are better documented tend to have more accurate savings estimates and receive fewer evaluation adjustments than those that are less documented. Large projects have a greater effect on overall savings adjustment factors. Therefore, large projects with better documentation are more likely to result in program-level adjustment factors closer to 100%.

18. **Finding:** Union custom projects utilized a project application summary workbook that summarizes the key project inputs, calculations, and most details. In general, this is a good approach that facilitates internal review and evaluation. One challenge was that different projects used the workbook in different ways:

    - The notes section was sometimes used to identify and highlight specific unique approaches and features in projects, but not always.
    - Calculations internal to the summary page were consistent for most projects, but not all; additional factors were sometimes added.
    - Sub-methods critical to the calculation were sometimes contained in hidden sheets.
    - Safety and influence adjustments were inserted in different locations and not always explained.

    Recommendation: Consider providing more training or adding quality control steps to ensure the summary workbook front page is completed and stored in a consistent manner. Identify a common approach for common measures and, if necessary, document deviations and the reasons for the deviations in a clearly labelled field on the summary sheet.

    Outcome: A consistent summary workbook aids both internal and external quality assurance, quality control, and measurement and verification.

19. **Finding:** Enbridge Etools is used as both a calculation tool and as a communication tool with customers. While it appears to serve the needs of the program, this form of communication is difficult for the evaluation efforts.

    - Etools does not easily allow for assumptions to be sourced within the record.
    - Some Etools selections may be site-specific and some may be defaults; the calculator does not clearly distinguish.
    - Energy savings that are calculated outside of Etools are hard-entered in Etools but not always sourced.

    Recommendation: Use a consistent summary workbook. Provide details used in Etools in the application along with supporting documentation.

    Outcome: A consistent summary workbook aids both internal and external quality assurance, quality control, and measurement and verification.

5.4 Data management

20. **Finding:** Neither Union nor Enbridge currently track participating customer or participating vendor contact information in their program tracking database. Providing the information to the evaluation puts significant burden on utility staff.

Recommendation A: Track contacts associated with projects in the program tracking database. At a minimum, the program tracking database should include:

- Project site address
- Customer mailing address
- Primary customer contact name
- Primary customer contact phone
- Primary customer contact email
- Primary customer contact mailing address
- Addresses are best tracked as multiple fields including:
  - Street address line 1
  - Street address line 2
  - City
  - Province
  - Postal code

Phone number fields should include data validation to enforce a consistent format and avoid missing or extra digit errors. Phone extensions should be tracked in a field separate from the ten-digit phone number and be restricted to numeric data only.

The best practice is to maintain contacts in a table separate from specific project or customer data. This allows for a single contact to be connected to multiple accounts and/or projects as necessary without creating duplication. This structure also makes it easier to associate multiple contacts with a single project and decreases quality control costs.

Vendor contact information should also be tracked in the database, in the same table as the participating customer contact information. With a relational database, the contact ID from the table can be added to a project record in the role consistent with the contact's participation (such as vendor, decision maker, or technical expert) with a separate table that allows a single vendor contact to be associated with multiple projects.

Outcome A: Reduced burden on utility staff to seek contact information for projects, whether for internal or evaluation use. Reduced evaluation costs and improved sample design expectations.

Recommendation B: The utilities should strongly consider investing in relational program tracking databases. Relational program tracking databases and customer relationship management (CRM) systems allow for multiple contacts to be associated with a single account and/or project. The incremental cost of implementation is low if it is part of the initial database design, populated as projects are started, and updated once they are complete.

For the implementation team, a query-able one-stop shop for data provides a wealth of information that can improve delivery. For example, these databases can help programs understand how contractors work across projects, identify when projects have hit snags and need attention, and give the program team access to key customer context such as historical participation and different contacts that have worked with the program.

For evaluation, this allows programs to easily clarify aspects of projects during implementation and to provide accurate, timely, and usable contact information to evaluators and verifiers.

Outcome B: Improved customer satisfaction from better delivery, and a reduced burden on utility staff for tracking information. A relational database would also streamline aggregation of program data for scorecards and make providing data simpler for annual savings evaluation and verification.

Recommendation C: Continue to use the improved structure for data integrity in the evaluator request for contact information for the 2019 savings verification and evaluation.

Outcome C: Reduced evaluation costs due to less data cleaning and research to fill missing information. Improved data collection with less returned advance letters and more accurate connection between projects and contacts.

21. **Finding:** The extracts from the utility program tracking database do not include dates for key project milestones. Enbridge's data did not include any dates and Union's included only the "install date."

    Recommendation: Track and provide to evaluators dates for key milestones in the project. Dates for project start, installation, and those that define the program year provide useful context for interviewers that is not always easy to find in project documentation

    Outcome: Improved data collection through more informed interviewers and reduced evaluation costs through less need to search for dates in documentation.

22. **Finding:** EUL and annual gross savings in the Enbridge program tracking database extract total to the correct cumulative savings but are a work around for advanced (accelerated) projects. The data structure provides accurate cumulative savings but does not store and report the underlying dual-baseline annual saving estimates, or the actual claimed RUL and the EUL for each measure.

    Recommendation: Include separate fields in the program tracking database for:

    - EUL
    - RUL
    - gross first year annual savings
    - gross post-RUL annual savings
    - net to gross (NTG)
    - gross cumulative gross
    - net cumulative savings
    - net first year savings

    Outcome: Improved data integrity results in less evaluation risk and more accurate savings totals. Providing each of the key savings types and their components allows evaluation to confirm that the savings provided are internally consistent.

6 APPENDICES

6.1 Technical Introduction

This study provides verified savings ratios and verified gross savings totals from Enbridge's and Union's natural gas DSM programs delivered in 2017-2018. The projects included are shown in Table 6-1. In the CPSV study of 2017-2018 programs, custom Market-Rate Multi-Residential (Multifamily) and custom Low Income Multi-Residential projects are both included as a part of the Commercial program.

Table 6-1. CPSV by program

Program		2017-2018 CPSV
Union Custom	Large Volume	✓
	Commercial & Industrial	✓
Enbridge Custom	Commercial	✓
	Industrial	✓

6.1.1 Background

Enbridge and Union deliver energy efficiency programs under the Demand Side Management Framework for Natural Gas Distributors (2015-2020)[6] developed by the OEB. In April 2016, the OEB hired an Evaluation Contractor (EC) team led by DNV GL to develop an overall evaluation, measurement, and verification (EM&V) plan. The objectives of the plan were to:

- Assess portfolio impacts to determine annual savings results, shareholder incentive and lost revenue amounts, and future year targets.
- Assess the effectiveness of energy efficiency programs on their participants and/or market, including results on various scorecard items.
- Identify ways in which programs can be changed or refined to improve their performance.

Under the plan, the DNV GL team conducted a verification of gross savings for custom projects implemented as part of the 2017-2018 program year. This report is a result of that study.

An evaluation advisory committee (EAC) provides input and advice to the OEB on the evaluation and audit of DSM results. The EAC consists of representatives from Union and Enbridge as well as representatives from non-utility stakeholders, independent experts, staff from the Independent Electricity System Operator (IESO), and observers from the Environmental Commissioner of Ontario and the Ministry of Energy. The DNV GL team worked closely with the EAC throughout this study and received comment, advice, and input on methodology and results. We thank them for their involvement.

[6] EB-2014-0134

6.1.2 Methodology Summary

The results presented in this report are based on data collection from the following four primary sources, supplemented with secondary source information:

- Union and Enbridge tracking databases
- Union and Enbridge project documentation
- In-Depth Interviews with a sample of participating customers (vendors provided supplementary information for some sites)
- On-site visits to a sample of participating customer sites

The data collection with a sample of participating customers included site visits and telephone interviews supporting a detailed measurement and verification (M&V) analysis. Table 2 shows the targeted and completed data collection activities.

Table 6-2. Data collection activities*

Target Group	Activity	Targeted Measures	Completed Measures
Enbridge			
Participating Customers	M&V Site Visit (On-site)	45	30
	TSER Interview		18
Union			
Participating Customers	M&V Site Visit (On-site)	65	63
	TSER Interview		11
Overall			
Participating Customers	M&V Site Visit (On-site)	110	93
	TSER Interview		29

*This table reports the number of measures targeted and completed as measures were used to design the sample before customers and sites had been identified.

At a high level, the gross savings verification (CPSV) study employed the following methodology:

- **Review program data and documentation.** The evaluation started with a review of the program tracking data, which formed the basis of the sample, and an initial review of the program documentation. Once the sample was selected, additional documentation was provided by the programs to describe the energy efficiency measures and support the tracking savings estimates, also called the ex ante estimates.
- **Design and select the sample.** The tracking data was used to design and select a sample. Full documentation and contact information was requested for all sites within the sample.
- **Collect data.** Data was collected to verify the ex ante energy savings.
- **Analyze the results.** The collected data was used to verify the gross savings at each site.
- **Report the results.** The final step was to report the results.

Key features of the methodology include:

- The **sample design** employed a stratified random sample that targeted 10% relative precision with 90% confidence at the program level. Details of the sampling methods are presented in the scope of work embedded in appendix section 6.5. Final sample achievements are provided in appendix section 6.2.
- **Ratio estimation** was used to expand sample results to the population. The evaluation collected data on all sampled or backup projects that a customer contact could speak to rather than only the first selected. In our calculation of sampling error (+/-, confidence intervals, relative precision and error ratios), we used two-tailed 90-percent confidence limits and clusters defined by customers to appropriately estimate error when multiple units are collected from a single source. The approach used is described in the scope of work embedded in appendix section 6.5.
- The **gross savings verification** used a combination of on-site data collection and interviews to collect primary data. Calculation of lifetime gross savings used a dual baseline approach to more accurately estimate savings for early replacement measures. Detailed site reports for each of the sites visited or called were prepared by the DNV GL team and reviewed by the EAC.

6.1.2.1 Understanding Statistical Error

Statistical error is reported for all of the ratio results in this report. The studies were designed with sample designs targeting 10% relative precision with 90% confidence (90/10) based on the best available assumptions at the start of the evaluation. Table 6-3 describes each of the statistics provided in this report.

Table 6-3: Relevant statistics

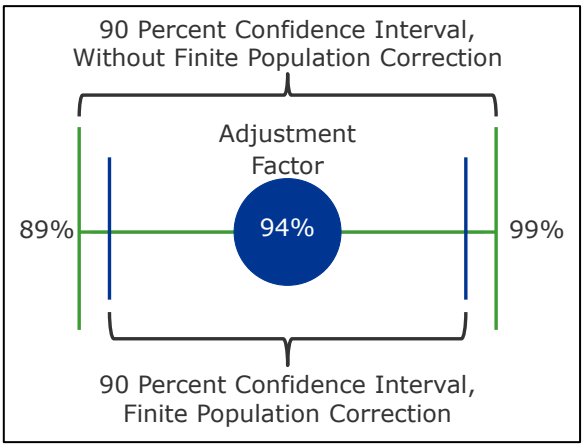
Term	Definition
Ratio/Adjustment factor	A point estimate of the evaluation findings expressed as a percent.
+/- or Absolute Precision	If the evaluation were repeated several times, selecting samples from the same population, 90%[7] of the time the ratio would be within this range
Confidence interval	The upper bound is defined by the ratio plus the absolute precision. The lower bound is defined by the ratio minus the absolute precision.
Relative Precision	The relative precision is calculated as the absolute precision divided by the ratio itself. By convention, relative precisions are the statistic that is targeted in sampling (i.e., 90/10 is a relative precision metric)
Finite population correction (FPC)	FPC is a factor that reduces the measured error of samples drawn from small populations (less than 300). FPC applies when the ratio is applied to the same population from which the sample was drawn.

Figure 6-1 shows an example of:

- the adjustment factor (ratio) as a blue point
- the 90% confidence interval *with finite population correction* (blue)
- the 90% confidence interval without finite population correction (green)

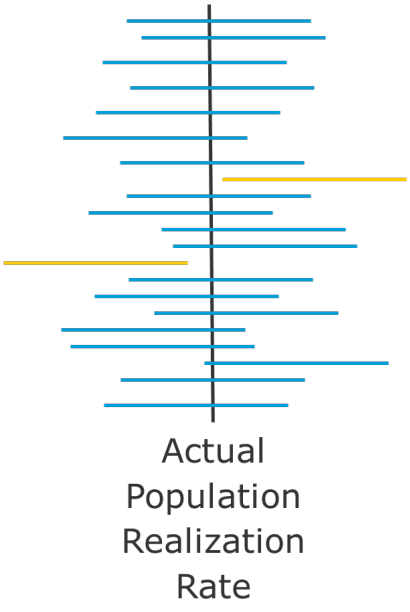
[7] 90% is the confidence limit that we are using.

Figure 6-1. Ratio diagram example



The plus/minus (±) error (%) indicated at the 90% confidence interval is the absolute difference between the estimated percentage and the upper or lower confidence bound. For example, in Figure 6-1, the ratio is 94% and the non-FPC 90% confidence interval is ± 5 percentage points (i.e., 94% ± 5%).[8] Another way of saying this is that there is a 90% probability that the actual ratio for the next year's program lies between 89 and 99%. Figure 6-2 demonstrates this concept by showing twenty hypothetical confidence intervals calculated from twenty different samples of the same population. Eighteen out of twenty (90%) include the true population ratio (overlap the black line representing the true ratio).

Figure 6-2. Ninety Percent Confidence Interval



Note: Each horizontal line represents a confidence interval, while the black vertical line is the actual population realization rate. Yellow confidence intervals do not include the actual ratio.

[8] The critical value for calculating the confidence interval ± for each adjustment factor is determined using Student's t-distribution and n-1 for the degrees of freedom, where n is the sample size. For 2-tailed estimates (ratios that could be above or below 100%) the appropriate t-stat used to calculate precision from the standard error is close to 1.645.

The relative precision of the ratio is calculated as 5%/94% =5.3%.

For low ratios, relative precisions may be quite high, even when the confidence interval around the ratio is quite narrow. Consider a ratio of 5% with the same 5% absolute precision as in the above example. While the absolute precisions are the same, the latter ratio (5%) has a relative precision of 5%/5% =100%. In absolute terms, we still are 90% confident the ratio is below 10%, despite the very high (100%) relative precision.

We report the relative precision in all cases at the 90% confidence level. That is, whether the relative precision is large or small, we have the same 90% confidence that the range defined by the point estimate +/- the absolute error captures the true unknown value. The "midpoint" estimate (the ratio) is the best (statistically most likely) estimate, while the confidence interval is calculated as an interval around that point. Thus, in all cases, we reported the best point estimate, with a symmetric 90% confidence interval (using the t-score for a 2-tailed 90% confidence interval).

6.2 Final Sample Achievement

The tables in this section show the achieved sample for each stratum in the sample designs. The tables are specific to each program and show the categorical stratification (segment) and size strata (larger numbers are bigger projects). Sampling was done at the measure level. The target column shows the number of units we attempted to complete. The complete column shows the number of measures randomly selected and completed. Cumulative savings (CCM) in the completed sample (completed CCM) and for the frame (total CCM) are also included. Note that in some cases measures beyond the target were completed. These completed measures were at sites with multiple measures in the sample.

6.2.1 Union C&I Custom: Summary of Participant Data Collection

Table 6-4 summarizes the participant data collection efforts for CPSV of the Union C&I Custom program. The table shows the portion of the program that:

- Completed on-site visits
- Completed telephone-supported engineering reviews (TSER)
- Did not respond to an evaluation attempt at contact, or refused verification
- Was not contacted by the evaluation team.[9]

The data collected is represented as the number of sites, the number of measures, and cumulative ex ante natural gas savings (ex ante CCM). The proportion of the program in each category is also represented in Table 6-5. In the table, size categories within segments (e.g. Industrial) are ordered with 1 being the smallest stratum within each segment. The study had a customer response rate of 65%, which is consistent with what DNV GL has seen in comparable studies in central North America.

[9] Sites or measures where contact was not attempted were either not selected for contact in sampling or in the backup sample or were not contacted due to strata quotas being met.

Table 6-4. Summary of CPSV data collection for the Union C&I Custom Program

Data Collection Category	Targeted	Completed		
	# Measures	# Sites	# Measures	Ex Ante CCM
Completed On-Site	39	19	28	568,326,085
Completed TSER		11	11	27,431,203
Attempted Contact, Not Completed		16	16	204,083,868
Not Attempted		450	904	2,371,721,795
Total		496	959	3,171,562,951

Table 6-5. CPSV Sample Achievement for Union CI&MF

Segment	Stratum	Max CCM	Target	Completed Measures	Frame Measures	Completed CCM	Total CCM
Agricultural	1	4,737,465	5	5	298	7,428,589	355,786,266
	2	25,068,700	4	4	50	27,705,255	515,023,490
	3	51,768,704	4	4	16	139,498,284	587,250,641
	4	98,247,900	1	0	1	0	98,247,900
Industrial	1	2,141,520	4	5	296	2,975,328	200,247,414
	2	5,996,460	4	3	75	9,929,912	266,047,381
	3	18,953,420	4	4	32	36,642,820	326,932,949
	4	54,888,000	4	5	12	142,230,535	367,428,050
	5	133,991,920	2	2	2	194,992,280	194,992,280
Commercial & MF	1	17,805,840	6	6	176	10,623,505	235,875,800
	2	23,730,780	1	1	1	23,730,780	23,730,780
Grand Total				39	959	595,757,288	3,171,562,951

6.2.2 Union Large Volume: Summary of Participant Data Collection

Table 6-6 summarizes the participant data collection efforts for CPSV of the Union Large Volume program. The table shows the portion of the program that:

- Completed on-site visits
- Did not respond to an evaluation attempt at contact, or refused verification
- Was not contacted by the evaluation team.[10]

The data collected is represented as the number of sites, the number of measures, and cumulative ex ante natural gas savings (ex ante CCM). The proportion of the program in each category is also represented in

Table 6-7. In the table, size categories are ordered with 1 being the smallest stratum. The study had a customer response rate of 72%, which is slightly higher what DNV GL has seen in comparable studies in central North America.

[10] Sites or measures where contact was not attempted were either not selected for contact in sampling or in the backup sample or were not contacted due to strata quotas being met.

Table 6-6. Summary of CPSV data collection for Union Large Volume

Data Collection Category	Targeted	Completed		
	# Measures	# Sites	# Measures	Ex Ante CCM
Completed On-Site	26	13	35	1,216,360,088
Attempted Contact, Not Completed		5	5	39,222,348
Not Attempted		19	48	296,512,561
Total		**37**	**88**	**1,552,094,997**

Table 6-7. CPSV Sample Achievement for Union Large Volume

Segment	Stratum	Max CCM	Target	Completed Measures	Frame Measures	Completed CCM	Total CCM
Large Volume	1	7,169,184	4	4	42	16,041,384	123,034,800
	2	12,064,530	4	7	15	70,059,960	156,405,427
	3	22,264,975	4	5	11	79,904,873	177,243,139
	4	29,209,000	4	7	7	182,923,339	182,923,339
	5	45,057,760	3	5	6	172,292,840	217,350,600
	6	61,626,540	3	3	3	162,841,212	162,841,212
	7	193,073,300	4	4	4	532,296,480	532,296,480
Grand Total				35	88	1,216,360,088	1,552,094,997

6.2.3 Enbridge C&I: Summary of Participant Data Collection

Table 6-8 summarizes the CPSV data collection efforts for the Enbridge C&I Custom program. The table shows the portion of the program that:

- Completed on-site visits
- Completed telephone supported engineering reviews (TSER)
- Did not respond to an evaluation attempt at contact, or refused verification
- Was not contacted by the evaluation team.[11]

The data collected is represented as the number of sites, the number of measures, and cumulative ex ante natural gas savings (ex ante CCM). The proportion of the program in each category is also represented in Table 6-9. In the table, size categories within segments (e.g. Industrial) are ordered with 1 being the smallest stratum within each segment. The study had a customer response rate of 66%, which is consistent with what DNV GL has seen in comparable studies in central North America.

[11] Sites or measures where contact was not attempted were not selected for contact in sampling or in the backup sample.

Table 6-8. Summary of CPSV data collection for Enbridge C&I Custom Program

Data Collection Category	Targeted	Completed		
	# Measures	# Sites	# Measures	Ex Ante CCM
Completed On-Site	45	26	30	152,282,237
Completed TSER		18	18	19,279,821
Attempted Contact, Not Completed		23	23	79,391,280
Not Attempted		1,321	1,834	1,210,405,585
Total		**1,388**	**1,905**	**1,461,358,923**

Table 6-9. CPSV Sample Achievement for Enbridge C&I Custom Program

Segment	Stratum	Max CCM	Target	Completed Measures	Frame Measures	Completed CCM	Total CCM
Commercial	1	487,050	5	5	507	1,268,457	79,357,624
	2	1,525,800	5	6	126	4,618,277	103,961,312
	3	7,893,920	4	5	48	14,264,779	126,387,524
	4	8,636,535	1	1	1	8,636,535	8,636,535
Industrial	1	2,709,350	5	5	234	1,534,800	162,681,383
	2	7,258,920	4	4	53	14,617,635	222,363,413
	3	27,231,760	4	4	19	69,655,462	253,416,602
	4	33,242,320	1	1	1	33,242,320	33,242,320
LI + MR Multi-Residential	1	427,650	4	4	559	860,650	88,021,628
	2	795,700	4	4	187	2,753,790	108,981,436
	3	1,632,800	4	5	113	5,598,568	123,260,418
	4	5,529,775	3	3	56	7,828,460	144,366,403
	5	6,682,325	1	1	1	6,682,325	6,682,325
Grand Total				48	1,905	171,562,058	1,461,358,923

6.3 Technical Policy Approaches

This appendix memorializes some of the more noteworthy topics that arose during the evaluation as part of Evaluation Advisory Committee (EAC) review of CPSV site reports. In some cases these decisions were made during the 2015 and 2016 CPSV (as noted in the text).

6.3.1 Measure categories and baseline selection

Table 6-10 shows the CPSV team's definitions of which baseline is appropriate for various situations. These are guidelines that apply to almost all projects. Some situations may require an exception, in which case the reasoning was described in the site report. In most cases where a code or market minimum baseline was an option, we used that rather than a customer specific baseline. This approach was used in order to maintain consistency of approach with the free ridership based attribution study, making the results applicable in conjunction with the results from this study.

Table 6-10. Measure categories and associated baselines

Measure Type	Gross Savings, based on remaining useful life from facility contact and documentation		Examples	Notes
	Early Replacement Baseline	Natural Replacement Baseline		
Replace on Burnout (ROB) and Existing Equipment More Efficient than Code or Where No Code Applies	NA	In Situ (use new equipment with the same size/rating and In Situ efficiency)	Unique measures where no code/Industry Standard Practice (ISP) exists; Drum Dryers	
Replace on Burnout (ROB) and Existing Equipment Less Efficient than Code	NA	Code/Standard Market Efficiency	Replacing a boiler which was no longer practical to operate	
New Construction (NC) / Capacity Expansion (CE)	NA	Code/Standard Market Efficiency or Minimum on Market/Customer Specific	New boiler for new space or system. Any new construction or natural gas load adding/increasing. Other recently constructed non-participating buildings onsite are a reasonable baseline	Minimum on market / customer specific applies where there is no enforced code
Retrofit Add On (REA)	In Situ	Code/Standard Market Efficiency or Minimum on Market/Customer-specific	Equipment controls; addition of boiler economizer; pipe/tank insulation	Minimum on market / customer specific applies where there is no enforced code
Early Replacement (ER) and Existing Equipment More Efficient than Code or Where No Code Applies	In Situ	In Situ (use new equipment with the same size/rating and In Situ efficiency)	Greenhouse components, such as a site with degraded double-layer polyethylene walls which then installs triple layer but uses single layer poly walls as the baseline (this is a regressive baseline) to estimate savings. Must use double layer (new not degraded) as the baseline in this case.	

Early Replacement (ER) and Existing Equipment Less Efficient than Code	In Situ	Code/Standard Market Efficiency or Minimum on Market/Customer Specific	Regenerative Thermal Oxidizer (RTO) – required to meet local air quality emissions requirements, that a recuperative or direct-fired oxidizer cannot achieve.	
Maintenance (Including Repair or Maintain to Code or Restoration to Prior Efficiency Level)	NA	In Situ	Re-tube boilers to rated efficiency levels; Repair or clean heat exchanger; Replace heat exchanger oil; Rewind motors; Repair or replace faulty/leaking valves, pipes, ductwork, etc.; Re-pipe condensate return lines.	
System Optimization (OPT)	NA	In Situ	Revamp Process Control Strategy; De-bottlenecking to increase production and m^3/widget; Modifying the sequence of processes.	

6.3.2 Estimated useful life

For most measures, we based EULs on those found in the Utility Measure Life Guide, when present and reasonable. Site contacts were asked about their expectations for the EUL of the measure installed. The simple decision matrix shown in Table 6-11 shows when the verification uses a site specific EUL instead of the measure life guide.

Table 6-11. EUL decision matrix

		Is there a measure specific (not other/process) EUL in the utility measure life guide?	
		Yes	**No**
Does site contact provide information that supports an EUL value determination?	**Yes**	Use utility measure life guide unless site contact has site specific reason for EUL value provided	Use site contact reported EUL
	No	Use utility measure life guide	Use utility measure life guide for other/process, ex ante EUL, or, in rare cases, secondary sources such as manufacturers or other studies

When EULs were not present in the Utility Measure Life Guide, and site contacts were not knowledgeable, we would base EULs on those used in other North American jurisdictions. In rare cases, manufacturer information may have been used to determine the applicable EUL for measures that were not found in a survey of EUL guides and TRMs.

6.3.2.1 Remaining useful life

The RUL of the existing equipment limited the EUL of the implemented measure for the following categories of measures:

- Retrofit Add-on (REA)
- System Optimization (OPT)

- Maintenance

RUL was determined based on the best available evidence. In some cases, the preponderance of evidence suggested that an REA measure was likely to be re-used with new equipment when the existing equipment was replaced. Evidence to support using an EUL rather than RUL for REA measures required that the re-use was both feasible (REA measure must be compatible with a wide range of substitute equipment) and likely (ISP was re-use for the application and/or site contact indicates that re-use was planned).

There are situations where the RUL of the existing measure is more than likely longer than the EUL of the REA measure. Pipe insulation is an example: in almost all cases we would expect existing pipes to outlast the insulation installed on them.

Site engineers and interviewers used a list of questions to help determine the RUL of existing equipment. Due to time constraints, project specifics and the site contact's willingness/ability to respond, not all questions were asked of all sites. In 2017-2018, we made this process more formalized as detailed below.

The following section provides the methodology we used for determining the applicable RULs. Question wording onsite and on telephone interviews did vary from the language used here as the questions were delivered in the context of the broader conversation about the implemented measures.

Framing Questions

These questions are intended to get the respondent thinking about their rebated equipment in the context of:

- Their broader facility or process
- Their typical maintenance and equipment replacement practices
- The performance of the equipment relative to their current needs

Interviewers ask these questions before moving to the measure-type-specific questions shown in the following sections.

- For all add-on measures, interviewers asked these questions of the host equipment, or the pre-existing energy using equipment that the add-on measure is making more efficient. Wording was informed by observed equipment condition.
- For add-on measures that replaced a pre-existing add-on, interviewers asked these questions referring to the pre-existing add-on in addition to and separate from the host equipment.
- For replacement measures, interviewers asked these questions referring to the condition of the replaced equipment at the time of replacement.
- Maintenance
  - frequency
  - costs relative to that anticipated for a new unit
  - costs over time (are they increasing or decreasing)
- Performance
  - Is/was it meeting needs?
  - Performing at its rated specification?
  - Degrading more or less quickly between maintenance/repairs?
- Any components whose failure would cause replacement of the equipment?
  - Which component is it?

- How much longer do you think it will last?

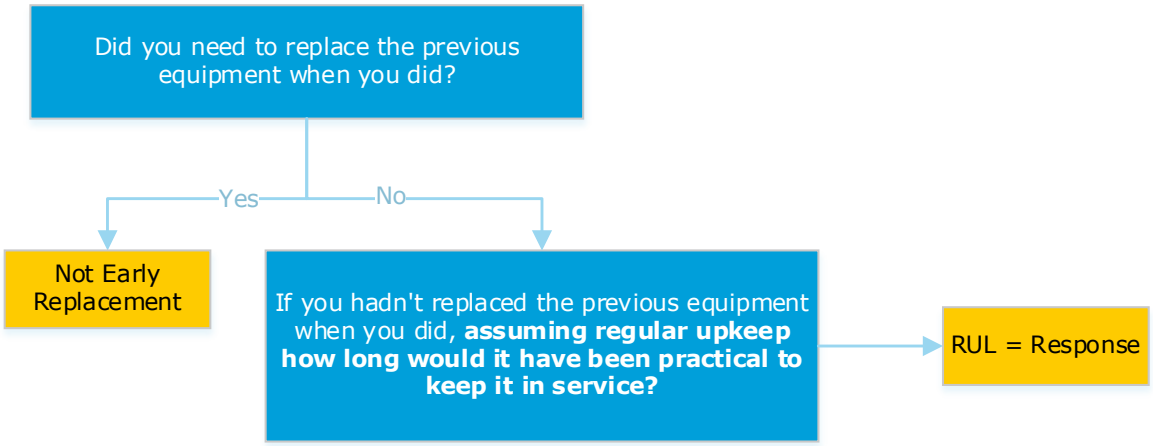
Equipment Replacement

The equipment replacement measure type refers to equipment that is installed in place of another piece of equipment being removed. In this case, the EUL of the installed equipment is split into two periods:

- **Early Replacement (ER) Period**: This is the period representing the RUL of the existing (replaced) equipment. During this period, the existing equipment is the baseline.
- **Non-ER Period:** The remaining EUL (after subtracting out the RUL) is referred to the non-ER period. During this period, the new standard efficiency baseline shall be used.

We determine the RUL for equipment replacement measures by asking the questions shown in Figure 6-3.

Figure 6-3. Equipment Replacement Data Collection Flow Chart



DNV GL ensured that the respondent understood that regular maintenance and upkeep should be assumed.

Note that the question does not refer to the program. The purpose was to understand how long the equipment would have stayed in service had it not been replaced at the time it was. This is different from a timing/acceleration question that might be found in a free ridership question sequence, in that the reasons for replacing now rather than later are not material in the gross context.

Put simply, for this gross-only evaluation, we do not care when a customer would have replaced their equipment without the program. Instead we are seeking to understand how much longer it would have been practical to keep the equipment in use.

Add-on Equipment

The add-on equipment measure type refers to equipment that is added to an existing system or piece of equipment to make it more efficient, such as a control or insulation. There are many potential periods within the EUL of the installed add-on equipment. These periods include:

- **ER Period 1**: The period where the existing add-on equipment (or none, if the existing equipment did not have any applicable add-on equipment) and existing host equipment could have continued operating in the same manner. During this period, the baseline would be the existing host equipment with the existing add-on (if any).

- **ER Period 2**: There could be a second ER period on rare occasions, for two reasons:
  - If the existing add-on equipment (if there was one) would have failed or been replaced, but the existing host equipment was still operating effectively. During this period, the baseline would be the existing host equipment with new standard efficiency add-on equipment.[12]
  - If the existing host equipment failed, but the existing add-on equipment could have been used with the new host equipment. During this period, the baseline would be the new host equipment (whatever the customer will most likely install) with the existing add-on equipment.
- **Non-ER Period**: The period after both the existing host equipment and the existing add-on (if any) would have failed or had to have been changed/replaced. During this period, the baseline is the new host equipment with a new standard efficiency add-on.[12]

These periods are represented visually in Figure 6-4. In this figure, the labels are defined as follows:

- **Exist. Add-on RUL > 0:** Existing add-on equipment was early replacement.
- **Exist. Host RUL > 0:** The add-on was installed on existing host equipment.
- **EUL of New Add-on > RUL of Exist. Host:** The host equipment will be replaced during the life of the new add-on
- **New Add-on Compatible with New Host:** The new add-on equipment is practical to reuse with whatever replaces the existing host equipment, as determined by the questions in Figure 6-3.

[12] Note that the "new std. eff. add-on" case may not include an add-on at all. For example, the standard efficiency case for many motors is not to use a motor drive but to allow the motor to run by itself. Sometimes customers even replace an existing VFD-driven motor with one that does not have a VFD.

Figure 6-4. Add-on Equipment Periods

Scenario					<----------New Add-on Equipment EUL---------->		
					Baseline is:		
#	Exist. Add-on RUL >0	Exist. Host RUL >0	EUL of New Add-on > RUL of Exist. Host	New Add-on Compatible with New Host.	ER Period 1	ER Period 2	Non ER Period
1	yes	yes	yes	yes	Exist. Host Pre-exist. Add-on	Exist. Host New Std. Eff. Add-on[12]	New Host New Std. Eff. Add-on[12]
2	yes	yes	yes	no	Exist. Host Pre-exist. Add-on[12]	Exist. Host New Std. Eff. Add-on[12]	No Savings
3	yes	yes	no	-	Exist. Host Pre-exist. Add-on (or none)	n/a	Exist. Host New Std. Eff. Add-on[12]
4	yes	no	-	yes	New Host Pre-exist. Add-on.	n/a	New Host New Std. Eff. Add-on[12]
5	no	yes	yes	yes	Exist. Host New Std. Eff. Add-on[12]	n/a	New Host New Std. Eff. Add-on[12]
6	no	yes	yes	no	Exist. Host New Std. Eff. Add-on[12]	n/a	No Savings
7	no	yes	no	-	n/a	n/a	Exist. Host New Std. Eff. Add-on[12]
8	no	no	-	yes	n/a	n/a	New Host New Std. Eff. Add-on[12]

Using the example of a boiler and a boiler controller, here is how these scenarios would work:

- Scenario 1:

  Customer had an existing boiler with an existing controller.
  Existing controller and boiler both had an RUL greater than zero.
  Boiler RUL was greater than the existing controller RUL.
  New controller EUL is greater than the existing boiler RUL.
  Controller would be compatible with a new boiler.

- Scenario 2

  Customer had an existing boiler with an existing controller.
  Existing controller and boiler both had an RUL greater than zero.
  Boiler RUL was greater than the existing controller RUL.
  New controller EUL is greater than the existing boiler RUL.
  Controller would not be compatible with a new boiler.

- Scenario 3

  Customer had an existing boiler with an existing controller.
  Existing controller and boiler both had an RUL greater than zero.
  Boiler RUL was greater than the existing controller RUL.
  New controller EUL is less than the existing boiler RUL.
  Controller would not be compatible with a new boiler.

- Scenario 4

  Customer had an existing controller which was re-installed on a new boiler.
  Existing controller had an RUL greater than zero.
  New boiler EUL is greater than the existing controller EUL

- Scenario 5

  Customer had an existing boiler with an RUL greater than zero.
  Existing controller had failed or did not exist.
  New controller EUL is greater than the existing boiler RUL.
  Controller would be compatible with a new boiler.

- Scenario 6

  Customer had an existing boiler with an RUL greater than zero.
  Existing controller had failed or did not exist.
  New controller EUL is greater than the existing boiler RUL.
  Controller would not be compatible with a new boiler.

- Scenario 7

  Customer had an existing boiler with an RUL greater than zero.
  Existing controller had failed or did not exist.
  New controller EUL is less than the existing boiler RUL.

- Scenario 8

  Customer installed a new controller on a new boiler.

Additional examples using other technologies:

- **Scenario 1:** A customer replaces damper driven speed control with a VFD on a make-up air (MUA) unit. The customer says that the VFD is easily removable and could easily be reused on a new MUA. The damper speed control had an RUL of 5 years, the MUA has an RUL of 10 years, and the VFD has an EUL of 15 years.

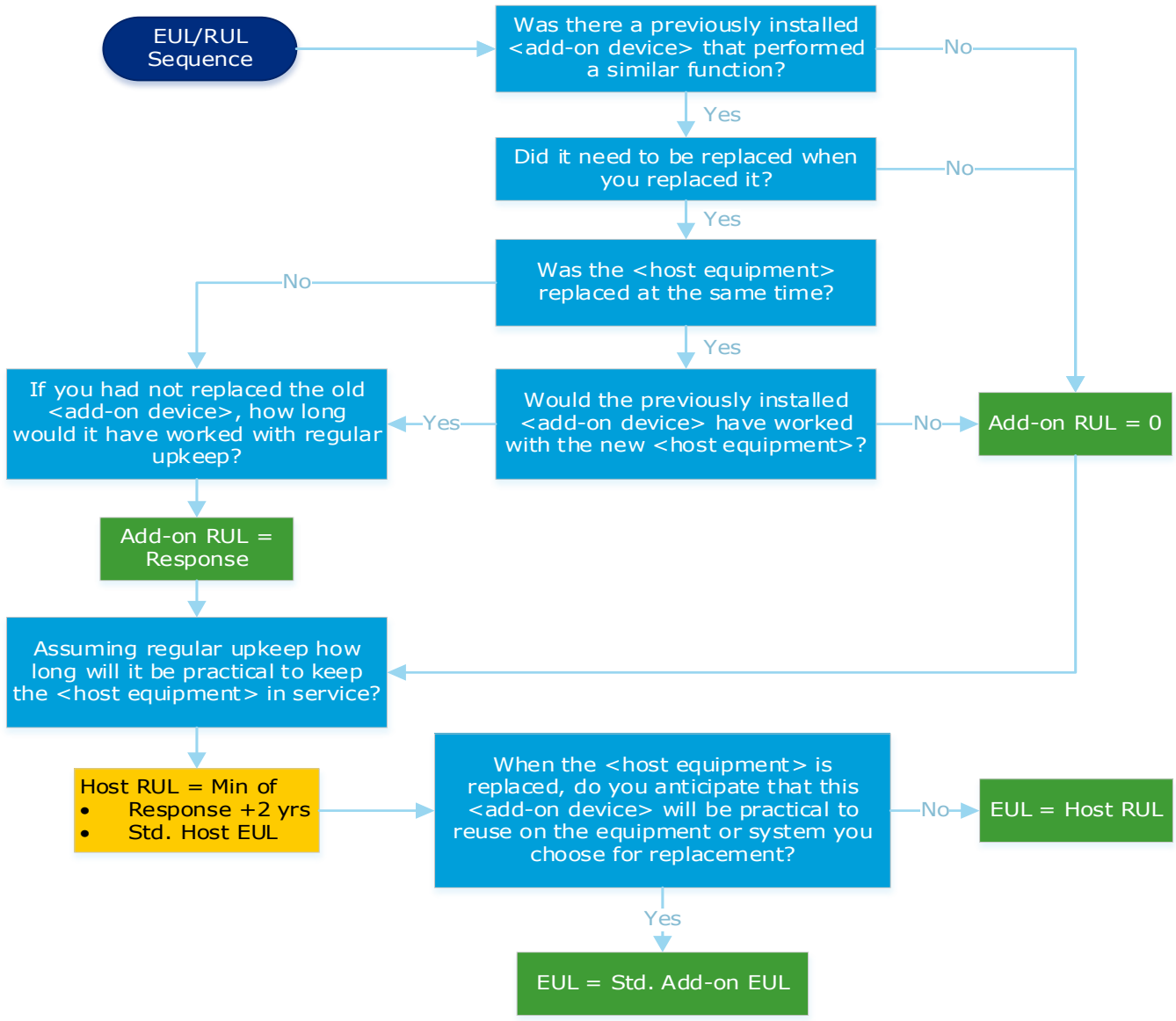
Period	Length (yrs.)	Baseline
ER Period 1	5	Exist. Host Exist. Add-on
ER Period 2	5	Exist. Host New Std. Eff. Add-on[12]
Non ER Period	5	New Host New Std. Eff. Add-on[12]

- **Scenario 2**: A customer adds a vendor-specific linkageless control to their existing steam boiler. The existing boiler did not have any similar controls. The customer says that the boiler has an RUL of 5 years. They do not like the existing system vendor, and so in a new system they would not find it practical to recycle the used vendor-specific linkageless control. The linkageless control has a standard EUL of 10 years, though in this case the EUL is limited to 5 years.

Period	Length (yrs.)	Baseline
Non ER Period	5	Exist. Host Exist. Add-on[12]

We determined the RUL and EUL for add-on measures by asking the questions shown in Figure 6-5. The purpose was to make sure that we got as much meaningful, accurate, and consistent information as possible from the customer, to minimize resorting to default guidelines.

Figure 6-5. Add-on Equipment Data Collection Flow Chart[13]



For customers who were hesitant to answer, we obtained approximate information by providing bracketed categories (e.g. "is it more or less than 10 years" … "is it more or less than 5 years") and incorporated any information available from the documentation or our own sources to help inform this value.

Summary

In the past, there was significant debate amongst the EAC on how to determine the length and nature of the EUL and RUL periods, particularly when the savings for one or more periods might have been zero.

[13] Note that we add 2 years to the final equipment life question response because the equipment was installed in 2017 or 2018 but we are asking about it in 2019.

For this reason, we chose to make explicit how we asked about these issues and collected the information necessary to reasonably quantify them. There were still situations where we had to follow default guidelines about items like RUL and whether equipment could be reused on new host equipment, though our approach reduced the number of times this was necessary.

6.3.3 Greenhouse baselines

For this round of CPSV, the evaluation team accepted most of the baseline assumptions used by the utilities, as applicable codes for commercial greenhouses do not provide specific guidance toward defining minimum efficiency levels for any of the equipment included in the utility programs. Further, Industry Standard Practice (ISP) for Ontario has not been studied. The baseline assumptions used by the utilities were generally closer to a "minimum available on the market" baseline rather than ISP. This approach was consistent with that used for the 2015 CPSV and NTG studies.

In accepting the program baseline for gross savings, the CPSV adjustment was smaller than it would have been with adjustment. The free ridership study asked about options that would have been installed in the absence of the program using the program baseline as the "full credit to the program" end of the scale. If ISP is more efficient than the program claimed baseline, this would theoretically result in more customers with higher free ridership relative to using an ISP based baseline. Mathematically, whether the "standard" baseline was set at minimum available or at an ISP level, the net savings would be the same or very similar as long as both the CPSV and FR projects work off of the same "standard."

Due to the number and size of these projects and the anticipated continued growth in greenhouse construction, we recommend scoping and undertaking a greenhouse baseline study in the future.

6.3.4 Union topics

Union specific topics that required significant decisions during the verification included evaluation approach to "influence factors," and steam traps.

Steam traps

The CPSV team used a six (6) year EUL for these measures, consistent with 2015 and 2016 CPSVs. The reasoning in 2015, which we carried forward in 2017-2018, is described below.

In previous project documentation, Union typically used seven (7) year EULs and Enbridge usually used six (6) year EULs. The CPSV team used a single EUL for both utilities, adopting a six (6) year EUL. The six-year value was based on a 2015 Massachusetts study and is also consistent with the California DEER database, Massachusetts evaluations and the Wisconsin Focus on Energy TRM. The Michigan MEMD (Michigan Efficient Measure Database) uses a five (5) year EUL.

Project documentation provided by Union to support a longer EUL for Union projects consisted of three reports from customers documenting their practices and survey results. Each of the three sites provided was a petrochemical plant.

The reports showed failure rates that could be consistent with 7, 11 and 13 years respectively.

Methodologically, "one divided by failure rate" is a way to estimate the EUL, but it assumes that all traps fail randomly. Many factors affect the life to the steam trap: temperature, pressure, flowrate, operating hours, quality of the installation of the steam trap, location of the steam trap in the system (e.g., near elbows and constrictions, or in a straight line of pipe, or somewhere near forklift traffic), presence of low concentrations

of chemicals in the steam and more. The steam traps replaced as part of a program are going to be more likely to be those with a higher rate of failure than those of the facility as a whole.

DNV GL also reviewed the project files sent for the 2015 CSPV sample. While most of the project files did not report the number of traps surveyed, the evaluation team found two others in the 2015 project files that did (the two largest, one petrochemical and one other manufacturing). The failure rates in those sites were consistent with 4.3 and 8.1 years, but it was not clear how often they conducted surveys, so these could have been multi-year failures (longer implied EUL with a "one divided by failure rate" method).

Five large customers do not necessarily represent the program population, and the steam traps replaced by the program are likely to fail at a rate greater than those not replaced. The evaluation team does not have enough evidence to support a longer steam trap EUL for Union and used 6 years as the EUL, consistent with the current best available research (the Massachusetts study).[14]

Union used three general approaches to calculate savings from steam traps. Most of the projects fell into approaches 1 and 2, with only a few projects using approach 3.

1. Standard: A calculation tool took inputs provided by vendors and applied them to a simplified version of the Spirax Sarco equation, then applied a derating factor. This is similar to the approach used by many vendors.
2. Chemical and Refinery: A calculation tool which used four different equations depending on pressure and steam trap type, including choked and non-choked versions of both the Napier equation and ANSI standard equation. This was generally applied to large chemical and refinery plants with thermodynamic traps.
3. Ad-Hoc: This approach represented a variety of methods which took different outputs (which were likely to have been based on different assumptions from simple vendor calculations) without specifically stating assumptions and converted steam loss to natural gas savings.

For this round of evaluation, we accepted Union's methodology for Approaches 1 and 2, retaining their savings estimates unless we learned something from the site contact about the pressure, leak rate, or other condition that differed from the ex ante assumption/documentation. Where site information differed from the documentation, the methodology used to estimate ex post savings was determined on a case-by-case basis. For Approach 3, we planned to recalculate savings using a formula from the Illinois TRM, which generally produces savings estimates similar to the results from the Enbridge and Union Approach 1 methods. Approach 3 was, in the end, not used.

In the future, we propose that Union document and provide the orifice sizes used to check the vendor calculations. We also propose that Union provide all documentation, including charts, tables, and vendor documentation where needed, to evaluate Approach 2 sites. Union should also provide Excel calculators with live formulas rather than hardcoded values when the values were determined based on a formula or table as opposed to a chart or curve. If the chart or curve was the source, Union should provide a copy of the source material.

[14] Massachusetts 2013 Prescriptive Gas impact Evaluation. Prepared by DNV GL for Massachusetts Gas Program Administrators and Massachusetts Energy Advisory Council, June 2015.

