ONTARIO GAS DSM EVALUATION CONTRACTOR

2022 Natural Gas Demand-Side Management Annual Verification Report

Ontario Energy Board

Date: March 13, 2024

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AUDIT OPINION

Enbridge Gas Inc. (formerly Enbridge Gas Distribution Inc. and Union Gas Limited)[1] implemented energy conservation programs designed to reduce natural gas use at participating customer's homes and businesses throughout the 2022 calendar year. The programs were approved by the Ontario Energy Board (OEB) and were available to all types of natural gas customers, including residential, low income, commercial, and industrial.

The energy conservation programs, called demand-side management (DSM) programs, are regulated by the OEB. The OEB establishes policy guidance, holds public hearings to determine the merit of utility proposals, and approves the use of ratepayer funding for the utility to implement the programs. Depending on the level of success in meeting its annual OEB-approved targets, the utility may be eligible for a performance incentive, called the shareholder incentive. The maximum possible shareholder incentive for each legacy utility is $10,450,000, although this amount is only available if performance meets 150% of all OEB-approved targets. The utility may claim lost revenue as a result of the lower natural gas sales.

The Evaluation Contractor team[2] (DNV and Dunsky) provides the following opinion on the achieved natural gas savings, lost revenue, shareholder incentive, and cost effectiveness of the DSM programs offered by Enbridge for the calendar year ending December 31, 2022.

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 Results	Union Results
Shareholder Incentive	$5,236,371	$0
Lost Revenue	$58,178	$118,878
Verified Net Cumulative Energy Savings (m^3)	819,797,964	561,247,308[3]
Total Dollars Spent (not reviewed)	$70,915,070	$50,034,650
Benefit Cost Ratio (TRC-plus test)[4]	2.41	1.76

[1] Enbridge Gas Distribution Inc. (Enbridge) and Union Gas Limited (Union) amalgamated effective January 1, 2019 to become Enbridge Gas Inc. However, in 2022, Enbridge Gas Inc. continued to deliver the two legacy utility DSM plans in its different rate zones – EGD rate zone and Union rate zones (North and South). For ease of reference, throughout this report, the EC has referred to the legacy utility DSM plans as Enbridge and Union.

[2] DNV leads the Evaluation Contractor team and led the evaluation of the 2022 DSM programs, with contributions from Dunsky.

[3] The verified net cumulative energy savings value does not include the 3.47% savings from the Strategic Energy Management program, which is part of the Performance Based scorecard. This 3.47% savings are estimated to be 4,840,000 net cumulative CCM savings.

[4] The cost-effectiveness results use 2022 carbon tax rates that increase by $15 per year up to $170 per tCO2e in 2030. Beyond 2030, a 2% inflation rate is applied.

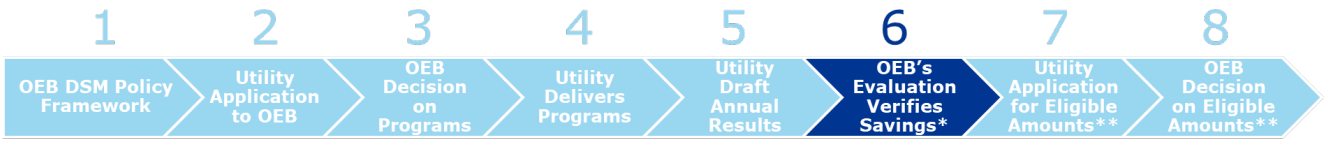
1 EXECUTIVE SUMMARY

Enbridge Gas Inc.[5] delivers demand-side management (DSM) programs under the Demand Side Management Framework for Natural Gas Distributors (2015-2020[6] and extended through 2022[7]) developed by the Ontario Energy Board (OEB). Through the framework development and approval of DSM plans, the OEB sets budgets, targets, and cost effectiveness thresholds, in addition to establishing a shareholder incentive for the successful delivery of the approved programs.

The OEB verifies, on an annual basis, natural gas savings and other aspects of energy conservation programs provided by Enbridge Gas Inc. and funded by ratepayers. The energy conservation programs are designed to reduce customer demand for gas through increases in energy efficient technologies and equipment using various methods such as financial incentives, building modifications, education, and outreach. These programs attempt to impact customers' energy usage (demand), rather than utility energy capacity (supply), which is why they are referred to as demand-side management programs.

This report provides results of the annual verification of natural gas DSM programs delivered in 2022 and offered by Enbridge Gas Inc. The verification was conducted on behalf of the OEB by its independent, third-party evaluation contractor (EC), the team of DNV and Dunsky.

The graphic below provides a general depiction of the broader process of creating DSM programs and their evaluation that led to this evaluation report.



*The OEB's EC 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

Independently verified program results, such as natural gas savings and the number of participants, provides important information to the OEB on the success and effectiveness of the programs and prudent use of ratepayer funding. Additionally, verified results are required for the utility to seek approval of any performance incentive related to OEB-approved targets. The financial incentive is to Enbridge Gas Inc.'s shareholders. The financial incentive is determined by reviewing the utility's accomplishments against their OEB-set targets, assembled in groupings called scorecards along with associated metrics that are used to determine program achievements. The degree of verified achievement (relative to the metric target) determines the shareholder incentive for each legacy utility DSM plan. The shareholder incentive is paid to the utility shareholders to encourage the utility to deliver DSM programs.

The annual verification uses the findings of any program-specific evaluation study applicable to the 2022 programs and applies them to the natural gas energy savings and achieved scorecard values reported by the utility to the OEB. For programs or metrics where no evaluation studies have been completed during the current evaluation, the EC team conducts a due diligence review of program documentation to verify the savings or metrics reported by the utilities.

[5] Enbridge Gas Distribution Inc. (Enbridge) and Union Gas Limited (Union) amalgamated effective January 1, 2019 to become Enbridge Gas Inc. However, the DSM framework and 2015-2020 DSM Plans were developed and approved by the OEB before amalgamation, and Enbridge Gas Inc. continues to deliver the two legacy utility DSM plans individually in its different rate zones – EGD rate zone and Union rate zones (North and South) through the remainder of the framework. As such, the EC still evaluates each DSM plan separately by legacy utility (Enbridge and Union). For ease of reference, throughout this report, the EC has referred to the legacy utility DSM plans as Enbridge and Union.

[6] EB-2014-0134

[7] EB-2019-0271, OEB Decision and Order on 2021 DSM Plans, July 16, 2020
EB-2021-0002, OEB Decision and Order on 2022 DSM Plans, August 26, 2021

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 accurately calculated.

Table 1-1 and Table 1-3 show the verified, comprehensive scorecard results for the Enbridge and Union rate zones, respectively.

The OEB also requires the utility to deliver DSM programs that are cost-effective, which means the benefits produced by the programs outweigh the cost of their implementation (including the benefit of reduced use of natural gas, electricity, and water, the cost of those resources, and carbon emissions). The methods that the EC used to calculate cost effectiveness in 2022 are the same ones used in the 2021 analysis. The cost effectiveness results (in terms of TRC-Plus benefit-cost ratio) for each program are found in Table 1-1 and Table 1-3 in the rightmost column. The bigger the number, the more cost effective the program is. These tables also show the amount of money spent by the utilities to implement the energy efficiency programs.

Table 1-2 and Table 1-4 show the verified revenues that Enbridge and Union lost, respectively, as a result of implementing DSM programs. The lost revenue is shown by rate class and is only the revenue lost during the 2022 calendar year.[8] A rate class is a group of customers that pay the same rate for their gas usage and service.

In summary:

- Enbridge programs offered in 2022 were verified to achieve:
  - Savings in 2022 of 42,849,977 m^3 (equal to the annual gas energy needs of 17,854 gas-using homes in Ontario[9])
  - Cumulative savings of 819,797,964 m^3 (translating to emissions reductions of 1,574,832 tons of CO_2 equivalent[10])
- Union programs offered in 2022 were verified to achieve:[11]
  - Savings in 2022 of 34,767,485 m^3 (equal to the annual gas energy needs of 14,486 gas-using homes in Ontario[12])
  - Cumulative savings of 561,247,308 m^3 (translating to emissions reductions of 1,078,156 tons of CO_2 equivalent[13])

In this report, we made several recommendations for the programs, focusing primarily on issues related to program data and documentation, energy modelling, and cost effectiveness.

[8] 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.

[9] This calculation uses an average annual natural gas usage of 90 GJ or 2,400 m^3 per year, as per Statistics Canada.

[10] This calculation uses CO_2 emission factors for natural gas provided by the Government of Canada.

[11] The first-year and cumulative energy savings values do not include the 3.47% savings from the Strategic Energy Management program, which is part of the Performance Based scorecard. This 3.47% savings are estimated to be 968,000 annual and 4,840,000 cumulative CCM savings.

[12] This calculation uses an average annual natural gas usage of 90 GJ or 2,400 m^3 per year, as per Statistics Canada.

[13] This calculation uses CO_2 emission factors for natural gas provided by the Government of Canada.

1.1 Enbridge Scorecard Results

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	Benefit Cost Ratio (TRC Plus Test)***		Net Present Value (TRC Plus)***
									O&A Costs	No O&A Costs	
Resource Acquisition		**37,630,798**	**713,337,723**			**$42,908,517**	**$51,967,130**	**$9,058,613**	**2.62**		**$130,174,000**
C&I Custom	CCM Savings	19,714,103	377,705,716	96.9%	$4,341,500	$7,658,968	$6,010,889	-$1,648,079	4.16	4.69	$72,147,000
C&I Direct Install	CCM Savings	1,905,959	25,032,134			$4,950,581	$2,493,307	-$2,457,274	3.50	3.75	$6,425,000
C&I Prescriptive	CCM Savings	3,617,784	44,622,254			$2,323,114	$2,257,132	-$65,982	2.89	3.06	$10,119,000
Comprehensive Energy Management	CCM Savings	-	-			$98,838	$0	-$98,838	-	-	-
Energy Leaders Initiative	CCM Savings	334,510	5,846,554			$0	$149,251	$149,251	0.47	0.47	-$1,969,000
Residential Adaptive Thermostats	CCM Savings	4,066,241	60,993,616			$2,262,870	$2,747,883	$485,013	2.98	3.12	$17,219,000
Run-it-Right	CCM Savings	33,379	166,893			$1,653,979	$177,285	-$1,476,694	2.43	2.58	$28,000
Home Energy Conservation	CCM Savings	7,958,822	198,970,556			$18,727,200	$33,335,467	$14,608,267	1.71	1.77	$26,205,000
	Participants	N/A	17,225	174.0%					N/A	N/A	N/A
Resource Acquisition Overhead	N/A		N/A	N/A		$5,232,967	$4,795,917	-$437,050			
Low Income		**5,219,179**	**106,460,241**			**$13,849,850**	**$13,068,578**	**-$781,272**	**1.61**		**$12,653,000**
Home Winterproofing	CCM Savings	1,628,043	34,647,732	130.0%	$894,872	$6,736,859	$7,857,577	$1,120,718	1.61	1.72	$4,514,000
Multi-Residential	CCM Savings	3,591,136	71,812,509	78.6%		$3,967,353	$2,831,475	-$1,135,878	1.61	1.74	$8,139,000
New Construction	Applications	N/A	7	53.8%		$1,456,560	$831,518	-$625,042	N/A	N/A	N/A
Low Income Overhead	N/A		N/A	N/A		$1,689,078	$1,548,008	-$141,070			
Market Transformation		**N/A**	**N/A**			**$7,181,118**	**$4,122,575**	**-$3,058,543**	**N/A**	**N/A**	**N/A**
School Energy Competition	Schools	N/A	0	0.0%	$0	$520,200	$0	-$520,200	N/A	N/A	N/A
Run-it-Right	Participants		0	0.0%		$329,209	-$3,252	-$332,461			
Comprehensive Energy Management	Participants		1	4.8%		$941,562	$23,818	-$917,744			
Residential Savings by Design	Builders		24	100.0%		$3,392,296	$2,752,161	-$640,135			
	Homes		2,831	115.0%							
Commercial Savings by Design	Developments		12	34.3%		$1,122,068	$547,209	-$574,859			
Market Transformation Overhead	N/A		N/A	N/A		$875,783	$802,639	-$73,144			
Enbridge Program Total		**42,849,977**	**819,797,964**		**$5,236,371**	**$63,939,485**	**$69,158,283**	**$5,218,798**	**2.41**		**$142,827,000**
Portfolio Overhead and Administrative Costs						**$3,817,891**	**$1,756,788**	**-$2,061,103**			
Enbridge Portfolio Total						**$67,757,376**	**$70,915,070**	**$3,157,694**			

*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.
***Cost-effectiveness results use 2022 carbon tax rates that increase by $15 per year up to $170 per tCO2e in 2030. Beyond 2030, a 2% inflation rate is applied. Please see Appendix O for a more complete discussion of these costs as well as the application of O&A costs.

Table 1-2. Enbridge lost revenue results*

Rate Class	Verified Lost Revenue
Rate 110	$31,912
Rate 115	$5,816
Rate 135	$11,163
Rate 145	$8,290
Rate 170	$996
TOTAL	**$58,178**

*Not all values may compute exactly due to rounding.

1.2 Union Scorecard Results

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	Benefit Cost Ratio (TRC Plus Test)***		Net Present Value (TRC Plus)***
									O&A Costs	No O&A Costs	
Resource Acquisition		**24,909,616**	**430,240,518**			**$36,310,983**	**$31,813,079**	**-$4,497,904**	**1.72**		**$47,192,000**
C&I Custom	CCM Savings	16,217,267	266,946,625	56.1%	$0	$7,808,000	$6,222,688	-$1,585,312	1.83	2.02	$25,449,000
C&I Direct Install	CCM Savings	1,460,844	19,359,319			$2,500,000	$2,219,314	-$280,686	3.08	3.40	$4,717,000
C&I Prescriptive	CCM Savings	1,599,218	22,979,889			$7,149,000	$1,947,142	-$5,201,858	2.02	2.17	$3,638,000
Residential Adaptive Thermostats	CCM Savings	1,985,248	29,778,714			$0	$1,386,356	$1,386,356	2.77	3.09	$8,299,000
Home Reno Rebate	CCM Savings	3,647,039	91,175,972			$12,226,000	$14,588,625	$2,362,625	1.21	1.29	$5,090,000
	Participants	N/A	6,568	120.7%					N/A	N/A	N/A
Overhead and Administrative Costs	N/A		N/A	N/A		$6,627,983	$5,448,953	-$1,179,030			
Low Income		**1,634,167**	**33,964,342**			**$15,005,488**	**$9,473,940**	**-$5,531,548**	**1.25**		**$2,235,000**
Home Weatherization	CCM Savings	1,277,512	28,654,910	53.6%	$0	$8,374,000	$7,169,897	-$1,204,104	1.27	1.41	$2,055,000
Furnace End-of-Life	CCM Savings	-	-			$917,000	$0	-$917,000	-	-	-
Indigenous	CCM Savings	7,982	182,982			$448,000	$151,183	-$296,817	0.46	0.48	-$73,000
Multi-Family - Market Rate	CCM Savings	319,457	4,573,515	46.2%		$3,573,000	$1,264,185	-$2,308,815	1.19	1.33	$253,000
Multi-Family - Social & Assisted	CCM Savings	29,216	552,935	4.4%							
Overhead and Administrative Costs	N/A	N/A	N/A	N/A		$1,693,488	$888,675	-$804,813	N/A	N/A	N/A
Large Volume		**8,223,702**	**97,042,448**			**$4,000,000**	**$3,079,272**	**-$920,728**	**3.50**		**$9,014,000**
Large Volume	CCM Savings	8,223,702	97,042,448	69.1%	$0	$3,150,000	$2,756,466	-$393,534	3.50	3.84	$9,014,000
Overhead and Administrative Costs	N/A	N/A	N/A	N/A		$850,000	$322,805	-$527,195	N/A	N/A	N/A
Market Transformation		**N/A**	**N/A**			**$2,338,070**	**$1,024,753**	**-$1,313,317**	**N/A**		**N/A**
Optimum Home	% of Homes Built	N/A	54.22%	54.2%	$0	$841,000	$24,000	-$817,000	N/A	N/A	N/A
Commercial New Construction	Developments		11	34.4%		$1,000,000	$474,270	-$525,730			
Overhead and Administrative Costs	N/A		N/A	N/A		$497,070	$526,483	$29,413			
Performance Based		**N/A**	**N/A**			**$1,053,000**	**$121,845**	**-$931,155**	**8.84**		**$955,000**
RunSmart	Participants	N/A	0	0.0%	$0	$163,000	$0	-$163,000	-	-	-
	% Savings		0.00%	0.0%							
Strategic Energy Management****	% Savings		3.47%	12.0%		$639,000	$39,846	-$599,154	8.84	27.03	$955,000
Overhead and Administrative Costs	N/A		N/A	N/A		$251,000	$81,999	-$169,001	N/A	N/A	N/A
Union Program Total		**34,767,485**	**561,247,308**		**$0**	**$58,707,541**	**$45,512,888**	**-$13,194,653**	**1.76**		**$59,397,000**
Portfolio Overhead and Administrative Costs						**$5,642,000**	**$4,521,761**	**-$1,120,239**			
Union Portfolio Total						**$64,349,541**	**$50,034,650**	**-$14,314,891**			

*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.
*** Cost-effectiveness results use 2022 carbon tax rates that increase by $15 per year up to $170 per tCO2e in 2030. Beyond 2030, a 2% inflation rate is applied. Please see Appendix O for a more complete discussion of these costs as well as the application of O&A costs.
**** The first-year and cumulative energy savings values do not include the 3.47% savings from the Strategic Energy Management program, which is part of the Performance Based scorecard. This 3.47% savings are estimated to be 968,000 annual and 4,840,000 cumulative CCM savings.

Table 1-4. Union lost revenue results*

Rate Class	Verified Lost Revenue
M4 Industrial	$84,960
M5 Industrial	$2,178
M7 Industrial	$24,930
T1 Industrial	$706
T2 Industrial	$1,125
20 Industrial	$3,266
100 Industrial	$1,713
TOTAL	**$118,878**

*Not all values may compute exactly due to rounding.

1.3 Report Structure

The table below provides an overview of the report structure and a link to each major section within the remainder of the report.

Section	Contents
2. Glossary of Key Terms and Concepts	This section contains a guide for readers to understand the terminology and concepts used throughout the report.
3. Introduction	This section provides the background of the annual verification report.
4. Scorecard: Resource Acquisition	• Scorecard achievements for Enbridge • Scorecard achievements for Union
5. Scorecard: Low Income	• Scorecard achievements for Enbridge • Scorecard achievements for Union
6. Scorecard: Large Volume	• Scorecard achievements for Union
7. Scorecard: Market Transformation	• Scorecard achievements for Enbridge • Scorecard achievements for Union
8. Scorecard: Performance Based	• Scorecard achievements for Union
9. Utility Summary of Shareholder Incentives, Program Spending, Cost Effectiveness, and Lost Revenue	• Enbridge Results • Union Results
10. Findings and Recommendations	Topics in this section include overall findings and recommendations, whole home simulation modelling, and cost effectiveness.
11. Appendices	• Evaluation Background • Metric Verification Activities • Changes from 2021 Evaluation • Summary of Verification Adjustments • Resource Acquisition Scorecards • Low Income Scorecards • Large Volume Scorecard • Market Transformation Scorecards • Performance Based (Union) and Market Transformation (Enbridge) Scorecards • Review of Metric Target Calculations • Review of Lost Revenue and DSM Shareholder Incentive Calculations • Lost Revenue and DSM Shareholder Incentive: Detailed Tables • Prescriptive Savings Verification • Program Spending Tables • Cost Effectiveness Methodology • eTools Boiler Tool Validation Study

2 GLOSSARY OF KEY TERMS AND CONCEPTS

Term	Description
Action	A DSM measure that generates savings through optimization, maintenance, or repair of existing systems. Actions (vs. equipment) were categorized for the populations of measures based on tracking database information provided by Enbridge for sample design.
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 energy savings or other benefits that are the result of a utility energy program's influence, including free ridership and spillover effects (see definitions in this Glossary).
Baseline, base case	Energy used / 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.
C&I	Commercial and Industrial
Capacity Expansion	Measure that allows customer to increase production/productivity
CCM	Cumulative cubic meters (cumulative m^3). In this report, represents the volume of natural gas savings verified over the life of the measure.
Code	An action or standard required by local or federal laws for safety, environmental, or other reasons. For example, a building code that requires a minimum fuel efficiency for furnaces.
Cost effectiveness	Refers to the analysis that determines whether or not the benefits of a project/measure (see Glossary) are greater than the costs. It is based on the net present value of savings over the equipment life of the measure.
Cost effectiveness test - PAC	A test that compares the utility's avoided cost benefits with energy efficiency program expenditures (incentives plus administrative costs).
Cost effectiveness test – TRC-Plus	A test that compares benefits to society as a whole (avoided cost benefits plus non-energy benefits) with the participant's cost of installing the measure plus the cost of incentives and program administration.
Custom project savings verification (CPSV)	Activities related to the collection, analysis, and reporting of data for purposes of measuring gross custom program impacts.
Customer	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, and account numbers. Customers can only be identified for records for which we received contact information. (i.e., records associated with account numbers that have measures in the sample or backup sample).
Demand side management (DSM)	Modification of perceived customer demand for a product 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.
Dual baseline	Savings calculation approach which addresses or combines the savings associated with early replacement and the savings after the early replacement period. This concept is relevant to the measurement of lifetime gas savings (CCM) but not first-year annual savings.

Term	Description
Early replacement (ER)	Measure that replaces a piece of equipment that is not past its estimated useful life (EUL) and in good operating condition. A measure category where a utility energy efficiency program has caused a customer to replace operable equipment with a higher efficiency alternative (also referred to as advancement).
Early replacement period (ER Period)	Time that the existing equipment would have continued to be in use. This is the same as remaining useful life (RUL). This concept is relevant to the measurement of lifetime gas savings (CCM) but not first-year annual savings.
Energy solutions advisor (ESA)	Energy Solutions Advisors work with customers on a one-to-one basis to address the unique processes and opportunities within each customer facility, identify energy savings opportunities, and promote Enbridge's DSM offerings.
Estimated useful life (EUL)	The length of time that a measure (see definition in Glossary) is expected to provide its estimated annual gas savings. EUL depends on equipment lifetime and measure persistence (see Glossary definition). 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.
Free rider	A customer who would install or perform the same energy-saving measure (see definition in Glossary) without utility influence.
Free ridership	The portion of a program's verified energy savings that would naturally occur without the utility program.
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 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.
In-depth interviews (IDIs)	Structured technical interviews administered by evaluation engineers and market researchers either in person or more frequently, over the phone, IDIs offer more flexibility than CATIs and are best leveraged for complex projects and topics.
Incentive	An incentive is often a payment from the utility to participants of a DSM program. Incentives can be paid to customers, vendors, or other parties.
Industry standard practice (ISP)	A common practice used within an industry but not formally defined by code or regulation.
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. It can be claimed, gross, or net. Sometimes referred to as just "cumulative" or "lifetime."
Maintenance (Maint.)	Repair, maintain, or restore to prior efficiency.

Term	Description
Measure	Equipment, technology, practice, or behaviour that, once installed or working, results in a reduction in energy use. Measures are identified in the tracking data as unique line items for which savings within a custom project are quantified. Multiple measures may belong to the same project.
Measure persistence	How long a measure remains installed and performs as originally predicted in relation to its EUL. This considers events like business turnover, early retirement of installed equipment, and other reasons measures might be removed or discontinued.
Measurement and Verification (M&V)	Verification of savings using methods not including attribution/free ridership assessment.
Metric	This is a term used by the OEB to measure a utility's program achievement. Under the DSM framework, programs are grouped into categories, called scorecards. Each program within a scorecard is assigned at least one metric that is used to measure utility performance. The metric for many programs is annual 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.
MF	Multifamily (multi-residential)
Natural Replacement	A measure category where the equipment is replaced on failure or where a utility energy efficiency program has not influenced the customer decision to replace but once the decision has been made, the utility program influences a higher efficiency alternative. (see replace on burnout)
Net-to-gross	The ratio of net energy savings to gross savings. The NTG ratio is applied to gross program savings to convert them into net program savings.
New construction (NC)	New buildings or spaces, or a category of efficiency measures in new construction or major renovations, whose baseline would be the relevant code or standard market practice.
Non-early replacement period (non-ER period)	Time after the ER period up to the EUL.
Non-energy impacts	Sometimes called non-energy benefits, these are the wider socio-economic or environmental outcomes that arise from energy efficiency improvements, aside from energy savings. NEIs can include but are not limited to impacts such as improved safety, improved health, and job creation. For example, offering participants may benefit from increased property value, and improved health and comfort. The TRC-Plus test includes a 15% adder to the benefits calculation to account for NEIs.
Normal replacement (NR)	Measure that replaces a piece of equipment that is past EUL and in good operating condition.
Offering	One or more DSM activities or measures which a utility may use to affect a specifically identified target market in their choices around the amount and timing of energy consumption.
Persistence	The extent to which a DSM measure remains installed and performing as originally predicted in relation to its EUL.
Portfolio	A group of DSM programs which have been selected and combined in order to achieve the objectives of a utility's DSM Plan.
Program	The programs outlined in Enbridge's Multi-Year Plan are comprised of one or more offerings and address the needs of a subset of Enbridge's customer base.

Term	Description
Program evaluation	Activities related to the collection, analysis, and reporting of data for purposes of measuring program impacts from past, existing, or potential program impacts.
Program spending	The amount spent running energy-savings programs, not including the costs of running (called overhead costs) the larger portfolio of programs. This value can be divided into spending for program measures and incentives, as well as program-specific costs.
Project	Projects are identified in the tracking data based on the project code. A project may have multiple measures as indicated by sub-codes in the current data tracking system.
Rate class	The OEB establishes distribution rate classes for Enbridge. Distribution rate classes group customers with similar energy profiles.
Realization rate	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.
Remaining useful life (RUL)	The number of years that the existing equipment would have remained in service and in good operating condition had it not been replaced. This is the same as the ER period.
Replace on burnout (ROB)	Measure that replaces a failed or failing piece of equipment. (see natural replacement)
Retrofit	A measure category that includes the addition of an efficiency measure to an existing facility such as insulation or air sealing to control air leakage.
Retrofit add-on (REA)	Measure that reduces energy use by modifying an existing piece of equipment.
Scorecard	A scorecard allows for multiple different kinds of metrics such as 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-2021-0002.
Scorecard Achievement	The verified value for program-specific metric targets (annual savings, 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, 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 up to a maximum of 125%.
Site	Sites are identified based on unique site addresses provided by 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 a site id.
Spillover effects	These are reductions in energy consumption and/or demand that occur as a result of the presence of a utility DSM program but are beyond program-related savings and are not part of the utility's verified savings. These effects could result from many factors including additional efficiency actions that program participants take outside the program as a result of having participated, changes in store availability of energy-using equipment, and changes in energy use by program non-participants as a result of utility program advertising.
System optimization (OPT)	Improve system or system settings to exceed prior efficiency.
TRM	Technical Resource Manual, which is a document that identifies standard methodologies and inputs for calculating energy savings.
TSER	Telephone-supported engineering review.

Term	Description
Unit of analysis	The level at which the data are analysed, which in 2023 will likely be a “measure” or sub-project level for Enbridge.
Vendors	Program trade allies, business partners, contractors, and suppliers who work with program participants to implement energy saving measures.

3 INTRODUCTION

Enbridge Gas Inc.[14] delivers demand-side management (DSM) programs[15] under the Demand Side Management Framework for Natural Gas Distributors (2015-2020[16] and extended through 2022[17]) developed by the Ontario Energy Board (OEB). The 2022 Natural Gas DSM Annual Verification Report has been prepared for the OEB to report the results of the annual verification of the utility's natural gas DSM programs delivered in 2022. These verifications were conducted by the OEB's Evaluation Contractor (EC) team of DNV and Dunsky.

As part of the utility DSM plan, programs are grouped into categories, called scorecards. Each program within a scorecard is assigned at least one metric that 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.[18] 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 the amount the utility is eligible for as a demand-side management shareholder incentive (DSMSI).[19]

In addition to the shareholder incentive, the OEB compensates the utilities for the reduced revenue taken 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.[20] Cost effectiveness results can be found in Sections 9.1.3, 9.2.3, and 11.15.

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, and an observer from the Independent Electricity System Operator (IESO), the Ministry of Energy, and Natural Resources Canada. 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.

[14] Enbridge Gas Distribution Inc. (Enbridge) and Union Gas Limited (Union) amalgamated effective January 1, 2019 to become Enbridge Gas Inc. In 2022, Enbridge Gas Inc. delivered the two legacy utility DSM plans in its different rate zones – EGD rate zone and Union rate zones (North and South). For ease of reference, throughout this report, the EC has referred to the legacy utility DSM plans as Enbridge and Union.

[15] Throughout this report, the word "program" is used consistent with the OEB's 2015-2020 DSM Framework and Decision on the utilities' 2015-2020 DSM Plans. See Section 2 for additional detail.

[16] EB-2014-0134

[17] EB-2019-0271, OEB Decision and Order on 2021 DSM Plans, July 16, 2020
EB-2021-0002, OEB Decision and Order on 2022 DSM Plans, August 26, 2021

[18] These targets, which were set in part based on 2021 performance, are described in detail in Section 11.10.

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

[20] The cost-effectiveness methodology is described in detail in Section 11.15.

4 SCORECARD RESULTS: RESOURCE ACQUISITION

Programs within the Resource Acquisition scorecard provide customers with financial incentives that reduce the cost of upgrading to more energy efficient technologies and equipment. This scorecard comprises the largest share of both utilities' budgets and shareholder incentive.

4.1 Scorecard achievements for Enbridge

The metrics for the Enbridge Resource Acquisition scorecard include:

- Total cumulative large volume customer natural gas savings
- Total cumulative small volume customer natural gas savings
- Number of Home Energy Conservation program participants

A detailed explanation of the verification activities for all Resource Acquisition programs can be found in Section 11.5. Verified program achievements are listed in Table 4-1 with DSM shareholder incentive results in Table 4-2.

Table 4-1. Enbridge 2022 Resource Acquisition verified achievements*

Programs	Metrics	Verified Achievement	
		Program-level Achievements	Metric-level Achievements
Home Energy Conservation**	Large Volume Customer - CCM	-	403,144,097
Residential Adaptive Thermostats		-	
C&I Custom		363,241,521	
C&I Direct Install		5,253,809	
C&I Prescriptive		29,109,669	
Comprehensive Energy Management		-	
Energy Leaders		5,372,206	
Run-it-Right		166,893	
Home Energy Conservation	Small Volume Customer - CCM	198,970,556	310,193,626
Residential Adaptive Thermostats		60,993,616	
C&I Custom		14,464,195	
C&I Direct Install		19,778,326	
C&I Prescriptive		15,512,586	
Comprehensive Energy Management		-	
Energy Leaders		474,348	
Run-it-Right		-	
Home Energy Conservation**	Participants	17,225	17,225

*Not all values may compute exactly due to rounding.
**This program is now marketed as Home Efficiency Rebate.

Table 4-2. Enbridge's 2022 Resource Acquisition targets, achievements, weights, and incentive*†

Metric	Target	Verified Achievement	Weight	Metric Score	Weighted Metric Score
LV RA (CCM)	491,364,320	403,144,097	40.00%	82.05%	32.82%
SV RA (CCM)	245,015,661	310,193,626	40.00%	126.60%	50.64%
HEC Participants	9,900	17,225	20.00%	173.99%	34.80%
Verified Total Weighted Scorecard Achieved					118.26%
Maximum Scorecard Incentive					$7,012,787
Verified Scorecard Incentive Achieved					**$4,341,500**

*Not all values may compute exactly due to rounding.
†See Section 11.11 for a detailed description of the scorecard and incentive calculations.

Table 4-3 shows the net cumulative natural gas savings (CCM) by program, as verified by the EC. Unlike Table 4-1, this table shows overall program totals, not broken out by Large or Small Volume metrics.

Table 4-3. Enbridge's verified 2022 Resource Acquisition savings*

Program	Net Cumulative Savings (m3)
Home Energy Conservation**	198,970,556
Residential Adaptive Thermostats	60,993,616
Commercial & Industrial Custom	377,705,716
Commercial & Industrial Direct Install	25,032,134
Commercial & Industrial Prescriptive	44,622,254
Comprehensive Energy Management	-
Energy Leaders	5,846,554
Run-it-Right	166,893
Resource Acquisition Total	**713,337,723**

*Not all values may compute exactly due to rounding.
**This program is now marketed as Home Efficiency Rebate.

4.2 Scorecard achievements for Union

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

- Total cumulative natural gas savings
- Number of Home Reno Rebate program participants

A detailed explanation of the verification activities for all Resource Acquisition programs can be found in Section 11.5. Verified program achievements are listed in Table 4-4 with DSM shareholder incentive results in Table 4-5.

Table 4-4. Union 2022 Resource Acquisition verified achievements*

Programs	Metrics	Verified Achievement	
		Program-level Achievements	Metric-level Achievements
Home Reno Rebate**	CCM	91,175,972	430,240,518
Residential Adaptive Thermostats		29,778,714	
C&I Custom		266,946,625	
C&I Direct Install		19,359,319	
C&I Prescriptive		22,979,889	
Home Reno Rebate**	Participants	6,568	6,568

*Not all values may compute exactly due to rounding.
**This program is now marketed as Home Efficiency Rebate.

Table 4-5. Union's 2022 Resource Acquisition targets, achievements, weights, and incentive*†

Metric	Target	Verified Achievement	Weight	Metric Score	Weighted Metric Score
CCM	766,386,474	430,240,518	75.00%	56.14%	42.10%
HRR Participants	5,443	6,568	25.00%	120.66%	30.17%
Verified Total Weighted Scorecard Achieved**					72.27%
Maximum Scorecard Incentive					$6,562,712
Verified Scorecard Incentive Achieved					**$0**

*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 Section 11.11 for a detailed description of the scorecard and incentive calculations.

5 SCORECARD RESULTS: LOW INCOME

Programs within the Low Income scorecard provide eligible customers with opportunities to improve the energy efficiency of their homes (for residential customers) and buildings (for building owners and multifamily customers).

5.1 Scorecard achievements for Enbridge

This section summarizes the results of the EC's review of the Enbridge Low Income scorecard. The metrics for the Enbridge 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 Section 11.6. Verified program achievements are listed in Table 5-1 with DSM shareholder incentive results in Table 5-2.

Table 5-1. Enbridge 2022 Low Income verified achievements

Programs	Metrics	Verified Achievement	
		Program-level Achievements	Metric-level Achievements
Home Winterproofing	CCM	34,647,732	34,647,732
Low Income Multi-Residential	CCM	71,812,509	71,812,509
Low Income New Construction	Applications	7	7

Table 5-2. Enbridge's 2022 Low Income scorecard targets, achievements, weights, and incentive*†

Metric	Target	Verified Achievement	Weight	Metric Score	Weighted Metric Score
Home Winterproofing CCM	26,650,377	34,647,732	45.00%	130.01%	58.50%
Low Income Multi Residential CCM	91,360,642	71,812,509	45.00%	78.60%	35.37%
Low Income New Construction Applications	13	7	10.00%	58.33%	5.83%
Verified Total Weighted Scorecard Achieved					99.71%
Maximum Scorecard Incentive					$2,263,561
Verified Scorecard Incentive Achieved					**$894,872**

*Not all values may compute exactly due to rounding.
†See Section 11.11 for a detailed description of the scorecard and incentive calculations.

5.2 Scorecard achievements for Union

This section summarizes the results of the EC's review of the Union Low Income scorecard. The metrics for the Union 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 Section 11.6. Verified program achievements are listed in Table 5-3 with DSM shareholder incentive results in Table 5-4.

Table 5-3. Union 2022 Low Income verified achievements*

Programs	Metrics	Verified Achievement	
		Program-level Achievements	Metric-level Achievements
Home Weatherization**	CCM	28,654,910	28,837,892
Furnace End-of-Life		-	
Indigenous		182,982	
Multi-Family Social & Assisted	CCM	552,935	552,935
Multi-Family Market Rate	CCM	4,573,515	4,573,515

*Not all values may compute exactly due to rounding.
**This program is now marketed as Home Winterproofing.

Table 5-4. Union's 2022 Low Income targets, achievements, weights, and incentive*†

Metric	Target	Verified Achievement	Weight	Metric Score	Weighted Metric Score
Single Family CCM	53,836,709	28,837,892	60.00%	53.57%	32.14%
Multi-Family - Social & Assisted CCM	12,543,352	552,935	35.00%	4.41%	1.54%
Multi-Family - Market Rate CCM	9,907,431	4,573,515	5.00%	46.16%	2.31%
Verified Total Weighted Scorecard Achieved**					35.99%
Maximum Scorecard Incentive					$2,604,447
Verified Scorecard Incentive Achieved					**$0**

*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 Section 11.11 for a detailed description of the scorecard and incentive calculations.

6 SCORECARD RESULTS: LARGE VOLUME

Union's Large Volume Program comprises the entire Large Volume scorecard. This program provides large volume customers[21] with training presentations, energy efficiency calculation tools, energy use analysis, and other technical assistance from Union's Technical Account Managers. It uses a self-directed funding model in which eligible customers can access and utilize funds included in their natural gas rates. Funds from customers electing not to participate are dispersed to fund energy efficiency projects for participating Large Volume customers.

Enbridge did not have DSM programs specifically for their large volume customers in 2022.

6.1 Scorecard achievements for Union

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 Section 11.7. Verified program achievements are listed in Table 6-1 with DSM shareholder incentive results in Table 6-2.

Table 6-1. Union 2022 Large Volume verified achievements

Programs	Metrics	Verified Achievement	
		Program-level Achievements	Metric-level Achievements
Large Volume	CCM	97,042,448	97,042,448

Table 6-2. Union's 2022 Large Volume targets, achievements, weights, and incentive*†

Metric	Target	Verified Achievement	Weight	Metric Score	Weighted Metric Score
CCM	140,451,580	97,042,448	100.00%	69.09%	69.09%
Verified Total Weighted Scorecard Achieved**					69.09%
Maximum Scorecard Incentive					$694,265
Verified Scorecard Incentive Achieved					**$0**

*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 Section 11.11 for a detailed description of the scorecard and incentive calculations.

[21] Large volume customers are those with very high natural gas consumption, typically large industrial and commercial facilities.

7 SCORECARD RESULTS: MARKET TRANSFORMATION

Programs within the Market Transformation scorecard focus on changing customer behaviour and attitudes related to energy efficiency, intending to cause permanent change in the marketplace over time. Although energy savings may result from these programs, savings are typically not the primary goal.

7.1 Scorecard achievements for Enbridge

This section summarizes the results of the EC's review of the Enbridge Market Transformation scorecard. The metrics for the Enbridge 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 Section 11.8 (Market Transformation Scorecards) and Section 11.9 (Performance Based (Union) and Market Transformation (Enbridge) Scorecards), as listed in Table 7-1.

Table 7-1. Enbridge Market Transformation program detailed evaluation, by appendix

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

Verified program achievements are listed in Table 7-2 with DSM shareholder incentive results in Table 7-3.

Table 7-2. Enbridge 2022 Market Transformation verified achievements

Programs	Metrics	Verified Achievement	
		Program-level Achievements	Metric-level Achievements
School Energy Competition	Schools	-	-
Run-it-Right	Participants	-	-
Comprehensive Energy Management	Participants	1	1
Residential Savings by Design	Builders	24	24
	Homes Built	2,831	2,831
Commercial Savings by Design	New Developments	12	12

Table 7-3. Enbridge's 2022 Market Transformation scorecard targets, achievements, weights, and incentive*†

Metric	Target	Verified Achievement	Weight	Metric Score	Weighted Metric Score
School Energy Competition Schools	58	-	10.00%	0.00%	0.00%
Run-it-Right Participants	53	-	20.00%	0.00%	0.00%
Comprehensive Energy Management Participants	21	1	20.00%	5.00%	1.00%
Residential Savings by Design Builders	24	24	10.00%	100.00%	10.00%
Residential Savings by Design Homes	2,462	2,831	15.00%	114.98%	17.25%
Commercial Savings by Design Developments	35	12	25.00%	34.62%	8.65%
Verified Total Weighted Scorecard Achieved					39.60%
Maximum Scorecard Incentive					$1,173,652
Verified Scorecard Incentive Achieved					**$0**

*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 Section 11.11 for a detailed description of the scorecard and incentive calculations.

7.2 Scorecard achievements for Union

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

- Percentage of homes built by builders enrolled in the Optimum Home program.
- 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 Section 11.8. Verified program achievements are listed in Table 7-4 with DSM shareholder incentive results in Table 7-5.

Table 7-4. Union 2022 Market Transformation verified achievements

Programs	Metrics	Verified Achievement	
		Program-level Achievements	Metric-level Achievements
Optimum Home	Percentage of Homes Built	54.22%	54.22%
Commercial New Construction	New Developments	11	11

Table 7-5. Union's 2022 Market Transformation targets, achievements, weights, and incentive*†

Metric	Target	Verified Achievement	Weight	Metric Score	Weighted Metric Score
Optimum Home Percentage of Homes Built	100.00%	54.22%	50.00%	40.67%	20.33%
Commercial New Construction Developments	32	11	50.00%	34.38%	17.19%
Verified Total Weighted Scorecard Achieved**					37.52%
Maximum Scorecard Incentive					$405,810
Verified Scorecard Incentive Achieved					**$0**

*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 Section 11.11 for a detailed description of the scorecard and incentive calculations.

8 SCORECARD RESULTS: PERFORMANCE BASED

Programs within the Performance Based scorecard focus on helping participating organizations make operational enhancements and improve their energy management practices. Although energy savings may result from these programs, savings are typically not the primary goal.

8.1 Scorecard achievements for Union

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

- Participants in the RunSmart program
- Percent savings achieved by participants in the RunSmart program
- Percent savings achieved by participants in the Strategic Energy Management program

A detailed explanation of the verification activities for all Performance programs can be found in Section 11.9. Verified program achievements are listed in Table 8-1 with DSM shareholder incentive results in Table 8-2.

Table 8-1. Union 2022 Performance Based verified achievements

Programs	Metrics	Verified Achievement	
		Program-level Achievements	Metric-level Achievements
RunSmart	Participants	-	-
	Savings %	0.00%	0.00%
Strategic Energy Management	Savings %	3.47%	3.47%

Table 8-2. Union's 2022 Performance Based targets, achievements, weights, and incentive*†

Metric	Target	Verified Achievement	Weight	Metric Score	Weighted Metric Score
RunSmart Participants	69	-	10.00%	0.00%	0.00%
RunSmart Savings %	0.44%	0.00%	40.00%	0.00%	0.00%
Strategic Energy Management Savings %	28.89%	3.47%	50.00%	12.02%	6.01%
Verified Total Weighted Scorecard Achieved**					6.01%
Maximum Scorecard Incentive					$182,765
Verified Scorecard Incentive Achieved					**$0**

*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 Section 11.11 for a detailed description of the scorecard and incentive calculations.

9 UTILTY SUMMARY OF SHAREHOLDER INCENTIVES, PROGRAM SPENDING, COST EFFECTIVENESS, AND LOST REVENUE

This section provides the results of the financial performance of the 2022 DSM programs by utility.

9.1 Enbridge Results

9.1.1 Scorecard Weights and Shareholder Incentives

Table 9-1 shows Enbridge scorecard weights by metric and shareholder incentives by target for all programs. These were the metrics reviewed as part of the annual verification. The utility achieved a shareholder incentive of $5,236,371 or 50% of the maximum possible DSMSI incentive.

Table 9-1. Summary of Enbridge's 2022 achievement weights and shareholder incentives

Scorecard	Program	Metric	Weight	Utility Incentive
Resource Acquisition	Home Energy Conservation Residential Adaptive Thermostats C&I Custom C&I Direct Install C&I Prescriptive Comprehensive Energy Management Run-it-Right	Large Volume (CCM)	40.00%	$4,341,500
		Small Volume (CCM)	40.00%	
	Home Energy Conservation	Participants	20.00%	
Low Income	Home Winterproofing	CCM	45.00%	$894,872
	Low Income Multi-Residential	CCM	45.00%	
	Low Income New Construction	Applications	10.00%	
Market Transformation	School Energy Competition	Schools	10.00%	$0
	Run-it-Right	Participants	20.00%	
	Comprehensive Energy Management	Participants	20.00%	
	Residential Savings by Design	Builders	10.00%	
		Homes	15.00%	
	Commercial Savings by Design	Developments	25.00%	
Total Verified Utility Incentive				**$5,236,371**
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.

9.1.2 Program Spending Summary

The Enbridge tracking database included reported program spending information. The EC has reported on what was provided by Enbridge but has not verified spending figures or conducted a financial audit. Table 9-2 summarizes the spending across the portfolio. Additional spending detail is in Section 11.14.

Table 9-2. Enbridge program cost summary*

Spending Area	OEB-Approved Budget	Utility Spending	Difference ($)	Difference (%)
Program Sub-total (no overhead)	$56,141,657	$62,011,719	$5,870,062	10%
Program Overhead	$7,797,828	$7,146,564	-$651,264	-8%
Process and Program Evaluation	$1,774,228	$443,279	-$1,330,949	-75%
Other**	$2,043,663	$1,313,509	-$730,154	-36%
Total DSM Budget	**$67,757,376**	**$70,915,070**	**$3,157,694**	**5%**

*Not all values may compute exactly due to rounding.
**Other includes DSM IT Chargeback (no utility spending in 2022) and Collaboration and Innovation.

9.1.3 Cost Effectiveness Summary

Table 9-3 and Table 9-4 show summary results for the TRC-Plus and PAC tests, respectively, including the benefit cost ratio and the net present value.[22,23] The EC cost effectiveness methodology applied in 2022 is consistent with what was done for the 2021 analysis. Additional detail, including the key inputs used in the TRC-Plus and PAC tests, is provided in Section 11.15.

Table 9-3. 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	$210,418,000	$80,244,000	$130,174,000	2.62
Low Income	$33,483,000	$20,831,000	$12,653,000	1.61
Total	**$243,901,000**	**$101,075,000**	**$142,827,000**	**2.41**

*Not all values may compute exactly due to rounding.

Table 9-4. 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	$181,869,000	$51,988,000	$129,882,000	3.50
Low Income	$29,696,000	$12,237,000	$17,459,000	2.43
Total	**$211,565,000**	**$64,225,000**	**$147,340,000**	**3.29**

*Not all values may compute exactly due to rounding.

[22] Unlike Table 1-1 in the Executive Summary or the Enbridge-specific tables in Section 11.15, these tables do not include alternative benefit cost ratios that do not apportion the portfolio-level overhead and administration costs. The alternative ratios are only computed at the OEB-defined individual program level, and not the scorecard or overall portfolio level.

[23] The cost-effectiveness results are based on 2022 carbon tax rates.

9.1.4 Lost Revenue by Rate Class

The EC summed the verified net annual savings (prorated by installation month) by rate class and estimated lost revenues. Table 9-5 shows the results for each rate class.

Table 9-5. Enbridge lost revenue results*

Rate Class	Verified Lost Revenue
Rate 110	$31,912
Rate 115	$5,816
Rate 135	$11,163
Rate 145	$8,290
Rate 170	$996
TOTAL	**$58,178**

*Not all values may compute exactly due to rounding.

9.2 Union Results

9.2.1 Scorecard Weights and Shareholder Incentives

Table 9-6 shows the Union scorecard weights by metric and shareholder incentives by target for all programs. These were the metrics reviewed as part of the annual verification. The utility achieved a shareholder incentive of $0 or 0% of the maximum possible DSMSI incentive.

Table 9-6. Summary of Union's 2022 achievement weights and shareholder incentives*

Scorecard	Program	Metric	Weight	Utility Incentive
Resource Acquisition	C&I Custom C&I Direct Install C&I Prescriptive Home Reno Rebate Residential Adaptive Thermostats	CCM	75.00%	$0
	Home Reno Rebate	Participants	25.00%	
Low Income	Indigenous Furnace End-of-Life Home Weatherization	CCM	60.00%	$0
	Multi-Family (Social & Assisted)	CCM	35.00%	
	Multi-Family (Market Rate)	CCM	5.00%	
Large Volume	Large Volume	CCM	100.00%	$0
Market Transformation	Optimum Home	% of Homes Built	50.00%	$0
	Commercial New Construction	Developments	50.00%	
Performance-Based	RunSmart	Participants	10.00%	$0
		Savings %	40.00%	
	Strategic Energy Management	Savings %	50.00%	
Total Verified Utility Incentive				**$0**
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.

9.2.2 Program Spending Summary

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 9-7 shows the Union budget for the portfolio overall. Additional spending detail is in Section 11.14.

Table 9-7. Union program cost summary*

Spending Area	OEB-Approved Budget	Utility Spending	Difference ($)	Difference (%)
Programs Sub-total (no overhead)	$48,788,000	$38,243,973	-$10,544,027	-22%
Program Overhead	$9,919,541	$7,268,916	-$2,650,625	-27%
Research	$1,000,000	$493,447	-$506,553	-51%
Evaluation	$1,300,000	$244,393	-$1,055,607	-81%
Administration	$2,842,000	$3,539,067	$697,067	25%
Other**	$500,000	$244,854	-$255,146	-51%
Total DSM Budget	**$64,349,541**	**$50,034,650**	**-$14,314,891**	**-22%**

*Not all values may compute exactly due to rounding.
**Other includes pilot programs and Open Bill Project.

9.2.3 Cost Effectiveness Summary

Table 9-8 and Table 9-9 show summary results for the TRC-Plus and PAC tests, respectively, including the benefit cost ratio and net present value.[24,25] The EC cost effectiveness methodology applied in 2022 is consistent with what was done for the 2021 analysis. Additional detail, including the key inputs used in the TRC-Plus and PAC tests, is shown in Section 11.15.

Table 9-8. 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	$112,723,000	$65,532,000	$47,192,000	1.72
Low Income	$11,265,000	$9,030,000	$2,235,000	1.25
Large Volume	$12,621,000	$3,606,000	$9,015,000	3.50
Performance Based	$1,077,000	$122,000	$955,000	8.84
Total	**$137,686,000**	**$78,290,000**	**$59,397,000**	**1.76**

*Not all values may compute exactly due to rounding.