Some options for increasing the evaluation rigour for steam traps, might entail one or more of the following:

- Attempting to independently gather orifice sizes and maximum flow capacity charts by reaching out to vendors to develop a database which would allow us to independently verify calculations
- Purchasing a license for steam trap auditing software allowing for independent verification
- Developing an assessment of measure life using DNV GL's ultrasonic leak detector to assess failure rate at participating sites.

Boiler Measure Lives

In the 2016 CPSV and continuing in 2017-2018, we harmonized the boiler measure lives for the two utilities. Previously, Union used 20 years for boilers, while Enbridge used 25 years. DNV GL senior engineers were asked which was more reasonable and consensus was that 25 years is a reasonable estimate of measure life for most large boiler applications.

6.3.5 Enbridge topics

Enbridge specific topics that required significant decisions during the verification included an evaluation approach to boilers and steam traps.

Boilers

For the 2017-2018 evaluation of the Enbridge programs, the DNV GL team accepted the Etools calculation method along with the inputs used by Enbridge, except in cases where we were able to verify with site contacts a different condition than what was shown in the documentation. This approach was consistent with 2015 and 2016.

For the future evaluations, the evaluation team will:

- Look for more existing evidence from Enbridge (including emails from the customers, photographs, inspection reports, cut sheets, invoices, and conversation notes) to explain why site-specific inputs were used
- Request that Enbridge explicitly state for domestic hot water (DHW) boiler replacements in buildings with storage tanks whether the existing tank was replaced as part of the boiler replacement, and whether the existing tank was insulated.
- Recommend that the DHW tank insulation be included as a separate measure from boiler replacement.
- Consider additional research and reporting that includes:
  - Pursuing a detailed review of the ASHRAE 155P research
  - Pursuing a review of the Etools calculator which digs into the underlying assumptions and formulas
  - Writing a detailed memo which summarizes the results of these reviews

One benefit to pursuing these activities would be greater clarity around the remaining calculation uncertainties and a better understanding of their effect. Another would be the identification of areas where the calculation rigour can be cost-effectively increased through further research.

During the evaluation, we noted that Enbridge's approach to boiler implementation appeared to take more of the boiler system into account than prescriptive and custom programs implemented elsewhere. This may be motivated by the savings estimation approach that Etools takes and provides justification for on average higher savings estimates from Etools than prescriptive boiler savings estimates elsewhere.

Due to the unique approach to market and calculation that Enbridge takes, future CPSV efforts should consider using an empirical measurement approach to directly estimate usage and/or savings for boilers. Empirical measurement could take the form of billing analysis or an on-site metering study which either measures natural gas directly or measures proxy values (such as flue gas temperature, water flow, or combustion fan electrical usage). On-site metering studies are becoming more cost effective as end-use natural gas metering expertise and the accuracy of meters to measure proxy variables continue to increase. An empirical sample-based study would not prevent Enbridge from using a custom calculation approach but would help to calibrate the custom calculation and may provide value to the ASHRAE committee attempting to quantify seasonal efficiency. A billing analysis approach to estimate savings for multifamily and/or commercial boiler replacements may yield reasonable statistical significance due to the large numbers of boilers installed by Enbridge and the fact that boiler usage represents the large majority of gas usage in most buildings.

Steam traps

For this round of evaluation, consistent with 2015 and 2016, the evaluation team accepted Enbridge's approach and savings estimates for steam trap evaluations unless we learned something from the site contact about the pressure, leak rate, or other condition that differed from the ex ante assumption/documentation. Where site contacts provided different information to the verifier than that included in the ex ante documentation, the approach used to estimate ex post savings was determined on a case by case basis (depending on what was different).

For their steam trap savings estimates, Enbridge used an internal database of vendor-provided orifice sizes to check the calculations done by vendors. Based on a review of the formulas used by each vendor, calculations with a sample of pressures and leak rates used by each vendor, and a comparison to Spirax Sarco (whose calculation approach is generally recognized as superior by independent industry experts), Enbridge determines an vendor-specific average derating factor which is applied to the steam losses reported by each vendor. These derating factors are used to convert vendor savings estimates to ex ante program estimates.

The estimates that each contractor's approach produces can vary widely depending on orifice size, leak rate, pressure, and whether condensate is returned or not, so we deviated from Enbridge's method where applicable based on site-specific information.

The Enbridge estimates appeared accurate for a group of projects averaged together. The evaluation checked these estimates using an alternative calculation method (based on the Illinois TRM approach) and achieved a similar total savings, though site specific estimates varied widely.

In the future, the evaluation team will consider requesting that Enbridge document the orifice sizes they used to check the calculations done by vendor for the evaluated site and independently confirm the calculated savings. We will also consider increasing the rigour for steam traps, which could entail one or more of the following options:

- Attempting to independently gather orifice sizes by reaching out to vendors to develop a database
- Purchasing a license for steam trap auditing software
- Assessing the measure life using DNV GL's ultrasonic leak detector to assess failure rate at participating sites.

6.4 Additional Results

First year savings are used in the annual verification report to calculate lost revenue for the utilities. The gross adjustment factors for first year savings for the 2017-2018 program years are provided here.

Table 6-12. First-year gross savings realization rate for the Enbridge C&I Custom program

Segment	Gross Realization Rate	+/- at 90% Confidence	Sampled Measures	Population Measures	Percent Population CCM Savings
Commercial	100.42%	7%	17	682	23%
Industrial	106.91%	6%	14	307	50%
LI & MR Multi-Residential	121.85%	15%	17	916	27%
Enbridge C&I Custom - Overall	108.83%	5%	48	1,905	100%

Table 6-13. First-year gross savings realization rate for the Union C&I Custom program

Segment	Gross Realization Rate	+/- at 90% Confidence	Sampled Measures	Population Measures	Percent Population CCM Savings
Agricultural & Industrial	90.47%	12%	32	782	93%
Commercial & Multifamily	95.04%	6%	7	177	7%
Union C&I Custom - Overall	90.94%	11%	39	959	100%

Table 6-14. First-year gross savings realization rate for the Union Large Volume program

Domain	Gross Realization Rate	+/- at 90% Confidence	Sampled Measures	Population Measures	Percent Population CCM Savings
Union - Large Volume	85.21%	7%	35	88	100%

Table 6-15 through Table 6-17 provide identical results to those in the body of the report, but with additional information.

Table 6-15. Cumulative gross RRs for the Enbridge C&I Custom program, additional Statistics

Segment	Gross Realization Rate	+/- at 90% Confidence	Sampled Measures	Population Measures	Percent Population CCM Savings
Commercial	94.99%	9%	17	682	22%
Industrial	110.79%	8%	14	307	46%
LI & MR Multi-Residential	121.09%	16%	17	916	32%
Enbridge C&I Custom - Overall	110.51%	7%	48	1,905	100%

Table 6-16. Cumulative gross RRs for the Union C&I Custom program, additional domains

Segment	Gross Realization Rate	+/- at 90% Confidence	Sampled Measures	Population Measures	Percent Population CCM Savings
Agricultural & Industrial	91.17%	13%	32	782	92%
Commercial & Multifamily	90.57%	6%	7	177	8%
Union C&I Custom - Overall	91.10%	11%	39	959	100%

Table 6-17. Cumulative gross RRs for the Union C&I Custom program, additional domains

Segment	Gross Realization Rate	+/- at 90% Confidence	Sampled Measures	Population Measures	Percent Population CCM Savings
Union - Large Volume	90.46%	13%	35	88	100%

6.5 Key Documents

The site verification template which will be used for reporting verified results for each site to the OEB and EAC is found below.

CPSV_Site_Report template

The Scope of Work and sample design memo for the CPSV study are embedded below.

Scope of Work

CPSV Sample Design

6.6 Site Level Savings Results

This appendix provides the verification results for each measure in the sample. For each measure, the utility's tracking savings, the verification's verified savings and the realization rate are provided.

Table 6-18. Site level verification results – Enbridge C&I Custom program

Segment	Measure Type	Measure ID	Gross Realization Rate	Utility Tracking CCM	Verified CCM
Commercial	Heating	ES129-1	92%	553,525	507,650
		ES152-1	100%	703,925	703,925
		ES159-2	76%	1,767,080	1,348,284
		ES178-1	100%	324,025	324,025
		ES200-1	100%	620,525	620,525
		ES206-1	119%	1,525,800	1,817,275
		ES220-1	123%	8,636,535	10,618,695
		ES243-1	100%	567,900	567,900
		ET103-1	56%	6,275,145	3,493,470
		ET118-1	100%	399,096	399,096
		ET127-1	100%	2,078,058	2,078,058
		ET201-1	100%	646,602	646,602
		ET216-1	122%	181,890	222,315
		ET239-1	146%	89,946	130,920
	Other Commercial	ES108-1	147%	1,821,420	2,670,510
		ES159-1	99%	2,323,076	2,289,476
		ES243-2	60%	273,500	164,100
Industrial	Heating	ES143-1	100%	27,231,760	27,231,760
		ES175-1	142%	716,610	1,014,060
		ET228-1	115%	26,970	31,000
	Other Industrial	ES120-1	100%	4,425,120	4,425,120
		ES138-1	164%	252,714	415,464
		ES143-2	100%	4,254,550	4,254,550
		ES197-1	129%	13,847,162	17,898,972
		ET135-1	94%	339,066	320,390
		ET234-1	115%	3,183,525	3,663,850
	Process	ES120-2	88%	20,905,860	18,293,708
		ES147-1	100%	2,754,440	2,754,440
		ES176-1	190%	7,670,680	14,603,780
		ES232-1	110%	199,440	219,640
		ES235-1	100%	33,242,320	33,242,320
LI & MR Multiresidential	Heating	ES121-1	132%	6,682,325	8,817,425
		ES125-1	131%	2,712,550	3,550,400
		ES137-1	98%	402,725	396,350
		ES184-1	94%	3,087,775	2,913,200
		ES211-1	97%	338,575	329,100
		ES236-1	63%	1,632,800	1,022,200
		ET183-1	100%	1,064,698	1,064,713
	Other Multi-Family	ES171-1	101%	2,028,135	2,040,735
		ES189-1	157%	779,385	1,224,630
		ET112-1	214%	939,720	2,011,110
		ET131-1	137%	97,250	132,950
		ET161-1	100%	794,400	794,400
		ET163-1	100%	951,850	951,850
		ET170-1	261%	685,725	1,789,650
		ET173-1	90%	1,009,500	909,025
		ET205-1	88%	494,280	436,905
		ET223-1	619%	22,100	136,825
Grand Total				171,562,058	185,493,348

Table 6-19. Site level verification results – Union C&I Custom program

Segment	Measure Type	Measure ID	Gross Realization Rate	Utility Tracking CCM	Verified CCM
Agriculture	Greenhouse - Heating or Water System	US116-2	100%	1,625,778	1,625,778
		US133-1	105%	5,171,020	5,428,280
		US146-1	44%	7,239,015	3,168,562
		US153-1	100%	30,856,260	30,856,260
		US217-1	317%	1,335,165	4,231,920
		UT229-1	103%	3,591,966	3,687,110
	Greenhouse - New Build	US116-1	91%	39,718,084	36,076,306
		US145-1	167%	40,825,772	68,065,536
		US181-1	106%	28,098,168	29,856,723
	Greenhouse - Other	US133-2	108%	5,198,320	5,611,080
		US154-1	100%	10,096,900	10,096,900
		US154-2	111%	535,360	592,520
		US213-1	100%	340,320	340,320
Commercial & Multi-Family	Commercial & Multi-Family	US240-1	104%	23,730,780	24,585,400
		UT123-1	91%	673,800	615,920
		UT141-1	100%	4,922,460	4,922,460
		UT166-1	85%	2,270,460	1,934,400
		UT167-1	42%	331,840	139,440
		UT168-1	73%	588,195	429,090
		UT198-1	80%	1,836,750	1,474,905
Industrial	HVAC	US102-1	90%	414,320	373,360
		US102-2	46%	261,880	119,580
		US130-1	0%	8,189,680	0
		US130-2	111%	596,280	663,980
		US191-1	74%	23,116,395	17,126,010
		US191-2	68%	14,351,500	9,749,505
		UT165-1	26%	2,696,860	708,080
		UT237-1	107%	1,621,060	1,742,550
	Other Industrial	US122-1	74%	133,991,920	99,025,900
		US140-1	101%	34,339,100	34,646,200
		US202-1	0%	5,079,180	0
		US212-1	87%	19,421,680	16,892,740
		US212-2	110%	23,737,720	26,017,580
		US212-3	85%	41,615,640	35,373,640
		US222-1	15%	61,000,360	8,875,820
		US226-1	26%	7,357,700	1,882,996
	Steam or Hot Water System	US140-2	100%	81,788	81,788
		UT106-1	91%	2,153,872	1,951,516
		UT225-1	33%	6,743,940	2,247,980
Grand Total				595,757,288	491,218,135

Table 6-20. Site level verification results – Union Custom Large Volume program

Segment	Measure Type	Measure ID	Gross Realization Rate	Utility Tracking CCM	Verified CCM
Large Volume	Large Volume	US101-1	100%	8,556,142	8,556,142
		US105-1	94%	3,580,000	3,355,720
		US105-2	5942%	117,800	6,999,504
		US114-1	286%	25,926,900	74,094,080
		US115-1	92%	15,465,939	14,235,531
		US150-1	20%	10,275,066	2,095,064
		US150-2	185%	7,169,184	13,288,836
		US150-3	88%	13,526,100	11,912,194
		US150-4	35%	7,946,412	2,786,157
		US169-1	100%	61,626,540	61,626,540
		US169-2	100%	55,499,612	55,499,612
		US187-1	85%	23,904,280	20,343,720
		US187-2	56%	93,083,320	52,349,520
		US187-3	28%	44,840,000	12,531,720
		US188-1	56%	34,499,880	19,338,020
		US188-2	57%	30,542,400	17,364,580
		US192-1	124%	16,396,719	20,261,130
		US192-2	93%	45,715,060	42,563,020
		US192-3	19%	27,366,374	5,278,998
		US193-1	102%	29,209,000	29,899,240
		US193-2	217%	24,675,560	53,622,740
		US203-1	2%	5,174,400	104,780
		US203-2	67%	30,564,100	20,485,660
		US203-3	100%	11,888,190	11,888,190
		US203-4	2%	65,221,420	1,307,876
		US203-5	80%	11,152,880	8,900,500
		US214-1	73%	22,264,975	16,325,095
		US214-2	72%	23,255,335	16,842,580
		US214-3	46%	28,585,890	13,284,666
		US215-1	63%	193,073,300	122,461,260
		US215-2	254%	12,064,530	30,608,840
		US215-3	82%	8,176,740	6,745,240
		US215-4	111%	180,918,440	201,116,740
		US218-1	126%	12,251,140	15,433,220
		US241-1	52%	31,846,460	16,594,880
Grand Total				1,216,360,088	1,010,101,595

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DNV·GL

2018 Natural Gas Demand Side Management Free Ridership Based Attribution Evaluation

Ontario Gas DSM Evaluation Contractor

Ontario Energy Board

March 13, 2020

SAFER, SMARTER, GREENER

Table of contents

1 INTRODUCTION

To encourage Enbridge Gas Distribution, Inc. (Enbridge) and Union Gas Limited (Union) to implement public benefits programs designed to reduce overall energy use, called conservation demand-side management (DSM) programs, the Ontario Energy Board (OEB) reimburses them for the cost of program implementation and provides an incentive, called the shareholder incentive, that reflects the utilities' performance against pre-determined targets. The OEB also compensates the utilities for the revenue lost as a result of the lower natural gas sales.

In the 2017 and 2018 calendar years, programs delivered by Enbridge and Union targeted all natural gas ratepayers, including residential, multifamily, low income, commercial, and industrial customers. This study is part of an overall conservation program cycle as shown in the following figure. This study is part of step 4.

Figure 1-1. Conservation Program Cycle

To verify the impacts of the Enbridge and Union DSM programs, the OEB sponsors studies to verify the energy savings achieved. Specifically, this study researches attribution rates, which are estimates of the influence the utility had on the energy efficiency projects that were installed and measured as a percentage of the savings "attributable" to the utility. As part of the annual verification report, the results of this study are combined with the results of two other studies[1] to produce verified net cumulative gas savings for the utilities' 2017 and 2018 Custom programs. This study was completed by DNV GL concurrent with the 2017/2018 Custom Savings Verification Study, though independent samples were selected and separate analyses performed for each.

The remainder of this report references the following industry terms. Additional definitions are found in the glossary in Appendix A.

- **Free rider:** a customer who would install the same energy efficiency measure without intervention from the utility.
- **Free ridership:** the portion of a program's verified energy savings that would naturally occur without intervention from the utility.
- **Spillover:** energy savings that occur as a result of the utility's intervention, but are not part of the utility's verified savings. For example, if the utility identifies (and the customer implements) an energy efficiency measure that does not require a capital investment, the customer would not receive an incentive and the utility would not claim those energy savings. The energy savings are considered spillover.
- **Attribution:** the portion of a program's verified energy savings that the utility influenced, including the effects of free ridership and spillover. When multiplied by the utility's claimed savings, the attribution ratio produces the volume of energy saved as a result of program implementation.

[1] *2017-2018 Natural Gas Demand Side Management Custom Savings Verification.* Prepared for The Ontario Energy Board by DNV GL, February 24, 2020.
CPSV Participant Spillover Results. Prepared for The Ontario Energy Board by DNV GL, May 23, 2018.

- **Free ridership based attribution:** The portion of a program's verified energy savings that they utility influenced if one only considers free ridership and not spillover. Free ridership based attribution is the complement of free ridership. (free ridership based attribution = 100% - free ridership)

2 ENBRIDGE C&I CUSTOM PROGRAMS

Enbridge's custom DSM programs for commercial and industrial (C&I) customers encourage customers to reduce their natural gas consumption by recommending and incentivizing energy saving projects and actions.

These custom programs differ from the prescriptive programs by providing additional technical support for projects and financial incentives based on overall natural gas savings realized by the customer rather than a per-unit incentive.[2]

A subset of the projects in this program is part of the multi-residential segment. The free ridership (FR) based attribution study included custom projects from the Market-Rate Multifamily (MR MF) section of the program. Under the the 2015-2020 DSM framework, low income projects use a deemed (pre-determined) value for Low Income Multifamily (LI MF) free ridership, so the LI MF segment was not included in the free ridership based attribution evaluation.

All non-LI MF projects implemented as part of these programs and claimed in 2018 as custom projects are included in the scope of the FR study.

2.1 Free ridership based attribution rate

The FR based attribution ratio represents the ratio of the savings influenced by the utility (considering only free ridership, not spillover) to the savings verified by the evaluation, as shown in the following equation. The methods used to determine evaluation verified savings are presented in a separate report.[3] A 90% FR based attribution ratio means the utility influenced savings (considering only free ridership) were 90% of the evaluation verified savings.

$$free\ ridership\ based\ attribution = \frac{Utility\ influenced\ savings\ considering\ only\ free\ ridership, not\ spillover}{Evaluation\ verified\ savings}$$

Table 2-1 shows the FR based attribution ratio by domain for the Enbridge Custom C&I programs. The table shows the FR based attribution ratio, statistical precision at the 90% confidence interval, the program-claimed population cumulative cubic meters of natural gas (CCM) savings, and percent of program savings for each customer segment. The percent of program savings represents the relative contribution that each customer segment makes to the overall result.

The ratio result is based on an overall sample size of 141 customers and 154 measures. Additional details on stratification, sample size, and population size are provided in Appendix C. Additional statistical details for the results are provided in Appendix E.

The Enbridge free ridership based attribution rate includes the effect of indirect utility influence on projects through vendors. Influence on projects through vendors increased the Commercial measure type free ridership based attribution rates by 6% for Boilers (from 36% to 42%) and Ventilation (8% to 14%) and 10% for "Other." Multi-Residential rates by 19% for Heating and 27% for "Other."

[2] Enbridge's Annual Report provides a more detailed description of the program and can be found here: https://www.oeb.ca/sites/default/files/2016-EGDI-DSM-Annual-Report_20181117.pdf

[3] *2017-2018 Natural Gas Demand Side Management Custom Savings Verification.* Prepared for The Ontario Energy Board by DNV GL, February 24, 2020.

Table 2-1. Free ridership based attribution ratio for Enbridge Custom C&I programs*

Segment - Measure Type	Free Ridership Based Attribution	+/- at 90% Cofidence	Population CCM Savings	Percent Population CCM Savings
Commercial Boilers	42.37%	11%	60,672,478	10%
Commercial Other	25.65%	7%	35,315,552	6%
Commercial Ventilation	14.12%	5%	28,854,855	5%
Industrial	50.62%	8%	282,799,242	48%
Multi-Residential Heating	57.67%	11%	114,449,741	20%
Multi-Residential Other	69.73%	9%	63,506,532	11%
Enbridge C&I Custom - Overall	49.90%	5%	585,598,400	100%

* The table shows statistical precision (+/- at 90% confidence factor) that does not include the effects of a finite population correction factor. See Appendix B for more information.

2.2 Components of free ridership based attribution

The FR based attribution rate for each measure is calculated based on participant survey responses to questions regarding the utility's influence on the timing, quantity, and efficiency of the measure installed. This section reports the program's effect on each component and provides an indication of which aspects of the projects show the greatest utility influence.

Throughout this section, a "Null" value in the table reflects less than five customer responses. For confidentiality reasons, results for less than five responses are not displayed. Customers with more than one installed measure and different survey responses by measure will appear multiple times in the table, resulting in a customer total greater than the number of customers interviewed.

Note that while the ratios in Table 2-1 include vendor influence for the commercial and multifamily segments, tables in Section 2.2 only provide insight into participant responses and do not incorporate vendor influence.

Table 2-2 represents the possible combinations of timing, efficiency, and quantity attribution. A "yes" in the timing, efficiency, or quantity column indicates partial or full FR based attribution for that source. A "no" indicates no FR based attribution for that source. For example, the row that has "yes" for timing, efficiency, and quantity reports the portion of the sample that indicated that the program had at least partial influence on the timing, efficiency, and quantity for that measure. For some measures, efficiency or quantity may not be applicable questions; for the purposes of this table, the not applicable measures are included as "no" on the non-applicable dimension.

The table shows the number of customers, measures, and savings that fall into each timing, efficiency, and quantity combination. The percentage of sample weighted cumulative savings shows the portion of population savings represented by that category.

The table shows that approximately the majority (63%) of program savings were at least partially influenced by the utility. Timing is the most common reflection of program influence, with respondents reporting that approximately 56% of the program savings were accelerated by the program. Efficiency affects approximately 26% of the program savings, and the program influenced quantity for approximately 13% of program savings.

Table 2-2. Overview of the sources of attribution for Enbridge Custom C&I programs*

Timing	Efficiency	Quantity	Sample Customers	Sample Measures	Percentage of Total Sample Weighted CCM Savings
Yes	Yes	Yes	Null	Null	5%
		No	13	14	16%
	No	Yes	12	12	6%
		No	37	40	28%
No	Yes	Yes	Null	Null	0%
		No	7	7	5%
	No	Yes	5	5	2%
		No	68	71	37%

Patrial or Full Attribution No Attribution

* Because of confidentiality reasons and "Null" table entries, the sum of sample customers and sample measures in this table may not match the sum of sample customers and sample measures in other tables.

2.2.1.1 Timing component

Respondents answered a sequence of questions that addresses the timing of the equipment installation. (See Appendix I for the full survey instrument.) First, respondents answered the likelihood of installing the same type of equipment at the same time without the program (DAT1a). Respondents who answered "Later" specified the number of months later in the next question (DAT1b).[4] During the acceleration period, the energy savings for early replacement installations includes additional savings credit which reflects the utility-influenced replacement of older, less efficient equipment.

Timing was the component most strongly influenced by the utility. More than 80 customers accounting for 45% of program savings said they would have installed their measure(s) at the same time. Projects representing approximately 29% of savings received full attribution by answering that they never would have installed the measure (9% of savings), would have delayed the project by 48 months or more (14% of savings), or would have delayed the project by between 24 months and 48 months (commercial and multifamily customers only). The remaining 27% of savings received partial timing attribution (Table 2-3).

[4] See the Scope of Work attached in Appendix I for the detailed scoring algorithm.

Table 2-3. Determining the Acceleration period, Enbridge Custom C&I programs*†

DAT1a. Without the utility when would you have performed the measure? DAT1b. Approximately how much later?					
DAT1a	DAT1b	Timing Attribution	Sample Customers	Sample Measures	Percentage of Total Sample Weighted CCM Savings
Same Time	N/A	0%	80	84	44%
Earlier	N/A	0%	Null	Null	1%
Later	Months <24	ER baseline credit for months accelerated	14	15	10%
	24<= Months <48	100%+ ER baseline credit	11	11	6%
		ER baseline credit for months accelerated	5	6	8%
	Months >=48	100%+ ER baseline credit	10	12	14%
	Don't Know/Refused	ER baseline credit for avg. of DAT1b	5	5	3%
Never	N/A	100%	11	12	9%
Don't Know/ Refused	N/A	ER baseline credit for avg. of DAT1a	8	8	6%

No Timing Attribution Full or Partial Timing Attribution

* Because of confidentiality reasons and "Null" table entries, the sum of sample customers and sample measures in this table may not match the sum of sample customers and sample measures in other tables.
†ER is an acronym for early replacement. N/A represents not applicable.

2.2.1.2 Efficiency Component

Respondents answered a sequence of questions that address the utility's influence on the efficiency level of the installed equipment. (See Appendix I for the full survey instrument.) First, respondents were asked whether they would have installed the same level of efficiency without the utility (DAT2a). Respondents who answered that they would have installed a less efficient option answered two follow-up questions: first "what would you have installed," (DAT2c) followed by the scored follow-up question (DAT2b) to put their answer into a predetermined category. DAT2c was used to confirm the responses to DAT2b.

The utility had limited influence on efficiency (Table 2-4). Most of the survey respondents (61% of savings) said the utility had no influence on the efficiency level of the equipment installed. Respondents who indicated the utility improved the efficiency level of their measures accounted for approximately 24% of program savings. Most of these indicated that the utility moved them from a standard baseline efficiency level to the level of efficiency that they installed.

Table 2-4. Determining Efficiency Attribution, Enbridge Custom C&I programs*†

DAT2a. Without the utility, would you have installed the same efficiency, lesser or greater?
DAT2b. What efficiency would you have installed?

DAT2a	DAT2b	Efficiency Attribution	Sample Customers	Sample Measures	Percentage of Total Sample Weighted CCM Savings
Same	N/A	0%	94	97	61%
Lower	Baseline Efficiency	100%	10	11	13%
	Between Baseline and Installed Efficiency	50%	6	6	8%
	Don't Know/Refused	Average of Dat2b	Null	Null	3%
Higher	N/A	0%	Null	Null	1%
Don't Know/Refused	N/A	Average of dat2a	5	5	2%
Not Applicable	N/A	Not Asked	29	29	12%

No Efficiency Attribution Full or Partial Efficiency Attribution

* Because of confidentiality reasons and "Null" table entries, the sum of sample customers and sample measures in this table may not match the sum of sample customers and sample measures in other tables.
† N/A represents not applicable.

2.2.1.3 Quantity Component

Respondents answered a sequence of questions that addressed the utility's effects on the quantity or size of the equipment installed. (See Appendix I for the full survey instrument.) First, respondents were asked whether they would have installed the same amount of equipment (or capacity for measures for which quantity is less relevant, such as boilers) without the utility (DAT3a). Respondents who answered that they would have installed less (or in some cases more/larger) equipment answered a follow-up question (DAT3b) to specify how the utility changed the amount/size that they installed.

The program had limited influence on the quantity of measures installed. Seventy-five customers accounting for 47% of program savings said they would have purchased the same quantity of equipment without the program (Table 2-5). Most of the remaining customers (14% of savings) received partial attribution. Another 40% of savings were from measures for which quantity is not applicable.

Table 2-5. Determining quantity/size attribution, Enbridge Custom C&I programs*†

DAT3a. Without the utility would you have installed the same amount, more or less? DAT3b. What amount would you have installed?					
DAT3a	DAT3b	Quantity Attribution	Sample Customers	Sample Measures	Percentage of Total Sample Weighted CCM Savings
Same	N/A	0%	75	80	47%
Less/Fewer/Smaller	Don't Know/Refused	Average of Dat3b	Null	Null	1%
	Partial change	0%<Value<100%	5	5	5%
Larger Boiler	Don't Know/Refused	Average of Dat3b	Null	Null	0%
None	N/A	100%	5	5	4%
Don't Know/Refused	N/A	Average of Dat3a	9	9	4%
Not Applicable	N/A	Not Asked	51	52	40%
No Quantity Attribution					
Full or Partial Quantity Attribution					

* Because of confidentiality reasons and "Null" table entries, the sum of sample customers and sample measures in this table may not match the sum of sample customers and sample measures in other tables.
† N/A represents not applicable.

3 UNION C&I CUSTOM PROGRAMS

Union's custom DSM programs for commercial and industrial (C&I) customers encourage customers within this sector to reduce their natural gas consumption by recommending and incentivizing energy saving projects and actions.

These custom programs differ from the prescriptive programs by providing additional technical support for projects. They also provide financial incentives based on overall natural gas savings realized by the customer rather than a per-unit incentive.[5]

A subset of the projects in this program is part of the multifamily segment. The free ridership based attribution portion of the evaluation included custom projects from the Market-Rate Multifamily (MR MF) section of the program. Under the the 2015-2020 DSM framework, low income projects use a deemed value for Low Income Multifamily LI MF free ridership, so the LI MF segment was not included in the FR based attribution evaluation.

All projects implemented as part of these programs and claimed in 2018 as custom projects are included in the scope of the free ridership (FR) based attribution study.

3.1 Free ridership based attribution rate

The FR based attribution ratio represents the ratio of the savings influenced by the utility (considering only free ridership, not spillover) to the savings verified by the evaluation, as shown in the following equation. The methods used to determine evaluation verified savings are presented in a separate report.[6] A 90% FR based attribution ratio means the utility influenced savings (considering only free ridership) were 90% of the evaluation verified savings.

$$free\ ridership\ based\ attribution = \frac{Utility\ influenced\ savings\ considering\ only\ free\ ridership, not\ spillover}{Evaluation\ verified\ savings}$$

Table 3-1 shows the FR based attribution ratio by customer segment for the Union Custom C&I programs. The table shows the FR based attribution ratio, statistical precision at the 90% confidence interval, the program-claimed population CCM savings, and percent of program savings for each customer segment. The percent of program savings represents the relative contribution that each customer segment makes to the overall result.

The ratio result is based on an overall sample size of 70 customers and 87 measures. Additional details on stratification, sample size, and population size are provided in Appendix C. Additional statistical details for the results are provided in Appendix E.

The Agricultural customer segment had the highest FR based attribution at 50%, representing the largest portion of the program at 49% of program savings. The combination of high FR based attribution and large percent of population savings allowed the overall program to rise above poor results in other segments, such as the 4% FR based attribution (representing 11% of savings) in the Industrial Other segment.

[5] Union's 2016 Annual Report provides a more detailed description of the program and can be found here: https://www.oeb.ca/sites/default/files/2016-Union-DSM-Annual-Report-20181130.pdf

[6] *2017-2018 Natural Gas Demand Side Management Custom Savings Verification.* Prepared for The Ontario Energy Board by DNV GL, February 24, 2020.

Table 3-1. Free ridership based attribution ratio for Union Custom C&I programs*

Segment - Measure Type	Free Ridership Based Attribution	+/- at 90% Cofidence	Population CCM Savings	Percent Population CCM Savings
Agricultural	50.16%	13%	707,932,787	49%
Commercial & Multifamily	28.62%	13%	120,228,342	8%
Industrial HVAC	39.88%	12%	213,589,410	15%
Industrial Other	4.11%	3%	152,680,320	11%
Industrial Steam/Hot Water	28.98%	10%	252,890,716	17%
Union C&I Custom - Overall	38.21%	7%	1,447,321,574	100%

* The table shows statistical precision (+/- at 90% confidence factor) that does not include the effects of a finite population correction factor. See Appendix B for more information.

3.2 Components of free ridership based attribution

The FR based attribution rate for each measure is calculated based on participant survey responses to questions regarding the utility's influence on the timing, quantity, and efficiency of the measure installed. This section reports the program's effect on each component and provides an indication of which aspects of the projects show the greatest utility influence.

Throughout this section, a "Null" value in the table reflects less than five customer responses. For confidentiality reasons, results for less than five responses are not displayed. Customers with more than one installed measure and different survey responses by measure will appear multiple times in the table, resulting in a customer total greater than the number of customers interviewed.

Table 3-2 represents the possible combinations of timing, efficiency, and quantity attribution. A "yes" in the timing, efficiency, or quantity column indicates partial or full FR based attribution for that source. A "no" indicates no FR based attribution for that source. For example, the row that has "yes" for timing, efficiency, and quantity reports the portion of the sample that indicated that the program had at least partial influence on the timing, efficiency, and quantity for that measure. For some measures, efficiency or quantity may not be applicable questions; for the purposes of this table, the not applicable measures are included as "no" on the non-applicable dimension.

The table shows the number of customers, measures, and savings that fall into each timing, efficiency, and quantity combination. The percentage of sample weighted cumulative savings shows the portion of population savings represented by that category.

The table shows that the majority program savings (66% of sample weighted savings) are at least partially influenced by the program. Timing is the most common reflection of program influence, with respondents reporting that approximately 50% of the program savings were accelerated by the program. Efficiency was

the next most common, with respondents reporting that approximately 39% of the program savings were from measures where the utility influenced an improved efficiency.

Table 3-2. Overview of the sources of attribution for Union Custom C&I programs*

Timing	Efficiency	Quantity	Sample Customers	Sample Measures	Percentage of Total Sample Weighted CCM Savings
Yes	Yes	Yes	6	7	14%
		No	10	11	10%
	No	Yes	5	5	7%
		No	17	19	20%
No	Yes	Yes	Null	Null	2%
		No	10	10	13%
	No	Yes	Null	Null	1%
		No	28	33	34%

Patrial or Full Attribution No Attribution

* Because of confidentiality reasons and "Null" table entries, the sum of sample customers and sample measures in this table may not match the sum of sample customers and sample measures in other tables.

3.2.1.1 Timing Component

Respondents answered a sequence of questions that address the timing of the equipment installation. (See Appendix I for the full survey instrument.) First, respondents answered the likelihood of installing the same type of equipment at the same time without the utility (DAT1a). Respondents who answered "Later" were asked "how much later" in the next question (DAT1b).[7] During the acceleration period, the energy savings for early replacement installations includes additional savings credit which reflects the utility-influenced replacement of older, less efficient equipment.

Timing was the component most strongly influenced by the utility. Thirty-eight customers, accounting for 49% of program savings, said they would have installed their measure(s) at the same time. Projects representing approximately 9% of savings received full attribution by answering that they never would have installed the measure (5% of savings) or would have delayed the project by 48 months or more (4% of savings). The remaining 41% of savings received partial timing attribution (Table 3-3).

[7] See the Scope of Work attached in Appendix I for the detailed scoring algorithm.

Table 3-3. Determining the acceleration period, Union Custom C&I programs*†

DAT1a. Without the utility when would you have performed the measure? DAT1b. Approximately how much later?					
DAT1a	DAT1b	Timing Attribution	Sample Customers	Sample Measures	Percentage of Total Sample Weighted CCM Savings
Same Time	N/A	0%	38	44	49%
Earlier	N/A	0%	Null	Null	0%
Later	Months <24	ER baseline credit for months accelerated	12	14	18%
	24<= Months <48	ER baseline credit for months accelerated	7	8	11%
	Months >=48	100%+ ER baseline credit	5	6	4%
	Don't Know/Refused	ER baseline credit for avg. of DAT1b	Null	Null	5%
Never	N/A	100%	8	8	5%
Don't Know/ Refused	N/A	ER baseline credit for avg. of DAT1a	Null	Null	8%
No Timing Attribution		Full or Partial Timing Attribution			

* Because of confidentiality reasons and "Null" table entries, the sum of sample customers and sample measures in this table may not match the sum of sample customers and sample measures in other tables.
†ER is an acronym for early replacement. N/A represents not applicable.

3.2.1.2 Efficiency Component

Respondents answered a sequence of questions that address the utility's influence on the efficiency level of the installed equipment. (See Appendix I for the full survey instrument.) First, respondents were asked whether they would have installed the same level of efficiency without the utility (DAT2a). Respondents who answered that they would have installed a less efficient option answered two follow-up questions: first "what would you have installed," (DAT2c) followed by the scored follow-up question (DAT2b) to put their answer into a predetermined category. DAT2c was used to confirm the responses to DAT2b.

The utility had less influence on efficiency than timing, affecting over one-third (39%) of the program savings (Table 3-4). Forty-two percent of program savings received zero attribution because the respondents indicated they would have installed the same level of efficiency without the utility. Another 19% of savings were from measures for which efficiency levels is not applicable, such as operational improvements, leak repairs or steam trap replacements.

Of note in this table is the row for greenhouse components. For agriculture measures where more than one technology was included in the bundle (and documentation provided to the evaluation team listed it as part of the measure scope), the evaluation asked about the efficiency of each sub-measure. This approach appeared to produce more reliable results than if we had asked about the bundle of measures as a single item as customers were better able to parse their decision making on each component.

Table 3-4. Determining efficiency attribution, Union Custom C&I programs*†

DAT2a. Without the utility, would you have installed the same efficiency, lesser or greater? DAT2b. What efficiency would you have installed?					
DAT2a	DAT2b	Efficiency Attribution	Sample Customers	Sample Measures	Percentage of Total Sample Weighted CCM Savings
Same	N/A	0%	37	43	42%
Lower	Baseline Efficiency	100%	6	7	6%
	Between Baseline and Installed Efficiency	50%	8	9	6%
	Average Score of Greenhouse Components	Average of sub-measure scores	8	8	21%
	Don't Know/Refused	Average of Dat2b	Null	Null	4%
Higher	N/A	0%	Null	Null	0%
Don't Know/Refused	N/A	Average of dat2a	Null	Null	3%
Not Applicable	N/A	Not Asked	14	14	19%

No Efficiency Attribution Full or Partial Efficiency Attribution

* Because of confidentiality reasons and "Null" table entries, the sum of sample customers and sample measures in this table may not match the sum of sample customers and sample measures in other tables.
† N/A represents not applicable.

3.2.1.3 Quantity Component

Respondents answered a sequence of questions that addressed the utility's effects on the quantity or size of the equipment installed. (See Appendix I for the full survey instrument.) First, respondents were asked whether they would have installed the same amount of equipment (or capacity for measures for which quantity is less relevant, such as boilers) without the utility (DAT3a). Respondents who answered that they would have installed less (or in some cases more/larger) equipment answered a follow-up question (DAT3b) to specify how the utility changed the amount/size that they installed.

The utility influenced approximately one-quarter (23%) of the program savings (Table 3-5). Approximately one-third (30%) of program savings received zero attribution because the respondents indicated they would have installed the same quantity without the utility. Another 47% of savings were from measures for which quantity is not applicable.

Table 3-5. Determining quantity/size attribution, Union Custom C&I programs*†

DAT3a. Without the utility would you have installed the same amount, more or less? DAT3b. What amount would you have installed?					
DAT3a	DAT3b	Quantity Attribution	Sample Customers	Sample Measures	Percentage of Total Sample Weighted CCM Savings
Same	N/A	0%	29	30	30%
Less/Fewer/Smaller	Don't Know/Refused	Average of Dat3b	Null	Null	3%
	Partial change	0%<Value<100%	Null	Null	9%
None	N/A	100%	5	5	7%
Don't Know/Refused	N/A	Average of Dat3a	Null	Null	5%
Not Applicable	N/A	Not Asked	37	43	47%

■ No Quantity Attribution ■ Full or Partial Quantity Attribution

* Because of confidentiality reasons and "Null" table entries, the sum of sample customers and sample measures in this table may not match the sum of sample customers and sample measures in other tables.
† N/A represents not applicable.

4 UNION LARGE VOLUME

Union encourages the adoption of energy efficient equipment, technologies, and actions via its Large Volume program. The Large Volume program in 2018 was applicable to customers in Rate T2/Rate 100.

The program uses a direct access budget mechanism for the customer incentive budget process. This mechanism collected funds from each customer through rates. Customers must use these funds to identify and implement energy efficiency projects, or the funds become available for use by other customers in the same rate class. This "use it or lose it" approach ensures each customer has first access to the amount of incentive budget funded by their rates. The Large Volume program is the only "direct access" program offered in Ontario.[8]

Custom projects implemented as part of this program and claimed in 2018 were included in this study.

4.1 Free ridership based attribution rate

The FR based attribution ratio represents the ratio of the savings influenced by the utility (considering only free ridership, not spillover) to the savings verified by the evaluation, as shown in the following equation. The methods used to determine evaluation verified savings are presented in a separate report.[9] A 90% FR based attribution ratio means the utility influenced savings (considering only free ridership) were 90% of the evaluation verified savings.

$$free\ ridership\ based\ attribution = \frac{Utility\ influenced\ savings\ considering\ only\ free\ ridership, not\ spillover}{Evaluation\ verified\ savings}$$

Table 4-1 shows the FR based attribution ratio for the Union Large Volume program. The table shows the FR based attribution ratio, statistical precision at the 90% confidence interval, the program-claimed population CCM savings, and percent of program savings.

The ratio result is based on an overall sample size of 16 customers and 23 measures. Additional details on stratification, sample size, and population size are provided in Appendix C. Additional statistical details for the results are provided in Appendix E.

The Large Volume program had the lowest FR based attribution among the three programs. This program faces unique challenges to increasing attribution, including the direct access budget mechanism, low gas rates for participating customers, and measures that typically address maintenance concerns. The result is often projects with very low or very high simple payback periods, which often have low FR based attribution.

[8] Union's 2016 Annual Report provides a more detailed description of the program and can be found here: https://www.oeb.ca/sites/default/files/2016-Union-DSM-Annual-Report-20181130.pdf

[9] *2017-2018 Natural Gas Demand Side Management Custom Savings Verification.* Prepared for The Ontario Energy Board by DNV GL, February 24, 2020.

Table 4-1. Free ridership based Attribution ratio for Union Large Volume*

Segment	Free Ridership Based Attribution	+/- at 90% Cofidence	Population CCM Savings	Percent Population CCM Savings
Union - Large Volume	14.49%	15%	643,724,391	100%

* The table shows statistical precision (+/- at 90% confidence factor) that does not include the effects of a finite population correction factor. See Appendix B for more information.

4.2 Components of free ridership based attribution

The FR based attribution rate for each measure is calculated based on participant survey responses to questions regarding the utility's influence on the timing, quantity, and efficiency of the measure installed. This section reports the program's effect on each component and provides an indication of which aspects of the projects show the greatest utility influence.

Throughout this section, a "Null" value in the table reflects less than five customer responses. For confidentiality reasons, results for less than five responses are not displayed. Customers with more than one installed measure and different survey responses by measure will appear multiple times in the table, resulting in a customer total greater than the number of customers interviewed.

Table 4-2 represents the possible combinations of timing, efficiency, and quantity attribution. A "yes" in the timing, efficiency, or quantity column indicates partial or full FR based attribution for that source. A "no" indicates no FR based attribution for that source. For example, the row that has "yes" for timing, efficiency, and quantity reports the portion of the sample that indicated that the program had at least partial influence on the timing, efficiency, and quantity for that measure. For some measures, efficiency or quantity may not be applicable questions; for the purposes of this table, the not applicable measures are included as "no" on the non-applicable dimension.

The table shows the number of customers, measures, and savings that fall into each timing, efficiency, and quantity combination. The percentage of sample weighted cumulative savings shows the portion of population savings represented by that category.

The table shows that one-third of program participation (~33% of savings) was at least partially influenced by the utility. Timing is the most common reflection of program influence, with respondents reporting that approximately 31% of the program savings were accelerated by the program. The utility influenced the efficiency levels of approximately 10% of the savings and the quantity/size of approximately 7%.

Table 4-2. Overview of the sources of attribution for Union Large Volume*

Timing	Efficiency	Quantity	Sample Customers	Sample Measures	Percentage of Total Sample Weighted CCM Savings
Yes	Yes	Yes	Null	Null	3%
		No	Null	Null	5%
	No	Yes	Null	Null	3%
		No	5	6	19%
No	Yes	No	Null	Null	1%
	No	Yes	Null	Null	1%
		No	9	12	67%

Patrial or Full Attribution No Attribution

* Because of confidentiality reasons and "Null" table entries, the sum of sample customers and sample measures in this table may not match the sum of sample customers and sample measures in other tables.

4.2.1.1 Timing Component

Respondents answered a sequence of questions that address the timing of the equipment installation. (See Appendix I for the full survey instrument.) First, respondents answered the likelihood of installing the same type of equipment at the same time without the utility (DAT1a). Respondents who answered "Later" specified the number of months later in the next question (DAT1b).[10] During the acceleration period, the energy savings for early replacement installations includes additional savings credit which reflects the utility-influenced replacement of older, less efficient equipment.

Timing was the component most strongly affected by the utility. Eleven out of 23 surveyed customers accounting for 69% of program savings said they would have installed their measure(s) at the same time. Eight customers indicated some amount of utility acceleration on at least one measure, mostly between 1 and 48 months (Table 4-3).

[10] See the Scope of Work attached in Appendix I for the detailed scoring algorithm.

Table 4-3. Determining the Acceleration period, Union Large Volume*†

DAT1a. Without the utility when would you have performed the measure? DAT1b. Approximately how much later?					
DAT1a	DAT1b	Timing Attribution	Sample Customers	Sample Measures	Percentage of Total Sample Weighted CCM Savings
Same Time	N/A	0%	11	14	69%
Later	Months <24	ER baseline credit for months accelerated	Null	Null	9%
	24<= Months <48	ER baseline credit for months accelerated	Null	Null	5%
	Don't Know/Refused	ER baseline credit for avg. of DAT1b	Null	Null	12%
Never	N/A	100%	Null	Null	5%

No Timing Attribution Full or Partial Timing Attribution

* Because of confidentiality reasons and "Null" table entries, the sum of sample customers and sample measures in this table may not match the sum of sample customers and sample measures in other tables.
†ER is an acronym for early replacement. N/A represents not applicable.

4.2.1.2 Efficiency Component

Respondents answered a sequence of questions that address the utility's influence on the efficiency level of the installed equipment. (See Appendix I for the full survey instrument.) First, respondents were asked whether they would have installed the same level of efficiency without the utility (DAT2a). Respondents who answered that they would have installed a less efficient option answered two follow-up questions: first "what would you have installed," (DAT2c) followed by the scored follow-up question (DAT2b) to put their answer into a predetermined category. DAT2c was used to confirm the responses to DAT2b.

The utility had less influence on efficiency than timing, partially affecting 9% of the program savings (Table 4-4). Nearly three-quarters of program savings received zero efficiency attribution.

Table 4-4. Determining Efficiency Attribution, Union Large Volume*†

DAT2a. Without the utility, would you have installed the same efficiency, lesser or greater? DAT2b. What efficiency would you have installed?					
DAT2a	DAT2b	Efficiency Attribution	Sample Customers	Sample Measures	Percentage of Total Sample Weighted CCM Savings
Same	N/A	0%	10	14	74%
Lower	Between Baseline and Installed Efficiency	50%	Null	Null	3%
	Don't Know/Refused	Average of Dat2b	Null	Null	5%
Don't Know/Refused	N/A	Average of dat2a	Null	Null	1%
Not Applicable	N/A	Not Asked	6	6	16%

■ No Efficiency Attribution ■ Full or Partial Efficiency Attribution

* Because of confidentiality reasons and "Null" table entries, the sum of sample customers and sample measures in this table may not match the sum of sample customers and sample measures in other tables.
† N/A represents not applicable.

4.2.1.3 Quantity Component

Respondents answered a sequence of questions that addressed the utility's effects on the quantity or size of the equipment installed. (See Appendix I for the full survey instrument.) First, respondents were asked whether they would have installed the same amount of equipment (or capacity for measures for which quantity is less relevant, such as boilers) without the utility (DAT3a). Respondents who answered that they would have installed less (or in some cases more/larger) equipment answered a follow-up question (DAT3b) to specify how the utility changed the amount/size that they installed.

The utility had little influence on the quantity of measures installed. Nine customers accounting for 41% of the program savings said they would have purchased the same amount of equipment without the utility

(Table 4-5). Seven percent of savings were influenced by the utility, while 52% were from measures for which quantity is not applicable.

Table 4-5. Determining quantity/size attribution, Union Large Volume*†

DAT3a. Without the utility would you have installed the same amount, more or less? DAT3b. What amount would you have installed?					
DAT3a	DAT3b	Quantity Attribution	Sample Customers	Sample Measures	Percentage of Total Sample Weighted CCM Savings
Same	N/A	0%	9	9	41%
Less/Fewer/Smaller	Don't Know/Refused	Average of Dat3b	Null	Null	4%
	Partial change	0%<Value<100%	Null	Null	3%
Not Applicable	N/A	Not Asked	8	11	52%
No Quantity Attribution		Full or Partial Quantity Attribution			

* Because of confidentiality reasons and "Null" table entries, the sum of sample customers and sample measures in this table may not match the sum of sample customers and sample measures in other tables.
† N/A represents not applicable.

5 FINDINGS AND RECOMMENDATIONS

The table in this section present the key findings and recommendations from the study. The tables show the party to whom the recommendation applies and the primary beneficial outcome of the recommendation. We classified outcomes into four categories: reduce costs, increase savings, increase (or maintain) customer satisfaction and decrease risk (multiple types of risk are in this category including risk of adjusted savings, risk to budgets or project schedules, and others). Details of the findings, recommendations and outcomes follow the tables. All recommendations address energy savings and program performance.

Table 5-1. Energy savings and program performance recommendations

#	Energy Savings and Program Performance		Applies to			Primary Beneficial Outcome			
	Finding	Recommendation	Union	Enbridge	Evaluation	Reduce Costs	Increase Savings	Customer Satisfaction	Decrease Risk
1	FR based attribution in some segments of the utilities' programs is low and variable	Evaluate free ridership for the programs annually and couple the free ridership evaluation with process evaluation			✓		✓		
2	Relative precision targets were not met for some targeted segments.	Error ratios from this report should inform sample design for future evaluation. Response rates from this report should inform the size of the backup sample for future evaluation.			✓	✓			✓
3	FR based attribution for the programs came primarily through acceleration	Align the program design with cumulative net goals	✓	✓			✓		
4	Some customers receive funding from multiple third-party sources	Consider the potential effect of multiple third-party incentives on free ridership			✓				✓

#	Energy Savings and Program Performance		Applies to			Primary Beneficial Outcome			
	Finding	Recommendation	Union	Enbridge	Evaluation	Reduce Costs	Increase Savings	Customer Satisfaction	Decrease Risk
5	Projects with very long and very short simple payback periods often have high free ridership.	Consider establishing a policy that defines an eligibility floor and cap based on simple payback period for energy efficiency projects.	✓	✓			✓		✓
6	Union's Large Volume program has a very low FR based attribution.	Consider the high free ridership within the context of the cost effectiveness of the program. High free rider programs can still deliver meaningful cost-effective net savings.	✓				✓	✓	
		Conduct a process evaluation to improve Large Volume influence on customer projects	✓				✓	✓	✓

#	Energy Savings and Program Performance		Applies to			Primary Beneficial Outcome			
	Finding	Recommendation	Union	Enbridge	Evaluation	Reduce Costs	Increase Savings	Customer Satisfaction	Decrease Risk
7	Vendor attribution increased program attribution significantly for the Enbridge Commercial and Multifamily Segments	Consider expanding approaches to market for other programs that leverage third-party vendors.	✓	✓		✓	✓		
8	Union Agriculture FR based attribution is the highest among the Union programs.	Continue the proactive approach to DSM marketing in this sector.	✓				✓	✓	✓
9	The assumption for "never would have implemented" has a significant effect on free ridership based attribution.	Consider studying the typical planning horizons for each of the customer segments.			✓				✓
10	The treatment of efficiency in the scoring has a relatively small effect free ridership based attribution.	Consider simplifying the efficiency question sequence in future research to reduce survey length.			✓			✓	
11	The current Lifecycle Net Savings method of free ridership based attribution has a large effect on free ridership based attribution	Continue to use the Lifecycle Net Savings method as long as the primary metrics for the program are based on Cumulative gas savings.			✓				✓

5.1 Energy Savings and Program Performance

1. **Finding:** FR based attribution in some segments of the utilities' programs is low and variable.

   Recommendation: Consistent annual evaluation of free ridership coupled with process evaluation will help identify specific ways for each program to manage and reduce free ridership. Consistent

measurement of free ridership early in the next DSM framework can help Enbridge and stakeholders to understand what is working to drive net savings and provide lessons for continuous improvement.

Outcome: Effective free ridership management will allow the programs to increase their net savings significantly in future years.

2. **Finding:** Relative precision targets were not met for some targeted segments. Error ratios from the evaluation were as high or higher than in the 2015 study and response rate was lower.

   Recommendation 1: Error ratios from the results provided in this report should be used to inform sample design for future evaluation years.

   Outcome 1: Better defined error ratios for the measures in the programs will allow more efficient sample design for future evaluations, improving precisions and reducing costs.

   Recommendation 2: Response rates from this evaluation should be considered in planning the amount of backup sample required for future studies.

   Outcome 2: A larger backup sample will provide more assurance of meeting sampling targets if response rates continue to be lower than in previous years. Approaches to increase response rates should be considered.

3. **Finding:** FR based attribution for the programs came primarily through acceleration rather than changes in efficiency or quantity. Acceleration is less valuable to programs that are seeking to meet cumulative net goals, because savings often drop after the acceleration period is over. Acceleration periods tend to be considerably shorter than the estimated useful life (EUL) of a measure and thus the partial FR based attribution that results is low relative to cumulative gross savings.

   Recommendation: To align the programs with cumulative net goals, the utilities should seek to:

   - Continue promoting long life measures and consider discontinuing promotion of short-lived measures
   - Proactively upsell equipment purchases from standard to efficient products
   - Stop providing incentives for standard efficiency products even in non-replace on burnout situations
   - Target hard to reach customers who have not participated in the past
   - Continue to identify unique solutions that save energy at customer plants
   - Expand promotion of energy efficiency measures with low market penetration (such as heat reflector panels)
   - motivate customers to increase the scope of their projects. Some options include multi-measure bonuses or escalating incentive structures that pay more for doing more.
   - Adopt lessons learned from the Enbridge Commercial and Multifamily approach to market, working proactively with vendors
   - Increase focus on promoting novel energy saving solutions to industrial customer problems. Several customers indicated that the project would not have happened without the utility because Union or Enbridge identified a solution that they had not considered

   Outcome 1: Focusing on proactive sales rather than reactive will help increase FR based attribution.

Outcome 2: Effective free ridership management will allow the program to increase net savings significantly in future years.

4. **Finding:** Some customers receive funding from multiple third-party sources (eg. IESO, municipalities, national and provincial carbon abatement programs/cap and trade), to complete the same energy efficiency measure. Both parties may claim the same changes in energy use, resulting in overlap when aggregated across fuels at the provincial level.

   Recommendation: Develop policies to collaborate across electric and gas projects to avoid double-counting fuel savings and increases from energy efficiency measures.

   Outcome: More accurate energy and carbon savings estimates across the province.

5. **Finding:** Projects with very long and very short simple payback periods often have low FR based attribution. However, from a customer service standpoint, it may be difficult for utilities to deny incentives to customers unless they have pre-established rules to point to.

   Recommendation: Consider establishing a policy that defines an eligibility floor and cap based on simple payback period for energy efficiency projects.

   Outcome: The rule will give utilities a guideline to restrict the program to projects that are more likely to result in FR based attribution. It will also allow the utilities to reject potentially poor projects without a large effect on customer satisfaction.

6. **Finding:** Union's Large Volume program has a very low FR based attribution.

   Recommendation 1: FR based attribution is one metric with which to judge a program, but low-cost programs with high savings totals and high free ridership can still deliver significant volumes of cost-effective savings. The Union Large Volume has low program costs relative to the net CCM saved. The program still provides cost effective net savings despite having low FR based attribution.

   Recommendation 2: This evaluation did not include a process evaluation. Union should consider conducting a process evaluation focused on how to reduce the rate of free ridership. Three options that the Union might consider are:

   - Consider the benefit-cost of eliminating maintenance and like-for-like measure replacements, as they are associated with high free ridership.
   - Use an application process that includes a committee review that can reject free rider projects. This option has been successful for government run programs, but would likely prove hard for utilities to manage as it can negatively affect customer satisfaction
   - Develop clear payback criteria such as "initial payback must be longer than X years and the incentive paid must reduce payback below Y years." This has the advantage of being a rule that account representatives can explain when talking to customers.
   - Consider the non-energy benefits realized by the customer when approving projects under a FR based attribution criterion. The non-energy benefits of many projects in the large industrial segment often large compared to the energy saving benefits, so simple payback criteria will not eliminate all free rider projects. Promote awareness of this issue among the implementation team.

   Outcome: Effective free ridership management may allow the program to increase its net savings significantly in future years.

7. **Finding:** Vendor attribution increased attribution significantly for the Enbridge multifamily program and moderately for the Enbridge commercial program. Participants of all programs indicated vendor involvement at key decision-making junctures, suggesting that if Enbridge and Union are able to influence vendor recommendations, there may be an opportunity to increase indirect influence on participants in all segments.

   Recommendation: The utilities should consider what lessons can be learned from the Enbridge multifamily approach to market that is applicable to other segments. All segments may have opportunities to leverage third-party vendors. A process evaluation that includes vendor interviews might uncover specific opportunities and approaches that would help in transferring the Enbridge multifamily lessons to other segments.

   Outcome: Effective leveraging of vendors could both increase FR based attribution and program uptake.

8. **Finding:** Union Agriculture FR based attribution is the highest among the Union programs. Customers reported that Union account representatives recommended novel solutions for specific problems and appear to be a conduit for disseminating information on best practices.

   Recommendation: Continue the proactive approach to DSM marketing in this sector. Union appears to be playing a role in reducing information barriers which is leading to increased uptake of energy efficiency measures in this growing sector.

   Outcome: Effective leveraging of vendors could both increase FR based attribution and program uptake.

9. **Finding:** The sensitivity testing shows that the assumption for "never would have implemented" has a significant effect on free ridership based attribution.

   Recommendation: Consider studying the typical planning horizons for each of the customer segments to verify if the 2 year or 4 year assumptions are consistent with participating Ontario businesses in each segment.

   Outcome: More accuracy and confidence in free ridership based attribution results.

10. **Finding:** The sensitivity testing shows that the treatment of efficiency in the scoring has a relatively small effect free ridership based attribution.

    Recommendation: Consider simplifying the efficiency question sequence in future research to reduce survey length.

    Outcome: Reduced customer burden during interviews.

11. **Finding:** The sensitivity testing shows that the current Lifecycle Net Savings method of free ridership based attribution has a large effect on free ridership based attribution relative to the simpler Year 1 Net Savings method.

    Recommendation: Continue to use the Lifecycle Net Savings method as long as the primary metrics for the program are based on Cumulative gas savings.

    Outcome: More accurate estimates of cumulative net savings for the programs.

6 APPENDICES

Appendix A Glossary of Terms and Key Concepts

Adjustment factor	The adjustment factors are ratios of savings that allow evaluation findings from a sample of projects to be applied to and "adjust" the population of program savings. Realization rates and ratios are other common terms.
Attribution	The portion of a program's verified energy savings that the utility influenced, including the effects of free ridership and spillover. When multiplied by the utility's claimed savings, the attribution ratio produces the volume of energy saved as a result of program implementation.
Baseline, base case	Energy use or equipment in place if the program measure had not been done
Building envelope	Exterior surfaces (e.g., walls, windows, roof, and floor) of a building that separate the conditioned space from the outdoors.
Capacity expansion (CE)	Measure that allows the customer to increase production or productivity
CCM	Cumulative Cubic meters (cumulative m^3)
Code	Measure required by regulations for safety, environmental, or other reasons
C&I	Commercial and Industrial
Cost Effectiveness	Ration of the stream benefits and costs for a given set of measures, programs, or portfolios. Two primary cost effectiveness ratios are calculated, PAC and TRC+.
Custom Program Savings Verification (CPSV)	Activities related to the collection, analysis, and reporting of data for purposes of verifying gross custom program savings impacts.
Customer - Enbridge	Unique customers can be identified based on the account number and the contact information provided by Enbridge. A customer may have multiple site addresses, decision makers, account numbers, and utilities. Customers can only be identified for records for which we received contact information (i.e. records associated with account number that have measures in the sample or backup sample).
Customer - Union	Unique customers can be identified based on the customer ID and the contact information provided by Union. A customer may have multiple site addresses, decision makers, customer IDs, and utilities. Customers can only be identified for records for which we received contact information (i.e. records associated with customer ID that have measures in the sample or backup sample).
Demand side management (DSM)	Modification of perceived customer demand for a product (in this case, energy) through various methods such as financial incentives, education, and other programs
Domain	Grouping of like projects. A domain may be defined as projects within a specific sector or a category of measure types, end uses or other criteria.
Dual Baseline	Savings calculation approach which addresses or combines the savings associated with early replacement and the savings after the early replacement period.
Early replacement (ER)	Measure that replaces a piece of equipment that is not past its EUL and is in good operating condition
Early replacement Period (ER Period)	Years that the existing equipment would have continued to be in use. This is the same as remaining useful life, or RUL.
Energy Advisors	Energy Advisors are utility and/or program staff who provide information to customers about energy saving opportunities and program participation. This

	term includes, but is not limited to, Enbridge's Energy Solutions Consultants and Union's Account Managers
Estimated useful life (EUL)	Typically, the median number of years that the measure will remain in service
Ex ante	Program claimed or reported inputs, assumptions, savings, etc.
Ex post	Program inputs, assumptions, savings, etc. which are verified after the claimed savings are finalized. Does not include assessment of program influence. Synonym for verified gross savings.
Free rider	a customer who would install the same energy efficiency measure without intervention from the utility.
Free ridership	the portion of a program's verified energy savings that would naturally occur without intervention from the utility.
Free ridership based attribution	The portion of a program's verified energy savings that they utility influenced if one only considers free ridership and not spillover. Free ridership based attribution is the complement of free ridership. (free ridership based attribution = 100% - free ridership)
Gross savings	Gross savings are changes in energy consumption and/or demand directly caused by program-related actions by participants regardless of reasons for participation (savings relative to baseline, defined above)
In situ	Existing measure, conditions, and settings
Incentive	An incentive is a transfer payment from the utility to participants of a DSM program. Incentives can be paid to customers, vendors or other parties.
Incremental cost	The difference in purchase price (and any differences in related installation or implementation costs), at the time of purchase, between the efficient measure and the base case measure. In some early retirements and retrofits, the full cost of the efficient technology is the incremental cost.
Industry standard practice (ISP)	Common measure implemented within the industry
Input assumptions	Assumptions such as operating characteristics and associated units of resource savings for DSM technologies and measures
Lifetime cumulative savings	Total natural gas savings (CCM) over the life of a DSM measure. Can be claimed, gross, or net. Sometimes referred to as just "cumulative" or "lifetime."
Maintenance (Maint.)	Repair or maintain, restore to prior efficiency
Measure – Enbridge	Measures are identified in the tracking data as a unique combination of project ID and measure ID. Multiple measures may belong to the same project.
Measure – Union	Measure refers to a project ID and line ID in the tracking data. Multiple measures may belong to the same project.
Measurement and Verification (M&V)	Verification of savings using methods not including attribution/free ridership assessment.
Metric	Metrics used within OEB Order and Decision to describe program achievement units.
MF	Multifamily (multi-residential).
New construction (NC)	New buildings or spaces
Non-early replacement period (non-ER period)	Years after the ER period up to the EUL
Normal replacement	Measure that replaces a piece of equipment that has reached or is past its EUL

<table>
<tr><td>(NR)</td><td>and in good operating condition</td></tr>
<tr><td>Persistence</td><td>The extent to which a DSM measure remains installed, and performing as originally predicted, in relation to its EUL</td></tr>
<tr><td>Program</td><td>Programs as listed within the OEB Decision and Order. Generally sub-units of Scorecards; for example, Commercial and Industrial Prescriptive Program within the Resource Acquisition Scorecard.</td></tr>
<tr><td>Program evaluation</td><td>Activities related to the collection, analysis, and reporting of data for purposes of measuring program impacts from past, existing, or potential program impacts</td></tr>
<tr><td>Program spending</td><td>Amount spent for implementation of programs, not including portfolio overhead. This value can be divided into spending for program measures and incentives, as well as program specific overhead.</td></tr>
<tr><td>Project - Enbridge</td><td>Projects are identified in the tracking data based on the project ID. A project may have multiple measures as indicated by measure IDs in the current data tracking system.</td></tr>
<tr><td>Project – Union</td><td>Projects are identified in the tracking data based on project ID. A project may have multiple measures as indicated by line IDs in the current data tracking system.</td></tr>
<tr><td>Remaining useful life (RUL)</td><td>The number of years that the existing equipment would have remained in service and in good operating condition. This is the same as ER Period.</td></tr>
<tr><td>Realization Rate</td><td>A combination of adjustment factors, which represents ratios between two savings values. For example, the final realization rate is the ratio between evaluated savings and program claimed savings.</td></tr>
<tr><td>Replace on burnout (ROB)</td><td>Measure that replaces a failed or failing piece of equipment</td></tr>
<tr><td>Retrofit add-on (REA)</td><td>Measure reduces energy use through modification of an existing piece of equipment</td></tr>
<tr><td>Rounding</td><td>The EC used the following rules for rounding values in terms of achievements, spending and budgets, targets, and adjustments.
<table>
<tr><th>Variable</th><th>Rule</th><th>Example</th></tr>
<tr><td>PY Achievement - large numbers</td><td>Rounded to 0 digits beyond decimal.</td><td>π*1000=3141.00000</td></tr>
<tr><td>PY Achievement - percents</td><td>Rounded to 4 significant digits</td><td>2/3 = 66.66% or .66660000</td></tr>
<tr><td>Spend and budget</td><td>Rounded to dollar</td><td>$100.66 = $101.00</td></tr>
<tr><td>Target</td><td>Rounded same as inputs (large numbers or percentages)</td><td>See above</td></tr>
<tr><td>Adjustments</td><td>Rounded same as inputs (large numbers or percentages)</td><td>See above</td></tr>
</table></td></tr>
<tr><td>Scorecard</td><td>Approach used to allow the gas utilities to be rewarded for undertaking important activities other than strictly reducing natural gas consumption, such as increasing customer participation in programs or installing energy efficiency measures with a long life. A scorecard approach allows for taking multiple metrics into consideration.

Each utility has a scorecard identified for each program year, which can be found in the Ontario Energy Board Decision and Order EB-2015-0029/EB-2015-0049</td></tr>
</table>

Scorecard Achievement	The verified value for program-specific metric targets (CCM, applications, etc.) of each scorecard identified by the Annual Scorecard. This is the value that is verified as the achieved value by the Annual Verification report and used for calculation of the shareholder incentive.
Shareholder Incentive	As part of the current DSM Framework, the OEB determined it was appropriate to make an annual shareholder incentive available. Each gas utility is eligible to receive a total annual maximum shareholder incentive of $10.45M, similar to the shareholder incentive at the start of 2012. The shareholder incentive is not part of the gas utilities' DSM budget. The incentive available to the gas utilities will not increase or decrease relative to approved DSM budgets, and is not increased annually for inflation.
Site	Sites are identified based on unique site addresses provided by Union and Enbridge through the contact information data request. A site may have multiple units of analysis, measures, and projects. Sites can be identified by the evaluation only for records for which we receive contact information – i.e. records associated with account number (EGD) or customer ID (Union) that have projects in the sample or backup sample.
System optimization (OPT)	Improve system or system settings to exceed prior efficiency
TRM	"Technical Reference Manual" – Generally accepted acronym and term for document that identifies standard methodologies and inputs for calculating energy savings.
TSER	Telephone Supported Engineering Review
Unit of Analysis – Enbridge	The level at which the data are analyzed, which in 2017 is a "measure" or sub-project level for Enbridge
Union Influence Factor	Factor applied by Union to a small number of projects. The factor reduces ex ante (claimed) savings to account for anticipated partial free ridership.
Unit of Analysis - Union	The level at which the data are analyzed, which in 2017 is a project for Union. A project is equivalent to a measure for Union as the database did not have a sub-project level.
Vendors	Program trade allies, business partners, contractors and suppliers who work with program participants to implement energy saving measures

Appendix B Technical Introduction

This study provides free ridership based attribution ratios from Enbridge's and Union's natural gas DSM programs delivered in 2018. The programs included are shown in Table 6-1. In free ridership based attribution studies, custom market-rate multi-residential (Multifamily) projects are included but custom low income multi-residential (LI MF) projects are not. LI MF use a deemed value for free ridership.

Table 6-1. FR Based Attribution by program

Program		FR
Union Custom	Large Volume	✓
	Commercial & Industrial*	✓
Enbridge Custom	Commercial*	✓
	Industrial	✓

*Custom Market-Rate Multi-Residential projects are included as a part of this program.

Evaluation Background

Enbridge and Union deliver energy efficiency programs under the Demand Side Management Framework for Natural Gas Distributors (2015-2020)[11] developed by the OEB. In April 2016, the OEB hired an Evaluation Contractor (EC) team led by DNV GL to develop an overall evaluation, measurement, and verification (EM&V) plan. The objectives of the plan were to:

- Assess portfolio impacts to determine annual savings results, shareholder incentive and lost revenue amounts, and future year targets.
- Assess the effectiveness of energy efficiency programs on their participants and/or market, including results on various scorecard items.
- Identify ways in which programs can be changed or refined to improve their performance.

Under the plan, the DNV GL team determined free ridership based attribution for custom projects implemented as part of the 2018 program year. This report is a result of that study.

The EAC consists of representatives from Union and Enbridge as well as representatives from non-utility stakeholders, independent experts, staff from the Independent Electricity System Operator (IESO), and observers from the Environmental Commissioner of Ontario and the Ministry of Energy. The DNV GL team worked closely with the EAC throughout this study and received comment, advice, and input on methodology and results. We thank them for their involvement.

Methodology Summary

The results presented in this report are based on data collection from the following four primary sources:

- Union and Enbridge tracking databases
- Union and Enbridge project documentation
- In-Depth Telephone Interviews with a sample of participating customers
- In-Depth Telephone Interviews with a sample of participating vendors

The data collection with samples of participating customers and vendors included telephone interviews focused on assessing free ridership. Table 6-2 shows the targeted and completed data collection activities.

[11] EB-2014-0134

Table 6-2. Data collection activities*

Target Group	Activity	Targeted Measures	Completed Measures
Enbridge			
Participating Customers	In-Depth Interview	169	154
Participating Vendors	In-Depth Interview	Census of Triggered EGD Comm & Multi-Res.	34
Union			
Participating Customers	In-Depth Interview	124	110
Participating Vendors	In-Depth Interview	0	0
Overall			
Participating Customers	In-Depth Interview	2293	254
Participating Vendors	In-Depth Interview	Census of Triggered EGD Comm & Multi-Res.	34

*This table reports the number of measures targeted and completed as measures were used to design the sample before customers and sites had been identified.

At a high level, the FR study employed the following methodology:

- **Receive program data and documentation.** The evaluation started with a review of the program tracking data, which formed the basis of the sample.
- **Design and select the sample.** The tracking data was used to design and select a sample. Once the sample was selected, additional documentation was provided by the program to describe the energy efficiency measures to customers.
- **Collect data.** Data was collected to estimate FR based attribution ratios.
- **Analyze the results.** The collected data was used to estimate FR based attribution ratios at each site and expand the results to the population.
- **Report the results.** The final step was to report the results.

Key features of the methodology include:

- The **sample design** employed a stratified random sample that targeted 10% relative precision with 90% confidence at the program level. Details of the sampling methods are presented in the sample design memo in Appendix I. Final sample achievements are provided in Appendix C.[12]
- **Ratio estimation** was used to expand sample results to the population. The evaluation collected data on all sampled or backup projects that a customer contact could speak to rather than only the first selected. In our calculation of sampling error (+/-, confidence intervals, relative precision and error ratios), we used two-tailed 90-percent confidence limits and clusters defined by customers to appropriately estimate error when multiple units are collected from a single source.[13] The approach used is described in the scope of work in Appendix I.

[12] This study was completed by DNV GL concurrent with the 2017-2018 Custom Savings Verification Study. Independent samples were selected for each study.

[13] Where a single site had two contacts, the site was used as a cluster to ensure conservative (higher) error estimates.

- The **FR methodology** included data collection from participating customers and vendors. The data collection instruments and free ridership scoring methods are provided with the scope of work in Appendix I. The results of this study include an update to the FR based attribution portion of the net to gross (NTG) study performed on the 2015 programs.[14] The spillover results from the 2013-14 Spillover study[15] should be combined with the FR based attribution results from this study to calculate the NTG ratio until an update to the spillover study is performed.

Methodological Changes from the 2015 NTG Study

The evaluation followed the same framework as the 2015 NTG study, with several incremental improvements.

1. Interviews with customers occurred in 2019 and included only participants from the 2018 program year. Interviewing customers more promptly after measure implementation improves customer recall of decision-making processes and influences. 2017 projects were not included with the understanding that the program design and operations were consistent across the years, so results from a study of 2018 would be applicable to 2017.
2. Overall interview length was reduced by reducing the length of the framing portion of the interview guide and limiting the number of measures included in a single survey.
3. Framing questions were enhanced by utility provided documentation of specific interactions prior to implementation of the project. These data were not used directly in scoring but allowed for more specific probes designed to improve customer recall of the project history.
4. Vendor influence triggers were adjusted to fit the new framing approach and enhanced by an improved understanding of the program designs.
5. Vendor interview approach was able to be tailored only to the Enbridge commercial and multi-residential vendors. This approach allowed for more specific reference to elements of the program design that are not a part of the design for other segments and programs.
6. The scoring approach for the vendor interview targeted Enbridge's effect on the vendor's actions rather than asking the vendor about their opinion of the program's effect on customer outcomes.
7. Commercial and Multifamily customer timing responses were assessed based on a 2-year planning horizon rather than 4 years. This change was in recognition of the fact that customers in these segments tend to have shorter planning horizons for equipment than industrial and agricultural customers. This meant that responses of 2-4 years of acceleration for projects were assessed as full credit to the program rather than partial.

Understanding Statistical Error

Statistical error is reported for all of the ratio results in this report. The studies were designed with sample designs targeting 10% relative precision with 90% confidence (90/10) based on the best available assumptions at the start of the evaluation. Table 6-3 describes each of the statistics provided in this report.

[14] *2015 Natural Gas Demand Side Management Custom Savings Verification and Free-ridership Evaluation*. Prepared for the Ontario Energy Board by DNV GL. August 15, 2017.

[15] *CPSV Participant Spillover Results.* Prepared for The Ontario Energy Board by DNV GL, May 23, 2018.

Table 6-3: Relevant statistics

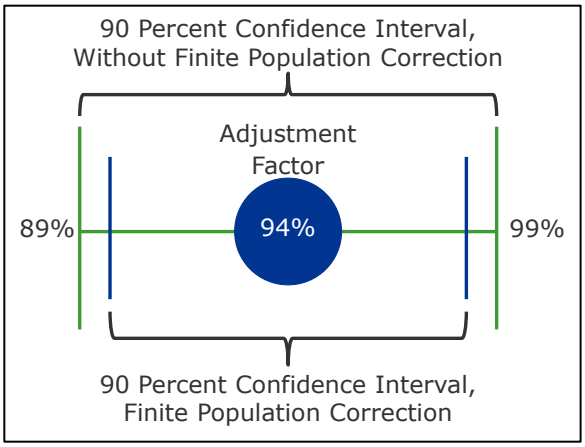
Term	Definition
Ratio/Adjustment factor	A point estimate of the evaluation findings expressed as a percent.
+/- or Absolute Precision	If the evaluation were repeated several times, selecting samples from the same population, 90%[16] of the time the ratio would be within this range of the ratio
Confidence interval	The upper bound is defined by the ratio plus the absolute precision. The lower bound is defined by the ratio minus the absolute precision.
Relative Precision	The relative precision is calculated as the absolute precision divided by the ratio itself. By convention, relative precisions are the statistic that are targeted in sampling (i.e., 90/10 is a relative precision metric)
Error Ratio	The error ratio is an approximation of the coefficient of variation (CV) that is used in sample design. It is calculated as a function of relative precision.
Finite population correction (FPC)	FPC is a factor that reduces the measured error of samples drawn from small populations (less than 300). FPC applies when the ratio is applied to the same population from which the sample was drawn. Statistics reported in the body of this report do not apply the FPC factor because this study is intended to support application of results to more than just the 2018 program year.

Figure 6-1 shows an example of:

- The adjustment factor (ratio) as a blue point
- The 90% confidence interval *with finite population correction* (blue)
- The 90% confidence interval *without finite population correction* (green)

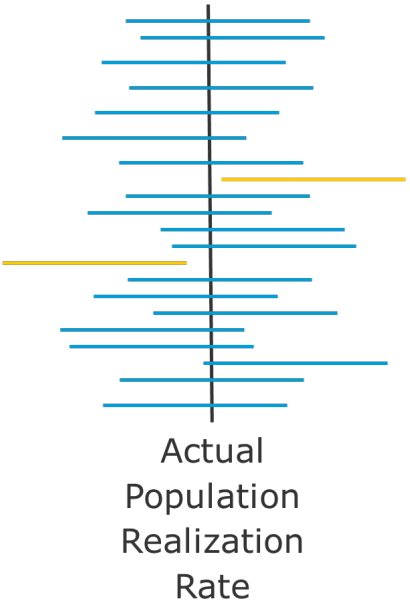
[16] 90% is the confidence limit that we are using.

Figure 6-1. Ratio diagram example



The plus/minus (±) error (%) indicated at the 90% confidence interval is the absolute difference between the estimated percentage and the upper or lower confidence bound. For example, in Figure 6-1, the ratio is 94% and the non-FPC 90% confidence interval is ± 5 percentage points (i.e., 94% ± 5%).[17] Another way of saying this is that there is a 90% probability that the actual ratio for the next year's program lies between 89% and 99%. Figure 6-2 demonstrates this concept by showing twenty hypothetical confidence intervals calculated from twenty different samples of the same population. Eighteen out of twenty (90%) include the true population ratio (overlap the black line representing the true ratio).

Figure 6-2. Ninety Percent Confidence Interval



Note: Each horizontal line represents a confidence interval, while the black vertical line is the actual population realization rate. Yellow confidence intervals do not include the actual ratio.

[17] The critical value for calculating the confidence interval ± for each adjustment factor is determined using Student's t-distribution and n-1 for the degrees of freedom, where n is the sample size. For 2-tailed estimates (ratios that could be above or below 100%) the appropriate t-stat used to calculate precision from the standard error is close to 1.645.

The relative precision of the ratio is calculated as 5%/94% =5.3%.

For low ratios, relative precisions may be quite high, even when the confidence interval around the ratio is quite narrow. Consider a ratio of 5% with the same 5% absolute precision as in the above example. While the absolute precisions are the same, the latter ratio (5%) has a relative precision of 5%/5% =100%. In absolute terms, we still are 90% confident the ratio is below 10%, despite the very high (100%) relative precision.

We reported the relative precision in all cases at the 90% confidence level. That is, whether the relative precision is large or small, we have the same 90% confidence that the range defined by the point estimate +/- the absolute error captures the true unknown value. The "midpoint" estimate (the ratio) is the best (statistically most likely) estimate, while the confidence interval is calculated as an interval around that point. Thus, in all cases, we reported the best point estimate, with a symmetric 90% confidence interval (using the t-score for a 2-tailed 90% confidence interval).

Appendix C Final Sample Achievement

The tables in this appendix show the achieved sample for each stratum in the sample designs. The tables are specific to a program group and show the categorical stratification (grouping) and size strata (larger numbers are bigger projects). Sampling was done at the measure level. The target column shows the number of units we attempted to complete. The complete column shows the number of measures randomly selected and completed. Cumulative cubic meters (CCM) of natural gas savings are also included under the header Ex Ante CCM. Note that in some cases measures beyond the target were completed. These completed measures were at sites with multiple measures in the sample.

Enbridge Custom C&I: Summary of participant data collected

Table 6-4 summarizes the FR based attribution data collection efforts for the Enbridge Custom C&I program. The table shows the portion of the program that:

- Completed an in-depth interview
- Did not respond to an evaluation attempt at contact
- Was not contacted by the evaluation team[18]

The data collected in Table 6-4 is shown as the number of customers and measures and the cumulative ex ante natural gas savings. The full sample design and achievement by strata can be found in Table 6-5.

The evaluation collected FR based attribution data for 55% of savings in the programs with a customer response rate of 31%.

Table 6-4. Summary of FR data collection for Enbridge Custom C&I programs

Data Collection Category	Targeted	Completed		
	# Measures	# Customers	# Measures	Ex Ante CCM
Completed In-Depth Interview	169	141	154	301,933,182
Attempted Contact, Not Completed		309	407	115,653,511
Not Attempted		115	135	168,011,707
Total		480	696	585,598,400

[18] Sites, projects, or units of analysis where contact was not attempted were either not selected for contact in sampling or in the backup sample and were not contacted due to strata quotas being met.

Table 6-5. FR Sample Achievement for Enbridge Custom C&I programs

Segment	Measure Group	Stratum	Max CCM	Target	Completed Measures	Frame Measures	Completed CCM	Total CCM
Commercial	Boilers	1	355,950	4	4	34	935,325	6,979,100
		2	633,450	4	3	17	1,480,425	8,123,350
		3	873,150	4	4	11	2,900,450	8,296,200
		4	1,681,750	4	4	8	5,672,375	10,244,100
		5	1,883,700	4	4	6	7,274,550	10,919,500
		6	2,201,700	4	3	4	6,503,553	8,397,553
		7	4,975,175	2	2	2	7,712,675	7,712,675
	Other	1	174,054	4	5	53	387,582	3,859,518
		2	427,275	4	4	17	1,136,451	4,738,016
		3	732,420	4	4	10	2,371,776	5,630,061
		4	1,189,908	4	3	7	3,207,558	6,816,009
		5	1,543,890	3	3	4	4,118,198	5,322,578
		6	4,090,880	3	3	3	8,949,370	8,949,370
	Ventilation	1	268,320	3	3	19	344,970	2,631,285
		2	474,105	3	3	8	1,242,990	3,055,845
		3	734,790	3	5	6	3,024,570	3,676,170
		4	936,150	3	1	3	936,150	2,586,165
		5	6,427,665	5	4	5	14,358,510	16,905,390
Industrial	Other	1	1,306,940	4	4	36	2,529,885	14,710,030
		2	3,183,525	4	4	8	7,909,890	18,027,200
		3	5,779,395	3	2	4	10,732,860	20,766,805
		4	21,228,675	4	4	4	50,170,425	50,170,425
	Process	1	1,834,720	3	4	21	3,354,660	15,169,120
		2	3,274,980	3	3	8	7,358,120	20,740,580
		3	4,857,940	3	4	5	16,593,600	20,773,600
		4	6,873,200	3	2	3	10,396,300	17,269,500
		5	20,905,860	4	3	4	38,198,760	59,104,620
	System Maintenance	1	832,458	3	5	17	1,850,306	5,638,872
		2	1,956,306	3	3	5	3,614,082	6,827,034
		3	2,949,114	2	1	3	2,515,030	7,786,604
		4	13,847,162	4	3	4	21,282,324	25,814,852
MR MF	Boilers	1	392,875	5	6	72	1,045,350	15,016,142
		2	649,275	5	5	35	2,335,040	17,577,497
		3	975,875	5	3	23	2,221,200	19,030,400
		4	1,632,800	5	6	17	7,806,500	20,976,300
		5	2,319,275	5	5	12	9,866,226	23,077,094
		6	3,541,825	4	4	8	12,741,626	23,113,541
		7	3,997,575	1	1	1	3,997,575	3,997,575
	Other	1	114,226	5	5	96	264,570	4,292,438
		2	306,795	4	3	30	462,360	5,306,471
		3	1,193,835	4	2	10	1,338,690	6,416,955
		4	1,294,035	1	0	1	0	1,294,035
	Ventilation	1	562,965	4	2	26	838,215	6,049,950
		2	758,040	4	2	11	1,397,685	7,442,775
		3	1,512,405	3	3	8	3,362,760	8,709,825
		4	2,028,135	3	3	4	5,191,665	7,089,375
		5	3,070,650	3	0	3	0	8,565,900
Grand Total					154	696	301,933,182	585,598,400

Union C&I: Summary of participant data collected

Table 6-6 summarizes the FR based attribution data collection efforts for the Union C&I program. The table shows the portion of the program that:

- Completed an in-depth interview
- Did not respond to an evaluation attempt at contact
- Was not contacted by the evaluation team.[19]

The data collected in Table 6-6 is shown as the number of customers and measures and the cumulative ex ante natural gas savings. The full sample design and achievement by strata can be found in Table 6-7.

The evaluation collected FR based attribution data for 55% of savings in the programs with a customer response rate of 32%.

Table 6-6. Summary of FR data collection for Union Custom CIMF programs

Data Collection Category	Targeted	Completed		
	# Measures	# Customers	# Measures	Ex Ante CCM
Completed In-Depth Interview	100	70	87	799,832,852
Attempted Contact, Not Completed		152	198	179,638,925
Not Attempted		57	73	467,849,797
Total		**229**	**358**	**1,447,321,574**

[19] Sites, projects, or units of analysis where contact was not attempted were either not selected for contact in sampling or in the backup sample and were not contacted due to strata quotas being met.

Table 6-7. FR Sample Achievement for Union Custom C&I programs

Segment	Measure Group	Stratum	Max CCM	Target	Completed Measures	Frame Measures	Completed CCM	Total CCM
Agricultural	GH - Heating or Water System	1	1,575,238	4	4	53	1,004,277	34,451,385
		2	4,089,915	4	4	18	10,585,660	46,153,297
		3	7,648,760	3	2	8	13,640,258	45,954,970
		4	13,834,838	3	1	5	9,878,271	53,536,639
		5	36,269,380	4	4	4	109,447,525	109,447,525
	GH - New Build	1	25,068,700	4	3	7	66,728,739	119,633,279
		2	38,386,754	3	2	4	67,080,860	124,650,694
		3	50,365,532	2	1	2	39,718,084	90,083,616
	GH - Other	1	1,306,140	4	3	32	2,432,435	16,209,112
		2	2,968,500	4	4	10	6,959,830	19,702,735
		3	6,371,700	3	1	4	4,272,780	20,526,040
		4	10,495,875	3	1	3	10,096,900	27,583,495
Commercial & Multifamily	All	1	1,056,060	4	6	38	1,526,737	14,507,222
		2	2,270,460	4	3	11	3,704,066	17,701,646
		3	4,378,080	3	2	6	7,662,660	20,190,230
		4	6,587,300	3	2	4	11,495,620	23,024,844
		5	17,805,840	4	4	4	44,804,400	44,804,400
Industrial	HVAC	1	1,690,780	4	4	47	1,813,735	27,772,020
		2	4,857,600	3	3	12	11,403,160	36,248,020
		3	13,416,920	3	3	4	29,215,720	39,567,560
		4	28,254,375	5	4	5	91,048,390	110,001,810
	Other	1	4,826,360	3	4	10	8,402,198	19,943,600
		2	7,476,560	3	2	3	12,555,740	17,417,140
		3	54,888,000	4	3	4	105,387,600	115,319,580
	Steam or Hot Water System	1	1,914,100	3	3	33	1,702,540	21,561,339
		2	3,480,260	3	4	12	8,996,722	29,706,752
		3	6,236,420	3	3	6	15,719,360	30,224,700
		4	7,848,980	2	3	4	21,373,620	29,222,600
		5	61,000,360	5	4	5	81,174,965	142,175,325
Grand Total					87	358	799,832,852	1,447,321,574

Union Large Volume: Summary of participant data collected

Table 6-8 summarizes the FR data collection efforts for the Union Large Volume program. The table shows the portion of the program that:

- Completed an in-depth interview
- Did not respond to an evaluation attempt at contact
- Was not contacted by the evaluation team[20]

The data collected in Table 6-8 is shown as the number of customers and measures and the cumulative ex ante natural gas savings. The full sample design and achievement by strata can be found in Table 6-9.

The evaluation collected FR data for 87% of savings in the program with a customer response rate of 84%. Both values are higher than the other two programs in this study, in part because DNV GL attempted to collect data with a census of participants.

Table 6-8. Summary of FR data collection for Union Large Volume

Data Collection Category	Targeted	Completed		
	# Measures	# Customers	# Measures	Ex Ante CCM
Completed In-Depth Interview	24	16	23	558,933,115
Attempted Contact, Not Completed		3	17	84,791,276
Total		19	40	643,724,391

Table 6-9. FR Sample Achievement for Union Large Volume

Segment	Measure Group	Stratum	Max CCM	Target	Completed Measures	Frame Measures	Completed CCM	Total CCM
Large Volume	All	1	4,656,400	3	5	15	8,571,024	27,052,253
		2	5,851,320	3	4	6	21,441,531	31,609,984
		3	10,275,066	3	2	4	20,416,986	35,762,910
		4	12,064,530	3	2	3	23,469,828	35,534,358
		5	16,396,719	2	1	2	16,396,719	28,647,859
		6	18,504,312	2	1	2	18,504,312	34,984,312
		7	193,073,300	8	8	8	450,132,715	450,132,715
Grand Total					23	40	558,933,115	643,724,391

[20] Sites, projects, or units of analysis where contact was not attempted were either not selected for contact in sampling or in the backup sample and were not contacted due to strata quotas being met.

Appendix D Free ridership Survey Responses

This section presents self-reported responses from the timing, efficiency, and quantity FR question battery where customers were asked "Why do you say that?".

A "yes" in the timing, efficiency, or quantity column indicates partial or full FR based attribution for that source based on the scored questions (not the responses here). A "no" indicates no FR based attribution for that source. For example, in the first table, a "yes" in the timing column indicates that the respondent answered the question DAT1a and DAT1b with responses that credited the program with influencing the acceleration of the project. A "no" in the timing column indicates that the respondent did not credit the program with influencing the acceleration of the project. A "no" for timing does not preclude the same respondent indicating the program affected the efficiency or quantity/size of the same project.

Additionally, following the specific timing, efficiency and quantity questions, customers were asked to summarize the program's effect on the timing, efficiency and amount of the project installed (Dat4). These responses are presented with the scored level of FR based attribution: full, partial, or none.

None of the responses provided below were used in the direct scoring of surveys. For respondent confidentiality, these responses are isolated from other responses from the interview and do not reflect the full story the respondent conveyed. The responses are provided here to provide insight into how customers describe their decision making on the project relative to the program. Responses are sometimes recorded in the voice of the participant and in other cases in the third person depending on the notation approach of individual interviewers. See the scope of work (Appendix I) for details on how FR based attribution was scored.

Enbridge Custom C&I Programs

Table 6-10. Timing Verbatim Responses for Enbridge Custom C&I programs

Timing	Dat1a_O. Why do you say that?
No	'Enbridge had no effect
No	(not sure) that was the need
No	- Because we conducted the audits at that particular time and during the audits, everything runs at 100% capacity so we would have repaired or replaced anything which was not working well during the audits
No	- It was the need of the hour and the owners needed to have better performance of their organization - Their budget worked out at that particular time, the project was in the pipeline but got delayed as it turned out to be expensive earlier
No	A lot easier to do the installation at the phase of construction we were at - it was a good opportunity to install the <measure> then.
No	Because it need replacing.
No	Because of the long term savings in terms of Operation & Maintenance
No	Because our financial position was such that we could afford this work at this time
No	Because the <other source of> funding was already awarded and Enbridge didn't offer as much as the <other source of funding> did.
No	Because ultimately the goal is to save steam loss and to save energy and based on our audits at that time It was the need to go ahead with the steam trap replacements
No	Boilers need to be installed before winter! Needed to do the project then with or without Enbridge.
No	Building requirements. Project would have been installed regardless of the incentive.
No	Enbridge did not really influence the timing; they were not involved in the project. <Vendor> told us how much the incentive would be and we used that in the business case to calculate ROI. But we wanted to proceed with the project and would have done so even without the incentive; that just made it a little easier to justify the project.
No	Enbridge had no impact on anything. It was a business decision based on taking on a new tenant and the timing of that. The incentive was just a bonus.