Table 9-9. 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	$94,822,000	$31,813,000	$63,009,000	2.98
Low Income	$9,715,000	$9,474,000	$241,000	1.03
Large Volume	$10,975,000	$3,079,000	$7,896,000	3.56
Performance Based	$988,000	$122,000	$867,000	8.11
Total	**$116,500,000**	**$44,488,000**	**$72,013,000**	**2.62**

*Not all values may compute exactly due to rounding.

[24] Unlike Table 1-3 in the Executive Summary or the Union-specific tables in Section 11.15, these tables do not include alternative benefit cost ratios that do not apportion the portfolio-level overhead and administration costs. The alternative ratios are only computed at the OEB-defined individual program level, and not the scorecard or overall portfolio level.

[25] The cost-effectiveness results are based on 2022 carbon tax rates.

9.2.4 Lost Revenue by Rate Class

The EC summed the verified net annual savings (prorated by installation month) by rate class and estimated lost revenues. Table 9-10 shows the results.

Table 9-10. Union lost revenue results*

Rate Class	Verified Lost Revenue
M4 Industrial	$84,960
M5 Industrial	$2,178
M7 Industrial	$24,930
T1 Industrial	$706
T2 Industrial	$1,125
20 Industrial	$3,266
100 Industrial	$1,713
TOTAL	**$118,878**

*Not all values may compute exactly due to rounding.

10 FINDINGS AND RECOMMENDATIONS

This section contains the findings and recommendations from all studies completed by the EC on the 2022 programs and recommendations from the previous annual verification report that are still relevant and remain outstanding, are in progress, or have been completed. For 2022, recommendations relate to the annual verification and the eTools Boiler Tool Validation Study. eTools is a digital Enbridge tool that leverages engineering calculations to estimate energy savings from boiler space and water heating projects. The EC conducted a study comparing the eTools savings estimates with those estimated by modelling site-level energy usage from customer bills, a methodology that leverages actual natural gas data.

10.1 2022 Annual Verification Recommendations

The 2022 annual verification identified several recommendations, most of which were previously identified in annual verification processes. The relative lack of new findings and recommendations is representative of a mature set of programs and a well-developed evaluation process. Compared to earlier evaluation years within this DSM Framework, the EC now encounters few issues, surprises, or gaps in data. This is a result of Enbridge responding effectively to previous recommendations and their willingness to proactively engage in the evaluation process.

Table 10-1, Table 10-2, and Table 10-3 show the findings and recommendations applying to the annual verification overall, whole home simulation modelling, and cost effectiveness, respectively. In the tables, primary outcomes of each finding 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). Further details follow the tables.

Table 10-1. Overall annual verification - summary of recommendations

#	Status	Finding	Recommendation	Previously Recommended	Applies to 2022		Primary Outcome		
					Utility	OEB	Reduce Costs	Improve Accuracy	Decrease Risk
O1	Completed	The approved 2023-2025 EM&V plan include activities such as participant surveys that provide independent verification of claimed achievements for non-savings metrics.	A: Third-party documentation for each required element for all non-savings metrics should be collected, requested, and delivered.	✓	✓		✓	✓	✓
O2	Completed	Under OEB direction, DNV developed the suggested electronic summary of the Technical Reference Manual (eTRM) and incorporated fully into the 2022 evaluation process.	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	✓	✓		✓	✓	✓

#	Status	Finding	Recommendation	Previously Recommended	Applies to 2022		Primary Outcome		
					Utility	OEB	Reduce Costs	Improve Accuracy	Decrease Risk
			descriptions that map to electronic TRM.						
			C: Once the electronic TRM spreadsheet is developed, utilize the same electronic TRM for both utilities.	✓	✓		✓	✓	✓
			D: Develop means for consistent system.	✓		✓	✓	✓	✓
O3	Completed	The newly approved 2023-2025 EM&V Plan entails additional, more rigorous evaluation activities for non-savings metrics, including end-user and participant surveys, site visits, and market studies.	A: In the next EM&V plan, consider shifting evaluation resources and attention towards areas that have historically received less rigorous focus but may have a higher risk of inaccurate verification.	✓		✓		✓	✓

Table 10-2. Whole home simulation modelling - summary of recommendations

#	Status	Finding	Recommendation	Previously Recommended	Applies to 2022		Primary Outcome		
					Utility	OEB	Reduce Costs	Improve Accuracy	Decrease Risk
SM1	In Progress	The energy savings from the home retrofit programs rely exclusively on the simulations provided by the delivery agents.	A: Should the program continue to use current modelling software, consider funding a study to verify the models produced by the utility agents.	✓		✓		✓	

Table 10-3. Cost-effectiveness - summary of recommendations

#	Status	Finding	Recommendation	Previously Recommended	Applies to 2022		Primary Outcome		
					Utility	OEB	Reduce Costs	Improve Accuracy	Decrease Risk
CE1	In Progress	All overhead is still applied at the sector level rather than the program level.	A: Allocate "sector"-level administrative and overhead costs to each individual program. Sector level costs refer to costs that are incurred at the program level and variable. The EC notes that the 2015-2020 DSM Framework did not clearly define the terms "sector" and "program", or at what level (e.g., measure, program, portfolio) to account for costs in CE screening. The 2023-2025 DSM Framework sets out clear definitions and direction on program-related costs and accounting for CE screening.	✓	✓	✓		✓	✓
CE2	Completed	Unlike the 2021 AV, the 2022 AV did not entail any methodological changes, and both the EC and Enbridge pledged to improve communication when changes do occur in the future.	A: Increase transparency when changes are made to accepted methodology.	✓	✓			✓	✓

10.1.1 Overall Annual Verification Recommendations

O1. Finding: Explicit documentation (ideally, from a third-party) was not available for all program qualification and participation requirements for all programs. For example, the EC found the following:

- Union's Optimum Home program has a metric of percent of homes built, which is a function of the number of Optimum Homes built and the total number of natural gas housing starts for each builder in the calendar year. Enbridge provided the total number of natural gas housing starts in an Excel file created by Enbridge, but no independent proof to support the requirement.

For the 2022 evaluation, the EC followed precedent with respect to metric verification, deciding against modifying existing verification protocols for well-established metrics in the final year of the existing framework. The 2023-2025 EM&V plan[26] covering the new plan period, which was proposed by the EC and approved by the OEB, does include activities such as participant surveys that provide independent verification of claimed achievements for the type of program cited above (Residential Savings by Design in the new framework). As a result, this recommendation from the previous report has been completed.

Recommendation A: Third-party documentation or verification for each required element for all non-savings metrics should be collected, requested, and delivered to the EC to prove program qualification and participation.

Previously Recommended: Yes – since the 2016 AV report.

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

Status: Complete

O2. Finding: Both Legacy Union and Legacy Enbridge tracking databases use prescriptive measure descriptions that map directly to *internally* consistent measure names. However, prior to 2022, there was not a universally accessible (i.e., public) dataset that is fully transparent and comprehensive for all prescriptive and quasi-prescriptive measures. DNV developed the recommendations below, and OEB gave DNV direction to develop the suggested electronic summary of the Technical Reference Manual (TRM) for implementation as part of the 2021 program evaluation process. DNV did so, incorporating the eTRM fully into the 2022 evaluation process.[27] Nearly all of the prescriptive measures in the tracking data for both LEG and LUG clearly map to the eTRM. The final recommendation below, relating to variations in capacity or other characteristics, is no longer applicable. As a result, these recommendations from the previous report have been completed.

Recommendation A: Develop, maintain, and use an electronic summary of the TRM, such as an Excel file. This allows for a historical record of the changes in the TRM and allows the evaluation to identify outdated values. For simplification and transparency, this system should be utilized for both legacy utilities.

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.

[26] Final 2023 – 2025 Evaluation Measurement and Verification Plan, DNV for the Ontario Energy Board, September 25, 2023

[27] The OEB has made the eTRM publicly available on its website. However, it is worth noting that several modifications have been made since its posting in December 2022.

Previously Recommended: Yes – since the 2015 AV Report.

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

Status: Complete

O3. Finding: Over the course of the current DSM Framework and EM&V Plans, the evaluation results have stabilized and there have been only small changes to the annual verification activities or results in recent years. The new DSM Framework (which begins in the 2023 program year) is based on the current programs and does not entail a wholesale change to program structure or make-up, meaning this stability in evaluation is likely to continue. This presents an opportunity in the EM&V planning process to construct a more rigorous evaluation for certain metrics than have been completed in recent annual verifications. In particular, this could entail more third-party verification of participation and project details for non-savings metrics.

The newly approved 2023-2025 EM&V Plan does entail additional, more rigorous evaluation activities for non-savings metrics through the Whole Building Pay for Performance and Building Beyond Code Program offerings. These activities include end-user and participant surveys, site visits, and market studies. As a result, this recommendation from the previous report has been completed.

Recommendation A: In the next EM&V plan, consider shifting evaluation resources and attention away from well-developed areas with relatively low risk of systematic errors (like prescriptive savings verification) towards those that have historically received less rigorous focus but may have a higher risk of inaccurate verification (like participation-type metrics).

Previously Recommended: Yes – since the 2021 AV report.

Outcome: Greater certainty of metric achievements. Decreased risk of inaccurate verification of non-savings metrics.

Status: Complete

10.1.2 Whole Home Simulation Modelling Recommendations

SM1. 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 modelling practices which may or may not follow industry standards. Although these assumptions and practices may follow NRCan protocols, those protocols were not specifically designed for the delivery of a DSM program and may not be appropriate in this situation. It is important to verify that the Energy Advisors using the modelling software are doing so consistently with industry best practice for natural gas efficiency programs. Such a detailed study is outside the scope of the annual verification. However, the 2023-2025 EM&V plan recommends a study to verify the savings estimates resulting from NRCan's modelling software. OEB is currently considering the value and timing of such a study. As a result, this recommendation from the previous report is in-progress.

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

Previously Recommended: Yes – since the 2015 AV report.

Outcome: Greater certainty around savings estimates.

Status: In progress

Utility Response: As noted in Table 10-2, this recommendation is directed to the OEB. For clarity, HOT2000 is the modelling software within Enbridge's OEB-approved DSM Plans for use in whole home modelling offerings.[28] The residential Home Efficiency Rebate offerings are delivered by registered Energy Advisors affiliated with NRCan-licensed Service Organizations, with the expectation that NRCan HOT2000 protocols/standards are being followed given that this is a licencing requirement. Failure to follow these protocols/standards could result in suspension or loss of licence by NRCan, which would in turn render Energy Advisors ineligible to participate in Enbridge's program.

OEB Response: As noted above, as part of the 2023-2025 EM&V plan, DNV recommends a study to verify the savings estimates resulting from NRCan's modelling software. The OEB is currently considering the value and timing of such a study. The scope of recent and future iterations of the home retrofit program and the applicability of evaluation results will be discussed with the EAC and EC to ensure any potential evaluation study will provide value.

10.1.3 Cost Effectiveness Recommendations

CE1. **Finding:** For 2022, like previous years, administrative and overhead costs are allocated differently by each legacy utility, reflecting the approved DSM plans developed in 2015 by separate organizations. In the absence of clear alignment of administrative and overhead costs, the EC has apportioned Enbridge 'overhead' costs based on the distribution of savings. In 2019, Enbridge and OEB agreed that it is not appropriate to make fundamental changes in the middle of the DSM Framework, and that full alignment should occur as part of the next DSM Framework and Plan, which begins with the 2023 program year. As a result, this recommendation from the previous report is in-progress.

Recommendation A: Under the new framework, Enbridge and the OEB should agree on a plan that calculates cost effectiveness at the appropriate level, allocates administrative costs and overhead to each component at the appropriate level, and ensures that cost-effectiveness results properly reflect true program costs and benefits.

Previously Recommended: Yes – since the 2015 AV Report.

Outcome: Ensure all costs are properly accounted for and allocated at the appropriate level so cost effectiveness results better reflect the true program costs.

Status: In progress

Utility Response: The allocation of administrative and overhead costs has been aligned via Enbridge's next multi-year DSM Plan. Administrative and overheard costs in the updated plan are consistently assigned at both program and portfolio levels where appropriate.[29]

CE2. **Finding**: In 2021, Enbridge was directed by the OEB to institute two changes to the methodology to calculate the cost of carbon to reflect federal regulatory updates. However, the EC did not become aware of the changes until late in the AV process. The EC encouraged Enbridge to communicate more clearly to the EC when methodological changes such as this occur during the DSM Framework. The 2022 Annual Verification did not entail any such methodological changes, and both the EC and Enbridge pledged to improve communication when changes do occur in the future. As a result, this recommendation from the previous report has been completed.

Recommendation A: Increase transparency and communication when changes are made to accepted methodology.

[28] See for example EB-2015-0029, 2015-2020 DSM Plan Union Gas Limited, Exhibit A Tab 2 Page 13 of 38

[29] See Decision and Order, Application for Multi-Year Demand Side Management Plan (2022 to 2027), EB-2021-0002, November 15, 2022, Schedule A

Previously Recommended: Yes – since the 2021 AV Report.

Outcome: Ensure consistent methodology to assess cost effectiveness and increase efficiency of the evaluation.

Status: Complete

10.2 eTools Boiler Tool Validation Study Recommendations

The results of this study show that, after key engineering assumptions are refined, eTools can provide a reasonably accurate estimate of aggregate advancement savings. The study also did not address factors external to the eTools calculator that could cause deviations from savings estimates and whose impacts could be studied, such as:

- Contractor equipment installation processes
- Boiler system commissioning processes
- End user operation and maintenance of boiler systems

Performance gaps in energy efficiency measures persist across all kinds in jurisdictions around the world. Despite significant performance gaps found in building energy conservation measures, for both new and retrofit buildings, no jurisdiction has discarded their performance simulation software. EnergyPlus, 3E Plus, Integrated Engineering Software, etc. are all used to provide forecasted savings in buildings even those these are seldom fully realized. eTools is a robust calculator with a solid engineering approach. Changing tools for evaluation will introduce additional uncertainty in the causes of differences in verified vs. claimed savings and there are no other boiler savings estimation tools that are known to be more accurate.

10.2.1 eTools and Implementation Recommendations

1. eTools advancement projects should not utilize the current 73% thermal efficiency default value, it should utilize site specific values, supported by documentation. If no defensible site-specific values are available the efficiency values identified in this study, 80.1% for space heating and 81.8% for domestic hot-water heating, should be utilized.

Utility Response: EGI no longer uses a 73% thermal efficiency value as a default. It uses site specific values supported by documentation. If no defensible site-specific values are available EGI uses default efficiencies of 80.1% for space heating and 81.8% for domestic hot-water heating.

2. Site specific documentation verifying any anticipated controls or setpoint changes should be gathered by Enbridge after boiler system commissioning. If documentation verifying controls changes are unavailable, then the installed systems should be assumed to utilize the same controls and setpoints as the existing systems.

Utility Response: EGI agrees to gather site-specific documentation to verify any anticipated controls or setpoint changes. If documentation verifying controls changes are unavailable, EGI will assume the installed system will utilize the same controls and setpoints as the existing systems.

3. Improve upon the weather normalization method for consumption data through adopting industry standard practices (ASHRAE, IPMVP, etc.) and thoroughly documenting the rationale for any deviations from those standards. Given the upward trend in temperatures, eTools should utilize weather normal values based on the 10 most recent years of data.

Utility Response: EGI uses the Canadian Weather Year for Engineering Calculations (CWEC) database, maintained by Government of Canada. This is consistent with industry best practice. The latest version of this database is CWEC2020, which was used starting with eTools v8. ETools weather data is updated as new datasets become available.

4. Investigate potential sources of bias in savings estimates associated with Air Handlers, Lead-lag installations, and combined systems. While the evaluation was not able to test changes to these settings in eTools, the multivariate analysis found that these characteristics were associated with errors in estimated savings.

Utility Response: EGI continues to update and refine eTools as new information becomes available and recognizes that future enhancements are always possible. Exploring air handler, lead-lag installation and combined system modules can be helpful for future eTools updates.

5. More rigorous data collection for existing and new boiler systems to capture empirical information to refine values for the various eTools' parameters that impact boiler performance, such as:

    a. Impacts of insulation on boiler shell heat losses
    b. Boiler purge frequency, and associated heat losses
    c. Hot water load of combined systems
    d. Percentage of load served by lead boilers in lead lag systems

Utility Response: Enbridge works with its customers and business partners to describe boiler systems in as much detail as possible. Not all sites will have the specific data noted in the recommendation. In these cases, best available engineering assumptions are used, documented, and remain subject to independent third-party verification.

10.2.2 Evaluation Recommendations

OEB should define a specific plan for boiler evaluation in consultation with the EAC prior to the next CPSV. There are few options, 1 is preferred, while 2 and 3 are less ideal:

1. CPSV with a realization rate applied to boiler project saving

    a. Advancement projects utilizing the 73% default efficiency value should include site specific documentation justifying the use of the default efficiency. Otherwise, the default efficiency should be changed to the values described in Section 3.5, with a caveat that these values will likely require future updates (schedule determined by the EAC) to account for changing baselines. Examples of supporting documentation include:

        i. Quantitative evidence such as combustion tests, or other empirical evidence of significant degradation in performance for the existing boilers
        ii. Qualitative information verifying the age, condition, and maintenance history of the existing boilers

    b. If ex ante savings estimates include improvements to boiler operations or controls from the existing system to the proposed system, then the project documentation should include site specific documentation verifying the changes were implemented when installed. If this documentation is unavailable then the proposed systems should be assumed to utilize the same control strategies as the existing systems. Examples of supporting documentation include:

        i. Commissioning reports
        ii. Or ex post photos, or reports from central control systems, verifying current set-points and control strategies

    c. After implementation of list items a and b, the realization rate from this study (79%) can be applied to aggregate eTools boiler project savings. Should the OEB, based on input from the EAC and advice from the EC, decide to incorporate the findings from Enbridge's study of non-participant natural gas consumption trends, then a maximum realization rate of 84% is recommended.

d. The OEB, based on input from the EAC and advice from the EC, should determine whether additional investigations should be conducted to:

   i. Determine if a different realization rate should be applied to replacement projects because the current realization rate was based on eTools estimates of advancement savings

   ii. Decide how the findings of this study will be used in upcoming Custom Program Savings Verification (CPSV) evaluations

2. More rigorous CPSV: More rigorous methodologies can be applied (in future CPSV evaluations) for a sample of boiler projects to investigate post-period operations, or potential NREs, including:

   a. Metering of installed boiler systems to determine:

      i. Load

      ii. Condensing functionality

      iii. Thermal Efficiency

   b. Creation and use of a robust NRE survey instruments

3. Billing Analysis on a regular basis: This is an evaluation option that is feasible but not recommended. Boilers would be excluded from CPSV and would instead be evaluated via billing analysis. This would cause boilers to be evaluated with a greater lag from participation to evaluation than other custom measures, and discussions on how to apply findings to both advancement and standard baseline installations will be necessary.

Utility Response: EGI will work with OEB Staff, the EC and the EAC to determine which of the above options or a suitable alternative is adopted.

OEB Response: As part of the ongoing CPSV efforts, the OEB will consider the options outlined above, with input from the EAC, with the objective of providing direction to DNV for boiler-related evaluations, consistent with the EC's recommendation noted above.

11 APPENDICES

11.1 Appendix A: Evaluation Background

Enbridge and Union deliver energy efficiency programs under the Demand Side Management Framework for Natural Gas Distributors (2015-2020 and extended through 2022) 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 2022), the new framework was implemented, resulting in changes to the programs offered, as shown in Table 11-1. Programs included in the plan and offered by the utilities are marked with a check, those in the plan and offered by the utilities but with no activity reported are marked with an X.

Table 11-1. DSM programs offered – 2015 through 2022

Scorecard	Program Name	2015	2016	2017	2018	2019	2020	2021	2022
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 New Construction	✓	✓	✓	✓	✓	✓	✓	✓
	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	✓	✓	✓	✓	✓	✓	✓	✓
	Residential Adaptive Thermostats					✓	✓	✓	✓
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 activity reported

Table 11-2 shows how the board-approved metrics under each scorecard have changed over time.

Table 11-2. Energy efficiency metrics – 2016 through 2022

Scorecard	Metric	2016	2017	2018	2019	2020	2021	2022
Enbridge								
Resource Acquisition	Large Volume Customer Savings (CCM)	✓	✓	✓	✓	✓	✓	✓
	Small Volume Customer Savings (CCM)	✓	✓	✓	✓	✓	✓	✓
	Home Energy Conservation - Participants	✓	✓	✓	✓	✓	✓	✓
Low Income	Home Winterproofing (CCM)	✓	✓	✓	✓	✓	✓	✓
	Low Income Multi-Residential (CCM)	✓	✓	✓	✓	✓	✓	✓
	Low Income New Construction – Project Applications	✓	✓	✓	✓	✓	✓	✓
Market Transformation	Commercial Savings by Design – New Developments	✓	✓	✓	✓	✓	✓	✓
	Comprehensive Energy Management – Participants	✓	✓	✓	✓	✓	✓	✓
	Residential Savings by Design – Builders	✓	✓	✓	✓	✓	✓	✓
	Residential Savings by Design – Homes Built			✓	✓	✓	✓	✓
	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.

This report applies the results of several, previously completed studies:

- A study measuring the free ridership within the custom projects[30] implemented in the 2018 program year[31]
- A study verifying the custom project savings (CPSV) during the 2017 and 2018 program years[32,33]
- A study verifying the prescriptive project savings from prescriptive projects implemented in the 2017 program year[34]
- A study of custom measure lives, completed in May 2018.[35]
- A study of the spillover resulting from the implementation of custom projects during the 2013-2014 program years, completed in May 2018.[36]
- A study verifying custom boiler project savings that used Enbridge's eTools energy modelling software, completed in January 2023.[37]

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

[31] 2018 Natural Gas Demand Side Management Free-ridership Evaluation, DNV for the Ontario Energy Board, December 27, 2019

[32] 2017-2018 Natural Gas Demand Side Management Custom Savings Verification, DNV for the Ontario Energy Board, December 26, 2019

[33] Due to complications from the COVID-19 pandemic, the EC was unable to complete planned studies verifying the custom project savings (CPSV) from the 2019, 2020, 2021, and 2022 program years. Instead, the EC used the same adjustment factors resulting from custom projects implemented in the 2017 and 2018 program years, adjusted for the mix of projects installed in 2019, 2020, 2021, and 2022.

[34] 2017 C&I Prescriptive Verification: Final Report – Measurement of NTG Factors and Gross Savings Verification, Itron for the Ontario Energy Board, June 7, 2019

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

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

[37] eTools Boiler Tool Validation Study, DNV for the Ontario Energy Board, January 31, 2023

11.2 Appendix B: Metric Verification Activities

To verify the metric achievements, the EC conducted the activities outlined in Table 11-3 and Table 11-4. The utilization of each activity depends on the "type" of measure being reviewed. DNV 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.

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.

- **Confirm Tracking:** Confirmation that the entries and calculations within the submitted tracking data accurately contribute to scorecard metrics.
  - *Prescriptive measures:* The EC confirmed that measure-level inputs were applied from the TRM where appropriate (such as savings per unit), then recalculated gross and net savings based on those inputs to verify the tracked 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.
- **Apply Factors:** Application of relevant factors that are not otherwise applied in the TRM, such as gross savings adjustments, eTools adjustments, free ridership adjustments, and spillover ratios.
  - *Prescriptive measures*: The EC used the results of the C&I Prescriptive Verification and installation rate studies conducted through separate processes.
  - *Custom measures*: The EC used the results of the CPSV, eTools, free ridership, and spillover studies conducted through separate processes.
- **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 11-3 and Table 11-4 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 11-3. 2022 Annual verification activities by program: Enbridge

Scorecard	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 2022 activity reported			
	Energy Leaders	C	✓	✓	✓
	Home Energy Conservation	W O	✓	✓	✓
	Residential Adaptive Thermostats	P	✓	✓	
	Run-it-Right	C	✓	✓	✓
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	No 2022 activity reported			
	School Energy Competition	No 2022 activity reported			

Table 11-4. 2022 Annual verification activities by program: Union

Scorecard	Program	Measure Types	Confirm Tracking	Apply Factors	Desk Review
Resource Acquisition	C&I Custom	C		✓	
	C&I Direct Install	P	✓	✓	
	C&I Prescriptive	P	✓	✓	
	Home Reno Rebate	W O	✓	✓	✓
	Residential Adaptive Thermostats	P	✓	✓	
Large Volume	Large Volume	C	✓	✓	
Low Income	Indigenous	P W	✓	✓	✓
	Furnace End-of-Life	No 2022 activity reported			
	Home Weatherization	P W	✓	✓	✓
	Multifamily Social & Assisted	P C	✓	✓	
	Multifamily Market Rate	P C	✓	✓	
Market Transformation	Commercial New Construction	O	✓		✓
	Optimum Home	O	✓		✓
Performance Based	RunSmart	No 2022 activity reported			
	Strategic Energy Management	O	✓		✓

Desk reviews of Whole Home and Other measures require additional information beyond what is provided in the tracking data. 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, Home Winterproofing, Home Weatherization, and Indigenous programs. Table 11-5 and Table 11-6 show the number of projects for which the EC requested additional documentation.

Table 11-5. Desk Review Sample: Enbridge

Scorecard	Program	Sample Requested
Resource Acquisition	Home Energy Conservation	30 Randomly Selected Homes
	Run-it-Right	Census
	Energy Leaders	Census
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

Table 11-6. Desk Review Sample: Union

Scorecard	Program	Sample Requested
Resource Acquisition	Home Reno Rebate	30 Randomly Selected Homes
Low Income	Home Weatherization	30 Randomly Selected Homes
	Indigenous	Census
Market Transformation	Optimum Home	5 Randomly Selected Homes
	Commercial New Construction	5 Randomly Selected Projects
Performance-Based	Strategic Energy Management	Census

11.3 Appendix C: Changes from 2021 Annual Verification

There were no major changes between the 2021 and 2022 program year evaluations, but several small changes did occur. These included:

- **Programs not previously executed**: Union's Indigenous program was paused from 2019 to 2021 but saw results in 2022.
- **Programs previously executed**: Enbridge's Comprehensive Energy Management (RA) and Run-it-Right (MT) programs were implemented in 2021, but had no activity in 2022.
- **Changed scorecard metrics:** There were no changes between 2021 and 2022 scorecard metrics.

11.4 Appendix D: Summary of Verification Adjustments

Table 11-7 and Table 11-8 provide a combined summary of metrics for Enbridge programs and Union programs, respectively. These tables show where the EC made adjustments of greater than 1% from the values identified in *tracking data*.

Table 11-7. Enbridge Metrics with Verified Value Greater than 1% Different from Tracked

Programs	Metrics	>1% Difference?
Resource Acquisition		
C&I Custom	Large Volume Customers CCM	✓
C&I Direct Install		
C&I Prescriptive		
Comprehensive Energy Management		
Energy Leaders		✓
Run-it-Right		
Home Energy Conservation (HEC)	Small Volume Customers CCM	
Residential Adaptive Thermostats		✓
C&I Custom		✓
C&I Direct Install		
C&I Prescriptive		
Energy Leaders		✓
Comprehensive Energy Management		
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 11-8. Union Metrics with Verified Value Greater than 1% Different from Tracked

Programs	Metrics	>1% Difference?
Resource Acquisition		
Home Reno Rebate	RA (CCM)	
Residential Adaptive Thermostats		✓
C&I Custom		✓
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	Percentage of Homes Built	
Commercial New Construction	CNC Developments	
Performance Based		
RunSmart	RS Participants	
	RS Savings %	
Strategic Energy Management	SEM Savings %	

11.5 Appendix E: Resource Acquisition Scorecards

This appendix describes the detailed process used to verify the metrics for the Resource Acquisition Scorecard programs for Enbridge (Table 11-9) and Union (Table 11-10). The programs addressed in this appendix are:

- Residential Home Retrofit – Home Energy Conservation – Enbridge[38]
- Residential Home Retrofit – Home Reno Rebate – Union[39]
- Residential Adaptive Thermostats – Enbridge
- Residential Adaptive Thermostats – Union
- C&I – Prescriptive – Enbridge
- C&I – Prescriptive – Union
- C&I – Direct Install – Enbridge
- C&I – Direct Install – Union
- C&I – Custom – Enbridge
- C&I – Custom – Union
- Comprehensive Energy Management – Enbridge
- Energy Leaders – Enbridge
- Run-it-Right – Enbridge

[38] This program is now called Home Efficiency Rebate.
[39] This program is now called Home Efficiency Rebate.

Table 11-9. Enbridge 2022 Resource Acquisition scorecard*[40]

Programs	Metrics	Verified Achievement		Metric Target			Weight
		Program-level Achievement	Metric-level Achievement	Lower Band	Target	Upper Band	
Home Energy Conservation**	Large Volume Customer - CCM	-	403,144,097	368,523,240	491,364,320	737,046,481	40.00%
Residential Adaptive Thermostats		-					
C&I Custom		363,241,521					
C&I Direct Install		5,253,809					
C&I Prescriptive		29,109,669					
Comprehensive Energy Management		-					
Energy Leaders		5,372,206					
Run-it-Right		166,893					
Home Energy Conservation**	Small Volume Customer - CCM	198,970,556	310,193,626	183,761,746	245,015,661	367,523,492	40.00%
Residential Adaptive Thermostats		60,993,616					
C&I Custom		14,464,195					
C&I Direct Install		19,778,326					
C&I Prescriptive		15,512,586					
Comprehensive Energy Management		-					
Energy Leaders		474,348					
Run-it-Right		-					
Home Energy Conservation**	Participants	17,225	17,225	7,425	9,900	14,850	20.00%

*Not all values may compute exactly due to rounding.
**This program is now marketed as Home Efficiency Rebate.

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

Table 11-10. Union 2022 Resource Acquisition scorecard*[41]

Programs	Metrics	Verified Achievement		Metric Target			Weight
		Program-level Achievement	Metric-level Achievement	Lower Band	Target	Upper Band	
Home Reno Rebate**	CCM	91,175,972	430,240,518	574,789,855	766,386,474	1,149,579,711	75.00%
Residential Adaptive Thermostats		29,778,714					
C&I Custom		266,946,625					
C&I Direct Install		19,359,319					
C&I Prescriptive		22,979,889					
Home Reno Rebate**	Participants	6,568	6,568	4,082	5,443	8,165	25.00%

*Not all values may compute exactly due to rounding.
**This program is now marketed as Home Efficiency Rebate.

[41] Ibid.

11.5.1 Residential Home Retrofit - Home Energy Conservation – Enbridge[42]

Overview

Table 11-11 shows the tracked and verified scorecard achievements for the 2022 Enbridge Home Energy Conservation (HEC) Program, with the metrics of CCM savings and participants (homes). As a result of this review, the EC verifies 198,652,712 CCM (100.16% of tracked) and 17,225 participants (100.00% of tracked). Each metric is discussed separately in this section, starting with the participants metric. Table 11-11 contains the following variables:

- Tracked: Metric value from original Tracking File sent by Enbridge upon first data request
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documentation section
- Ratio: Ratio of verified to tracked achievement. A value of 100.00% indicates that verified values match tracked values

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

Metric	Achievement		Ratio
	Tracked	Verified	
Large Volume Customer - CCM	-	-	-
Small Volume Customer - CCM	198,652,712	198,970,556	100.16%
Participants (Homes)	17,225	17,225	100.00%

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 11-12 to verify the metrics for the Home Energy Conservation program.

Table 11-12. 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 2022 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, OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016 and OEB Decision and Order, EB-2021-0002, August 26, 2021
Enbridge Plan	Enbridge Gas Multi-Year DSM Plan (2015-2020), EB-2015-0049

Participant Selection

Enbridge provided the Tracking File listing 17,225 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 folder had the following information:

- Photographs of pre- and post-installation conditions
- HOT2000 Model input or “Simulation” Files (.h2k)

[42] This program is now marketed as Home Efficiency Rebate.

- HOT2000 Model Output Files (.xls) aggregated in one spreadsheet

Participants Metric

Table 11-13 shows the tracked and verified scorecard achievements for the 2022 Enbridge HEC program with the metric of participant homes.

Table 11-13. Enbridge Resource Acquisition achievement: HEC Program participants metric*

Metric	Achievement		Ratio
	Tracked	Verified	
Participants (Homes)	17,225	17,225	100.00%

*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.[43] The EC next looked to Enbridge's plan, which identified the following criteria:[44,45]

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[46]

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.
- **Criterion 3:** At the conclusion of the 2019 evaluation, Enbridge confirmed that their administrative process for contracting with Service Organizations includes a requirement to be NRCan-licensed and for the Service Organizations to ensure that all Energy Advisors remain certified, registered, and in good standing. While the EC does not have 100% certainty about certification status at the time of audit, we accept Enbridge's process as sufficient for this criterion.
- **Criterion 4:** The tracking data for all 17,225 records (including the 30 sampled) indicated that at least two measure types were installed at each location, with 18 homes (of the total population) receiving as many as seven.
- **Criterion 5:** Each project contained pre- and post- project photos. 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:** As decided by the EAC in 2016, the EC uses the same criterion applied to the equivalent Union program, which is a 15% *average* savings across all homes. Tracking data, corroborated by HOT2000 model files, showed an average of 15.42% for the 30 sample projects reviewed, which was identical to the percentage predicted by the

[43] Ontario Energy Board Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016, Page 13
[44] Enbridge's Proposed 2015-2020 DSM Plan, EB-2015-0049, Exhibit B, Tab 2, Schedule 2, Page 19 of 55
[45] Enbridge's Proposed 2015-2020 DSM Plan, EB-2015-0049, Exhibit B, Tab 2, Schedule 1, Page 25 of 100
[46] 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. The EAC has chosen to use the second (average) criteria for evaluation.

Tracking File for those 30 homes. This gave the EC confidence in the average natural gas savings of 16.28% across all participants in the Tracking File. Therefore, the EC verified that the homes meeting this criterion.

In addition to these six criteria, the EAC identified one additional criterion for homes that installed air sealing. The EC also identified baseline adjustments occurring on some installed furnaces measures in addition to updating eligibility for participants who installed furnace measures.

- **Criterion 7:** For air sealing to qualify as a measure, the EAC determined that a reduction of at least 10% of the cubic feet per minute of air leakage (as measured by a documented blower-door test) must occur. Tracking data for all projects that claimed air sealing as an installed measure identified a reduction of 10% or more.[47] Therefore, the air sealing measure qualified for all air sealing measures that were claimed.
- **Criterion 8:** As part of an effort to achieve deeper savings, starting January 1, 2021, Enbridge required participants who installed a furnace to install 2 additional measures. At the same time, governmental regulations came into force requiring all new furnaces to have at least 95% AFUE. Enbridge provided documentation and additional explanation to show adjusted furnace baselines based on pre- and post-audit dates. If a participant installed a furnace plus one measure and had a pre audit date before January 2021, they were determined to be eligible as a program participant.

Table 11-14 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 air sealing upgrade, with 16,753 total homes.

Table 11-14. 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		
Air Sealing	9,036	5,019	2,153	435	92	18	16,753	**97%**
Attic Insulation	8,387	4,207	2,017	408	91	18	15,128	**88%**
Furnace	-	3,148	1,768	363	84	18	5,381	**31%**
Water Heater	478	1,660	1,617	330	74	18	4,177	**24%**
Windows	279	710	530	248	90	18	1,875	**11%**
Basement Insulation	164	605	588	345	95	18	1,815	**11%**
Boiler	244	74	29	8	6	-	361	**2%**
Wall Insulation	28	75	78	73	44	18	316	**2%**
Total Measure Types	**18,616**	**15,498**	**8,780**	**2,210**	**576**	**126**	**45,806**	**N/A**
Total Homes	**9,308**	**5,166**	**2,195**	**442**	**96**	**18**	**17,225**	**N/A**

*Not all values may compute exactly due to rounding.

Verification Result

As a result of this review, the EC verifies that 17,225 homes satisfy the requirements of participation (100.00% of tracked).

CCM Savings Metric

Table 11-15 shows the tracked and verified scorecard achievements for the 2022 Enbridge HEC program with the metric of CCM savings.

[47] Average air leakage reduction among projects claiming air sealing as an installed measures was 13.55%, with the vast majority (nearly 94% of projects) claiming air leakage reductions between 10% and 20%.

Table 11-15. Enbridge Resource Acquisition scorecard achievements: HEC Program CCM metric*

Metric	Achievement		Ratio
	Tracked	Verified	
Large Volume Customer - CCM	-	-	-
Small Volume Customer - CCM	198,652,712	198,970,556	100.16%
TOTAL	**198,652,712**	**198,970,556**	**100.16%**

*Not all values may compute exactly due to rounding.

Verify Tracked Savings

In calculating net 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 11-1 for the 2022 HEC verification. The process was necessary because the simulation mode (EnerGuide or Expert[48]) 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 (H2K) and output (XLS) 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. This documentation explained the adjustments used to calculate approved furnace baselines for accurate reported savings values.
- If no additional documentation or explanation was available, the EC compared the output file values to the project documentation to determine whether they were consistent. If they were not consistent, the output file value was used as the verified value.

[48] "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 11-1. Overview of Gross Savings Verification for 2022 HEC Verification

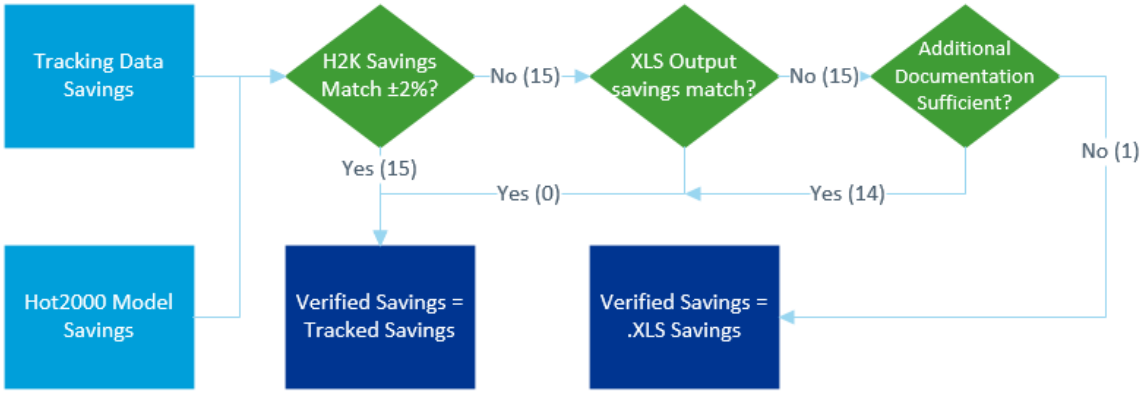


Table 11-16 shows how many customers were verified in each evaluation step.

Table 11-16. Overview of gross savings verification

Evaluation Step	# Verified
Simulation re-run (H2K) and compared to tracking, verified if ± 2%	15
Output files for (XLS) compared to tracking, verified if ± 2%	0
Additional Explanation request	14
Comparison to output file values	1
Total Verified	**30**

The gross savings realization rate (RR) is 100.16%, shown in Table 11-17.

Table 11-17. Enbridge HEC Realization Rate*

Numbers of Houses	Realization Rate	90% Confidence Interval			
		Absolute Precision	Lower Bound	Upper Bound	Relative Precision
30	100.16%	0.17%	100.00%	100.33%	0.28%

*Not all values may compute exactly due to rounding.

Verification Result

As a result of this review, the EC confirms total savings of 198,970,556 CCM for Enbridge's Home Energy Conservation CCM savings metric (100.16% of tracked).

11.5.2 Residential Home Retrofit - Home Reno Rebate – Union[49]

Overview

Table 11-18 shows the tracked and verified scorecard achievements for the 2022 Union Home Reno Rebate (HRR) program, with the metrics of CCM savings and homes built. As a result of this review, the EC verifies 91,175,972 CCM (100.09% of tracked) and 6,568 participants (100.00% of tracked). Each metric is discussed separately in this section, starting with the participants metric. Table 11-18 contains the following variables:

- Tracked: Metric value from original Tracking File sent by Enbridge upon first data request
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documentation section
- Ratio: Ratio of verified to tracked achievement. A value of 100.00% indicates that verified values match tracked values

Table 11-18. Union Resource Acquisition achievement: Home Reno Rebate metrics*

Metric	Achievement		Ratio
	Tracked	Verified	
CCM	91,093,987	91,175,972	100.09%
Participants (Homes)	6,568	6,568	100.00%

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 11-19 to verify the metrics for the Home Reno Rebate program.

Table 11-19. Documentation used to verify the Home Reno Rebate program

Report Language	Description or Citation
Enbridge-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2022 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, OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016 and OEB Decision and Order, EB-2021-0002, August 26, 2021
Union Plan	Union's 2015-2020 DSM Plan, EB-2015-0029

Participant Selection

Union provided the Tracking File listing 6,568 individual participants in the HRR 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
- HOT2000 Model simulation or "Simulation" Files (.h2k)
- HOT2000 Model Output Files (.xls) aggregated in one spreadsheet

[49] This program is now marketed as Home Efficiency Rebate.

Participants Metric

Table 11-20 shows the tracked and verified scorecard achievements for the 2022 Union HRR program with the metric of participant homes.

Table 11-20. Union Resource Acquisition achievement: HRR Program participants metric*

Metric	Achievement		Ratio
	Tracked	Verified	
Participants (Homes)	6,568	6,568	100.00%

*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[50]. The EC looked next to Union's plan, which identified the following criteria:[51]

> *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 review, all participants met this requirement. Table 11-21 shows the measure types and number of measures in the homes that met this requirement.
- **Criterion 2:** Of the 30 homes randomly sampled, tracking files allowed the EC to calculate average savings of 15.62%. The EC further calculated from tracking data that the population of homes satisfied the 15% requirement, with an average of 20.76% savings across all homes.

Table 11-21 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 air sealing, with 6,242 total homes.

[50] Ontario Energy Board Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016, Page 13
[51] Union's Proposed 2015-2020 DSM Plan, EB-2015-0029, Exhibit A, Tab 3, Page 24 of 73

Table 11-21. 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		
Air Sealing	3,429	1,679	813	243	61	17	6,242	**95%**
Attic Insulation	3,010	1,307	705	209	56	17	5,304	**81%**
Furnace	-	830	530	162	57	17	1,596	**24%**
Windows	272	565	382	197	60	17	1,493	**23%**
Water Heater	234	490	461	138	35	17	1,375	**21%**
Basement Insulation	183	365	357	194	56	17	1,172	**18%**
Wall Insulation	25	93	110	111	41	17	397	**6%**
Boiler	65	29	14	6	-	-	114	**2%**
Total Measure Types	**7,218**	**5,358**	**3,372**	**1,260**	**366**	**119**	**17,693**	**N/A**
Total Homes	**3,609**	**1,786**	**843**	**252**	**61**	**17**	**6,568**	**N/A**

*Not all values may compute exactly due to rounding.

Verification Result

As a result of this review, the EC verifies that all 6,568 homes (100.00%) satisfy the requirements for participation.

CCM Savings Metric

Table 11-22 shows the tracked and verified scorecard achievements for the 2022 Union HRR program with the metric of CCM savings.

Table 11-22. Union Resource Acquisition scorecard achievements: HRR Program savings metric*

Metric	Achievement		Ratio
	Tracked	Verified	
CCM	91,093,987	91,175,972	100.09%

*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 the tracking data, allowing for a simple summing of tracked savings. The EC 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

For the 2022 HRR verification, the EC used a multi-step process to verify tracked energy savings for the sampled homes, shown in Figure 11-2. The process was necessary because the simulation mode (EnerGuide or Expert[52]) 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:

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

- 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. This documentation explained the adjustments used to calculate approved furnace baselines for accurate reported savings values.
- If no additional documentation or explanation was available, the EC compared the output file values to the project documentation to determine whether they were consistent.

Figure 11-2. Overview of gross savings verification for 2022 HRR verification

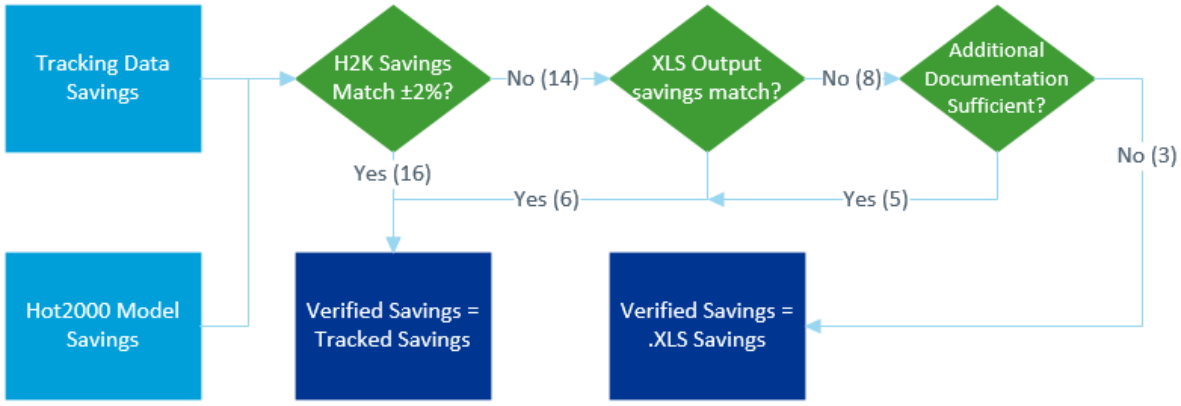


Table 11-23 shows how many customers were verified in each evaluation step.

Table 11-23. Overview of gross savings verification

Evaluation Step	# Verified
Simulation re-run (H2K) and compared to tracking, verified if ± 2%	16
Output files for (XLS) compared to tracking, verified if ± 2%	6
Additional Explanation request	5
Comparison to output file values	3
Total Verified	**30**

The EC produced verified savings for all 30 homes in the sample. The gross savings realization rate (RR) is 100.09%, shown in Table 11-24.

Table 11-24. Union HRR realization rate*

Numbers of Houses	Realization Rate	90% Confidence Interval			
		Absolute Precision	Lower Bound	Upper Bound	Relative Precision
30	100.09%	0.86%	99.23%	100.95%	1.41%

*Not all values may compute exactly due to rounding.

Verification Result

As a result of this review, the EC confirms the total savings of 91,175,972 CCM for Union's Home Reno Rebate CCM savings metric (100.09% of tracked).

11.5.3 Residential Adaptive Thermostats - Enbridge

Overview

Table 11-25 shows the tracked and verified scorecard achievements for the 2022 Enbridge Residential Adaptive Thermostat Program, with the metric of CCM savings. As a result of this review, the EC verifies 60,993,616 CCM (102.81%of tracked). Table 11-25 contains the following variables:

- Tracked: Metric value from original Tracking File sent by Enbridge upon first data request
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documentation section
- Ratio: Ratio of verified to tracked achievement. A value of 100.00% indicates that verified values match tracked values

Table 11-25. Enbridge Resource Acquisition achievement: Residential Adaptive Thermostats CCM metric*

Metric	Achievement		Ratio
	Tracked	Verified	
Large Volume Customer - CCM	-	-	-
Small Volume Customer - CCM	59,328,945	60,993,616	102.81%
TOTAL	**59,328,945**	**60,993,616**	**102.81%**

*Not all values may compute exactly due to rounding.

Documentation

The EC used documentation shown in Table 11-26 to verify the metrics for the Residential Adaptive Thermostat program.

Table 11-26. Documentation used to verify the Residential Adaptive Thermostats program

Report Language	Description or Citation
Enbridge-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2022 Enbridge DSM programs
Adaptive Thermostat Ping Report	2022 Adaptive Thermostats Ping Reports LUG and LEG
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016, OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016 and OEB Decision and Order, EB-2021-0002, August 26, 2021
Enbridge Plan	Enbridge Gas Multi-Year DSM Plan (2015-2020), EB-2015-0049
TRM 6.0	Natural Gas Demand Side Management Technical Resource Manual, Version 6.0

Verify Cumulative Natural Gas Savings

The EC reviewed natural gas savings for prescriptive measures from the Tracking File, using the procedures identified in Section 11.13. In calculating gas savings, the EC used:

- Tracking File data, which reported 26,391 units
- TRM 6.0
- Adaptive Thermostat Ping Report, which reported 86.71% installation rate[53]

[53] The Residential Adaptive Thermostat Offering provides participants with a point-of-sale instant discount for purchasing adaptive thermostat. Ecobee supported Enbridge by "pinging" its devices claiming the offering's discount, allowing Ecobee to identify which purchased thermostats have been installed and connected to the internet. In early 2023, Ecobee pinged all Ecobee adaptive thermostats purchased online through the 2022 point-of-sale instant discount offer. If a device was determined to be online during at least one of five pings, it was considered an installed device, and an installation verification adjustment factor was determined using this information (installed devices / all devices pinged). The adjustment factor was applied to all adaptive thermostats purchased through the 2022 point-of-sale instant discount offer (including in-store Ecobee purchased devices and non-Ecobee devices). For legacy Enbridge, 3,209 devices were determined to be installed out of 3,701 total devices pinged (86.71% installation rate).

The EC certified the tracked savings, for a savings ratio of 102.81%.[54]

Verification Result

As a result of this review, the EC confirms the savings of 60,993,616 CCM (102.81% of tracked) for Enbridge's Residential Adaptive Thermostat small volume customer CCM metric.

[54] The savings ratio is more than 100% because the program used a lower installation rate than the EC, so the EC verifies more than 100% of the savings reported by the program.

11.5.4 Residential Adaptive Thermostats - Union

Overview

Table 11-27 shows the tracked and verified scorecard achievements for the 2022 Union Residential Adaptive Thermostat Program, with the metric of CCM savings. As a result of this review, the EC verifies 29,778,714 CCM (102.97% of tracked). Table 11-27 contains the following variables:

- Tracked: Metric value from original Tracking File sent by Enbridge upon first data request
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documentation section
- Ratio: Ratio of verified to tracked achievement. A value of 100.00% indicates that verified values match tracked values

Table 11-27. Union Resource Acquisition achievement: Residential Adaptive Thermostats CCM metric*

Metric	Achievement		Ratio
	Tracked	Verified	
CCM	28,919,652	29,778,714	102.97%

*Not all values may compute exactly due to rounding.

Documentation

The EC used documentation shown in Table 11-28 to verify the metrics for the Residential Adaptive Thermostat program.