Timing	Dat1a_O. Why do you say that?
No	End of their useful life
No	Energy Efficiency was primary motivator.
No	Equipment was at the end of the useful life
No	Failing steam traps needed to be replaced immediately regardless of incentives. Incentives were a good bonus for the company.
No	Good payback period, didn't rely on the incentive
No	Had to replace the <measure> anyway. And the incentive was only about ***% of project budget, so it did not really influence the decision one way or another.
No	In addition to Enbridge incentives, there was a large grant that was providing most of the funding for the equipment replacement; that grant had sunset provisions.
No	Initially we decided we were going to buy the unit instead of renting. We decided and put the plan proposal in unit owner meeting. Took up collection from unit owners. Then we start going to install. Takes about 1 year to do that. Once we decided in October 2017, then did the PO. None of this timing was affected by Enbridge.
No	Installing it at all # sites.
No	Installing it at all <#> sites. Save on consumption
No	It apart of our sustainability approach - we need to have these <measures> for our operational approach.
No	It had to be replaced and we began moving forward even before we knew about incentives
No	It needed to be done as soon as possible. Incentive was just a bonus.
No	It was a part of a greater project and there was a pretty strict timeline to be done by.
No	It was time to replace the boiler; it was old, and it was inefficient.
No	It would have been the same time because we had $<#> million from provincial cap and trade program which dwarfed the Enbridge incentives
No	Needed to present to management before heating season.
No	Needed to resolve the problem with the boiler before winter.
No	Save on consumption.
No	The <measures> would have been replaced anyway and we needed to do so before the heating season began.
No	The boilers in this apartment building were old, prone to failure, expensive to keep repairing. The boiler replacement had to happen before the heating season began.
No	The boilers needed to be replaced anyways, since they were very old, and they were replaced as soon as the budget was allocated.
No	The bulk of our funding came from <another source of funding> and so the Enbridge incentives were much smaller and not the driver of the timing
No	The decision was already made to replace the boilers. Enbridge's incentive was an added benefit.
No	The equipment needed to be replaced regardless of the incentives, the incentives were not enough and there was too much paperwork to make it useful
No	The heating system had to be replaced before winter and we did not want to spend another season with temporary, makeshift replacements.
No	The incentive provided by Enbridge was an added benefit. We would have installed the new boiler systems anyway, because the boilers were very old.
No	The incentive was only an added benefit. The project would have been installed regardless of the incentive, since the boilers might fail.
No	The old boiler needed to be replaced.
No	The project had already been proposed and approved internally, the incentive had no influence on timing.
No	The project should have even been done earlier, but it was not. When we decided to get a new boiler in Feb 2019 we needed to move quickly to get everything approved and ready for the 19/20 winter
No	The project would have been installed regardless of the incentive.
No	The timing of the <measure> was the same as the boiler replacements, which was driven by **********
No	This project needed to happen, it was funded for 2018 so it had to happen in 2018.
No	This project was part of a much larger whole-building renovation, and we had a lot of problems with leaking. It happened when it had to happen.
No	This was apart of the whole project, part of the renovation.
No	Timing of installation was important; it had to be done when it was done. It was part of a larger project to rehab the <building> and included lighting upgrades as well.
No	Unit past end of life and needed replacement. Replaced <#> of the <#> <measures>. These <#> were the originals from when the building was built.
No	Wanted to save gas <While waiting for feedback from head office, we learned about incentive.>

Timing	Dat1a_O. Why do you say that?
No	We already planned and approved the project. We saw savings from the <similar measures> and were going ahead with the work with or without Enbridge.
No	We had to replace the boiler when we did.
No	We had to sign off on this before the end of July because tariffs were going up and rebates were going to be taken away.
No	We started the installation at the end of the heating season last year (spring of 2018) so we could have it done by the beginning of that heating season. (Boilers provide DHW and space heating.) Going another winter with only <#> boilers and no safety reserve <was not> an option; we had to have the new boilers and could not wait.
No	We wanted the new equipment being installed at the building to be integrated with the <measure> sooner rather than later.
No	We wanted to go earlier as we saw the need but did not pursue it earlier as we did not have the time to do it.
No	We were already on this path.
No	We would have gone with the routine plan
No	We would have installed the <measures> at the same time. We installed when we did because we were already doing work in the apartment units. We would have installed then rather than waiting to take advantage of savings sooner rather than later.
No	When the building's boiler failed suddenly, we had no choice but to install the replacement right away.
No	When we do projects, <the projects> will go forward with or without funding.
No	While waiting for feedback from head office, we learned about incentive. <similar on other measure> same
No	With **********, we had to act right away (we were using space heaters to keep buildings warm in interim).
No	because incentives were applied after the project was already complete
No	because the install had to be done with winter approaching, if not for incentive maybe we would have fixed the part
No	boiler was coming close to needing replacement
No	decision was not revolving around whether Enbridge is there or not.
No	equipment needed to be upgraded soon anyways
No	needed to be done anyways
No	part of lease agreement/negotiations, had to be completed
No	project would have been done anyways, role Enbridge played was too minor
No	scheduling needed to be done anyways
No	that was the need of the hour, it definitely needed the replacement
No	the upgrades were going to happen anyways regardless of Enbridge
Yes	- was researching to find better alternatives for the existing setup - spend 6-8 months to review all designs - prepared proposals to present situation based revenue
Yes	- would have proposed it based on personal thought process
Yes	Because of the incentive opportunities. The guarantee that we will be getting it. It pads payback calculation.
Yes	Because of the rebates, it pays for 50% of the project
Yes	Because steam traps are not a higher priority
Yes	Because the prioritization of things here - it's a tight cash environment. The incentives helped put the project at a palatable ratio. The assistance was the icing on the cake.
Yes	Because the project came without budget; the incentives were the only thing that made it possible.
Yes	Cost, the incentive helped to pursue this project at that particular time
Yes	Didn't affect timing, would have waited without the financial incentive.
Yes	Enbridge had no effect on the decision making but their incentive decreased the payback period by 50%. Ultimately the decision would have been up to the executive leadership.
Yes	Enbridge originally brought the idea to <us>, project might never <have been done> otherwise
Yes	Financial requirements of the greenhouse would have been too large at that time.
Yes	Gas consumption was high so would have looked for savings solutions
Yes	Hard to say. I need to look at the numbers and depends on the numbers of the job.
Yes	If we could not have proven there were significant energy savings, we would have done it later.
Yes	Incentives and help from Enbridge speeds up processing and company decision making.
Yes	It was something that we have to do as there was a need to do the changes to address the needs and also improve their facility
Yes	It would have taken longer because we would have needed to fund our own studies and approval for the project may have taken longer due to longer payback.

Timing	Dat1a_O. Why do you say that?
Yes	Later to never, added on after 2 other projects (5-10 yrs later)
Yes	Maybe could have pushed them 5 more years if the payback wasn't there while making other building improvements.
Yes	Might very well have waited until the carbon surcharge in Canada, but it had to be done by then. The incentive let them do it when we did.
Yes	Money, so that we can get a proper budget in place
Yes	Need to check documentation
Yes	Same reasoning as before, there were other competing projects that had better ratios so the incentives helped.
Yes	Sooner or later. But eventually would, the site would not have considered high efficiency equipment. but would have installed a minimum bid code compliant equipment because we had to replace the failing equipment after a year or two.
Yes	Still thought of installing it but need 2 seasons (2 yrs) for proof of concept
Yes	That fit into the schedule that we were looking at, but Enbridge did accelerate the [internal] approval of the project based on higher returns.
Yes	That wasn't part of the plan. It was only after talking to Enbridge that we decided to install the <measure>. The incentive played a major role.
Yes	The <measures> could have run the same way for 20 years. There was no need to install them.
Yes	The energy savings along with the payback period for the project was the decision making criteria for this project
Yes	The financial benefit received from Enbridge was the main driving factor of installation. They may not have installed at all without the incentive.
Yes	The heating system had to be replaced before winter but their tech assistance and financial assistance definitely aided in making a timely decision. Their contact at Enbridge was good at ushering them to the correct engineering firm, helping them navigate the process, etc. He also facilitated the process very well.
Yes	The incentive and the payback period associated was the key driver as far as installing the project is concerned. If the incentive was not available and if the payback period was not attractive, then the project wouldn't have been installed.
Yes	The incentive helped justify the upgrade w/ immediate increase in gas savings and quicker payback on the project.
Yes	The incentive is important to our planning process, especially to making decisions on timing. The incentive lets us replace equipment on our own schedule rather than responding to an equipment burn-out.
Yes	The incentive provided by Enbridge was the trigger for installing the project immediately. Without the incentive, the project would have been installed anyway, but not in the short term, and the site would have waited for a couple of years before installing it.
Yes	The incentives and the consolation / analysis from Enbridge helped speed up the process of expansion and <installing the measure>. We would have moved forward with the <measure> anyway but we would have taken up to 2 years longer to do things themselves and fund it.
Yes	The incentives increased the ROI enough to justify doing the project in 2018.
Yes	The program had to be done before a certain time - there were time constraints when the program was available. That helped me convince other people to do the project when we did.
Yes	The project would have been installed anyway, but could have possibly been delayed by about a year owing to cost.
Yes	The replacement would have been done in phases owing to budget constraints and not all at once if there was no incentive.
Yes	The reserve fund would have provided us with enough money only to keep the old boilers running. I have to convince the board of directors that the return on investment is there. The incentive is huge for that.
Yes	The site contact that we would have never installed the <measure> without the incentive if it was 2 years ago. But now, after realizing the importance of energy <the measure>, we would install it with or without the utility's incentive.
Yes	The system was running fine, and there was no need to replace it. It was done only because there was an incentive.
Yes	The unknown on the ROI, so probably later. <Name> took care of all of this.
Yes	There are motivating people at Enbridge - you have to complete your project to get the incentive so there's motivation to get it done. Financially motivated.
Yes	There were financial motivations to do it earlier.
Yes	Things had been done to understand what was needed, and the process was moving for some of the boilers in need of repair. Enbridge offered to triple incentive if we made decision within 30 days, and we

Timing	Dat1a_O. Why do you say that?
	chose to speed up process
Yes	Things might not have gone too quickly, but there was concern incentives might have gone away. Wanted to make sure to grab Enbridge incentives especially.
Yes	Try to get everything we can to get out of the traps
Yes	We had the idea in mind to install new boilers, but the project did not seem to be of any urgency and we could have waited.
Yes	We pushed to get this done because the incentives were being discontinued. Gas savings <are> not a lot of money, and not good for creating a business case for buying this equipment.
Yes	We would have used the previous boiler until it failed.
Yes	We would like to extend the life of the older equipment. Ultimately the decision for the time of installation would have been based on temperature condition, condition of the existing equipment, building envelope or any other need of the hour
Yes	We would not necessarily do a steam trap project every year without the incentives.
Yes	When machines were at the end of their useful life
Yes	When the machines were at the end of their useful life.
Yes	Without the Enbridge's incentive, the management would not have approved installing the new expensive <measure>
Yes	Would have needed to test it which would have taken at least 2 production seasons (years)
Yes	Would have waited for <measure> to fail
Yes	because rebates help pay for contractor to assess the traps
Yes	may have been delayed due to cost
Yes	project would only have been done if there had been a total equipment failure
Yes	rebate sped the process up somewhat
Yes	the Enbridge incentives did help move the budgeting process along

Table 6-11. Efficiency Verbatim Responses for Enbridge Custom C&I programs

Efficiency	Dat2a_O. Why do you say that?
Yes	A lower-efficiency unit was the original plan; the incentive paid for the efficient upgrade.
Yes	Big price difference between 85% and 95% boilers, and we probably would've gotten the 85% because it would have worked for this specific building. The incentive helped we get up to the 95% and we are definitely seeing it in the lower gas bills.
Yes	Depends on the ROI of each project
Yes	Don't know
Yes	Enbridge made us aware of technologies that we weren't aware of.
Yes	Higher efficiency of boiler allowed same amount of heat to be delivered with fewer input BTUs
Yes	Incentive allowed for high quality and <implementing more of the measure>
Yes	Incentive helped.
Yes	It is easier to replace in kind, and financially it is cheaper.
Yes	It would've been status quo - we wouldn't have change anything.
Yes	Might have gone with lower efficiency; the incentive had an impact on that.
Yes	Not aware of being able to do <an alternative method>.
Yes	Since we are <business type> and do not have budget to install high-end systems
Yes	The <measure> were the ones proposed by the contractor.
Yes	The <measure> would not have been done
Yes	The financial incentive made for an attractive return on investment.
Yes	The incentive helped cover the incremental cost of the <measures>.
Yes	Wanted to get a larger boiler, but were told we did not need it. Then the incentive really helped them get a more efficient boiler because it allowed them to install the best recommendation.
Yes	We would not have installed at all.
Yes	We would not have made any changes so we would not have saved any natural gas.
Yes	Without Enbridge, would not have thought because it's a small part of cost. Biggest cost is <materials>.
Yes	Would have looked for an alternative **********.
Yes	came up with the idea in the brainstorming session with Enbridge rep.
Yes	project may not have been done without contractor/Enbridge
No	'Enbridge had no effect
No	- The need of the hour and would have opted for the best efficient solution
No	- that was the system was setup
No	<An earlier install at another site was high efficiency and cost more. Asked for clarify but stuck to same

Efficiency	Dat2a_O. Why do you say that?
	overall eff>
No	<I> go for the best and efficient alternative which can save money and also improve the overall performance of the production
No	<Our> goal is to be as efficient as possible.
No	<We go> with what fits our need best, and Enbridge's help did not influence the efficiency
No	<We knew what we> wanted and opted for the same equipment
No	<the measure> was going to be done no matter what
No	An earlier install at another site was high efficiency and cost more.
No	Based on the engineer's recommendation.
No	Because regardless of incentives, we have a pretty good long term analysis and through this analysis, we would have gotten to the same decision.
No	Because that's what they had already decided to go with
No	Because this is the typical <measure> for greenhouses. If we went with a <better measure>, we were paying more for the same outcome, and if you go <worse measure>, you are not <implementing the measure> correctly.
No	Because we're constrained by the number***** we have to perform. ********** Our priority is not to save gas but to deliver the proper amount of <thing> to the facility. The energy savings were nice, but getting rid of the ********** to minimize facility problems was the main goal.
No	Building requirements
No	Bulk of the funding came from another source
No	Efficiency was the goal from the start, and we already decided we wanted this plant to be better than the best. We worked in a collaborative effort to find the most efficient <measure> possible.
No	Enbridge didn't have any effect about this.
No	Enbridge had no effect
No	Enbridge had no impact on anything.
No	Enbridge had nothing to do with this.
No	Enbridge was not a factor in the decision making and all our decisions were based on our contractors recommendations
No	Energy conservation is a high priority here so it would have been the same with our without Enbridge.
No	Facility requirements
No	Facility requirements, since most applications are high temperature requirements for which condensing boilers are not suited.
No	Followed recommendations of <name> consultants.
No	Happy with the design choice recommended by <engineering firm>
No	If the new proposed system was not more efficient than the older one then instead of installing a new one, I would have done repairs to the older system and not installed the new system
No	Improve drying process a few every year across all <#> plants
No	Just the same.
No	Like to like, we would have installed the same equipment.
No	Long time to think about question. If there were more incentives, we would have installed something better, but at this level we probably would have installed something at about the same level of efficiency.
No	Needed to provide the proper environment **********, based on input from the manufacturer and local agricultural experts. We installed the <measure size> that was called for and would have done so without help from Enbridge.
No	Not applicable. **********
No	Same boiler at <nearby building>. Less on <measure>. There might have been cheaper option selected. Didn't think about an alternative.
No	Saving money and energy were the reasons we installed the <measure>; Enbridge may have affected the timing of the project but not the scope.
No	Still needed the same efficiency results and needed proper <measure> regardless of incentives.
No	That was what was recommended to the Board by our consultants.
No	The boiler system that we put in was spec'd by the engineering firm.
No	The design was pretty well fixed with what we wanted to do, so Enbridge would not have influenced the overall design.
No	The facility wanted to install a high efficiency boiler anyways.
No	The installed system is a high efficiency system (mostly a condensing boiler)
No	The new <measures> are high efficiency <measures>, and <we> wanted to install them for the energy savings
No	The project was driven by the cap and trade $ not the Enbridge $
No	The project would have been installed anyway, since there was a similar system that was already

Efficiency	Dat2a_O. Why do you say that?
	operational.
No	The site contact was primarily concerned about the potential gas savings and other operational parameters such as reduced maintenance costs. So, we would have installed similar high efficiency equipment with or without the incentive. The time horizon might have differed though.
No	The site knew what they wanted and opted for the required equipment.
No	The size of the system had been specified by the engineer
No	The steam traps used for our applications do not have any lower quality options
No	There is standard practice that the site follows with regard to installing <measure>.
No	They weren't in the calculation there. The savings were the reason we went with an energy-efficient system- hydro and gas are getting more expensive.
No	Those are the ones we preferred - based off our **** needs
No	Wanted to hit the incentive requirements for efficiency but would have installed similar <measure>.
No	We absolutely would have bought the same high-efficiency boiler. Everybody wants to save money and energy. Cost savings and energy efficiency are driving forces.
No	We already knew we wanted something very efficient to help save money in the long run
No	We already planned and approved the project with a design already chosen.
No	We estimate that efficiencies may have improved by the time it would have taken us to get the project approved without incentives.
No	We had already decided to achieve the greatest efficiency possible before we became aware of the incentives.
No	We had consultants on board, and we chose the higher efficiency boilers. It's just the nature of the business, things become more efficient so you upgrade when you're doing these projects.
No	We needed the same efficiency results and needed to properly <implement the measure> without skimping.
No	We recognize the benefit of the package we put in for long-term savings.
No	We used the <measure> recommended by our contractor; Enbridge had no effect on that decision.
No	We wanted to install this anyway - and this size was the right size for our building.
No	We wanted to select a good boiler that was going to last. Want to make sure it can operate for years to come.
No	We will always look for the best option to achieve higher overall performance and it is our ongoing effort to keep on enhancing our system & making the buildings more efficient
No	We would have gone with what was recommended by vendor and Enbridge if it saves gas. Said same but might have meant less.
No	We would have likely come to the same conclusion about what to install but just installed at a later time.
No	We would not have done any less efficient.
No	Went with vendor's recommendation. The <measure> had to be pretty much a drop-in replacement, so Enbridge was not really a factor. We already knew we wanted <the measure>.
No	Without Enbridge, we probably would not have done the project at all.
No	Would have gone with high efficiency because we were supposed to be as efficient as possible.
No	Would have gone with what the engineer recommended regardless of incentive.
No	all three proposed systems had equivalent energy savings, role Enbridge played was too minor
No	because incentives were applied after the project was already complete
No	boiler had to be replaced regardless of incentives
No	boiler needed to be a certain specification no matter what
No	decision was not revolving around whether Enbridge is there or not, we wanted to go for best efficient option that made sense for that particular facility
No	equipment had to operate within given specs so it had to be similar
No	general policy is to achieve energy efficiency
No	part of the lease negotiation
No	save on consumption
No	save on consumption, Improve <a few measures> every year across all *** plants
No	the company has a policy to install high efficiency equipment, so this would have been done anyways
No	the upgrades were going to happen anyways regardless of Enbridge
No	there was no need to replace it.
No	was going to get most efficient install possible regardless of incentives
No	wasn’t considered
No	would have installed higher eff either way because wanted to improve on 30 yr old boiler

Table 6-12. Quantity Verbatim Responses for Enbridge Custom C&I programs

Quantity	Dat3a_O. Why do you say that?
Yes	Because of the lack of financial support
Yes	Couldn't afford it
Yes	Didn't recall *****. HVAC Vendor might know. *********
Yes	Don't know. The incentives were likely necessary to install the <measure> ,but amount of<measure> that were needed to match the number of <related facility feature> units. They would have not needed any more or any less.
Yes	I would try to get the same number of the replaced but would not be able to get the approval for the replacement without the Enbridge's rebates
Yes	It is hard to say, Enbridge gave us the information from the study. Without Enbridge we would not have known it needed to be replaced.
Yes	It would have depended on the cost. If it was over our budget, it would have been delayed or we wouldn't have done as many. But I can't say whether it would have been over our budget because we factored in the Enbridge incentives from the beginning
Yes	The audit funding helped us get the consultation, and ultimately the smallest and most efficient boiler.
Yes	The incentive allowed them to do the entire <##> area, rather than half now and half at some later date. The original capital improvement project specified replacement of half of the existing <measures> in 2018, and the remaining half later.
Yes	The replacement would have been done in phases owing to budget constraints and not all at once if there was no incentive.
Yes	This program allowed us to finish all <measure opportunities>, but we got to pick and choose when to install them based on our budget.
Yes	We will definitely be replacing the traps which have 100% failed but with Enbridge, it will help us to go an extra mile.
Yes	We would have bought a cheaper version.
Yes	We would have used the previous boiler until it stopped working.
Yes	rebates help contractor to assess condition of steam traps
No	**********
No	<I> would have reviewed a number of alternatives to improve our performance and made a proposition to go for the best alternative for our overall organization.
No	<We were> primarily concerned about the potential gas savings and other operational parameters such as reduced maintenance costs. So, we would have installed similar high efficiency equipment with or without the incentive. The time horizon might have differed though.
No	Always replace the same number every year; ******
No	As that capacity was working fine for the building
No	As that was the need for the system and this were the ones which didn't need replacement but for the benefit of **********.
No	As the replaced ones were malfunctioning or at the end of their useful life so we definitely needed replacement for the proper and better performance of the whole system.
No	Because Ultimately the goal is to save steam loss and to save energy and based on our audits at that time It was the need to go ahead with that particular amount of steam traps
No	Because that was our main <part of system> - going to <take care of> all of it, not just a quarter of it.
No	Both <measures> would have still needed to be insulated.
No	Building requirements
No	Consultants made this decision.
No	Depends on the audit, whatever is not working, we will replace
No	Enbridge did not change my decision about capacity.
No	Enbridge had no effect
No	Enbridge had no effect on the decision making surrounding the type or quantity of equipment but our incentive decreased the payback period by ***%. Ultimately the decision would have been up to the executive leadership.
No	Enbridge had no effect on the project.
No	Enbridge had nothing to do with that decision.
No	Enbridge has no effect on capacity.
No	Enbridge was not a factor in the decision making and all our decisions were based on our contractors recommendations
No	End of useful life, We install the capacity that is needed on their buildings
No	Engineer designed the appropriate size and didn't want to go bigger or smaller than their recommendation.
No	Facility requirements, since most applications are high temperature requirements for which high

Quantity	Dat3a_O. Why do you say that?
	efficiency condensing boilers are not suited.
No	I could reduce the capacity a bit because they are high-efficiency. But Enbridge did not affect the decision to install high-efficiency boilers.
No	It was the facility's requirements.
No	It was the size specified by the engineer - we didn't have a choice
No	Just the way the business does things around here.
No	Like I said, we had consultants.
No	My designers chose the capacity. Nothing to do with Enbridge at all.
No	Needed to meet demand of the building
No	Needed to meet sizing requirements, which have not changed.
No	No <additional> equipment were installed. <measure> replaced, and there were no quantity decisions - just replace x <units> with x <units>.
No	Normally the engineering team will decide the capacity of the boiler based on the need & the demand of the building The reason behind going for larger capacity is the reasoning that if the boilers are not high efficiency boilers than we need to have larger capacity to satisfy the load
No	Number of spaces that need <measure> remain the same regardless of Enbridge.
No	Our contractor did load calcs and determined that the existing capacity met the load requirements.
No	Our loads haven't changed, so we chose to go with the same capacity we had before.
No	Recommendation of the engineer, and the building load requirements.
No	Same as efficiency, hit incentive requirements but similar.
No	That particular capacity works for the facility
No	That was the need and the efficient alternative
No	The boiler sizing is the boiler sizing, and would not have been impacted by Enbridge incentives or any discussions I had with them.
No	The old boiler was larger, but from what <respondent> knew from how the project manager and engineers operated they picked the right size, and efficiency was the only difference.
No	The plan was to replace the existing equipment 1:1 with new equipment with the same heating capacities.
No	The rebate was not a factor in my decision. We learned about the rebate after we decided how many to do. If I had known about [the rebates] earlier, I would have done more.
No	They had no effect on the size of the boiler.
No	This capacity was the design capacity. Consultants recalculated BTU requirements as part of the project and determined that a boiler of the same capacity was appropriate.
No	This was what we needed regardless of Enbridge.
No	This would have been up to the design engineer and just the heating load of the building - would've been the same with or without Enbridge.
No	To satisfy the need and to improve the production
No	We could not skimp on <the measure>. It may have taken them longer to , <implement it> but by the end of it, we would have <implemented> all ***** as necessary.
No	We did not want to do half a job just to save money; the entire ***** system needed to be <done>, so that's what we did.
No	We needed to replace the dead boiler.
No	We needed what we needed, and relied on a professional to make the decision for us. Enbridge did help influence quantity of boilers
No	We replaced any number of traps that needed to be replaced.
No	We went with a lower capacity than original boiler. Leaned on *** consultant for engineer recommendation. So we would have gone with the same smaller capacity boiler ie the same capacity.
No	We would choose the most aggressive that we could. I don't see us being in a situation where we could cut the <measure> down to x but not all the way.
No	We would have installed the same boilers with or without Enbridge; we installed the capacity that meets our heating and DHW demand.
No	We would have only installed what we need.
No	Would have changed <#> but would have taken longer. Half of them in 2018 and see if there was more money to replace more later.
No	because incentives were applied after the project was already complete
No	boiler install was fixed, had to be done anyways
No	boiler needed the same capacity no matter what
No	Enbridge had no effect, <measure> replacement was needed
No	just needed the same capacity as before
No	that was the need

Quantity	Dat3a_O. Why do you say that?
No	the boiler needed to be a specific capacity and that was met regardless of Enbridge
No	the company has a policy to install high efficiency equipment and the equipment was a good fit for location
No	unit had to meet the correct specifications given by the engineering department

Table 6-13. Dat4 Verbatim Responses for Enbridge Custom C&I programs

Attribution	Dat4. Summarize the program's effect on the timing, efficiency, and amount that you installed.
Full	- Incentive played a huge role and it spurred the immediateness of going for the project - Helped through the whole process
Full	- It was great, helpful and productive - With the help of Enbridge's financial and non-financial aid, they were able to improve their efficiency and that also contributed in their overall profits - The project would not have been possible without Enbridge
Full	- The incentive was really helpful as it lead them to pursue the project at that particular time
Full	- Their incentive played a role in defining the timing of the project - The process of the incentive application was smooth and easy, Enbridge's rep guided them along the way - They would want to have the best efficient system but the incentive in the picture made their decision making process easier in terms of going with the high efficiency boiler
Full	<Vendor> recommended the new <measure> and we went with their recommendation.
Full	Accelerated it because it made the payback better to get it sooner. Didn't want to wait for incentive to not be there. Additional incentive was not larger enough to go with higher efficiency.
Full	Enbridge makes it really easy to do these projects. Enbridge can confirm our organizations numbers - estimated savings, they are a third party confirmation that can say - we will save money in the end. There are monetary considerations too, my job is to have the most energy efficiency as possible, and I can see this through our energy bills. We need to lower these bills. It's easy to raise money to start a new project, but its hard to raise money for ongoing costs, like utility bills. Enbridge helped make a case for installing high efficiency equipment. They also verify that these energy savings are real.
Full	Enbridge played a pivotal role. The incentives and technical help (especially with calculating savings) made it possible to take on this project at all.
Full	Enbridge proposed the project in the first place and account rep was very helpful with the incentive process. There were some issues with communication but overall the project went smoothly.
Full	Enbridge was 100% necessary to enable the project and it was positive at every turn.
Full	Enbridge's incentive along with the incentive provided by the City of Toronto were very important parameters in terms of setting the ball rolling for installing the project.
Full	Enbridge's involvement let them buy higher efficiency equipment by boosting the ROI; it allowed them to install sooner than they otherwise would have.
Full	Enbridge's main effect was the rebate offering at the time. Without the effect would have installed at a later time at the end of their useful life.
Full	Good company to work with, it took a long time to get checks 6-7 months, too long!! But we got it anyway, and it was good of Enbridge to help people to conserve. He hopes other utilities do the same. Incentives helped get the project going much sooner.
Full	Having the Enbridge incentive improved the business case and allows the company to move forward with projects easier. So it might have pushed the project up from a timing perspective.
Full	Incentives helped them install the boiler. The financial incentives are the number one driver of the project being pursued.
Full	Indicated these two separate projects were referring to same overall process and that these should be taken in tandem. Property management was influenced by Enbridge financial incentives in terms of time and quantity.
Full	Installed 8 new boilers, Enbridge was very professional and their offer to triple the incentives worked to speed things up greatly
Full	Natural Gas isn't a large cost item in the industry. Enbridge had a big effect of what we went to save. Enbridge Consultant wants to save more energy and we worried more about paving and other items day in and day out. If he wasn't there at Feb 2018 meeting, we wouldn't have done it. We would have done something because they're always looking to save cost but not sure what.

Attribution	Dat4. Summarize the program's effect on the timing, efficiency, and amount that you installed.
Full	Overall program, Enbridge and Union help with business planning every year. Bosses ask if Enbridge is involved and what incentives, quarterly workshops are useful as well. Gets the mind thinking of how you reduce your carbon footprint. Union was better but now Enbridge is better. Union was more adaptable before the merge. Rep interactions are helpful.
Full	The incentive provided by Enbridge was very important as it was the main reason for installing the system.
Full	The incentives definitely helped, but no other comment.
Full	The main driving factor for the company is the financial benefit including the incentives that would help justify the upgrades. They would not have installed the <measure> if not for the incentives received.
Full	The major impact was with the timing. The incentives available helped the owner pull ahead the capital related to what was originally planned. And the other two components, Enbridge had no effect.
Full	They realized they were wasting gas with one building when Enbridge did a site visit and started to consider ways to improve. Gas isn't high on the cost savings list but Enbridge ESC helped them think about solution. The financial incentives made it viable and are now looking at economizers to further improve their efficiency because of Enbridge.
Full	We involve Enbridge at the beginning of every gas project. They provide all kinds of assistance including savings analysis, incentive calculations, and technical consulting. Without Enbridge we might have had to wait for the next annual cycle to replace this equipment, and we would certainly have gone with lower-efficiency equipment and stuck with <baseline measure>.
Full	We would have installed the boilers at least 3 years later if not for the incentives.
Full	Without Enbridge, we probably wouldn't have gone with a higher-efficiency upgrade, nor would we have installed it as fast. For us to get from project inception through execution in 3 years is remarkable.
Full	Without the incentive, we would not have completed the project for several years.
Full	Without the study that Enbridge helped us with, we wouldn't have known about this system. And without the incentive, this project would <have> never have gotten off the ground.
None	- Enbridge's rep's talk in a seminar led them to know more about the different incentives and to work closely with them - Their advice and feedback was helpful throughout the process - But ultimately the installment decision relied on the need of the hour
None	- For this particular project, Enbridge's incentive was an add-on - They had conversations with the Enbridge's Rep regarding their no. of projects to understand how the incentives be applicable for their different projects
None	- Overall the decision regarding the timing, efficiency and the amount of the steam trap replacements that were installed was based on the personal initiatives that were taken and the audit - Enbridge's incentive were helpful and they deeply appreciated the program
None	<Vendor> had more of an influence on this project, Enbridge incentives were a bonus.
None	As a collective, Enbridge has been very effective timewise with vendors and suppliers. And I have been working with Enbridge for 30+ years. They're great. But for this project, they incentives may have helped, but we needed to do this project anyway.
None	As mentioned in discussion of the boiler measures, the incentives had no influence on the project since the timing was mandatory and the system had already been specified before we became aware of the incentives
None	Enbridge Incentives didn't factor in, the Board wanted to lower energy savings and reduce O&M over the long term and went with what the engineer recommended.
None	Enbridge did not have much affect on our decision to replace the <measures>. We were planning to replace the <measures> anyway regardless of incentive and the incentive was a bonus.
None	Enbridge didn't have any effect at all; as far as I know, they weren't involved in the planning, and the incentive wasn't a deciding factor either. We did this project because we had to do it. The project cost $*****and the incentive was $*****. It was useful but not a deciding factor.
None	Enbridge didn't have any effect on when or what we installed, but I'd like to say they were fantastic, extremely efficient and helpful. Enbridge saw the incentive payment as a priority for us, and they were quite helpful throughout the entire process.
None	Enbridge had little to no effect on the decision. Rebate incentives that were available were soon being lost, influenced us to install in July, but I don't think Enbridge had a decision on giving out rebates. I think only the government has control over that.
None	Enbridge had minimal effect on the installation, the project would likely have been done anyways

Attribution	Dat4. Summarize the program's effect on the timing, efficiency, and amount that you installed.
	since the old equipment was at the end of its life and the decision was primarily based on the vendor and their products
None	Enbridge had no bearing on the project at all
None	Enbridge had no effect on the timing, efficiency, or size of boiler that they installed.
None	Enbridge had no impact at all on these projects
None	Enbridge had no impact on anything.
None	Enbridge had no real effect on the outcome of the project, but the incentives helped justify the installation to the board of directors
None	Enbridge had not bearing on the project at all
None	Enbridge helped us to refined their decision and Enbridge backed our decisions
None	Enbridge influenced us financially. This helped us save money and move the project along. We were going to do this anyways, but Enbridge helped.
None	Enbridge is responsive and helpful. But overall, we would have gotten to the same decisions with or without Enbridge's input. The incentives help; the incentives aren't big enough to make a huge financial impact. But the incentives look good to the public. When you're using government money, it's good for people to see you're taking advantage of these types of programs.
None	Enbridge made the paperwork and project documentation aspects easier but overall did not effect the outcome of the project
None	Enbridge only got involved after the installation. Consultant reached out to Enridge after installation because the pressure on the new boiler wasn't high enough, so Enbridge was involved to correct this.
None	Enbridge really didn't have an effect on the timing or efficiency. We have a corporate policy of treating our birds as humanely as possible; this entire project was designed to maximize their comfort and minimize our operating costs.
None	Enbridge really had no impact on the timing or the equipment. The incentive and the energy savings are good, but we had to do this ***** upgrade.
None	Enbridge reps helped make things move along smoothly. We offered good information and were helpful in seeing the project through. However, we would have installed the <measure> with or without Enbridge because the payback was expected to be good regardless.
None	Enbridge was helpful in notifying them about the rebate (except they only knew about it after the project was complete)
None	Enbridge's incentive assisted with business case but did not make decision. Didn't change the timing other than making sure application was in before we started. We would have installed high efficiency and the capacity that was needed for the building without incentive.
None	Enbridge's incentives were used to fund other projects <at location>l. The <measures> were "low hanging fruit" and would have been done anyways regardless of rebates.
None	Enbridge's rebate program was helpful and did assist the project moving forward, however it did not really impact the design decisions
None	Enbridge's rebates certainly helped but did not really influence the course of the project.
None	Enbridge's support did help us, but I think the scope of the project would've been the same with or without the funding.
None	Enbridge is helpful but we approached them after learning about the technology and would have installed it either way
None	Final payments are still waiting to be paid out. There are issues with the *** system concerning <feature> that the vendor *** is still trying to resolve. We have not received help from Enbridge regarding this because it is a technical issue that we are having <contractor> resolve.
None	For this specific project the incentives didn't play a factor in any of our decision making due to the catastrophic failure of the boiler which made the timing mandatory and their decision to go with most efficient option (condensing boilers) before we were even aware of the incentives.
None	In this case, Enbridge had a fairly mild effect, from the money point of view. From the perception point of view, Enbridge was really influential. Enbridge sent us a notification that said <#> trees were saved by installing these new boilers. We posted this fact on a flyer, and people were really happy about saving trees! They didn't understand/care about emissions or consuming less energy, but people were excited about saving trees. Now people are waiting for us to make more improvements. Enbridge gave us feedback in a more understandable way and this was helpful.
None	Incentive amount was not an influence (large capital project with small incentive proportionally, **********. Engineer from Enbridge did not have knowledge of this very custom furnace or niche industry, so it was a learning experience for him as well. <Enbridge ESC> was very helpful with paperwork and getting rebates though.
None	It would be no effect.

Attribution	Dat4. Summarize the program's effect on the timing, efficiency, and amount that you installed.
None	On the <measure>, Enbridge didn't really do much. The incentive was minor. We'd have gone ahead as we did even without any help from Enbridge.
None	Overall Enbridge was really helpful
None	Same as above. The incentive was helpful but not required.
None	She said that the Enbridge incentives was not the driver for this project but the benefits were that the Enbridge $ were useful for funding subsequent EE projects in other buildings since the capital budget for EE projects is limited
None	She said that the Enbridge incentives were not a driver of this particular project but was useful for subsequent projects in other buildings since their capital budget for EE projects is limited
None	The Enbridge contributions (both financial and non-financial) were helpful, but the main funding was from a grant that was about to expire. So the work needed to be completed before that happened.
None	The boilers were at the end of their useful life and Enbridge was not involved. Would have installed the same efficiency and capacity regardless but wanted to hit incentive requirements.
None	The savings were a bonus, we would have done exactly what we did without Enbridge.
None	The upgrades were going to be done anyways for financial/energy savings reasons. The incentive offered by Enbridge barely covered the consultant's fees to apply for the rebates. All 3 proposed systems had the same savings and costed about the same, just had different features so the decision ultimately came down to user preference.
None	There were health and safety concerns about having HVAC equipment running even when the facilities are unoccupied. There was also a concern about gas usage and effect on the environment. The site contact had been thinking about the <measures> for a while and needed to bring up to management before the heating season started. The cost savings and incentives helped sell it to management to go through with the project. They likely would have installed <the measures> anyway but the incentives made it an easy sell.
None	Timing, efficiency, rebates - they were willing to provide rebates for our project. Timing: preapproval process, had to wait for Enbridge to approve us before continuing our project. Efficiency- the higher the efficiency, the higher the rebate offered. But we would've bought the boiler we did without the rebates
None	We didn't have much contact with Enbridge, we just used them for the incentive. They reviewed our system so we could get the incentive right at the end I think.
None	We would have replaced the steam traps regardless of whether or not there were incentives. However, the incentives were a nice bonus to the company which covered 50% of the cost.
None	We've been looking for ways to improve our drying process in all 35 plants. Plant production manager (Interviewee) designs the process in house, reviews during winter, and looks to implement it in spring across all sites.
None	Working with Enbridge went smoothly and their involvement didn't hinder anything.
None	incentives not enough to matter, not a huge part of the project, goes for the incentives after the project is finished
None	install would have been done anyways, incentives are more trouble than they're worth, too much paperwork
Partial	- He admired and loved the program, work, guidance and people from the Enbridge's initiative - The knowledge base of the representatives was really helpful during their whole project lifecycle - They were able to process high volume of product due to the installed measures - They were encouraged to feel responsible for a high level environmental stewardship
Partial	- The incentive fast tracked the project otherwise they would have delayed the project for the next year to get it on a proper budget - It was a great financial help for the project
Partial	Didn't affect the timing of the boiler replacement, but it allowed them to upgrade to an HE condensing boiler.
Partial	Enbridge assisted in getting the project in and running. Helped also with projects located at <similar projects>. Contributed to installing high efficiency to sell less gas. We appreciate Enbridge's financial incentive. It shortened the payback period by 6 months.
Partial	Enbridge definitely played a role
Partial	Enbridge definitely played a role.
Partial	Enbridge did accelerate the [internal] approval of the project based on higher returns.
Partial	Enbridge did not effect the timing, efficiency, or amount installed.

Attribution	Dat4. Summarize the program's effect on the timing, efficiency, and amount that you installed.
Partial	Enbridge didn't have anything to do with it, company was just replacing seals.
Partial	Enbridge had no effect on the decision making surrounding the type or quantity of equipment but their incentive decreased the payback period by 50%. Ultimately the decision would have been up to the executive leadership.
Partial	Enbridge had some influence - this project was going to happen with or without them. They had some input, and they assisted with the review.
Partial	Enbridge incentives helped prioritize the project to management, Enbridge also assisted in the application process which was helpful
Partial	Enbridge made it possible to install a smaller and more efficient boiler than the alternatives considered with just the internal <extrenal> consulting. <Consultant> and Enbridge showed them about the incentives and potential units. Interviewee was happily surprised Enbridge wanted to help them install something that would use less gas.
Partial	Enbridge's assistance calculating the energy savings was particularly helpful. Also knowing what the rebate was ahead of time helped in the planning process.
Partial	Enbridge's incentives programs helped speed up the installation and expansion of the <facilities>. The time frame was made shorter instead of having to take longer without the financial help. Enbridge made the process very easy and convenient, making the amount of work required on their end much less.
Partial	Enbridge's rebate allows the company to hire a contractor who assesses the quality of the steam traps on a yearly basis, this would probably be done less frequently without the rebates.
Partial	Generally, Enbridge works closely with <respondent> throughout any energy project. At a minimum, Enbridge helps them figure out what incentives might be available. Then they work with their contractor and Enbridge to make sure the project qualifies. On larger projects Enbridge will offer submetering and other project assistance. They're usually part of the project from beginning to end. *********
Partial	Good apartment owners are always looking to invest in the asset and keep the equipment current to minimize maintenance and operating costs. It's important to have an incentive program that helps with the capital outlays, meeting carbon footprint requirements, etc. Enbridge's incentive adds into the overall calculation of return on investment and lifecycle of equipment, allowing us to meet other goals ("greater good", in this context meaning environmental impacts) than just operating the building.
Partial	Incentives were very important. The savings certification from Enbridge via the contractor also helped justify the expense.
Partial	Not sure Enbridge influenced us at all unless they influenced the HVAC company.
Partial	Once they saw there was an incentive, there was no hesitation to proceed; it may even have accelerated the decision to implement the project. Enbridge had no effect on the "efficiency or amount" (project scope)
Partial	Overall Enbridge was really helpful, and they were really accessible with information. <Happy that> they were able to get more efficient boilers and says it has noticeably lowered gas bills.
Partial	Overall program, Enbridge and Union help with business planning every year. Bosses ask if Enbridge is involved and what incentives, quarterly workshops are useful as well. Gets the mind thinking of how you reduce your carbon footprint. Union was better but now Enbridge is better. Union was more adaptable before the merge. Rep interactions are helpful.
Partial	The end of the day, I don't think they had much of an effect on the specific system. They had an effect on the project itself in that if the incentive dollars weren't there it may have been postponed. I just sent my Enbridge rep the estimate, he sent me back what the incentive dollars would be and then I sent him the final bill when we were done.
Partial	The incentives were beneficial. But the project would have been done anyways.
Partial	The incentives were likely necessary to install the <measure>. Installed because of prior incentives received for the <measure> for other properties. The incentives Enbridge offers are especially helpful for larger projects such as boiler replacements.
Partial	The technical and financial assistance provided by Enbridge was critical in the installation of the project. Although the equipment would have to be replaced anyway since it was at the end of its useful life, the incentive provided by Enbridge and the assistance the site had with respect to the audit ********** and calculating savings helped to speed up the process and ensured that the project was installed at the earliest and that the installation proceeded smoothly.
Partial	Their tech assistance and financial assistance definitely aided in making a timely decision. Our contact at Enbridge was good at ushering us to the correct engineering firm, helping us navigate the process, etc. He also facilitated the process very well.
Partial	There was a little delay in the process with Enbridge as their assigned Enbridge contact person got replaced during the process.

Attribution	Dat4. Summarize the program's effect on the timing, efficiency, and amount that you installed.
Partial	They are well connected, they can give examples like other industries do, they validate your assumptions (energy efficiency and cost).
Partial	They gave us guidance on available technologies, validation on cost savings and energy efficiency. Motivation on moving faster to get it installed based on financial incentives.
Partial	We heard Enbridge had a program, we heard we could get 60%-70% money back if we installed. So we went forward with <measure> .
Partial	We put all the decisions is the hands of <vendor>. We trusted the <vendor> to work with Enbridge to get the cost savings that <vendor> promised us.
Partial	We thank Enbridge a lot, they provide incentives for the financial aspects and technical expertise for other areas. Thank you!
Partial	We would have taken longer to get through the process without Enbridge. The consultation and incentives helped speed up the process which may have taken up to 2 years longer if we did things on our own.
Partial	With the incentive, they were able to do it a couple of years sooner, allowing energy savings in shorter term rather than longer term.
Partial	Without Enbridge, respondent would be doing the survey, paying half of it is nice but the results are where it counts. Without Enbridge, respondent would try to replace the same number but it would take longer.
Partial	the project would have happened either way but Enbridge helped guide the process and speed up the completion timeline

Union Custom C&I Programs

Table 6-14. Timing Verbatim Responses Union Custom C&I programs

Timing	Why do you say that?
Yes	Again, the advice and the incentive from Union take a lot of the risk out.
Yes	Because it takes time for developing the design and biding process
Yes	Because working with Utility Rep helps them calculate business case and get incentives so projects can be moved up since they are cheaper.
Yes	Budgets concerns and incentive helped
Yes	Business case was around saving money and needed 2 yrs payback, without incentive it was 5 yrs. Incentive produced a 2 yr payback period. No age to report.
Yes	Cost
Yes	Equipment was approaching end of useful life and needed to upgrade but could have put off for 4-5 years
Yes	Financial help let us get there sooner.
Yes	Financial. The incentive helped us decide to go ahead with it, and to go ahead with it when we did.
Yes	Funding goals would not have been met.
Yes	Helped with payback
Yes	I don't recall just how important Union Gas was in the timing decision.
Yes	I would have let another winter go by because of the costs. I didn't know what the value was of this project - it was my first year there.
Yes	Incentive shortened payback period. would have done later based on market forces.
Yes	Incentives help push projects to higher priority.
Yes	Incentives help us with the capital costs with these projects.
Yes	It was expensive, and I don't know that I would have built it without all the incentives.
Yes	It would have required a commitment from management; I am not sure if we would have gotten that commitment.
Yes	Just because of the opportunity with the incentive; it was available, and it made this <measure> more affordable.
Yes	Lack of financial support will generate a delay in the whole decision making process
Yes	Money helped accelerate when it was done but would have done it.
Yes	Need to do it to operate but would have had to base it more on what the market could return in capital
Yes	No plan of installing the system if not for Union's incentive.
Yes	Possible still gone ahead. Maybe would have invested in something else.
Yes	Somewhere between later and never

Yes	The incentive played a big role in getting the project moving, if not the decision would have had to wait at least another couple of years.
Yes	The incentive was a key driver in the decision making process
Yes	The incentive. When you know it's there, that's a good reason to move forward.
Yes	The project would not have been installed if not for the incentive from Union.
Yes	Timing-wise, having the electricians available. If it's one item on to-do list as opposed to something we prioritized (because of the incentive)
Yes	We might have revisited this project to save energy
Yes	We needed to make sure in the early stages that this project was viable. We worked with Union from the beginning to make sure the <measure> would meet our needs. Without Union's help, this whole project would have taken longer.
Yes	We would have had to wait for operating costs to pay for it.
Yes	We would need more time to work around the financial aspect of the project to pursue it
Yes	Without the prior good experience, this was a non-starter.
Yes	Working with Union for other projects and learning about the incentives from the Utility rep ****** helped them see how we could save money by undertaking energy efficiency projects like this one. As for incentives, some had a bonus if you did it in a certain time. So there was a rush to get it done quickly and push things through after the projects were identified.
Yes	Would have waited or not installed anything at all
Yes	cost, most of our decision revolves around the financial aspect of the project
Yes	incentives help justify the payback period, start getting the savings sooner
Yes	later to never, Union helped support case
Yes	the ROI was not there without the incentives
Yes	there were other projects with higher priority and which were more financially feasible than this project
No	"The evolution of what we were doing with this greenhouse (and our company) required it. Ten years ago, nobody had <this measure>. Now it is commonplace. So we had to do what we did, when we did, to provide the most stable growth environment for our crops in order to stay competitive."
No	"We were looking to grow the business, and the timing was good. We wanted to build before prices rose much further."
No	Aside from the incentive, which was nice but not essential, Union had no involvement in the greenhouse construction.
No	At end of life; we needed to replace them, and the incentives made that possible.
No	Because the timing was a business decision unaffected by Union.
No	Because we were going to do it or not do it. We were not going to hold it on the project off because of Union.
No	Facility was expanding and required <measure> regardless
No	Funding was coupled with <an external grant>
No	Generally based on available time, equipment lead times. We plan based on market.
No	I don't think Union Gas had any time constraint on us.
No	I need to be able to maintain a stable growth environment for my crops. I want to make sure heat is used only where it is needed.
No	I needed to address the <issue solved> before it became a problem.
No	I run my business based on what I need and what I have; if Union Gas has a program that I fit into, that is great, but it is not what drives my decisions. We're looking at <small> incentive on a <large> investment.
No	It was a new construction project. If they did not install it at that time, it would have been retrofitted later or might not have been feasible.
No	It's a new construction facility, and the measure would have to be installed at the same time as the rest of the project was getting completed.
No	Management already decided to go through with the project with incentive or not. Incentive was a very small portion of project cost.
No	Needed to complete renovations regardless of incentives
No	New facility was being built regardless
No	Project was bigger than just the incentives
No	Project was bigger than the incentives
No	Project was larger than the incentives offered
No	Same as other project. Production requirements demanded it.
No	The boiler needed to be installed anyway, since it was old
No	The company already identified that we wanted to install <the measures> regardless of incentives.
No	The money was good, but the Union Gas incentives did not influence the timing. The timing was driven by product demand. There had been some delays due to waiting longer than expected for a permit and some delays in construction.

No	The system needed to be installed at the time it was because the building was new construction. It would not have been possible to install at another time otherwise.
No	The timing was right, with the other construction work going on we were a little disrupted anyway.
No	This project was a test case to learn about Union's program processes for future projects.
No	Union gas had zero to do with it. We would have installed it anyway.
No	Union had nothing to do with this project.
No	We had to do this work in 2018 as a result of capital improvements funding cycle.
No	We have been installed <the measures> throughout <buildings> since 2012.
No	We needed a boiler in the new <building>.
No	We needed to install these <measures> for crop survival.
No	We wanted to get this project done while we were doing other upgrades as well. We had to push Union to move faster with everything to get it done when we wanted it.
No	We were already redoing the HVAC in this building, so with that installation taking place and having the contractors come in and do it anyway, it was a perfect opportunity to install a new <measure>.
No	We were building the new <building>; it was the obvious time to install the <measure>.
No	We were constrained by the seasons, availability of contractors, etc. We had to install them when those factors allowed.
No	With all the construction we were doing at the site, the timing was right.
No	With the data that come from having the new equipment at our other locations, we knew that there would be operational savings anyway.
No	Would have installed it either way
No	Yearly budget, we were thinking about it before and the incentive was a nice bonus.
No	project needed to be done no matter what, project was bigger than the incentives
No	saw the need of the system at that particular time
No	upgrades had to be done anyways

Table 6-15. Efficiency Verbatim Responses for Union Custom C&I programs

Efficiency	Why do you say that?
Yes	Cost
Yes	Enabled us to implement it and would not have done something else such as <alternative approach> or **********
Yes	Financial.
Yes	I would have needed Union Gas to tell me what was a more efficient system.
Yes	Incentive was important, but I think there's really only one type of product. You either do it, or you don't do it.
Yes	It is expensive to do this stuff and <utility rep> helps us get the calculations to understand how this will improve our business and also helps us get the incentives
Yes	It was economical to install <the measure>.
Yes	It would have been cheaper; without the incentive, management would likely decide to go with a less expensive option, or stick with the existing boilers until they died.
Yes	It would not have changed anything. The system was designed around our operating requirements.
Yes	Purchase cost. The burner alone can cost over $*****
Yes	The <measure> would not have been installed if not for Union, but the <measure> that have been installed now are top-of -the line and the best.
Yes	The cost. I could not afford the high-efficiency boiler on my own.
Yes	The incentive helped pay for a more efficient system.
Yes	The incentive let us buy <a better measure> for about the same cost to us; it was a no-brainer.
Yes	The incentives allowed us to use better ******* systems, which contribute to efficiency.
Yes	Union helped justify the case
Yes	Union's technical expertise helped select the best <measure 1>. Less advanced for <measure 2>
Yes	When we knew about the incentive, bang t
Yes	Without the incentive we would have installed a less advanced system.
Yes	Without the incentive, we might not have been able to afford the <measure> we put in.
Yes	Would have kept old system running. New system needed to be inline with <company> standard and regulatory compliant.
Yes	incentives help get the best of the best, without the incentives product would have been lesser quality
No	<We know what we> wanted to install. We used an exact same system that we used before.
No	<We> prioritizes projects that can get better ROI and rebates.
No	<measure> is standardized across the site

No	Chose the equipment and efficiency based on status quo among neighbors and contractors advice. We wanted to be sure that the equipment was commonly being used in the area to ensure the equipment would be easily serviceable and there would be spare parts.
No	Design requirements as approved by the engineer
No	Due to the fact that we have ********** experts at that building everyday, we knew exactly what we needed to <implement in> the building.
No	Engineering firm/Vendor advised the change and there was no viable alternative so we would have implemented it nonetheless
No	Equipment was predetermined regardless of incentives.
No	Had similar boilers in other parts of facility. Also selected boilers before learned Union Gas incentives would be available
No	I had to do the entire job to protect my crops.
No	No standard in facility, contractor just matched <size> that was already <there>. I wish we would have had better engineering estimates for this because we probably could have gone <more efficient>.
No	Plant requirements
No	Same because would have installed it regardless.
No	The <measure> is really an all-or-nothing job. There is no point to doing less than the complete area.
No	The equipment was already decided upon regardless of incentive.
No	The incentive came about after the purchase order was made.
No	The vendors designed the system to meet the needs of the building and to be efficient. We would have installed the right equipment regardless of Union
No	There is no alternative to what was installed.
No	Union did not help select equipment.
No	Union didn't have an effect on their decision-making because this project was a test case to learn about Union's program for future projects.
No	Union had no bearing on this decision.
No	Union had no impact on the selection of materials. That was all proposed by the contractor.
No	Union helped absorb the cost of what we wanted, which certainly helps. They were helpful in working with us to do calculations and stuff, but we looked at other projects and had an idea of what we wanted.
No	Wanted to be more efficiency and would have done regardless
No	We decided early on that we wanted the highest <measure> value we could find.
No	We did not have a lot of options for the controls.
No	We might have delayed the project later until funding was available to install the specific equipment the consulting firm recommended
No	We needed to install what we installed to keep the **** ***.
No	We would have installed the same type of ***** system. The project was mainly driven by the needs of the building occupants.
No	We would have selected the right equipment for the job but it may have taken longer to get approved.
No	Whatever <vendor> would have recommended. R Value was same as in the past. R Value.
No	Would opt for the best and higher efficient option
No	any opportunity to save energy, we will take
No	equipment needed to meet specifications given by the design firm
No	project needed to meet certain specifications and was getting done anyways
No	project was larger than the incentives offered
No	the <measure> simply needed to meet the required specification and efficiency is not considered

Table 6-16. Quantity Verbatim Responses for Union Custom C&I programs

Quantity	Dat3a_O. Why do you say that?
Yes	Again, it came down to costs. I'd have had to make do with a smaller, less efficient boiler without the incentives.
Yes	Eventually would have installed the same system. If we would have installed the <measure>, it would have saved less ****.
Yes	For the <measure> it was mainly the incentive. And I should mention that Union Gas brought the equipment to our attention, thinking that it might be of value to us, and they helped us run the ROI. For this measure, Union was pretty crucial to our decision to proceed.
Yes	That recommendation came from <vendor>, so I'm not sure.
Yes	The cost.
Yes	Union helped quantify savings
Yes	We have ** boilers providing heat to this <building>; we likely would only have done ** without the incentives from Union.
Yes	We may very well have stuck with the existing boilers, since they had enough capacity to maintain our

Quantity	Dat3a_O. Why do you say that?
	operations.
Yes	We might have chosen to add less <measure> to some of the internal spaces, but I don't really know.
Yes	We would have gone for all the necessary components of a <measure> but not with this system as It is costly plus a new venture and It was something which was not a dire need as It is something new
Yes	less <of the measure> would have been <implemented> since business case is harder to make
Yes	the ROI was not there for the project without the incentives
No	**********
No	**********
No	Already working on conversion and wanted to replaced entire building's set of <measures>.
No	Business need; our process requires a specific output. Anything less, we can't optimize our crops; anything more is wasted.
No	Capacity would have been the same; it's based on our business needs.
No	Design requirements
No	Equipment needed to meet minimum specifications
No	I didn't even consider <doing> only part of my ****** system; that just makes no sense to me.
No	Similar boilers to what we are using elsewhere in our facility, also made decision about boilers before the Union Gas rep got back to us about qualifying for the incentives
No	The installed boiler suits the requirements of the site
No	The size is dictated by what is available and how much heat there is **********. This also maximizes our rebates. Since we did the most efficient <measure>, the rebate is covering up to 3/4 of the cost.
No	The system was constrained by the size of the room, so it would've been the same either way.
No	They didn't have any impact on this design.
No	Union didn't affect the capacity; the boiler system was designed to meet our business requirements.
No	Union didn't have an effect on their decision-making because this project was a test case to learn about Union's program for future projects.
No	We are getting a great deal on the ****** gas, and we buy what we need.
No	We chose the specific equipment based on what our neighbors and others in the community had. We would have likely installed the same equipment without Union
No	We had to install the <measure> we installed; the project would have been same scope without the incentive, which was just a nice surprise.
No	We planned to cover the maximum possible area even before figuring out how much the incentive was.
No	We submit an application for however many we need to replace.
No	We wanted to make sure we saved as much gas as possible
No	We were targeting all of the <measures opportunities>.
No	We would have gone for the best efficient option even though it might get done later on due to lack of financial support
No	equipment needed to meet specifications given by the design firm
No	project was larger than the incentives offered
No	the <# measure> were in most need of replacement and would be replaced anyways

Table 6-17. Dat4 Verbatim Responses for Union Custom C&I programs

Attribution	Please summarize <the utility's> effect on the timing, efficiency and amount of that you installed
Full	"The incentives had a distinctly positive effect; w/out the incentives we probably couldn't have afforded many of the energy saving measures we installed."
Full	- Since Union is very active in their area, they always motivate them to such new technologies through their incentives and guidance
Full	Combined with <other projects> with incentive. Without the incentive, we would have kept the current boiler running for 4/5 years.
Full	For the <measure> it was mainly the incentive. And I should mention that Union Gas brought the equipment to our attention, thinking that it might be of value to us, and they helped us run the ROI. For this measure, Union was pretty crucial to our decision to proceed.
Full	Funding for the project was highly dependent on all sources of funding including Union's incentives. Without the incentives, we may have not installed the project at all. The project was dependent on approval in funding from all of our <#> or so sources.
Full	HVAC had been on our radar but the cost of implementation left a 5 yr payback period. Combined with incentives allowed to for 2 yr payback.
Full	Important. Union saying "it makes sense to us" validated the decision. But the incentive was just as important.

Full	Once we established a relationship with our rep, they were able to provide more information and see where incentives would apply, it helped us make better decision.
Full	Our prior experience with Union Gas sold us on this project. Without proven support and incentives, we would not have installed <the measure>.
Full	Since <Union representative> didn't come in and do the audit, he didn't have an effect on the design or ultimate installed <measure>. He drove the process though, and helped me see how easy it was to keep going with other <measure> projects after showing me how to do the incentives and paperwork. A good relationship with <utility Rep> helped me get the forms completed and look for other projects to be done. I became his contact within our organization to help drive other conservation projects at our facilities. I even tried to help with the other projects, but the people in charge of them aren't good at getting this type of stuff done.
Full	The Union Gas programs are fantastic. They allow growers like us to implement state-of-the-art technologies that are otherwise out of our reach. We compete internationally, including 3rd-world producers with much lower operating costs; with these incentives, we can afford technologies that let us compete with anybody.
Full	The incentive let us add the <measure>; without it, we'd have had to wait to be able to afford it, and we were concerned about our bio-security.
Full	The project was installed only because Union provided the incentive, otherwise it would have never happened.
Full	They had a big effect. The incentive covered the higher cost of higher R-value.
Full	Timing of it was perfect because they were considering doing something. Union came to the table and study done. We had to show savings. Efficient working with them.
Full	Union Gas had a tremendous impact on our decision making. They helped with numbers in advance, so we could see both short-term and long-term savings. The incentives and Union's follow-up support definitely helped us make the decisions. Some upgrades would not have been done at all and some others would have been done at lower efficiencies.
Full	Union role is integral in getting it done and getting it done properly. It's a leg on the stool.
Full	Union was a good resource for info, so it allowed us to make an efficient decision. The incentive allowed us to do the roof upgrade with less risk and more confidence, and it let us do it a little bit earlier than we might otherwise have done.
Full	Union was enthusiastic about energy reduction, which pushed the project to be done. The incentives made the ROI worth it as well.
Full	Union was instrumental in making sure the energy study for the <measure> was completed; w/out the study, we wouldn't have known about the actual energy savings. And without the incentives we couldn't have put in any of the higher-efficiency options.
Full	With Union's incentives we saved a considerable amount of money in fuel, and it's helped the crops quite a bit too (especially the curtains.)
None	"Not much effect; we did what we had to do when we had to do it."
None	"They validated the project, and right up front they made sure our gas supply would be adequate, but the design was set without their involvement."
None	Incentives from Union were a nice bonus but we had already decided to complete the project.
None	No effect, we're going to do what we want to install.
None	No impact from the rebates. It's always good to have rebates but in the discussions that he and his co-owners had about the scope and input for this project 99% of the time did not mention the rebates
None	The <business> needed to install the <measure> at the time of the construction of the building. We appreciated the incentive but we would have likely pursued to project regardless of Union because we had time constraints to meet.
None	The incentive was very helpful; we wouldn't have done anything differently, but it was very helpful. If Union Gas had educated us on best practices, that might have helped, but we got no such reliable information from them.
None	The incentives were certainly welcome but the project would have been pursued regardless of the incentives.
None	Their involvement did not impact our decisions at all in terms of timing, length, or thickness of insulation we installed.
None	They helped with other projects and their involvement was appreciated.
None	Union did a great job facilitating the process, however project was so large that the incentives made very little difference
None	Union didn't have an effect on their decision-making because this project was a test case to learn about Union's program for future projects.
None	Union encouraged us to consider the upgrades and told me about the incentives. Union definitely saved us money.
None	Union gas is what turned the company onto CHP technology in the first place. Project was significantly

	helped by incentives, incentives helped justify the project to upper management
None	Union had little effect on timing and equipment installed. Incentive was a nice bonus
None	Union had zero effect on our project. We're building a $<XX> million facility; the $<1XX,XXX> doesn't really change my decisions. Like I said, if they want to give me some money back, that's great, but it wasn't a factor in the project.
None	Union turned company onto CHP technology in the first place, project would not have been done without Union gas. Also incentives helped in selling the project to management and moving the project through the bureaucratic process.
None	Union was not involved with any aspect of this project - no rebates, they didn't help us with the design choices, they didn't help us with the size of the system. We can't access any rebates until we can show savings can be earned.
None	Union was somewhat helpful but the incentives did not impact the project in a meaningful way. Project was happening without Union.
None	Union was very helpful but we were considering the system before they got involved.
None	Union wasn't a consideration at all. They approached me after I'd begun installation, letting me know they had incentives available.
None	Union wasn't responding in a timely fashion. We provided Union <info> in March and we didn't hear back until late September. <Measure> was installed in early summer but not commissioned until early fall.
None	Union worked with us form an incentive viewpoint - we were able to push through the project from a cost stand point.
None	Union's effect was making the project more attractive and full scope at the same time due to coupling with provincial grant. Would have tried to install every thermostat without it but it helped.
None	Union's help didn't really affect the project timing; I was planning to do what I did, but the incentive "sealed the deal."
None	We would have been better prepared after conversation with ****. We needed to quantify our numbers before and after. Our Records aren't the best. We're going to think about it going forward but least of our thought in the past. **** was up to speed.
None	Working with Union gas was easy as an end user, very helpful. As far as this project goes, we would do this project regardless of the incentive but helped with project decision. Reduce energy use is a company policy every fiscal year and we set aside money to look at ways to save gas.
None	project would have been done anyways at the same efficiency and quantity.
Partial	Essentially, once we realized we could save energy and had incentives, we went this way. Without incentives, we wouldn't have put the <measures> on there.
Partial	I'm very glad and it was almost unexpected to get this much help from Union. <Utility Rep> is a very helpful contact at Union and helps us maximize the amount of projects we are able to do.
Partial	My area rep was awesome in promoting the incentives. ******* listens and takes advantage of what is recommended. The Union reps were excellent to deal with. Union accelerated the timing, but did not have an effect on the number <of measure>.
Partial	Overall impact on project was that we would've gone ahead regardless with size and efficiency, because we have the long term margins in mind so we reduce energy usage when feasible and also since we had to redo the HVAC anyway. Rebate has not so much on the immediate decision making for the project, but it did make the project appear much more feasible to the people who are actually signing off on the purchasing. The money we save is actually going into <measures> at the same store, <measures> that are much more efficient.
Partial	Same as the greenhouse roof. From Union we got advice, guidance, and of course the incentive; from the baseline study on to the end of the project, Union's support is very valuable.
Partial	The effect on the project was the amount of insulation on the pipes, and the amount of areas that we did insulation on. They also helped with the location of the equipment so energy wasn't wasted by traveling through more lengths of pipes. The incentives increased the ability to pass this project with upper management because the incentives helped to reduce the payback time.
Partial	The incentive allowed us to tap into top-level gear and build a super-efficient system (both in terms of gas savings and operational efficiencies.
Partial	The incentive let us get a more efficient boiler than we could otherwise afford, but otherwise Union didn't really have any effect on the boiler project.
Partial	Their incentives are factors in the business decisions we make; our ROI calculations include the incentives. It didn't make sense to build a new greenhouse now, and add in these energy-efficiency elements later, so Union didn't really have much effect on the timing of the project. And aside from the curtains, they didn't have much effect on the materials or design either.
Partial	Union Gas helped me out quite a bit determining the efficiency and understanding more about natural gas. But they did not have an impact on the timing of the project.
Partial	Union assisted on everything - they gave us estimated savings in our operations and with incentives. The time of year helped too, ********** when this was approved and getting colder. From a design

	point they didn't help, but from a consultation point, they helped. They helped us explore every type of project that would save us gas, and money. Their expertise really helped us with or without the incentives - the incentives was the icing on top, but also pushed this project forward. Working with Union greatly improved the chance of getting any gas saving project approved.
Partial	Union gas incentives are necessary to complete these projects, they likely wouldn't be done without the incentives. Process is quick and helpful as well. "If we didn't have union gas incentives, we would likely only do one out of <#> projects"
Partial	Union gave us another set of eyes that confirmed that the change would save natural gas. The financial incentive and "feel good effect" gave us the confidence to implement it sooner.
Partial	Union had an important impact on the <measure>. The incentive, their consulting along the way, just having them look at the plan and say it made sense to them. That validation was important to us.
Partial	Union incentives allow them to pursue more projects and get approvals more easily due to better ROI.
Partial	Union is quick to get back to us with incentive money, faster than we can send it application material and we appreciate working with them.
Partial	Union played an important role in the whole project by providing technical guidance and also providing funding & incentives.
Partial	Union's incentives allowed me to buy thicker insulation than I'd budgeted.
Partial	Union's incentives helped make the upgrades to the system a higher priority project to pursue. Typically, projects with higher than 15% ROI or less than 4 years of payback are preferred projects. The incentives offered increased the likeliness and timeliness of project completion. Although most technical assistance was from the vendor, Union was helpful in determining incentives and financials.
Partial	Union's involvement helped us move to the next level; the incentives and their advice early on helped us get to the next level, efficiency-wise.
Partial	Utility Rep was reaching out more frequently to the <facility>, handful of phone calls and emails. They helped us along. Could have invested in something else but savings calcs helped push it.
Partial	We would have installed the same equipment, although maybe less <measure>. We would have waited to install the full amount of <measure> if there was no incentive.
Partial	With the incentives, we were able to get started on the project and move ahead. We took full advantage of Union Gas help, including working with them in the beginning to make sure the <measure> would meet our supply needs.
Partial	the biggest effect was the timing, we were able to do the project sooner with their help (incentives).

Union Large Volume

Table 6-18. Timing Verbatim Responses for Union Large Volume

Timing	Dat1a_O. Why do you say that?
Yes	Normally the <number> of <measures> is constrained by how much <money> we have in our maintenance budget minus <money> held in reserve in case a failed <measures>. The incentive allows us to replace or clean more <measures> than we otherwise would.
Yes	They probably would have done the same <measure> due to "company standards" but it might be a tougher sale to the absence of the incentives. I
No	Do not believe the size could have been reduced due to technical reasons
No	Efficiency savings was a big driver of the cost savings since we use a lot of energy at the facility for ********
No	If the incentives had not been available and we had done the project, it would have been the same efficiency
No	Incentive and energy savings was "nice" but it didn't drop the project cost in half. We still had to pay ***** just for the install and incurred most of the project costs themselves. "It's still nice to show you're going down the path of "green" energy reduction but it's not like [the incentives] were ***% of the funding."
No	See previous response about incentives not impacting project. The incentives did not influence the size or scope of the project.
No	Since there was a limited window of opportunity to do the <measure> when the facility was shut down, we decided to <do all measures> when we had the opportunity.
No	The direct access fund is less than *** percent of total $****** project cost
No	The incentives did not impact the project decision-making. The decisions about the size of the project were made before the incentives came into play
No	The project selected the technology independent of the energy savings and the energy savings was a side benefit of the technology we had already selected.
No	We needed "something that works." The duty requirements for the <measure> were scoped into the

	spec. As noted this is a very specialized <measure> design, almost proprietary technology that only a very firm vendors can offer. **********
No	We probably would have done the *** upgrade anyway, but we use the <money> from the Direct Access Fund and put it into our O&M fund for fixing <maintenance issues> and other EE funding
No	We use a lot of energy in ****** and so the energy savings benefits are large enough so we would go forward with projects even if the incentives had not been available.
No	We would have installed the same <measures> based on our own internal research. Union did validate our project plan, including <measure> selection, though.

Table 6-19. Efficiency Verbatim Responses for Union Large Volume

Efficiency	Dat2a_O. Why do you say that?
Yes	Normally the <number> of <measures> is constrained by how much <money> we have in our maintenance budget minus <money> held in reserve in case a failed <measures>. The incentive allows us to replace or clean more <measures> than we otherwise would.
Yes	They probably would have done the same <measure> due to "company standards" but it might be a tougher sale to the absence of the incentives. I
No	Do not believe the size could have been reduced due to technical reasons
No	Efficiency savings was a big driver of the cost savings since we use a lot of energy at the facility for ********
No	If the incentives had not been available and we had done the project, it would have been the same efficiency
No	Incentive and energy savings was "nice" but it didn't drop the project cost in half. We still had to pay ***** just for the install and incurred most of the project costs themselves. "It's still nice to show you're going down the path of "green" energy reduction but it's not like [the incentives] were ***% of the funding."
No	See previous response about incentives not impacting project. The incentives did not influence the size or scope of the project.
No	Since there was a limited window of opportunity to do the <measure> when the facility was shut down, we decided to <do all measures> when we had the opportunity.
No	The direct access fund is less than *** percent of total $****** project cost
No	The incentives did not impact the project decision making. The decisions about the size of the project were made before the incentives came into play
No	The project selected the technology independent of the energy savings and the energy savings was a side benefit of the technology we had already selected.
No	We needed "something that works." The duty requirements for the <measure> were scoped into the spec. As noted this is a very specialized <measure> design, almost proprietary technology that only a very firm vendors can offer. **********
No	We probably would have done the *** upgrade anyway, but we use the <money> from the Direct Access Fund and put it into our O&M fund for fixing <maintenance issues> and other EE funding
No	We use a lot of energy in ****** and so the energy savings benefits are large enough so we would go forward with projects even if the incentives had not been available.
No	We would have installed the same <measures> based on our own internal research. Union did validate our project plan, including <measure> selection, though.

Table 6-20. Quantity Verbatim Responses for Union Large Volume

Quantity	Dat3a_O. Why do you say that?
Yes	We might be replacing fewer steam traps and spacing the replacements out more, without Union verifying that it really makes sense to do it the way we are now.
Yes	Without the funding they only would have replaced "bad actor" steam traps or steam traps otherwise noticed by operations staff as having issues.
No	It was the right amount ***** for those sections that needed it
No	The funding does make it easier. "The funding is there and so it provides an extra incentive for us to do this." <I do not know if these steam trap replacements were occurring before we became involved with the Direct Access Program because that was before my time (2014)>
No	We had already done some spot patching and kept finding new leaks and so figured might as well do the whole <measure>. <Our> VP of HR was a former maintenance guy and had told **** that it was unacceptable that ******. "You just have to get whatever <money> is required to fix it."
No	We had already submitted the <measure> project for corporate approval

No	We have to have the same level of unit in the area as was there before.
No	Without the incentives we still would eventually have replaced all the leaking steam traps due to concerns about inefficiency (lost steam) and icicle buildup. The incentives just accelerated the replacement

Table 6-21. Dat4 Verbatim Responses for Union Large Volume

Attribution	Dat4. Summarize the program's effect on the timing, efficiency, and amount that you installed.
Full	Without the incentives, the project wouldn't have been done.
None	$******** project and only $******** of it was incentives. It was going to get done anyway. For this project in particular, the timing to do it was independent and The timing is more dictated by the maintenance schedule. You do the maintenance when it's required. You take the opportunity when you have other maintenance that is due. So in this case we would have to disassemble the turbine anyway for maintenance reasons. So instead of doing this and then reassembling the turbines with the old parts, we decided to use this window of opportunity to disassemble it and then reassemble it with new parts. Since it coincided with our normal maintenance schedule, no additional time was lost with the upgrade. Also the project economics based on our investment valuation tool would have passed our priority test even without the additional incentives. For this project in particular, the timing and the decision to do it were independent of the incentive $. We were able to justify the project "on it's own." The timing was primarily based on where the units were in their maintenance cycle. We viewed the incentives "almost like a bonus" that reduced the overall cost and therefore increased their ROI for this project.
None	In general, the incentives wouldn't have affected this project. The decision for the projects going forward was made before the incentives dollars became available.
None	In this particular case there was very little impact on their decision-making from the incentives. However, there were other projects through the program (e.g., maintenance) where the incentives had more influence
None	It really didn't impact their project decision making at all. They typically apply for the incentive <payment> after the projects were already approved. Because for these large projects they have to plan well in advance. This was also a <large> project so incentives were not consequential.
None	Not to diminish the incentives, but very little effect due to size, scope, and nature .
None	Regardless whether we had the funding or not we would still do this based on the efficiency increases and due to the need to replace defective traps. "It would still happen … We would still see the impact of the efficiency increases. And the timing wouldn't change."
None	The Direct Access $, it's "nice to have" it's "a little perk at the end of the year." But our average gas consumption is about $****** a month so our savings from the project was small compared to the amount of gas we consume. It was a nice little cost savings, it was "a small celebration" but it didn't impact the cost of the project
None	The incentives didn't really have an impact on this project. The energy savings alone would have driven the project and the safety concern was another motivation.
None	The incentives had "no effect" on the likelihood, size, or timing of the *** project. The incentives had no influence on this project. They didn't even amount to ***% of the total project cost.
None	The incentives was helpful to get the project approved. It had been difficult to get it approved in the past and it was still difficult to get it approved even with the incentives. <regulations> would have driven the main project and then they leveraged the incentives to do the measures.
None	The incentives were a fairly small influence, "kind of an afterthought" since the project had been approved before the incentives were factored in.
None	Union was useful through each phase, particularly their support of our review of available technologies. We rely on Union to review all of our gas-related projects. Our Direct Access budget and the LVP's Aggregate Pool are both a big part of our energy efficiency planning.
Partial	By having the EnerSmart program and the incentives through Direct Access and the pool, they can make their energy calcs better, because they have better understanding of the energy savings potential and they can make some progress improvements in the purchase price which means that energy projects have a better chances of being accepted when competing with other projects. So the program does allow them to install energy projects a little bit faster than they otherwise would
Partial	He said that the influence of the program on the kiln project was similar to what it would be for the infrared heater - the program accelerates the projects but doesn't impact their likelihood or size.
Partial	It significantly moved the payback so that they did it this year much later.
Partial	On the timing it would be a year later because the incentives moved the project up the priority list for capital improvement approval and there would also be a seasonal delay (We would need to do the project before the next winter season). But in terms of size the project would not have been smaller .

Attribution	Dat4. Summarize the program's effect on the timing, efficiency, and amount that you installed.
	However, if more incentives had been available (without the ***** cap) we might have installed more <measures> than we actually did
Partial	The incentives allow us to clean more heat exchangers than we otherwise would. A side benefit of cleaning more heat exchangers also gives us more data on the typical run time/measure life of these heat exchangers so we can be more proactive about cleaning in the future or identifying poor performing heat exchangers earlier based on this performance data.
Partial	The incentives caused us to do more steam trap replacement sooner than we otherwise would have. We also mentioned that the steam trap project was much smaller ********** than the <measure> project ********** and so the incentives were a larger proportion of project costs than for the other project
Partial	The incentives help them push <measure>. If more incentive $ had been available they might have pushed a bigger project
Partial	The incentives helped with the prioritization of project within our <Capital expense> budget. It also helped us justify the project but it didn't change the size or scope of the project or whether it would go forward.
Partial	Through their support in helping us demonstrate potential savings realized in maintaining steam traps more proactively, Union has confirmed that what we're doing is the right thing.
Partial	With the funding it made more sense to have a vendor come in and do the full steam trap survey of the facility. As a result, more steam traps were replaced as well as any issues identified with existing traps. The funding had the impact of increasing our steam efficiency by increasing the # of working traps.

Appendix E Attribution Results with Additional Statistics

The results in this section are not applied to calculate savings totals. These results are different aggregations of the data that provide additional information to the programs and stakeholders. In the tables, results with less than 5 completes or absolute precision (+/-) greater than 20% are not shown, but the categories remain in the table to provide context for the results that can be reported.

The final table in each section has the application domain, Segment, which is the same domain as in the body of the report. Unlike the body of the report, these values are reported with finite population corrected (FPC) errors. FPC errors provide a more appropriate estimate of error for applying results onto populations that were part of the sample frame, i.e. the 2018 program year.

Overall ratios in these tables are the sample weighted average and not used in calculating net savings for the programs.

Enbridge Custom C&I Programs

Table 6-22. Applied Domains with Additional Statistics for Enbridge Custom C&I programs

Domain	Free Ridership Based Attribution	+/- FPC On	+/- FPC Off	Sample Customers	Sample Measures	Population Measures	Percent Population CCM Savings
Commercial Boilers	42%	11%	18%	23	24	82	10%
Commercial Ventilation	14%	5%	7%	16	16	41	5%
Commercial Other	26%	7%	10%	21	22	94	6%
Industrial	51%	8%	18%	34	42	122	48%
Multi-Residential Heating	58%	11%	14%	29	29	167	20%
Multi-Residential Other	70%	9%	10%	21	21	190	11%
Enbridge C&I Custom - Overall	50%	5%	9%	141	154	696	100%

Table 6-23. Targeted Sample Domain for Enbridge Custom C&I programs

Domain	Free Ridership Based Attribution	+/- FPC On	+/- FPC Off	Sample Customers	Sample Measures	Population Measures	Percent Population CCM Savings
Industrial Process	46%	16%	30%	15	16	41	23%
Industrial System Maintenance	46%	17%	32%	10	12	29	8%
Industrial Other	58%	8%	30%	13	14	52	18%
Commercial Boilers	42%	11%	18%	23	24	82	10%
Commercial Ventilation	14%	5%	7%	16	16	41	5%
Commercial Other	26%	7%	10%	21	22	94	6%
Multi-Residential Boilers	59%	11%	13%	28	30	168	21%
Multi-Residential Ventilation	82%	6%	7%	10	10	52	6%
Multi-Residential Other	41%	9%	10%	10	10	137	3%
Enbridge C&I Custom - Overall	50%	5%	9%	141	154	696	100%

Union Custom C&I Programs

Table 6-24. Applied Domains with Additional Statistics for Union Custom C&I programs

Domain	Free Ridership Based Attribution	+/- FPC On	+/- FPC Off	Sample Customers	Sample Measures	Population Measures	Percent Population CCM Savings
Agricultural	50%	13%	18%	23	30	150	49%
Industrial Steam/Hot Water	29%	10%	17%	15	17	60	17%
Industrial HVAC	40%	12%	17%	12	14	68	15%
Industrial Other	4%	3%	6%	9	9	17	11%
Commercial & Multifamily	29%	13%	26%	15	17	63	8%
Union C&I Custom - Overall	38%	7%	10%	70	87	358	100%

Table 6-25. Targeted Sample Domain for Union Custom C&I programs

Domain	Free Ridership Based Attribution	+/- FPC On	+/- FPC Off	Sample Customers	Sample Measures	Population Measures	Percent Population CCM Savings
Agricultural New Build	40%	23%	32%	6	6	13	23%
Agricultural Heating/Water	59%	13%	20%	14	15	88	20%
Agricultural Other	63%	20%	22%	8	9	49	6%
Industrial Steam/Hot Water	29%	10%	17%	15	17	60	17%
Industrial HVAC	40%	12%	17%	12	14	68	15%
Industrial Other	4%	3%	6%	9	9	17	11%
Commercial & Multifamily	29%	13%	26%	15	17	63	8%
Union C&I Custom - Overall	38%	7%	10%	70	87	358	100%

Union Large Volume

Table 6-26. Applied Domains with Additional Statistics for Union Large Volume

Domain	Free Ridership Based Attribution	+/- FPC On	+/- FPC Off	Samp Cust	Samp Meas	Pop Meas	Percent Population CCM Savings
Union - Large Volume	14%	4%	15%	16	23	40	100%

Appendix F EGD Commercial and Multi-Residential Vendor Attribution

Evaluation interviews with the Union and Enbridge program teams indicated that the program design for the Enbridge Commercial and Multifamily (C&M) segments focuses on working with and influencing vendors who in turn influence customers in their DSM project decisions. Since the other programs and segments are focused on selling DSM directly to customers, not through influencing vendors, it was decided in consultation with the EAC to focus vendor survey resources on designing an approach specific to the Enbridge C&M program.

The FR participant interviews included a series of framing questions that served to help respondents think through the decision-making process for their projects. Through the responses to these questions, the interview was able to identify projects where a vendor played a role in the decision making. This data was collected for each program and was used to trigger vendor interviews for the Enbridge C&M segments.

Across all programs and segments, vendors play a role in the decision making for most projects. This indicates that there could be opportunity for programs to increase net savings through proactively working with vendors as is the case with the Enbridge C&M segment's program strategy.

Table 6-27 shows that nearly all participants in the Union C&I program indicated that a vendor was involved in their decision making on the project.

Table 6-27. Vendor Interview Trigger for Union Custom C&I programs

Vendor Involvement	Participant Attribution	Customers	Measures
Not Involved in Decision	100% Paticipant Attribution	Null	Null
	Less than 100% Participant Attribution	5	5
Involved in Decision	100% Paticipant Attribution	20	23
	Less than 100% Participant Attribution	48	58

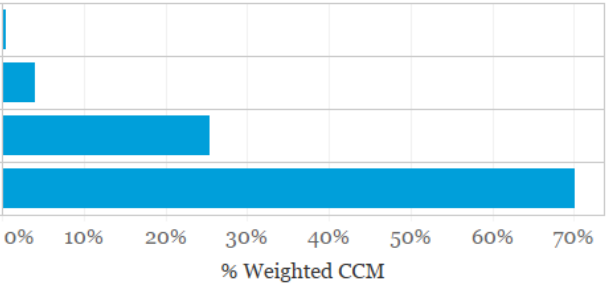


Table 6-28 shows that most projects in the Union Large Volume program indicated that a vendor was involved in their decision making on the project.

Table 6-28. Vendor Interview Trigger for Union Large Volume Program

Vendor Involvement	Participant Attribution	Customers	Measures
Not Involved in Decision	Less than 100% Participant Attribution	7	7
Involved in Decision	100% Paticipant Attribution	Null	Null
	Less than 100% Participant Attribution	11	15

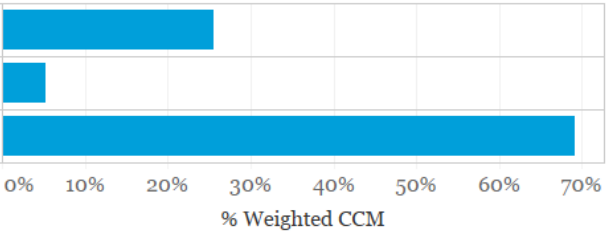


Table 6-29 shows that most projects in the Enbridge Industrial Segment indicated that a vendor was involved in their decision making on the project.

Table 6-29. Vendor Interviews for Enbridge Custom Industrial Segment

Vendor Involvement	Participant Attribution	Customers	Measures
Not Involved in Decision	100% Paticipant Attribution	5	5
	Less than 100% Participant Attribution	5	5
Involved in Decision	100% Paticipant Attribution	5	7
	Less than 100% Participant Attribution	20	25

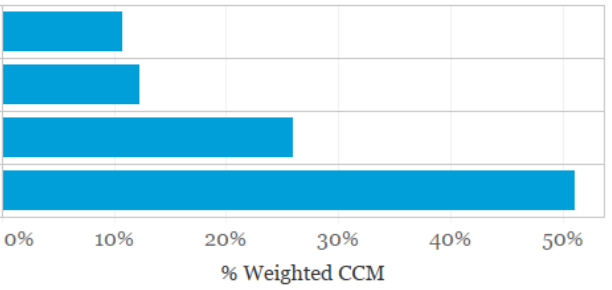


Table 6-30 shows that of nearly all measures in the Enbridge C&M segments had vendor involvement in project decision making.

Table 6-30. Vendor Interviews for Enbridge Custom C&I programs

Vendor Involvement	Participant Attribution	Vendor Interview	Vendor Complete	Customers	Measures
Not Involved in Decision	Less than 100% Participant Attribution	Did not attempt vendor interview	N/A	Null	Null
Involved in Decision	100% Paticipant Attribution	Did not attempt vendor interview	N/A	23	23
	Less than 100% Participant Attribution	Attempted vendor interview	N/A	49	52
			Completed Vendor Interview	34	34

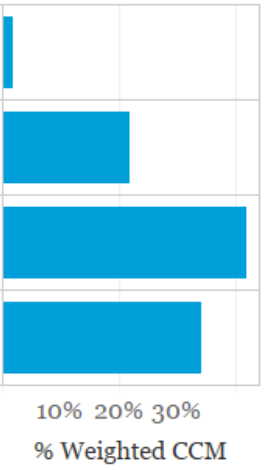


Table 6-31 shows that vendor attribution increased attribution by 7% for the Enbridge Commercial segment and by 22% for the Enbridge Multifamily segment. The results indicate that Enbridge is affecting vendor recommendations and that customers, particularly in the multifamily segment, rely on vendor involvement in making equipment and maintenance decisions.

Table 6-31. Free ridership based attribution with and without vendors for Enbridge C&M segments

Domain	Approach	Free Ridership Based Attribution	Lower Bound at 90% Confidence	Upper Bound at 90% Confidence	Population CCM Savings	Percent Population CCM Savings
Commercial	Vendor Included	31%	22%	41%	124,842,885	21%
	Without Vendor	24%	14%	34%	124,842,885	21%
Market-Rate Mulit-Family	Vendor Included	62%	53%	71%	177,956,273	30%
	Without Vendor	40%	27%	53%	177,956,273	30%

Appendix G Sensitivity Analysis

Four sensitivity analyses were performed to assess the influence of DNV GL assumptions in the participant FR scoring method. These scores are not intended for application in determining program net savings. The four sensitivity tests are:

1. Using an assumption of 2 years rather than 4 years for when the acceleration period is equivalent to a "never would have implemented" response (100% FR based attribution). Mathematically, this increases attribution for Industrial, Ag and Large Volume projects, and helps inform us how much the assumption matters.
2. Using an assumption of 4 years rather than 2 years when the acceleration period is equivalent to a "never would have implemented" response (100% FR based attribution) for all measures. Mathematically, this decreases attribution for commercial and multifamily projects, and helps inform us how much the assumption matters.
3. Giving 100% FR based attribution to programs for customers who say they would have done a different efficiency than what they did, rather than FR based attribution that ranges from partial to full based on a later response. Mathematically, this increases attribution, and informs us how much the assumption matters.
4. Compare results using the life cycle net savings (LCNS) scoring method and the first year net savings (Y1NS) scoring method. This will test the sensitivity of results to the combined effect of measure life weighting of results (CCM rather than m^3) and the different treatment of acceleration period savings.

Across utilities and programs, the high-level findings from each test are:

1. Test 1 indicates that changing the "never would have implemented" assumption from 4 to 2 years would have a significant effect on both utilities' industrial segments, suggesting that we should include future research to verify the assumed planning horizon for these projects.
2. Test 2 indicates that changing the "never would have implemented" assumption from 2 to 4 years would have a significant effect on Enbridge commercial and multi-residential projects, suggesting that we should include future research to verify the assumed planning horizon for these projects.
3. Test 3 indicates that the specific scoring of the efficiency question has relatively little effect on any segment. This may argue for using a simplified approach in future net-to-gross research in order to reduce survey length.
4. Test 4 shows a large effect for most segments. The primary difference in the approaches is the incorporation of measure life both in the weighting of results and the individual measure free ridership score. As long as the program metrics are based on CCM savings, this finding indicates that the evaluation should continue to use the current Lifecycle Net Savings method as it should provide a more appropriate estimate of free ridership based attribution for cumulative savings.

In the following tables, the first column (standard approach, vendor) is the official free ridership based attribution that corresponds to the body of the report, shown here at the segment level. To ascertain the results of the sensitivity analysis using the tables in this appendix, the reader should compare blue columns (standard approach, vendor and the four sensitivity tests) to the green column (standard approach, no vendor):

- The first column (standard approach, vendor) to the second column (standard approach, no vendor), to show the effect of including the results of the vendor survey.
- The second column (standard approach, no vendor) to the final four columns (Test #1, Test #2, Test #2, and Test #4) to show the effect of the sensitivity analysis.

Table 6-32 shows the results of the sensitivity analysis by sector for the Enbridge Custom C&I programs. None of the sensitivity tests produced a result that is statistically different from the "standard, no vendor" result (at 90% confidence).

All segments showed some sensitivity (8-9%) to the timing assumption for what constitutes an equivalent to "never" response (Tests #1 and #2). This is shown as an increase in the FR based attribution on test #1 vs standard for industrial and as a decrease on test #2 for commercial and multifamily segments. This indicates that across all segments a significant portion of participants indicated acceleration of between 2-4 years.

Test #3, which removes baseline from the efficiency scoring by giving 100% credit for any project where the customer would have done a different efficiency from what they did, increases the FR based attribution by less than three percent. None of the segment scores was particularly sensitive to this assumption.

The biggest difference at the overall level (7%) among the scores is test #4, using the LCNS scoring vs. the Y1NS method. The Y1NS approach does not incorporate measure life and thus gives a higher score for acceleration if a program is made up of measures with EULs significantly longer than 4 years. The multi-family segment was the most affected by this comparison.