Table 11-28. Documentation used to verify the Residential Adaptive Thermostats program

Report Language	Description or Citation
Enbridge-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2022 Union DSM programs
Adaptive Thermostat Ping Report	2022 Adaptive Thermostats Ping Reports LUG and LEG
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016, OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016, OEB Mid-Term Review, EB-2017-0127/EB-2017-0128, and OEB Decision and Order, EB-2021-0002, August 26, 2021
Union Plan	Union's 2015-2020 DSM Plan, EB-2015-0029
TRM 6.0	Natural Gas Demand Side Management Technical Resource Manual, Version 5.0

Verify Cumulative Natural Gas Savings

The EC reviewed natural gas savings for prescriptive measures from the Tracking File, using the procedures identified in Section 11.13. In calculating gas savings, the EC used:

- Tracking File data, which reported 12,986 units
- TRM 6.0
- Adaptive Thermostat Ping Report, which reported 86.07% installation rate[55]

[55] The Residential Adaptive Thermostat Offering provides participants with a point-of-sale instant discount for purchasing adaptive thermostat. Ecobee supported Enbridge by "pinging" its devices claiming the offering's discount, allowing Ecobee to identify which purchased thermostats have been installed and connected to the internet. In early 2023, Ecobee pinged all Ecobee adaptive thermostats purchased online through the 2022 point-of-sale instant discount offer. If a device was determined to be online during at least one of three pings, it was considered an installed device, and an installation verification adjustment factor was determined using this information (installed devices / all devices pinged). The adjustment factor was applied to all adaptive thermostats purchased through the 2022 point-of-sale instant discount offer (including in-store Ecobee purchased devices and non-Ecobee devices). For legacy Union, 1,384 devices were determined to be installed out of 1,608 total devices pinged (86.07% installation rate).

The EC certified the tracked savings, for a savings ratio of 102.97%.[56]

Verification Result

As a result of this review, the EC confirms the savings of 29,778,714 CCM (102.97% of tracked) for Union's Residential Adaptive Thermostat CCM metric.

[56] The savings ratio is more than 100% because the program used a lower installation rate than the EC, so the EC verifies more than 100% of the savings reported by the program.

11.5.5 C&I - Prescriptive – Enbridge

Overview

Table 11-29 shows the tracked and verified scorecard achievements for the 2022 Enbridge C&I Prescriptive program, with the metric of CCM savings. As a result of this review, the EC verifies total savings of 44,622,254 CCM for large and small volume customers (100.00% of tracked). Table 11-29 contains the following variables:

- Tracked: Metric value from original Tracking File sent by Enbridge upon first data request
- 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 achievement. A value of 100.00% indicates that verified values match tracked values.

Table 11-29. Enbridge Resource Acquisition achievement: C&I Prescriptive CCM metric*

Metric	Achievement		Ratio
	Tracked	Verified	
Large Volume Customer - CCM	29,109,668	29,109,669	100.00%
Small Volume Customer - CCM	15,512,585	15,512,586	100.00%
TOTAL	**44,622,254**	**44,622,254**	**100.00%**

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 11-30 to verify the metrics for the C&I Prescriptive program.

Table 11-30. 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 2022 Enbridge DSM programs
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016, OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016, and OEB Decision and Order, EB-2021-0002, August 26, 2021
Enbridge Plan	Enbridge Gas Multi-Year DSM Plan (2015-2020), EB-2015-0049
TRM 6.0	Natural Gas Demand Side Management Technical Resource Manual, Version 6.0
C&I Prescriptive Verification Study	2017 C&I Prescriptive Study – Measure of NTG Factors and Gross Savings Verification, Itron, June 2019

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 Section 11.13. Table 11-31 and Table 11-32 show the results of the analysis.

Table 11-31. Enbridge Resource Acquisition achievement by measure group: small volume customers*

Measure Group	Installed Measures	Tracked Achievement (CCM)	Verified Achievement (CCM)	Savings Ratio
Air Curtain	12	724,883	724,883	100.00%
Broiler	1	32,131	32,131	100.00%
Demand Control Kitchen Ventilation	48	2,652,953	2,652,953	100.00%
Demand Control Ventilation	33	254,184	254,184	100.00%
Destratification Fan	1	39,447	39,447	100.00%
Dock Door Seal	199	4,942,888	4,942,888	100.00%
Energy Recovery Ventilation	30	777,471	777,471	100.00%
Fryer	244	3,298,099	3,298,099	100.00%
Oven	171	1,734,192	1,734,192	100.00%
Ozone Washer Extractor	1	185,306	185,306	100.00%
Steam Cooker	2	170,669	170,669	100.00%
Water Heater	95	700,361	700,361	100.00%
Total	**837**	**15,512,585**	**15,512,586**	**100.00%**

*Not all values may compute exactly due to rounding.

Table 11-32. Enbridge Resource Acquisition achievement by measure group: large volume customers*

Measure Group	Installed Measures	Tracked Achievement (CCM)	Verified Achievement (CCM)	Savings Ratio
Air Curtain	12	793,041	793,041	100.00%
Demand Control Kitchen Ventilation	9	482,356	482,356	100.00%
Dock Door Seal	365	9,335,185	9,335,185	100.00%
Energy Recovery Ventilation	14	14,768,458	14,768,458	100.00%
Fryer	53	716,390	716,390	100.00%
Heat Recovery Ventilation	2	215,500	215,500	100.00%
Make-Up Air Unit	3	892,611	892,611	100.00%
Oven	69	745,747	745,747	100.00%
Ozone Washer Extractor	1	526,064	526,064	100.00%
Steam Cooker	4	341,338	341,338	100.00%
Water Heater	30	292,979	292,979	100.00%
Total	**562**	**29,109,668**	**29,109,669**	**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 15,512,586 CCM for small volume customers (100.00% of tracked) and 29,109,669 CCM for large volume customers (100.00% of tracked) for Enbridge's C&I Prescriptive Program.

11.5.6 C&I - Prescriptive – Union

Overview

Table 11-33 shows the shows the tracked and verified scorecard achievements for the 2022 Union C&I Prescriptive program, with the metric of CCM savings. As a result of this review, the EC verifies 22,979,889 CCM (100.00% of tracked). Table 11-33 contains the following variables:

- Tracked: Metric value from original Tracking File sent by Enbridge upon first data request
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documentation section
- Ratio: Ratio of verified to tracked achievement. A value of 100.00% indicates that verified values match tracked values

Table 11-33. Union Resource Acquisition achievement: C&I Prescriptive CCM metric*

Metric	Achievement		Ratio
	Tracked	Verified	
CCM	22,979,889	22,979,889	100.00%

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 11-34 to verify the metrics for the C&I Prescriptive program.

Table 11-34. 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 2022 Union DSM programs
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016, OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016 and OEB Decision and Order, EB-2021-0002, August 26, 2021
Union Plan	Union's 2015-2020 DSM Plan, EB-2015-0029
TRM 6.0	Natural Gas Demand Side Management Technical Resource Manual, Version 6.0
C&I Prescriptive Verification Study	2017 C&I Prescriptive Study – Measure of NTG Factors and Gross Savings Verification, Itron, June 2019

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 Section 11.13. Table 11-35 shows the results of the analysis.

Table 11-35. Union Resource Acquisition achievement by measure group*

Measure Group	Installed Measures	Tracked Achievement (CCM)	Verified Achievement (CCM)	Savings Ratio
Air Curtain	19	914,948	914,948	100.00%
Demand Control Kitchen Ventilation	11	929,200	929,200	100.00%
Demand Control Ventilation	52	5,473,475	5,473,475	100.00%
Destratification Fan	17	562,100	562,100	100.00%
Dock Door Seal	105	1,282,985	1,282,985	100.00%
Energy Recovery Ventilation	335	6,435,668	6,435,668	100.00%
Fryer	163	2,203,238	2,203,238	100.00%
Heat Recovery Ventilation	13	186,797	186,797	100.00%
Make-Up Air Unit	9	3,087,776	3,087,776	100.00%
Oven	114	1,126,330	1,126,330	100.00%
Water Heater	95	777,373	777,373	100.00%
Total	**933**	**22,979,889**	**22,979,889**	**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 22,979,889 CCM savings (100.00% of tracked) for Union's C&I Prescriptive Program.

11.5.7 C&I – Direct Install – Enbridge

Overview

Table 11-36 shows the tracked and verified scorecard achievements for the 2022 Enbridge C&I Direct Install Program, with the metric of CCM savings. As a result of this review, the EC verifies total savings of 25,032,134 CCM for large and small volume customers (100.00% of tracked). Table 11-36 contains the following variables:

- Tracked: Metric value from original Tracking File sent by Enbridge upon first data request
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documentation section
- Ratio: Ratio of verified to tracked achievement. A value of 100.00% indicates that verified values match tracked values

Table 11-36. Enbridge Resource Acquisition achievement: C&I Direct Install CCM metric*

Metric	Achievement		Ratio
	Tracked	Verified	
Large Volume Customer - CCM	5,253,809	5,253,809	100.00%
Small Volume Customer - CCM	19,778,326	19,778,326	100.00%
TOTAL	**25,032,134**	**25,032,134**	**100.00%**

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 11-37 to verify the metrics for the C&I Direct Install program.

Table 11-37. 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 2022 Enbridge DSM programs
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016, OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016 and OEB Decision and Order, EB-2021-0002, August 26, 2021
Enbridge Plan	Enbridge Gas Multi-Year DSM Plan (2015-2020), EB-2015-0049
TRM 6.0	Natural Gas Demand Side Management Technical Resource Manual, Version 6.0

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 Section 11.13. Three measures were installed, with 99 individual installations with large volume customers and 367 with small volume customers. The EC verified the tracked savings which resulted in a savings ratio of 100.00%.

Table 11-38. Enbridge C&I Direct Installation measure groups: large volume customers*

Measure Group	Installed Measures	Tracked Achievement (CCM)	Verified Achievement (CCM)	Savings Ratio
Air Curtain	24	1,847,128	1,847,128	100.00%
Dock Door Seal	67	1,708,138	1,708,138	100.00%
Demand Control Kitchen Ventilation	8	1,698,543	1,698,543	100.00%
TOTAL	**99**	**5,253,809**	**5,253,809**	**100.00%**

*Not all values may compute exactly due to rounding.

Table 11-39. Enbridge C&I Direct Installation measure groups: small volume customers*

Measure Group	Installed Measures	Tracked Achievement (CCM)	Verified Achievement (CCM)	Savings Ratio
Air Curtain	133	10,964,919	10,964,919	100.00%
Dock Door Seal	206	5,406,374	5,406,374	100.00%
Demand Control Kitchen Ventilation	28	3,407,033	3,407,033	100.00%
TOTAL	**367**	**19,778,326**	**19,778,326**	**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 5,253,809 CCM for large volume customers (100.00% of tracked) and 19,778,326 CCM for small volume customers (100.00% of tracked) for Enbridge's C&I Direct Install Program.

11.5.8 C&I – Direct Install – Union

Overview

Table 11-40 shows the tracked and verified scorecard achievements for the 2022 Union C&I Direct Install Program, with the metric of CCM savings. As a result of this review, the EC verifies total savings of 19,359,319 CCM (100.00% of tracked). Table 11-40 contains the following variables:

- Tracked: Metric value from original Tracking File sent by Enbridge upon first data request
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documentation section
- Ratio: Ratio of verified to tracked achievement. A value of 100.00% indicates that verified values match tracked values

Table 11-40. Union Resource Acquisition achievement: C&I Direct Install CCM metric*

Metric	Achievement		Ratio
	Tracked	Verified	
CCM	19,359,319	19,359,319	100.00%

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 11-41 to verify the metrics for the C&I Direct Install program.

Table 11-41. 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 2022 Union DSM programs
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016, OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016 and OEB Decision and Order, EB-2021-0002, August 26, 2021
Union Plan	Union's 2015-2020 DSM Plan, EB-2015-0029
TRM 6.0	Natural Gas Demand Side Management Technical Resource Manual, Version 6.0

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 Section 11.13. Three measures were installed, with 332 individual installations. The EC verified the tracked savings which resulted in a savings ratio of 100.00%.

Table 11-42. Union C&I Direct Installation measure groups*

Measure Group	Installed Measures	Tracked Achievement (CCM)	Verified Achievement (CCM)	Savings Ratio
Air Curtain	138	11,724,815	11,724,815	100.00%
Demand Control Kitchen Ventilation	24	2,527,808	2,527,808	100.00%
Dock Door Seal	170	5,106,697	5,106,697	100.00%
TOTAL	**332**	**19,359,319**	**19,359,319**	**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 19,359,319 (100.00% of tracked) for Union's C&I Direct Install Program.

11.5.9 C&I - Custom – Enbridge

Overview

Table 11-43 shows the shows the tracked and verified scorecard achievements for the 2022 Enbridge C&I Custom program, with the metric of CCM savings. As a result of this review, the EC verifies total savings of 377,705,716 CCM (106.30% of tracked). Table 11-43 contains the following variables:

- Tracked: Metric value from original Tracking File sent by Enbridge upon first data request
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documentation section
- Ratio: Ratio of verified to tracked achievement. A value of 100.00% indicates that verified values match tracked values

Table 11-43. Enbridge Resource Acquisition achievement: C&I Custom CCM metric*

Metric	Achievement		Ratio
	Tracked	Verified	
Large Volume Customer - CCM	339,685,104	363,241,521	106.93%
Small Volume Customer - CCM	15,626,224	14,464,195	92.56%
TOTAL	**355,311,327**	**377,705,716**	**106.30%**

*Not all values may compute exactly due to rounding.

Table 11-44 includes these variables:

- Tracking Gross Savings: Gross cumulative tracking savings for all customers in the Enbridge C&I Custom program. This is the amount of savings before any adjustments (including free ridership and spillover) are applied.
- CPSV RR: Gross realization rate from the 2017-2018 CSPV report.
- eTools RR: Gross realization rate adjustments from the eTools Boiler Tool Validation Study.
- 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 CPSV RR, eTools RR, and the sum of the Att ratio and Spillover ratio

Equation 1: Adjustment Ratio

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

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

Equation 2: Verified Net Savings

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

Table 11-44. Adjustment factors applied to Enbridge C&I Custom Program cumulative gross savings*

Attribution Group	eTools Group	Tracking Gross Savings (CCM)	CPSV RR (%)	eTools RR (%)	Att (%)	Spillover (%)	Adj (%)	Verified Net Savings (CCM)
Commercial - Boilers	eTools Boilers	60,553,101	94.99%	68.63%	42.37%	1.36%	28.51%	17,262,661
Multi-Residential - Heating		97,159,261	121.09%	68.63%	57.67%	8.24%	54.77%	53,217,907
Multi-Residential - Other		18,852,987	121.09%	68.63%	69.73%	8.24%	64.80%	12,216,027
Commercial - Other	Other	41,938,587	94.99%	100.00%	25.65%	1.36%	25.66%	10,760,099
Commercial - Ventilation		5,584,362	94.99%	100.00%	14.12%	1.36%	14.70%	821,150
Commercial - Boilers		1,248,126	94.99%	100.00%	42.37%	1.36%	41.54%	518,461
Multi-Residential - Heating		25,914,226	121.09%	100.00%	57.67%	8.24%	79.81%	20,682,252
Multi-Residential - Other		11,518,417	121.09%	100.00%	69.73%	8.24%	94.41%	10,874,984
Industrial		435,706,971	110.79%	100.00%	50.62%	1.45%	57.69%	251,352,175
TOTAL		**698,476,037**					**54.08%**	**377,705,716**

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 11-45 to verify the metrics for the C&I Custom program.

Table 11-45. 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 2022 Enbridge DSM programs
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016, OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016 and OEB Decision and Order, EB-2021-0002, August 26, 2021
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[57,58]
2018 NTG Report	2018 Natural Gas Demand Side Management Free-ridership Evaluation[59]
2013-2014 Spillover Study	CPSV Participant Spillover Results[60]
eTools Study	eTools Boiler Tool Validation Study[61]

Verify Savings

Adjustment Values – Realization Rates

The 2017-2018 CPSV Report conveyed gross realization rate by sector, as shown in Table 11-46. The EC used the same sectors to apply the relevant rates at the measure level.

[57] 2017-2018 Natural Gas Demand Side Management Custom Savings Verification, DNV for the Ontario Energy Board, December 26, 2019

[58] The EC did not complete studies verifying the custom project savings (CPSV) during the 2019 through 2022 program years. Instead, the EC used the same adjustment factors resulting from custom projects implemented in the 2017 and 2018 program years, adjusted for the mix of projects installed in 2022.

[59] 2018 Natural Gas Demand Side Management Free-ridership Evaluation, DNV for the Ontario Energy Board, December 27, 2019

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

[61] eTools Boiler Tool Validation Study, DNV for the Ontario Energy Board, January 31, 2023

Table 11-46. 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%

The eTools Study conveyed gross realization rates for eTools boiler savings by program year. The realization rate for 2022 was 68.63%.

Adjustment Values – Attribution Ratios

The 2018 NTG Report conveyed attribution ratios using a combination of sector and measure group, shown in Table 11-47.

Table 11-47. 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 11-48. The EC used the same sectors to apply the relevant rates at the measure level.

Table 11-48. 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 11-44 were built up from a measure-level application of the CPSV RR, eTools RR, Attribution, and Spillover ratios. Each measure was assigned a CPSV RR or Spillover ratio based on its sector, and an Attribution ratio based on the combination of sector and measure group. The eTools RR was only applicable to boilers with savings estimated by eTools. 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 377,705,716 CCM (106.30% of tracked) for Enbridge's C&I Custom Program.

11.5.10 C&I - Custom – Union

Overview

Table 11-49 shows the shows the tracked and verified scorecard achievements for the 2022 Union C&I Custom program, with the metric of CCM savings. As a result of this review, the EC verifies total savings of 266,946,625 CCM (90.69% of tracked). Table 11-49 contains the following variables:

- Tracked: Metric value from original Tracking File sent by Enbridge upon first data request
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documentation section
- Ratio: Ratio of verified to tracked achievement. A value of 100.00% indicates that verified values match tracked values

Table 11-49. Union Resource Acquisition achievement: C&I Custom CCM metric*

Metric	Achievement		Ratio
	Tracked	Verified	
CCM	294,337,139	266,946,625	90.69%

*Not all values may compute exactly due to rounding.

Table 11-50 includes these variables:

- Tracking Gross Savings: Gross cumulative tracking savings for all customers in the Enbridge C&I Custom program. This is the amount of savings before any adjustments (including free ridership and spillover) are applied.
- CPSV RR: Gross realization rate from the 2017-2018 CSPV report
- eTools RR: Gross realization rate adjustments from the eTools Boiler Tool Validation Study.
- 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 CPSV RR, eTools RR, and the sum of the Att ratio and Spillover ratio

Equation 3: Adjustment Ratio

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

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

Equation 4: Verified Net Savings

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

Table 11-50.Adjustment factors applied to Union C&I Custom Program cumulative gross savings*

Attribution Group	eTools Group	Tracking Gross Savings (CCM)	CPSV RR (%)	eTools RR (%)	Att (%)	Spillover (%)	Adj (%)	Verified Net Savings (CCM)
Commercial and Multi-Family	eTools Boilers	33,312,338	90.57%	68.63%	28.62%	0.00%	17.79%	5,926,156
Agricultural	Other	464,300,581	91.17%	100.00%	50.16%	0.89%	46.54%	216,096,100
Commercial and Multi-Family		14,735,200	90.57%	100.00%	28.62%	0.00%	25.92%	3,819,531
Industrial - Other		95,218,424	91.17%	100.00%	4.11%	0.89%	4.56%	4,340,532
Industrial - HVAC		24,276,090	91.17%	100.00%	39.88%	0.89%	37.17%	9,023,425
Industrial - Steam/Hot Water System		101,866,896	91.17%	100.00%	28.98%	0.89%	27.23%	27,740,881
TOTAL		**733,709,530**					**36.38%**	**266,946,625**

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 11-51 to verify the metrics for the C&I Custom program.

Table 11-51. 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 2022 Union DSM programs
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016, OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016 and OEB Decision and Order, EB-2021-0002, August 26, 2021
Union Plan	Union's 2015-2020 DSM Plan, EB-2015-0029
2017-2018 CPSV Report	2018 Natural Gas Demand Side Management Custom Savings Verification[62,63]
2018 NTG Report	2018 Natural Gas Demand Side Management Free-ridership Evaluation[64]
2013-2014 Spillover Study	CPSV Participant Spillover Results[65]
eTools Study	eTools Boiler Tool Validation Study[66]

Verify Savings

Adjustment Values – Realization Rates

The 2017-2018 CPSV Report conveyed gross realization rate by sector, as shown in Table 11-52. The EC used the same sectors to apply the relevant rates at the measure level.

Table 11-52. Verified gross savings rates for the Union Custom C&I program

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

The eTools Study conveyed gross realization rates for eTools boiler savings by program year. The realization rate for 2022 was 68.63%.

Adjustment Values – Attribution Ratios

The 2018 NTG Report conveyed attribution ratios using a combination of sector and measure group, as shown in Table 11-53.

[62] 2017-2018 Natural Gas Demand Side Management Custom Savings Verification, DNV for the Ontario Energy Board, December 26, 2019

[63] The EC did not complete studies verifying the custom project savings (CPSV) during the 2019 through 2022 program years. Instead, the EC used the same adjustment factors resulting from custom projects implemented in the 2017 and 2018 program years, adjusted for the mix of projects installed in 2022.

[64] 2018 Natural Gas Demand Side Management Free-ridership Evaluation, DNV for the Ontario Energy Board, December 27, 2019

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

[66] eTools Boiler Tool Validation Study, DNV for the Ontario Energy Board, January 31, 2023

Table 11-53. Attribution ratios for the Union Custom C&I program

Attribution Group	Att (%)
Agricultural	50.16%
Commercial and Multi-Family	28.62%
Industrial - Other	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 11-54. The EC used the same sectors to apply the relevant rates at the measure level.

Table 11-54. 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 11-50 were built up from a measure-level application of the CPSV RR, eTools RR, Attribution, and Spillover ratios. Each measure was assigned a CPSV RR or Spillover ratio based on its sector, and an Attribution ratio based on the combination of sector and measure group. The eTools RR was only applicable to boilers with savings estimated by eTools. 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 total savings of 266,946,625 CCM (90.69% of tracked) for Union's C&I Custom Program.

11.5.11 Comprehensive Energy Management – Enbridge

No activity was reported for this program metric in 2022.

11.5.12 Energy Leaders – Enbridge

Overview

Table 11-55 shows the tracked and verified scorecard achievements for the 2022 Enbridge Energy Leaders program, with the metric of CCM savings. As a result of this review, the EC verifies total savings of 5,846,554 CCM (97.53% of tracked) for large and small volume customers. Table 11-55 contains the following variables:

- Tracked: Metric value from original Tracking File sent by Enbridge upon first data request
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documentation section
- Ratio: Ratio of verified to tracked achievement. A value of 100.00% indicates that verified values match tracked values

Table 11-55. Enbridge Resource Acquisition achievement: Energy Leaders CCM metric*

Metric	Achievement		Ratio
	Tracked	Verified	
Large Volume Customer - CCM	5,508,260	5,372,206	97.53%
Small Volume Customer - CCM	486,361	474,348	97.53%
TOTAL	**5,994,621**	**5,846,554**	**97.53%**

*Not all values may compute exactly due to rounding.

Table 11-56 includes the following variables:

- Tracking Gross Savings: Gross cumulative tracking savings for all customers in the Enbridge Energy Leaders program.
- 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

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

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

Equation 6: Verified Net Savings

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

Table 11-56. Adjustment Factors Applied to Enbridge Energy Leaders Program cumulative gross savings*

Metric	Tracking Gross Savings (CCM)	RR (%)	Att (%)	Spillover (%)	Adj* (%)	Verified Net Savings (CCM)
Large Volume Customers CCM	5,508,260	97.53%	100.00%	0.00%	97.53%	5,372,206
Small Volume Customers CCM	486,361	97.53%	100.00%	0.00%	97.53%	474,348
TOTAL	**5,994,621**	**97.53%**	**100.00%**	**0.00%**	**97.53%**	**5,846,554**

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 11-57 to verify the metrics for the Energy Leaders program.

Table 11-57. Documentation used to verify the Energy Leaders program

Report Language	Description or Citation
Enbridge-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2022 Enbridge DSM programs
Project Files	PDF 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, OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016 and OEB Decision and Order, EB-2021-0002, August 26, 2021
Enbridge Plan	Enbridge Gas Multi-Year DSM Plan (2015-2020), EB-2015-0049

Participant Selection

Enbridge first provided the Tracking File listing Energy Leaders participants with customer and site IDs, listing 9 measures across 7 individual projects. The EC requested full documentation for all projects.

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

In 2022, program participation consisted of the following projects:

Tracking Project Number	Building Type	Measure Type	RR (%)	RR notes
251729	Other – C Professional	Chiller Heat Recovery to decrease use of main SH boilers	100.0	N/A
251729	Other – C Professional	GSHP to decrease use of main SH boilers	100.0	N/A
251729	Other – C Professional	ASHP to decrease the use of main SH boilers	86.0	ASHP regression equations were incorrect due to incorrect interpolation of performance data, and formulas for ASHP capacities and COPs were incorrectly using °F instead of °C.
252664	Entertainment	Hydrothermal heat pump replacing SH and DHW boilers	100.0	N/A
252894	Multi-Family	ASHP to decrease use of main SH boilers	100.0	N/A
582005	Office	Natural gas heat pumps	100.0	N/A

Tracking Project Number	Building Type	Measure Type	RR (%)	RR notes
582251	Education	ASHP replacing RTU	100.0	N/A
588790	Hotel/Motel	ASHP replacing SH boilers	100.0	N/A
589975	Service	ASHP replacing DHW	41.4	Reduced savings found in program documentation, due to the ASHP only feasibly serving DHW load five months per year.

Project 251729

The EC reviewed the documentation provided to determine whether the savings estimates for the Chiller Heat Recovery, GSHP, and ASHP measures were reasonable. The program calculated savings using an 8760 natural gas consumption versus weather regression model, which the EC deems appropriate.

The ASHP measure received an 86% RR for the following reasons:

- The regression equations utilized trend lines based on performance charts that appeared to have been interpolated inaccurately. Figure 11-3 is the performance chart referenced in the tracking calculations. Table 11-58 shows the differences in capacity and power values interpolated from Figure 11-3 by the program and by the EC for outlet water temperature of 55°C. Figure 11-4 shows the differing COP trend lines for the ASHP by the Program and EC respectively, arising from the differences in interpolated values for capacity and power because the COP is the quotient of the two parameters. The trend equation in Figure 11-4, based on EC interpolation of Figure 11-3, results in decreased savings.
- The EC identified an additional error: the trend line from Figure 11-4 (based on degrees Celsius temperatures) was using degrees Fahrenheit temperatures as the input variable, which incorrectly inflated savings.

Figure 11-3. Project 251729 ASHP Performance Data

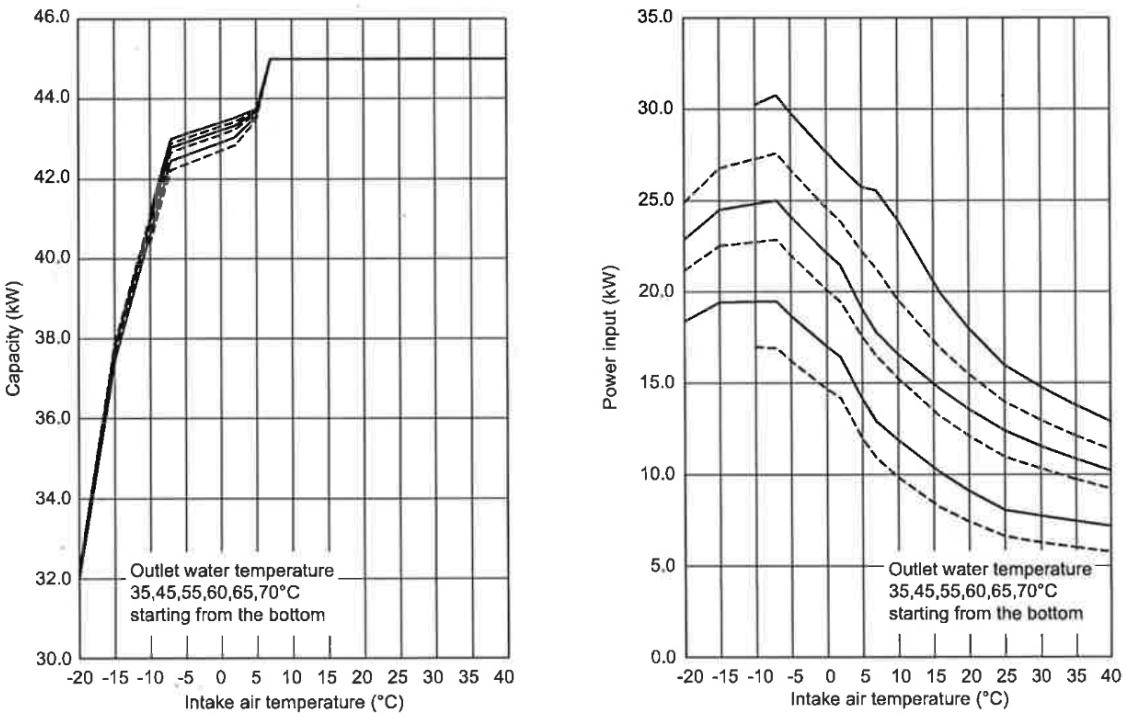
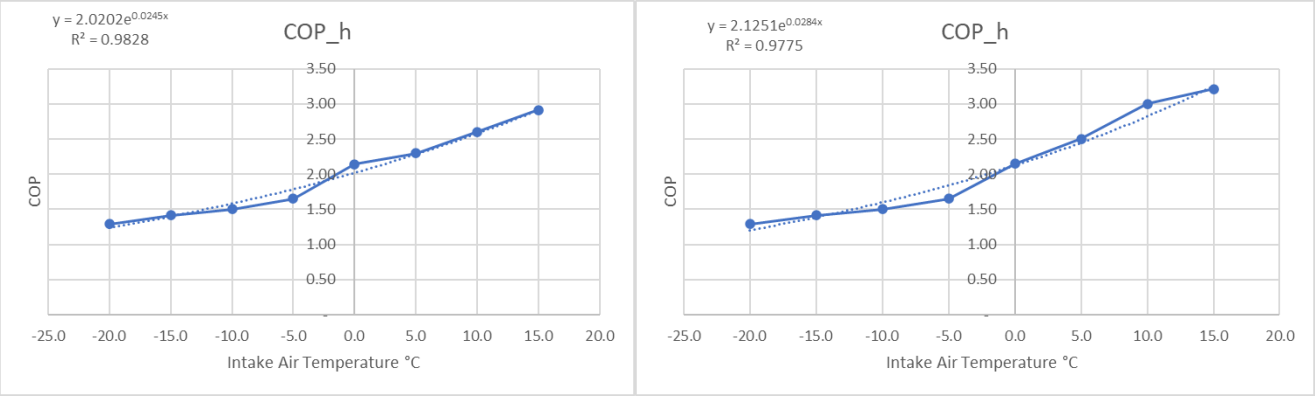


Table 11-58. Project 251729 ASHP Performance Data Interpretation Comparison

Intake Air Temp	Capacity		Power Input		Outlet water temp
°C	kW		kW		°C
	Program	EC	Program	EC	
0.0	43.1	43.0	20.1	20.0	55
5.0	48.8	43.8	21.2	17.5	55
10.0	65.9	45.0	25.3	15.0	55
15.0	69.6	45.0	23.9	14.0	55

Figure 11-4. Project 251729 ASHP COP_h Regression by Program (Left) and EC (Right)



Project 589975

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

$$Nat.Gas\ Savings\ = Q * 1/HHV * 1/\Delta E_t$$

In which:

Q = DHW heating load (BTU/hr)

$$Q = GPM * C * \rho * \Delta T * 60$$

In which,

GPM = flowrate of water (gallon per minute)

C = Specific heat of water (BTU/lb/°T)

ρ = density of water (lb/gallons)

ΔT = Temperature difference between input and output

HHV = High Heating Value of natural gas (BTU/m^3)

ΔE_t = Difference in thermal efficiencies of heating systems

The custom project documentation shows the inputs used in the equation.

During review of the project documentation the EC found that the calculated annual savings (10,527 therms) were slightly lower than the tracked annual savings 10,597 therms. Additionally, the EC found language in project documentation stating that the ASHPs are only able to serve the DHW load five months annually, with accompanying calculations reducing the calculated savings (10,527 therms) by five-twelfths (41.7%) resulting in verified annual savings of 4,386 therms.

Adjustment Values – Attribution and Spillover Ratios

In evaluating the 2016 programs, the EAC agreed to deem the Attribution and Spillover ratios at 100.00% and 0%, respectively. These deemed values continued into 2022. Therefore, the adjustment factor is equal to the realization rate.

Verification Result

As a result of this review, the EC confirms the savings of 5,846,554 CCM (97.53% of tracked) for large and small volume customers of the Energy Leaders program.

11.5.13 Run-it-Right – Enbridge

Overview

Table 11-59 shows the tracked and verified scorecard achievements for the 2022 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 Section 11.9. As a result of this review, the EC verifies total savings of 166,893 CCM (100.00% of tracked) for large volume customers. Table 11-59 contains the following variables:

- Tracked: Metric value from original Tracking File sent by Enbridge upon first data request
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documentation section
- Ratio: Ratio of verified to tracked achievement. A value of 100.00% indicates that verified values match tracked values

Table 11-59. Enbridge Resource Acquisition achievement: Run-it-Right CCM metric*

Metric	Achievement		Ratio
	Tracked	Verified	
Large Volume Customer - CCM	166,893	166,893	100.00%
Small Volume Customer - CCM	-	-	-
TOTAL	**166,893**	**166,893**	**100.00%**

*Not all values may compute exactly due to rounding.

Table 11-60 includes the following variables:

- Tracking Gross Savings: Gross cumulative tracking savings for all customers in the Enbridge 2022 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

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

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

Equation 8: Verified Net Savings

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

Table 11-60. 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	333,385	100.00%	50.06%	0.00%	50.06%	166,893
Small Volume Customers CCM	-	-	-	-	-	-

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 11-61 to verify the metrics for the Run-it-Right program.

Table 11-61. 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 2022 Enbridge 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, OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016 and OEB Decision and Order, EB-2021-0002, August 26, 2021
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[67]
2013-2014 Spillover Study	CPSV Participant Spillover Results[68]

Participant Selection

Enbridge first provided the Tracking File listing RIR participants with customer and site IDs, listing 9 individual participants. The EC requested full documentation for all participants.

Methodology Review

The program methodology did not change for the 2022 program year. For the certification, a senior engineer reviewed the calculation methods for each selected site. The following conclusion from the 2015 certification[69] 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 2022, 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?
- 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 is 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?

[67] 2016 Natural Gas Demand Side Management Custom Savings Verification, DNV for the Ontario Energy Board, June 31, 2018
[68] CPSV Participant Spillover Results, DNV for the Ontario Energy Board, May 23, 2018
[69] 2015 Natural Gas Demand Side Management Annual Verification, DNV for the Ontario Energy Board, December 20, 2018, Appendix F

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 baseline model specifications and time period definitions were reasonable for all projects examined. Overall, the savings claimed are reasonable, in part because both positive and negative savings are included in the program Tracking File and Project Files.

The EC assigned five sites as low-risk, two normal-risk, and two high-risk. Based on our experience, this distribution is similar to comparable programs. Across the participants, all savings claims were supported by actions taken at the facilities. Clear changes in consumption patterns occurred. The EC's review supports the savings claim for all sites.

Adjustment Values – Attribution 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.[70] 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 166,893 CCM (100.00% of tracked) for customers of the Run-it-Right program.

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

11.6 Appendix F: Low Income Scorecards

This appendix describes the detailed process used to verify the metrics for the Low Income Scorecard programs for Enbridge (Table 11-62) and Union (Table 11-63). The programs addressed in this appendix are:

- Winter Retrofit - Furnace End-of-Life – Union
- Winter Retrofit - Home Winterproofing – Enbridge
- Winter Retrofit - Home Weatherization – Union[71]
- Winter Retrofit - Indigenous Offering – 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 11-62. Enbridge 2022 Low Income scorecard[72]

Programs	Metrics	Verified Achievement		Metric Target			Weight
		Program-level Achievement	Metric-level Achievement	Lower Band	Target	Upper Band	
Home Winterproofing	CCM	34,647,732	34,647,732	19,987,782	26,650,377	39,975,565	45.00%
Low Income Multi-Residential	CCM	71,812,509	71,812,509	68,520,481	91,360,642	137,040,963	45.00%
Low Income New Construction	Applications	7	7	9	13	19	10.00%

Table 11-63. Union 2022 Low Income scorecard[73]

Programs	Metrics	Verified Achievement		Metric Target			Weight
		Program-level Achievement	Metric-level Achievement	Lower Band	Target	Upper Band	
Home Weatherization*	CCM	28,654,910	28,837,892	40,377,532	53,836,709	80,755,064	60.00%
Furnace End-of-Life		-					
Indigenous		182,982					
Multi-Family Social & Assisted	CCM	552,935	552,935	9,407,514	12,543,352	18,815,028	35.00%
Multi-Family Market Rate	CCM	4,573,515	4,573,515	7,430,573	9,907,431	14,861,146	5.00%

*This program is now marketed as Home Winterproofing.

[71] This program is now marketed as Home Winterproofing.

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

[73] Ibid

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

No activity was reported for this program in 2022.

11.6.2 Winter Retrofit – Home Winterproofing – Enbridge

Overview

Table 11-64 shows the tracked and verified scorecard achievements for the 2022 Enbridge Home Winterproofing program, with the metric of CCM savings. As a result of this review, the EC verifies 34,647,732 CCM (100.05% of tracked). Table 11-64 contains the following variables:

- Tracked: Metric value from original Tracking File sent by Enbridge upon first data request
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documentation section
- Ratio: Ratio of verified to tracked achievement. A value of 100.00% indicates that verified values match tracked values

Table 11-64. Enbridge Low Income achievements: Home Winterproofing CCM metrics*

Metric	Achievement		Ratio
	Tracked	Verified	
CCM – Prescriptive	8,808,148	8,808,148	100.00%
CCM - Whole Home	25,821,509	25,839,584	100.07%
TOTAL	**34,629,657**	**34,647,732**	**100.05%**

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 11-65 to verify the metrics for the Home Winterproofing program.

Table 11-65. Documentation used to verify the Home Winterproofing program

Report Language	Description or Citation
Enbridge-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2022 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, OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016 and OEB Decision and Order, EB-2021-0002, August 26, 2021
Enbridge Plan	Enbridge Gas Multi-Year DSM Plan (2015-2020), EB-2015-0049
TRM 6.0	Natural Gas Demand Side Management Technical Resource Manual, Version 6.0
TAPS Report	TAPS Verification Program 2012 Year End Research Report, Quadra Research. April 2013[74]
Prescriptive Showerheads	2012 Multi-Residential Low Income Showerhead Verification, Ipsos Research, March 2013
Low Income Kits Verification Study	Final Report Following an Audit of the Union Gas ESK - Helping Homes Conserve – HHC – Program, Beslin Communication Group, March 15, 2013

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

Simulation-based Savings

Participant Selection

Enbridge provided the tracking file listing 1,640 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
- HOT2000 Model simulation Files (.h2k)
- HOT2000 Model Output Files (.xls)

Calculate Realization Rate

The EC used a multi-step process to verify tracked energy savings for the 30 sampled homes, shown in Figure 11-5 for the 2022 Winterproofing verification. The process was necessary because the simulation mode (EnerGuide or Expert[75]) 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 (H2K) and output (XLS) 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 the output file values to the project documentation summary to determine whether they were consistent. If they were not consistent, the output file value was used as the verified value.

[75] "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 11-5. Overview of gross simulation savings verification for 2022 Home Winterproofing

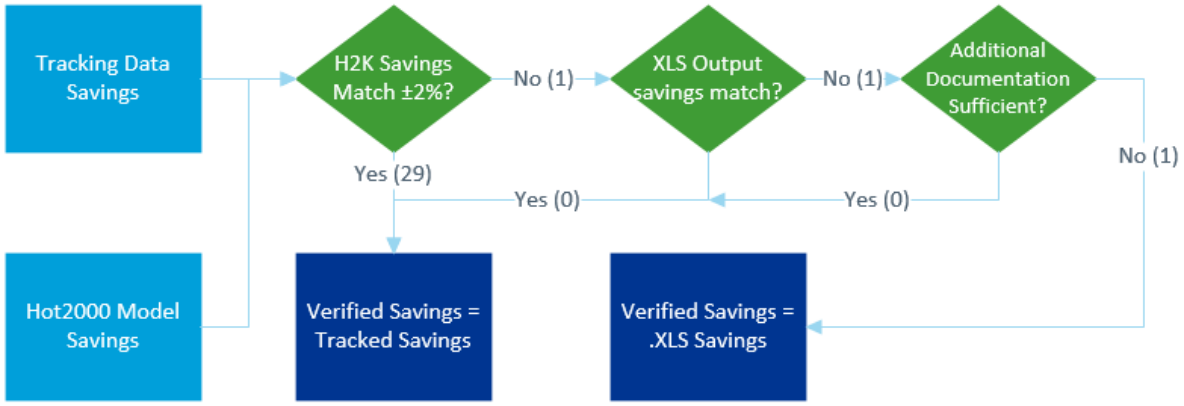


Table 11-66 shows how many customers were verified in each evaluation step.

Table 11-66. Overview of gross simulation savings verification

Evaluation Step	# Verified
Simulation re-run (H2K) and compared to tracking, verified if ± 2%	29
Output files for (XLS) compared to tracking, verified if ± 2%	0
Additional Explanation request	0
Comparison to output file values	1
Total Verified	**30**

The gross savings realization rate is 100.07%, shown in Table 11-67.

Table 11-67. Enbridge Home Winterproofing realization rate

Numbers of Houses	Realization Rate	90% Confidence Interval			
		Absolute Precision	Lower Bound	Upper Bound	Relative Precision
30	100.07%	0.08%	100.00%	100.15%	0.12%

Prescriptive Savings

In calculating net CCM, the EC reviewed natural gas savings for prescriptive measures from the Tracking File, using the procedures identified in Section 11.13. The EC certified the tracked savings which resulted in a savings ratio of 100.00%, as shown in Table 11-68.

Table 11-68. Enbridge scorecard achievements (cumulative savings) by measure group*

Measure Group	Installed Measures	Tracked Achievement (CCM)	Verified Achievement (CCM)	Savings Ratio
Faucet Aerator	1,084	25,072	25,072	100.00%
Pipe Insulation	690	116,041	116,041	100.00%
Showerhead	778	192,410	192,410	100.00%
Thermostat	3,119	8,474,625	8,474,625	100.00%
TOTAL	**5,671**	**8,808,148**	**8,808,148**	**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 34,647,732 CCM (100.05% of tracked) for Enbridge's Home Winterproofing program.

11.6.3 Winter Retrofit – Home Weatherization – Union[76]

Overview

Table 11-69 shows the tracked and verified scorecard achievements for the 2022 Union Home Weatherization Program, with the metric of CCM savings. As a result of this review, the EC verifies 28,654,910 CCM (100.00% of tracked). Table 11-69 includes the following variables:

- Tracked: Metric value from original Tracking File sent by Enbridge upon first data request
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documentation section
- Ratio: Ratio of verified to tracked achievement. A value of 100.00% indicates that verified values match tracked values

Table 11-69. Union Low Income achievements: Home Weatherization CCM metrics*

Metric	Achievement		Ratio
	Tracked	Verified	
CCM – Prescriptive	4,773,717	4,773,717	100.00%
CCM - Whole Home	23,881,193	23,881,193	100.00%
TOTAL	**28,654,910**	**28,654,910**	**100.00%**

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 11-70 to verify the metrics for the Home Weatherization program.

Table 11-70. Documentation used to verify the Home Weatherization program

Report Language	Description or Citation
Enbridge-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2022 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, OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016 and OEB Decision and Order, EB-2021-0002, August 26, 2021
Union Plan	Union's 2015-2020 DSM Plan, EB-2015-0029
TRM 6.0	Natural Gas Demand Side Management Technical Resource Manual, Version 6.0
Low Income Kits Verification Study	Final Report Following an Audit of the Union Gas ESK - Helping Homes Conserve – HHC – Program, Beslin Communication Group, March 15, 2013

Simulation-based Savings

Participant Selection

Union provided the tracking file, listing 1,152 individual participant homes in the Home Winterproofing program. To certify the scorecard metric, 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.

[76] This program is now marketed as Home Winterproofing.

Received Files

The typical file folder had the following information:

- Photographs of pre- and post-installation conditions
- HOT2000 Model simulation Files (.h2k)
- HOT2000 Model Output Files (.xls)

Calculate Realization Rate

The EC used a multi-step process to verify tracked energy savings for the 30 sampled homes, shown in Figure 11-6 for the Home Weatherization program. The process was necessary because the simulation mode (EnerGuide or Expert[77]) 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 (H2K) and output (XLS) 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. If they were not consistent, the output file value was used as the verified value.

Figure 11-6. Overview of gross savings verification for 2022 Home Weatherization program

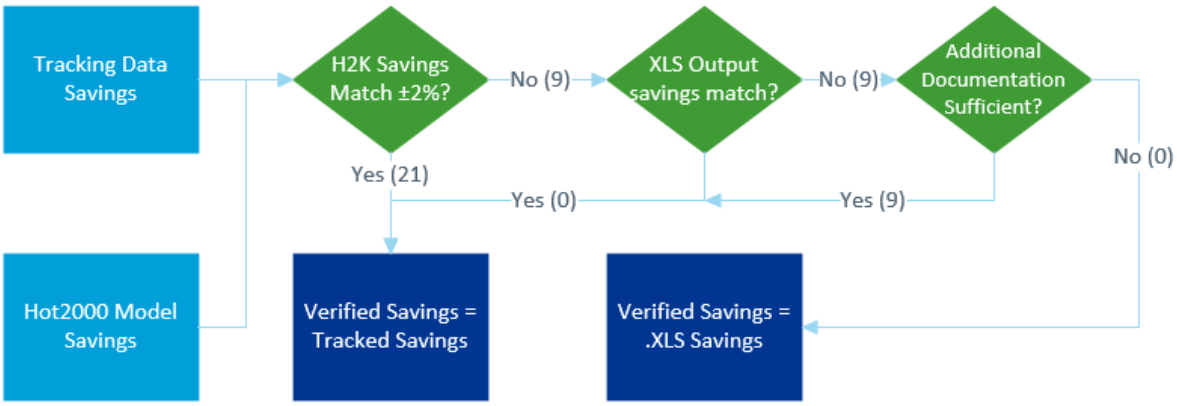


Table 11-71 shows how many customers were verified in each evaluation step. Savings for 30 homes were verified with comparison of tracking data against either simulation (H2K) or output (XLS) files.

[77] "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 11-71. Overview of gross simulation savings verification

Evaluation Step	# Verified
Simulation re-run (H2K) and compared to tracking, verified if ± 2%	21
Output files for (XLS) compared to tracking, verified if ± 2%	0
Additional Explanation request	9
Comparison to output file values	0
Total Verified	**30**

The gross savings realization rate (RR) is 100.00%, shown in Table 11-72.

Table 11-72. Union Home Weatherization realization rate

Numbers of Houses	Realization Rate	90% Confidence Interval			
		Absolute Precision	Lower Bound	Upper Bound	Relative Precision
30	100.00%	0.00%	100.00%	100.00%	0.00%

Prescriptive Savings

In calculating net CCM, the EC reviewed natural gas savings for prescriptive measures from the Tracking File, using the procedures identified in Section 11.13. The EC certified the tracked savings which resulted in a savings ratio of 100.00%, as shown in Table 11-73.

Table 11-73. Union scorecard achievements by measure group*

Measure Group	Installed Measures	Tracked Achievement (CCM)	Verified Achievement (CCM)	Savings Ratio
Faucet Aerator	664	49,348	49,348	100.00%
Pipe Insulation	636	105,890	105,890	100.00%
Showerhead	319	71,158	71,158	100.00%
Thermostat	1665	4,547,322	4,547,322	100.00%
TOTAL	**3,284**	**4,773,717**	**4,773,717**	**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 28,654,910 CCM (100.00% of tracked) for Union's Home Weatherization program.

11.6.4 Winter Retrofit – Indigenous Program – Union

Overview

Table 11-74 shows the tracked and verified scorecard achievements for the 2022 Union Indigenous Program, with the metric of CCM savings. As a result of this review, the EC verifies 182,982 CCM (94.06% of tracked). Table 11-74 includes the following variables:

- Tracked: Metric value from original Tracking File sent by Enbridge upon first data request
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documentation section
- Ratio: Ratio of verified to tracked achievement. A value of 100.00% indicates that verified values match tracked values

Table 11-74. Union Low Income achievements: Indigenous CCM metrics*

Metric	Achievement		Ratio
	Tracked	Verified	
CCM - Prescriptive	11,042	11,042	100.00%
CCM - Whole Home	183,500	171,940	93.70%
TOTAL	**194,542**	**182,982**	**94.06%**

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 11-75 to verify the metrics for the Indigenous program.

Table 11-75. Documentation used to verify the Indigenous program

Report Language	Description or Citation
Enbridge-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2022 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, OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016, and OEB Decision and Order, EB-2021-0002, August 26, 2021
Union Plan	Union's 2015-2020 DSM Plan, EB-2015-0029
TRM 6.0	Natural Gas Demand Side Management Technical Resource Manual, Version 6.0

Simulation-based Savings

Participant Selection

Union provided the tracking file listing 15 individual participants in the Indigenous program. 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:

- Photographs of pre- and post-installation conditions
- HOT2000 Model simulation Files (.h2k)
- HOT2000 Model Output Files (.xls)

Calculate Realization Rate

The EC used a multi-step process to verify tracked energy savings for the 15 homes, shown in Figure 11-7. for the Indigenous program. The process was necessary because the simulation mode (EnerGuide or Expert[78]) 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 (H2K) and output (XLS) 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.