Table 6-32. Sensitivity Analysis for Enbridge Custom C&I programs

Segment	Standard Approach, Vendor	Standard Approach, No Vendor	Test #1: 2 year+ acceleration = Never	Test #2: 4 year+ acceleration = Never	Test #3: No Partial Efficiency Score	Test #4: Year1 Net Savings
Industrial	51%	51%	59%	51%	54%	57%
Commercial	31%	24%	24%	16%	26%	31%
Market-Rate Mulit-Family	62%	40%	40%	32%	42%	51%
Enbridge C&I Custom - Overall	50%	42%	46%	37%	44%	49%

Table 6-33 shows the results of the sensitivity analysis by sector for the Union Custom C&I programs. None of the sensitivity tests produced a result that is statistically different from the "standard, no vendor" result (at 90% confidence).

The results show that changing the "never" threshold in the timing scoring to two years from four years for the Industrial and Ag sectors (Test #1) produces a 5 percent change overall, driven primarily by industrial projects, which had an increase of 8%. Changing the "never" threshold to four years from two years for the Commercial and MF sectors (Test #2) had no effect

Test #3, which removes baseline from the efficiency scoring by giving 100% credit for any project where the customer would have done a different efficiency from what they did, increases the FR based attribution by only three percent. The Agriculture segment is most significantly affected with an increase to FR based attribution of 5%, which may in part be due to the many Agriculture projects that represent a bundle of measures, each of which was asked about separately in the FR interview.

The biggest difference at the overall level (7%) among the scores is test #4, using the LCNS scoring vs. the Y1NS method. The Y1NS approach does not incorporate measure life and thus gives a higher score for acceleration if a program is made up of measures with EULs significantly longer than 4 years. The Industrial segment was most affected by this comparison.

Table 6-33. Sensitivity Analysis for Union Custom C&I programs

Segment	Standard Approach, Vendor	Standard Approach, No Vendor	Test #1: 2 year+ acceleration = Never	Test #2: 4 year+ acceleration = Never	Test #3: No Partial Efficiency Score	Test #4: Year1 Net Savings
Agricultural	50%	50%	54%	50%	55%	51%
Industrial	26%	26%	34%	26%	27%	39%
Commercial & Multifamily	29%	29%	29%	29%	29%	31%
Union C&I Custom - Overall	38%	38%	43%	38%	42%	45%

Table 6-34 shows the results of the sensitivity analysis for Union Large Volume. None of the sensitivity tests produced a result that is statistically different from the "standard, no vendor" result (at 90% confidence).

The results show that the Large Volume score is not particularly sensitive to changes of the assumptions in the FR scoring. The largest difference (11%) for Large Volume is using the LCNS scoring vs. the Y1NS method. The Y1NS approach does not incorporate measure life and thus gives a higher score for acceleration if a program is made up of measures with EULs significantly longer than 4 years.

Table 6-34. Sensitivity Analysis for Union Large Volume

Segment	Standard Approach, Vendor	Standard Approach, No Vendor	Test #1: 2 year+ acceleration = Never	Test #2: 4 year+ acceleration = Never	Test #3: No Partial Efficiency Score	Test #4: Year1 Net Savings
Union - Large Volume	14%	14%	17%	14%	15%	25%

Appendix H Free ridership Survey Data Quality Control

This appendix includes summaries of survey responses used to conduct quality control (QC) on the scored FR based attribution responses. The QC process involves comparison of scored question responses to responses to other questions in the same interview. Interviews with potentially conflicting responses are reviewed by the project manager (PM), who reads the entire interview before determining if an adjustment to a score is required. The options for adjusting a score include:

- Drop the measure from the sample – for very muddled responses
- Replace the inconsistent response with a "Don't Know" (effectively using the average if it is clear that there should be some FR based attribution for the component, but unclear how much)
- Adjust the flagged score to more accurately reflect the intent of the respondent (employed in cases where there is overwhelming evidence of intent; for instance, the open-ended response says clearly what the score should be)

Table 6-35 provides the count of measures adjusted for each utility and whether the adjustment increased (Inc) or decreased (Dec) FR based attribution for that measure. In total, 24 out of 274 FR based attribution scores were adjusted through this process, including 10 measures which were dropped. The percent of adjusted scores (9%) is consistent with the prior study.

Table 6-35. PM quality assurance adjustments

PM Quality Assurance Status			Union			Enbridge			Overall		
			Inc	Dec	Total	Inc	Dec	Total	Inc	Dec	Total
Total Measures Completed from FR IDIs					112			162			274
Not Adjusted					105			145			250
PM Adjustments from QA	Dropped				2			8			10
	Assign DNK Attribution, but unclear amount.	Timing	0	0	0	2	0	2	2	0	2
		Efficiency	3	0	3	1	0	1	4	0	4
		Quantity/Size	0	0	0	1	0	1	1	0	1
	Adjust Score Attribution Clear based on open, conflicted with scored response	Timing	0	0	0	1	0	1	1	0	1
		Efficiency	0	0	0	2	2	4	2	2	4
		Quantity/Size	2	0	2	0	0	0	2	0	2

Appendix I Key Documents

Four key documents previously reviewed by the EAC preceded this final report: the scope of work which includes details on the methodologies and scoring used, the sample design memo, and the interview guides for participants and vendors.


Scope of Work


FR Sample Design Memo.pdf


Participant IDI Guide

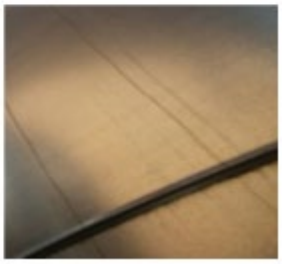

Vendor IDI Guide

Appendix S Commercial & Industrial Prescriptive Program NTG Verification Report

This report has been prepared for the OEB. The study, completed by Itron, includes results from Commercial & Industrial Prescriptive Program Net to Gross Verification of the Enbridge and Union natural gas DSM programs delivered in 2017 and 2018.





2017 C&I PRESCRIPTIVE VERIFICATION

FINAL REPORT – MEASUREMENT OF NTG FACTORS AND GROSS SAVINGS VERIFICATION

Submitted to:
Ontario Energy Board

Submitted by:

Itron

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June 7, 2019


TERMINOLOGY

This section defines several key concepts that will be used throughout this report, using the definitions from the Ontario DSM Guidelines for spillover and free rider.

A *free rider* is "a program participant who would have installed a measure on his or her own initiative even without the program."[1]

Free-ridership rate: Ratio of savings claimed from participants that were not influenced by the utility program.

Gross Realization Rate (Gross RR): Adjustment factor used to multiply tracked savings to arrive at verified gross savings estimate, or "ex-post" savings estimate; disaggregated by measure type and utility. Each gross RR is developed through data collected during the gross impact portion of the C&I Prescriptive program verification efforts, which will verify program-achieved gross savings for measures at a sample of sites. It is the ratio of the verified gross savings to the tracking estimate of gross savings for installed measures, and includes corrections to the numbers of units installed, eligibility criterion (as listed in the measure Sub Docs), etc. (as detailed in section 2.2.2 of the workplan in Appendix A). The Gross RR is derived through the participant survey data collection (either via phone or an on-site), which confirms that the reported equipment / measure was installed and is currently operational at the facility.

Gross savings are "the changes in energy consumption and/or demand that result directly from program-related actions taken by participants in an efficiency program, regardless of why they participated."[2]

In-Depth Interviews (IDIs) are structured interviews administered by evaluation engineers (for gross impact verification and SO follow-up data collection) and market researchers/ project analysts (for FR and SO data collection) either in person or, more frequently, over the phone.

Net-to-Gross Ratio (NTGR): Ratio that accounts for effects such as attribution, free riders, and the spillover effects (if any); disaggregated by measure type and utility.

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1 Ontario Energy Board Demand Side Management Guidelines for Natural Gas Utilities, EB-2008-0346, June 2011, Chapter 7.

2 SEE Action, Energy Efficiency Program Impact Evaluation Guide: Evaluation, Measurement, and Verification Working Group, DOE/EE-0829, December 2012. https://www4.eere.energy.gov/seeaction/sites/default/files/pdfs/emv_ee_program_impact_guide_1.pdf, page xiv

Priority Measure Groups: Per the final workplan, the evaluation addressed the top four Priority Measure Groups for each utility. See Appendix A (workplan) for complete details.

Spillover(SO) "refers to effects of customers that adopt energy efficiency measures because they are influenced by a utility's program-related information and marketing efforts, but do not actually participate in the program."[3] We considered both inside and outside, and both like and unlike spillover through this project.

- Inside spillover refers to non-incented measures that were installed within the same facility.[4]
- Outside spillover refers to measures for which the customer did not receive an incentive adopted in an outside location for a participating customer.[5]
- Like spillover refers to non-incented measures of the same type as incented measures.[6]
- Unlike spillover refers to non-incented measures of a different type as incented measures.[7]

Telephone Supported Engineering Reviews (TSERs) are desk reviews, entailing a phone interview with program participants (typically the person(s) most knowledgeable about the measure in question), conducted for those projects outside the on-site sample points, to verify measure installation and operation.

Tracked Savings: Gross natural gas savings claimed by each utility (in CCM) for each measure, or "ex-ante" savings estimate.

Verified Savings: Gross natural gas savings by each utility (in CCM) for each measure, verified by the evaluation team, or "ex-post" savings estimate.

Vendors are program trade allies, business partners, service providers, contractors and suppliers who work with program participants to implement energy saving measures.

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3 Ontario Energy Board Demand Side Management Guidelines for Natural Gas Utilities, EB-2008-0346, June 2011, Chapter 7.

4 Ontario Energy Board Demand Side Management Guidelines for Natural Gas Utilities, EB-2008-0346, June 2011, Chapter 7.

5 Ontario Natural Gas Technical Evaluation Committee (TEC), Request for Proposal: Measurement of Net-to-Gross (NTG) Factors for Ontario's Natural Gas Custom Commercial and Industrial Demand Side Management (DSM) Programs, RFP-002-2013 (2), December 2013, Section 2.

6 NREL, Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures, December 2014. http://www.nrel.gov/docs/fy14osti/62678.pdf

7 Ibid

+/- or Absolute Precision: If the evaluation were repeated several times selecting samples from the same population, 90% of the time the ratio would be within this range of the ratio.

Confidence interval: The upper bound is defined by the ratio plus the absolute precision. the lower bound is defined by the ratio minus the absolute precision.

Relative Precision is calculated as the absolute precision divided by the ratio itself. By convention, relative precisions are the statistic that are targeted in sampling (i.e., 90/10 is a relative precision metric).

Coefficient of Variation (CV): is a statistical measure of the dispersion of data points in a data series around the mean. The coefficient of variation represents the ratio of the standard deviation to the mean.

Finite population correction (FPC) is a factor that reduces the measured error of samples drawn from small populations (less than 300). FPC applies when the ratio is applied to the same population from which the sample was drawn.[8]

[8] Results from this study with FPC will be applied to the lost revenue calculations for the 2017 program. Those without FPC will be applied to future study year shareholder incentive and lost revenue calculations.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 EXECUTIVE SUMMARY

This report has been prepared for the Ontario Energy Board (OEB) and provides the results of the gross savings verification and net-to-gross ratios (NTGRs), by Priority Measure Group, for the commercial and industrial prescriptive programs in Enbridge Gas Distribution Inc.'s (Enbridge) and Union Gas Limited's (Union) natural gas demand-side management (DSM) portfolio delivered in 2017. The combined study produced gross impact verification, free ridership (FR) and participant spillover (SO) ratios.[9]

1.1 EVALUATION OBJECTIVES

The overall goals of the combined evaluation were to develop:

- Verified gross and net ratios for a selected set of Priority Measure Group projects (designed to meet 90/10 statistical confidence and relative precision levels) from the 2017 prescriptive commercial and industrial programs
- Participant spillover factors applicable to commercial and industrial prescriptive projects, for a selected set of Priority Measure Groups, based on projects installed in 2017

1.2 EVALUATION APPROACH

At a high level, the gross savings verification and NTG study employed the following methodology:

- Receive program data and documentation.
- Design and select the sample.
- Collect data.
- Analyze the results.
- Report the results.

The methodology selected for the gross impact portion of the study consisted of telephone supported engineering reviews (TSERs) and on-site verification visits to aid in calculation of the ex-post gross savings. The methodology selected for the NTG evaluation relied on end-user self-report surveys and interviews. The end user self-reports were supplemented by interviews with vendors to capture their and the

[9] Free-ridership rate: Ratio of savings claimed from participants that were not influenced by the utility program.

program's influence on end-user decision making. The NTG analysis also considered spillover savings due to the programs.

1.3 RESULTS

The following section presents the results from gross impact verification and NTG research study for Enbridge and Union. Table 1-1 and Table 1-2 show the Enbridge gross verification and NTG results, respectively. Itron did not find any participant spillover results for Enbridge or Union.

The Enbridge results show that the program's gross savings estimates are accurate and confirm with the specifications in the technical reference manual (TRM) and subdocuments (subdocs) describing savings calculations.

TABLE 1-1: ENBRIDGE GROSS IMPACT RESULTS SUMMARY

Priority Measure Group	Gross Verification Realization Rate	90% Confidence Interval			
		(+/-)	Lower Bound	Upper Bound	Relative Precision
Boilers	100%	0%	100%	100%	0%
Kitchen Ventilation	103%	3%	100%	106%	3%
Infrared Heating	103%	6%	97%	109%	6%
DCV	104%	2%	102%	106%	2%

The NTG results show that the program is influencing installations that represent less than 62% of the energy savings reported by the program, with a very minimal influence on the DCV Priority Measure Group.

TABLE 1-2: ENBRIDGE NET-TO-GROSS RESULTS

Priority Measure Group	Free Ridership Rate	Spillover	NTGR	90% Confidence Interval			Absolute Precision (w/ FPC) (+/-)	Absolute Precision (w/o FPC) (+/-)
			= [(1-FR) + SO]	+/-	Lower Bound	Upper Bound		
Boilers	70%	0%	**30%**	20%	10%	50%	17%	21%
Kitchen Ventilation	38%	0%	**62%**	24%	38%	86%	24%	26%
Infrared Heating	89%	0%	**11%**	9%	2%	20%	9%	10%
DCV	92%	0%	**8%**	17%	0%	25%	13%	21%

Table 1-3 and Table 1-4 show the Union gross verification and NTG results, respectively.

The Union results show that the program's gross savings estimates are accurate and confirm with the specifications in the TRM and subdocs describing savings calculations.

TABLE 1-3: UNION GROSS IMPACT RESULTS SUMMARY

Priority Measure Group	Gross Verification Realization Rate	90% Confidence Interval			
		(+/-)	Lower Bound	Upper Bound	Relative Precision
Boilers	102%	1%	100%	103%	1%
ERV	100%	1%	99%	100%	1%
Infrared Heating	103%	3%	99%	106%	3%
Air Curtains	100%	0%	100%	100%	0%

The NTG results show that the program is influencing installations that represent less than 50% of the energy savings reported by the program, with a very minimal influence on the Infrared Heating Priority Measure Group.

TABLE 1-4: UNION NET-TO-GROSS RESULTS

Priority Measure Group	Free Ridership Rate	Spillover	NTGR	90% Confidence Interval			Absolute Precision (w/ FPC) (+/-)	Absolute Precision (w/o FPC) (+/-)
			= [(1-FR) + SO]	+/-	Lower Bound	Upper Bound		
Boilers	76%	0%	**24%**	9%	15%	32%	9%	9%
ERV	70%	0%	**30%**	13%	17%	43%	8%	13%
Infrared Heating	93%	0%	**7%**	6%	1%	13%	6%	6%
Air Curtains	50%	0%	**50%**	22%	29%	72%	19%	24%

1.4 FINDINGS & RECOMMENDATIONS SUMMARY

Key findings and recommendations from the study are presented in Table 1-5 below.

TABLE 1-5: 2017 C&I PRESCRIPTIVE PROGRAM VERIFICATION: FINDINGS & RECOMMENDATIONS

Finding	Recommendation	Applicable Entity
Free-ridership levels for Enbridge ranged from 38% to 92% and from 50% to 93% for Union.	The utilities should consider evaluating free-ridership for the programs annually and consider coupling the free-ridership evaluation with process evaluation to better understand how the utilities are influencing the vendors and their outreach to the end-users.	Enbridge & Union

Finding	Recommendation	Applicable Entity
Both utilities had high ex-post gross realization rates, implying that the utilities are accurately estimating the ex-ante savings based on the measure sub-docs and/or the TRM.	GRRs were close to 100% for all evaluated Priority Measure Groups; ***no action recommended.***	Enbridge & Union
There was no participant spillover for either utility.	■ The utilities should work with the vendors to find out their protocol on recommending the installation of program measures at customers' facilities. This would enable the utilities to better understand the influence the programs have on the customers' behavior, especially in the context of spillover. ■ The utilities should also consider conducting a market study to quantify any nonparticipant spillover, contingent on EAC and EC consideration.	Enbridge & Union
Union could benefit from investing in a modern program tracking database with document storage capabilities as most of the participant and vendor contact information had to be extracted by the verification team.	■ Digitize and file project documentation for all projects as they are completed and paid during project closeout. ■ Track contacts associated with projects in the program tracking database. ■ Strongly consider investing in relational program tracking databases.	Union; however, it must be noted that Union has indicated the presence of an online tracking database for their 2018 programs
Vendor surveys had very low response rates	■ Incentives to complete survey ■ Recommendation for utilities to communicate with vendors regarding the importance of this evaluation step during future NTG studies	Enbridge & Union and Verification Team
Participants were generally receptive in responding to surveys. The response rate for participants was around 50% for the first few months. After the first wave of customers were contacted, the more difficult corporate customers and unresponsive customers were attempted to be reached. By the end, after many attempts and exhausting the sample, the overall response rate was about 30% overall for participants.	■ Incentives to complete survey ■ Recommendation for Utility to communicate with customers about the importance of this evaluation steps during future NTG studies	Enbridge & Union and Verification Team

2 INTRODUCTION

This report has been prepared for the Ontario Energy Board (OEB) and provides the results of the gross savings verification and net-to-gross ratios (NTGRs), by Priority Measure Group, for the commercial and industrial prescriptive programs in Enbridge Gas Distribution Inc.'s (Enbridge) and Union Gas Limited's (Union) natural gas demand-side management (DSM) portfolio delivered in 2017. The combined study produced gross impact verification, free ridership (FR) and participant spillover (SO) ratios.

2.1 EVALUATION OBJECTIVES

The overall goals of the combined evaluation were to develop:

- Verified gross and net ratios for a selected set of Priority Measure Group projects (designed to meet 90/10 statistical confidence and relative precision levels) from the 2017 prescriptive commercial and industrial programs
- Participant spillover factors applicable to commercial and industrial prescriptive projects, for a selected set of Priority Measure Groups, based on projects installed in 2017

The programs and projects included in each portion of the study are shown in Table 2-1.

TABLE 2-1: 2017 C&I PRESCRIPTIVE VERIFICATION - GROSS IMPACT, NTG AND SO ACTIVITIES BY PROGRAM

Utility	Scorecard	Program Offering	Gross Impact	NTG	SO
Enbridge	Resource Acquisition	Commercial and Industrial Prescriptive Offer (including both pure and quasi- prescriptive projects)	✓	✓	✓
Union	Resource Acquisition	Commercial /Industrial Prescriptive Offering (including both pure and quasi- prescriptive projects)	✓	✓	✓

2.2 BACKGROUND

Customers receive an incentive through Enbridge and Union C&I prescriptive programs for installing eligible high efficiency pure prescriptive or quasi-prescriptive gas-saving equipment. Prescriptive programs offer fixed incentives that offset the cost of installing energy efficient equipment for a set of technologies. Due to the general nature of prescriptive programs, it is not uncommon for prescriptive programs to remain cost-effective while having higher free-ridership rates. Vendors and distributors also receive an incentive through Enbridge and Union C&I prescriptive programs to offset the increased cost

of participating in the program. Vendors receive $100 per application while distributors received $50; these values are nominal compared to the customer incentives, which range from $100 to $8,500 per unit, depending on the measure. Customer eligibility is dependent on TRM/subdocs requirements as well as measure-level technical requirements. Both Enbridge and Union also provide vendors with marketing and technical tools to educate them on the high efficiency equipment.

2.3 EVALUATION APPROACH

At a high level, the gross savings verification and NTG study employed the following methodology:

- **Receive program data and documentation.** The evaluation started with a review of the program tracking data, which formed the basis of the sample, and an initial review of the program documentation. Once the sample was selected, additional documentation was provided by the program to describe the energy efficiency measures and support the tracking savings estimates, also called the ex-ante estimates.
- **Design and select the sample.** The tracking data was used to design and select a sample for the Priority Measure Groups (the top four measure groups contributing to the two programs' CCM in 2017). Full documentation and contact information was requested for all sites within the sample. The gross impact sample was designed as a subset of the NTG sample.
- **Collect data.** Data was collected (via onsites and telephone) to verify the ex-ante energy savings and estimate NTG ratios at the Priority Measure Group level.
- **Analyze the results.** The collected data was used to verify the gross savings and estimate NTG ratios at the Priority Measure Group level.
- **Report the results.** The final step was to report the results, presented in Section 4below.

The methodology selected for the gross impact portion of the study consisted of telephone supported engineering reviews (TSERs) and on-site verification visits to aid in calculation of the ex-post gross savings. Full details of the gross impact methodology can be found in the embedded workplan in Appendix A (Task 2; pages 2-9 to 2-23). Gross Realization Rate (Gross RR) is the adjustment factor used to multiply tracked savings to arrive at verified gross savings estimate, or "ex-post" savings estimate; disaggregated by Priority Measure Group and utility. Gross RR is the ratio of the verified gross savings to the tracking estimate of gross savings for installed measures, and includes corrections to the numbers of units installed, eligibility criterion (as listed in the measure Sub Docs), etc. (as detailed in section 2.2.2 of the embedded workplan in Appendix A). This ratio can be applied to the tracking savings to produce verified gross savings within the Priority Measure Group.

FOR A PRESCRIPTIVE PROJECT:

$$Verified\ project\ savings\ =$$

$$Claimed\ project\ savings\ \times \frac{\#\ Verified\ \boldsymbol{eligible}\ units}{\#\ Claimed\ units} \times \frac{Verified\ prescr\ savings\ value\ from\ subdoc}{Claimed\ prescr\ savings\ value}$$

FOR A QUASI-PRESCRIPTIVE PROJECT:

$$Verified\ project\ savings\ =$$

$$\text{Claimed project savings} \times \frac{\#\ Verified\ \boldsymbol{eligible}\ units}{\#\ Claimed\ units} \times \frac{Verified\ prescr\ savings\ rate\ from\ subdoc}{Claimed\ prescr\ savings\ rate} \times \frac{Verified\ quasi\ input}{Claimed\ quasi\ input}$$

Gross savings realization rates are then calculated for each measure sampled as follows:

$$Gross\ RR\ = \frac{Verified\ project\ savings}{Claimed\ project\ savings}$$

The methodology selected for the NTG evaluation relied on end-user self-report surveys and interviews. These surveys produce a score based on the participants' responses to questions pertaining to the program's influence on their decision to install energy efficient equipment. This type of influence, of the utility directly on the participant, is called direct influence. These end-user self-reports were supplemented by interviews with vendors to capture the utility's influence on vendor actions when selling the equipment. This indirect utility influence cannot be seen by the customer and therefore cannot be captured in customer surveys. Again, the surveys produce a score based on the vendors' responses to the questions. The NTG analysis also considered participant spillover savings due to the programs. The final free-ridership for each project is the minimum of vendor and customer free-ridership scores. The NTG analysis also considered participant spillover savings due to the programs, which is added to the complement of free ridership to produce the overall net-to-gross ratio. Full details of the NTG methodology can be found in the embedded workplan in Appendix A (Task 3; pages 2-23 to 2-36). This ratio can be applied to the verified gross savings to produce net savings within a priority measure group.

$$NTGR\ = \left(1 - \min\left(FR_{participant}, FR_{vendor}\right)\right) + SO$$

3 SAMPLE DISPOSITION

Table 3-1 and Table 3-2 summarize the data collection efforts of both participant and vendor surveys. The targeted number of projects, the completed number of projects, the number of unique customers, the associated savings, and the vendor surveys are displayed below for each Priority Measure Group.

TABLE 3-1: SUMMARY OF ENBRIDGE NTG DATA COLLECTION

Priority Measure Group	Target	Completed			
	Number of Projects	Number of Projects	Number of Unique Customers	Lifecycle Verified CCM of Survey Completes	Vendor Survey Completes
Boilers	31	19	13	4,836,281	0
Kitchen Ventilation	32	16	11	2,716,072	6
Infrared Heating	32	12	12	1,123,778	3
DCV	26	23	4	2,862,741	1
Total	121	70	40	11,538,872	10

TABLE 3-2: SUMMARY OF UNION NTG DATA COLLECTION

Priority Measure Group	Target	Completed			
	Number of Projects	Number of Projects	Number of Unique Customers	Lifecycle Verified CCM of Survey Completes	Vendor Survey Completes
Boilers	44	41	32	12,624,586	5
ERV	40	45	30	13,754,494	11
Infrared Heating	43	28	28	4,024,533	5
Air Curtains	19	13	10	6,614,880	4
Total	146	127	100	37,018,493	25

4 RESULTS

The outcome of the 2017 C&I Prescriptive Verification project produced verified gross and net ratios for the 2017 programs. Section 4.1 below presents the results of this study for Enbridge while Section 4.2 presents the results for Union.

4.1 2017 C&I PRESCRIPTIVE VERIFICATION RESULTS – ENBRIDGE

4.1.1 Enbridge Gross Impact Results

A summary of the measure specific gross realization rates for Enbridge's 2017 C&I Prescriptive program is provided below.

TABLE 4-1: ENBRIDGE GROSS IMPACT RESULTS SUMMARY

Priority Measure Group	Gross Verification Realization Rate	90% Confidence Interval			
		(+/-)	Lower Bound	Upper Bound	Relative Precision
Boilers	100%	0%	100%	100%	0%
Kitchen Ventilation	103%	3%	100%	106%	3%
Infrared Heating	103%	6%	97%	109%	6%
DCV	104%	2%	102%	106%	2%

The gross verification realization rates for Enbridge's 2017 C&I Prescriptive programs indicate that the program's ex-ante gross savings estimates are accurate and conform with TRM/ subdoc stipulations. The measure specific gross impact reports, which present detailed findings for each of the evaluated Priority Measure Groups, are presented in Appendix C. The small relative precisions indicate that the verified savings for most projects were close to the reported savings. While there were a few adjustments, they were not large.

4.1.2 Enbridge NTG Results

Enbridge NTG Ratios

Table 4-2 summarizes Enbridge NTG ratios along with confidence interval and absolute precision statistics. The free-ridership ratio is 70% for the Boilers measure group, 38% for the Kitchen Ventilation measure group, 89% for the Infrared Heating measure group, and 92% for the DCV measure group. Based on the

participant IDIs, Itron found no evidence of participant spillover. Therefore, the NTG ratios are 30%, 62%, 11%, and 8% respectively for Boilers, Kitchen Ventilation, Infrared Heating, and DCV.

Absolute precisions are calculated with and without finite population correction (FPC).[10] The absolute precisions with FPC are 17%, 24%, 9%, and 13% respectively for Boilers, Kitchen Ventilation, Infrared Heating, and DCV. The absolute precisions without FPC are 21%, 26%, 10%, and 21% respectively for Boilers, Kitchen Ventilation, Infrared Heating, and DCV. The absolute precisions of the study were in line with the study objectives, but the low NTG ratios resulted in lower than planned relative precisions. While the absolute precisions are not always in compliance with the standards set forth for applying ratios to produce verified savings in other programs such as the Custom Program Savings Verification (CPSV), the results presented here are indicative of program performance based on data collected during the NTG interviews.

The free-ridership rates in the NTG results are the ratio of savings claimed from participants that were not influenced by the utility program. NTG ratios are an estimation statistic of the true population net to gross value. Unlike the variations seen with the gross realization rates, the variations seen with the NTGRs are higher due to the larger ranges of customer responses regarding program influence. For example, the variation seen with Infrared Heating Priority Measure Group interview responses is lower than the variation of interview responses for other Priority Measure Groups. This indicates that customers generally had similar interview responses, where the NTGR for each project remained +/- nine percent within the average NTGR value of eleven percent.

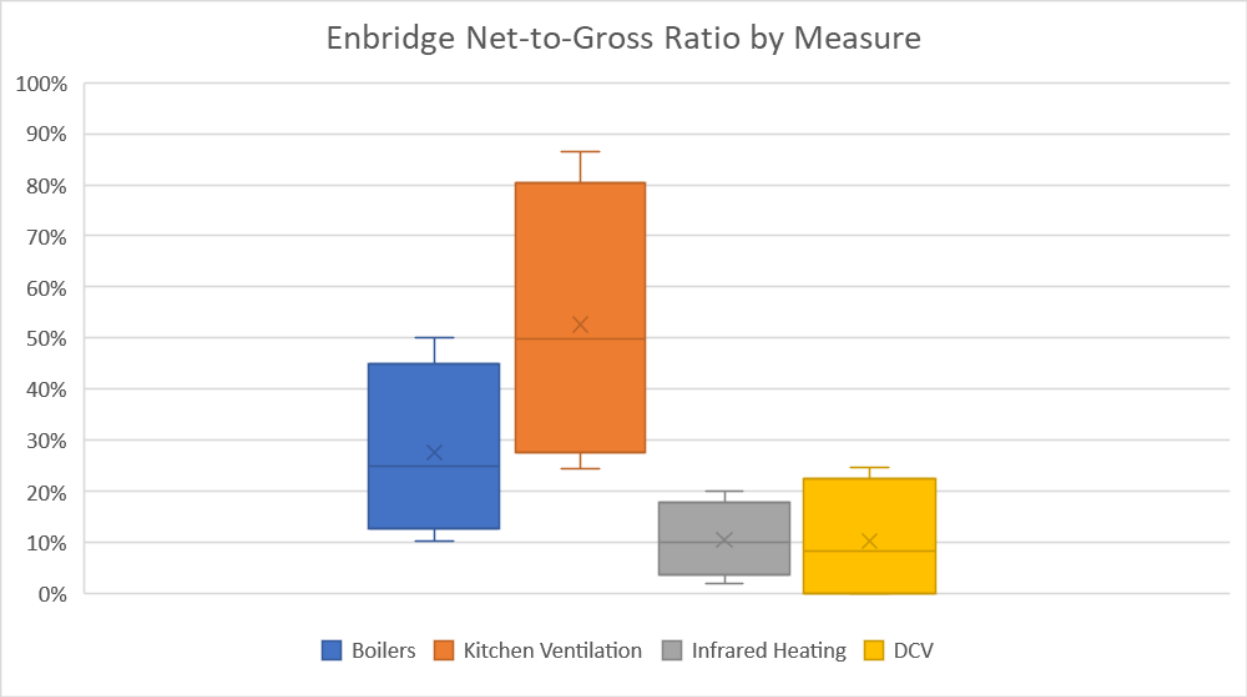
TABLE 4-2: ENBRIDGE NET-TO-GROSS RESULTS

Priority Measure Group	Free Ridership Rate	Spillover	NTGR	90% Confidence Interval			Absolute Precision (w/ FPC) (+/-)	Absolute Precision (w/o FPC) (+/-)
			= [(1-FR) + SO]	+/-	Lower Bound	Upper Bound		
Boilers	70%	0%	**30%**	20%	10%	50%	17%	21%
Kitchen Ventilation	38%	0%	**62%**	24%	38%	86%	24%	26%
Infrared Heating	89%	0%	**11%**	9%	2%	20%	9%	10%
DCV	92%	0%	**8%**	17%	0%	25%	13%	21%

[10] Results from this study with FPC will be applied to the lost revenue calculations for the 2017 program. Those without FPC will be applied to future study year shareholder incentive and lost revenue calculations.

Figure 4-1 displays the results at 90% confidence, meaning that the probability that the true NTGR is within the confidence interval range is 90%.

FIGURE 4-1: ENBRIDGE NET-TO-GROSS RESULTS



These NTG results are indicative of the program influence on the participants' decision-making. For example, the free-ridership ratio of 70% for the Boilers Priority Measure Group indicates that the program is influencing 30% of the energy savings they report.

Enbridge Vendor Surveys

The decision to pursue a vendor interview is dependent on participant questions VT1 and VT2, listed below.

> Now, I am going to ask you some questions about factors that influenced your decision-making process. If you were to allocate 100 points among the various factors that influenced your decision to install the equipment you did, how many 'influence points' would you give to:
>
> - VT1. <Vendor> recommendation regarding equipment selection?
>   - VT1a. What specific recommendations did <Vendor> provide that influenced your decision to purchase the equipment?
> - VT2. Price of the equipment

- VT2x. I would like to get a sense of your price sensitivity for the equipment. Let's say the project would have cost <20% vendor rebate in dollars> more, would you have still done it? What about <40% vendor rebate in dollars>? What about <60% vendor rebate in dollars>? <80% vendor rebate in dollars>? <100% vendor rebate in dollars>?

When the sum points of VT1 and VT2 are greater than 50%, given that VT1>0 and/or VT2x is valid (participant indicates that the amount more they would spend on the equipment is equal to or less than the vendor rebate), then that vendor is given priority to be contacted for an interview. These vendors are prioritized by being the first group of vendors to dial, with more allotted calling attempts (6 attempts). Participants that allocate VT1+VT2 with less points are also contacted after the high priority vendors are contacted. Participant VT1+VT2 scores ranked less than 30% are generally not contacted, unless this vendor happens to overlap with a vendor of a different customer with a high score. Please note that any participant interviews that were conducted in the last few days of data collection did not warrant enough time to schedule vendor interviews. Vendor interviews are scheduled the week after the data collection for the participant interview is completed. Also, if the participant NTG ratio was already 1.0, then the vendor was not contacted for an interview. The 5 vendors that were not contacted belonged to two boiler projects, two kitchen ventilation projects, and an infrared heating project.

A total of 30 vendor IDIs were attempted and 10 completed, as shown in Table 4-3 below. One vendor interview can apply to more than one project. There were five participants that did not purchase the program qualifying equipment through a vendor.

TABLE 4-3: ENBRIDGE VENDOR SURVEY DATA COLLECTION – COMPLETES

	# Vendors	# Projects
Completed	10	14

There were five vendors where Itron did not attempt an interview due to varying reasons such as participant score being 1.0, or if the VT1+VT2 scores were <30%, or due to the timing of the interview.

Table 4-4 provides the summary of the data collection disposition of vendor surveys that we could not complete.

TABLE 4-4: ENBRIDGE VENDOR SURVEY DATA COLLECTION – NOT COMPLETED

	No Vendor	Attempted, Not Completed # Vendors in Participant Sample	Not Attempted # Vendors in Participant Sample
Not Completed	5	20	5

Table 4-5 shows the percentage of program savings broken up by the VT1 score, which asks the customer to allocate a certain amount of points to the vendor recommendation. Customers representing 2% of savings gave the vendor recommendation 100 influence points. Customers representing another 2% of savings gave the vendor recommendation between 76-99 influence points. Customers representing another 4% of savings gave the vendor between 51-75 influence points. Customers representing another 64% of savings gave the vendor between 1-50 influence points. Customers representing another 28% of savings gave the vendor 0 influence points.

TABLE 4-5: PERCENTAGE OF SAVINGS OF ENBRIDGE PROJECTS WITH VENDOR TO PARTICIPANT INFLUENCE

Level of Influence	% Energy Savings Influenced by Vendor
Fully Influenced (VT1 100%)	2%
High Influence (VT1 76-99%)	2%
Moderate Influence (VT1 51-75%)	4%
Low Influence (VT1 1-50%)	64%
No Influence (VT1 0%)	28%

Enbridge Spillover

Based on the participant IDIs, we found no evidence of spillover in the analysis for Enbridge. To determine spillover, Itron asked participants to identify projects they installed as a result of their participation in the Enbridge prescriptive program. Five customers responded with something that they considered as inside spillover, while four customers responded to what they considered was outside spillover. To confirm that these were spillover projects, Itron followed up with questions about the installed equipment, such as if a rebate was received, what fuel type did the equipment use, and if the equipment was purchased under a different program, etc. Using the results of that activity, Itron confirmed that these projects were not spillover because the potential spillover action was either incentivized, performed under another Enbridge/Union program, was performed under an electric utility program, or was not influential on the customer. Therefore, we found no evidence of spillover in the analysis for Enbridge. Greater detail on the participant responses and subsequent analysis of the spillover battery of question is provided in Appendix D.4 of this report.

4.2 2017 C&I PRESCRIPTIVE VERIFICATION RESULTS – UNION

4.2.1 Union Gross Impact Results

A summary of the measure specific realization rates for Union's 2017 C&I Prescriptive program is provided below.

TABLE 4-6: UNION GROSS IMPACT RESULTS SUMMARY

Priority Measure Group	Gross Verification Realization Rate	90% Confidence Interval			
		(+/-)	Lower Bound	Upper Bound	Relative Precision
Boilers	102%	1%	100%	103%	1%
ERV	100%	1%	99%	100%	1%
Infrared Heating	103%	3%	99%	106%	3%
Air Curtains	100%	0%	100%	100%	0%

The gross verification realization rates for Union's 2017 C&I Prescriptive programs indicate that the program's ex-ante gross savings estimates are accurate and conform with TRM/ subdoc stipulations. The measure specific gross impact reports, which present detailed findings for each of the evaluated Priority Measure Groups, are presented in Appendix D. The small relative precisions indicate that the verified savings for most projects were close to the reported savings. While there were a few adjustments, they were not large.

4.2.2 Union NTG Results

Union NTG Ratios

Table 4-7 summarizes Union NTG ratios along with confidence interval and absolute precision statistics. The free-ridership ratio is 76% for Boilers measure group, 70% for the ERV measure group, 93% for the Infrared Heating measure group, and 50% for the Air Curtains measure group. Based on the participant IDIs, Itron found no evidence of spillover. Therefore, the NTG ratios are 24%, 30%, 7%, and 50% respectively for Boilers, ERV, Infrared Heating, and Air Curtains.

Absolute precisions are calculated with and without FPC.[11] The absolute precisions with the FPC are 9%, 8%, 6%, and 19% respectively for Boilers, ERV, Infrared Heating, and Air Curtains. The absolute precisions without the FPC are 9%, 13%, 6%, and 24% respectively for Boilers, ERV, Infrared Heating, and Air Curtains.

[11] Results from this study with FPC will be applied to the lost revenue calculations for the 2017 program. Those without FPC will be applied to future study year shareholder incentive and lost revenue calculations.

The absolute precisions of the study were in line with the study objectives, but the low NTG ratios resulted in lower than planned relative precisions. While the absolute precisions are not always in compliance with the standards set forth for applying ratios to produce verified savings in other programs such as the Custom Program Savings Verification (CPSV), the results presented here are indicative of program performance based on data collected during the NTG interviews.

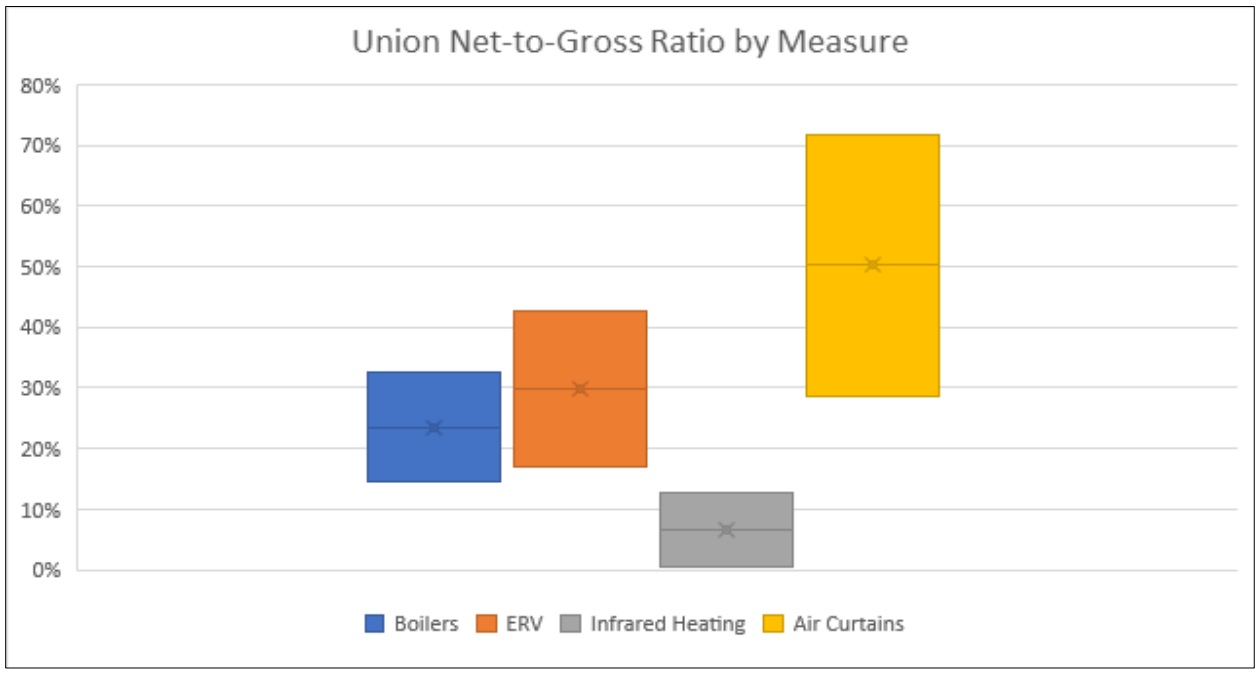
The free-ridership rates in the NTG results are the ratio of savings claimed from participants that were not influenced by the utility program. NTG ratios are an estimation statistic of the true population net to gross value. Unlike the variations seen with the gross realization rates, the variations seen with the NTGR are higher due to the larger range of customer responses regarding program influence. For example, the variation seen with Infrared Heating Priority Measure Group interview responses is lower than the variation of interview responses for other Priority Measure Groups. This indicates that customers generally had similar interview responses, where the NTGR for each project remained +/- six percent within the average NTGR value of seven percent.

TABLE 4-7: UNION NET-TO-GROSS RESULTS

Priority Measure Group	Free Ridership Rate	Spillover	NTGR	90% Confidence Interval			Absolute Precision (w/ FPC) (+/-)	Absolute Precision (w/o FPC) (+/-)
			= [(1-FR) + SO]	+/-	Lower Bound	Upper Bound		
Boilers	76%	0%	**24%**	9%	15%	32%	9%	9%
ERV	70%	0%	**30%**	13%	17%	43%	8%	13%
Infrared Heating	93%	0%	**7%**	6%	1%	13%	6%	6%
Air Curtains	50%	0%	**50%**	22%	29%	72%	19%	24%

Figure 4-2 displays the results at 90% confidence, meaning that the probability that the true NTGR is within the confidence interval range is 90%.

FIGURE 4-2: UNION NET-TO-GROSS RESULTS



These NTG results are indicative of the program influence on the participants' decision-making. For example, the free-ridership ratio of 76% for the Boilers Priority Measure Group indicates that the program is influencing 24% of the energy savings they report.

Union Vendor Surveys

The decision to pursue a vendor interview is dependent on participant questions VT1 and VT2, listed below.

> Now, I am going to ask you some questions about factors that influenced your decision-making process. If you were to allocate 100 points among the various factors that influenced your decision to install the equipment you did, how many 'influence points' would you give to:
>
> - VT1. <Vendor> recommendation regarding equipment selection?
>   - VT1a. What specific recommendations did <Vendor> provide that influenced your decision to purchase the equipment?
> - VT2. Price of the equipment
>   - VT2x. I would like to get a sense of your price sensitivity for the equipment. Let's say the project would have cost <20% vendor rebate in dollars> more, would you have still done it? What about <40% vendor rebate in dollars>? What about <60% vendor rebate in dollars>? <80% vendor rebate in dollars>? <100% vendor rebate in dollars>?

When the sum points of VT1 and VT2 are greater than 50%, given that VT1>0 and/or VT2x is valid (participant indicates that the amount more they would spend on the equipment is equal to or less than the vendor rebate), then that vendor is given priority to be contacted for an interview. These vendors are prioritized by being the first group of vendors to dial, with more allotted calling attempts (6 attempts). Participants that allocate VT1+VT2 with less points are also contacted after the high priority vendors are contacted. Participant VT1+VT2 scores ranked less than 30% are generally not contacted, unless this vendor happens to overlap with a vendor of a different customer with a high score. Please note that any participant interviews that were conducted in the last few days of data collection did not warrant enough time to schedule vendor interviews. Vendor interviews are scheduled the week after the data collection for the participant interview is completed. Also, if the participant NTG ratio was already 1.0, then the vendor was not contacted for an interview. The 15 vendors that were not contacted belonged to five ERV projects, six boiler projects, and four infrared heating projects.

A total of 79 vendor IDIs were attempted and 25 completed as shown in Table 4-8 below. One vendor interview can apply to more than one project. There were five participants that did not purchase the program qualifying equipment through a vendor.

TABLE 4-8: UNION VENDOR SURVEY DATA COLLECTION – COMPLETED

	# Vendors	# Projects
Completed	25	32

There were 15 vendors where Itron did not attempt an interview due to varying reasons such as participant score being 1.0, or if the VT1+VT2 scores were <30%, or due the timing of the interview. Table 4-9 provides the summary of the data collection disposition of vendor surveys that we could not complete.

TABLE 4-9: UNION VENDOR SURVEY DATA COLLECTION – NOT COMPLETED

	No Vendor	Attempted, Not Completed # Vendors in Participant Sample	Not Attempted # Vendors in Participant Sample
Not Completed	5	54	15

Table 4-10 shows the percentage of program savings broken up by the VT1 score, which asks the customer to allocate a certain amount of points to the vendor recommendation. Customers representing 8% of savings gave the vendor recommendation 100 influence points. Customers representing another 5% of savings gave the vendor recommendation between 76-99 influence points. Customers representing another 14% of savings gave the vendor between 51-75 influence points. Customers representing another 60% of savings gave the vendor between 1-50 influence points. Customers representing another 14% of savings gave the vendor 0 influence points.

TABLE 4-10: PERCENTAGE OF SAVINGS OF UNION PROJECTS WITH VENDOR TO PARTICIPANT INFLUENCE

Level of Influence	% Energy Savings Influenced by Vendor
Fully Influenced (VT1 100%)	2%
High Influence (VT1 76-99%)	2%
Moderate Influence (VT1 51-75%)	4%
Low Influence (VT1 1-50%)	64%
No Influence (VT1 0%)	28%

Union Spillover

Based on the participant IDIs, we found no evidence of spillover in the analysis for Union. To determine spillover, Itron asked participants to identify projects they participated in outside if the Enbridge and Union prescriptive programs. Seven customers responded with something that they considered as inside spillover, while one of the customers responded to what they considered was outside spillover. To confirm that they were spillover, Itron followed up with questions about the equipment, such as if a rebate was received, and the equipment was purchased under a different program. Using the results of that activity, Itron confirmed that these projects were not spillover because the potential spillover action was either incentivized, performed under another Enbridge/Union program, was performed under an electric utility program, or was not influential on the customer. Therefore, we found no evidence of spillover in the analysis for Union. Greater detail on the participant responses and subsequent analysis of the spillover battery of question is provided in Appendix F.4 of this report.

5 FINDINGS & RECOMMENDATIONS

Key findings and recommendations from the study are presented in Table 5-1 below.

TABLE 5-1: 2017 C&I PRESCRIPTIVE PROGRAM VERIFICATION: FINDINGS & RECOMMENDATIONS

Finding	Recommendation	Applicable Entity
Free-ridership levels for Enbridge ranged from 38% to 92% and from 50% to 93% for Union.	The utilities should consider evaluating free-ridership for the programs annually and consider coupling the free-ridership evaluation with process evaluation to better understand how the utilities are influencing the vendors and their outreach to the end-users.	Enbridge & Union
Both utilities had high ex-post gross realization rates, implying that the utilities are accurately estimating the ex-ante savings based on the measure sub-docs and/or the TRM.	GRRs were close to 100% for all evaluated Priority Measure Groups; ***no action recommended.***	Enbridge & Union
There was no participant spillover for either utility.	■ The utilities should work with the vendors to find out their protocol on recommending the installation of program measures at customers' facilities. This would enable the utilities to better understand the influence the programs have on the customers' behavior, especially in the context of spillover. ■ The utilities should also consider conducting a market study to quantify any nonparticipant spillover, contingent on EAC and EC consideration.	Enbridge & Union
Union could benefit from investing in a modern program tracking database with document storage capabilities as most of the participant and vendor contact information had to be extracted by the verification team.	■ Digitize and file project documentation for all projects as they are completed and paid during project closeout. ■ Track contacts associated with projects in the program tracking database. ■ Strongly consider investing in relational program tracking databases.	Union; however, it must be noted that Union has indicated the presence of an online tracking database for their 2018 programs
Vendor surveys had very low response rates	■ Incentives to complete survey	Enbridge & Union and Verification Team

Finding	Recommendation	Applicable Entity
	■ Recommendation for Utility to communicate with vendors regarding the importance of this evaluation step during future NTG studies	
Participants were generally receptive in responding to surveys. The response rate for participants was around 50% for the first few months. After the first wave of customers were contacted, the more difficult corporate customers and unresponsive customers were attempted to be reached. By the end, after many attempts and exhausting the sample, the overall response rate was about 30% overall for participants.	■ Incentives to complete survey ■ Recommendation for utilities to communicate with customers about the importance of this evaluation steps during future NTG studies	Enbridge & Union and Verification Team
Scoring methodology for participant's responses to efficiency questions "between standard and high" was sometimes not clear.	■ This item should be re-visited during subsequent NTG studies contingent on EAC and EC discussion. One alternative is that if a respondent indicates that they would have used an efficiency between standard and high without the program, but cannot answer the follow up question of the efficiency level they would use, instead of taking the average "between standard and high" responses for the measure, use the scoring for "standard efficiency" instead. The logic behind this is that if the customer does not know the efficiency level, it is likely that they may not have equipment at this efficiency.	Verification Team

6 APPENDICES

This section presents the appendices for this report.

APPENDIX A – WORKPLAN

This appendix provides the final workplan for the combined C&I Prescriptive Gross and NTG Ratios measurement project. It provides complete details on the program background, the evaluation objectives, sampling details and gross and NTG methodologies.

OEB_2017_CIPMSV Workplan_Sent_To_I

APPENDIX B – NTG METHODOLOGY SUMMARY

In addition to providing full details on the NTG methodology in Appendix A (Workplan; Task 3; pages 2-23 to 2-36), we present an overview of the NTG methodology employed for this study in this section. The evaluation team used an end-user self report approach (SRA) to estimate net-to-gross ratios, which is the most commonly used approach for this type of program, and relies on participating customer survey results.

The free-ridership (FR) and participant spillover (SO) scores for each Priority Measure Group are developed using data collected from participant and vendor interviews. FR data is collected via in-depth telephone surveys. For the FR determination, a specific project completed by a customer for each Priority Measure Group (identified by unique *contract account numbers* for Enbridge and by *Customer IDs* and *measure name* for Union) as listed within the program tracking databases is defined as one sampling unit.

A minimum CV of 0.8 was used to determine the net-to-gross sample size, which yielded 121 participants for Enbridge and 146 participants for Union. Full details on NTG sampling can be found in in Appendix A (Workplan; pages 2-24 and 2-25). Greater detail on the number of attempted and achieved completes is provided in Appendix D for Enbridge and in Appendix F for Union.

The free-ridership portion of the customer-decision maker survey was divided into three sections: timing, efficiency, and quantity. Timing questions determine the free-ridership during the acceleration period,[12] where applicable, and efficiency and quantity determine the free-ridership during the post-acceleration period.

B.1 NOTATION

AE = Efficiency Attribution

AQ = Quantity (size) Attribution

fE = Efficiency free ridership

fQ = Quantity (size) free ridership

NS_A = Net Acceleration Period Savings

[12] Program causes the participant to install a piece of equipment (not necessarily high efficiency) sooner than they would have otherwise

NS_L = Net Lifetime Savings

NS_P = Net Post-Acceleration Period Savings

SPA = Simple Program Attribution (function of efficiency and quantity free ridership, not timing)

VGS_E = Verified Gross Savings based on pre-existing equipment baseline (annual)

VGS_S = Verified Gross Savings based on ISP or code efficiency equipment baseline (annual)

VGS_L = Verified Gross Lifetime Savings

Y_A = Years Accelerated

B.2 INTRODUCTION

B.2.1 What is Net-to-Gross?

Net-to-gross is a ratio that measures the portion of program gross savings that were installed because of utility influence. These are energy savings that would not have happened if there wasn't a utility energy efficiency program. This included analyzing reasons for participation and investigating various program related factors that influenced the customers' decision to participate in the Enbridge and Union energy efficiency C&I prescriptive programs. NTG measures the utilities' influence on the customer's decision to install high efficiency priority measures.

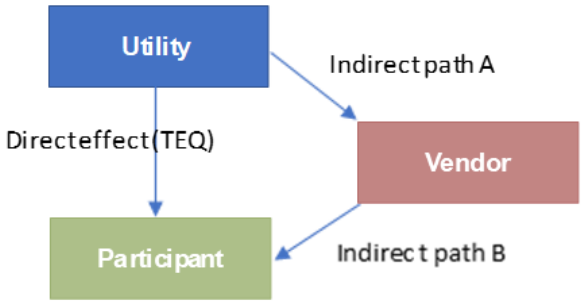
There are two main channels of influence that were studied. Direct influence occurs when the utility directly influences the customers' decision to install energy efficient equipment. Indirect influence is when the utility influences the actions of the vendor, and the new vendor actions influence the customer's decision to install energy efficient equipment.

The relationship between utility, participant, and vendor is shown in the flow chart below. [13] The influence the utility has on the customer is a direct effect because the influence is "seen" by the customer and can be measured using the customer self-report survey. There is also an indirect influence that we must account for: the influence of the utility on the participant through the vendor. The customer does not see how the utility influenced the vendor in ways that influenced the customer. In the customer self-

[13] Infographic developed by DNV GL and used with permission

report survey, any such indirect influence would be attributed to the vendor. Therefore, vendor surveys are necessary to complete the picture and fully recognize the utility's impact.

FIGURE B-1: INDIRECT INFLUENCE PATHWAY



To capture indirect influence, two pathways are examined. Utility to vendor influence is assessed through vendor interviews (Indirect path A), while vendor to participant influence is assessed through participant interviews (Indirect path B).

Both upselling and price were factors analyzed in determining indirect influence. Upselling occurs when the utility gives the vendor marketing materials, education on energy efficiency benefits, selling tools, etc., which the vendor then uses to influence the customers' purchasing decision. Indirect influence due to price occurs when the incentive from the utility to the vendor is passed on to the customer.

B.2.2 NTG – Spillover & Free-Ridership

The Net-to-Gross calculation is the sum of spillover and (1-freeridership).

$$NTGR = (1 - FR) + SO$$

B.2.3 Free-Ridership – Relation between Participant and Vendor Result

The overall customer level free-ridership ratio is the minimum free-ridership ratio of the vendor and participant. Ratios are calculated at the customer/measure level, where each customer/measure has one free-ridership value. Then, results are aggregated to a utility/measure level final ratio.

$$FR = \min\left(FR_{participant}, FR_{vendor}\right)$$

B.2.4 Data Collection & Self-Reported Surveys

Data used to calculate the NTGR was obtained through two sources: the participant survey, and the vendor survey. The participant survey provided responses to direct influence (TEQ), vendor trigger (Indirect path B), and spillover. The vendor survey provided responses to the utility to vendor influence (Indirect path A).

B.2.5 Final Net-to-Gross Calculation

$$NTGR = \left(1 - \min\left(FR_{participant}, FR_{vendor}\right)\right) + SO$$

B.3 FREE-RIDERSHIP

B.3.1 Participant Free-Ridership (TEQ)

The terms direct attribution and participant free-ridership are used interchangeably as compliments of one another. Direct attribution is determined by responses to the timing, efficiency, and quantity (TEQ) questions. The period of time the program accelerated the measure is called the acceleration period, and is calculated from the timing questions. The post-acceleration period is the effect of efficiency and quantity. The participant survey is also used to assess vendor trigger, if a customer reports that the vendor recommendation(upselling) or price had influenced their decision.

Timing

The acceleration period is dependent on question DAT1 in the survey, which asks:

1. DAT1a: "Without < the program>, would you have <installed, performed> <measure> at the same time, earlier, later, or never?"
    - DAT1a_O: "Why do you say that?"
2. DAT1b: "Approximately how many months later?" (DAT1b is only asked if DAT1a is "Later.")

Savings within the acceleration period are calculated as the difference in energy use of the replaced equipment and the rebated equipment.

$$NS_A = VGS_E \times Y_A$$

If the respondent answers DAT1 saying that they would "Never" have installed the measure without the program, or if the acceleration period is greater than four years, then the program attribution is 100% and free-ridership is 0%.

Four years is the time horizon beyond which we assume the respondent cannot answer with certainty. Anything answer to Dat1b of beyond four years (Y_A>=4) is treated as a "never would have installed" response (100% attributable), rather than an accelerated measure.

If the respondent answers DAT1 with the response of "Don't know" or "Refused", and the efficiency and quantity parameters are valid, then the weighted average of DAT1 responses that are not "Don't know" or "Refused" for that measure is used. If the respondent indicates, however, that without the program they would have installed the measure at a later time, but consequentially don't know or refuse how much time later, then the average free-ridership for the accelerated measures within the same Priority Measure Group is applied.

Efficiency

The efficiency attribution (AE) is determined by question DAT2:

1. DAT2a: "Without <the program>, would you have installed the same efficiency as what you installed, lower efficiency, or higher efficiency?"
2. DAT2b: "Without <the program>, would you have installed <measure> that was "< baseline> efficiency," or "between <baseline> efficiency and the efficiency that you installed?" (DAT2b is only asked if DAT2a is "Lesser.")

If the respondent indicates that they would have installed equipment of lesser efficiency without the program, then if the equipment installed would have been standard efficiency, the efficiency attribution is 100%. If the equipment installed would have been between standard efficiency and the efficiency of the equipment that was installed, the efficiency attribution is 50%.

If the respondent answers DAT2 with the response of "Don't know" or "Refused", and the timing and quantity parameters are valid, then the weighted average of DAT2 responses that are not "Don't know" or "Refused" for that measure is used. If the respondent indicates, however, that they would have installed a lesser efficiency without the program, and don't know if it would be at baseline efficiency or between baseline and standard efficiency, then the average score for the measures with response of DAT2a of lesser efficiency is applied.

Quantity

The quantity attribution (AQ) is determined by question DAT3:

1. DAT3a: “Without <the program>, how different would the <number/size> of the <equipment type> have been? Would you say you would have installed the same amount, less, more, or not have installed anything?”
2. DAT3b: “By what percentage did you change the amount of <equipment type> installed because of <the program>?” (DAT3b is only asked if DAT3a is “Less” or “More.”)

If the respondent would have installed less of the equipment without the program, the quantity attribution would be the percent decrease/(1+percent decrease). If more equipment would have been installed without the program, the quantity attribution is the percent increase. *(Note that the workplan mistakenly states the opposite effect, corrected here and within the analysis based on EC team’s review).*

If the respondent answers DAT3 with the response of “Don’t know” or “Refused”, and the timing and efficiency parameters are valid, then the weighted average of DAT3 responses that are not “Don’t know” or “Refused” for that measure is used. If DAT3 is answered with “None”, then the quantity attribution is 100%. If the respondent indicates, however, that they would have installed a different quantity (less/more) without the program, and don’t know the quantity they would have installed, then the average score for the measures with response of DAT3a of “less” quantity is applied to DAT3a “less” responses, and DAT3a of “more” is applied to DAT3a “more” responses.

Direct Attribution Score

Simple Program Attribution (SPA) measures the portion of the post-acceleration period gross savings due to the influence of the program and is based on efficiency and quantity. SPA is equal to 100% when the DAT1 response is “Never”. The following equations show how SPA is calculated.

$$fE = 1 - AE$$
$$fQ = 1 - AQ$$

$$SPA = 1 - fQ\,fE$$

For measures without baseline efficiency, also termed “add-on measures”, the SPA score is solely a function of quantity.

$$fQ = 1 - AQ$$

$$SPA = 1 - fQ$$

The final estimate of lifetime net savings (NS_L) is:

$$NS_L = VGS_E \, x \, Y_A + VGS_S \, x \, SPA \, x \, (Y_{V.EUL} - Y_A)$$

The net and gross savings for each sample point within a Priority Measure Group are summed, and the participant attribution is:

$$Direct\ Attribution = \frac{NS_L}{VGS_L}$$

How Participant Surveys Trigger Vendor Surveys

The decision to pursue a vendor interview is dependent on participant questions VT1 and VT2. VT1, VT2, and VT3 are the participant's scores for upselling, price, and other influence respectively. Combined, all three scores total to 100%. VT1, VT2, and VT3 ask the following:

> Now, I am going to ask you some questions about factors that influenced your decision-making process. If you were to allocate 100 points among the various factors that influenced your decision to install the equipment you did, how many 'influence points' would you give to:

- VT1. <Vendor> recommendation regarding equipment selection?
  - VT1a. What specific recommendations did <Vendor> provide that influenced your decision to purchase the equipment?
- VT2. Price of the equipment
  - VT2x. I would like to get a sense of your price sensitivity for the equipment. Let's say the project would have cost <20% vendor rebate in dollars> more, would you have still done it? What about <40% vendor rebate in dollars>? What about <60% vendor rebate in dollars>? <80% vendor rebate in dollars>? <100% vendor rebate in dollars>?
- VT3. All other influences
  - VT3a. What other factors influenced your decision to purchase the equipment?

When the sum points of VT1 and VT2 are greater than 50%, given that VT1>0 and/or VT2x is valid (participant indicates that the amount more they would spend on the equipment is equal to or less than the vendor rebate), then that vendor is given priority to be contacted for an interview. These vendors are prioritized by being the first group of vendors to dial, with more allotted calling attempts (6 attempts). Participants that allocate VT1+VT2 with less points are also contacted after the high priority vendors are contacted. Participant VT1+VT2 scores ranked less than 30% are generally not contacted, unless this vendor happens to overlap with a vendor of a different customer with a high score. Please note that any participant interviews that were conducted in the last few days of data collection did not warrant enough time to schedule vendor interviews. Vendor interviews are scheduled the week after the data collection for the participant interview is completed. Also, if the participant NTG ratio was already 1.0, then the vendor was not contacted for an interview. Total indirect influence scores are the product of indirect path A and indirect path B and represents the influence of the utility on the participant through the vendor.

Note that although participant surveys are asked at a project level, vendor surveys are not specific to the customer or project but based on general questions on the vendor's behavior for each measure as a result of the program. The actual scoring, however, is at the customer level, where the vendor attribution from vendor responses is applied by customer.

B.3.2 Vendor Free-Ridership

The terms indirect attribution and vendor free-ridership are used interchangeably as compliments of one another. Indirect attribution is determined by upselling and price. A vendor interview is triggered if a customer reports that the vendor recommendation(upselling) or price had influenced their decision (Indirect path B). Then, the vendor is also asked questions regarding upselling and price (Indirect path A). Indirect attribution from both path A and path B are used in the final indirect attribution score.

Upselling

Upselling refers to the influence of the vendor on the customer due to the vendor's recommendation to consider program qualifying equipment over other options, like less efficiency equipment or doing nothing at all, in the case of add-on measures. If the customer allocates any points to upselling, the customer is asked to explain the recommendations the vendor provided to assist their decision. If the vendor interview is triggered, the following questions are asked of the vendor:

1. U2: "In situations where you are selling <project_n>, about what percent of the time are you recommending the high-efficiency equipment?"
2. U4: "For <project_n> measure, what percent of the time would you recommend the high-efficiency equipment option without the program?"

Therefore, the total vendor upselling score is a combination of a few components.

- Part 1- Customer Allocation Upselling % (VT1)
- Part 2- Vendor Response = (U2-U4)/U2
- Total Vendor Upselling= Part1*Part2

Price

The purpose of this question is to see if any vendor rebate passed onto the customer has an influence on the customer's decision to participate in the program. If the customer allocates any points to pricing, follow up questions are asked, where the customer must identify if their involvement in the project would change due to increase in cost by incremental amounts of the vendor incentive – either by 20%, 40%, 60%, 80% or 100% of the vendor incentive.

If the vendor interview is triggered, then the vendor is asked the following question:

1. P5: "On average, what percent of the rebate is passed on to the buyer for <project_n>, either directly or indirectly?"

A dollar amount is calculated by multiplying the total vendor incentive amount by the response of P5. If this dollar amount of passed on rebate is greater than the customer's dollar threshold level, a pricing score of 1 is given.

Therefore, the total pricing score is a combination of a few components.

- Part 1- Customer Allocation Pricing % (VT2)
- Part 2- Binary (0/1) Response dependent on Customer Threshold and Amount Vendor Rebate Passed On
- Total Price= Part1*Part2

Other Influence

If there are other significant influences that are not accounted for by upselling and price, then this other influence will be asked of the customer. There is an open-end follow up that is used to identify the other factors. The other influence score is the percent allocation the customer gives to this influence. This other influence is not used in the indirect influence score. It is used to give opportunity to other areas of influence that may not be directly asked from other questions. The reason behind "other influence" is to allow the customer to rank all of their influences fairly, and if the main source of influence was not due to upselling or price, then this question allows for an unbiased point distribution. After careful review of

'other influence' responses, none of these responses warrant another form of indirect influence that was not already captured by upselling, price, or TEQ.

All 'other influence' open-ended responses have been post-coded are presented in the word cloud below. The larger words indicate more common responses from the customers.

FIGURE B-2: OPEN-END RESPONSE WORD CLOUD FOR "OTHER INFLUENCE"

B.3.3 Overall Free-Ridership

Determining Overall Free-Ridership

The total indirect influence score is the sum of Total Vendor Upselling and Total Price. The total vendor free-ridership is (1-indirect influence score). The minimum vendor free-ridership and participant/TEQ free-ridership score is used as the final free-ridership for that customer/measure level.

$$FR_{participant} = 1 - \frac{NS_L}{VGS_L}$$

$$Total\ Vendor\ Upselling = \mathrm{VT1} * (\mathrm{U2} - \mathrm{U4})/\mathrm{U2}$$

$$Total\ Price\ (if\ vendor\ passed\ incentive) = \mathrm{VT2}$$

$$FR_{vendor} = Total\ Vendor\ Upselling + Total\ Price$$

$$\boldsymbol{FR_{overall}(\ at\ customer/measure\ level)} = \left(\mathbf{min}\ (\boldsymbol{FR_{participant}}, \boldsymbol{FR_{vendor}})\right)$$

B.4 SPILLOVER

B.4.1 Initial Data Collection

The participant spillover estimate will be developed through data collected from participant and vendor surveys, and a follow-up participant interview. Spillover is present when any of the following conditions are met:

- A non-program measure is installed outside the program after initial program participation by the participant
- A program measure is installed that does not receive a program incentive
- The original measure was attributable to the program and the spillover measure is at least partially attributable to the participant's experience with the program

B.4.2 Confirmation of Spillover

Potential participant spillover savings are identified through a separate battery of spillover questions in the participating customer survey. The survey collects initial general information on what was installed and the degree to which the installed measure was influenced by their previous participation in the program. The findings are then analyzed to confirm attribution and to validate that the measure is indeed spillover and did not receive an incentive through the program. Once a causal link is established between the program and the project, a separate follow-up interview is conducted by the engineer responsible for the energy savings calculation and the collected data are used to develop an estimate of spillover savings for each pertinent project. This produces a more accurate savings estimate than if the customer were asked to provide an estimate themselves.

B.4.3 Follow-up Data & Spillover Estimation

Attribution of claimed spillover is based on the following question: "If you had not made the earlier energy-efficiency improvements I just listed, how likely would you have been to make this additional energy efficiency improvement?"

The Attribution Factor is assigned in the following way:

1. Not likely at all- Attribution Factor=1.00
2. Not very likely- Attribution Factor=0.90
3. Somewhat likely- Attribution Factor=0.55
4. Very likely- Attribution Factor=0.00

Spillover Savings = Estimate Spillover Measure Savings X Attribution Factor

The NTG calculator produces measure-level ratios of spillover cumulative m^3 to tracked or verified cumulative m^3, which are the source data for the Workplan's Task 4 (expansion process).

APPENDIX C — ENBRIDGE GROSS IMPACT REPORTS

C.1 BOILERS

Enbridge_Boilers_Final.pdf

C.2 DEMAND CONTROLLED KITCHEN VENTILATION

Enbridge_Kitchen Ventilation_Final.pd

C.3 INFRARED HEATING

Enbridge_Infrared Heating_Final.pdf

C.4 DEMAND CONTROLLED VENTILATION

Enbridge_DCV_Final.pdf

APPENDIX D — ENBRIDGE NTG STUDY DETAILS

D.1 ENBRIDGE NET-TO-GROSS DATA COLLECTION

The Net-to-Gross analysis for Enbridge was conducted for the following four Priority Measure Groups:

- Boilers
- Kitchen Ventilation
- Infrared Heating
- DCV

The number of targeted completes for Enbridge NTG data collection (121) was determined using a 90/10 relative precision with a CoV of 0.8, as detailed on pages 2-24 and 2-25 of the embedded workplan in Appendix A. Due to lower than expected response rates, a total of 70 of the targeted 121 projects completed NTG interviews.

Some customers represented multiple projects. The 70 completed NTG interviews entailed 40 customers. Of the data collection not completed, 83 projects attempted an NTG interview without success, while dialing was attempted on the entire population.

The verified lifecycle savings of projects with completed NTG data collection represents at total of 11,538,872 CCM, which is approximately 30% of total population savings in 2017, on a lifecycle CCM basis.

Across all four Enbridge Priority Measure Groups, vendors for 10 projects completed a vendor NTG survey. Table D-1 summarizes Enbridge NTG data collection.

TABLE D-1: ENBRIDGE NET-TO-GROSS DATA COLLECTION ACTIVITIES

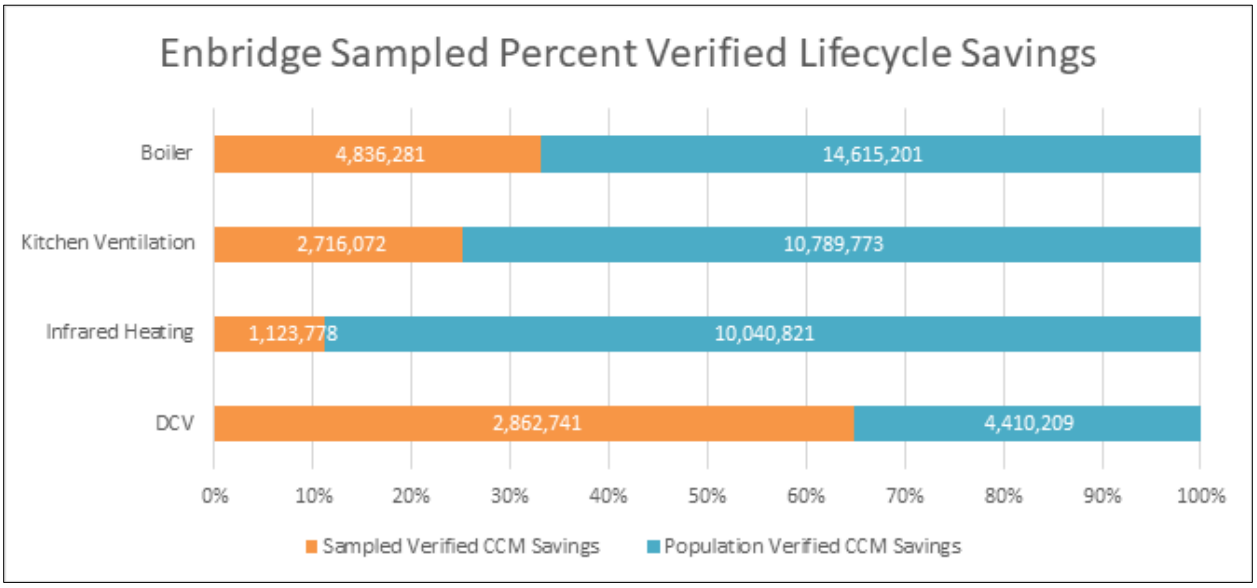
	Total Pop			Target	Completed				Not Completed	
Priority Measure Group	Number of Projects	Number of Unique Customers	Lifecycle Verified CCM of Population	Number of Projects	Number of Projects	Number of Unique Customers*	Lifecycle Verified CCM of Survey Completes	Vendor Survey Completes (# Projects) **	Attempted, Not Completed # Projects	Not Attempted # Projects
Boilers	59	34	14,615,201	31	19	13	4,836,281	0	40	0
Kitchen Ventilation	72	61	10,789,773	32	16	11	2,716,072	6	56	0
Infrared Heating	85	81	10,040,821	32	12	12	1,123,778	3	73	0
DCV	29	6	4,410,209	26	23	4	2,862,741	1	6	0
Total	245	182	39,856,003	121	70	40	11,538,872	10	175	0

* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

** A vendor can appear multiple times if their responses varied by measures, resulting in a total greater than the number of vendors interviewed.

Figure D-1 displays the proportion of sampled verified lifecycle CCM savings in relation to the population verified lifecycle CCM savings for Enbridge. NTG survey data encompasses ~35% of Boiler population savings, ~25% of Kitchen Ventilation population, ~11% of Infrared Heating population, and ~65% of DCV population savings.

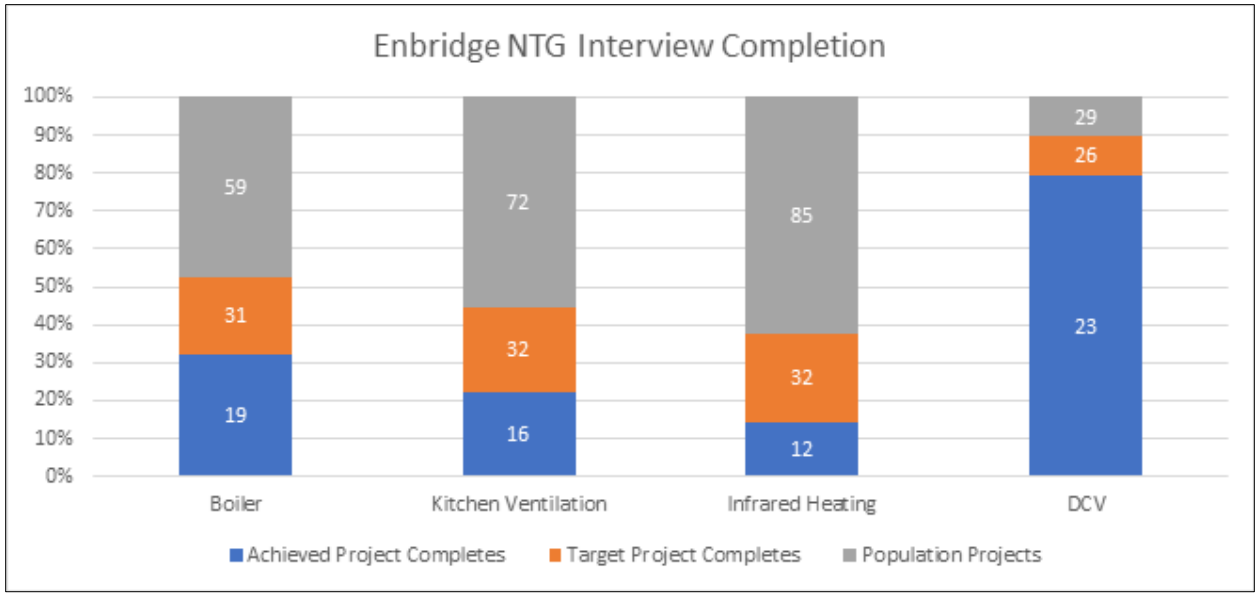
FIGURE D-1: ENBRIDGE NET-TO-GROSS SAMPLED PERCENT VERIFIED LIFECYCLE SAVINGS



In Figure D-2 the achieved NTG survey completes are compared to targets in relation to the overall population.

- The target number of completed Boilers Priority Measure Group NTG IDIs was 31, while 19 were achieved. Approximately 32% of the population of Boiler projects was sampled.
- The target number of completed Kitchen Ventilation NTG IDIs was 32, while 16 were achieved. Approximately 22% of the population of Kitchen Ventilation projects was sampled.
- The target number of completes for Infrared Heating NTG IDIs was 32, while 12 were achieved. Approximately 14% of the population of Infrared Heating projects was sampled.
- The target number of completes for DCV was 26, while 23 were achieved. Approximately 80% of the population of DCV projects was sampled.

FIGURE D-2: ENBRIDGE NET-TO-GROSS INTERVIEW COMPLETION



* Note that the project counts in the figure above are cumulative, where the top value includes the counts of the bottom value.

D.2 ENBRIDGE NET-TO-GROSS RATIOS

Table D-2 summarizes Enbridge NTG ratios along with confidence interval and absolute precision statistics. The free-ridership ratio is 70% for the Boilers measure group, 38% for the Kitchen Ventilation measure group, and 89% for the Infrared Heating measure group, and 92% for the DCV measure group. Based on the participant IDIs, Itron found no evidence of spillover. Therefore, the NTG ratios are 30%, 62%, 11%, and 8% respectively for Boilers, Kitchen Ventilation, Infrared Heating, and DCV.

Absolute precisions are calculated with finite population correction (FPC), and without FPC[14]. The absolute precisions with FPC are 17%, 24%, 9%, and 13% respectively for Boilers, Kitchen Ventilation, Infrared Heating, and DCV. The absolute precisions without FPC are 21%, 26%, 10%, and 21% respectively for Boilers, Kitchen Ventilation, Infrared Heating, and DCV.

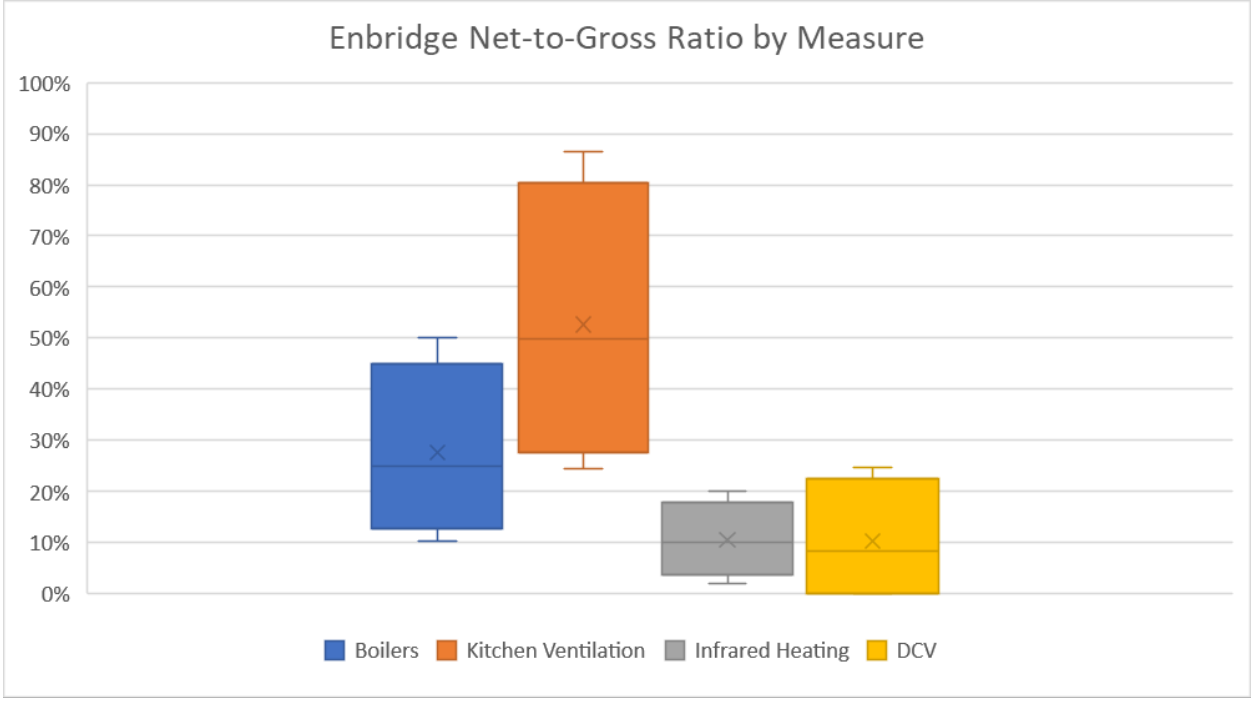
TABLE D-2: ENBRIDGE NET-TO-GROSS RESULTS

Priority Measure Group	Free Ridership Rate	Spillover	NTGR	90% Confidence Interval			Absolute Precision (w/ FPC) (+/-)	Absolute Precision (w/o FPC) (+/-)
			= [(1-FR) + SO]	+/-	Lower Bound	Upper Bound		
Boilers	70%	0%	**30%**	20%	10%	50%	17%	21%
Kitchen Ventilation	38%	0%	**62%**	24%	38%	86%	24%	26%
Infrared Heating	89%	0%	**11%**	9%	2%	20%	9%	10%
DCV	92%	0%	**8%**	17%	0%	25%	13%	21%

The NTG ratios along with their confidence intervals are presented in Figure D-3, which displays the results at 90% confidence, meaning that the probability that the true NTGR is within the confidence interval range is 90%. Unlike the variation seen with the gross realization rates, the variation seen with the NTGR are higher due to the larger range of customer responses regarding program influence. For example, the variation seen with infrared heating interview responses is lower than the variation of interview responses for other measures. This indicates that customers generally had similar interview responses, where the NTGR for each project remained +/- 9% within the average NTGR value of 8%.

[14] Results from this study with FPC will be applied to the lost revenue calculations for the 2017 program. Those without FPC will be applied to future study year shareholder incentive and lost revenue calculations.

FIGURE D-3: ENBRIDGE NET-TO-GROSS RESULTS



The breakdown of the components of the NTG score is summarized below in Table D-3. Not all measures have the efficiency component Only customers with Boiler projects were asked the efficiency questions.

Of the sampled group of projects, 47% responded that timing, efficiency, and quantity had no influence on their decision to purchase the equipment under the Enbridge Prescriptive Program. Of the remaining 53%, 89% indicated that they were influenced by timing, and 24% indicated that they were influenced by quantity. Of the Boilers Priority Measure Group respondents that were asked the efficiency question, 16% indicate that efficiency was a factor of influence.

TABLE D-3: ENBRIDGE TEQ OVERVIEW

Timing	Efficiency*	Quantity	Customers**	Projects
YES	YES	YES	0	0
YES	YES	NO	2	2
YES	NO	YES	0	0
YES	NO	NO	2	4
NO	YES	YES	0	0
NO	YES	NO	1	1
NO	NO	YES	1	3
NO	NO	NO	7	9
YES	NA	YES	2	6
YES	NA	NO	10	21
NO	NA	YES	0	0
NO	NA	NO	15	24
Total			**40**	**70**

* Efficiency levels not asked for all measures.

** A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

An overview of the Enbridge timing, efficiency, and quantity data collection responses are listed below in Table D-4, Table D-5, and Table D-6 respectively. Detailed results by Priority Measure Group are presented in the subsequent tables (Table D-7 through Table D-15).

Based on table values, Enbridge had the most impact on helping customers accelerate their purchases, increasing the scope of the project, or right-sizing the equipment, while Enbridge had much less impact on the efficiency of the equipment.

Of the technologies Enbridge influenced, Kitchen Ventilation had a substantial number of sampled projects that were influenced by timing, and quantity, where ~38% of sampled projects would not have taken place at all without the influence of the program (full attribution). Regarding the timing question, ~42% of infrared heaters, and ~52% of DCV sampled projects would have installed the equipment at a later time without the program. The Boilers Priority Measure Group did not show as much influence as the other measure groups in regard to the timing question, where only ~26% of sampled projects were accelerated.

TABLE D-4: ENBRIDGE TIMING OVERVIEW

Dat1a. Without the utility, how different would the timing have been?

Dat1b. Approximately how many months later?

Dat1a	Dat1b	Customers*	Projects	Timing Attribution
Same Time	NA	24	37	None

Later	Months (Cap at 48 mo.)	11	23	0-4 (mo. Converted to years)
	Don't Know/ Refused	2	3	Timing Attribution of avg. of DAT1b
Never	NA	2	6	Full
Don't Know/Refused	NA	1	1	Timing Attribution of avg. of DAT1a

* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

TABLE D-5: ENBRIDGE EFFICIENCY OVERVIEW

Dat2a. Without the utility, would you have installed the same, higher, or lower efficiency?

Dat2b. Without the utility, what efficiency would you have installed?

Dat2a	Dat2b	Customers*	Projects	Efficiency Attribution
Same	NA	10	16	None
Lower	Standard Efficiency	3	3	Full
	Between Standard and High	0	0	Half
	Don't know / Refused	0	0	Average of Dat2b
Don't Know/Refused	NA	0	0	Average of Dat2a
Not Applicable	NA	27	51	Not Asked

* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

TABLE D-6: ENBRIDGE QUANTITY OVERVIEW

Dat3a. Without the utility, how different would the quantity/size have been?

Dat3b. By what percentage did you change the amount installed because of the utility?

Dat3a	Dat3b	Customers*	Projects	Quantity Attribution
Same	NA	30	52	None
Less	% Less	2	4	(% Less)/(1 + % Less)
	Don't know / Refused	2	3	Average of DAT3a
More	% More	1	2	% More
	Don't know / Refused	2	2	Average of DAT3a
None	NA	2	6	Full
Don't Know/Refused	NA	1	1	Average of DAT3
Not Applicable	NA	0	0	Not Asked

* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

D.2.1 Enbridge Boilers: Timing, Efficiency, Quantity Response Summary

TABLE D-7: TIMING ENBRIDGE BOILERS

Dat1a. Without the utility, how different would the timing have been?

Dat1b. Approximately how many months later?

Dat1a	Dat1b	Customers*	Projects	Timing Attribution
Same Time	NA	9	13	None
Later	Months (Cap at 48 mo.)	3	5	0-4 (mo. Converted to years)
	Don't Know/ Refused	0	0	Timing Attribution of avg. of DAT1b
Never	NA	0	0	Full
Don't Know/Refused	NA	1	1	Timing Attribution of avg. of DAT1a

* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

TABLE D-8: EFFICIENCY ENBRIDGE BOILERS

Dat2a. Without the utility, would you have installed the same, higher, or lower efficiency?

Dat2b. Without the utility, what efficiency would you have installed?

Dat2a	Dat2b	Customers*	Projects	Efficiency Attribution
Same	NA	10	16	None
Lower	Standard Efficiency	3	3	Full
	Between Standard and High	0	0	Half
	Don't know / Refused	0	0	Average of Dat2b
Don't Know/Refused	NA	0	0	Average of Dat2a
Not Applicable	NA	0	0	Not Asked

* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

TABLE D-9: QUANTITY ENBRIDGE BOILERS

Dat3a. Without the utility, how different would the quantity/size have been?

Dat3b. By what percentage did you change the amount installed because of the utility?

Dat3a	Dat3b	Customers*	Projects	Quantity Attribution
Same	NA	11	15	None
Less	% Less	1	3	(% Less)/(1 + % Less)
	Don't know / Refused	0	0	Average of DAT3a
More	% More	0	0	% More
	Don't know / Refused	1	1	Average of DAT3a
None	NA	0	0	Full
Don't Know/Refused	NA	0	0	Average of DAT3
Not Applicable	NA	0	0	Not Asked

* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

D.2.2 Enbridge Kitchen Ventilation: Timing, Quantity Response Summary

TABLE D-10: TIMING ENBRIDGE KITCHEN VENTILATION

Dat1a. Without the utility, how different would the timing have been?
Dat1b. Approximately how many months later?

Dat1a	Dat1b	Customers*	Projects	Timing Attribution
Same Time	NA	6	6	None
Later	Months (Cap at 48 mo.)	1	1	0-4 (mo. Converted to years)
	Don't Know/ Refused	2	3	Timing Attribution of avg. of DAT1b
Never	NA	2	6	Full
Don't Know/Refused	NA	0	0	Timing Attribution of avg. of DAT1a

* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

TABLE D-11: QUANTITY ENBRIDGE KITCHEN VENTILATION

Dat3a. Without the utility, how different would the quantity/size have been?
Dat3b. By what percentage did you change the amount installed because of the utility?

Dat3a	Dat3b	Customers*	Projects	Quantity Attribution
Same	NA	7	7	None
Less	% Less	0	0	(% Less)/(1 + % Less)
	Don't know / Refused	1	2	Average of DAT3a
More	% More	0	0	% More
	Don't know / Refused	1	1	Average of DAT3a
None	NA	2	6	Full
Don't Know/Refused	NA	0	0	Average of DAT3
Not Applicable	NA	0	0	Not Asked

* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

D.2.3 Enbridge Infrared Heating: Timing, Quantity Response Summary

TABLE D-12: TIMING ENBRIDGE INFRARED HEATING

Dat1a. Without the utility, how different would the timing have been?

Dat1b. Approximately how many months later?

Dat1a	Dat1b	Customers*	Projects	Timing Attribution
Same Time	NA	7	7	None
Later	Months (Cap at 48 mo.)	5	5	0-4 (mo. Converted to years)
	Don't Know/ Refused	0	0	Timing Attribution of avg. of DAT1b
Never	NA	0	0	Full
Don't Know/Refused	NA	0	0	Timing Attribution of avg. of DAT1a

* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

TABLE D-13: QUANTITY ENBRIDGE INFRARED HEATING

Dat3a. Without the utility, how different would the quantity/size have been?

Dat3b. By what percentage did you change the amount installed because of the utility?

Dat3a	Dat3b	Customers*	Projects	Quantity Attribution
Same	NA	9	9	None
Less	% Less	1	1	(% Less)/(1 + % Less)
	Don't know / Refused	1	1	Average of DAT3a
More	% More	0	0	% More
	Don't know / Refused	0	0	Average of DAT3a
None	NA	0	0	Full
Don't Know/Refused	NA	1	1	Average of DAT3
Not Applicable	NA	0	0	Not Asked

* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

D.2.4 Enbridge DCV: Timing, Quantity Response Summary

TABLE D-14: TIMING ENBRIDGE DCV

Dat1a. Without the utility, how different would the timing have been?

Dat1b. Approximately how many months later?

Dat1a	Dat1b	Customers*	Projects	Timing Attribution
Same Time	NA	2	11	None
Later	Months (Cap at 48 mo.)	2	12	0-4 (mo. Converted to years)
	Don't Know/ Refused	0	0	Timing Attribution of avg. of DAT1b
Never	NA	0	0	Full
Don't Know/Refused	NA	0	0	Timing Attribution of avg. of DAT1a

* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

TABLE D-15: QUANTITY ENBRIDGE DCV

Dat3a. Without the utility, how different would the quantity/size have been?

Dat3b. By what percentage did you change the amount installed because of the utility?