Figure 11-7. Overview of gross savings verification for 2022 Indigenous program

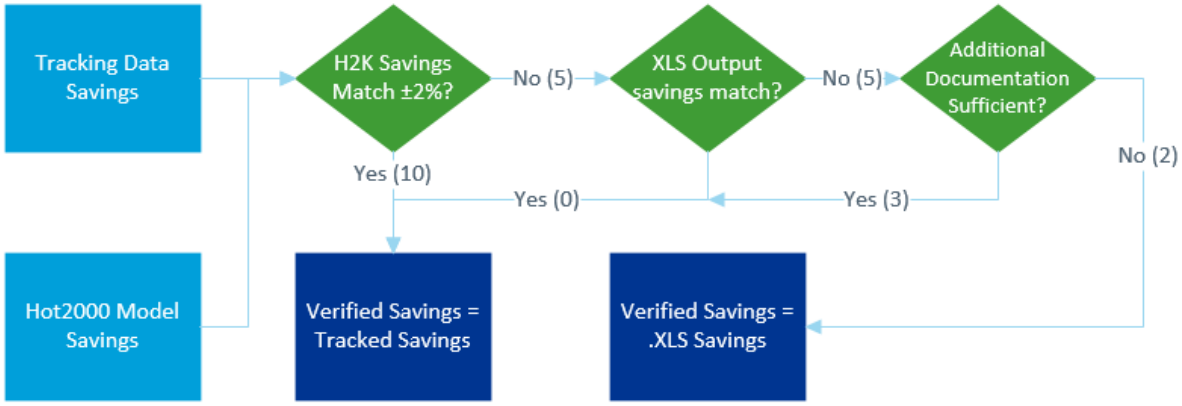


Table 11-76 shows how many customers were verified in each evaluation step. Savings for all 15 homes were verified with comparison of tracking data against either simulation (HSE) or output (TSV) files. Fourteen homes did not match their HSE or TSV files. Therefore, the output from their respective records was accepted as the verified result.

[78] "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 11-76. Overview of gross simulation savings verification

Evaluation Step	# Verified
Simulation re-run (HSE) and compared to tracking, verified if ± 2%	10
Output files for (TSV) compared to tracking, verified if ± 2%	0
Additional Explanation request	3
Comparison to output file values	2
Total Verified	**15**

The gross savings realization rate (RR) is 93.70%, shown in Table 11-77.

Table 11-77. Union Indigenous realization rate*

Numbers of Houses	Realization Rate	90% Confidence Interval			
		Absolute Precision	Lower Bound	Upper Bound	Relative Precision
15	93.70%	5.24%	88.46%	98.95%	9.82%

*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 11.13. The EC certified the tracked savings which resulted in a savings ratio of 100.00%, as shown in Table 11-78.

Table 11-78. Union scorecard achievements by measure group*

Measure Group	Installed Measures	Tracked Achievement (CCM)	Verified Achievement (CCM)	Savings Ratio
Faucet Aerator	30	2,667	2,667	100.00%
Showerhead	30	8,375	8,375	100.00%
TOTAL	**60**	**11,042**	**11,042**	**100.00%**

*Not all values may compute exactly due to rounding.

Verification Result

As a result of this review, the EC confirms savings of 182,982 CCM (94.06% of tracked) for Union's Indigenous program.

11.6.5 Low Income New Construction – Enbridge

Overview

Table 11-79 shows the tracked and verified scorecard achievements for the 2022 Enbridge Low Income New Construction Program, with the metric of participants. As a result of this review, the EC verifies 7 participants (100.00% of tracked). Table 11-79 contains the following variables:

- Tracked: Metric value from original Tracking File sent by Enbridge upon first data request
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documentation section
- Ratio: Ratio of verified to tracked achievement. A value of 100.00% indicates that verified values match tracked values

Table 11-79. Enbridge Low Income achievement: New Construction participants metric*

Metric	Achievement		Ratio
	Tracked	Verified	
Participants	7	7	100.00%

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 11-80 to verify the metrics for the Low Income New Construction (LINC) program.

Table 11-80. 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 2022 Enbridge 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, OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016 and OEB Decision and Order, EB-2021-0002, August 26, 2021
Enbridge Plan	Enbridge Gas Multi-Year DSM Plan (2015-2020), EB-2015-0049
Enbridge's Draft 2022 Report	Enbridge Gas Inc. DRAFT 2022 Demand Side Management Annual Report

Participant Selection

Enbridge first provided the Tracking file listing Program Year, Project Code (unique ID), Participant Status, Application Date, Charrette Date, and IDP Report Receipt. The spreadsheet listed 7 individual participants. The EC requested full documentation for all participants.

Received Files

Enbridge provided the EC with document folders identified by LINC Project number and containing project PDF documents. The EC first confirmed the folders received matched the IDs requested from the Tracking file. 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.[79]

The OEB Decision also includes the Enbridge proposed metric of "New Construction Program Participants."[80] 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:[81]

> *"Enbridge's proposed low-income new construction program will provide home builders with workshops, energy efficiency modelling 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 modelling tools
- Design options
- Energy efficiency education
- Financial incentives

The EC evaluated all participant files against the criteria above and determined that all seven 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 11-81).

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

Table 11-81. Eligibility requirements documentation

Document	Relevant Contents
2016-2020 OFFER DESCRIPTIONS[82]	*"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[83]	• *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 2022 Report[84]	*Eligibility criteria consists of the following:* • *New construction project must be located within the EGD rate zone; and,* • *The project proponent must have been recognized as a builder or provider of affordable housing by a municipal, provincial, and/or federal body, by virtue of receiving financial assistance, in the present or at any time in the past, from a government program aimed at affordable housing.*

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 did contain identification of projects as Part 3 or Part 9 projects. Additionally, project files for all participants indicated that each development qualified as affordable housing.

Verification Result

As a result of this review, the EC confirms that all projects meet the definition and eligibility requirements, resulting in a scorecard achievement of 7 participants (100.00% of tracked) for Enbridge's Low Income New Construction program.

[82] Enbridge's Proposed 2015-2020 DSM Plan, EB-2015-0049, Exhibit B, Tab 2, Schedule 1, page 45 of 100
[83] Enbridge's Proposed 2015-2020 DSM Plan, EB-2015-0049, Exhibit B, Tab 2, Schedule 2, page 31 of 55
[84] Enbridge Gas Inc. Draft 2021 Demand Side Management Annual Report, April 1, 2021, page 98

11.6.6 Low Income Multi-Residential – Affordable Housing Program – Enbridge

Overview

Table 11-82 shows the tracked and verified scorecard achievements for the 2022 Enbridge Affordable Housing Program, with the metric of CCM savings. As a result of this review, the EC verifies 71,812,509 CCM for all program measures (113.35% of tracked). Table 11-82 contains the following variables:

- Tracked: Metric value from original Tracking File sent by Enbridge upon first data request
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documentation section
- Ratio: Ratio of verified to tracked achievement. A value of 100.00% indicates that verified values match tracked values

Table 11-82. Enbridge Low Income achievements: Low Income Multi-Residential CCM metrics*

Metric	Achievement		Ratio
	Tracked	Verified	
Prescriptive CCM	2,560,692	2,560,692	100.00%
Custom CCM	60,791,864	69,251,817	113.92%
TOTAL	**63,352,556**	**71,812,509**	**113.35%**

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 11-83 to verify the metrics for the Affordable Housing program.

Table 11-83. Documentation used to verify the Low Income Multi-Residential Program

Report Language	Description or Citation
Enbridge-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2022 Enbridge DSM programs
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016, OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016 and OEB Decision and Order, EB-2021-0002, August 26, 2021
Enbridge Plan	Enbridge Gas Multi-Year DSM Plan (2015-2020), EB-2015-0049
TRM 6.0	Natural Gas Demand Side Management Technical Resource Manual, Version 6.0
2017-2018 CPSV Report	2018 Natural Gas Demand Side Management Custom Savings Verification[85,86]
eTools Study	eTools Boiler Tool Validation Study[87]

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 Section 11.13. The EC certified the tracked savings which resulted in a savings ratio of 100.00%, as shown in Table 11-84.

[85] 2017-2018 Natural Gas Demand Side Management Custom Savings Verification, DNV for the Ontario Energy Board, December 26, 2019

[86] The EC did not complete studies verifying the custom project savings (CPSV) during the 2019 through 2022 program years. Instead, the EC used the same adjustment factors resulting from custom projects implemented in the 2017 and 2018 program years, adjusted for the mix of projects installed in 2022.

[87] eTools Boiler Tool Validation Study, DNV for the Ontario Energy Board, January 31, 2023

Table 11-84. Enbridge - prescriptive measures - scorecard achievements by measure group*

Measure Group	Installed Measures	Tracked Achievement (CCM)	Verified Achievement (CCM)	Savings Ratio
Energy Recovery Ventilation	3	1,276,842	1,276,842	100.00%
Make-Up Air Unit	2	1,262,460	1,262,460	100.00%
Showerhead	69	21,390	21,390	100.00%
TOTAL	**74**	**2,560,692**	**2,560,692**	**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 11-85. The EC applied a gross realization rate from the 2017-2018 CPSV report for Multi-Residential of 121.09%. The EC also applied a realization rate of 68.63% from the eTools Study to boilers with savings estimated by eTools, which resulted in a combined realization rate of 83.10% for these measures.

Table 11-85. Enbridge - custom measures - scorecard achievements*

Measure Group	Installed Measures	Tracked Gross Savings (CCM)**	Verified Achievement (CCM)	Savings Ratio
Boiler - Condensing - Combo	1	330,702	274,827	83.10%
Boiler - Condensing - Water Heating - Less than 300 MBH	1	20,777	17,266	83.10%
Boiler - Condensing - Water Heating	19	4,375,943	3,636,587	83.10%
Boiler - Condensing - Space Heating - Less than 300 MBH	3	201,766	167,676	83.10%
Boiler - Condensing - Space Heating	12	8,775,899	7,293,129	83.10%
Boiler - High Efficiency - Combo	3	4,240,394	3,523,940	83.10%
Boiler - High Efficiency - Water Heating	2	384,066	319,174	83.10%
Boiler - High Efficiency - Space Heating	7	5,062,357	4,207,024	83.10%
Boiler Controls - Combo	1	442,948	536,366	121.09%
Boiler Controls - Water Heating	5	303,442	367,438	121.09%
Boiler Controls - Space Heating	5	1,353,694	1,639,188	121.09%
Building Automation System	2	624,125	755,753	121.09%
Controls - Cogeneration	1	1,467,448	1,776,933	121.09%
Energy/Heat Recovery Ventilation	1	387,541	469,273	121.09%
Heat Pump - Electric	1	212,730	257,595	121.09%
Make-Up Air Unit - Direct Fired	5	1,487,688	1,801,442	121.09%
Make-Up Air Unit - High Efficiency	4	1,160,275	1,404,977	121.09%
Reciprocating Engine	21	32,782,943	39,696,866	121.09%
Reflective Panel	4	609,645	738,219	121.09%
Storage Water Heater - Condensing	1	15,093	18,277	121.09%
Variable Frequency Drive	2	288,934	349,870	121.09%
TOTAL	**101**	**64,528,408**	**69,251,817**	**107.32%**

*Not all values may compute exactly due to rounding.
**This value represents savings in the tracking data before any adjustments were made. This differs from tracked net savings, which do account for adjustments.

Verification Result

As a result of this review, the EC confirms the total savings of 71,812,509 CCM (113.35% of tracked) for Enbridge's Affordable Housing Program.

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

Overview

Table 11-86 shows the tracked and verified scorecard achievements for the 2022 Union Multifamily (Social and Assisted) Program, with the metric of CCM savings. As a result of this review, the EC verifies 552,935 CCM (79.44% of tracked). Table 11-86 contains the following variables:

- Tracked: Metric value from original Tracking File sent by Enbridge upon first data request
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documentation section
- Ratio: Ratio of verified to tracked achievement. A value of 100.00% indicates that verified values match tracked values

Table 11-86. Union Low Income achievements: Multifamily Program (SA) CCM metrics*

Metric	Achievement		Ratio
	Tracked	Verified	
CCM - Prescriptive	11,969	11,969	100.00%
CCM - Custom	684,112	540,966	79.08%
TOTAL	**696,081**	**552,935**	**79.44%**

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 11-87 to verify the metrics for the Multifamily (Social and Assisted) program.

Table 11-87. Documentation used to verify the Multifamily (Social and Assisted) program

Report Language	Description or Citation
Enbridge-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2022 Union DSM programs
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016, OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016 and OEB Decision and Order, EB-2021-0002, August 26, 2021
Union Plan	Union's 2015-2020 DSM Plan, EB-2015-0029
TRM 6.0	Natural Gas Demand Side Management Technical Resource Manual, Version 6.0
2017-2018 CPSV Report	2018 Natural Gas Demand Side Management Custom Savings Verification[88,89]
eTools Study	eTools Boiler Tool Validation Study[90]

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 11.13. The EC certified the tracked savings which resulted in a savings ratio of 100.00%, as shown in Table 11-88.

[88] 2017-2018 Natural Gas Demand Side Management Custom Savings Verification, DNV for the Ontario Energy Board, December 26, 2019

[89] The EC did not complete studies verifying the custom project savings (CPSV) during the 2019, through 2022 program years. Instead, the EC used the same adjustment factors resulting from custom projects implemented in the 2017 and 2018 program years, adjusted for the mix of projects installed in 2022.

[90] eTools Boiler Tool Validation Study, DNV for the Ontario Energy Board, January 31, 2023

Table 11-88. Union - prescriptive measures - scorecard achievements by measure group*

Measure Group	Installed Measures	Tracked Achievement (CCM)	Verified Achievement (CCM)	Savings Ratio
Showerhead	39	11,969	11,969	100.00%
TOTAL	**39**	**11,969**	**11,969**	**100.00%**

*Not all values may compute exactly due to rounding.

Verify Custom Savings

The EC identified the custom savings totals from Union Tracking Files shown in Table 11-89. The EC applied an attribution factor of 95.00%, which is the deemed attribution for Low Income Multi-Residential programs, and a gross realization rate from the 2017-2018 CPSV report for Multi-Residential of 90.57%, which resulted in a savings ratio of 86.04%. The EC also applied a realization rate of 68.63% from the eTools Study to boilers with savings estimated by eTools, which resulted in an overall savings ratio of 59.05% for these measures.

Table 11-89. Union - custom measures - scorecard achievements*

Measure Group	Installed Measures	Tracked Gross Savings (CCM)**	Verified Achievement (CCM)	Savings Ratio
Boiler - Condensing - Space Heating	2	499,781	295,122	59.05%
Boiler - High Efficiency - Space Heating	1	94,829	55,997	59.05%
Building Automation System	1	184,155	158,450	86.04%
Variable Frequency Drive	1	36,491	31,397	86.04%
TOTAL	**5**	**815,255**	**540,966**	**66.36%**

*Not all values may compute exactly due to rounding.
**This value represents savings in the tracking data before any adjustments were made. This differs from tracked net savings, which do account for adjustments.

Verification Result

As a result of this review, the EC confirms total savings of 552,935 CCM (79.44% of tracked) for Union's Multifamily (Social and Assisted) Program.

11.6.8 Low Income Multi-Residential – Multifamily Program (MR) – Union

Overview

Table 11-90 shows the tracked and verified scorecard achievements for the 2022 Union Multifamily (Market Rate) Program, with the metric of CCM savings. As a result of this review, the EC verifies 4,573,515 CCM for all program measures (89.78% of tracked). Table 11-90 contains the following variables:

- Tracked: Metric value from original Tracking File sent by Enbridge upon first data request
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documentation section
- Ratio: Ratio of verified to tracked achievement. A value of 100.00% indicates that verified values match tracked values

Table 11-90. Union Low Income achievements: Multifamily (MR) Program CCM metrics*

Metric	Achievement		Ratio
	Tracked	Verified	
CCM - Prescriptive	-	-	-
CCM - Custom	5,094,212	4,573,515	89.78%
TOTAL	**5,094,212**	**4,573,515**	**89.78%**

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 11-91 to verify the metrics for the Multifamily (Market Rate) program.

Table 11-91. Documentation used to verify the Multifamily (Market Rate) program

Report Language	Description or Citation
Enbridge-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2022 Union DSM programs
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016, OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016 and OEB Decision and Order, EB-2021-0002, August 26, 2021
Union Plan	Union's 2015-2020 DSM Plan, EB-2015-0029
TRM 6.0	Natural Gas Demand Side Management Technical Resource Manual, Version 6.0
2017-2018 CPSV Report	2018 Natural Gas Demand Side Management Custom Savings Verification[91,92]
eTools Study	eTools Boiler Tool Validation Study[93]

Verify Custom Savings

The EC identified the custom savings totals from Union Tracking Files shown in Table 11-92. The EC applied an attribution factor of 95.00%, which is the deemed attribution for Low Income Multi-Residential programs, and a gross realization rate from the 2017-2018 CPSV report for Multi-Residential of 90.57%, which resulted in a savings ratio of 86.04%. The EC also applied a realization rate of 68.63% from the eTools Study to boilers with savings estimated by eTools, which resulted in a savings ratio of 59.05% for these measures.

[91] 2017-2018 Natural Gas Demand Side Management Custom Savings Verification, DNV for the Ontario Energy Board, December 26, 2019

[92] The EC did not complete studies verifying the custom project savings (CPSV) during the 2019 through 2022 program years. Instead, the EC used the same adjustment factors resulting from custom projects implemented in the 2017 and 2018 program years, adjusted for the mix of projects installed in 2022.

[93] eTools Boiler Tool Validation Study, DNV for the Ontario Energy Board, January 31, 2023

Table 11-92. Union - custom measures - scorecard achievements*

Measure Group	Installed Measures	Tracked Gross Savings (CCM)**	Verified Achievement (CCM)	Savings Ratio
Condensing Boiler - Combination - Less than 300 MBH	2	153,721	90,773	59.05%
Condensing Boiler - Space Heating - Less than 300 MBH	1	45,719	26,997	59.05%
Condensing Boiler - Space Heating	1	105,391	62,234	59.05%
Building Automation System	1	401,535	345,487	86.04%
HVAC - Upgrade Existing	1	37,750	32,481	86.04%
Reflective Panel	13	4,666,985	4,015,544	86.04%
TOTAL	**19**	**5,411,101**	**4,573,515**	**84.52%**

*Not all values may compute exactly due to rounding.
**This value represents savings in the tracking data before any adjustments were made. This differs from tracked net savings, which do account for adjustments.

Verification Result

As a result of this review, the EC confirms total savings of 4,573,515 CCM (89.78% of tracked) for Union's Multifamily (Market Rate) Program.

11.7 Appendix G: Large Volume Scorecard

This appendix describes the detailed process used to verify the metrics for the Large Volume Scorecard programs for Union, shown in Table 11-93. The program addressed in this appendix is the Large Volume program.

Table 11-93. Union 2022 Large Volume (Rate T2/Rate 100) program scorecard*

Programs	Metrics	Verified Achievement		Metric Target			Weight
		Program-level Achievement	Metric-level Achievement	Lower Band	Target	Upper Band	
Large Volume	CCM	97,042,448	97,042,448	105,338,685	140,451,580	210,677,370	100%

Overview

Table 11-94 shows the tracked and verified scorecard achievements for the 2022 Union Large Volume program, with the metric of CCM savings. As a result of this review, the EC verifies 97,042,448 CCM for all program measures (90.46% of tracked). Table 11-94 contains the following variables:

- Tracked: Metric value from original Tracking File sent by Enbridge upon first data request
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documentation section
- Ratio: Ratio of verified to tracked achievement. A value of 100.00% indicates that verified values match tracked values

Table 11-94. Union Large Volume achievement: Large Volume CCM metrics*

Metric	Achievement		Ratio
	Tracked	Verified	
CCM - Prescriptive	-	-	-
CCM - Custom	107,276,640	97,042,448	90.46%
Total	**107,276,640**	**97,042,448**	**90.46%**

*Not all values may compute exactly due to rounding.

Table 11-95 includes these variables:

- Tracking Gross Savings: 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

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

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

Equation 10: Verified Net Savings

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

Table 11-95. 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	-	-	-	-	-	-
Custom	700,696,538	90.46%	14.49%	0.82%	13.85%	97,042,448
TOTAL	**700,696,538**					**97,042,448**

*Not all values may compute exactly due to rounding.
**This value represents savings in the tracking data before any adjustments were made. This differs from tracked net savings, which do account for adjustments.

Documentation

The EC used the documentation shown in Table 11-96 to verify the metrics for the Large Volume program.

Table 11-96. Documentation used to verify the Large Volume program

Report Language	Description or Citation
Enbridge-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2022 Union DSM programs
Documents Used by EC	
OEB Decision	OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016, OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016 and OEB Decision and Order, EB-2021-0002, August 26, 2021
Union Plan	Union's 2015-2020 DSM Plan, EB-2015-0029
Union's Draft 2022 Report	Union Gas 2022 Demand Side Management Draft Annual Report[94]
2017-2018 CPSV Report	2018 Natural Gas Demand Side Management Custom Savings Verification[95]
2018 NTG Report	2018 Natural Gas Demand Side Management Free-ridership Evaluation[96,97]
2013-2014 Spillover Study	CPSV Participant Spillover Results[98]

Custom Savings

The EC identified 76 tracked custom measures with tracked cumulative gross savings of 700,696,538 CCM. These projects are grouped by measure in Table 11-97.

Table 11-97. Union - custom measures – cumulative gross savings by measure group*

Measure Group	Installed Measures	Tracking Gross Savings (CCM)
HVAC	4	50,685,789
Process	35	293,891,855
Power Generation	2	15,123,660
Steam or Hot Water System	35	340,995,234
TOTAL	**76**	**700,696,538**

*Not all values may compute exactly due to rounding.

[94] While the EC recognizes 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.
[95] 2017-2018 Natural Gas Demand Side Management Custom Savings Verification, DNV for the Ontario Energy Board, December 26, 2019
[96] 2018 Natural Gas Demand Side Management Free-ridership Evaluation, DNV for the Ontario Energy Board, December 27, 2019
[97] The EC did not complete studies verifying the custom project savings (CPSV) during the 2019 through 2022 program years. Instead, the EC used the same adjustment factors resulting from custom projects implemented in the 2017 and 2018 program years, adjusted for the mix of projects installed in 2022.
[98] CPSV Participant Spillover Results, DNV for the Ontario Energy Board, May 23, 2018

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 11-98. 2022 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	700,696,538	90.46%	14.49%	0.82%	13.85%	97,042,448

*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 two-digit level, as displayed.

Verification Result

As a result of this review, the EC confirms total savings of 97,042,448 CCM (90.46% of net tracked) for Union's Large Volume (Rate T2/Rate 100) Program.

11.8 Appendix H: Market Transformation Scorecards

This appendix describes the detailed process used to verify the metrics for the Market Transformation Scorecard programs for Enbridge (Table 11-99) and Union (Table 11-100). 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 11-99. Enbridge 2022 market transformation scorecard[99]†

Programs	Metrics	Verified Achievement		Metric Target			Weight
		Program-level Achievement	Metric-level Achievement	Lower Band	Target	Upper Band	
School Energy Competition	SEC Schools	-	-	44	58	87	10.00%
Run-it-Right	Participants	-	-	40	53	80	20.00%
Comprehensive Energy Management (CEM)	CEM Participants	1	1	15	21	31	20.00%
Residential Savings by Design	Builders	24	24	18	24	35	10.00%
Residential Savings by Design	Homes	2,831	2,831	1,847	2,462	3,694	15.00%
Commercial Savings by Design	Developments	12	12	26	35	52	25.00%

†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 Section 11.9.

Table 11-100. Union 2022 market transformation scorecard[100]

Programs	Metrics	Verified Achievement		Metric Target			Weight
		Program-level Achievement	Metric-level Achievement	Lower Band	Target	Upper Band	
Optimum Home	Percentage of Homes Built	54.22%	54.22%	100.00%	100.00%	100.00%	50.00%
Commercial New Construction	New Developments	11	11	24	32	49	50.00%

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

11.8.1 Commercial New Construction – Commercial Savings by Design – Enbridge

Overview

Table 11-101 shows the tracked and verified scorecard achievements for the 2022 Enbridge Commercial Savings by Design (SBD) Program, with the metric of New Developments. As a result of this review, the EC verifies 12 New Developments (100.00% of tracked). Table 11-101 contains the following variables:

- Tracked: Metric value from original Tracking File sent by Enbridge upon first data request
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documentation section
- Ratio: Ratio of verified to tracked achievement. A value of 100.00% indicates that verified values match tracked values

Table 11-101. Enbridge Market Transformation achievement: Commercial Savings by Design developments metric*

Metric	Achievement		Ratio
	Tracked	Verified	
New Developments	12	12	100.00%

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 11-102 to verify the metrics for the Commercial Savings by Design program.

Table 11-102. 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 2022 Enbridge DSM programs
Project Files	PDF documents
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, OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016 and OEB Decision and Order, EB-2021-0002, August 26, 2021
Enbridge Plan	Enbridge Gas Multi-Year DSM Plan (2015-2020), EB-2015-0049

Participant Selection

Enbridge provided the Tracking File listing Project Number (unique ID), program year, commitment date, and IDP date. As tracking data indicated that all 12 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 two types of documents in response to this request:

- Commitment form, including terms and conditions
- IDP report

The EC first confirmed that the documentation received matched the IDs requested. The EC confirmed that 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:[101]

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,"[102] 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:

- Only projects from enrolled builders/developers count towards the metric. Enrolment 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 2017 building code
    - A project which is a single building or multiples of the same building which sum to at least 50,000 ft^2

The EC noted that the IDPs submitted for the 5 developments cited an average savings of 39% improvement against the 2017 OBC code, with a range of 20.2% to 72.4% savings. The average square footage was 375,296 ft^2 with a range of 89,440 ft^2 to 906,279 ft^2.

[101] Ontario Energy Board Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016, Page 39
[102] Enbridge's Proposed 2015-2020 DSM Plan, EB-2015-0049, Exhibit B, Tab 1, Schedule 4, 37 of 41

Table 11-103. 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 identify EnergyPlus v9.3, IES VE 2021, or eQuest v3.65[103]
Sufficient energy savings achieved	Yes	See below
-IDP demonstrates how to achieve 15% energy savings over 2017 building code	N/A	All IDP reports states savings 15% over 2017 OBC
Project must be at least 50,000 ft^2	Yes	Applications and IDP Reports included in documentation
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.

Verify Eligibility

Enbridge's Plan, approved by the OEB, further identifies eligibility criteria. As stated in Enbridge's Plan:[104]

> *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;*
> - *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.

[103] ASHRAE 90.1-2013 section 11 as modified by Supplementary Standard SB10-2017 Division 3, Chapter 2, were followed in generating reference and baseline models
[104] Enbridge's Proposed 2015-2020 DSM Plan, EB-2015-0049, Exhibit B, Tab 2, Schedule 1, 61 of 100

Table 11-104. 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 enrolment
Commissioning within 1 year of construction	N/A	

After reviewing the stated eligibility criteria and Project Files, the EC confirms the 5 sampled projects all 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 projects meet all requirements for a participant
- Project files for the submitted projects meet further criteria for eligibility

As a result of this review, the EC confirms the scorecard metric of 12 new developments (100.00% of tracked) for the Enbridge Commercial Savings by Design program.

11.8.2 Commercial New Construction – Union

Overview

Table 11-105 shows the tracked and verified scorecard achievements for the 2022 Union 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 11 New Developments enrolled by participating builders (100.00% of tracked). Table 11-105 contains the following variables:

- Tracked: Metric value from original Tracking File sent by Enbridge upon first data request
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documentation section
- Ratio: Ratio of verified to tracked achievement. A value of 100.00% indicates that verified values match tracked values

Table 11-105. Union Market Transformation achievement: Commercial New Construction developments metric*

Metric	Achievement		Ratio
	Tracked	Verified	
New Developments	11	11	100.00%

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 11-106 to verify the metrics for the Commercial New Construction program.

Table 11-106. Documentation used to verify the Commercial New Construction program

Report Language	Description or Citation
Enbridge-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2022 Union DSM programs
Project Files	Various documents for each requested participant, supporting program metrics
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, OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016 and OEB Decision and Order, EB-2021-0002, August 26, 2021
Union Plan	Union's 2015-2020 DSM Plan, EB-2015-0029

Participant Selection

Union provided the Tracking File listing Project Code (unique ID), program year, application date, Visioning Date, and IDP date. The spreadsheet identified 11 participants, all with 2022 dates. As tracking data indicated that all the 11 listed participants were equally qualified, the EC requested all supporting documentation for 5 developments, including documentation that supports eligibility and participation criteria.

Received Files

The EC received four types of documents in response to this request:

- Commitment form
- Terms and Conditions
- IDP report

- Supporting Letter

The EC first confirmed that the documents received matched the IDs requested. The EC confirmed that 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:[105]

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:[106]

To be eligible for an incentive, the submitted projects must fulfill the following criteria:

- *Construction projects must have a minimum threshold of 50,000 square feet per project (including aggregate multi-location projects)*
- *Building(s) must be in the design phase or earlier*
- *Building construction must be completed within 5 years of completion of the IDP, and building must be commissioned within 1 year of construction completion*
- *Builders are eligible to participate in the offering multiple times for different projects*

From these definitions, the EC observed the following criteria:

- 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 2017 building code
    - A project is a building or multiples of same building which sum to at least 50,000 ft^2

The EC noted that the IDPs submitted for 5 sampled participants cited an average savings of 32.18% improvement against the 2017 OBC code, with a range of 20% to 44.5% in savings. Upon initial review, IDPs for 4 of the 5 developments showed at least 50,000 ft^2 with an average of 85,846 ft^2 and a range of 23,200 ft^2 to 155,232 ft^2. Therefore, one development initially did not qualify on the basis of being smaller than 50,000 ft^2. However, a supporting letter was provided to the EC from the builder confirming the development would in fact exceed 50,000 ft^2.

[105] Ontario Energy Board Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016, Page 39
[106] Union's DRAFT 2021 Demand Side Management Evaluation Report, Page 110

Table 11-107. 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 EnergyPlus v9.3, IES VE 2021, or eQuest v3.65[107]
Sufficient energy savings achieved	Yes	See below
- IDP demonstrates how to achieve 15% energy savings over 2017 code	N/A	All IDP reports state savings 15% over 2017 OBC
Project must be at least 50,000 ft^2	Yes	Commitment Forms and supporting letters
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 Union Commercial New Construction program.

Verify 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.

Table 11-108. 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 Forms and supporting letters
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 enrolment
Commissioning within 1 year of construction	N/A	

After reviewing these stated eligibility criteria and Project Files, the EC confirms that all 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 5 of the submitted projects meet all requirements for a participant
- Project files for 5 of those projects meet further criteria for eligibility

The EC verifies the achievement of 11 projects (100.00% of tracked) for the Union Commercial New Construction program.

[107] ASHRAE 90.1-2013 section 11 as modified by Supplementary Standard SB10-2017 Division 3, Chapter 2, were followed in generating reference and baseline models

11.8.3 Residential New Construction – Residential Savings by Design – Enbridge

Overview

Table 11-109 shows the tracked and verified scorecard achievements for the 2022 Enbridge Residential Savings by Design (SBD) Program, with the metrics of enrolled builders and number of homes built. As a result of this review, the EC verifies 24 builders (100.00% of tracked) and 2,831 homes built (100.00% of tracked). Each metric is discussed separately in this section, starting with the builders metric. Table 11-109 contains the following variables:

- Tracked: Metric value from original Tracking File sent by Enbridge upon first data request
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documentation section
- Ratio: Ratio of verified to tracked achievement. A value of 100.00% indicates that verified values match tracked values

Table 11-109. Enbridge Market Transformation achievement: Residential Savings by Design metrics*

Program	Metric	Achievement		Ratio
		Tracked	Verified	
Residential Savings by Design	Builders	24	24	100.00%
	Homes Built	2,831	2,831	100.00%

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 11-110 to verify the metrics for the Residential Savings by Design program.

Table 11-110. 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 2022 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, OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016 and OEB Decision and Order, EB-2021-0002, August 26, 2021
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 Number (unique ID), Enrolment Year, Signed Commitment (date), and IDP date. The spreadsheet identified 24 builders, all with 2022 IDP dates. As tracking data indicated that all the 24 listed builders were equally qualified, the EC randomly selected 5 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 three types of files to support participation:

- “Project Application”
- “IDP Report”

- Letters from participants supporting participation criteria

Verify Participation

To determine the definition of Enrolled Builders, the EC looked first to the OEB Decision, which approved the Enbridge ESC Plan[108] 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:[109]

> *"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 modelling 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:
  - 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."
  - All ten 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:

[108] Ontario Energy Board Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016, Page 34

[109] Enbridge's Proposed 2015-2020 DSM Plan, EB-2015-0049, Exhibit B, Tab 1, Schedule 4, Page 35-36 of 41

– The Project Applications of all ten randomly selected builders identified the total development size of 50 homes or more, satisfying the requirement for no less than 50.

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
- 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 of this review, the EC confirms the scorecard metric of 24 enrolled builders (100.00% of tracked) for the Enbridge Residential Savings by Design program.

Homes Built Metric

Participant Selection

Enbridge first provided the Tracking File listing Project Code (unique ID), Builder, and Savings Percent over OBC for program homes. The spreadsheet identified 1,467 program-rebated homes, separate from the 1,364 additional homes built to program requirements but not receiving program rebates. The EC randomly selected five homes from the 1,467 program-rebated 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:

- "Application Form" – PDF document outlining initial plans
- "IDP Workshop Report" – PDF document outlining qualification documentation
- "H2K Results" – JPG showing the Total Annual Fuel Consumption in megajoules (MJ) of the sampled house

In addition to these documents to support program homes, Enbridge also confirmed that supporting letters were received 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[110] "*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:[111]

> *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 2017 Ontario Building Code.*

[110] Ontario Energy Board Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016, Page 34
[111] Enbridge's Proposed 2015-2020 DSM Plan, EB-2015-0049, Exhibit B, Tab 1, Schedule 4, Page 36-37 of 41

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.

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 Builders metric (see above). The EC assumed that this 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, HOT2000 screenshots, and REM-Rate documents for all five randomly selected homes demonstrated modelled as-built energy consumption 15% or greater above 2017 OBC.
- Requirement iii:
  - The EC does not find that this requirement applies 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 incentivized. 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 of this review, the EC confirms 1,467 rebated program homes and 1,364 non-rebated homes, for an achievement of 2,831 Homes Built (100.00% of tracked) for the Enbridge Residential Savings by Design program.

11.8.4 Residential New Construction – Optimum Home Program – Union

Overview

Table 11-111 shows the tracked and verified scorecard achievements for the 2022 Union Optimum Home Program, with the metric of percentage of homes built (>15% above OBC 2017) by participating builders. As a result of this review, the EC verifies 54.22% of homes built (100.00% of tracked). Table 11-111 contains the following variables:

- Tracked: Metric value from original Tracking File sent by Enbridge upon first data request
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documentation section
- Ratio: Ratio of verified to tracked achievement. A value of 100.00% indicates that verified values match tracked values

Table 11-111. Union Market Transformation achievement: Optimum Home percentage of homes built metric*

Metric	Achievement		Ratio
	Tracked	Verified	
Percentage of Homes Built	54.22%	54.22%	100.00%

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 11-112 to verify the metrics for the Optimum Home program.

Table 11-112. Documentation used to verify the Optimum Home program

Report Language	Description or Citation
Enbridge-Provided Documentation	
Tracking File	Excel spreadsheet tracking metrics for all 2022 Union DSM programs
Optimum Home Top 10 and Homes Built List	Excel spreadsheet listing builders in each region by housing starts and all participating homes
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, OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016 and OEB Decision and Order, EB-2021-0002, August 26, 2021
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

Participant Selection

Union first provided the Tracking File listing anonymized builders with the year each builder enrolled, the number of total new gas attachments in 2022, the number of program homes, and a percentage of homes built calculation. This file showed the claimed metric achievement, identifying 764 of 1,409 total homes built by the 22 enrolled builders, as demonstrated in Table 11-113.

Table 11-113. Optimum Home claimed total and program homes built, by builder*

Builder	Total Homes Built	Optimum Homes Built	% of Homes Built
Builder 1	8	0	0%
Builder 2	107	107	100%
Builder 3	31	15	48%
Builder 4	399	399	100%
Builder 5	33	18	55%
Builder 6	98	29	30%
Builder 7	61	61	100%
Builder 8	0	0	0%
Builder 9	0	0	0%
Builder 10	0	0	0%
Builder 11	200	0	0%
Builder 12	0	0	0%
Builder 13	10	10	100%
Builder 14	0	0	0%
Builder 15	23	0	0%
Builder 16	4	0	0%
Builder 17	53	53	100%
Builder 18	174	39	22%
Builder 19	99	0	0%
Builder 20	3	0	0%
Builder 21	9	0	0%
Builder 22	97	33	34%
Total	**1,409**	**764**	**54.22%**

*Not all values may compute exactly due to rounding.

In addition, Union provided a list of Optimum Homes built in 2022 with individual listings for the 1,409 program homes, identifying builder, file number, and enrolment type (e.g., ES BOP Version 17). From these, the EC randomly selected five program homes for review and verification.

Union provided the following documentation to support verification of each of the selected program homes:

- Energy Star for New Homes Compliance Report – PDF
- Balance-of-Plant summary verifying building energy performance to ESNH v17

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 builders of the randomly selected homes. The EC confirmed these builders enrolled in the program, 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 for the Annual Verification of 2017 DSM programs, 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").[112] The EC continues to use that definition through this Annual Verification.

The EC requested documentation for verification of five sites, randomly selected from the 2022 Optimum Homes Built spreadsheet. Files provided by Union confirmed the eligibility of the homes. The ESNH v17 Compliance Report demonstrated both qualifying inspection dates (all 2022) and that the sites met the ESNH v17 energy performance threshold.

As a result, the EC confirms that the submitted projects meet the criteria for eligibility for the Union Optimum Homes program.

Verification Result

As a result of this review:

- The EC confirms proper documentation for the requested sites and builders
- Project files for the randomly selected sites meet energy savings compliance criteria

The EC verifies the scorecard metric of 764 out of 1,409 (54.22%) total participating builder homes (100.00% of tracked) for the Optimum Home program.

[112] Union's Draft 2017 Demand Side Management Evaluation Report, Page 89

11.8.5 School Energy Competition – Enbridge

No activity was reported for this program in 2022.

11.9 Appendix I: 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 (Table 11-115) and the similar programs for Enbridge that are contained under the Market Transformation Scorecard (Table 11-114). 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:

C&I Operational Efficiency Improvement – Run-it-Right – Enbridge
C&I Operational Efficiency Improvement – RunSmart – Union
C&I Energy Management – Comprehensive Energy Management – Enbridge
C&I Energy Management – Strategic Energy Management – Union

Table 11-114. Enbridge 2022 market transformation & energy management scorecard†

Programs	Metrics	Verified Achievement		Metric Target			Weight
		Program-level Achievement	Metric-level Achievement	Lower Band	Target	Upper Band	
School Energy Competition	SEC Schools	-	-	44	58	87	10.00%
Run-it-Right	Participants	-	-	40	53	80	20.00%
Comprehensive Energy Management (CEM)	CEM Participants	1	1	15	21	31	20.00%
Residential Savings by Design	Builders	24	24	18	24	35	10.00%
Residential Savings by Design	Homes	2,831	2,831	1,847	2,462	3,694	15.00%
Commercial Savings by Design	Developments	12	12	26	35	52	25.00%

†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 Section 11.8.

Table 11-115. Union 2022 performance-based scorecard

Programs	Metrics	Verified Achievement		Metric Target			Weight
		Program-level Achievement	Metric-level Achievement	Lower Band	Target	Upper Band	
RunSmart	Participants	-	-	52	69	104	10.00%
	Savings %	0.00%	0.00%	0.33%	0.44%	0.67%	40.00%
Strategic Energy Management	Savings %	3.47%	3.47%	21.67%	28.89%	43.33%	50.00%

11.9.1 C&I Operational Efficiency Improvement – Run-it-Right – Enbridge

No activity was reported for this program metric in 2022.

11.9.2 C&I Operational Efficiency Improvement – RunSmart – Union

No activity was reported for this program in 2022.

11.9.3 C&I Energy Management – Comprehensive Energy Management – Enbridge

Overview

Table 11-116 shows the tracked and verified scorecard achievements for the 2022 Enbridge Comprehensive Energy Management (CEM) program, with the metric of Participants. The RIR Program has two metrics under separate scorecards, CCM Savings (Resource Acquisition) and Participants (Market Transformation). Participant is discussed here, while the CCM Savings metric is discussed in Section 11.5. As a result of this review, the EC verifies one participant (100.00% of tracked). Table 11-116 contains the following variables:

- Tracked: Metric value from original Tracking File sent by Enbridge upon first data request
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documentation section
- Ratio: Ratio of verified to tracked achievement. A value of 100.00% indicates that verified values match tracked values

Table 11-116. Enbridge Market Transformation achievement: Comprehensive Energy Management participants metric*

Metric	Achievement		Ratio
	Tracked	Verified	
Participants	1	1	100.00%

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 11-117 to verify the metrics for the Comprehensive Energy Management program.

Table 11-117. 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 2022 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, OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016 and OEB Decision and Order, EB-2021-0002, August 26, 2021
Enbridge Plan	Enbridge Gas Multi-Year DSM Plan (2015-2020), EB-2015-0049

Participant Selection

Enbridge first provided the Tracking File listing CEM Project Codes, Account Numbers, Enrolment Date, and Energy Model Date. The spreadsheet listed one individual participant. The EC requested full documentation for the participant.

Received Files

The EC received one PDF application form documents, identified by CEM Project number. The EC first confirmed the documents received matched the IDs requested, 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, documentation indicates that the CEM program is intended to be a multi-year, 'holistic' process with ongoing engagement resulting in energy savings.

As a result, the EC understands that evidence of initial engagement and a specific agreement to participate are 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. 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
- Will share energy data with Enbridge
- Will allow continued communication with Enbridge

The EC confirmed documentation supports participation of both participants.

Verify Eligibility

The EC also used the Project File to confirm the eligibility of the participant,[113,114] namely to verify that the customer had annual gas consumption between 340,000 m^3 and 5,000,000 m^3.

The Account Number listed in the Project Files matched Account Number listed in the Tracking File.

Project Files identified previous year gas consumption for the customer:

- One customer with consumption between 340,000 m^3 and 5,000,000 m^3

The customer's consumption falls between the required usage, the EC verifies the eligibility of this participant.

Verification Result

As a result of this review, the EC confirms that:

- Documentation confirmed the participant met the participation definition
- Documentation confirmed the participant met the eligibility definition
- Further review by the EC verified the remaining participant

The EC confirms the scorecard metric of 1 participant (100.00% of tracked) for the Enbridge Comprehensive Energy Management Program.

[113] Ontario Energy Board Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016, page 47
[114] Enbridge Gas Program Plan: DSM Plan Overview and Guiding Principles, EB-2015-0049, Exhibit B, Tab 2, Schedule 1, Page 53 of 100

11.9.4 C&I Energy Management – Strategic Energy Management – Union

Overview

Table 11-118 shows the tracked and verified scorecard achievements for the 2022 Union Strategic Energy Management (SEM) program, with the metric of Percent Savings. As a result of this review, the EC verifies 3.47% savings (100.00% of tracked). Table 11-118 contains the following variables:

- Tracked: Metric value from original Tracking File sent by Enbridge upon first data request
- Verified: Metric value verified from review of Tracking File, Project Files, and other relevant documents identified in the Documentation section
- Ratio: Ratio of verified to tracked achievement. A value of 100.00% indicates that verified values match tracked values

Table 11-118. Union Performance Based achievement: Strategic Energy Management percent savings metric*

Metric	Achievement		Ratio
	Tracked	Verified	
Savings %	3.47%	3.47%	100.00%

*Not all values may compute exactly due to rounding.

Documentation

The EC used the documentation shown in Table 11-119 to verify the metrics for the Strategic Energy Management program.

Table 11-119. 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 2022 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, OEB Revised Decision and Order, EB-2015-0029/EB-2015-0049, February 24, 2016 and OEB Decision and Order, EB-2021-0002, August 26, 2021
Enbridge Plan	Enbridge Gas Multi-Year DSM Plan (2015-2020), EB-2015-0049

Participant Selection

Union first provided the Tracking File listing Year, SEM Project Codes, Savings, Reference Consumption, and Percent Saved. The spreadsheet listed three individual participants, but only one participant had energy savings in 2022. The EC requested full documentation for this participant.

Received Files

The EC received one PDF document – a Savings Report that detailed the energy efficiency measures taken by the active participant and the resulting energy savings. The EC confirmed that the participant details in this documentation matched the details listed in the Tracking File.

Verify Savings Calculation

Union's plan defines savings percent[115] as "the aggregate percentage of savings achieved by the program participants within a program year." The savings report utilized on-site meter data and baseline consumption to model consumption and

[115] Description of Strategic Energy Management Savings Percent from Overview of Union's Proposed 2015-2020 DSM Plan, 2015EB-2015-0029, Exhibit A, Tab 3, Page 35 of 73

reductions in gas usage resulting from the implementation of the SEM Program. Union used the following equation for the participant's percentage savings:

$$Participant\ Savings\ \% = \frac{Pre\ Consumption\ Change}{Listed\ PY\ Consumption}$$

Union's tracked calculation then took the individual savings percent values for each participant and used the following equation to arrive at a program-level Savings Percent value:

$$\frac{\sum Participant\ Savings\ \%}{Count\ of\ Participants}$$

The EC agrees and confirms this methodology.

Verification Result

As a result of this review, the EC confirms a Savings Percent value of 3.47% (100.00% of tracked) for the Strategic Energy Management Savings Percent metric.

11.10 Appendix J: Review of Metric Target Calculations

Overview

For 2022, targets for metrics that existed in the previous year are defined based on the previous year's (PY) achievement[116] and spend,[117] the current year (CY) budget, and a multiplier.[118] 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 above is the Union Large Volume Program, which uses the 3 Year cost effectiveness (CE),[119] the current year (CY) budget, and a multiplier of 2% (1.02):

$$Union\ Large\ Volume\ Target = 3\ Year\ CE \times CY\ Budget \times 1.02$$

Calculation Inputs

Table 11-120 and Table 11-121 provide the specific values used to calculate the 2022 metric targets.

Table 11-122 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, as defined in the Decision & Order, is calculated via the final verified metric achievement divided by final actual program spend for that year. This rounded 3-year average value, termed "cost effectiveness" in the Decision & Order, is what DNV used for target calculations. It is worth noting that this is different than the definition of "cost effectiveness" used in the CE analysis in Appendix O if this report.

Table 11-123 and Table 11-124 provide the targets for all 2022 metrics, calculation-based and prescribed.

Table 11-120. Enbridge Metric Target Calculation Inputs – 2022

Scorecard	Metric	2021 Achievement	2021 Spend	2022 Budget	Multiplier
Resource Acquisition	LV RA (CCM)	398,551,440	$8,209,537	$9,922,880	1.02
	SV RA (CCM)	314,021,599	$36,280,279	$27,752,670	
	HEC Participants*	15,321	$29,560,475	$18,727,200	
Low Income	LISF (CCM)	26,443,935	$6,818,367	$6,736,859	
	LIMR (CCM)	78,419,182	$3,473,475	$3,967,353	
	LINC Applications	13	$1,540,866	$1,456,560	
Market Transformation	CSBD Developments	17	$604,724	$1,122,068	1.10
	CEM Participants	2	$100,646	$941,562	
	RSBD Builders	24	$3,809,618	$3,392,296	
	RSBD Homes	2,514			
	RiR Participants	36	$244,172	$329,209	
	SEC Schools	-	$0	$520,200	

*HEC budget is a subset of, and not a separate line item from, the Resource Acquisition budget.

[116] Gas savings values used in calculating targets for 2022 are slightly different than the final savings values reported in the 2021 Annual Verification report because achievements for the target calculations use the more updated TRM 6.0 assumptions, compared to the final 2021 achievements which use the TRM 5.0 assumptions.

[117] Program spending used in calculating targets do not include overheads. They are also slightly different than spending values included in the 2021 Annual Verification report, as some of the program-specific spending in the 2021 report includes program-specific overheads. Budget values used in calculating targets also exclude overhead costs.

[118] 1.02 or 1.10 depending on the scorecard

[119] Three-year rolling average (2019-2021) 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." This is different than the definition of "cost effectiveness" in Appendix O if this report.

Table 11-121. Union Metric Target Calculation Inputs – 2022

Scorecard	Metric	2021 Achievement	2021 Spend	2022 Budget	Multiplier
Resource Acquisition	RA (CCM)	629,222,801	$26,114,077	$31,183,000	1.02
	HRR Participants*	5,032	$11,528,676	$12,226,000	
Large Volume	LV (CCM)†	43.71 (see Table 11-122)		$3,150,000	
Low Income	LISF (CCM)	45,903,844	$8,470,033	$9,739,000	
	LIMF-SA (CCM)	8,833,724	$1,901,977	$2,647,737	
	LIMF-MR (CCM)	6,977,358	$664,654	$925,263	
Market Transformation	CNC Developments	24	$816,326	$1,000,000	1.10
	OH % Built	73.08%	$63,077	$841,000	
Performance Based	RS Participants	-	$27,405	$163,000	
	RS Savings %	0.00%			
	SEM Savings %	3.55%	$86,438	$639,000	

*HRR budget is a subset of, and not a separate line item from, the Resource Acquisition budget.
†Union's Large Volume program metric target is based on different inputs; instead of the 2021 CCM achievement, the formula is based off the three-year rolling average (2019-2021) Rate T2/Rate 100 cost effectiveness. This average value (43.71) is what is listed for the 2021 achievement.

Table 11-122. Union Large Volume Cost Effectiveness* Ratios

Year	CE Ratio*
2019	26.96
2020	43.35
2021	60.84
3-Year Average	**43.71**

*Cost effectiveness here is defined as "Final verified metric achievement used for MRAMVA purposes divided by final actual program spend for that year." This is different than the definition of "cost effectiveness" in Appendix O if this report. Annual CE Ratios and the 3-year average are rounded to 2 digits past the decimal.

Table 11-123. Enbridge Metric Targets – 2022

Scorecard	Metric	2022 Target
Resource Acquisition	LV RA (CCM)	491,364,320
	SV RA (CCM)	245,015,661
	HEC Participants	9,900
Low Income	LISF (CCM)	26,650,377
	LIMR (CCM)	91,360,642
	LINC Applications	13
Market Transformation	CSBD Developments	35
	CEM Participants	21
	RSBD Builders	24
	RSBD Homes	2,462
	RiR Participants	53
	SEC Schools	58

Table 11-124. Union Metric Targets – 2022

Scorecard	Metric	2022 Target
Resource Acquisition	RA (CCM)	766,386,474
	HRR Participants	5,443
Large Volume	LV (CCM)	140,451,580
Low Income	LISF (CCM)	53,836,709
	LIMF-SA (CCM)	12,543,352
	LIMF-MR (CCM)	9,907,431
Market Transformation	CNC Developments	32
	OH % Built	100.00%
Performance Based	RS Participants	69
	RS Savings %	0.44%
	SEM Savings %	28.89%

11.11 Appendix K: Review of Lost Revenue and DSM Shareholder Incentive Calculations

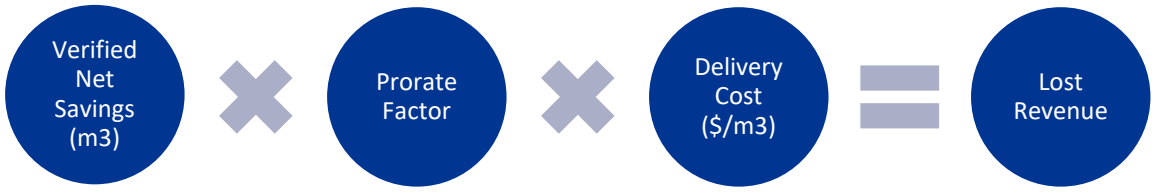
This appendix describes the EC team's review of the lost revenue and demand side management shareholder incentive calculations.

11.11.1 Lost Revenue Calculations

The basic approach to the lost revenue calculation is illustrated in Figure 11-8. The calculation 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 11-8. 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 11-125. Values specific to these rates for the evaluated year are included in Section 11.12.

Table 11-125. 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 11-8. 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 November 2022 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 11-126 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 11-126. 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 1,000 cubic meters. Prorated energy savings are divided by 1,000 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:

$$Total\ Lost\ Revenue = \sum_{Rate\ Class}^{Utility} \sum_{Measure}^{Rate\ Class} Lost\ Revenue$$

11.11.2 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 independently calculated DSM shareholder incentive values for both legacy 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 the verified net savings used in the lost revenue calculation represent the best available information at the time of the verification, the verified net savings used in the DSM shareholder incentive 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.

If the achieved metric is less than or equal to the 2022 Lower Band, the Metric Score is then calculated as:

$$Metric\ Score = \frac{0.75 * achieved\ metric}{lower\ band}$$

If the achieved metric is greater than the 2022 Lower Band and less than or equal to the 2022 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 2022 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.[120] 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.

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 11-127.

[120] OEB Decision and Order, EB-2015-0029/EB-2015-0049, January 20, 2016, page 80

Table 11-127. Calculation to determine shareholder incentive

WSA 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:

$$Total\ Incentive = \sum_{Utility} Scorecard\ Incentive$$

11.11.3 Example Calculations

Lost revenue

As an example, a widget carries an 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 11-128 shows the prorated total savings for all widgets with one installed per month, in 1000 m^3.

Table 11-128. 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 11-129, 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 1,000 m^3. All applicable rate class lost revenue are then summed for total lost revenue.

Table 11-129. 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 is to determine the correct formula based on whether the verified achievement for the scorecard metric was less than or equal to the lower band, greater than the lower band and less than or equal to the target, or greater than the annual target. In the example in Table 11-130, the verified achievement for the first Scorecard A CCM metric was greater than the 2022 lower band and less than the 2022 target, so the formula for achievement greater than the lower band and less than or equal to the target is used to determine the metric score. The verified achievement for the second Scorecard A CCM metric was less than the 2022 lower band, so the formula for achievement less than or equal to the lower band is used to determine the metric score. The verified achievement for participants was greater than the 2022 target, so the formula for achievement greater than the target is used. Each formula is illustrated below.

Table 11-130. Example metric score*

Scorecard	Metric	Verified Achievement	Lower Band	2022 Target	Upper Band	Metric Score
Scorecard A	CCM 1	9,000,000	7,500,000	10,000,000	15,000,000	0.90
	CCM 2	6,000,000	7,500,000	10,000,000	15,000,000	0.60
	Participants	250	150	200	300	1.25

*Not all values may compute exactly due to rounding.

$$CCM\ 1\ Metric\ Score = 1 - \frac{0.25 * (10{,}000{,}000 - 9{,}000{,}000)}{(10{,}000{,}000 - 7{,}500{,}000)} = 1 - 0.1 = 0.9$$

$$CCM\ 2\ Metric\ Score = \frac{0.75 * 6{,}000{,}000}{7{,}500{,}000} = 0.6$$

$$Participant\ Metric\ Score = 1 + \frac{0.5 * (250 - 200)}{(300 - 200)} = 1 + 0.25 = 1.25$$

The metric score for each metric is then multiplied by the applicable weight. In this example, both CCM savings metrics are weighted at 45% and the participant metric is weighted at 10%. The weighted metric scores are summed for the weighted scorecard achievement.

Table 11-131. Example scorecard weighted score (WSA)*

Scorecard	Metric	Metric Score	Weight	Weighted Metric Score	Weighted Scorecard Achievement
Scorecard A	CCM 1	0.90	45%	0.4050	0.8000
	CCM 2	0.60	45%	0.2700	
	Participants	1.25	10%	0.1250	

*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 0.8000 would result in an incentive of $8,000, as demonstrated below.

$$(40\%\ x\ \$100{,}000)\frac{(0.8000-.75)}{0.25}=\$40{,}000\ x\ \frac{(0.0500)}{0.25}=\$40{,}000\ x\ 0.20=\$8{,}000$$

11.12 Appendix L: Lost Revenue and DSM Shareholder Incentive: Detailed Tables

11.12.1 Enbridge DSM shareholder incentive

Table 11-132. Enbridge's 2022 Resource Acquisition targets, achievements, and incentive*

Metric	Target	Verified Achievement	Weight	Metric Score	Weighted Metric Score
Large Volume Customer - CCM	491,364,320	403,144,097	40.00%	82.05%	32.82%
Small Volume Customer - CCM	245,015,661	310,193,626	40.00%	126.60%	50.64%
Home Energy Conservation Participants	9,900	17,225	20.00%	173.99%	34.80%
Verified Total Weighted Scorecard Achieved					118.26%
Maximum Scorecard Incentive					$7,012,787
Verified Scorecard Incentive Achieved					**$4,341,500**

*Not all values may compute exactly due to rounding.

Table 11-133. Enbridge's 2022 Low Income scorecard targets, achievements, and incentive*

Metric	Target	Verified Achievement	Weight	Metric Score	Weighted Metric Score
Home Winterproofing CCM	26,650,377	34,647,732	45.00%	130.01%	58.50%
Low Income Multi Residential CCM	91,360,642	71,812,509	45.00%	78.60%	35.37%
Low Income New Construction Applications	13	7	10.00%	58.33%	5.83%
Verified Total Weighted Scorecard Achieved					99.71%
Maximum Scorecard Incentive					$2,263,561
Verified Scorecard Incentive Achieved					**$894,872**

*Not all values may compute exactly due to rounding.

Table 11-134. Enbridge's 2022 Market Transformation scorecard targets, achievements, and incentive*

Metric	Target	Verified Achievement	Weight	Metric Score	Weighted Metric Score
School Energy Competition Schools	58	-	10.00%	0.00%	0.00%
Run-it-Right Participants	53	-	20.00%	0.00%	0.00%
Comprehensive Energy Management Participants	21	1	20.00%	5.00%	1.00%
Residential Savings by Design Builders	24	24	10.00%	100.00%	10.00%
Residential Savings by Design Homes	2,462	2,831	15.00%	114.98%	17.25%
Commercial Savings by Design Developments	35	12	25.00%	34.62%	8.65%
Verified Total Weighted Scorecard Achieved**					36.90%
Maximum Scorecard Incentive					$1,173,652
Verified Scorecard Incentive Achieved					**$0**

*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.

11.12.2 Union DSM shareholder incentive

Table 11-135. Union's 2022 Resource Acquisition targets, achievements, and incentive*

Metric	Target	Verified Achievement	Weight	Metric Score	Weighted Metric Score
CCM	766,386,474	430,240,518	75.00%	56.14%	42.10%
Home Reno Rebate Participants	5,443	6,568	25.00%	120.66%	30.17%
Verified Total Weighted Scorecard Achieved**					72.27%
Maximum Scorecard Incentive					$6,562,712
Verified Scorecard Incentive Achieved					**$0**

*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 11-136. Union's 2022 Low Income targets, achievements, and incentive*

Metric	Target	Verified Achievement	Weight	Metric Score	Weighted Metric Score
Single Family CCM	53,836,709	28,837,892	60.00%	53.57%	32.14%
Multi-Family - Social & Assisted CCM	12,543,352	552,935	35.00%	4.41%	1.54%
Multi-Family - Market Rate CCM	9,907,431	4,573,515	5.00%	46.16%	2.31%
Verified Total Weighted Scorecard Achieved**					35.99%
Maximum Scorecard Incentive					$2,604,447
Verified Scorecard Incentive Achieved					**$0**

*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 11-137. Union's 2022 Large Volume targets, achievements, and incentive*

Metric	Target	Verified Achievement	Weight	Metric Score	Weighted Metric Score
CCM	140,451,580	97,042,448	100.00%	69.09%	69.09%
Verified Total Weighted Scorecard Achieved**					69.09%
Maximum Scorecard Incentive					$694,265
Verified Scorecard Incentive Achieved					**$0**

*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 11-138. Union's 2022 Market Transformation targets, achievements, and incentive*

Metric	Target	Verified Achievement	Weight	Metric Score	Weighted Metric Score
Optimum Home Percentage of Homes Built	100.00%	54.22%	50.00%	40.67%	20.33%
Commercial New Construction Developments	32	11	50.00%	34.38%	17.19%
Verified Total Weighted Scorecard Achieved**					37.52%
Maximum Scorecard Incentive					$405,810
Verified Scorecard Incentive Achieved					**$0**

*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 11-139. Union's 2022 Performance Based targets, achievements, and incentive*

Metric	Target	Verified Achievement	Weight	Metric Score	Weighted Metric Score
RunSmart Participants	69	-	10.00%	0.00%	0.00%
RunSmart Savings %	0.44%	0.00%	40.00%	0.00%	0.00%
Strategic Energy Management Savings %	28.89%	3.47%	50.00%	12.02%	6.01%
Verified Total Weighted Scorecard Achieved**					6.01%
Maximum Scorecard Incentive					$182,765
Verified Scorecard Incentive Achieved					**$0**

*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.

11.12.3 Enbridge Lost Revenue

Table 11-140. 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	817	149	1,223	663	62	37	22	1,731	27	75	6	-	4,813
Rate 115	-	-	-	-	1,647	-	-	-	212	-	-	-	1,858
Rate 135	-	-	-	103	-	-	312	179	-	-	-	-	594
Rate 145	-	-	-	-	-	-	-	39	139	-	-	-	179
Rate 170	-	55	-	-	-	-	-	-	168	-	-	-	223
TOTAL	**817**	**203**	**1,223**	**766**	**1,709**	**37**	**334**	**1,950**	**547**	**75**	**6**	**-**	**7,667**

*Not all values may compute exactly due to rounding.

Table 11-141. 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	4,813	$6.63	$31,912
Rate 115	1,858	$3.13	$5,816
Rate 135	594	$18.79	$11,163
Rate 145	179	$46.36	$8,290
Rate 170	223	$4.47	$996
TOTAL	**7,667**		**$58,178**

*Not all values may compute exactly due to rounding.

11.12.4 Union Lost Revenue

Table 11-142. 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	1,380	1,142	101	464	98	330	16	463	224	33	13	2	4,266
M5 Industrial	-	-	-	-	-	-	-	65	5	-	-	-	70
M7 Industrial	470	1,138	1,091	166	309	854	93	869	107	7	-	-	5,105
T1 Industrial	7	-	-	43	445	-	1	-	-	43	-	-	539
T2 Industrial	705	212	1,451	731	475	96	61	69	549	76	23	-	4,446
20 Industrial	215	-	-	40	-	-	-	-	-	156	7	-	418
100 Industrial	72	38	1	-	336	-	-	-	103	6	62	-	619
TOTAL	**2,850**	**2,531**	**2,643**	**1,445**	**1,663**	**1,280**	**171**	**1,466**	**988**	**319**	**104**	**2**	**15,462**

*Not all values may compute exactly due to rounding.

Table 11-143. 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	4,266	$19.91	$84,960
M5 Industrial	70	$31.24	$2,178
M7 Industrial	5,105	$4.88	$24,930
T1 Industrial	539	$1.31	$706
T2 Industrial	4,446	$0.25	$1,125
20 Industrial	418	$7.81	$3,266
100 Industrial	619	$2.77	$1,713
TOTAL	**15,462**		**$118,878**

*Not all values may compute exactly due to rounding.

11.13 Appendix M: Prescriptive Savings Verification

This appendix describes the detailed process used to verify the reported (tracked) prescriptive and quasi-prescriptive savings for Enbridge and Union programs.

11.13.1 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 2021 TRM (TRM 6.0) 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 7.0[121].

Other Supporting Documentation

The Joint Submission documents did not contain all of the necessary detail to verify the savings for all measures. For example, gross realization rates and net-to-gross factors were not included in TRM 6.0. 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.

- Prescriptive Showerheads, Enbridge, “Showerhead Verification Among Rental Buildings”, Ipsos Research, March 2012
- C&I Prescriptive Verification Study, “2017 C&I Prescriptive Study – Measure of NTG Factors and Gross Savings Verification”, Itron, June 7, 2019
- “Low Income Kits Verification Study”: Final Report Following an Audit of the Union Gas ESK - Helping Homes Conserve – HHC – Program, Beslin Communication Group, March 15, 2013
- “TAPS Report”, TAPS Verification Program 2012 Year End Research Report, Study CR-604, Quadra Research, April 3, 2013
- “Adaptive Thermostat Ping Report”, 2022 Adaptive Thermostats Ping Reports LUG and LEG

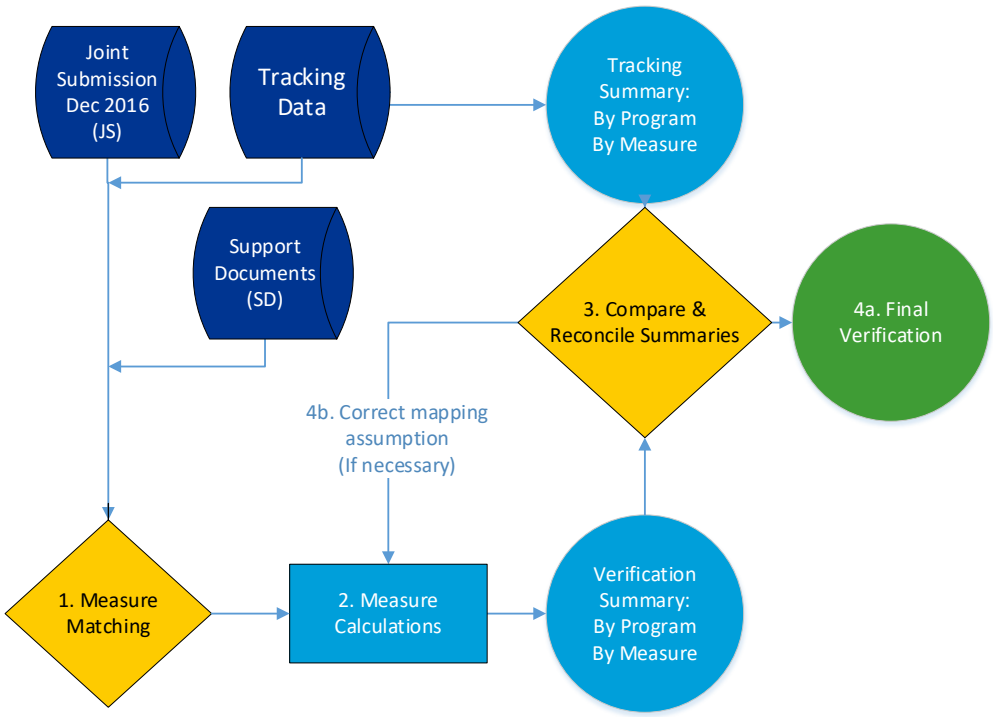
Ultimately, the EC utilized the eTRM+, an electronic version of the TRM that also incorporates information not found in the TRM; namely, free-ridership, installation, and gross realization rates, in conjunction with the tracking data to verify gross and net annual and lifetime savings. If inconsistencies arise between the TRM, source documents, and the eTRM+, the TRM and source documents take precedence. In these instances, the eTRM+ is updated to reflect the TRM and source documents and changes are tracked in a change log within the eTRM+.

[121] Natural Gas Demand Side Management Technical Resource Manual Version 6.0

11.13.2 Overall Methodology

The EC used a straightforward process to consistently verify savings for both utilities, summarized in Figure 11-9.

Figure 11-9. 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, as contained in the eTRM+, 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 11-144 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 the eTRM+, TRM, and SD values for the verified savings calculations.

Table 11-144. 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
Building Type	X		X
Equipment Type	X		X
Install 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 eTRM+, 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 list all tracked measure groups and their corresponding savings values and JS or SD 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 11-145 summarizes the differences between the two types.

Table 11-145. 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 list 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 tables 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.

11.13.3 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 11-146. Enbridge measure savings calculation values*

Program	Measure	Source	Annual Natural Gas Savings per Quantity Unit (m3)	Quantity Unit	Annual Natural Gas Savings per Size Unit (m3)	Size Unit	EUL	Gross Realization Rate	Installation Factor	Free Ridership
C&I Direct Install	Air Curtain - Dock-In - 10 x 10	TRM 6.0	5,517.00	unit	-		15	100.00%	100.00%	5.00%
C&I Direct Install	Air Curtain - Dock-In - 8 x 10	TRM 6.0	4,941.00	unit	-		15	100.00%	100.00%	5.00%
C&I Direct Install	Air Curtain - Dock-In - 8 x 8	TRM 6.0	4,713.00	unit	-		15	100.00%	100.00%	5.00%
C&I Direct Install	Air Curtain - Drive-In - 10 x 10	TRM 6.0	4,844.00	unit	-		15	100.00%	100.00%	5.00%
C&I Direct Install	Air Curtain - Drive-In - 12 x 12	TRM 6.0	5,753.00	unit	-		15	100.00%	100.00%	5.00%
C&I Direct Install	Air Curtain - Drive-In - 14 x 14	TRM 6.0	6,504.00	unit	-		15	100.00%	100.00%	5.00%
C&I Direct Install	Air Curtain - Drive-In - 16 x 16	TRM 6.0	7,081.00	unit	-		15	100.00%	100.00%	5.00%
C&I Direct Install	Air Curtain - Drive-In - 18 x 18	TRM 6.0	7,459.00	unit	-		15	100.00%	100.00%	5.00%
C&I Direct Install	Air Curtain - Drive-In - 20 x 20	TRM 6.0	7,605.00	unit	-		15	100.00%	100.00%	5.00%
C&I Direct Install	DCKV- TNR - 10,001 to 15,000 cfm	TRM 6.0	17,529.00	unit	-		15	100.00%	100.00%	5.00%
C&I Direct Install	DCKV- TNR - 5,001 to 10,000 cfm	TRM 6.0	10,517.00	unit	-		15	100.00%	100.00%	5.00%
C&I Direct Install	DCKV- TNR - 5,001 to 10,000 cfm - 2021 Incentive	TRM 6.0	10,517.00	unit	-		15	100.00%	100.00%	5.00%
C&I Direct Install	DCKV- TNR - Up to 5,000 cfm	TRM 6.0	4,207.00	unit	-		15	100.00%	100.00%	5.00%
C&I Direct Install	DCKV- TNR - Up to 5,000 cfm - 2021 Incentive	TRM 6.0	4,207.00	unit	-		15	100.00%	100.00%	5.00%
C&I Direct Install	Dock Door Seals - Compression (8x8 - 8x10)	TRM 6.0	5,087.00	unit	-		10	100.00%	100.00%	5.00%
C&I Direct Install	Dock Door Seals - Compression (8x8 - 8x10)	TRM 6.0	4,853.00	unit	-		10	100.00%	100.00%	5.00%
C&I Direct Install	Dock Door Seals - Compression (8x8 - 8x10)	TRM 6.0	4,988.00	unit	-		10	100.00%	100.00%	5.00%
C&I Direct Install	Dock Door Seals - Compression (8x8 - 8x10)	TRM 6.0	2,041.00	unit	-		10	100.00%	100.00%	5.00%
C&I Direct Install	Dock Door Seals - Compression (8x8 - 8x10)	TRM 6.0	1,897.00	unit	-		10	100.00%	100.00%	5.00%
C&I Direct Install	Dock Door Seals - Compression (8x8 - 8x10)	TRM 6.0	1,977.00	unit	-		10	100.00%	100.00%	5.00%
C&I Direct Install	Dock Door Seals - Shelter (10x10)	TRM 6.0	4,501.00	unit	-		10	100.00%	100.00%	5.00%
C&I Direct Install	Dock Door Seals - Shelter (10x10)	TRM 6.0	1,736.00	unit	-		10	100.00%	100.00%	5.00%
C&I Prescriptive	Air Curtain - 7 x 3 Door	TRM 6.0	845.00	unit	-		15	100.00%	100.00%	5.00%
C&I Prescriptive	Air Curtain - Dock-In - 8 x 10	TRM 6.0	4,941.00	unit	-		15	100.00%	100.00%	5.00%

Program	Measure	Source	Annual Natural Gas Savings per Quantity Unit (m3)	Quantity Unit	Annual Natural Gas Savings per Size Unit (m3)	Size Unit	EUL	Gross Realization Rate	Installation Factor	Free Ridership
C&I Prescriptive	Air Curtain - Dock-In - 8 x 8	TRM 6.0	4,713.00	unit	-		15	100.00%	100.00%	5.00%
C&I Prescriptive	Air Curtain - Drive-In - 10 x 10	TRM 6.0	4,844.00	unit	-		15	100.00%	100.00%	5.00%
C&I Prescriptive	Air Curtain - Drive-In - 12 x 12	TRM 6.0	5,753.00	unit	-		15	100.00%	100.00%	5.00%
C&I Prescriptive	Air Curtain - Drive-In - 14 x 14	TRM 6.0	6,504.00	unit	-		15	100.00%	100.00%	5.00%
C&I Prescriptive	Air Curtain - Drive-In - 16 x 16	TRM 6.0	7,081.00	unit	-		15	100.00%	100.00%	5.00%
C&I Prescriptive	Air Curtain Ambient - w/ Vestibule - (2)7x3	TRM 6.0	1,082.00	unit	-		15	100.00%	100.00%	5.00%
C&I Prescriptive	Commercial Energy Star Combi Oven	TRM 6.0	1,186.00	unit	-		12	100.00%	100.00%	20.00%
C&I Prescriptive	Commercial Energy Star Convection Oven	TRM 6.0	954.00	unit	-		12	100.00%	100.00%	20.00%
C&I Prescriptive	Commercial Energy Star Conveyor Oven less than 1520in	TRM 7.0	562.00	unit	-		12	100.00%	100.00%	20.00%
C&I Prescriptive	Commercial Energy Star Double Rack Oven	TRM 6.0	1,187.00	unit	-		12	100.00%	100.00%	20.00%
C&I Prescriptive	Commercial Energy Star Fryer	TRM 6.0	1,408.00	unit	-		12	100.00%	100.00%	20.00%
C&I Prescriptive	Commercial Energy Star Fryer LTO	TRM 6.0	1,408.00	unit	-		12	100.00%	100.00%	20.00%
C&I Prescriptive	Commercial Energy Star Single Rack Oven	TRM 6.0	915.00	unit	-		12	100.00%	100.00%	20.00%
C&I Prescriptive	Commercial Energy Star Steam Cooker	TRM 6.0	8,889.00	unit	-		12	100.00%	100.00%	20.00%
C&I Prescriptive	Commercial Under-Fired Broiler	TRM 6.0	3,347.00	unit	-		12	100.00%	100.00%	20.00%
C&I Prescriptive	Condensing Storage Water Heater - GT 250 kBTU/hr	TRM 6.0	-		2.2200	kBtu/hr input capacity	15	100.00%	100.00%	5.00%
C&I Prescriptive	Condensing Storage Water Heater - GT 250 kBTU/hr	TRM 6.0	-		1.3600	kBtu/hr input capacity	15	100.00%	100.00%	5.00%
C&I Prescriptive	Condensing Storage Water Heater - GT 250 kBTU/hr	TRM 6.0	-		3.0900	kBtu/hr input capacity	15	100.00%	100.00%	5.00%
C&I Prescriptive	Condensing Storage Water Heater - GT 75 & LTE 250 kBTU/Hr	TRM 6.0	-		1.3600	kBtu/hr input capacity	15	100.00%	100.00%	5.00%
C&I Prescriptive	Condensing Storage Water Heater - GT 75 & LTE 250 kBTU/Hr	TRM 6.0	-		2.2200	kBtu/hr input capacity	15	100.00%	100.00%	5.00%
C&I Prescriptive	Condensing Storage Water Heater - GT 75 & LTE 250 kBTU/Hr	TRM 6.0	-		3.0900	kBtu/hr input capacity	15	100.00%	100.00%	5.00%

Program	Measure	Source	Annual Natural Gas Savings per Quantity Unit (m3)	Quantity Unit	Annual Natural Gas Savings per Size Unit (m3)	Size Unit	EUL	Gross Realization Rate	Installation Factor	Free Ridership
C&I Prescriptive	Condensing Tankless Water Heater - GT 75 & LT 200 kBTU/hr	TRM 6.0	212.00	unit	1.2900	kBtu/hr input capacity	20	100.00%	100.00%	2.00%
C&I Prescriptive	Condensing Tankless Water Heater - GT 75 & LT 200 kBTU/hr	TRM 6.0	212.00	unit	0.7900	kBtu/hr input capacity	20	100.00%	100.00%	2.00%
C&I Prescriptive	Condensing Tankless Water Heater - GT 75 & LT 200 kBTU/hr	TRM 6.0	212.00	unit	1.7900	kBtu/hr input capacity	20	100.00%	100.00%	2.00%
C&I Prescriptive	Condensing Tankless WH- GT 75 & LT 200 kBTU/hr 2022 LTO	TRM 6.0	212.00	unit	1.2900	kBtu/hr input capacity	20	100.00%	100.00%	2.00%
C&I Prescriptive	Condensing Tankless WH- GT 75 & LT 200 kBTU/hr 2022 LTO	TRM 6.0	212.00	unit	1.7900	kBtu/hr input capacity	20	100.00%	100.00%	2.00%
C&I Prescriptive	Condensing Tankless WH- GT 75 & LT 200 kBTU/hr 2022 LTO	TRM 6.0	212.00	unit	0.7900	kBtu/hr input capacity	20	100.00%	100.00%	2.00%
C&I Prescriptive	DCKV- NC - 5,001 to 10,000 cfm	TRM 6.0, 2017 C&I Prescriptive Verification Study	10,517.00	unit	-		15	102.74%	100.00%	38.00%
C&I Prescriptive	DCKV- NC - Up to 5,000 cfm	TRM 6.0, 2017 C&I Prescriptive Verification Study	4,207.00	unit	-		15	102.74%	100.00%	38.00%
C&I Prescriptive	DCKV- TNR - 5,001 to 10,000 cfm	TRM 6.0, 2017 C&I Prescriptive Verification Study	10,517.00	unit	-		15	102.74%	100.00%	38.00%
C&I Prescriptive	DCKV- TNR - 5,001 to 10,000 cfm	TRM 6.0, 2017 C&I Prescriptive Verification Study	10,517.00	unit	-		15	102.74%	100.00%	38.00%
C&I Prescriptive	DCKV- TNR - Up to 5,000 cfm	TRM 6.0, 2017 C&I Prescriptive Verification Study	4,207.00	unit	-		15	102.74%	100.00%	38.00%
C&I Prescriptive	DCKV- TNR - Up to 5,000 cfm	TRM 6.0, 2017 C&I Prescriptive Verification Study	4,207.00	unit	-		15	102.74%	100.00%	38.00%
C&I Prescriptive	DCV	TRM 6.0, 2017 C&I Prescriptive Verification Study	-		0.3920	sq ft	15	104.14%	100.00%	92.00%
C&I Prescriptive	DCV	TRM 6.0, 2017 C&I Prescriptive Verification Study	-		1.4840	sq ft	15	104.14%	100.00%	92.00%

Program	Measure	Source	Annual Natural Gas Savings per Quantity Unit (m3)	Quantity Unit	Annual Natural Gas Savings per Size Unit (m3)	Size Unit	EUL	Gross Realization Rate	Installation Factor	Free Ridership
C&I Prescriptive	DCV	TRM 6.0, 2017 C&I Prescriptive Verification Study	-		0.1120	sq ft	15	104.14%	100.00%	92.00%
C&I Prescriptive	DCV	TRM 6.0, 2017 C&I Prescriptive Verification Study	-		0.3920	sq ft	15	104.14%	100.00%	92.00%
C&I Prescriptive	Destratification Fan - 24ft	TRM 6.0	2,922.00	fan	-		15	100.00%	100.00%	10.00%
C&I Prescriptive	Dock Door Seals - Compression (8x8 - 8x10)	TRM 6.0	5,087.00	unit	-		10	100.00%	100.00%	5.00%
C&I Prescriptive	Dock Door Seals - Compression (8x8 - 8x10)	TRM 6.0	4,853.00	unit	-		10	100.00%	100.00%	5.00%
C&I Prescriptive	Dock Door Seals - Compression (8x8 - 8x10)	TRM 6.0	4,988.00	unit	-		10	100.00%	100.00%	5.00%
C&I Prescriptive	Dock Door Seals - Compression (8x8 - 8x10)	TRM 6.0	2,041.00	unit	-		10	100.00%	100.00%	5.00%
C&I Prescriptive	Dock Door Seals - Compression (8x8 - 8x10)	TRM 6.0	1,897.00	unit	-		10	100.00%	100.00%	5.00%
C&I Prescriptive	Dock Door Seals - Compression (8x8 - 8x10)	TRM 6.0	1,977.00	unit	-		10	100.00%	100.00%	5.00%
C&I Prescriptive	Dock Door Seals - Shelter (10x10)	TRM 6.0	4,501.00	unit	-		10	100.00%	100.00%	5.00%
C&I Prescriptive	Dock Door Seals - Shelter (10x10)	TRM 6.0	1,736.00	unit	-		10	100.00%	100.00%	5.00%
C&I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 55% Sensible Heat Recovery	TRM 6.0	-		1.6000	CFM	14	100.00%	100.00%	5.00%
C&I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 55% Sensible Heat Recovery	TRM 6.0	-		1.6000	CFM	14	100.00%	100.00%	5.00%
C&I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 65% Sensible Heat Recovery	TRM 6.0	-		1.9100	CFM	14	100.00%	100.00%	5.00%
C&I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 65% Sensible Heat Recovery	TRM 6.0	-		5.3700	CFM	14	100.00%	100.00%	5.00%
C&I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 65% Sensible Heat Recovery	TRM 6.0	-		1.9100	CFM	14	100.00%	100.00%	5.00%
C&I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 75% Sensible Heat Recovery	TRM 6.0	-		2.2100	CFM	14	100.00%	100.00%	5.00%
C&I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 75% Sensible Heat Recovery	TRM 6.0	-		2.2100	CFM	14	100.00%	100.00%	5.00%
C&I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 75% Sensible Heat Recovery	TRM 6.0	-		6.2200	CFM	14	100.00%	100.00%	5.00%
C&I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 85% Sensible Heat Recovery	TRM 6.0	-		2.5100	CFM	14	100.00%	100.00%	5.00%
C&I Prescriptive	Heat Recovery Ventilator (HRV)-GTE 55% Sensible Heat Recovery	TRM 6.0	-		1.3600	CFM	14	100.00%	100.00%	5.00%

Program	Measure	Source	Annual Natural Gas Savings per Quantity Unit (m3)	Quantity Unit	Annual Natural Gas Savings per Size Unit (m3)	Size Unit	EUL	Gross Realization Rate	Installation Factor	Free Ridership
C&I Prescriptive	Heat Recovery Ventilator (HRV)-GTE 65% Sensible Heat Recovery	TRM 6.0	-		1.6100	CFM	14	100.00%	100.00%	5.00%
C&I Prescriptive	Make-Up Air Unit (MUA) - Constant Speed	TRM 6.0	-		0.9190	CFM	20	100.00%	100.00%	5.00%
C&I Prescriptive	Make-Up Air Unit (MUA) - VFD	TRM 6.0	-		2.0300	CFM	20	100.00%	100.00%	5.00%
C&I Prescriptive	Make-Up Air Unit (MUA) - VFD	TRM 6.0	-		3.0000	CFM	20	100.00%	100.00%	5.00%
C&I Prescriptive	Ozone Laundry - Washer Extractor purchased after June 21st 2019	TRM 6.0	-		0.0373	lbs/yr	15	100.00%	100.00%	8.00%
C&I Prescriptive	Ozone Laundry - Washer Extractor purchased after June 21st 2019	TRM 6.0	-		0.0373	lbs/yr	15	100.00%	100.00%	8.00%
Home Winterproofing	Bathroom Aerator	TRM 6.0, TAPS Report	6.40	unit	-		10	100.00%	22.50%	0.00%
Home Winterproofing	Kitchen Aerator	TRM 6.0, TAPS Report	11.56	unit	-		10	100.00%	33.50%	0.00%
Home Winterproofing	Pipe Insulation	TRM 6.0, Low Income Kits Verification Study	3.64	ft	-		15	100.00%	93.90%	0.00%
Home Winterproofing	Showerhead Replacement 1.25 GPM	TRM 6.0, Showerhead Verification Study Among Rental Buildings	28.20	unit	-		10	100.00%	87.70%	0.00%
Home Winterproofing	Smart Thermostats	TRM 6.0	173.00	unit	-		15	100.00%	100.00%	0.00%
Home Winterproofing	Smart Thermostats	TRM 6.0	173.00	unit	-		15	100.00%	100.00%	0.00%
Home Winterproofing	Smart Thermostats	TRM 6.0	217.00	unit	-		15	100.00%	100.00%	0.00%
Home Winterproofing	Smart Thermostats	TRM 6.0	217.00	unit	-		15	100.00%	100.00%	0.00%
Low-Income Multi-Residential	Energy Recovery Ventilator (ERV)-GTE 85% Sensible Heat Recovery-LI	TRM 6.0	-		7.0700	CFM	14	100.00%	100.00%	0.00%
Low-Income Multi-Residential	Make-Up Air Unit (MUA) - VFD	TRM 6.0	-		3.0000	CFM	20	100.00%	100.00%	0.00%
Low-Income Multi-Residential	Showerhead Replacement 1.5 GPM Handheld	TRM 6.0	31.00	unit	-		10	100.00%	100.00%	0.00%
Low-Income Multi-Residential	Showerhead Replacement 1.5 GPM Standard	TRM 6.0	31.00	unit	-		10	100.00%	100.00%	0.00%
Residential Adaptive Thermostats	Smart Thermostats	TRM 6.0	217.00	unit	-		15	100.00%	100.00%	4.00%

Program	Measure	Source	Annual Natural Gas Savings per Quantity Unit (m3)	Quantity Unit	Annual Natural Gas Savings per Size Unit (m3)	Size Unit	EUL	Gross Realization Rate	Installation Factor	Free Ridership
Residential Adaptive Thermostats	Smart Thermostats	TRM 6.0	173.00	unit	-		15	100.00%	100.00%	4.00%
Residential Adaptive Thermostats	Smart Thermostats	TRM 6.0, Adaptive Thermostat Ping Report	185.00	unit	-		15	100.00%	86.71%	4.00%

*Not all values may compute exactly due to rounding.

Table 11-147. Union measures savings calculation values*

Program	Measure	Source	Annual Natural Gas Savings per Quantity Unit (m3)	Quantity Unit	Annual Natural Gas Savings per Size Unit (m3)	Size Unit	EUL	Gross Realization Rate	Installation Factor	Free Ridership
C&I Direct Install	Air Curtain - Dock-In - 10 x 10	TRM 6.0, 2017 C&I Prescriptive Verification Study	5,517.00	unit	-		15	100.00%	100.00%	5.00%
C&I Direct Install	Air Curtain - Dock-In - 8 x 10	TRM 6.0, 2017 C&I Prescriptive Verification Study	4,941.00	unit	-		15	100.00%	100.00%	5.00%
C&I Direct Install	Air Curtain - Dock-In - 8 x 8	TRM 6.0, 2017 C&I Prescriptive Verification Study	4,713.00	unit	-		15	100.00%	100.00%	5.00%
C&I Direct Install	Air Curtain - Drive-In - 10 x 10	TRM 6.0, 2017 C&I Prescriptive Verification Study	4,844.00	unit	-		15	100.00%	100.00%	5.00%
C&I Direct Install	Air Curtain - Drive-In - 12 x 12	TRM 6.0, 2017 C&I Prescriptive Verification Study	5,753.00	unit	-		15	100.00%	100.00%	5.00%
C&I Direct Install	Air Curtain - Drive-In - 14 x 14	TRM 6.0, 2017 C&I Prescriptive Verification Study	6,504.00	unit	-		15	100.00%	100.00%	5.00%
C&I Direct Install	Air Curtain - Drive-In - 16 x 16	TRM 6.0, 2017 C&I Prescriptive Verification Study	7,081.00	unit	-		15	100.00%	100.00%	5.00%
C&I Direct Install	Air Curtain - Drive-In - 18 x 18	TRM 6.0, 2017 C&I Prescriptive Verification Study	7,459.00	unit	-		15	100.00%	100.00%	5.00%
C&I Direct Install	DCKV- TNR - 10,001 to 15,000 cfm	TRM 6.0	17,529.00	unit	-		15	100.00%	100.00%	5.00%
C&I Direct Install	DCKV- TNR - 5,001 to 10,000 cfm	TRM 6.0	10,517.00	unit	-		15	100.00%	100.00%	5.00%
C&I Direct Install	DCKV- TNR - Up to 5,000 cfm	TRM 6.0	4,207.00	unit	-		15	100.00%	100.00%	5.00%

Program	Measure	Source	Annual Natural Gas Savings per Quantity Unit (m3)	Quantity Unit	Annual Natural Gas Savings per Size Unit (m3)	Size Unit	EUL	Gross Realization Rate	Installation Factor	Free Ridership
C&I Direct Install	Dock Door Seals - Compression (8x8 - 8x10)	TRM 6.0	5,087.00	unit	-		10	100.00%	100.00%	5.00%
C&I Direct Install	Dock Door Seals - Compression (8x8 - 8x10)	TRM 6.0	4,853.00	unit	-		10	100.00%	100.00%	5.00%
C&I Direct Install	Dock Door Seals - Compression (8x8 - 8x10)	TRM 6.0	2,041.00	unit	-		10	100.00%	100.00%	5.00%
C&I Direct Install	Dock Door Seals - Compression (8x8 - 8x10)	TRM 6.0	1,897.00	unit	-		10	100.00%	100.00%	5.00%
C&I Direct Install	Dock Door Seals - Compression (8x8 - 8x10)	TRM 6.0	1,977.00	unit	-		10	100.00%	100.00%	5.00%
C&I Direct Install	Dock Door Seals - Shelter (10x10)	TRM 6.0	4,501.00	unit	-		10	100.00%	100.00%	5.00%
C&I Direct Install	Dock Door Seals - Shelter (10x10)	TRM 6.0	1,736.00	unit	-		10	100.00%	100.00%	5.00%
C&I Prescriptive	Air Curtain - Dock-In - 10 x 10	TRM 6.0, 2017 C&I Prescriptive Verification Study	5,517.00	unit	-		15	100.00%	100.00%	50.00%
C&I Prescriptive	Air Curtain - Dock-In - 8 x 10	TRM 6.0, 2017 C&I Prescriptive Verification Study	4,941.00	unit	-		15	100.00%	100.00%	50.00%
C&I Prescriptive	Air Curtain - Drive-In - 12 x 12	TRM 6.0, 2017 C&I Prescriptive Verification Study	5,753.00	unit	-		15	100.00%	100.00%	50.00%
C&I Prescriptive	Air Curtain - Drive-In - 14 x 14	TRM 6.0, 2017 C&I Prescriptive Verification Study	6,504.00	unit	-		15	100.00%	100.00%	50.00%
C&I Prescriptive	Air Curtain - Drive-In - 16 x 16	TRM 6.0, 2017 C&I Prescriptive Verification Study	7,081.00	unit	-		15	100.00%	100.00%	50.00%
C&I Prescriptive	Commercial Energy Star Combi Oven	TRM 6.0	1,186.00	unit	-		12	100.00%	100.00%	20.00%
C&I Prescriptive	Commercial Energy Star Convection Oven	TRM 6.0	954.00	unit	-		12	100.00%	100.00%	20.00%
C&I Prescriptive	Commercial Energy Star Conveyor Oven greater or equal 1520in	TRM 7.0	1,519.00	unit	-		12	100.00%	100.00%	20.00%
C&I Prescriptive	Commercial Energy Star Conveyor Oven less than 1520in	TRM 7.0	562.00	unit	-		12	100.00%	100.00%	20.00%
C&I Prescriptive	Commercial Energy Star Double Rack Oven	TRM 6.0	1,187.00	unit	-		12	100.00%	100.00%	20.00%
C&I Prescriptive	Commercial Energy Star Fryer	TRM 6.0	1,408.00	unit	-		12	100.00%	100.00%	20.00%
C&I Prescriptive	Commercial Energy Star Fryer LTO	TRM 6.0	1,408.00	unit	-		12	100.00%	100.00%	20.00%
C&I Prescriptive	Commercial Energy Star Single Rack Oven	TRM 6.0	915.00	unit	-		12	100.00%	100.00%	20.00%

Program	Measure	Source	Annual Natural Gas Savings per Quantity Unit (m3)	Quantity Unit	Annual Natural Gas Savings per Size Unit (m3)	Size Unit	EUL	Gross Realization Rate	Installation Factor	Free Ridership
C&I Prescriptive	Condensing Storage Water Heater - GT 250 kBTU/hr	TRM 6.0	-		3.0900	kBtu/hr input capacity	15	100.00%	100.00%	5.00%
C&I Prescriptive	Condensing Storage Water Heater - GT 250 kBTU/hr	TRM 6.0	-		1.3600	kBtu/hr input capacity	15	100.00%	100.00%	5.00%
C&I Prescriptive	Condensing Storage Water Heater - GT 75 & LTE 250 kBTU/Hr	TRM 6.0	-		3.0900	kBtu/hr input capacity	15	100.00%	100.00%	5.00%
C&I Prescriptive	Condensing Storage Water Heater - GT 75 & LTE 250 kBTU/Hr	TRM 6.0	-		1.3600	kBtu/hr input capacity	15	100.00%	100.00%	5.00%
C&I Prescriptive	Condensing Tankless Water Heater - GT 75 & LT 200 kBTU/hr	TRM 6.0	212.00	unit	0.7900	kBtu/hr input capacity	20	100.00%	100.00%	2.00%
C&I Prescriptive	Condensing Tankless Water Heater - GT 75 & LT 200 kBTU/hr	TRM 6.0	212.00	unit	1.7900	kBtu/hr input capacity	20	100.00%	100.00%	2.00%
C&I Prescriptive	Condensing Tankless WH- GT 75 & LT 200 kBTU/hr 2022 LTO	TRM 6.0	212.00	unit	1.7900	kBtu/hr input capacity	20	100.00%	100.00%	2.00%
C&I Prescriptive	Condensing Tankless WH- GT 75 & LT 200 kBTU/hr 2022 LTO	TRM 6.0	212.00	unit	0.7900	kBtu/hr input capacity	20	100.00%	100.00%	2.00%
C&I Prescriptive	Condensing Tankless WH- GT 75 & LT 200 kBTU/hr 2022 LTO	TRM 6.0	212.00	unit	1.2900	kBtu/hr input capacity	20	100.00%	100.00%	2.00%
C&I Prescriptive	DCKV- NC - 5,001 to 10,000 cfm	TRM 6.0	10,517.00	unit	-		15	100.00%	100.00%	5.00%
C&I Prescriptive	DCKV- NC - Up to 5,000 cfm	TRM 6.0	4,207.00	unit	-		15	100.00%	100.00%	5.00%
C&I Prescriptive	DCKV- TNR - 5,001 to 10,000 cfm	TRM 6.0	10,517.00	unit	-		15	100.00%	100.00%	5.00%
C&I Prescriptive	DCKV- TNR - 5,001 to 10,000 cfm	TRM 6.0	10,517.00	unit	-		15	100.00%	100.00%	5.00%
C&I Prescriptive	DCKV- TNR - Up to 5,000 cfm	TRM 6.0	4,207.00	unit	-		15	100.00%	100.00%	5.00%
C&I Prescriptive	DCV	TRM 6.0	-		0.4350	sq ft	15	100.00%	100.00%	20.00%
C&I Prescriptive	DCV	TRM 6.0	-		1.4840	sq ft	15	100.00%	100.00%	5.00%
C&I Prescriptive	DCV	TRM 6.0	-		1.4840	sq ft	15	100.00%	100.00%	20.00%
C&I Prescriptive	DCV	TRM 6.0	-		0.3920	sq ft	15	100.00%	100.00%	5.00%
C&I Prescriptive	DCV	TRM 6.0	-		0.4350	sq ft	15	100.00%	100.00%	5.00%
C&I Prescriptive	DCV	TRM 6.0	-		0.3920	sq ft	15	100.00%	100.00%	20.00%
C&I Prescriptive	DCV	TRM 6.0	-		0.6010	sq ft	15	100.00%	100.00%	5.00%
C&I Prescriptive	Destratification Fan - 20ft	TRM 6.0	2,029.00	fan	-		15	100.00%	100.00%	10.00%

Program	Measure	Source	Annual Natural Gas Savings per Quantity Unit (m3)	Quantity Unit	Annual Natural Gas Savings per Size Unit (m3)	Size Unit	EUL	Gross Realization Rate	Installation Factor	Free Ridership
C&I Prescriptive	Destratification Fan - 24ft	TRM 6.0	2,922.00	fan	-		15	100.00%	100.00%	10.00%
C&I Prescriptive	Dock Door Seals - Compression (8x8 - 8x10)	TRM 6.0, 2017 C&I Prescriptive Verification Study	4,501.00	unit	-		10	100.00%	100.00%	50.00%
C&I Prescriptive	Dock Door Seals - Compression (8x8 - 8x10)	TRM 6.0, 2017 C&I Prescriptive Verification Study	5,087.00	unit	-		10	100.00%	100.00%	50.00%
C&I Prescriptive	Dock Door Seals - Compression (8x8 - 8x10)	TRM 6.0, 2017 C&I Prescriptive Verification Study	4,988.00	unit	-		10	100.00%	100.00%	50.00%
C&I Prescriptive	Dock Door Seals - Compression (8x8 - 8x10)	TRM 6.0, 2017 C&I Prescriptive Verification Study	2,041.00	unit	-		10	100.00%	100.00%	50.00%
C&I Prescriptive	Dock Door Seals - Compression (8x8 - 8x10)	TRM 6.0, 2017 C&I Prescriptive Verification Study	1,897.00	unit	-		10	100.00%	100.00%	50.00%
C&I Prescriptive	Dock Door Seals - Compression (8x8 - 8x10)	TRM 6.0, 2017 C&I Prescriptive Verification Study	1,977.00	unit	-		10	100.00%	100.00%	50.00%
C&I Prescriptive	Dock Door Seals - Shelter (10x10)	TRM 6.0, 2017 C&I Prescriptive Verification Study	4,501.00	unit	-		10	100.00%	100.00%	50.00%
C&I Prescriptive	Dock Door Seals - Shelter (10x10)	TRM 6.0, 2017 C&I Prescriptive Verification Study	5,087.00	unit	-		10	100.00%	100.00%	50.00%
C&I Prescriptive	Dock Door Seals - Shelter (10x10)	TRM 6.0, 2017 C&I Prescriptive Verification Study	1,736.00	unit	-		10	100.00%	100.00%	50.00%
C&I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 55% Sensible Heat Recovery	TRM 6.0, 2017 C&I Prescriptive Verification Study	-		1.6000	CFM	14	99.55%	100.00%	70.00%
C&I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 55% Sensible Heat Recovery	TRM 6.0, 2017 C&I Prescriptive Verification Study	-		1.6000	CFM	14	99.55%	100.00%	70.00%
C&I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 65% Sensible Heat Recovery	TRM 6.0, 2017 C&I Prescriptive Verification Study	-		1.9100	CFM	14	99.55%	100.00%	70.00%
C&I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 65% Sensible Heat Recovery	TRM 6.0, 2017 C&I Prescriptive Verification Study	-		1.9100	CFM	14	99.55%	100.00%	70.00%
C&I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 65% Sensible Heat Recovery	TRM 6.0, 2017 C&I Prescriptive Verification Study	-		5.3700	CFM	14	99.55%	100.00%	70.00%

Program	Measure	Source	Annual Natural Gas Savings per Quantity Unit (m3)	Quantity Unit	Annual Natural Gas Savings per Size Unit (m3)	Size Unit	EUL	Gross Realization Rate	Installation Factor	Free Ridership
C&I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 65% Sensible Heat Recovery	TRM 6.0, 2017 C&I Prescriptive Verification Study	-		2.9800	CFM	14	99.55%	100.00%	70.00%
C&I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 65% SHR - In-Suite	TRM 6.0, 2017 C&I Prescriptive Verification Study	-		5.3700	CFM	14	99.55%	100.00%	70.00%
C&I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 65% SHR - In-Suite	TRM 6.0, 2017 C&I Prescriptive Verification Study	-		1.9100	CFM	14	99.55%	100.00%	70.00%
C&I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 75% Sensible Heat Recovery	TRM 6.0, 2017 C&I Prescriptive Verification Study	-		2.2100	CFM	14	99.55%	100.00%	70.00%
C&I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 75% Sensible Heat Recovery	TRM 6.0, 2017 C&I Prescriptive Verification Study	-		2.2100	CFM	14	99.55%	100.00%	70.00%
C&I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 75% Sensible Heat Recovery	TRM 6.0, 2017 C&I Prescriptive Verification Study	-		3.4500	CFM	14	99.55%	100.00%	70.00%
C&I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 75% Sensible Heat Recovery	TRM 6.0, 2017 C&I Prescriptive Verification Study	-		3.4500	CFM	14	99.55%	100.00%	70.00%
C&I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 85% Sensible Heat Recovery	TRM 6.0, 2017 C&I Prescriptive Verification Study	-		2.5100	CFM	14	99.55%	100.00%	70.00%
C&I Prescriptive	Energy Recovery Ventilator (ERV)-Incremental-GTE 65% Sensible Heat Recovery	TRM 6.0, 2017 C&I Prescriptive Verification Study	-		0.3000	CFM	14	99.55%	100.00%	70.00%
C&I Prescriptive	Energy Recovery Ventilator (ERV)-Incremental-GTE 75% Sensible Heat Recovery	TRM 6.0, 2017 C&I Prescriptive Verification Study	-		0.6100	CFM	14	99.55%	100.00%	70.00%
C&I Prescriptive	Energy Recovery Ventilator (ERV)-Incremental-GTE 85% Sensible Heat Recovery	TRM 6.0, 2017 C&I Prescriptive Verification Study	-		0.9100	CFM	14	99.55%	100.00%	70.00%
C&I Prescriptive	Heat Recovery Ventilator (HRV)-GTE 55% Sensible Heat Recovery	TRM 6.0	-		1.3600	CFM	14	100.00%	100.00%	5.00%
C&I Prescriptive	Heat Recovery Ventilator (HRV)-GTE 55% Sensible Heat Recovery	TRM 6.0	-		3.8400	CFM	14	100.00%	100.00%	5.00%
C&I Prescriptive	Heat Recovery Ventilator (HRV)-GTE 55% Sensible Heat Recovery	TRM 6.0	-		2.1300	CFM	14	100.00%	100.00%	5.00%
C&I Prescriptive	Heat Recovery Ventilator (HRV)-GTE 65% Sensible Heat Recovery	TRM 6.0	-		2.5200	CFM	14	100.00%	100.00%	5.00%
C&I Prescriptive	Heat Recovery Ventilator (HRV)-GTE 75% Sensible Heat Recovery	TRM 6.0	-		1.8600	CFM	14	100.00%	100.00%	5.00%

Program	Measure	Source	Annual Natural Gas Savings per Quantity Unit (m3)	Quantity Unit	Annual Natural Gas Savings per Size Unit (m3)	Size Unit	EUL	Gross Realization Rate	Installation Factor	Free Ridership
C&I Prescriptive	Heat Recovery Ventilator (HRV)-GTE 85% Sensible Heat Recovery	TRM 6.0	-		2.1100	CFM	14	100.00%	100.00%	5.00%
C&I Prescriptive	Make-Up Air Unit (MUA) - VFD	TRM 6.0	-		2.0300	CFM	20	100.00%	100.00%	5.00%
C&I Prescriptive	Make-Up Air Unit (MUA) - VFD	TRM 6.0	-		3.0000	CFM	20	100.00%	100.00%	5.00%
Home Weatherization	Bathroom Aerator	TRM 6.0, Low Income Kits Verification Study	6.40	unit	-		10	100.00%	86.10%	1.00%
Home Weatherization	Kitchen Aerator	TRM 6.0, Low Income Kits Verification Study	11.56	unit	-		10	100.00%	81.20%	1.00%
Home Weatherization	Pipe Insulation	TRM 6.0, Low Income Kits Verification Study	3.64	ft	-		15	100.00%	93.90%	1.00%
Home Weatherization	Showerhead Replacement 1.25 GPM	TRM 6.0, Low Income Kits Verification Study	28.20	unit	-		10	100.00%	79.90%	1.00%
Home Weatherization	Smart Thermostats	TRM 6.0	217.00	unit	-		15	100.00%	100.00%	1.00%
Home Weatherization	Smart Thermostats	TRM 6.0	173.00	unit	-		15	100.00%	100.00%	1.00%
Home Weatherization	Smart Thermostats	TRM 6.0	217.00	unit	-		15	100.00%	100.00%	1.00%
Home Weatherization	Smart Thermostats	TRM 6.0	173.00	unit	-		15	100.00%	100.00%	1.00%
Indigenous	Bathroom Aerator	TRM 6.0	6.40	unit	-		10	100.00%	100.00%	1.00%
Indigenous	Kitchen Aerator	TRM 6.0	11.56	unit	-		10	100.00%	100.00%	1.00%
Indigenous	Showerhead Replacement 1.25 GPM	TRM 6.0	28.20	unit	-		10	100.00%	100.00%	1.00%
Multi-family	Showerhead Replacement 1.5 GPM Handheld	TRM 6.0	31.00	unit	-		10	100.00%	100.00%	1.00%
Multi-family	Showerhead Replacement 1.5 GPM Standard	TRM 6.0	31.00	unit	-		10	100.00%	100.00%	1.00%
Residential Adaptive Thermostats	Smart Thermostats	TRM 6.0	173.00	unit	-		15	100.00%	100.00%	4.00%
Residential Adaptive Thermostats	Smart Thermostats	TRM 6.0	217.00	unit	-		15	100.00%	100.00%	4.00%
Residential Adaptive Thermostats	Smart Thermostats	TRM 6.0, Adaptive Thermostat Ping Report	185.00	unit	-		15	100.00%	86.07%	4.00%

*Not all values may compute exactly due to rounding.