Dat3a	Dat3b	Customers*	Projects	Quantity Attribution
Same	NA	3	21	None
Less	% Less	0	0	(% Less)/(1 + % Less)
	Don't know / Refused	0	0	Average of DAT3a
More	% More	1	2	% More
	Don't know / Refused	0	0	Average of DAT3a
None	NA	0	0	Full
Don't Know/Refused	NA	0	0	Average of DAT3
Not Applicable	NA	0	0	Not Asked

* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

D.3 ENBRIDGE INDIRECT INFLUENCE

D.3.1 Vendor to Participant Influence

The decision to pursue a vendor interview is dependent on participant questions VT1 and VT2. VT1, VT2, and VT3 are the participant's scores for upselling, price, and other influence respectively. Combined, all three scores total to 100%. VT1, VT2, and VT3 ask the following:

> Now, I am going to ask you some questions about factors that influenced your decision-making process. If you were to allocate 100 points among the various factors that influenced your decision to install the equipment you did, how many 'influence points' would you give to:

- VT1. <Vendor> recommendation regarding equipment selection?
  - VT1a. What specific recommendations did <Vendor> provide that influenced your decision to purchase the equipment?
- VT2. Price of the equipment
  - VT2x. I would like to get a sense of your price sensitivity for the equipment. Let's say the project would have cost <20% vendor rebate in dollars> more, would you have still done it? What about <40% vendor rebate in dollars>? What about <60% vendor rebate in dollars>? <80% vendor rebate in dollars>? <100% vendor rebate in dollars>?
- VT3. All other influences
  - VT3a. What other factors influenced your decision to purchase the equipment?

How Participants Trigger Vendor Interviews

When the sum points of VT1 and VT2 are greater than 50%, given that VT1>0 and/or VT2x is valid (participant indicates that the additional amount they would spend on the equipment is equal to or less than the vendor rebate), then that vendor is given priority to be contacted for an interview.

These vendors are prioritized by being the first group of vendors to dial, with more allotted calling attempts (6 attempts). Participants that allocate VT1+VT2 with less points are also contacted after the high priority vendors are contacted.

Vendors with participant VT1+VT2 scores ranked less than 30% were generally not contacted, unless those vendors happened to overlap with a vendor of a different customer with a high score. Vendor interviews were scheduled after the NTG IDI is completed. Also, if the participant NTG ratio was already 1.0, then the vendor was not contacted for an interview.

Distribution of Participant Responses on Upselling and Price (VT1 & VT2)

The distribution of VT1 and VT2 responses are displayed in Table D-16 and Table D-17. Of VT1 upselling responses, 92% of sampled projects allocate 50% or less points to upselling.

TABLE D-16: ENBRIDGE CUSTOMER DISTRIBUTION OF VT1, VT2, & VT3 POINT ALLOCATION

	VT1	VT2	VT3
0-10%	7	5	15
11-20%	4	3	8
21-30%	6	10	5
31-40%	5	11	3
41-50%	9	9	8
51-60%	6	0	1
61-70%	0	1	0
71-80%	1	1	0
81-90%	0	0	0
91-100%	2	0	0
Total Customers	**40**	**40**	**40**

TABLE D-17: PERCENT OF SAVINGS OF ENBRIDGE PROJECTS WITH VENDOR TO PARTICIPANT INFLUENCE (VT1)

	% Energy Savings Influenced by Vendor
Fully Influenced (VT1 100%)	2%
High Influence (VT1 76-99%)	2%
Moderate Influence (VT1 51-75%)	4%
Low Influence (VT1 1-50%)	64%
No Influence (VT1 0%)	28%

In order to receive price attribution, the additional amount that the customer would spend on the energy efficient equipment must be less than the amount of vendor rebate that the vendor passes to the customer. Once these criteria are met, the price attribution is VT2, the amount of points the participant allocates to price.

The following eight customers represented in Table D-18 indicated that the additional amount they would spend was equal to or less than the vendor rebate. The vendors for these customers were given high priority contact for an interview. However, if there was no vendor, or the participant already received full attribution from the TEQ score, then the vendor was not contacted.

TABLE D-18: ENBRIDGE VT2 PRICE RESPONSES

Questions to customers:				
If you were to allocate 100 points among the various factors that influenced your decision to install the equipment you did, how many 'influence points' would you give to:				
VT1. <Vendor> recommendation regarding equipment selection?				
VT2. Price of the equipment				
VT3. Other				
VT2	**Customers***	**Average Vendor Rebate ($)**	**Avg Additional Amount Customer Would Spend ($)**	**Average VT1 Score**
0-20%	1	200	160	0.8
21-40%	6	415	220	0.44
41-60%	1	100	20	0.5
61-80%	0	-	-	-
81-100%	0	-	-	-

D.3.2 Utility to Vendor Influence

Vendor Surveys Data Collection

Ten Enbridge vendors completed interviews representing 14 projects. There were five participants that did not purchase program qualifying equipment through a vendor. Twenty vendors were contacted without success. Five vendors were not contacted.

TABLE D-19: ENBRIDGE VENDOR SURVEY DATA COLLECTION – COMPLETES

	# Vendors	# Projects
Completed	10	14

There were five vendors where Itron did not attempt an interview due to varying reasons such as participant score being 1.0, or if the VT1+VT2 scores were <30%, or due to the timing of the interview. Table D-20 provides the summary of the data collection disposition of vendor surveys that we could not complete.

TABLE D-20: ENBRIDGE VENDOR SURVEY DATA COLLECTION – NOT COMPLETED

	No Vendor	Attempted, Not Completed # Vendors in Participant Sample	Not Attempted # Vendors in Participant Sample
Not Completed	5	20	5

Vendor Survey Questions & Responses

A vendor interview is triggered if a customer reports that the vendor recommendation(upselling) or price had influenced their decision (Indirect path B). Then, the vendor is also asked questions regarding upselling and price (Indirect path A). Indirect attribution from both path A and path B are used in the final indirect attribution score.

Upselling

Upselling refers to the influence of the vendor on the customer due to the vendor's recommendation to consider program qualifying equipment over other options, like less efficiency equipment or doing nothing at all, in the case of add-on measures. If the customer allocates any points to upselling, the customer is asked to explain the recommendations the vendor provided to assist their decision. If the vendor interview is triggered, the following questions are asked of the vendor:

3. U2: "In situations where you are selling <project_n>, about what percent of the time are you recommending the high-efficiency equipment?"
4. U4: "For <project_n> measure, what percent of the time would you recommend the high-efficiency equipment option without the program?"

Price

The purpose of this question is to see if any vendor rebate passed onto the customer has an influence on the customer's decision to participate in the program. If the customer allocates any points to pricing, follow up questions are asked, where the customer must identify if their involvement in the project would change due to increase in cost by incremental amounts of the vendor incentive – either by 20%, 40%, 60%, 80% or 100% of the vendor incentive.

If the vendor interview is triggered, then the vendor is asked the following question:

2. P5: "On average, what percent of the rebate is passed on to the buyer for <project_n>, either directly or indirectly?"

The responses of ten participants with vendors that completed an interview are listed in Table D-21. Five of the ten participants received positive vendor attribution scores, with one participant receiving a score of 1.0. Only one score received price attribution, while the source of the other scores were from upselling.

TABLE D-21: ENBRIDGE VENDOR COMPLETES RESPONSES AND RESULTS

Questions to customers:
If you were to allocate 100 points among the various factors that influenced your decision to install the equipment you did, how many 'influence points' would you give to:
VT1. <Vendor> recommendation regarding equipment selection?
VT2. Price of the equipment
VT3. Other
Questions to vendors:
U2: "In situations where you are selling <project_n>, about what percent of the time are you recommending the high-efficiency equipment?"
U4: "For <project_n> measure, what percent of the time would you recommend the high-efficiency equipment option without the program?
P5: "On average, what percent of the rebate is passed on to the buyer for <project_n>, either directly or indirectly ?"

Priority Measure Group	VT1.	VT2.	U2	U4	P5	Upselling Attribution (VT1 * (U2-U4)/U4)	Price Attribution (if P5 * Vendor Rebate > Amt more cust would pay, then VT2)	Vendor Indirect Attribution
Kitchen Ventilation	1	0	1	0	1	1	0	1
Kitchen Ventilation	0.5	0.3	0.8	0.5	NA	0.1875	0	0.1875
Infrared	0.6	0.3	1	1	1	0	0.3	0.3
Kitchen Ventilation	0.25	0.5	1	0	1	0.25	0	0.25
Kitchen Ventilation	0.5	0.3	1	1	0	0	0	0
DCV	0.2	0.2	0.8	1	NA	0	0	0
Kitchen Ventilation	0.5	0.5	0.1	0.1	REF	0	0	0
Infrared	0.1	0.4	0	0	DK	0	0	0
Infrared	0.6	0	0.5	0.5	0	0	0	0
Kitchen Ventilation	0.2	0.3	0.8	0.5	NA	0.075	0	0.075

D.4 ENBRIDGE SPILLOVER

Participants were asked the spillover battery of questions, of which the responses for five participants indicated possible spillover. Upon further inquiries (based on the skip patterns in the survey guide), it was evident that none of the spillover responses were indicative of actual spillover. This was either due to the participants receiving (or being in the process of applying for) an incentive for a completed measure(s), or due to them indicating that participating in the 2017 C&I prescriptive program had no influence on their pursuit of the completed measure(s). None of these five participants needed an engineer's call-back to quantify the effect of spillover.

Only one respondent indicated that they did not receive any incentives for a completed measure, triggering both inside and outside spillover probes. When asked about the likelihood of pursuing this additional energy efficiency measure, the customer responded, "very likely", which implied an attribution

factor=0.00 for participant spillover; therefore, we did not pursue a call-back to quantify the effect of spillover for this respondent.

Attribution of claimed spillover is based on the following question: "If you had not made the earlier energy-efficiency improvements I just listed, how likely would you have been to make this additional energy efficiency improvement?"

The Attribution Factor is assigned in the following way:

1. Not likely at all- Attribution Factor=1.00
2. Not very likely- Attribution Factor=0.90
3. Somewhat likely- Attribution Factor=0.55
4. Very likely- Attribution Factor=0.00

Spillover Savings = Estimate Spillover Measure Savings X Attribution Factor

The findings from spillover battery are provided below in Table D-22 for inside spillover responses and in Table D-23 for outside spillover responses.

TABLE D-22: ENBRIDGE INSIDE SPILLOVER RESPONSES

Enbridge Program with Incentive	Incentive Through Electric Utility	Not a Source of Spillover	Action Inside Spillover	Timing Inside Spillover	Incentive Inside Spillover	Source Inside Spillover	Score Inside Spillover
1	0	0	HVAC and Boiler	2017	Yes	Enbridge	2
0	1	0	Lighting	2018	Yes	Electric Utility	4
0	1	0	HVAC	2018	Yes	Electric Utility	4
1	0	0	Boiler	2018	In progress	Enbridge	4
0	0	1	Envelope	2017	No		NA

TABLE D-23: ENBRIDGE OUTSIDE SPILLOVER RESPONSES

Enbridge Program with Incentive	Incentive Through Electric Utility	Not a Source of Spillover	Action Outside Spillover	Timing Outside Spillover	Incentive Outside Spillover	Source Outside Spillover	Score Outside Spillover
1	0	0	DCKV	2018	Yes	Enbridge	0
0	0	1	Water Conservation				0
1	0	0	Envelope	2018	In progress	Enbridge	NA
0	0	1	Envelope	2017	No		NA

APPENDIX E — UNION GROSS IMPACT REPORTS

E.1 BOILERS

Union_Boilers_Final.pdf

E.2 ENERGY RECOVERY VENTILATION

Union_ERV_Final.pdf

E.3 INFRARED HEATING

Union_Infrared Heating_Final.pdf

E.4 AIR CURTAINS

Union_Air Curtains_Final.pdf

APPENDIX F – UNION NTG STUDY DETAILS

F.1 UNION NET-TO-GROSS DATA COLLECTION

The Net-to-Gross analysis for Union was conducted for the following four Priority Measure Groups:

- Boilers
- ERV
- Infrared Heating
- Air Curtains

The number targeted completes for Union NTG data collection (146) was determined using a 90/10 relative precision with a CoV of 0.8, as detailed on pages 2-24 and 2-25 of the embedded workplan in Appendix A. Due to lower than expected response rates, a total of 127 of the targeted 146 projects completed NTG interviews.

Some customers represented multiple projects. The 127 completed NTG interviews entailed 100 customers. Of the data collection not completed, 130 projects attempted a NTG interview without success, while dialing was not attempted on 255 boiler and infrared heating projects.

The verified lifecycle savings of projects with completed NTG data collection represents at total of 37,018,493 CCM, which is approximately 20% of total population savings in 2017, on a lifecycle CCM basis.

Across all four Union Priority Measure Groups, vendors for 25 projects completed a vendor NTG survey. Table F-1 summarizes Union NTG data collection.

TABLE F-1: UNION NET-TO-GROSS DATA COLLECTION

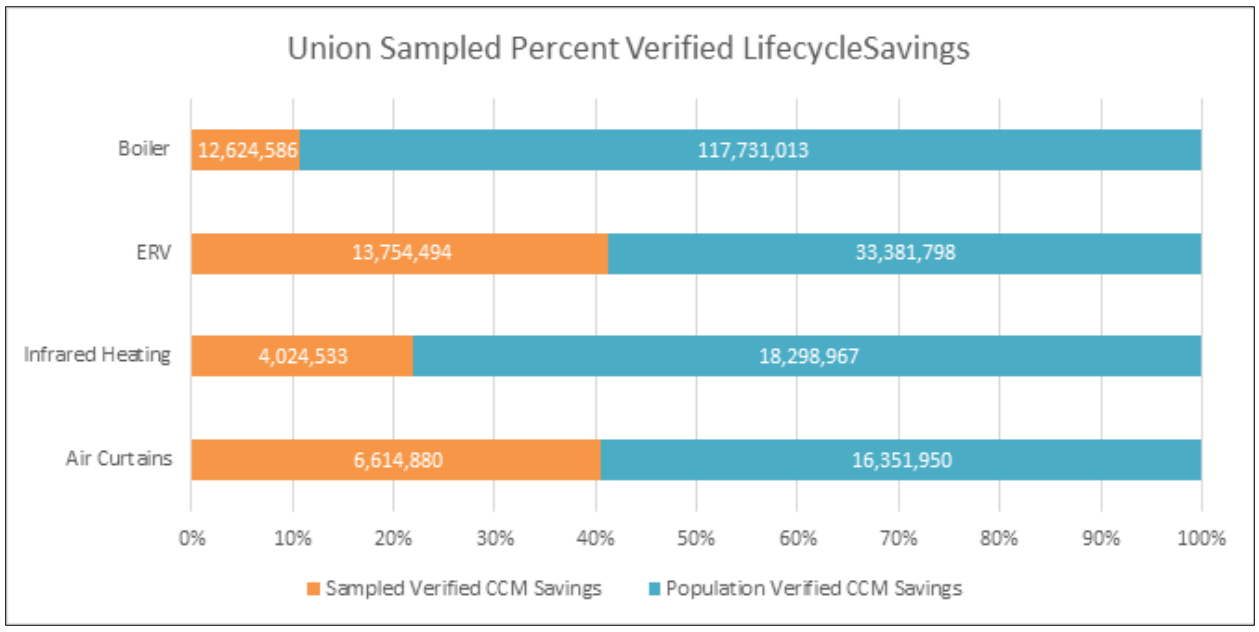
	Total Pop			Target	Completed				Not Completed	
Priority Measure Group	Number of Projects	Number of Unique Customers	Lifecycle Verified CCM of Population	Number of Projects	Number of Projects	Number of Unique Customers*	Lifecycle Verified CCM of Survey Completes	Vendor Survey Completes (# Projects)**	Attempted, Not Completed # Projects	Not Attempted # Projects
Boiler	380	350	117,731,013	44	41	32	12,624,586	5	63	276
ERV	53	49	33,381,798	40	45	30	13,754,494	11	8	0
Infrared Heating	184	179	18,298,967	43	28	28	4,024,533	5	34	122
Air Curtains	28	26	16,351,950	19	13	10	6,614,880	4	15	0
Total	645	604	185,763,728	146	127	100	37,018,493	25	120	398

* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

** A vendor can appear multiple times if their responses varied by measures, resulting in a total greater than the number of vendors interviewed.

Figure F-1 displays the proportion of sampled verified lifecycle CCM savings in relation to the population verified lifecycle CCM savings for Union. NTG survey data encompasses ~11% of Boiler population savings, ~41% of ERV population savings, ~22% of Infrared Heating population savings, and ~40% of Air Curtain population savings.

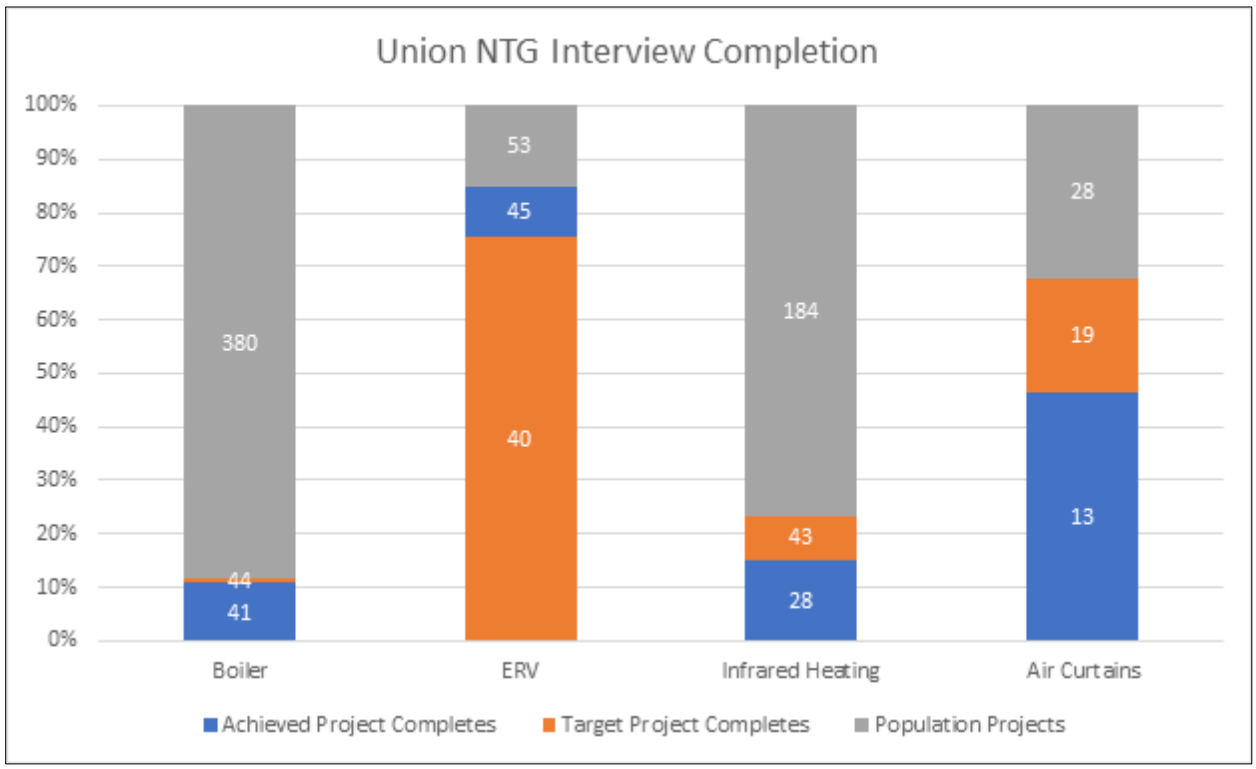
FIGURE F-1: UNION NET-TO-GROSS SAMPLED PERCENT VERIFIED LIFECYCLE SAVINGS



In Figure F-2, the achieved NTG survey completes are compared to targets in relation to the overall population.

- The target number of completed Boiler surveys was 44, while 41 were achieved. Approximately 11% of the population of Boiler projects was sampled.
- The target number of completed ERV surveys was 40, while 45 were achieved. Approximately 85% of the population of ERV projects was sampled.
- The target number of completed Infrared Heating surveys was 43, while 28 were achieved. Approximately 15% of the population of Infrared Heating projects was sampled.
- The target number of completed Air Curtain surveys was 19, while 13 were achieved. Approximately 50% of the population of Air Curtain projects was sampled.

FIGURE F-2: UNION NET-TO-GROSS INTERVIEW COMPLETION



*Note that the project counts in the figure above are cumulative, where the top value includes the counts of the bottom value.

F.2 UNION NET-TO-GROSS RATIOS

Table F-2 summarizes Enbridge NTG ratios along with confidence interval and absolute precision statistics. The free-ridership ratio is 76% for Boilers measure group, 70% for the ERV measure group, 93% for the Infrared Heating measure group, and 50% for the Air Curtains measure group. Based on the participant

IDIs, no evidence of spillover was found in the analysis. Therefore, the Net-to-Gross ratios are 24%, 30%, 7%, and 50% respectively for Boilers, ERV, Infrared Heating, and Air Curtains.

Absolute precisions are calculated with and without FPC[15]. The absolute precisions with the FPC are 9%, 8%, 6%, and 19% respectively for Boilers, ERV, Infrared Heating, and Air Curtains. The absolute precisions without the FPC are 9%, 13%, 6%, and 24% respectively for Boilers, ERV, Infrared Heating, and Air Curtains.

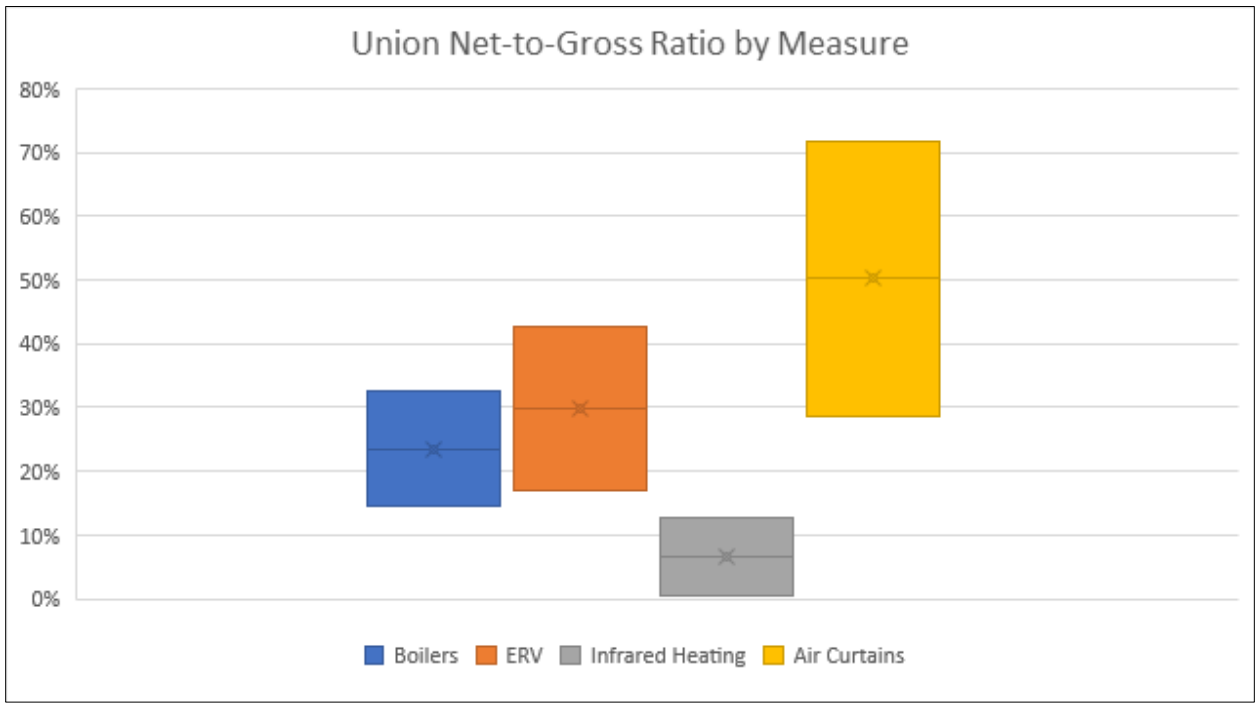
TABLE F-2: UNION NET-TO-GROSS RESULTS

Priority Measure Group	Free Ridership Rate	Spillover	NTGR	90% Confidence Interval			Absolute Precision (w/ FPC) (+/-)	Absolute Precision (w/o FPC) (+/-)
			= [(1-FR) + SO]	+/-	Lower Bound	Upper Bound		
Boilers	76%	0%	**24%**	9%	15%	32%	9%	9%
ERV	70%	0%	**30%**	13%	17%	43%	8%	13%
Infrared Heating	93%	0%	**7%**	6%	1%	13%	6%	6%
Air Curtains	50%	0%	**50%**	22%	29%	72%	19%	24%

The Net-To-Gross results along with their confidence intervals are presented in Figure F-3, which displays the results at 90% confidence, meaning that the probability that the true NTGR is within the confidence interval range is 90%. Unlike the variation seen with the gross realization rates, the variation seen with the NTGR are higher due to the larger range of customer responses regarding program influence. For example, the variation seen with infrared heating interview responses is lower than the variation of interview responses for other measures. This indicates that customers generally had similar interview responses, where the NTGR for each project remained +/- 6% within the average NTGR value of 7%.

[15] Results from this study with FPC will be applied to the lost revenue calculations for the 2017 program. Those without FPC will be applied to future study year shareholder incentive and lost revenue calculations.

FIGURE F-3: UNION NET-TO-GROSS RESULTS



The breakdown of the components of the NTG score is summarized below in Table F-3. Not all measures have the efficiency component on a bracketed basis (i.e., providing actual range of values). Only customers with Boilers and some ERV projects were asked the bracketed efficiency questions.

Of the sampled group of projects, 60% responded that timing, efficiency, and quantity had no influence on their decision to purchase the equipment under the Union Prescriptive Program. Of the remaining 40%, 78% indicate that they were influenced by timing, and 8% indicate that they were influenced by quantity. Of the Boilers and ERV Priority Measure Group respondents that were asked the efficiency question that had program influence, 26% indicate that efficiency was a factor of influence.

TABLE F-3: UNION TEQ OVERVIEW

Timing	Efficiency*	Quantity	Customers**	Projects
YES	YES	YES	1	1
YES	YES	NO	6	7
YES	NO	YES	1	1
YES	NO	NO	11	16
NO	YES	YES	0	0
NO	YES	NO	7	11
NO	NO	YES	0	0
NO	NO	NO	30	38
YES	NA	YES	2	2
YES	NA	NO	10	13
NO	NA	YES	0	0
NO	NA	NO	32	38
Total			**100**	**127**

* Efficiency not asked for all measures.

** A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

An overview of the Union timing, efficiency, and quantity data collection responses are listed below in Table F-4, Table F-5, and Table F-6, respectively. Detailed results by Priority Measure Group are presented in the subsequent tables (Table F-7 through Table F-16). Based on table values, Union influenced ~27% of sampled projects overall with regards to timing, ~15% of sampled projects in regard to efficiency, and ~10% of sampled projects with regards to quantity. Boilers and air curtains were influenced the most by Union. Regarding the timing question, ~46% of boilers, and ~69% of air curtain sampled projects would have installed the equipment at a later time without the program.

TABLE F-4: UNION TIMING OVERVIEW

Dat1a. Without the utility, how different would the timing have been?

Dat1b. Approximately how many months later?

Dat1a	Dat1b	Customers*	Projects	Timing Attribution
Same Time	NA	69	87	None
Later	Months (Cap at 48 mo.)	16	20	0-4 (mo. Converted to years)
	Don't Know/ Refused	3	3	Timing Attribution of avg. of DAT1b
Never	NA	7	11	Full
Don't Know/Refused	NA	5	6	Timing Attribution of avg. of DAT1a

* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

TABLE F-5: UNION EFFICIENCY OVERVIEW

Dat2a. Without the utility, would you have installed the same, higher, or lower efficiency?

Dat2b. Without the utility, what efficiency would you have installed?

Dat2a	Dat2b	Customers*	Projects	Efficiency Attribution
Same	NA	36	46	None
Lower	Standard Efficiency	4	5	Full
	Between Standard and High	4	5	Half
	Don't know / Refused	6	9	Average of Dat2b
Don't Know/Refused	NA	6	9	Average of Dat2a
Not Applicable	NA	44	53	Not Asked

TABLE F-6: UNION QUANTITY OVERVIEW

Dat3a. Without the utility, how different would the quantity/size have been?

Dat3b. By what percentage did you change the amount installed because of the utility?

Dat3a	Dat3b	Customers*	Projects	Quantity Attribution
Same	NA	79	99	None
Less	% Less	5	6	(% Less)/(1 + % Less)
	Don't know / Refused	3	3	Average of DAT3a
More	% More	3	3	% More
	Don't know / Refused	0	0	Average of DAT3a
None	NA	1	1	Full
Don't Know/Refused	NA	9	15	Average of DAT3
Not Applicable	NA	0	0	Not Asked

* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

F.2.1 Union Boilers: Timing, Efficiency, Quantity Response Summary

TABLE F-7: TIMING UNION BOILERS

Dat1a. Without the utility, how different would the timing have been?
Dat1b. Approximately how many months later?

Dat1a	Dat1b	Customers*	Projects	Timing Attribution
Same Time	NA	20	27	None
Later	Months (Cap at 48 mo.)	8	9	0-4 (mo. Converted to years)
	Don't Know/ Refused	1	1	Timing Attribution of avg. of DAT1b
Never	NA	2	3	Full
Don't Know/Refused	NA	1	1	Timing Attribution of avg. of DAT1a

* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

TABLE F-8: EFFICIENCY UNION BOILERS

Dat2a. Without the utility, would you have installed the same, higher, or lower efficiency?
Dat2b. Without the utility, what efficiency would you have installed?

Dat2a	Dat2b	Customers*	Projects	Efficiency Attribution
Same	NA	22	26	None
Lower	Standard Efficiency	0	0	Full
	Between Standard and High	2	2	Half
	Don't know / Refused	3	5	Average of Dat2b
Don't Know/Refused	NA	5	8	Average of Dat2a
Not Applicable	NA	0	0	Not Asked

*A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

TABLE F-9: QUANTITY UNION BOILERS

Dat3a. Without the utility, how different would the quantity/size have been?
Dat3b. By what percentage did you change the amount installed because of the utility?

Dat3a	Dat3b	Customers*	Projects	Quantity Attribution
Same	NA	26	32	None
Less	% Less	2	3	(% Less)/(1 + % Less)
	Don't know / Refused	0	0	Average of DAT3a
More	% More	0	0	% More
	Don't know / Refused	0	0	Average of DAT3a
None	NA	0	0	Full
Don't Know/Refused	NA	3	5	Average of DAT3
Not Applicable	NA	1	1	Not Asked

* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

F.2.2 Union ERV: Timing, Efficiency, Quantity Response Summary

TABLE F-10: TIMING UNION ERV

Dat1a. Without the utility, how different would the timing have been?
Dat1b. Approximately how many months later?

Dat1a	Dat1b	Customers*	Projects	Timing Attribution
Same Time	NA	22	33	None
Later	Months (Cap at 48 mo.)	3	4	0-4 (mo. Converted to years)
	Don't Know/ Refused	0	0	Timing Attribution of avg. of DAT1b
Never	NA	4	7	Full
Don't Know/Refused	NA	1	1	Timing Attribution of avg. of DAT1a

* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

TABLE F-11: EFFICIENCY UNION ERV

Dat2a. Without the utility, would you have installed the same, higher, or lower efficiency?
Dat2b. Without the utility, what efficiency would you have installed?

Dat2a	Dat2b	Customers*	Projects	Quantity Attribution
Same	NA	14	20	None
Lower	Standard Efficiency	4	5	Full
	Between Standard and High	2	3	Half
	Don't know / Refused	3	4	Average of Dat2b
Don't Know/Refused	NA	1	1	Average of Dat2a
Not Applicable	NA	6	12	Not Asked

* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

TABLE F-12: QUANTITY UNION ERV

Dat3a. Without the utility, how different would the quantity/size have been?				
Dat3b. By what percentage did you change the amount installed because of the utility?				
Dat3a	**Dat3b**	**Customers***	**Projects**	**Quantity Attribution**
Same	NA	23	37	None
Less	% Less	1	1	(% Less)/(1 + % Less)
	Don't know / Refused	2	2	Average of DAT3a
More	% More	1	1	% More
	Don't know / Refused	0	0	Average of DAT3a
None	NA	1	1	Full
Don't Know/Refused	NA	1	2	Average of DAT3
Not Applicable	NA	1	1	Not Asked

* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

F.2.3 Union Infrared Heating: Timing, Quantity Response Summary

TABLE F-13: TIMING UNION INFRARED HEATING

Dat1a. Without the utility, how different would the timing have been?				
Dat1b. Approximately how many months later?				
Dat1a	**Dat1b**	**Customers***	**Projects**	**Timing Attribution**
Same Time	NA	25	25	None
Later	Months (Cap at 48 mo.)	0	0	0-4 (mo. Converted to years)
	Don't Know/ Refused	0	0	Timing Attribution of avg. of DAT1b
Never	NA	1	1	Full
Don't Know/Refused	NA	2	2	Timing Attribution of avg. of DAT1a

* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

TABLE F-14: QUANTITY UNION INFRARED HEATING

Dat3a. Without the utility, how different would the quantity/size have been?				
Dat3b. By what percentage did you change the amount installed because of the utility?				
Dat3a	**Dat3b**	**Customers***	**Projects**	**Quantity Attribution**
Same	NA	25	25	None
Less	% Less	1	1	(% Less)/ (1 + % Less)
	Don't know / Refused	1	1	Average of DAT3a
More	% More	0	0	% More
	Don't know / Refused	0	0	Average of DAT3a
None	NA	0	0	Full
Don't Know/Refused	NA	1	1	Average of DAT3
Not Applicable	NA	0	0	Not Asked

* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

F.2.4 Union Air Curtains: Timing, Quantity Response Summary

TABLE F-15: TIMING UNION AIR CURTAINS

Dat1a. Without the utility, how different would the timing have been?

Dat1b. Approximately how many months later?

Dat1a	Dat1b	Customers*	Projects	Timing Attribution
Same Time	NA	2	2	None
Later	Months (Cap at 48 mo.)	5	7	0-4 (mo. Converted to years)
	Don't Know/ Refused	2	2	Timing Attribution of avg. of DAT1b
Never	NA	0	0	Full
Don't Know/Refused	NA	1	2	Timing Attribution of avg. of DAT1a

* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

TABLE F-16: QUANTITY UNION AIR CURTAINS

Dat3a. Without the utility, how different would the quantity/size have been?

Dat3b. By what percentage did you change the amount installed because of the utility?

Dat3a	Dat3b	Customers*	Projects	Quantity Attribution
Same	NA	5	5	None
Less	% Less	1	1	(% Less)/(1 + % Less)
	Don't know / Refused	0	0	Average of DAT3a
More	% More	2	2	% More
	Don't know / Refused	0	0	Average of DAT3a
None	NA	0	0	Full
Don't Know/Refused	NA	2	5	Average of DAT3
Not Applicable	NA	0	0	Not Asked

* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

F.3 UNION VENDOR SURVEYS AND RESULTS

The decision to pursue a vendor interview is dependent on participant questions VT1 and VT2. VT1, VT2, and VT3 are the participant's scores for upselling, price, and other influence respectively. Combined, all three scores total to 100%. VT1, VT2, and VT3 ask the following:

> Now, I am going to ask you some questions about factors that influenced your decision-making process. If you were to allocate 100 points among the various factors that influenced your decision to install the equipment you did, how many 'influence points' would you give to:

- VT1. <Vendor> recommendation regarding equipment selection?
  - VT1a. What specific recommendations did <Vendor> provide that influenced your decision to purchase the equipment?
- VT2. Price of the equipment
  - VT2x. I would like to get a sense of your price sensitivity for the equipment. Let's say the project would have cost <20% vendor rebate in dollars> more, would you have still done it? What about <40% vendor rebate in dollars>? What about <60% vendor rebate in dollars>? <80% vendor rebate in dollars>? <100% vendor rebate in dollars>?
- VT3. All other influences
  - VT3a. What other factors influenced your decision to purchase the equipment?

How Participants Trigger Vendor Interviews

When the sum points of VT1 and VT2 are greater than 50%, given that VT1>0 and/or VT2x is valid (participant indicates that the additional amount they would spend on the equipment is equal to or less than the vendor rebate), then that vendor is given priority to be contacted for an interview.

These vendors are prioritized by being the first group of vendors to dial, with more allotted calling attempts (6 attempts). Participants that allocate VT1+VT2 with less points are also contacted after the high priority vendors are contacted.

Vendors with participant VT1+VT2 scores ranked less than 30% were generally not contacted, unless those vendors happened to overlap with a vendor of a different customer with a high score. Vendor interviews were scheduled after the NTG IDI is completed. Also, if the participant NTG ratio was already 1.0, then the vendor was not contacted for an interview.

Distribution of Participant Responses on Upselling and Price (VT1 & VT2)

The distribution of VT1 and VT2 responses are displayed in Table F-17 and Table F-18. Of VT1 upselling responses, 74% of sampled projects allocate 50% or less points to upselling.

TABLE F-17: UNION CUSTOMER DISTRIBUTION OF VT1, VT2, & VT3 POINT ALLOCATION

	VT1	VT2	VT3
0-10%	16	28	49
11-20%	4	10	18
21-30%	6	24	16
31-40%	15	13	5
41-50%	23	19	5
51-60%	4	1	1
61-70%	8	0	0
71-80%	10	3	2
81-90%	3	2	1
91-100%	11	0	3
Total Customers	**100**	**100**	**100**

TABLE F-18: PERCENT OF SAVINGS OF UNION PROJECTS WITH VENDOR TO PARTICIPANT INFLUENCE (VT1)

	% Energy Savings Influenced by Vendor
Fully Influenced (VT1 100%)	8%
High Influence (VT1 76-99%)	5%
Moderate Influence (VT1 51-75%)	14%
Low Influence (VT1 1-50%)	60%
No Influence (VT1 0%)	14%

In order to receive price attribution, the additional amount that the customer would spend on the energy efficient equipment must be less than the amount of vendor rebate that the vendor passes to the customer. Once these criteria are met, the price attribution is VT2, the amount of points the participant allocates to price.

The following 15 customers represented in Table F-19 indicated that the additional amount they would spend was equal to or less than the vendor rebate. The vendors for these customers were given high priority contact for an interview. However, if there was no vendor, or the participant already received full attribution from the TEQ score, then the vendor was not contacted.

TABLE F-19: UNION VT2 PRICE RESPONSES

Questions to customers:				
If you were to allocate 100 points among the various factors that influenced your decision to install the equipment you did, how many 'influence points' would you give to:				
VT1. <Vendor> recommendation regarding equipment selection?				
VT2. Price of the equipment				
VT3. Other				
VT2	**Customers***	**Average Vendor Rebate ($)**	**Avg Additional Amount Customer Would Spend ($)**	**Average VT1 Score**
0-20%	6	400	300	0.68
21-40%	6	540	300	0.42
41-60%	2	150	130	0.48
61-80%	0	-	-	-
81-100%	1	1300	1300	0

F.3.1 Utility to Vendor Influence

Vendor Surveys Data Collection

Twenty-five Union vendors completed interviews representing 32 projects. There were five participants that did not purchase program qualifying equipment through a vendor. Fifty-four vendors were contacted without success. Fifteen vendors were not contacted.

TABLE F-20: UNION VENDOR SURVEY DATA COLLECTION – COMPLETED

	# Vendors	# Projects
Completed	25	32

There were 15 vendors where Itron did not attempt an interview due to varying reasons such as participant score being 1.0, or if the VT1+VT2 scores were <30%, or due to the timing of the interview. Table F-21 provides the summary of the data collection of vendor surveys that we could not complete.

TABLE F-21: UNION VENDOR SURVEY DATA COLLECTION – NOT COMPLETED

	No Vendor	Attempted, Not Completed # Vendors in Participant Sample	Not Attempted # Vendors in Participant Sample
Not Completed	5	54	15

Vendor Survey Questions & Responses

A vendor interview is triggered if a customer reports that the vendor recommendation(upselling) or price had influenced their decision (Indirect path B). Then, the vendor is also asked questions regarding

upselling and price (Indirect path A). Indirect attribution from both path A and path B are used in the final indirect attribution score.

Upselling

Upselling refers to the influence of the vendor on the customer due to the vendor's recommendation to consider program qualifying equipment over other options, like less efficiency equipment or doing nothing at all, in the case of add-on measures. If the customer allocates any points to upselling, the customer is asked to explain the recommendations the vendor provided to assist their decision. If the vendor interview is triggered, the following questions are asked of the vendor:

5. U2: "In situations where you are selling <project_n>, about what percent of the time are you recommending the high-efficiency equipment?"
6. U4: "For <project_n> measure, what percent of the time would you recommend the high-efficiency equipment option without the program?"

Price

The purpose of this question is to see if any vendor rebate passed onto the customer has an influence on the customer's decision to participate in the program. If the customer allocates any points to pricing, follow up questions are asked, where the customer must identify if their involvement in the project would change due to increase in cost by incremental amounts of the vendor incentive – either by 20%, 40%, 60%, 80% or 100% of the vendor incentive.

If the vendor interview is triggered, then the vendor is asked the following question:

3. P5: "On average, what percent of the rebate is passed on to the buyer for <project_n>, either directly or indirectly?"

The responses of 25 participants with vendors that completed an interview are listed in Table F-22. Three of the 25 participants received positive vendor upselling attribution scores. None of the respondents received a price attribution score.

TABLE F-22: UNION VENDOR RESPONSES AND RESULTS

Questions to customers:
If you were to allocate 100 points among the various factors that influenced your decision to install the equipment you did, how many 'influence points' would you give to:
VT1. <Vendor> recommendation regarding equipment selection?
VT2. Price of the equipment
VT3. Other
Questions to vendors:

U2: "In situations where you are selling <project_n>, about what percent of the time are you recommending the high-efficiency equipment?"

U4: "For <project_n> measure, what percent of the time would you recommend the high-efficiency equipment option without the program?

P5: "On average, what percent of the rebate is passed on to the buyer for <project_n>, either directly or indirectly ?"

Priority Measure Group	VT1.	VT2.	U2	U4	P5	Upselling Attribution (VT1 * (U2-U4)/U4)	Price Attribution (if P5 * Vendor Rebate > Amt more cust would pay, then VT2)	Vendor Indirect Attribution
Infrared	0.5	0.25	0.5	0.5	NA	0	0	0
Air Curtains	0.25	0.25	0.05	0.5	NA	0	0	0
ERV	0.5	0.25	1	0.75	0	0.125	0	0.125
ERV	0.3	0.4	0.8	0.5	NA	0.1125	0	0.1125
ERV	0.9	0.1	0.7	0.7	NA	0	0	0
ERV	0.9	0.1	1	1	1	0	0	0
Boiler	1	0	1	1	DK	0	0	0
ERV	0.5	0.3	0.5	1	NA	0	0	0
Boiler	0.6	0.4	1	1	1	0	0	0
Boiler	0.5	0.5	1	DK	NA	0	0	0
Air Curtains	0.4	0.4	1	1	0	0	0	0
Infrared	0	0.25	0	0	NA	0	0	0
Infrared	0.8	0	0	0	0.5	0	0	0
Air Curtains	0	0	1	1	0	0	0	0
ERV	0.6	0.2	0.5	0.5	0	0	0	0
Air Curtains	1	0	1	1	0	0	0	0
Boiler	0	0	0.7	0.7	NA	0	0	0
Boiler	1	0	0.95	0.95	NA	0	0	0
Infrared	0.6	0.3	1	1	DK	0	0	0
Infrared	1	0	0	0	NA	0	0	0
ERV	0.95	0	0.7	0.7	NA	0	0	0
ERV	0.75	0	0.7	0.7	NA	0	0	0
ERV	0.7	0.2	1	0.85	DK	0.105	0	0.105
ERV	0.5	0.25	1	1	1	0	0	0
ERV	0.33	0.33	0.75	0.75	NA	0	0	0

F.4 UNION SPILLOVER

Participants were asked the spillover battery of questions, of which the responses for seven participants indicated possible spillover. Upon further inquiries (based on the skip patterns in the survey guide), it was evident that none of the spillover responses were indicative of actual spillover. This was either due to the

participants receiving (or being in the process of applying for) an incentive for a completed measure(s), or due to the completed measure(s) being an electric fuel measure. None of these seven participants needed an engineer's call-back to quantify the effect of spillover.

Only one respondent indicated that they did not receive any incentives for a completed measure, triggering both inside and outside spillover probes. When asked about the completed measure, the customer responded that the measure is electric powered, which implied an attribution factor=0.00 for participant spillover; therefore, we did not pursue a call-back to quantify the effect of spillover for this respondent.

Attribution of claimed spillover is based on the following question: "If you had not made the earlier energy-efficiency improvements I just listed, how likely would you have been to make this additional energy efficiency improvement?"

The Attribution Factor is assigned in the following way:

1. Not likely at all- Attribution Factor=1.00
2. Not very likely- Attribution Factor=0.90
3. Somewhat likely- Attribution Factor=0.55
4. Very likely- Attribution Factor=0.00

Spillover Savings = Estimate Spillover Measure Savings X Attribution Factor

The findings from spillover battery are provided below in Table F-23 for inside spillover responses and in Table F-24 for outside spillover responses.

TABLE F-23: UNION INSIDE SPILLOVER RESPONSES

Union Program with Incentive	Incentive Through Electric Utility	Not a Source of Spillover	Action Inside Spillover	Timing Inside Spillover	Incentive Inside Spillover	Source Inside Spillover	Score Inside Spillover
1	0	0	Boiler and HVAC	2018	In progress	Union	2
0	1	0	Lighting	Ongoing	Yes	Electric Utility	4
1	0	0	Lighting	NA	Yes	Union	NA
1	0	0	HVAC Controls	2018	Yes	Union	3
1	0	0	Furnace	2017	Yes	Union	3
0	0	1	Plug-Ins	2016	No		4
0	1	0	Furnace	2018	Yes	Electric Utility	4

TABLE F-24: UNION OUTSIDE SPILLOVER RESPONSES

Union Program with incentive	Incentive through electric utility	Not a source of spillover	Action Outside spillover	Timing Outside Spillover	Incentive Outside Spillover	Source Outside Spillover	Score Outside Spillover
1	0	0	HVAC and Boiler	2018	Yes	Union	4

APPENDIX G — DATA COLLECTION INSTRUMENTS

The embedded documents below are the interview guides used for participant and vendor data collection for the NTG portion of the evaluation.

2017 CIPMSV Participant Survey

2017 CIPMSV Vendor Survey