11.13.4 Savings Calculation Measure Totals

Table 11-148. 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	Air Curtain - Dock-In - 10 x 10	137,925	131,029	2,068,875	1,965,431	137,925	131,029	2,068,875	1,965,431
C&I Direct Install	Air Curtain - Dock-In - 8 x 10	59,292	56,327	889,380	844,911	59,292	56,327	889,380	844,911
C&I Direct Install	Air Curtain - Dock-In - 8 x 8	42,417	40,296	636,255	604,442	42,417	40,296	636,255	604,442
C&I Direct Install	Air Curtain - Drive-In - 10 x 10	125,944	119,647	1,889,160	1,794,702	125,944	119,647	1,889,160	1,794,702
C&I Direct Install	Air Curtain - Drive-In - 12 x 12	247,379	235,010	3,710,685	3,525,151	247,379	235,010	3,710,685	3,525,151
C&I Direct Install	Air Curtain - Drive-In - 14 x 14	143,088	135,934	2,146,320	2,039,004	143,088	135,934	2,146,320	2,039,004
C&I Direct Install	Air Curtain - Drive-In - 16 x 16	120,377	114,358	1,805,655	1,715,372	120,377	114,358	1,805,655	1,715,372
C&I Direct Install	Air Curtain - Drive-In - 18 x 18	7,459	7,086	111,885	106,291	7,459	7,086	111,885	106,291
C&I Direct Install	Air Curtain - Drive-In - 20 x 20	15,210	14,450	228,150	216,743	15,210	14,450	228,150	216,743
C&I Direct Install	DCKV- TNR - 10,001 to 15,000 cfm	122,703	116,568	1,840,545	1,748,518	122,703	116,568	1,840,545	1,748,518
C&I Direct Install	DCKV- TNR - 5,001 to 10,000 cfm	147,238	139,876	2,208,570	2,098,142	147,238	139,876	2,208,570	2,098,142
C&I Direct Install	DCKV- TNR - 5,001 to 10,000 cfm - 2021 Incentive	42,068	39,965	631,020	599,469	42,068	39,965	631,020	599,469
C&I Direct Install	DCKV- TNR - Up to 5,000 cfm	37,863	35,970	567,945	539,548	37,863	35,970	567,945	539,548
C&I Direct Install	DCKV- TNR - Up to 5,000 cfm - 2021 Incentive	8,414	7,993	126,210	119,900	8,414	7,993	126,210	119,900
C&I Direct Install	Dock Door Seals - Compression (8x8 - 8x10)	674,052	640,349	6,740,520	6,403,494	674,052	640,349	6,740,520	6,403,494
C&I Direct Install	Dock Door Seals - Shelter (10x10)	74,844	71,102	748,440	711,018	74,844	71,102	748,440	711,018
C&I Prescriptive	Air Curtain - 7 x 3 Door	2,535	2,408	38,025	36,124	2,535	2,408	38,025	36,124
C&I Prescriptive	Air Curtain - Dock-In - 8 x 10	19,764	18,776	296,460	281,637	19,764	18,776	296,460	281,637
C&I Prescriptive	Air Curtain - Dock-In - 8 x 8	9,426	8,955	141,390	134,321	9,426	8,955	141,390	134,321
C&I Prescriptive	Air Curtain - Drive-In - 10 x 10	9,688	9,204	145,320	138,054	9,688	9,204	145,320	138,054
C&I Prescriptive	Air Curtain - Drive-In - 12 x 12	28,765	27,327	431,475	409,901	28,765	27,327	431,475	409,901
C&I Prescriptive	Air Curtain - Drive-In - 14 x 14	26,016	24,715	390,240	370,728	26,016	24,715	390,240	370,728
C&I Prescriptive	Air Curtain - Drive-In - 16 x 16	7,081	6,727	106,215	100,904	7,081	6,727	106,215	100,904
C&I Prescriptive	Air Curtain Ambient - w/ Vestibule - (2)7x3	3,246	3,084	48,690	46,256	3,246	3,084	48,690	46,256
C&I Prescriptive	Commercial Energy Star Combi Oven	113,856	91,085	1,366,272	1,093,018	113,856	91,085	1,366,272	1,093,018
C&I Prescriptive	Commercial Energy Star Convection Oven	97,308	77,846	1,167,696	934,157	97,308	77,846	1,167,696	934,157
C&I Prescriptive	Commercial Energy Star Conveyor Oven less than 1520in	1,686	1,349	20,232	16,186	1,686	1,349	20,232	16,186
C&I Prescriptive	Commercial Energy Star Double Rack Oven	42,732	34,186	512,784	410,227	42,732	34,186	512,784	410,227

Program	Measure	Tracked				Verified			
		Annual		Cumulative		Annual		Cumulative	
		Gross	Net	Gross	Net	Gross	Net	Gross	Net
C&I Prescriptive	Commercial Energy Star Fryer	271,744	217,395	3,260,928	2,608,742	271,744	217,395	3,260,928	2,608,742
C&I Prescriptive	Commercial Energy Star Fryer LTO	146,432	117,146	1,757,184	1,405,747	146,432	117,146	1,757,184	1,405,747
C&I Prescriptive	Commercial Energy Star Single Rack Oven	2,745	2,196	32,940	26,352	2,745	2,196	32,940	26,352
C&I Prescriptive	Commercial Energy Star Steam Cooker	53,334	42,667	640,008	512,006	53,334	42,667	640,008	512,006
C&I Prescriptive	Commercial Under-Fired Broiler	3,347	2,678	40,164	32,131	3,347	2,678	40,164	32,131
C&I Prescriptive	Condensing Storage Water Heater - GT 250 kBTU/hr	11,731	11,144	175,962	167,164	11,731	11,144	175,962	167,164
C&I Prescriptive	Condensing Storage Water Heater - GT 75 & LTE 250 kBTU/Hr	13,955	13,257	209,324	198,857	13,955	13,257	209,324	198,858
C&I Prescriptive	Condensing Tankless Water Heater - GT 75 & LT 200 kBTU/hr	25,639	25,126	512,783	502,528	25,639	25,126	512,784	502,528
C&I Prescriptive	Condensing Tankless WH- GT 75 & LT 200 kBTU/hr 2022 LTO	6,367	6,240	127,337	124,790	6,367	6,240	127,337	124,790
C&I Prescriptive	DCKV- NC - 5,001 to 10,000 cfm	32,415	20,098	486,232	301,464	32,415	20,098	486,232	301,464
C&I Prescriptive	DCKV- NC - Up to 5,000 cfm	82,123	50,916	1,231,847	763,745	82,123	50,916	1,231,847	763,745
C&I Prescriptive	DCKV- TNR - 5,001 to 10,000 cfm	118,857	73,691	1,782,852	1,105,368	118,857	73,691	1,782,852	1,105,368
C&I Prescriptive	DCKV- TNR - Up to 5,000 cfm	103,735	64,315	1,556,018	964,731	103,735	64,315	1,556,018	964,731
C&I Prescriptive	DCV	211,820	16,946	3,177,301	254,184	211,820	16,946	3,177,301	254,184
C&I Prescriptive	Destratification Fan - 24ft	2,922	2,630	43,830	39,447	2,922	2,630	43,830	39,447
C&I Prescriptive	Dock Door Seals - Compression (8x8 - 8x10)	1,381,624	1,312,543	13,816,240	13,125,428	1,381,624	1,312,543	13,816,240	13,125,428
C&I Prescriptive	Dock Door Seals - Shelter (10x10)	121,331	115,264	1,213,310	1,152,645	121,331	115,264	1,213,310	1,152,645
C&I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 55% Sensible Heat Recovery	13,568	12,890	189,952	180,454	13,568	12,890	189,952	180,454
C&I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 65% Sensible Heat Recovery	627,537	596,160	8,785,522	8,346,245	627,537	596,160	8,785,522	8,346,245
C&I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 75% Sensible Heat Recovery	490,322	465,806	6,864,515	6,521,289	490,322	465,806	6,864,515	6,521,289
C&I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 85% Sensible Heat Recovery	37,439	35,567	524,148	497,941	37,439	35,567	524,148	497,941
C&I Prescriptive	Heat Recovery Ventilator (HRV)-GTE 55% Sensible Heat Recovery	8,636	8,204	120,904	114,859	8,636	8,204	120,904	114,859
C&I Prescriptive	Heat Recovery Ventilator (HRV)-GTE 65% Sensible Heat Recovery	7,567	7,189	105,938	100,641	7,567	7,189	105,938	100,641
C&I Prescriptive	Make-Up Air Unit (MUA) - Constant Speed	9,650	9,167	192,990	183,341	9,650	9,167	192,990	183,341
C&I Prescriptive	Make-Up Air Unit (MUA) - VFD	37,330	35,464	746,600	709,270	37,330	35,464	746,600	709,270
C&I Prescriptive	Ozone Laundry - Washer Extractor purchased after June 21st 2019	51,549	47,425	773,229	711,371	51,549	47,425	773,229	711,371

Program	Measure	Tracked				Verified			
		Annual		Cumulative		Annual		Cumulative	
		Gross	Net	Gross	Net	Gross	Net	Gross	Net
Home Winterproofing	Bathroom Aerator	1,001	1,001	10,008	10,008	1,001	1,001	10,008	10,008
Home Winterproofing	Kitchen Aerator	1,506	1,506	15,064	15,064	1,506	1,506	15,064	15,064
Home Winterproofing	Pipe Insulation	7,736	7,736	116,041	116,041	7,736	7,736	116,041	116,041
Home Winterproofing	Showerhead Replacement 1.25 GPM	19,241	19,241	192,410	192,410	19,241	19,241	192,410	192,410
Home Winterproofing	Smart Thermostats	564,975	564,975	8,474,625	8,474,625	564,975	564,975	8,474,625	8,474,625
Low-Income Multi-Residential	Energy Recovery Ventilator (ERV)-GTE 85% Sensible Heat Recovery-LI	91,203	91,203	1,276,842	1,276,842	91,203	91,203	1,276,842	1,276,842
Low-Income Multi-Residential	Make-Up Air Unit (MUA) - VFD	63,123	63,123	1,262,460	1,262,460	63,123	63,123	1,262,460	1,262,460
Low-Income Multi-Residential	Showerhead Replacement 1.5 GPM Handheld	1,085	1,085	10,850	10,850	1,085	1,085	10,850	10,850
Low-Income Multi-Residential	Showerhead Replacement 1.5 GPM Standard	1,054	1,054	10,540	10,540	1,054	1,054	10,540	10,540
Residential Adaptive Thermostats	Smart Thermostats	4,120,027	3,955,263	61,800,406	59,328,945	4,235,668	4,066,241	63,535,017	60,993,616

*Not all values may compute exactly due to rounding.

Table 11-149. Union 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 - Dock-In - 10 x 10	44,136	41,929	662,040	628,938	44,136	41,929	662,040	628,938
C&I Direct Install	Air Curtain - Dock-In - 8 x 10	34,587	32,858	518,805	492,865	34,587	32,858	518,805	492,865
C&I Direct Install	Air Curtain - Dock-In - 8 x 8	42,417	40,296	636,255	604,442	42,417	40,296	636,255	604,442
C&I Direct Install	Air Curtain - Drive-In - 10 x 10	82,348	78,231	1,235,220	1,173,459	82,348	78,231	1,235,220	1,173,459
C&I Direct Install	Air Curtain - Drive-In - 12 x 12	178,343	169,426	2,675,145	2,541,388	178,343	169,426	2,675,145	2,541,388
C&I Direct Install	Air Curtain - Drive-In - 14 x 14	318,696	302,761	4,780,440	4,541,418	318,696	302,761	4,780,440	4,541,418
C&I Direct Install	Air Curtain - Drive-In - 16 x 16	84,972	80,723	1,274,580	1,210,851	84,972	80,723	1,274,580	1,210,851
C&I Direct Install	Air Curtain - Drive-In - 18 x 18	37,295	35,430	559,425	531,454	37,295	35,430	559,425	531,454
C&I Direct Install	DCKV- TNR - 10,001 to 15,000 cfm	17,529	16,653	262,935	249,788	17,529	16,653	262,935	249,788
C&I Direct Install	DCKV- TNR - 5,001 to 10,000 cfm	105,170	99,912	1,577,550	1,498,673	105,170	99,912	1,577,550	1,498,673
C&I Direct Install	DCKV- TNR - Up to 5,000 cfm	54,691	51,956	820,365	779,347	54,691	51,956	820,365	779,347
C&I Direct Install	Dock Door Seals - Compression (8x8 - 8x10)	464,439	441,217	4,644,390	4,412,171	464,439	441,217	4,644,390	4,412,171

Program	Measure	Tracked				Verified			
		Annual		Cumulative		Annual		Cumulative	
		Gross	Net	Gross	Net	Gross	Net	Gross	Net
C&I Direct Install	Dock Door Seals - Shelter (10x10)	73,108	69,453	731,080	694,526	73,108	69,453	731,080	694,526
C&I Prescriptive	Air Curtain - Dock-In - 10 x 10	11,034	5,517	165,510	82,755	11,034	5,517	165,510	82,755
C&I Prescriptive	Air Curtain - Dock-In - 8 x 10	9,882	4,941	148,230	74,115	9,882	4,941	148,230	74,115
C&I Prescriptive	Air Curtain - Drive-In - 12 x 12	17,259	8,630	258,885	129,443	17,259	8,630	258,885	129,443
C&I Prescriptive	Air Curtain - Drive-In - 14 x 14	13,008	6,504	195,120	97,560	13,008	6,504	195,120	97,560
C&I Prescriptive	Air Curtain - Drive-In - 16 x 16	70,810	35,405	1,062,150	531,075	70,810	35,405	1,062,150	531,075
C&I Prescriptive	Commercial Energy Star Combi Oven	30,836	24,669	370,032	296,026	30,836	24,669	370,032	296,026
C&I Prescriptive	Commercial Energy Star Convection Oven	68,688	54,950	824,256	659,405	68,688	54,950	824,256	659,405
C&I Prescriptive	Commercial Energy Star Conveyor Oven greater or equal 1520in	1,519	1,215	18,228	14,582	1,519	1,215	18,228	14,582
C&I Prescriptive	Commercial Energy Star Conveyor Oven less than 1520in	1,124	899	13,488	10,790	1,124	899	13,488	10,790
C&I Prescriptive	Commercial Energy Star Double Rack Oven	14,244	11,395	170,928	136,742	14,244	11,395	170,928	136,742
C&I Prescriptive	Commercial Energy Star Fryer	154,880	123,904	1,858,560	1,486,848	154,880	123,904	1,858,560	1,486,848
C&I Prescriptive	Commercial Energy Star Fryer LTO	74,624	59,699	895,488	716,390	74,624	59,699	895,488	716,390
C&I Prescriptive	Commercial Energy Star Single Rack Oven	915	732	10,980	8,784	915	732	10,980	8,784
C&I Prescriptive	Condensing Storage Water Heater - GT 250 kBTU/hr	3,287	3,123	49,311	46,845	3,287	3,123	49,311	46,845
C&I Prescriptive	Condensing Storage Water Heater - GT 75 & LTE 250 kBTU/Hr	4,504	4,279	67,564	64,186	4,504	4,279	67,564	64,186
C&I Prescriptive	Condensing Tankless Water Heater - GT 75 & LT 200 kBTU/hr	22,148	21,705	442,955	434,096	22,148	21,705	442,955	434,096
C&I Prescriptive	Condensing Tankless WH- GT 75 & LT 200 kBTU/hr 2022 LTO	11,849	11,612	236,985	232,246	11,849	11,612	236,986	232,246
C&I Prescriptive	DCKV- NC - 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- NC - Up to 5,000 cfm	4,207	3,997	63,105	59,950	4,207	3,997	63,105	59,950
C&I Prescriptive	DCKV- TNR - 5,001 to 10,000 cfm	21,034	19,982	315,510	299,735	21,034	19,982	315,510	299,735
C&I Prescriptive	DCKV- TNR - Up to 5,000 cfm	29,449	27,977	441,735	419,648	29,449	27,977	441,735	419,648
C&I Prescriptive	DCV	430,645	364,898	6,459,669	5,473,475	430,645	364,898	6,459,669	5,473,475
C&I Prescriptive	Destratification Fan - 20ft	18,261	16,435	273,915	246,524	18,261	16,435	273,915	246,524
C&I Prescriptive	Destratification Fan - 24ft	23,376	21,038	350,640	315,576	23,376	21,038	350,640	315,576
C&I Prescriptive	Dock Door Seals - Compression (8x8 - 8x10)	212,451	106,226	2,124,510	1,062,255	212,451	106,226	2,124,510	1,062,255
C&I Prescriptive	Dock Door Seals - Shelter (10x10)	44,146	22,073	441,460	220,730	44,146	22,073	441,460	220,730
C&I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 55% Sensible Heat Recovery	48,654	14,596	681,151	204,345	48,654	14,596	681,151	204,345

Program	Measure	Tracked				Verified			
		Annual		Cumulative		Annual		Cumulative	
		Gross	Net	Gross	Net	Gross	Net	Gross	Net
C&I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 65% Sensible Heat Recovery	500,974	150,292	7,013,641	2,104,092	500,974	150,292	7,013,641	2,104,092
C&I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 65% SHR - In-Suite	32,186	9,656	450,597	135,179	32,186	9,656	450,597	135,179
C&I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 75% Sensible Heat Recovery	798,721	239,616	11,182,099	3,354,630	798,721	239,616	11,182,099	3,354,630
C&I Prescriptive	Energy Recovery Ventilator (ERV)-GTE 85% Sensible Heat Recovery	46,331	13,899	648,634	194,590	46,331	13,899	648,634	194,590
C&I Prescriptive	Energy Recovery Ventilator (ERV)-Incremental-GTE 65% Sensible Heat Recovery	10,902	3,271	152,631	45,789	10,902	3,271	152,631	45,789
C&I Prescriptive	Energy Recovery Ventilator (ERV)-Incremental-GTE 75% Sensible Heat Recovery	28,981	8,694	405,729	121,719	28,981	8,694	405,729	121,719
C&I Prescriptive	Energy Recovery Ventilator (ERV)-Incremental-GTE 85% Sensible Heat Recovery	61,725	18,517	864,146	259,244	61,725	18,517	864,146	259,244
C&I Prescriptive	Heat Recovery Ventilator (HRV)-GTE 55% Sensible Heat Recovery	11,109	10,554	155,527	147,750	11,109	10,554	155,527	147,750
C&I Prescriptive	Heat Recovery Ventilator (HRV)-GTE 65% Sensible Heat Recovery	277	263	3,881	3,687	277	263	3,881	3,687
C&I Prescriptive	Heat Recovery Ventilator (HRV)-GTE 75% Sensible Heat Recovery	1,209	1,149	16,926	16,080	1,209	1,149	16,926	16,080
C&I Prescriptive	Heat Recovery Ventilator (HRV)-GTE 85% Sensible Heat Recovery	2,659	2,526	37,220	35,359	2,659	2,526	37,220	35,359
C&I Prescriptive	Make-Up Air Unit (MUA) - VFD	162,515	154,389	3,250,291	3,087,776	162,515	154,389	3,250,291	3,087,776
Home Weatherization	Bathroom Aerator	1,774	1,757	17,743	17,566	1,774	1,757	17,743	17,566
Home Weatherization	Kitchen Aerator	3,210	3,178	32,103	31,782	3,210	3,178	32,103	31,782
Home Weatherization	Pipe Insulation	7,131	7,059	106,959	105,890	7,131	7,059	106,959	105,890
Home Weatherization	Showerhead Replacement 1.25 GPM	7,188	7,116	71,876	71,158	7,188	7,116	71,876	71,158
Home Weatherization	Smart Thermostats	306,217	303,155	4,593,255	4,547,322	306,217	303,155	4,593,255	4,547,322
Indigenous	Bathroom Aerator	96	95	960	950	96	95	960	950
Indigenous	Kitchen Aerator	173	172	1,734	1,717	173	172	1,734	1,717
Indigenous	Showerhead Replacement 1.25 GPM	846	838	8,460	8,375	846	838	8,460	8,375
Multi-family	Showerhead Replacement 1.5 GPM Handheld	372	368	3,720	3,683	372	368	3,720	3,683
Multi-family	Showerhead Replacement 1.5 GPM Standard	837	829	8,370	8,286	837	829	8,370	8,286

Program	Measure	Tracked				Verified			
		Annual		Cumulative		Annual		Cumulative	
		Gross	Net	Gross	Net	Gross	Net	Gross	Net
Residential Adaptive Thermostats	Smart Thermostats	2,008,309	1,927,977	30,124,638	28,919,652	2,067,966	1,985,248	31,019,493	29,778,714

*Not all values may compute exactly due to rounding.

11.13.5 Savings Verification Notes

Table 11-150. Enbridge measure verification notes

Program	Measure	Issue	Resolution	Cumulative Natural Gas Savings			
				Tracked		Verified	
				Gross	Net	Gross	Net
Residential Adaptive Thermostats	Smart Thermostats	Tracked installation rate does not reflect most recent ping report. Tracked savings apply an installation rate of 100% and free rider rate of 0% to instant rebate (on-bill credit) thermostats.	Installation rate updated to reflect most recent ping report. Installation rate from ping report and free rider rate of 4% applied to instant rebate (on-bill credit) thermostats.	61,800,406	59,328,945	63,535,017	60,993,616

Table 11-151. Union measure verification notes

Program	Measure	Issue	Resolution	Cumulative Natural Gas Savings			
				Tracked		Verified	
				Gross	Net	Gross	Net
Residential Adaptive Thermostats	Smart Thermostats	Tracked installation rate does not reflect most recent ping report. Tracked savings apply an installation rate of 100% to instant rebate (on-bill credit) thermostats.	Installation rate updated to reflect most recent ping report. Installation rate from ping report applied to instant rebate (on-bill credit) thermostats.	30,124,638	28,919,652	31,019,493	29,778,714

11.14 Appendix N: Program Spending Tables

Table 11-152. Enbridge 2022 approved and spent budget*

Scorecard/Program	OEB-Approved Budget	Utility Spending	Difference	
			$	%
Resource Acquisition Total	**$42,908,517**	**$51,967,130**	**$9,058,613**	**21%**
Home Energy Conservation	$18,727,200	$33,335,467	$14,608,267	78%
Residential Adaptive Thermostats	$2,262,870	$2,747,883	$485,013	21%
C&I Custom	$7,658,968	$6,010,889	-$1,648,079	-22%
C&I Direct Install	$4,950,581	$2,493,307	-$2,457,274	-50%
C&I Prescriptive	$2,323,114	$2,257,132	-$65,982	-3%
Energy Leaders Initiative	$0	$149,251	$149,251	-
Run-it-Right (RA Portion)	$1,653,979	$177,285	-$1,476,694	-89%
Comprehensive Energy Management (RA portion)	$98,838	$0	-$98,838	-100%
Resource Acquisition Overhead	$5,232,967	$4,795,917	-$437,050	-8%
Low Income Total	**$13,849,850**	**$13,068,578**	**-$781,272**	**-6%**
Home Winterproofing	$6,736,859	$7,857,577	$1,120,718	17%
Low Income Multi Residential	$3,967,353	$2,831,475	-$1,135,878	-29%
Low Income New Construction	$1,456,560	$831,518	-$625,042	-43%
Low Income Overhead	$1,689,078	$1,548,008	-$141,070	-8%
Market Transformation Total	**$7,181,118**	**$4,122,575**	**-$3,058,543**	**-43%**
Residential Savings by Design	$3,392,296	$2,752,161	-$640,135	-19%
Commercial Savings by Design	$1,122,068	$547,209	-$574,859	-51%
Run-it-Right (MTEM portion)	$329,209	-$3,252	-$332,461	-101%
Comprehensive Energy Management (MTEM portion)	$941,562	$23,818	-$917,744	-97%
School Energy Competition	$520,200	$0	-$520,200	-100%
Market Transformation Overhead	$875,783	$802,639	-$73,144	-8%
Portfolio Overhead	**$3,817,891**	**$1,756,788**	**-$2,061,103**	**-54%**
Process and Program Evaluation	$1,774,228	$443,279	-$1,330,949	-75%
DSM IT Chargeback**	$1,000,000	$0	-$1,000,000	-100%
Collaboration and Innovation**	$1,043,663	$1,313,509	$269,846	26%
Enbridge Total	**$67,757,376**	**$70,915,070**	**$3,157,694**	**5%**

*Not all values may compute exactly due to rounding.
**These line items are collapsed into the Other category in Table 9-2.

Table 11-153. Union 2022 approved and spent budget*

Scorecard/Program	OEB-Approved Budget	Utility Spending	Difference	
			$	%
Resource Acquisition Total	**$36,310,983**	**$31,813,079**	**-$4,497,904**	**-12%**
Resource Acquisition - Residential	$13,907,697	$17,940,968	$4,033,271	29%
Home Reno Rebate	$12,226,000	$14,588,625	$2,362,625	19%
Residential Adaptive Thermostats	$0	$1,386,356	$1,386,356	-
Residential Overhead	$1,681,697	$1,965,987	$284,290	17%
Resource Acquisition - C&I	$22,403,286	$13,872,110	-$8,531,176	-38%
C&I Custom	$7,808,000	$6,222,688	-$1,585,312	-20%
C&I Direct Install	$2,500,000	$2,219,314	-$280,686	-11%
C&I Prescriptive	$7,149,000	$1,947,142	-$5,201,858	-73%
C&I Overhead	$4,946,286	$3,482,966	-$1,463,320	-30%
Low Income Total	**$15,005,488**	**$9,473,940**	**-$5,531,548**	**-37%**
Home Weatherization	$8,374,000	$7,169,897	-$1,204,104	-14%
Furnace End-of-Life	$917,000	$0	-$917,000	-100%
Indigenous	$448,000	$151,183	-$296,817	-66%
Multi-Family	$3,573,000	$1,264,185	-$2,308,815	-65%
Low Income Overhead	$1,693,488	$888,675	-$804,813	-48%
Large Volume Total	**$4,000,000**	**$3,079,272**	**-$920,728**	**-23%**
Large Volume	$3,150,000	$2,756,466	-$393,534	-12%
Large Volume Overhead	$850,000	$322,805	-$527,195	-62%
Market Transformation Total	**$2,338,070**	**$1,024,753**	**-$1,313,317**	**-56%**
Optimum Home	$841,000	$24,000	-$817,000	-97%
Commercial New Construction	$1,000,000	$474,270	-$525,730	-53%
Market Transformation Overhead	$497,070	$526,483	$29,413	6%
Performance Based Total	**$1,053,000**	**$121,845**	**-$931,155**	**-88%**
RunSmart	$163,000	$0	-$163,000	-100%
Strategic Energy Management	$639,000	$39,846	-$599,154	-94%
Performance-Based Overhead	$251,000	$81,999	-$169,001	-67%
Portfolio Overhead	**$5,642,000**	**$4,521,761**	**-$1,120,239**	**-20%**
Research	$1,000,000	$493,447	-$506,553	-51%
Evaluation	$1,300,000	$244,393	-$1,055,607	-81%
Administration	$2,842,000	$3,539,067	$697,067	25%
Pilots**	$500,000	$245,439	-$254,561	-51%
Open Bill Project**	$0	-$585	-$585	-
Union Total	**$64,349,541**	**$50,034,650**	**-$14,314,891**	**-22%**

*Not all values may compute exactly due to rounding.
**These line items are collapsed into the Other category in Table 9-7.

11.15 Appendix O: Cost Effectiveness Methodology

11.15.1 Cost Effectiveness Overview

The OEB requires the utilities to deliver portfolios that are cost effective at the "program" level. Each utility defines "program" differently, and both utilities define "program" differently from the OEB, as shown in Table 11-154. Throughout this report, the EC uses the OEB-defined Programs. The relevant cost effectiveness results are based on the utilities' definition of program.

Table 11-154: 2022 "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
	Comprehensive Energy Management
	Run-it-Right
	Energy Leaders
Low Income	Home Winterproofing
	Multi-Residential
	New Construction
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
	Residential Adaptive Thermostats
C&I Resource Acquisition	Commercial and Industrial Custom
	Commercial and Industrial Direct Install
	Commercial and Industrial Prescriptive
Low Income	Home Weatherization
	Indigenous
	Furnace End of Life
	Low Income Multi-Family
Large Volume	Large Volume
Market Transformation	Optimum Home
	Commercial New Construction
Performance Based	RunSmart
	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.

The key inputs used to calculate the TRC-Plus and PAC tests are shown in Table 11-155.

Table 11-155: Key inputs used in the TRC-Plus and PAC tests

Input	Description	TRC	PAC
Overhead & Administration Costs	Fixed costs, including overhead & administration, program management, program support, enabling strategies (communications, marketing, and outreach) done by utilities, costs, and fees for service (e.g., data management, contractor management).	✓	✓
Utility Incentives	Utility provided incentives to encourage adoption of efficiency measures.	✓	✓
Promotion Costs	Variable expenditures to deliver and promote programs.	✓	✓
Evaluation Costs	Expenditures associated with evaluation of programs at the scorecard level.		
Participant Cost	The incremental cost to the participant after subtracting any program rebates.	✓	
Discount Rate	Discount rate used to weight long-term versus short-term benefits provided by the utilities (nominal discount rate of 7.0472%).[122]	✓	✓
Net Savings	Savings net of free rider and spillover effects.	✓	✓
Avoided Costs	Utility- avoided costs related to generation and distribution of energy from natural gas lines. Avoided Costs were provided by the utilities (see Section 11.15.3).	✓	✓
Measure EUL	See glossary.	✓	✓
Non-Energy Benefits	A 15% non-energy benefit (NEB) adder is applied to gas, electricity and water avoided costs representing environmental, economic, and health-related externalities.	✓	
Cost of Carbon	The avoided costs of carbon expressed as dollars per m^3 based on established annual carbon pricing increases of $15/tonne from 2023 to 2030. Beyond 2030, a 2% inflation rate for remaining years. See Table 11-160 and Table 11-162 below.	✓	✓

The cost effectiveness model had two main 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 modified to adjust gross savings using realization rates and free ridership and spillover from the annual savings verification activities. Because the realization rates for other savings (e.g., 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 2022 is consistent with what has been done since 2015. This includes the cost of carbon, which was first included in 2017. How the cost of carbon is treated was updated for the 2021 annual verification.[123] In December 2020, a federal regulatory update[124] established annual carbon pricing increases of $15/tonne from 2023 to 2030. The updated federal prices are $65/tCO2e in 2023 and $170/tCO2e in 2030. Beyond 2030, a 2.93% inflation rate for remaining years (i.e., year 20 to 30) is applied. See Table 11-160 and Table 11-162 below. To accurately reflect the impact of carbon pricing in the TRC calculations, a weighting is used to produce an adjusted carbon price that applies to programs that include larger customers that are exempt.

[122] The cost-effectiveness analysis uses a real discount rate of 4% per the DSM Framework requirement, inflation rate of 2.93% for a nominal discount rate of 7.0472%.

[123] Ontario Energy Board. 2022. 2021 Natural Gas Demand-Side Management Annual Verification Report.

[124] Update to the Pan-Canadian Approach to Carbon Pollution Pricing 2023-2030. Accessed at https://www.canada.ca/en/environment-climate-change/services/climate-change/pricing-pollution-how-it-will-work/carbon-pollution-pricing-federal-benchmark-information/federal-benchmark-2023-2030.html#toc3

The 15% non-energy benefit (NEB) adder is applied to gas, electricity, and water avoided costs before adding carbon costs. The cost of carbon and NEB adder is applied to the TRC-Plus. The PAC test includes carbon and natural gas resources only (i.e., there are no electricity and water benefits), but it does not include the NEB adder. In tables later in this section, the EC has reported on what was provided by Enbridge and has not verified avoided figures.

In 2019, the EC began reporting program level cost effectiveness results with and without overhead & administration costs**.** A variety of costs are incurred by utilities to deliver programs, and how they are allocated at various levels (measure, program, sector, scorecard, and portfolio) can impact their perceived economic benefits. Consistent with previous years, the EC did not apply the utilities' portfolio overhead costs for research, evaluation, and administration. However, in past years, the EC has apportioned Enbridge's explicit 'overhead' spend at the scorecard level to individual programs based on the distribution of savings. In 2019, EAC members debated whether this was appropriate. The National Standards Practice Manual[125] provides guidance on how to properly allocate overhead & administrative (O&A) costs (see text box below), however some believe that all O&A costs should be fully accounted for at the program level, and it is not clear what the utilities include in the "overhead & admin costs" and what is truly variable and fixed. The OEB agreed to show program level cost effectiveness results with and without O&A costs. The O&A costs are still applied at the scorecard and portfolio levels. The new Ontario Energy Board Natural Gas Demand Side Management Framework will guide cost effectiveness analysis changes beginning January 1, 2023.

Allocating Costs to Assess Cost Effectiveness

The National Standards Practice Manual (NSPM) for Benefit-Cost Analysis of Distributed Energy Resources recommends that only truly variable costs (i.e., costs that can be avoided) be included at the appropriate levels (e.g., measure, program, sector, portfolio) and costs that are largely fixed at a particular level be excluded. Including fixed costs at the wrong level may results in removal of programs that do not appear cost effective, reducing the economic benefits of efficiency resource acquisition. Fixed costs at one level should not, however, be excluded altogether and should be included at higher levels where they are variable and thus avoidable. The NSPM provides examples of the costs to include at various levels when assessing cost effectiveness and shown below:

- **Measure level**: Include only costs that increase or decrease in proportion to the number of measures installed. This includes the measure incremental cost and could include some variable program delivery costs such as rebate processing costs (e.g., vendor costs for every rebate processed).
- **Program level**: Costs of administering and evaluating the program should be included at the program level and, in some cases, where marketing is variable. Marketing is often treated as a fixed cost; it can play an important role in raising awareness and driving program participation, but costs do not typically change with participation.
- **Portfolio level**: Portfolio level costs that are largely fixed and do not change in proportion to the number of programs or participation levels (e.g., portfolio level marketing, management, and evaluation costs) should be included at portfolio level analysis.

[125] The National Efficiency Screening Project .2017. National Standards Practice Manual. Accessed at https://www.nationalenergyscreeningproject.org/the-national-standard-practice-manual-for-energy-efficiency/

11.15.2 Summary of Results

Table 11-156 shows summary results for Enbridge TRC-Plus and PAC tests. Table 11-157 shows the same information for Union. The end of this section contains more tables with detailed results.[126]

All the utility-defined programs pass the OEB-defined cost effectiveness threshold of 0.7 for Low Income programs and 1.0 for all other programs using the TRC-Plus test.

Table 11-156. 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	2.62	3.50	130.17	129.88
Low Income	1.61	2.43	12.65	17.46
Total	**2.41**	**3.29**	**142.83**	**147.34**

*Not all values may compute exactly due to rounding.

Table 11-157. 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	1.72	2.98	47.19	63.01
Large Volume	3.50	3.56	9.01	7.90
Low Income	1.25	1.03	2.23	0.24
Performance Based	8.84	8.11	0.96	0.87
Total	**1.76**	**2.62**	**59.39**	**72.01**

*Not all values may compute exactly due to rounding.

While federal carbon taxes changes have increased the cost effectiveness of most programs, several OEB-defined programs did not meet the OEB-defined TRC-Plus cost effectiveness threshold with and without overhead & administrative (O&A) costs. Ratios without O&A costs are shown in brackets:

- **Enbridge's Resource Acquisition Run-It-Right program** fell significantly short of 1.0 in the PAC test with a cost effectiveness ratio of 0.25 (0.25). However, the program was cost-effective under the TRC-Plus Test.
- **Enbridge's Energy Leaders program** fell short of 1.0 in the TRC-Plus test with a cost effectiveness ratio of 0.47 (0.47). The program is cost-effective under the PAC test.
- **Union's Performance Based Indigenous program** fell short of the 0.7 threshold in the TRC-Plus and PAC tests with a cost-effective ratio of 0.46 (0.48) and 0.33 (0.34) respectively.

[126] The cost-effectiveness results are based on 2022 carbon tax rates.

11.15.3 Cost Effectiveness Inputs

Avoided Costs

Table 11-158: Enbridge Gas Avoided Costs

Year	Residential/Commercial			
	Baseload ($/m³)		Weather Sensitive ($/m³)	
	Rate	NPV	Rate	NPV
1	0.169	0.169	0.189	0.189
2	0.154	0.313	0.178	0.355
3	0.150	0.444	0.167	0.501
4	0.170	0.582	0.188	0.654
5	0.160	0.704	0.178	0.790
6	0.157	0.815	0.176	0.915
7	0.175	0.932	0.195	1.045
8	0.196	1.054	0.216	1.179
9	0.206	1.173	0.227	1.311
10	0.224	1.295	0.245	1.444
11	0.239	1.416	0.262	1.576
12	0.253	1.535	0.275	1.706
13	0.271	1.655	0.294	1.836
14	0.286	1.773	0.310	1.965
15	0.290	1.885	0.315	2.086
16	0.305	1.995	0.331	2.205
17	0.333	2.107	0.359	2.326
18	0.359	2.220	0.386	2.447
19	0.373	2.329	0.401	2.565
20	0.377	2.432	0.406	2.676
21	0.376	2.529	0.406	2.780
22	0.396	2.623	0.426	2.882
23	0.436	2.721	0.468	2.986
24	0.488	2.823	0.520	3.095
25	0.482	2.917	0.515	3.196
26	0.505	3.009	0.539	3.294
27	0.530	3.099	0.565	3.390
28	0.555	3.187	0.591	3.484
29	0.581	3.274	0.618	3.576
30	0.609	3.358	0.647	3.666

Table 11-159: Enbridge Water and Electricity Avoided Costs

Year	Res/Com/Ind			
	Water ($/1000 litres)		Electricity ($/KWh)	
	Rate	NPV	Rate	NPV
1	1.020	1.020	0.123	0.123
2	1.050	2.001	0.127	0.242
3	1.081	2.944	0.131	0.356
4	1.112	3.851	0.134	0.465
5	1.145	4.723	0.138	0.571
6	1.179	5.562	0.142	0.672
7	1.213	6.368	0.147	0.769
8	1.249	7.143	0.151	0.863
9	1.285	7.888	0.155	0.953
10	1.323	8.605	0.160	1.039
11	1.362	9.294	0.164	1.123
12	1.402	9.957	0.169	1.203
13	1.443	10.594	0.174	1.280
14	1.485	11.207	0.179	1.354
15	1.528	11.796	0.185	1.425
16	1.573	12.362	0.190	1.493
17	1.619	12.907	0.196	1.559
18	1.667	13.431	0.201	1.622
19	1.716	13.934	0.207	1.683
20	1.766	14.419	0.213	1.742
21	1.818	14.884	0.220	1.798
22	1.871	15.332	0.226	1.852
23	1.926	15.762	0.233	1.904
24	1.982	16.176	0.239	1.954
25	2.040	16.574	0.246	2.002
26	2.100	16.957	0.254	2.048
27	2.161	17.325	0.261	2.093
28	2.225	17.679	0.269	2.135
29	2.290	18.019	0.277	2.177
30	2.357	18.346	0.285	2.216

Table 11-160: Enbridge Carbon Avoided Costs

Year	Res/Com/Ind ($/m³)	
	Rate	NPV
1	0.098	0.098
2	0.127	0.217
3	0.157	0.353
4	0.186	0.505
5	0.215	0.669
6	0.245	0.843
7	0.274	1.025
8	0.303	1.214
9	0.333	1.407
10	0.343	1.593
11	0.353	1.771
12	0.363	1.943
13	0.374	2.108
14	0.385	2.266
15	0.396	2.419
16	0.407	2.566
17	0.419	2.707
18	0.432	2.842
19	0.444	2.973
20	0.457	3.098
21	0.471	3.219
22	0.485	3.335
23	0.499	3.446
24	0.513	3.553
25	0.528	3.656
26	0.544	3.755
27	0.560	3.851
28	0.576	3.942
29	0.593	4.030
30	0.610	4.115

Table 11-161: Union Gas Avoided Costs

Year	Residential/Commercial			
	Baseload (m3)		Weather Sensitive (m3)	
	Rate	NPV	Rate	NPV
1	0.141	0.141	0.198	0.198
2	0.133	0.266	0.185	0.370
3	0.129	0.378	0.177	0.524
4	0.152	0.502	0.202	0.689
5	0.143	0.612	0.194	0.837
6	0.139	0.710	0.191	0.973
7	0.157	0.815	0.211	1.113
8	0.179	0.926	0.234	1.258
9	0.188	1.035	0.245	1.401
10	0.205	1.146	0.263	1.543
11	0.221	1.258	0.281	1.686
12	0.233	1.368	0.295	1.825
13	0.250	1.479	0.314	1.964
14	0.265	1.588	0.331	2.100
15	0.269	1.691	0.337	2.230
16	0.282	1.793	0.352	2.357
17	0.312	1.898	0.384	2.486
18	0.339	2.005	0.413	2.616
19	0.354	2.108	0.430	2.742
20	0.356	2.206	0.434	2.861
21	0.353	2.297	0.434	2.972
22	0.370	2.385	0.453	3.080
23	0.410	2.477	0.495	3.191
24	0.461	2.573	0.549	3.306
25	0.459	2.662	0.549	3.413
26	0.482	2.750	0.575	3.518
27	0.506	2.836	0.602	3.620
28	0.531	2.921	0.630	3.720
29	0.557	3.004	0.659	3.818
30	0.585	3.085	0.689	3.914

Table 11-162: Union Carbon Avoided Costs

Year	Res/Com/Ind	
	Baseload/Weather Sensitive	
	Rate	NPV
1	0.098	0.098
2	0.127	0.217
3	0.157	0.353
4	0.186	0.505
5	0.215	0.669
6	0.245	0.843
7	0.274	1.025
8	0.303	1.214
9	0.333	1.407
10	0.343	1.593
11	0.353	1.771
12	0.363	1.943
13	0.374	2.108
14	0.385	2.266
15	0.396	2.419
16	0.407	2.566
17	0.419	2.707
18	0.432	2.842
19	0.444	2.973
20	0.457	3.098
21	0.471	3.219
22	0.485	3.335
23	0.499	3.446
24	0.513	3.553
25	0.528	3.656
26	0.544	3.755
27	0.560	3.851
28	0.576	3.942
29	0.593	4.030
30	0.610	4.115

Table 11-163: Union Water Avoided Costs

Year	Res/Com/Ind	
	Water ($/1000 litres)	
	Rate	NPV
1	0.928	0.928
2	0.955	1.820
3	0.983	2.678
4	1.012	3.502
5	1.041	4.295
6	1.072	5.058
7	1.103	5.791
8	1.136	6.496
9	1.169	7.174
10	1.203	7.826
11	1.238	8.453
12	1.275	9.055
13	1.312	9.635
14	1.350	10.192
15	1.390	10.728
16	1.431	11.243
17	1.473	11.738
18	1.516	12.215
19	1.560	12.673
20	1.606	13.113
21	1.653	13.536
22	1.701	13.944
23	1.751	14.335
24	1.803	14.711
25	1.855	15.073
26	1.910	15.421
27	1.966	15.756
28	2.023	16.078
29	2.083	16.387
30	2.144	16.685

Table 11-164: Union Electricity Avoided Costs

Year	Res/Com/Ind	
	Electricity ($/KWh)	
	Rate	NPV
1	0.123	0.123
2	0.127	0.242
3	0.131	0.356
4	0.134	0.465
5	0.138	0.571
6	0.142	0.672
7	0.147	0.769
8	0.151	0.863
9	0.155	0.953
10	0.160	1.039
11	0.164	1.123
12	0.169	1.203
13	0.174	1.280
14	0.179	1.354
15	0.185	1.425
16	0.190	1.493
17	0.196	1.559
18	0.201	1.622
19	0.207	1.683
20	0.213	1.742
21	0.220	1.798
22	0.226	1.852
23	0.233	1.904
24	0.239	1.954
25	0.246	2.002
26	0.254	2.048
27	0.261	2.093
28	0.269	2.135
29	0.277	2.177
30	0.285	2.216

11.15.4 Results Tables[127]

Enbridge Results

Table 11-165: Enbridge overall PAC results*†

Program	PAC Benefits ($)	PAC Costs ($)	PAC Value ($)	PAC Ratio
Resource Acquisition	181,869,000	51,988,000	129,882,000	3.50
Low Income	29,696,000	12,237,000	17,459,000	2.43
Total	**211,565,000**	**64,225,000**	**147,340,000**	**3.29**

*Not all values may compute exactly due to rounding.
†All dollar values are rounded to the nearest thousand.

Table 11-166: 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 w/ O&A Costs	PAC Ratio w/o O&A Costs
Residential Adaptive Thermostat	4,066,000	2,042,000	1,116,000	131,000	18,316,000	3,158,000	15,158,000	5.80	6.67
Home Energy Conservation	7,959,000	32,183,000	2,491,000	426,000	54,528,000	34,673,000	19,855,000	1.57	1.64
Verified Final Results	**12,025,000**	**34,225,000**	**3,606,000**	**557,000**	**72,844,000**	**37,831,000**	**35,013,000**	**1.93**	**-**

*Not all values may compute exactly due to rounding.
†All dollar and savings values are rounded to the nearest thousand.

[127] The cost-effectiveness results use 2022 carbon tax rates that increase by $15 per year up to $170 per tCO2e in 2030. Beyond 2030, a 2% inflation rate is applied.

Table 11-167: Enbridge Commercial & 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 w/ O&A Costs	PAC Ratio w/o O&A Costs
Run-it-Right‡	33,000	188,000	-13,000	-	43,000	175,000	-132,000	0.25	0.25
C&I Prescriptive	3,618,000	1,549,000	1,008,000	96,000	13,134,000	2,557,000	10,576,000	5.14	5.82
C&I Direct Install	1,906,000	2,359,000	302,000	54,000	7,429,000	2,662,000	4,768,000	2.79	2.98
C&I Custom	19,714,000	5,393,000	3,158,000	809,000	86,730,000	8,550,000	78,179,000	10.14	14.43
Comprehensive Energy Management	-	24,000	-	-	-	24,000	-24,000	-	-
Energy Leaders	335,000	147,000	41,000	13,000	1,690,000	189,000	1,501,000	8.96	11.32
Verified Final Results	**25,606,000**	**9,661,000**	**4,496,000**	**972,000**	**109,025,000**	**14,157,000**	**94,869,000**	**7.70**	**-**

*Not all values may compute exactly due to rounding.
†All dollar and savings values are rounded to the nearest thousand.
‡Run-it-Right costs include costs attributable to both the Resource Acquisition and Market Transformation scorecards.

Table 11-168: 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 w/ O&A Costs	PAC Ratio w/o O&A Costs
Multi-Residential	3,591,000	2,203,000	1,672,000	154,000	19,974,000	3,876,000	16,098,000	5.15	7.05
Home Winterproofing	1,628,000	5,428,000	2,933,000	74,000	9,722,000	8,361,000	1,361,000	1.16	1.24
Verified Final Results	**5,219,000**	**7,632,000**	**4,606,000**	**228,000**	**29,696,000**	**12,237,000**	**17,459,000**	**2.43**	**-**

*Not all values may compute exactly due to rounding.
†All dollar and savings values are rounded to the nearest thousand.

Table 11-169: 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 w/ O&A costs
Resource Acquisition	37,631,000	72,142,000	210,418,000	3,306,000	4,796,000	80,244,000	130,174,000	2.62
Low Income	5,219,000	16,225,000	33,483,000	3,057,000	1,548,000	20,831,000	12,653,000	1.61
Total	**42,850,000**	**88,367,000**	**243,901,000**	**6,364,000**	**6,344,000**	**101,075,000**	**142,827,000**	**2.41**

*Not all values may compute exactly due to rounding.
†All dollar and savings 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, with the exception of Run-it-Right, which includes Market Transformation costs.

Table 11-170: 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 w/ O&A costs	TRC Plus Ratio w/o O&A costs
Residential Adaptive Thermostat	4,066,000	7,601,000	25,936,000	7,601,000	18,336,000	3.41	1,116,000	2.98	3.12
Home Energy Conservation	7,959,000	34,573,000	63,269,000	34,573,000	28,696,000	1.83	2,491,000	1.71	1.77
Verified Final Results	**12,025,000**	**42,174,000**	**89,205,000**	**42,174,000**	**47,031,000**	**2.12**	**3,606,000**	**1.95**	**-**

*Not all values may compute exactly due to rounding.
†All dollar and savings values are rounded to the nearest thousand.

Table 11-171: Enbridge Commercial/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 w/ O&A costs	TRC Plus Ratio w/o O&A costs
Run-it-Right‡	33,000	32,000	47,000	32,000	15,000	1.45	-13,000	2.43	2.58
C&I Prescriptive	3,618,000	4,346,000	15,473,000	4,346,000	11,127,000	3.56	1,008,000	2.89	3.06
C&I Direct Install	1,906,000	2,267,000	8,994,000	2,267,000	6,727,000	3.97	302,000	3.50	3.75
C&I Custom	19,714,000	19,649,000	94,954,000	19,649,000	75,304,000	4.83	3,158,000	4.16	4.69
Comprehensive Energy Management	-	-	-	-	-	-	-	-	-
Energy Leaders	335,000	3,673,000	1,745,000	3,673,000	-1,928,000	0.48	41,000	0.47	0.47
Verified Final Results	**25,606,000**	**29,968,000**	**121,213,000**	**29,968,000**	**91,245,000**	**4.04**	**4,496,000**	**3.52**	

*Not all values may compute exactly due to rounding.
†All dollar and savings values are rounded to the nearest thousand.
‡Run-it-Right costs include costs attributable to both the Resource Acquisition and Market Transformation scorecards.

Table 11-172: 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 w/ O&A costs	TRC Plus Ratio w/o O&A costs
Multi-Residential	3,591,000	11,721,000	21,532,000	11,721,000	9,811,000	1.84	1,672,000	1.61	1.74
Home Winterproofing	1,628,000	4,504,000	11,951,000	4,504,000	7,447,000	2.65	2,933,000	1.61	1.72
Verified Final Results	**5,219,000**	**16,225,000**	**33,483,000**	**16,225,000**	**17,258,000**	**2.06**	**4,606,000**	**1.61**	**-**

*Not all values may compute exactly due to rounding.
†All dollar and savings values are rounded to the nearest thousand.

Union Results

Table 11-173: 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 w/ O&A costs	PAC Ratio w/o O&A costs
Home Reno Rebate	3,647,000	13,173,000	1,416,000	900,000	25,769,000	16,071,000	9,699,000	1.60	1.77
Residential Thermostats	1,985,000	924,000	946,000	105,000	9,225,000	1,870,000	7,355,000	4.93	6.65
C&I Prescriptive	1,599,000	1,578,000	628,000	123,000	6,360,000	2,206,000	4,154,000	2.88	3.27
C&I Direct Install	1,461,000	2,134,000	303,000	136,000	5,940,000	2,437,000	3,502,000	2.44	2.68
Commercial & Institutional Custom	16,217,000	5,779,000	3,450,000	517,000	47,528,000	9,229,000	38,299,000	5.15	7.64
Verified Final Results	**24,910,000**	**23,588,000**	**8,225,000**	**1,781,000**	**94,822,000**	**31,813,000**	**63,009,000**	**2.98**	**-**

*Not all values may compute exactly due to rounding.
†All dollar and savings values are rounded to the nearest thousand.

Table 11-174: 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 w/ O&A costs	PAC Ratio w/o O&A costs
Furnace End-of-Life	-	-	-	-	-	-	-	-	-
Indigenous	8,000	96,000	55,000	9,000	52,000	156,000	-104,000	0.33	0.34
Home Weatherization	1,278,000	3,941,000	3,229,000	443,000	8,221,000	7,920,000	301,000	1.04	1.15
Multi Family	349,000	549,000	715,000	78,000	1,443,000	1,398,000	44,000	1.03	1.14
Verified Final Results	**1,634,000**	**4,586,000**	**3,999,000**	**530,000**	**9,715,000**	**9,474,000**	**241,000**	**1.03**	**-**

*Not all values may compute exactly due to rounding.
†All dollar and savings values are rounded to the nearest thousand.

Table 11-175: 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 w/ O&A costs	PAC Ratio w/o O&A costs
Large Volume	8,224,000	2,714,000	365,000	172,000	10,975,000	3,079,000	7,896,000	3.56	3.98
Verified Final Results	**8,224,000**	**2,714,000**	**365,000**	**172,000**	**10,975,000**	**3,079,000**	**7,896,000**	**3.56**	**-**

*Not all values may compute exactly due to rounding.
†All dollar and savings values are rounded to the nearest thousand.

Table 11-176: Union Performance Based 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 w/ O&A costs	PAC Ratio w/o O&A costs
RunSmart	-	-	-	-	-	-	-	-	-
Strategic Energy Management	968,000	-	122,000	7,000	988,000	122,000	867,000	8.11	24.80
Verified Final Results	**968,000**	**-**	**122,000**	**7,000**	**988,000**	**122,000**	**867,000**	**8.11**	**-**

*Not all values may compute exactly due to rounding.
†All dollar and savings values are rounded to the nearest thousand.

Table 11-177: 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 w/ O&A costs	TRC Plus Ratio w/o O&A costs
Home Reno Rebate	3,647,000	21,279,000	29,267,000	21,279,000	7,988,000	1.38	2,898,000	1.21	1.29
Residential Thermostats	1,985,000	3,740,000	12,985,000	3,740,000	9,245,000	3.47	946,000	2.77	3.09
C&I Prescriptive	1,599,000	2,949,000	7,215,000	2,949,000	4,266,000	2.45	628,000	2.02	2.17
C&I Direct Install	1,461,000	1,966,000	6,986,000	1,966,000	5,020,000	3.55	303,000	3.08	3.40
Commercial & Institutional Custom	16,217,000	27,372,000	56,271,000	27,372,000	28,899,000	2.06	3,450,000	1.83	2.02
Verified Final Results	**24,910,000**	**57,306,000**	**112,723,000**	**57,306,000**	**55,417,000**	**1.97**	**8,225,000**	**1.72**	**-**

*Not all values may compute exactly due to rounding.
†All dollar and savings values are rounded to the nearest thousand.

Table 11-178: 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 w/ O&A costs	TRC Plus Ratio w/o O&A costs
Furnace End-of-Life	-	-	-	-	-	-	-	-	-
Indigenous	8,000	76,000	63,000	76,000	-13,000	0.82	60,000	0.46	0.48
Home Weatherization	1,278,000	3,610,000	9,643,000	3,610,000	6,033,000	2.67	3,978,000	1.27	1.41
Multi Family	349,000	456,000	1,559,000	456,000	1,103,000	3.42	850,000	1.19	1.33
Verified Final Results	**1,634,000**	**4,142,000**	**11,265,000**	**4,142,000**	**7,123,000**	**2.72**	**4,888,000**	**1.25**	**-**

*Not all values may compute exactly due to rounding.
†All dollar and savings values are rounded to the nearest thousand.

Table 11-179: 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 w/ O&A costs	TRC Plus Ratio w/o O&A costs
Large Volume	8,224,000	3,242,000	12,621,000	3,242,000	9,380,000	3.89	365,000	3.50	3.84
Verified Final Results	**8,224,000**	**3,242,000**	**12,621,000**	**3,242,000**	**9,380,000**	**3.89**	**365,000**	**3.50**	**-**

*Not all values may compute exactly due to rounding.
†All dollar and savings values are rounded to the nearest thousand.

Table 11-180: Union Performance Based 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 w/ O&M costs	TRC Plus Ratio w/o O&M costs
Run Smart	-	-	-	-	-	-	-	-	-
Strategic Energy Management	968,000	-	1,077,000	-	1,077,000	-	122,000	8.84	27.03
Verified Final Results	**968,000**	**-**	**1,077,000**	**-**	**1,077,000**	**-**	**122,000**	**8.84**	**-**

*Not all values may compute exactly due to rounding.
†All dollar and savings values are rounded to the nearest thousand.

11.16 Appendix P: eTools Boiler Tool Validation Study

The final report for the eTools Boiler Tool Validation Study can be found in the following pages.

ETOOLS BOILER TOOL VALIDATION STUDY

Ontario Energy Board

January 31, 2023

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1 EXECUTIVE SUMMARY

This report discusses the analysis completed during the study of Enbridge Gas Inc.'s (EGI) eTools energy modelling software. EGI has used eTools to estimate natural gas savings for many years. EGI uses eTools to estimate gas savings from the installation of energy-efficient boiler equipment offered through EGI's Custom Commercial Program and Affordable Multi-Family Housing Program. These programs, approved by the Ontario Energy Board (OEB) as part of EGI's broader natural gas demand side management (DSM) portfolio, offer customers incentives and guidance related to specific retrofits at their buildings which typically include efficiency upgrades to the boilers. Historically, commercial and multi-residential projects containing boiler system interventions have represented approximately 25% of annual custom program savings.

Gas consumption savings in eTools are estimated (ex ante) utilizing pre-period gas consumption and detailed engineering assumptions. The OEB has accepted these estimates as part of its evaluation process and subsequently, to calculate performance incentives and lost revenues.

The findings of this study will be used to provide guidance to the OEB on whether eTools can be relied on to estimate savings for projects completed through EGI's approved DSM programs and relied on by the OEB for use as part of future evaluation activities and ultimately as part of final verified natural gas savings results that are used to assess EGI's performance relative to OEB-approved metrics.

This study included two phases of analysis.

- Phase 1 used billing analysis to estimate natural gas savings (referred to as evaluated savings) by utilizing gas consumption of a facility before and after the installation of the efficiency measure, in this case, a boiler. This was compared to the estimate produced by EGI's eTools model. The Phase 1 analysis found that billing analysis savings were 64% to 68% of eTools estimates of savings. The realization rate figures for Phase 1 were preliminary results only with many known limitations that affected the analysis.
- Below is a description of how eTools estimates savings compared to the billing analysis conducted by DNV as part of this study:
  - eTools: Produces a forecast of gas savings from boiler system interventions using a calibrated engineering model that incorporates the usage at the site prior to the boiler system intervention, as well as anticipated configurations and settings for the new boiler systems. eTools makes several assumptions about the existing boiler system configuration, condition, use, and interaction with other systems in the facility. eTools also assumes that the new boiler will operate as intended, with no changes to settings after system commissioning.
  - Billing analysis: Uses actual natural gas consumption pre-intervention and post-intervention, it assumes that all observed changes in heating load at the site are due to the intervention, e.g., boiler system changes.
  - While neither method is perfect, billing analysis provides an empirical estimate of savings because it can leverage measured site usage from after the boiler system intervention.
- Phase 2 addressed several limitations in the Phase 1 analysis, including:
  - Using a consistent modern version of eTools for all sites and focusing on eTools savings estimates of advancement savings (existing consumption vs. efficient consumption) for an apples-to-apples comparison with billing analysis. The finding was that advancement savings estimated by the most recent version (e8-00) of eTools available during this study are 55% of the billing analysis estimates. However, advancement savings are not frequently used as reported program savings. Of the initial 456 projects for which Enbridge provided data to DNV only 85 projects (19%) utilized advancement savings for program savings and for these projects the advancement savings were only used for the remaining useful life of the existing equipment, not all of the lifetime savings. The balance of lifetime savings for advancement projects and non-advancement projects (81%) used standard savings (a counterfactual

industry standard system's consumption vs. efficient consumption) which are lower in magnitude than advancement savings, which is why the RR decreased from 64% in Phase 1 to 55% in this step of Phase 2.

- Explaining the differences in savings through simulating changes in assumptions in eTools that might produce estimates of savings more in line with billing analysis estimates. This investigation found that changing eTools' default assumption for existing boiler efficiency (73%) to values closer to market standard efficiencies (80.1% for space heating and 81.8% for domestic hot-water heating systems) and being more conservative with inputs to the efficient system control settings, increased the realization rate from 55% to 79%.
- Incorporating the findings from EGI's study of non-participant natural gas consumption trends (details in Section 3.11, the full study in APPENDIX A) into the billing analysis results increases the overall realization rate from 79% to 84%. The latter value is the one recommended for use in adjusting aggregate gross savings for commercial boiler projects that utilized eTools.
- Accounting for the possible double counting of changes to eTools boiler gross savings in this study and those in evaluation findings in the annual Custom Project Savings Verification (CPSV). The potential for double counting stems from adjustments to the system characteristics and control settings on the existing or efficient boilers during evaluations which are also captured in the billing data used in billing analysis. During the investigation, all eTools boiler projects (a total of 41) from previous evaluations were reviewed to identify the potential sources of double counting. The findings were that most changes to system characteristics and control settings from previous evaluations increased gross savings, and removing these adjustments decreased the aggregate eTools boiler gross savings realization rates from 102% (+/- 5%) to 97% (+/- 4%). Overall, the gross savings realization rates for previous evaluations with or without inclusion of adjustments potentially double counted are not statistically different from 100%.

Results of this study show that the savings from past and present eTools versions do not align with more empirical results from billing analysis. However, after key engineering assumptions are refined, eTools can provide an estimate of aggregate savings closer to those from billing analysis. Based on the analysis conducted in this study, the following recommendations are provided for the OEB's consideration:

1. Continue using eTools for implementation and evaluation. eTools is a sophisticated engineering-based estimation calculator that exceeds industry standard practice and generates local knowledge of implementation practices. There are no other boiler savings estimation models that are known to be more accurate, nor any known to be in development. Changing tools for evaluation will introduce additional uncertainty as to the causes of differences in verified vs. claimed savings. The continued use of this modelling software is akin to other simulation software which contain known performance gaps across all kinds in jurisdictions around the world. Despite these performance gaps, no jurisdiction has discarded their performance simulation software. EnergyPlus, 3E Plus, Integrated Engineering Software, etc. are all used to provide forecasted savings in buildings despite rarely being accurate for an individual building. DNV recommends the following changes to eTools to address the study's findings and provide a more accurate estimate of savings:

    a. eTools advancement projects should not utilize the current 73% thermal efficiency default value, rather site-specific values (supported by documentation) should be utilized. If documented site-specific values are not available, the efficiency values identified in this study, 80.1% for space heating and 81.8% for domestic hot-water heating, should be utilized by implementers and evaluators.
    b. Site-specific documentation verifying any anticipated controls or setpoint changes should be gathered by Enbridge after boiler system commissioning. If documentation verifying controls changes are unavailable, then the installed systems should be assumed to utilize the same controls and setpoints as the existing systems.

c. Version e8-00 of eTools was the latest version reviewed during this study and should be utilized by the evaluation team to assess any projects using eTools e8-00 or earlier.
d. Projects using a version of eTools more modern than e8-00 should use the modern version of eTools in evaluation. A "between version" calibration factor that takes the savings from version e8-00 relative to the new version should be employed to ensure that the changes from one version to another are accounted for without restricting the evaluation to using only version e8-00 prior to re-calibrating the billing analysis (see below in point 5). This calibration can be calculated using the sample plus the backup sample of projects in the evaluation (those that the evaluation requests files for as part of the typical evaluation process).

2. Future evaluations of eTools commercial boiler projects should continue in a manner consistent with Custom Project Savings Verification (CPSV) evaluations from 2015-2018 while updating the model to eTools version e8-00 or more modern. This means updating inputs to eTools based on site-specific data collected through evaluation activities.
3. After implementation of list items 1.a. and 1.b., the recommended realization rate from this study (84%), can be applied to evaluate aggregate eTools boiler gross savings. This recommended realization rate uses that described in 1a) above as well as incorporates the findings from EGI's study of non-participant natural gas consumption trends (APPENDIX A), explained in Section 3.11.
4. A correction factor for the double counting between evaluated gross savings and billing analysis should be utilized. As part of this study, it was found that based on past projects, the adjustment factor was 0.97. An alternative to using this factor is to re-estimate the correction factor based on the sample of projects evaluated in CPSV to apply to that year's CPSV results. The determination of which to use will be made by the evaluation team with input from the EAC and OEB. The primary factor in the decision will be the sample size of boilers evaluated.
5. eTools should be periodically calibrated via billing analysis to improve the accuracy of aggregate savings estimates. The precise cadence/timing of the calibration cannot be defined at this time in part because evaluation budget consideration necessarily have a role in determining the timing. Re-calibrating the billing analysis will be more about changes in use of eTools (defaults, assumptions and data entry choices) and less about the changes in the underlying calculations, which will be captured in the suggested "between version" calibration factor in 1d.
   The OEB and EAC should consider the following key factors when determining whether a billing analysis calibration should be conducted:

   a. Whether EGI's internal user guidelines for eTools have changed in a manner that materially impacts savings estimates produced. As informed by Enbridge's analysis of the impact of its user guideline changes to eTools. Materially in this case would be a change that is expected to change boiler savings by more than 5% in aggregate for boilers in the program. Note that 5% is a starting point to inform the EAC when it is time to start planning the next study.
   b. If newer eTools versions are found to produce savings materially different from the versions evaluated in this study As informed by Enbridge's analysis of the impact of its updates to eTools and/or the calibration factors estimated in 1d above. If calibration factors in 1d exceed 10% it is of higher priority to conduct another calibration. 10% is a starting point, given that 1d is likely based on a relatively small sample, it is prudent to use a higher threshold than 5a.
   c. If there is sufficient post-case heating data (minimum of two heating seasons) for the population of sites to be included in the billing analysis

Results from the two phases are reported separately in this report.

2 PHASE 1 OBJECTIVES AND APPROACH

2.1 Phase 1 Summary

Billing analysis is an industry-accepted empirical method of estimating ex post savings by utilizing gas consumption of a facility before and after the installation of the efficiency measure, in this case, a boiler. When the two methods (ex ante vs. ex post) are compared, the ratio of the ex post billing analysis results (evaluated results) to the ex ante results (e-Tools results) is called a realization rate (RR). Essentially, the RR represents the percentage of forecast efficiency savings that were found to be present when usage was measured through customer billing data. The purpose of Phase 1 was to produce RRs that provide insight into the accuracy of eTools as a basis for further investigation, not to produce a fully representative realization rate.

There are several ways to calculate the RR. In this analysis, DNV used three accepted methods, which showed RR results of 68%, 66%, and 64%. This means that the evaluated results were 64% to 68% of the eTools results. If described instead as an overestimation percentage, the three methods showed that eTools results were 47% to 56% higher than the evaluated results measured using a before and after billing analysis.[1] Table 2-1 the ratio-estimator RR (in the far-right column) is a ratio of the sum of savings for each approach. The other two RRs in the table (left columns) are calculated from regression lines through scatter plots of the two approaches (Figure 2-5 and Figure 2-6) based on savings, or savings as a percent of consumption. The three methods for determining RR weight customer facilities differently, but overall, provide consistent evidence that eTools savings are statistically greater than those found from the billing analysis conducted in Phase 1. This difference needs to be investigated further.

These RRs are conservative values because the billing analysis savings (in the numerator) are all advancement savings[2] (baseline is existing efficiency), whereas some eTools savings (in the denominator) are replacement savings utilizing a standard efficiency baseline greater than the existing efficiency, which decreases the denominator. If the two approaches were perfectly aligned, the resulting RR would be greater than one (>100%) making the difference in savings larger than indicated by these results.[3]

Table 2-1. Realization rates regression vs. quotient of sums

Population	Regression Trend RR		Ratio-Estimator RR
	Savings	% of Consumption	
Full analysis population	66%	64%	68%

The billing analysis method offers empirical results to compare against eTools' engineering estimate method. The billing analysis is a comparison of weather-normalized pre- and post-installation consumption that offers an estimate of advancement savings based on the consumption that occurred at the site. The primary risk to the billing analysis approach is the presence of non-routine events (NREs) that could undermine the assumption of steady-state pre- and post-installation operations separate from the energy efficiency measure's (EEM) implementation. NREs may cause significant changes (either positive or negative) in energy usage. Their impacts can also be small and impossible to identify within the distribution of energy savings estimates, but the presence of many NREs can bias billing analysis results in either direction.

[1] RR values have changed from those noted in the Phase 1 Study filed in EB-2021-0002, Undertaking J3.7 due to a change in the project start date field used in DNV's analysis. The Phase 1 Study reported values of 70%, 62%, and 64%, respectively. Details concerning this change are noted in Section 2.3.

[2] Advancement savings is the OEB term for savings calculated relative to existing efficiency at the site prior to measure installation. Replacement savings is the OEB term for savings calculated relative to the standard efficiency measure that would have been installed in the absence of the program measure.

[3] Even if all sites with negative savings are removed from the analysis, an action that ignores the natural variability of billing analysis results and injects upward bias into the results, these results stay well below one at 73%, 83%, and 91% respectively. These results should also be compared to an expected RR greater than one.

While addressing NREs directly is considered best practice in pre-post billing analysis, it is difficult to do so in a way that does not risk exchanging one source of potential bias for another.

A primary objective of this analysis was to explore if any potential sources of bias existed in eTools savings estimates. The analysis, in this first phase, was not designed to provide an exhaustive, fully-representative, RR. Rather, if the preliminary billing analysis results indicated either over or under-estimated savings, the site-level savings estimates could be used to explore potential sources of bias within the eTools calculator. In this preliminary stage, no attempt to address NREs was made. This means the resulting RR assumes NREs across the entire study population do not bias the result. Similarly, this result also assumes there are no underlying general trends, impacting natural gas usage, across time. That said, qualitative considerations were made as to the possibility that NRE-related bias could explain the preliminary RRs. Some considerations include:

- The billing analysis assumption that all resulting savings are from an advancement baseline could be a source of upward bias.
- eTools and the billing analysis both utilize outdated weather normals that substantially overestimate heating degree days (relative to current standard practice and expected future temperatures) producing an upward bias to both eTools savings and the billing analysis savings.

The analysis explored some potential drivers of low savings realization, such as intervention type, eTools version, audit sector, and pre-intervention consumption, but no obvious relationships were identified. The RR figures in this Phase 1 are preliminary results only. There are many known limitations, discussed in the memo body, to the comparison as it was done in Phase 1 that could make the actual performance of the e-Tools model better or worse than the preliminary numbers. Phase 2 is intended to address the identified limitations from Phase 1.

2.2 Phase 1 objectives and approach

The objectives of Phase 1 of the project were to:

- Estimate a RR for advancement period savings (existing equipment baseline) using a PRISM-based billing analysis for boilers installed through the EGI custom commercial, industrial, and multi-residential (including low-income) programs.
- Provide next steps to explore correlations between eTools project attributes and the alignment of eTools and billing analysis savings.
- Establish and maintain transparency throughout the project.
- Follow industry best practices.

The analysis approach included the 4 stages of data cleaning, weather-normalized savings calculation, site selection, and comparison of calculated savings with eTools modelled savings. Table 2-2 provides a summary of differences between the billing analysis and eTools approaches that could impact results.

Table 2-2. Summary of differences across billing analysis and eTools approaches

Area	Billing analysis	eTools	Comments
Data sufficiency	Two years pre- & post-implementation, actual reads only, minimum number of data points overall & in heating season	One year pre-implementation data, uses actual & estimated reads, selected from several years of consumption data based on good coefficient of determination	Best practice: Limiting to actual reads, 12 data points, and sufficient seasonal data to support heating trend.

Area	Billing analysis	eTools	Comments
Weather-normalizing regressions	Variable degree-day, separate for pre- & post-implementation	Fixed degree-day base	Variable degree-day offers the greatest flexibility to optimize data
Weather data	Calculate heating degree days (HDD) for specific days in each actual data bill period	HDD based on daily weather data	HDD for specific consumption days is essential to establish correlation
Weather normals	Required daily normals for variable DD modelling, so used actual weather year in last 10 with closest HDD to normals (had to be the coldest year to match the normal used by eTools)	Weather normals from 1970-2000 or 1980-2010 from Environment Canada.	Minimal effect on results. Also compared results based on fixed DD models using consistent normal. Historic weather normal are not representative of expected temperatures during EEM expected useful lives
Baseline efficiency in savings estimate	Existing efficiency (advancement savings)	Mix of existing & standard code (advancement & replacement savings)	Billing analysis results would be greater than eTools, all else being equal.
NREs	Not addressed. For this analysis, assumed not to bias result.	Could be present in pre-implementation data used to calibrate engineering estimate	NREs may explain some portion of the difference between evaluated savings & eTools savings but are extremely unlikely to explain most of the difference.

2.3 Data cleaning

Billing consumption data were first “rolled-up” to non-estimated reads. That is, estimated reads were combined with subsequent reads until an accurate reading for the combined billing period is confirmed with an “actual” read. For example, many sites offer monthly consumption reads but every other month had an estimated, not actual, value. The modelling process for the validation should reflect only “actual” reads rather than including reads that are themselves estimates from the utility with respect to when consumption took place. To have enough data for a robust model, the analysis included two full calendar years of pre- and post-installation data requiring a minimum number of data points as well as a minimum amount of data coverage during those two years. At the time of assessment, the eTools weather normalization procedure appears to use 12 months of data that are often a mix of actual and estimated billing data. Weather normalizing with too little actual data is a greater risk to the analysis than the possibility of including additional NREs by expanding windows to two full calendar years.

In the data cleaning step, DNV also established periods for calculating pre-intervention and post-intervention savings. For the original Phase 1 memo, data dated close to the project date variable in eTools–three months before the date and the next three to six months afterward[4]—were removed to account for lags in data entry or adjustments to the new equipment. Then the two years prior to this “exclusion period” were defined as the pre-intervention analysis period and the two years afterward as the post-intervention analysis period.

[4] If the project date occurred in spring, a longer exclusion date was created to ensure that the post period contained two full heating seasons.

EGI later indicated that the eTools files themselves had a more accurate way to estimate when the boiler was installed than simply relying on the tracking data field that was used as part of the initial Phase 1 analysis. Initial reporting used the "project date" variable from the tracking data. In response to the new information provided by EGI, DNV updated its analysis, relying on installation information fields from the eTools project files directly to help improve the accuracy of boiler installation dates. The preferred field for installation year is the "replacement year" variables for each space heating and water heating boilers. As these fields do not contain values for all of the sites in the sample, when "replacement year" values are absent, the year of "project closing date" is used instead; when the year of the "project closing date" is also absent, the year of the "project date" field is used. Once the year of installation was determined, the exclusion period was defined as the entire potential heating period in the installation year, August through the following April. Consumption during the exclusion period is excluded from the dataset used in analysis.

This shift in project dates and derived exclusion periods affected which sites met DNV's criteria for data sufficiency. This change from the initial Phase 1 analysis is discussed in Section 2.6.

2.4 Weather-Normalized savings calculation

For each premise in the analysis, DNV fit a premise-specific degree-day regression model separately for the pre and post periods, modelling the heating energy consumption for each billing period as a function of the total number of heating degree days during that period, as shown below:

$$E_m = \mu + \beta_H H_m + \varepsilon_m$$

where:

E_m	=	Average consumption per day during interval *m*;
H_m	=	Specifically, $H_m(\tau_H)$, average daily heating degree-days at the base temperature(τ_H) during meter read interval m, based on daily average temperatures over those dates;
μ	=	Average daily baseload consumption estimated by the regression;
β_H	=	Heating coefficient estimated by the regression;
ε_m	=	Regression residual

To produce a model specific to the energy consumption dynamics of each site, a variable degree-day model was fit. This variable degree-day approach entails the following:

1. estimating each site-level regression and period for a range of heating degree-day bases
2. choosing an optimal model (with the best fit, as measured by the coefficient of determination R^2) from among all models.

With degree-days allowed to vary, the estimated heating degree-day base τ_H approximates the highest average daily outdoor temperature at which the heating system is needed. These base temperatures reflect both average thermostat setpoint and building dynamics such as insulation, internal, and solar heat gains.[5] The base temperatures for most sites

[5] The analysis allowed different optimal degree-day bases for pre- and post- periods. This is standard best practice. DNV also performed the analysis using the fixed degree day base consistent with eTools. The flexible degree-day base does not cause substantially different results but does produce slightly higher estimates of savings than the fixed degree day base.

shifted between pre and post periods, with an average decrease of approximately 2% in the base temperature used. There was no statistically significant aggregate trend associated with a shift in degree day basis and the difference between savings reported by eTools and those found by DNV's analysis. The sites with higher base temperatures used for post intervention analysis had lower savings reported by eTools at approximately the same proportional level as those found in DNV's evaluation.

For this model, DNV also decided to weight consumption data points differently in the model based on the number of days included in the billing period. Periods with very few days were given low weights because they are more likely to be noisy because of day-to-day anomalies. Data points that included many months of data were also down weighted, as they were more likely to include both days with and without heating, and so may not represent the assumed linear relationship of heating and gas usage. Data points with greater than 65 days of data were down weighted using the function:

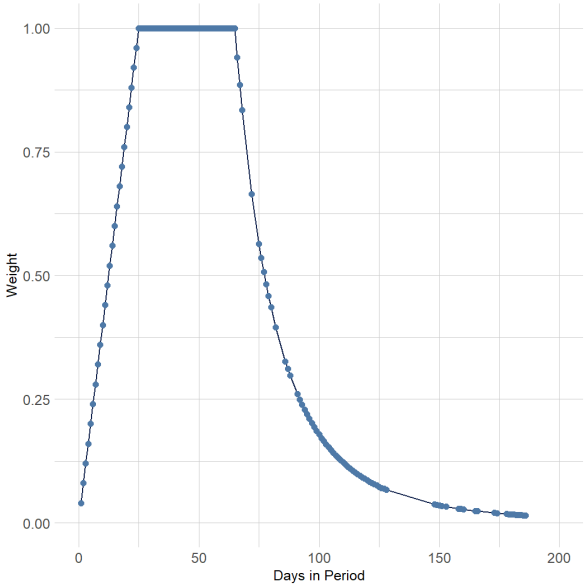
$$Weight = 65 - \left(\frac{65}{Number\ of\ Days}\right)^4$$

Datapoints with fewer than 25 days (Figure 2-1) were down weighted using the following function:

$$Weight = \frac{Numer\ of\ Days}{25}$$

This weighting schema was applied to data points representing different period lengths in the billing analysis model. This recognizes that a read with 5 days of data should not have the same weights as one with 30.[6] Points shown in Figure 2-1 represent data points in the model, but many points may be in the same spot. Most points fall in the weight =1 category. Fifteen points representing periods longer than 200 days are excluded.

Figure 2-1. Visual of weighting schema



[6] It is not uncommon to weight using count of days to account for the different amount of daily data in different length periods, especially when billing periods on are consistent monthly cycles. This analysis diverges from that here primarily due to the inclusion of longer read periods present in the billing data, which have less information to support heating trends. These periods are down-weighted rather than letting them get extra weight.

For each period, pre and post, DNV combined the coefficients of the fitted model with normal-year degree-days to calculate normalized annual consumption (NAC) for that period. That is, the fitted model was used to predict what the pre and post period energy usage would have been given weather from a given normal year.

The eTools models use normal degree day bases from either the years 1970-2000 or 1980-2010, which are not reflective of current weather trends. Therefore, billing analysis utilized a normalized weather base that is not representative of current weather but is aligned with eTools' weather data. Given the upward trend in temperatures, eTools should utilize weather normal values based on the 10 most recent years of data.

Additionally, EGI was only able to provide a fixed (18°C) base temperature degree-day count, rather than actual normal temperature data for these periods. The billing analysis relies on a variable degree-day base and this analysis cannot use these degree-day counts. Instead, for each weather station to be used, DNV selected a year for which there were temperature data and whose degree day counts at an 18°C base matched the historical normals well. Then the actual temperatures from these years were used as stand-ins for the historical normals to calculate normalized annual consumption and normalized savings.

For each site, the difference between pre- and post-program NAC values (ΔNAC) represents the change in consumption under normal weather conditions. These are the billing analysis estimated savings, referred to as *evaluated savings*.

2.5 Site selection

The following criteria were used to identify the sites for this analysis:

Pre- and post-installation data. The billing analysis involves a comparison of gas usage before and after the boiler measure installation. DNV eliminated any sites without data in the "pre" period (the two years before the installation) or the "post" period (the two years after the installation). The site-level modelling approach also assumes that no other major events (aside from weather) caused changes in gas usage in either the pre or post periods, so sites with other non-boiler measures installed during the analysis period were also eliminated.

Data sufficiency. To be accurate, the modelling approach also requires sufficient data for each site in both the pre- and post-installation periods for a robust linear model. Because of this, sites that had fewer than 10 total data points in either the pre or post period were removed. Additionally, the PRISM approach flexibly chooses a temperature (degree day base) below which the boiler is active and energy use will increase as the temperature decreases. An accurate characterization of the relationship between consumption and heating degree days from an optimal degree day base is essential to the weather normalization process. Therefore, to estimate a robust model, there must also be sufficient data points in this range where energy use is increasing with temperature decrease. Any sites with fewer than six total data points in this temperature range, in either the pre or post periods, were also removed.

Data coverage. The models should capture enough of the pre- and post-period timeframes to accurately represent the site's operations during these periods. Sites without 80% of the days in the pre or post period represented in the data were removed. For example, this rule would remove a site whose data coverage was missing any more than about 5 months of the total 24 months of data targeted. These could be five key winter months which would make a model impossible to reasonably estimate.

Model fit criteria. In addition to having enough data for the models to fit, DNV also chose sites where the models fit well, and therefore are likely to accurately predict how energy use changes with the weather, allowing a good comparison of the pre and post conditions under a normalized weather situation. Using the site-level model discussed above, the adjusted R^2 measure of model goodness of fit was calculated to assess the relative accuracy of models with different degree-day bases.

The adjusted R^2 statistic varies from zero to one, with zero meaning the model does no better than an average, and one meaning the model explains all the variation in energy usage. Sites with a space heat or space and water heat intervention with an R^2 less than 0.8 were eliminated. Sites with a water heat intervention only tended to have lower R^2 values, so to include a large enough sample of these sites, sites with an R^2 less than 0.5 were eliminated.

This selection process left 475 total sites for analysis. A summary of a number of sites retained after each elimination step is shown in Table 2-3.

Table 2-3. Removal of sites due to data insufficiency or model fit

Elimination Step	Sites Remaining
Removing those with other measures during analysis period, and those lacking data during the pre or post period	856
Removing those with fewer than 10 points in either the pre or post period	627
Removing those with fewer than 6 points in the temperature range where energy use varies, in either the pre or post period	623
Removing those with less than 80% of days present in either the pre or post period	564
Removing those with R^2 values less than 0.8 (Space Heat or Space and Water Heat) or 0.5 (Water Heat)	475
Total	**1,097**

Below is the distribution of R^2 values among the 564 sites with sufficient data.

Table 2-4. R^2 distribution of sites with sufficient data

R^2 bin	Number of Sites
Less than 0.5	27
0.5-0.7	36
0.7-0.8	49
0.8-0.9	121
Greater than 0.9	331

The numbers of sites remaining in different categories after the above filters are applied are shown in the Table 2-5.

Table 2-5. Filtered table of simple boiler installations and sites retained for analysis

Sector		Type of Boilers (Installed in a Single Year)		Original Number of Accounts in Each Boiler Combination	Retained Number of Accounts in Each Boiler Combination
		Space Heat	Water Heat		
Commercial		✓		366	153
		✓	✓	33	11
			✓	41	12
Multi-Residential	Low Income	✓		30	22
		✓	✓	50	27
			✓	21	17
	Market Rate	✓		303	144
		✓	✓	148	61
			✓	81	28
	Total	✓		333	166
		✓	✓	198	88
			✓	102	45
Total		✓		699	319
		✓	✓	231	99
			✓	143	57

2.6 Comparison of eTools and Evaluated Savings (Billing Analysis)

DNV received data on 456 projects from EGI, as EGI was unable to find digitized data from approximately 20 projects. Upon receipt of this data, 8 sites had two associated projects and so were dropped, for a total of 440 sites and projects. Two sites where the mismatch between eTools and evaluated savings was a clear outlier compared to the other data were also removed for a final total of 438 sites.[7]

However, as noted in section 2.3, the “exclusion period” established by DNV shifted with the provision of additional information from EGI. As the site sufficiency metrics rely on the amount of billing data before and after the exclusion period, as well as the model results, which will also shift when a different time span is observed, several sites initially used in the Phase 1 analysis were excluded and no longer considered in the updated analysis. Table 2-6 is an attrition table showing how many sites fail to meet the sufficiency criteria after the new, more accurate exclusion period has been applied.

[7] Both dropped sites had very small percentage savings coming out of eTools. Both less than 1.5%. The calculation of difference in fraction savings over eTools saving got very big, one positive, one negative.

Table 2-6. Attrition table of sites used in Phase 1 with sufficiency metrics appropriately applied

Elimination step	Sites eliminated	Sites remaining
Sites used in Phase 1 memo	-	438
Removing those with less than 80% of days present in either the pre or post period	61	377
Removing those with R^2 values less than 0.8 (Space Heat or Space and Water Heat) or 0.5 (Water Heat)	17	360
Removing those with other measures during analysis period	2	358
Removing those with fewer than 10 points in either the pre or post period	2	356
Removing those lacking data during the pre or post period	1	355
Total	**83**	**355**

Following the updated exclusion period analysis, 18.9% (83) of sites used to produce results as part of Phase 1 fail to meet DNV's sufficiency criteria for analysis under the newly applied exclusion periods. The amended Phase 1 results relied on only the 355 sufficient sites shown in Table 2-6.

Most of the newly eliminated sites are due to insufficient days present in the pre or post period. Under DNV's understanding of installation dates and the resulting exclusion periods used in the Phase 1 analysis, project dates in the original dataset trended earlier than the actual reported installation year, which shifted the exclusion window into the past. With the correct, later installation date applied, many accounts lacked sufficient post-intervention data.

Once site sufficiency was established, DNV calculated several metrics to compare eTools-estimated to evaluated savings:

Difference in savings: The difference between each savings estimate in m^3

$$Evaluated\ Savings - Etools\ Savings$$

Difference in savings, as a percent of total usage:

$$\frac{(Evaluated\ Savings - Etools\ Savings)}{Evaluated\ Pre\ Usage}$$

Difference in percent saved:

$$\frac{Evaluated\ Savings}{Evaluated\ Pre\ Usage} - \frac{ETools\ Savings}{ETools\ Pre\ Usage}$$

DNV also calculated a RR, the ratio of total evaluated savings overall evaluated projects to eTools claimed savings for the same projects:

$$\frac{\sum Evaluated\ Savings}{\sum ETools\ Savings}$$

2.7 Phase 1 Results

The reported preliminary RR for the original Phase 1 analysis was 0.70. However, after applying the new project installation dates and modifying the exclusion periods and reducing the population of sites to only those meeting our stated sufficiency criteria given the new exclusion periods, the parallel RR was found to be 0.68. This means that at most only 68% of the savings calculated by eTools showed up in the evaluated savings for the selected sites. Possible explanations for this are explored in the following graphs.

There are multiple possible explanations for differences between the eTools estimates and the billing analysis estimates. The hypothesis (put forward in past CPSV recommendations) that motivated this study is that eTools is overestimating savings. The preliminary results are consistent with that hypothesis.

Also, it has been acknowledged from the beginning of the analysis, pre-post analyses of this sort can be sensitive to NREs or other external trends. While an engineering-based model will always estimate positive savings when provided with input showing an increase in efficiency, variations in consumption and unknown external factors can cause post-installation usage to be higher, or lower, than pre-installation usage even after accounting for weather. Aggregated across all sites, the external factors not accounted for in an engineering model could have a net effect of either more or less savings than initially projected. Finally, the limitations of this analysis approach could contribute to the differences. Specific reasons for potential differences in the evaluated versus eTools estimates that relate to the analysis approach may include:

- Different pre-periods being modelled
- The difference between variable and fixed degree day base models
- The normal-like years used in the evaluation model were not the exact same as the 1970-2000 normals used by eTools.

These analysis-related differences, as well as possible external trends and effects, are unlikely to fully explain the degree of difference in savings estimates leaving a reasonable presumption that eTools may consistently overestimate savings.

The black line in each of the figures below is a 45° line, showing where the data points would be if the two estimation techniques yielded the same results. If the x-axis estimate (DNV-evaluated results) is higher, points will fall below the black line. Similarly, if the y-axis estimate (EGI eTools results) is higher, points will fall above the black line. The blue line in the figures is a linear estimate of the relationship between the two.

In comparing the eTools versus evaluated energy consumption and savings, the analysis first looked at how total consumption values compare. Overall, they are very similar. Figure 2-2 shows that total evaluated pre-project consumption is an average of 2% higher than eTools estimates. The Phase 1 analysis found a difference of 3.75%. By improving the exclusion period definition logic to match measure installation dates more closely, DNV's estimate was closer to the reported eTools value than before.

Figure 2-2. Pre-project consumption

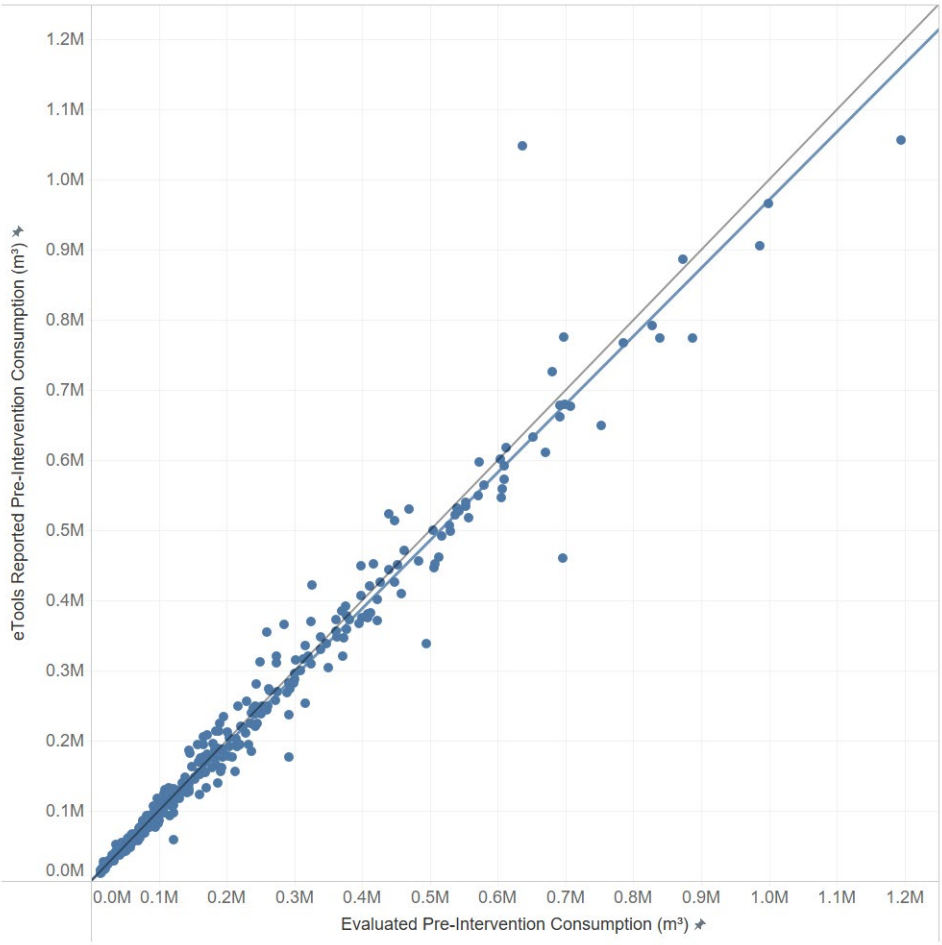
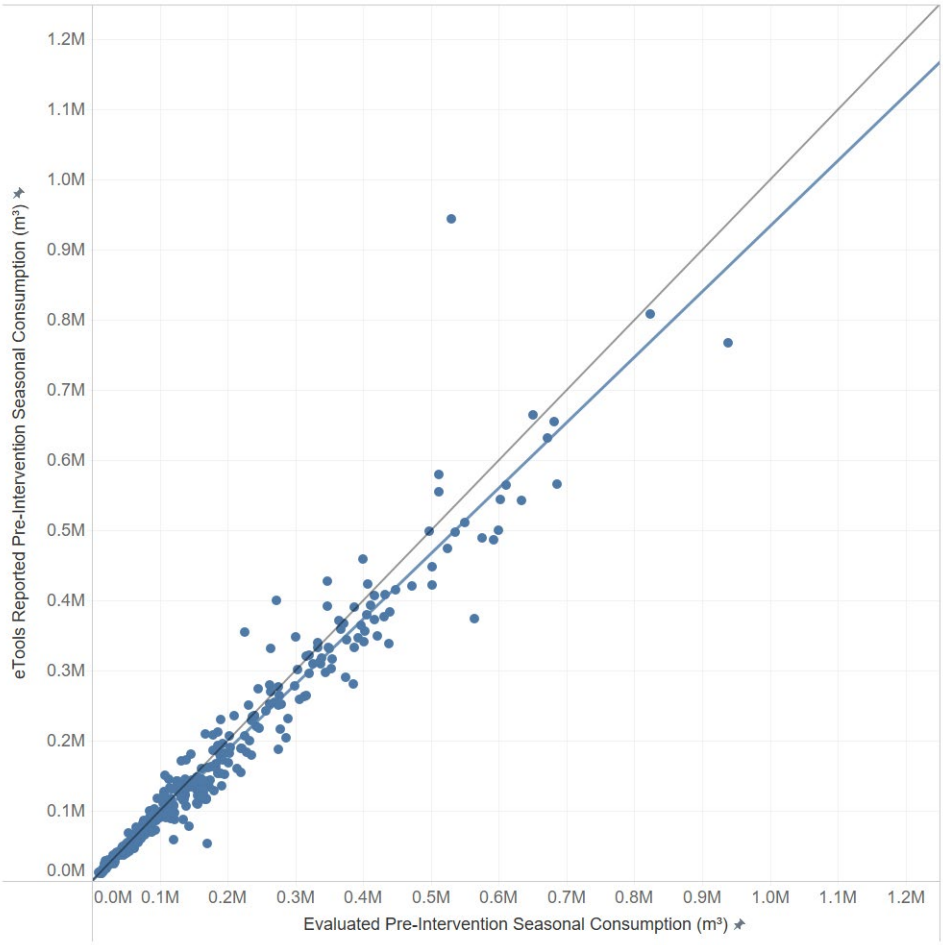


Figure 2-3 shows that the evaluated pre-project seasonal consumption is greater than eTools estimates by an average of 7.4%. The original Phase 1 analysis found a difference of 7.7%, however, utilizing more accurate project installation dates lead to smaller differences between reported eTools figures and evaluated figures than before.[8] Overall, these values show a high correlation between individual site-level estimates across the two methods, but the evaluation approach allocates a greater proportion of consumption to seasonal or weather-correlated consumption.

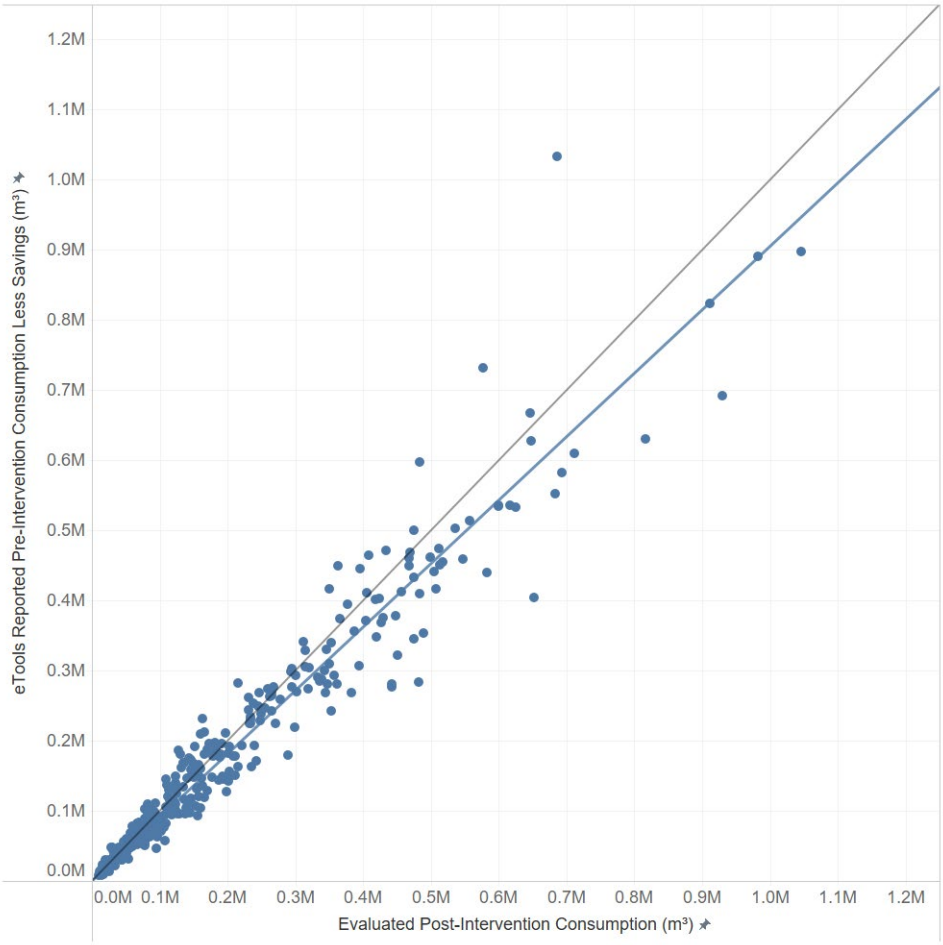
[8] This shift is also likely due to the shift in sample composition associated with the removal of sites no longer meeting sufficiency criteria for analysis. The sites removed from analysis trended towards having lower eTools pre-intervention seasonal consumption relative to billing analysis pre-intervention seasonal consumption.

Figure 2-3. Pre-project seasonal consumption



Because eTools does not provide post-period consumption, it was calculated by subtracting reported savings from a sum of seasonal and non-seasonal pre-period consumption. Figure 2-4 compares DNV's total evaluated post-period consumption using this metric and shows that evaluated estimates are 10.1% higher than eTools estimates, which follows from the lower overall evaluated savings estimates (Figure 2-5). The original Phase 1 analysis found 12.1% higher consumption.

Figure 2-4. Post-project consumption (note that eTools values are calculated)



It is important to note that the evaluated estimates include all observed consumption-related site changes, whether project-related or not, which include operational, behavioral, and other changes. In contrast, eTools calculates quantitative usage changes based on boiler efficiency, utilizing normalized whole-building gas consumption, and engineering assumptions.

Despite these differences in estimation technique, DNV would expect to see some correlation between the engineering estimates and the billing analysis estimates. Billing analysis measures consumption change between pre- and post-intervention periods. Therefore, the operating hypothesis is that a plurality of consumption changes identified via billing analysis is due to the program intervention, on average.

While Figure 2-5 and Figure 2-6 (displaying m^3 saved and fractional consumption saved) appear to show limited correlation between these estimates, a simple regression-based RR (e.g., forced through zero) produces estimates of 66% and 64% respectively, with greater than 90/10 precision. The original Phase 1 analysis found estimates of 62% and 64%.

The points below zero “Evaluated Fraction Saved” indicate that the billing analysis yielded negative savings, or increased gas consumption after the project was completed. eTools, by design, will not yield negative estimates. These sites represent less than 20% of the sites; major outliers will be discussed in the NRE analysis in Section 7.6.

Figure 2-5. Comparison of consumption saved (m^3) with 1:1 trend line

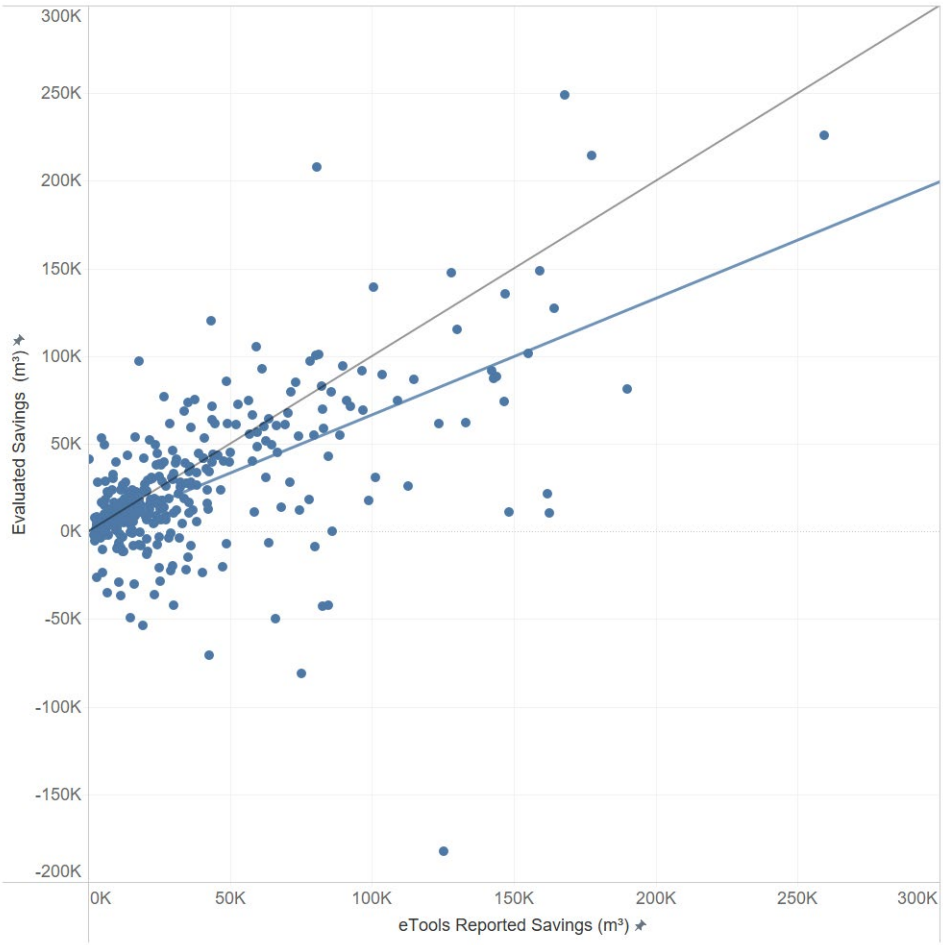


Figure 2-6. Comparison of fraction of consumption saved with 1:1 trend line

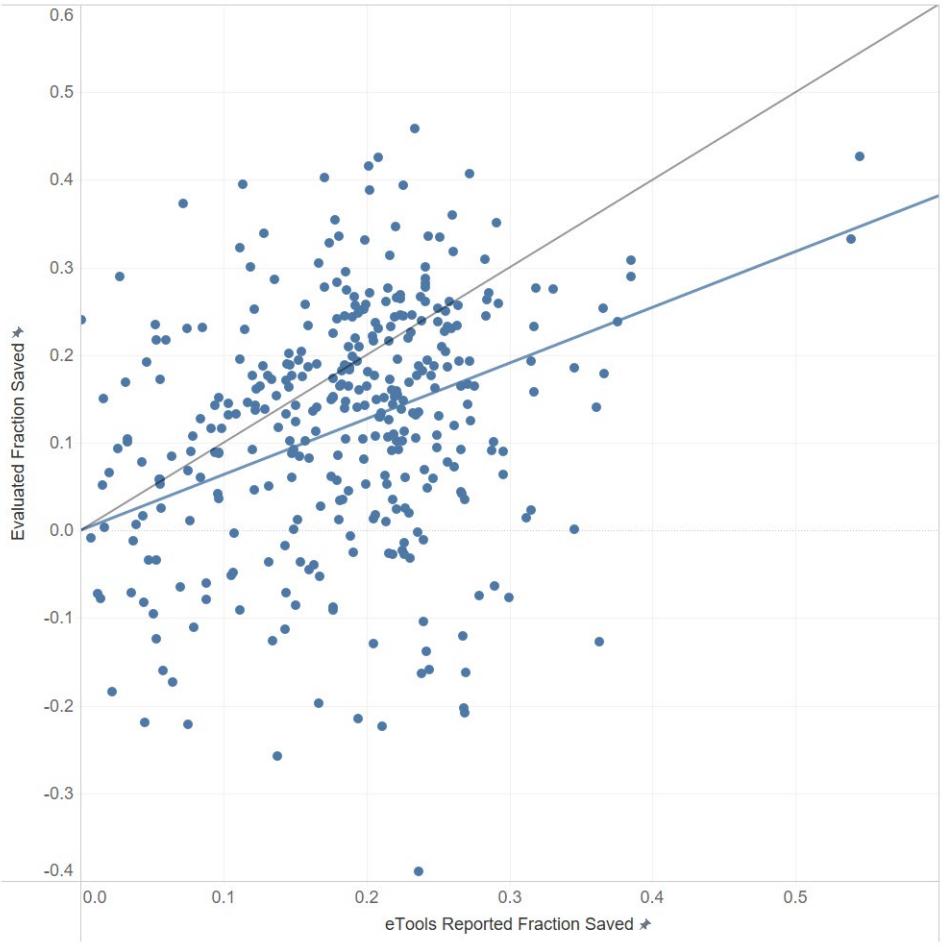
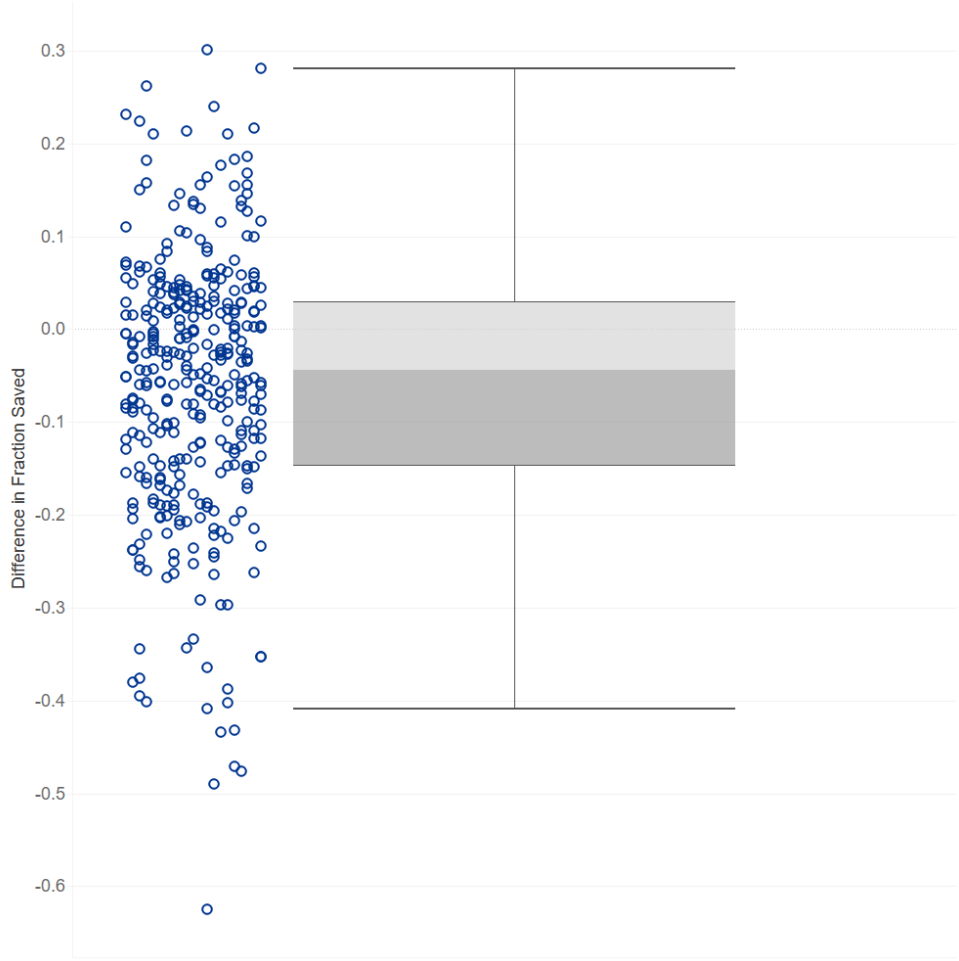


Figure 2-7, similarly, shows the difference between these two fraction-saved numbers, i.e., Evaluated Fraction Saved less eTools Fraction Saved.[9] Thus, if the evaluated fraction saved is greater, this number will be greater than zero; if the evaluated fraction saved is smaller, this number will be less than zero. As expected, given previous results, most points are less than zero, indicating that the evaluation is finding lower savings than eTools, and the spread is large, indicating no consistent level of difference. The horizontal spread simply allows all points to be seen. These results are consistent with plots of pre- and post-installation consumption in Figure 2-2 and Figure 2-4. Pre- and post-installation consumption is 2% and 11% higher than eTools, respectively, driving a roughly 6 percentage point difference in savings.

The spread of difference in fractional savings is not statistically significantly different from that reported in the original Phase 1Phase 1 memo.

[9] The boxplot provides the median (solid line in middle of box), the 25th and 75th percentiles (the box) and 1.5 the inter-quartile range as whiskers. The horizontal dashed line represents the mean, while the dashed triangles delineate the standard deviation.

Figure 2-7. Spread of difference in fractional savings



The next series of graphs explore if some types of projects may show eTools savings closer to evaluated savings. In the original Phase 1 analysis, there was not a highly statistically significant correlation found between different intervention types and the difference in fraction of usage saved; that remains true, and there is no statistically significant difference between the spread of difference in savings by intervention type between the Phase 1 memo and these amended results.

Figure 2-8. Difference in savings by intervention type

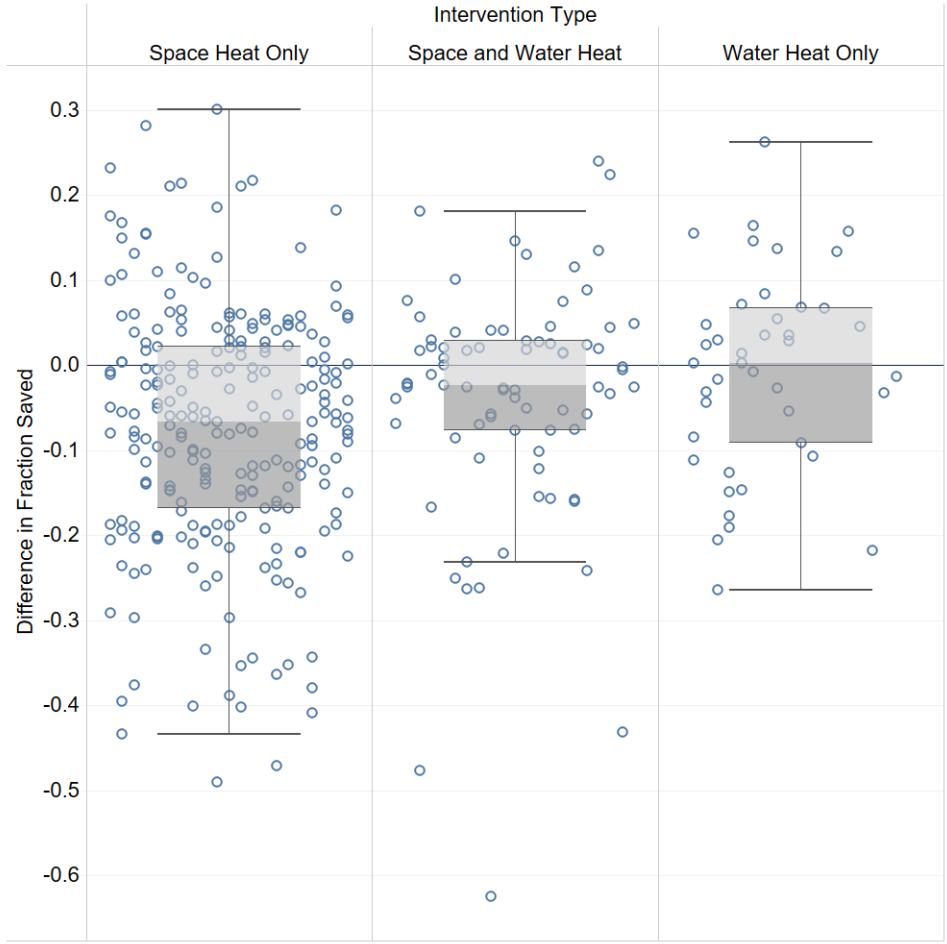
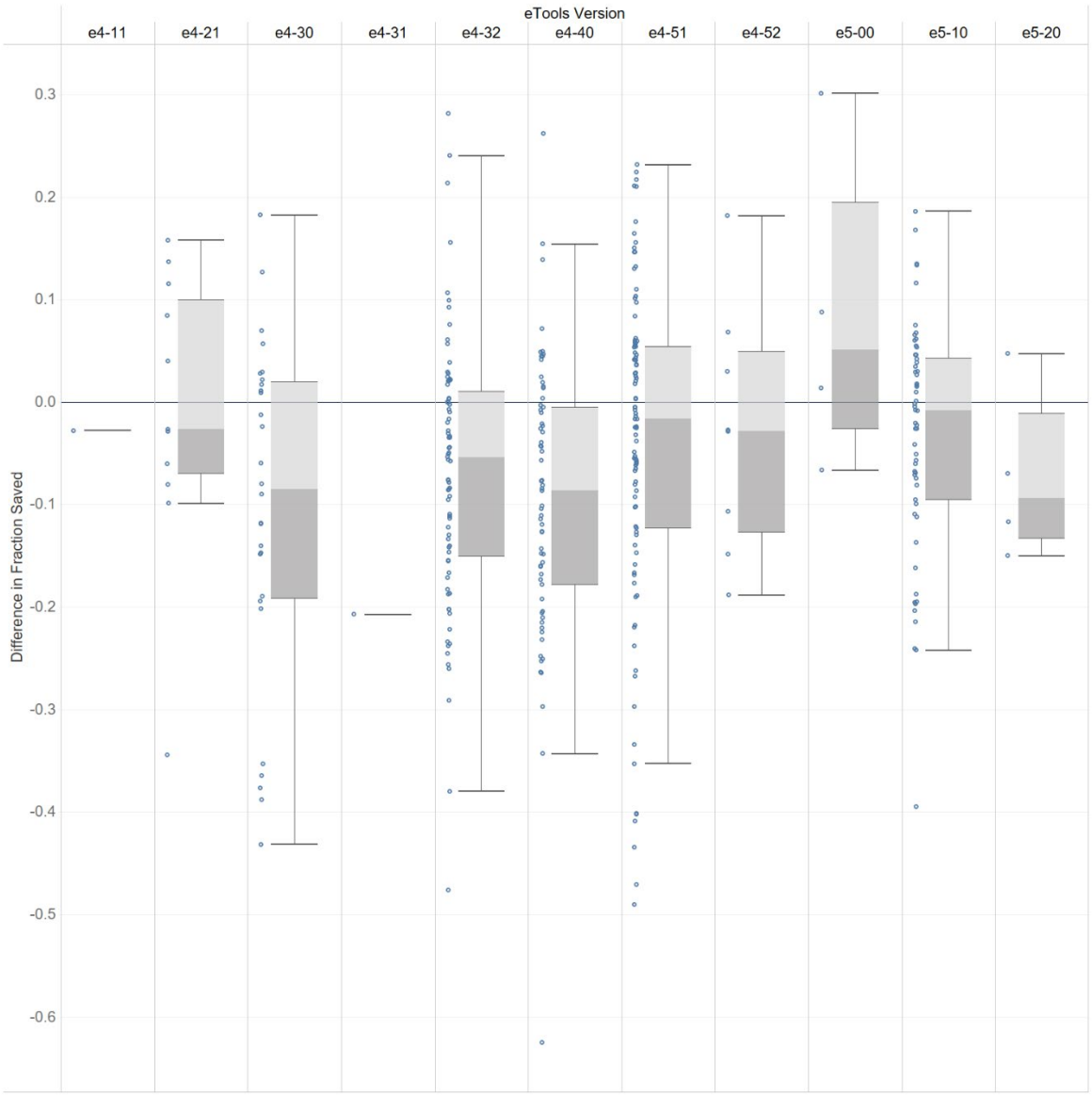


Figure 2-9 shows variation in the difference of fraction saved across eTools versions[10] found in the Phase 1 memo dataset. There is again no significant difference between these new results and those found in the previous Phase 1 analysis.

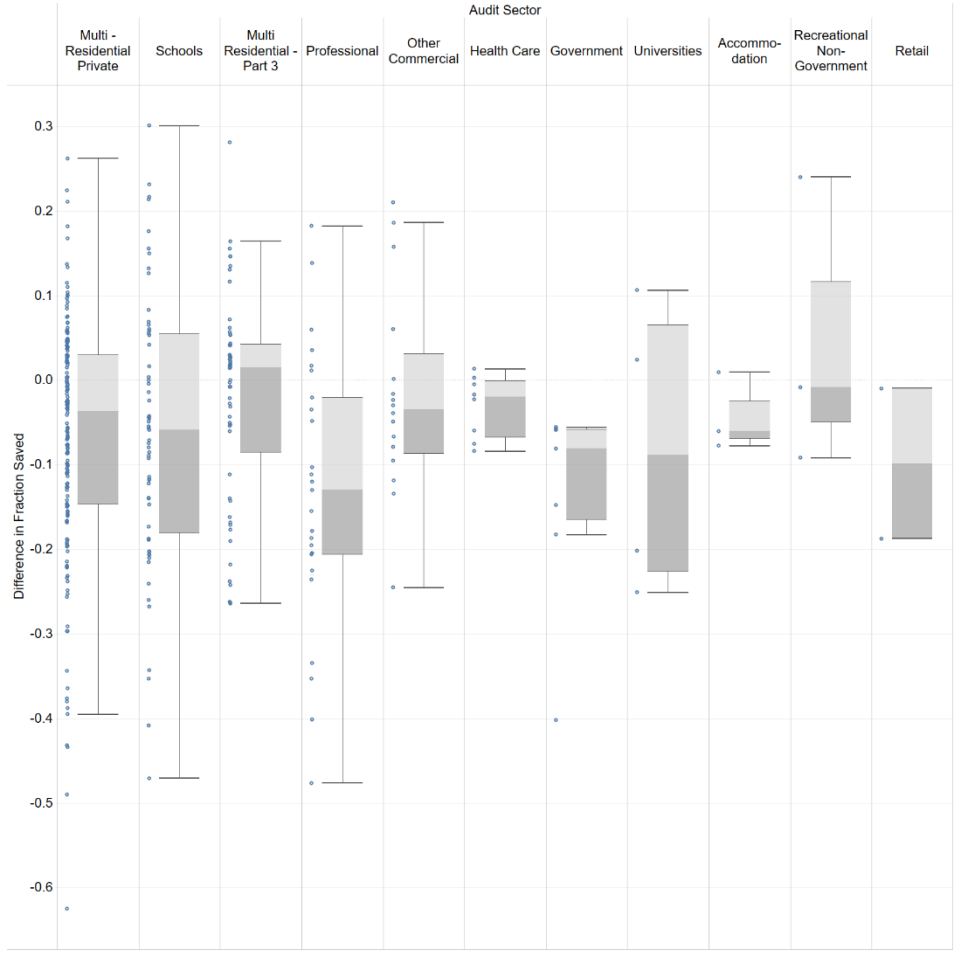
[10] Each eTools version is an update to the modelling software in the form of updates to calculation formulas, default assumptions, weather data, addition of energy saving measures, or bug fixes.

Figure 2-9. Difference in savings by eTools version



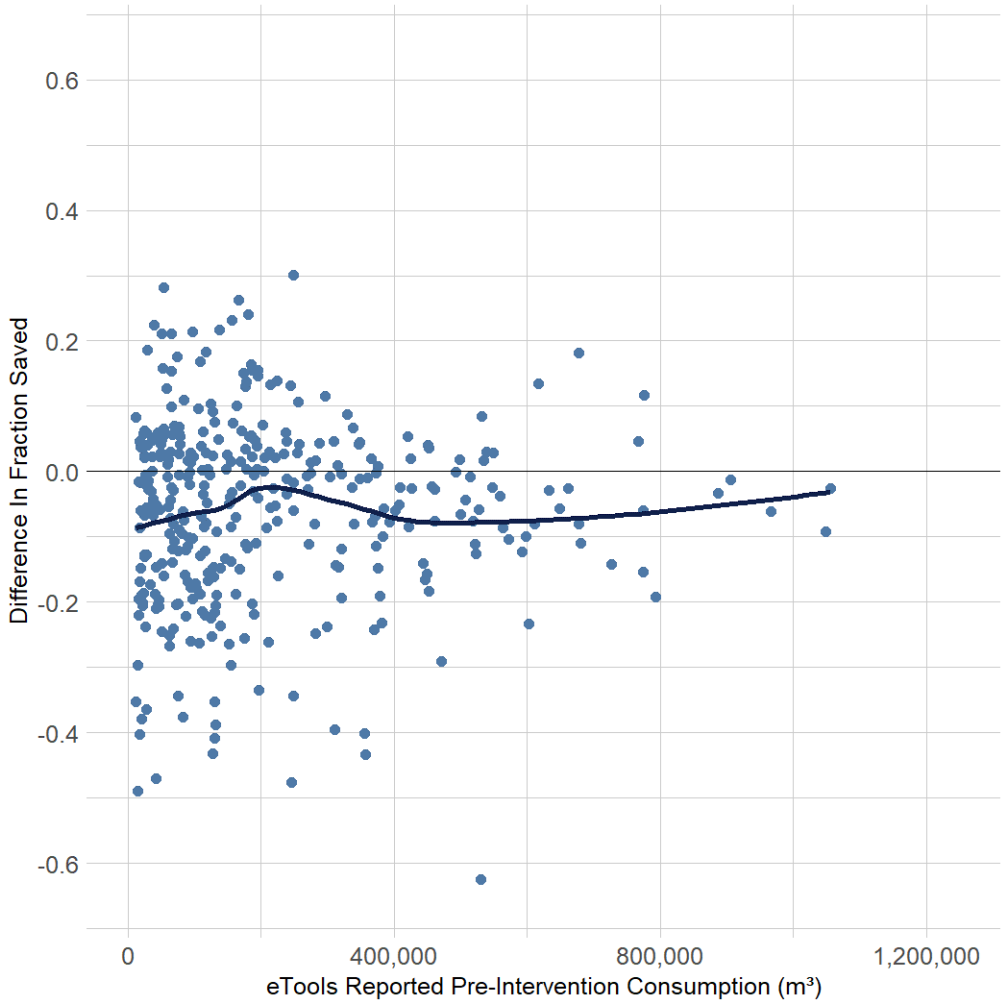
In Figure 2-10, we examine the difference in savings across Audit Sectors. In the original Phase 1 analysis, DNV found that a few Audit Sector categories appeared to perform better, on average: Multi-Residential Part 3, Other Commercial, and Health Care. With the shift in project installation dates, Multi-Residential Part 3 is the only remaining Audit Sector category where eTools savings estimates perform better, on average, than the evaluated savings from DNV's billing analysis; and even in that case, with such a wide spread over zero, it is not an especially significant difference.

Figure 2-10. Difference in savings by audit sector



The LOESS trend line in Figure 2-11 relates the difference in fraction saved for a given site with the eTools reported consumption of that site. The original Phase 1 analysis found a tenuous connection that sites with the greatest pre-program consumption performed worse, on average, than more moderately sized sites. With improved exclusion dates applied, the LOESS trendline shows that for accounts with low and moderately high sized sites, the difference in fraction saved diminishes as site size increases. However, for sites in the middle of the distribution, there is an association with increased pre-intervention consumption and worse model performance. Generally, the relationship shows a trend towards a lower magnitude of difference in fraction saved as site size increases, but a linear regression applied to the data fails to find a statistically significant trend.

Figure 2-11. Difference in Savings by pre-intervention consumption



2.8 Phase 1 Conclusions

The comparison of eTools savings estimates with billing analysis results provides an opportunity to assess the accuracy of eTools. The billing analysis results are a purely empirical change in consumption from the existing technology period to the post-program technology period, controlling for weather. The updated Phase 1 analysis accounts for new information about project intervention dates and filters down to a subset of the sites analyzed in Phase 1 based on their data sufficiency metrics using the newly defined exclusion periods. The findings from Phase 1 of the evaluation are:

- Overall, at most 68% of the savings calculated by eTools showed up in the evaluated savings for the selected sites. This preliminary analysis did not address NREs, though it is unlikely that they could explain this low of an RR. See section 7.6 for analysis and discussion of NRE's in Phase 2. Some additional reasons for potential differences in the

billing analysis versus eTools estimates related to the way the analysis was constructed are listed below. These differences are also unlikely to fully explain the large deviations in savings estimates:

  - Different pre-implementation periods being modelled
  - Differences between variable and fixed degree-day base models
  - The weather normals used in the evaluation model were not the exact same as the 1970-2000 weather normals used by eTools

- Overall and seasonal pre-project evaluated site-level consumption show high correlation with individual site-level eTools estimates despite a difference in trends.
- The difference in trends indicates that the evaluation approach allocates a greater proportion of consumption to seasonal or weather-correlated consumption.
- All RRs were estimated with roughly 90/10 precision, meaning DNV is 90% confident that the true answer falls within the range of +/-10%.
- Comparison of eTools and evaluated savings were conducted for various project characteristics (heating end use, eTools version, and facility type) but at the individual characteristic level no discernible correlations were identified.

A caveat for the billing analysis is that the results are a purely empirical estimate of change in consumption from the existing technology period to the post-program technology period, controlling for weather. The billing analysis savings estimates may include non-program-related events (NRE) that impact consumption, which may obscure the estimated savings of the relevant EEM. Example NREs are as follows:

- Implementation of a control strategy different from the expected ex ante strategy
- Changes to operating schedules (hours of occupancy) or control strategies
- Behaviour of occupants (e.g., adjusting HVAC settings, etc.)
- Building shell renovations and additions, or changes to space usage (changing laundry rooms to gyms, etc.)

NREs are likely a significant driver of the extensive variation in the results at the site level but are unlikely to be primary drivers of the relatively poor RR at the population level. Non-program-related changes can cause either increases or decreases in post-period consumption. While the mean effect of non-program-related changes may make the RR worse, they are unlikely to be the primary driver of the low RR.

In Phase 1, some eTools projects had “replacement” savings in which “standard” units, were used as the baseline. Standard unit efficiency is based on mandated minimum efficiency ratings for newly manufactured units which are often higher than efficiencies of existing units. This was a structural bias in Phase 1 of the evaluation that caused the RRs reported in this memo to be higher than they would have been if only the advancement savings from eTools were utilized. See section 7.3 for discussion of the impacts of advancement savings in the Phase 2 analysis.

Some potential sources of error in the eTools savings include:

- Engineering default assumptions that are inaccurate which could lead to overestimation of savings
- Engineering errors related to interactive effects and additive limitations which could lead to inaccurate savings
- Inability to model complex manual operation of the baseline system. Control strategies like boiler purging, flue gas venting, supply temperature setback, etc. can be implemented manually in the existing system but that information can be difficult to gather or too complex to model in eTools which could lead to overestimation of savings.

Phase 2 is intended, in part, to address the biases from Phase 1, the influence of NREs, and the top two potential sources of error in eTools.

3 PHASE 2

3.1 Phase 2 objectives and approach

The objective of Phase 2 of the project was to identify the reasons that eTools estimates were greater than evaluated savings through engineering review, multivariate analysis, previous CPSV verification findings, and further analysis of Phase 1's sample billing data. This data will enable discussions and decisions regarding the future use of eTools in verification. The approach used in Phase 2 is described below.

3.2 Review of CPSV evaluation year 2019 results

Results from the most recent CPSV evaluation (EY2019) of boilers were used in the following sections 3.6, and 3.7. Further details are provided in those sections.

3.3 eTools version updates

eTools projects utilizing older versions of the calculator were migrated into the newest calculator version (as of January 2022) e7-00. Re-running older projects in the newest calculator was necessary to ensure results reflect the performance of the current eTools calculator and eliminate the potential variability in savings due to a mix of prior versions.

A newer version of eTools (e8-00) was released by EGI in March 2022, during Phase 2 of the study. A non-random sample of projects was updated to e8-00 to determine if there were significant differences in savings between e7-00 and e8-00. A significant difference in savings would warrant updating all projects to e8-00. The sample of projects updated to e8-00 resulted in negligible differences (<1%) in savings between their e7-00 and e8-00 counterparts. Therefore, e7-00 was utilized for the remainder of the Phase 2 study.

3.4 Extraction of eTools advancement savings

A secondary goal of updating savings for eTools projects utilizing the latest version was to extract advancement savings for all projects. Advancement savings are based upon the comparison of the consumption of the proposed boiler systems to the consumption of the existing boiler systems; these savings are more accurate for comparison to billing analysis results because of the common baseline between the two methods. The dataset utilized in Phase 1 contained only reported savings which were a mix of advancement and non-advancement savings. Many of the earliest projects included in the sample for this study utilized versions of eTools that did not always calculate advancement savings that could be extracted. Therefore, updating these projects to e7-00 enabled advancement savings to be extracted for all projects.

3.5 Adjusting existing boiler default efficiency

eTools utilizes a default thermal efficiency of 73% for existing boiler systems for which nameplate thermal efficiencies are unknown. This is significantly lower than the industry standard seen in most Technical Reference Manuals (TRMs) which often utilize 80% thermal efficiency as their baseline efficiencies for all replacement scenarios. To investigate the accuracy of this assumption, the thermal efficiencies of all existing boiler systems that did not utilize the default efficiency were reviewed. The efficiencies were then weighted by total system input capacities to determine the weighted average efficiencies for Space Heating (SH) and Domestic Hot-Water (DHW) systems. Results are displayed in Table 3-1.

Table 3-1. Existing non-default boiler thermal efficiencies

System Type	Total Project Count	Non-Default Project Counts	Min Thermal Efficiency (%)	Max Thermal Efficiency (%)	Weighted Average Efficiency (%)
Space Heating (SH)	369	92	58.0	97.0	80.1
Domestic Hot-Water (DHW)	188	85	70.1	97.0	81.8

The resulting efficiencies were more than seven percentage points greater than eTools' default efficiency. The weighted average efficiencies were utilized as default efficiencies to update advancement savings in projects that used default efficiency for existing boilers.

3.6 Adjusting proposed boiler settings

A review of the results from CPSV EY2019 revealed that the most common verification adjustments made to eTools boiler projects (based on customer reported information and data gathered from site visits) were as follows:

- Changes to boiler loop temperatures
- Changes to pumping, purge, and flue controls

In most cases, the changes were reversions of proposed setpoints and controls to those of the existing system. To investigate the potential overestimation of savings caused by overly ideal assumptions used for system commissioning and site operations, the values for the aforementioned parameters in the proposed systems were set equal to their existing system counterparts.

3.7 Non-routine events investigation

Data collected from CPSV EY2019 evaluation revealed only 2 of 18 boiler projects reported potential NREs. One site reported pipe insulation on their SH and DHW systems after the boiler projects, which should increase billing analysis savings compared to eTools. The second site reported no NREs at the time of the evaluation but mentioned that there could be future increases in gas load, due to a potential new building, which should decrease billing analysis savings compared to eTools savings. As evidenced by the customer-provided information noted above, NREs can have effects on system consumption in either direction. The aforementioned sites were not included in the study's sample; therefore, it was not possible to determine the manifestation nor impacts of the expected NREs.

Additionally, analysis of consumption load shapes for sites with negative modelled savings and sites with high magnitudes of difference in fraction saved between eTools results and our evaluated savings was performed. Figure 3-1 shows the load shapes of the sites with the five highest and lowest differences in fraction saved between the savings produced by billing analysis and those reported by eTools. These 10 sites represent the largest outliers in the findings, but a visual inspection shows that there are no noticeable anomalies present.

Some sites do contain some bill periods where average daily consumption rises or falls significantly, but the patterns observed are repeated in both the pre and post periods. Sites, such as site 11, see a shift from zero usage in the summer to high usage in the heating season, but this trend is present in both pre and post periods.

Figure 3-1. Load shapes of top and bottom five sites with greatest magnitude of difference in fraction saved

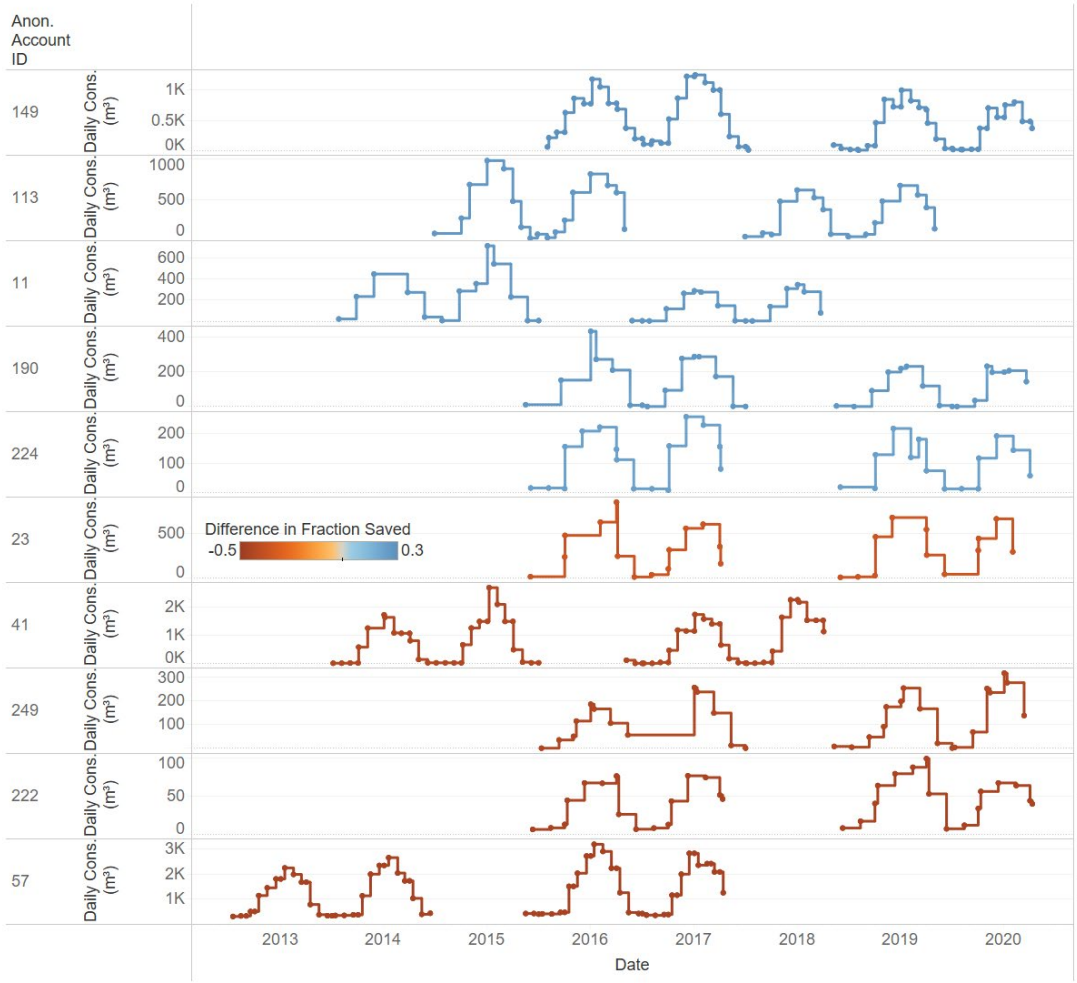
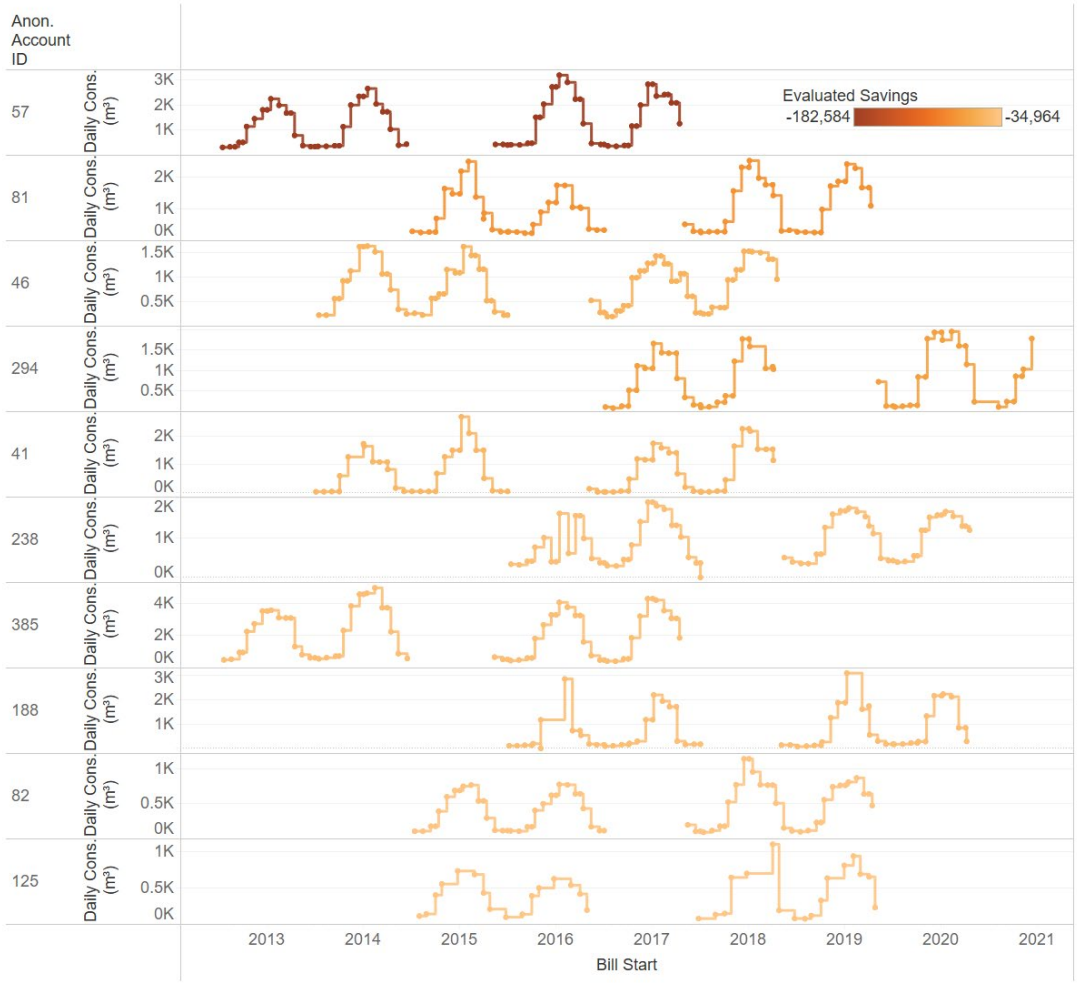


Figure 3-2 likewise shows the five sites with the greatest magnitude of negative savings from DNV's evaluation. Again, these sites show no significant discrepancies between pre period data and post period data that would suggest the presence of NREs. While some of these sites' billing data contained payment periods with long durations (such as site 188 and site 125), no statistically significant relationship can be established between the length of bill periods and the evaluated savings or the difference in fraction saved.

Figure 3-2. Load shapes of 10 sites with the least evaluated savings



3.8 Comparison of consumption normalization methodologies

An investigation into the differences between the consumption normalization method implemented in eTools and the method utilized in billing analysis was conducted. The following are findings about the eTools methodology:

- eTools suggests a baseload (non-seasonal use) value, from the billed consumption data. This is selected as the lowest consumption value, but it is up to the user to utilize the suggested value or select a different period.
  - Because some facilities (schools, etc.) can have zero summer consumption, manual baseload values can be entered.
  - Baseload can be selected by eTools from a different billing year than the data selected for the seasonal baseload.
  - Baseload does not currently account for the potential seasonal change in DHW usage.
  - Other potential baseloads (besides DHW) are estimated via engineering assumptions and subtracted from the eTools suggested baseload.
- There were often temporal differences between the billing period, meter read date, and actual HDD weather data used.

  - For example, a meter read date in February could represent consumption in December and January but would use HDD from February.
  - This issue is present in versions of eTools up to e7-00 but was corrected in e8-00. Our investigation showed no quantifiable impact of this correction on normalized consumption values which are equal for the sample of projects updated to e8-00.

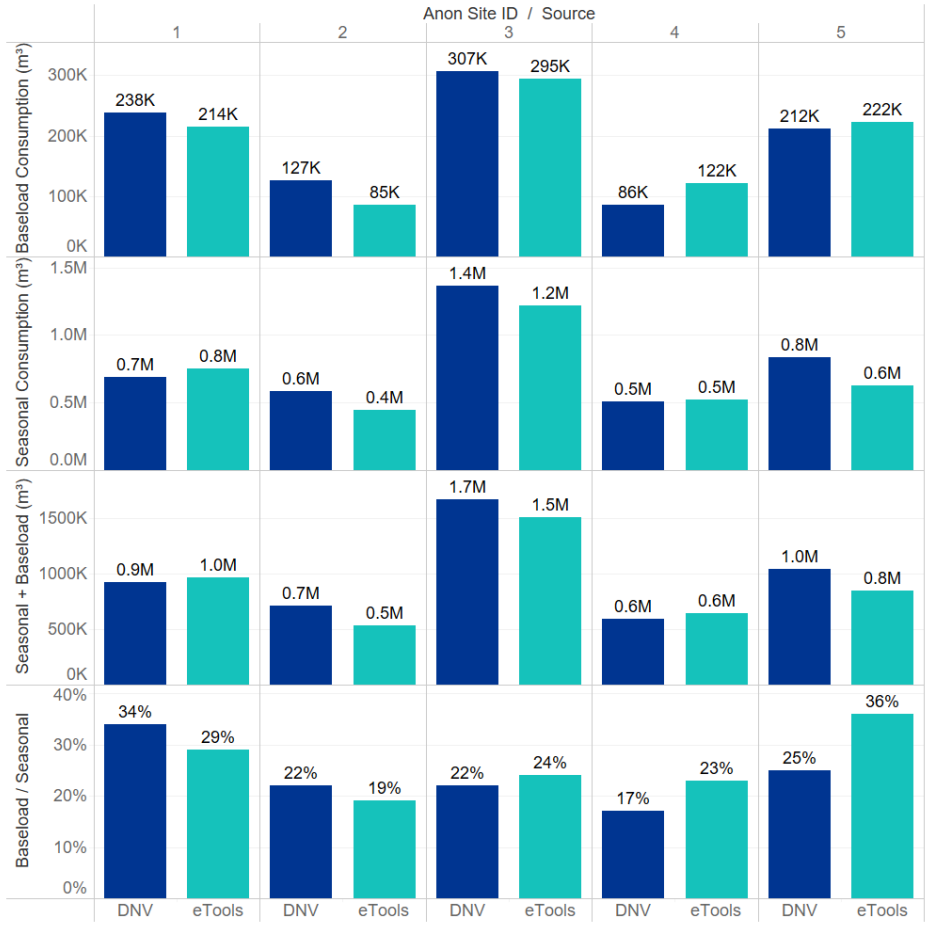
- Because the baseload is removed manually, the seasonal consumption regression equations are constrained to a zero-intercept due to the baseload being removed in prior steps.
- Annual actual weather seasonal consumption is calculated using the regression. That number is weather normalized by the application of a linear scalar of the ratio of normal to actual HDD. This is an unfamiliar but satisfactory approach made possible by the manual separation of the baseload.
- eTools maintains monthly values, adjusting them with pre-set monthly profiles meant to attempt to account for non-heating months with nominal HDDs and to account for building HVAC schedules.
  - It is unclear how the monthly values feed into the wider calculation of savings. Basic weather normalization occurs at the annual level.
  - No sources or documentation were provided for the values of the monthly pre-set profiles, nor the logic behind their application
- When there is insufficient billing data the estimated average daily consumption utilized in the regression gets the same weight same as all the other data points. The industry standard practice is weighting by the number of days in a billing period.

In summary, eTools utilizes a methodology with some departures from industry standard practice. EGI was unable to provide documentation explaining the reasons behind their departures from standard practice, so in many cases we could not confirm the rationale. These departures from standard normalization methodology raised doubts about the accuracy of the baseload and seasonal values resulting from it. Specifically, they created concern that the baseload savings were being underestimated, while the seasonal load was being overestimated. In fact, comparison of evaluated versus eTools seasonal load belies this concern. Furthermore, the overall small difference between evaluation and eTools pre-period consumption indicates that methodological differences did not lead to substantially different estimates of consumption.

A further investigation looked at billed consumption data, actual weather data, and normal weather data manually extracted from eTools for a sample of sites. Because manual extraction was necessary, only a small sample of five could be assessed. DNV's normalization process was applied to the data from the sample sites and no conclusive directional bias was identified for the normalized season loads being generated by eTools. The seasonal loads generated from this analysis were both greater than and less than their eTools counterparts, see Figure 3-2.

Overall, while we have some concerns with the approach used in eTools for consumption data normalization, the small sample of sites we could look at in detail did not provide evidence that a clear bias was being introduced by the approach.

Figure 3-2. Differences in seasonal and baseload consumption calculated by eTools and DNV



3.9 Multivariate regression analysis

Phase one considered the divergence between the billing analysis and eTools individually across several characteristics without discovering any obvious individual drivers of the differences. It is possible that multiple variables could have a combined effect on the divergence of eTools estimates from billing analysis estimates. In this case, the joint effect of these variables could be difficult to see in those individual, bivariate comparison graphs. To explore this possibility of a joint effect across multiple characteristics, a multivariate linear regression was conducted to see if multiple variables affect the divergence in ways that were not obvious individually.

The multi-variate analysis resulted in the variables, shown in Table 3-2, being statistically correlated with eTools advancement savings greater than billing analysis savings. Further investigation was conducted to dig deeper and identify any sub-variables that may be statistically correlated with the overestimate of savings, but the model did not identify any.

Table 3-2. Variables correlated with eTools' overestimation of savings

Variables	DESCRIPTION	Percentage of Phase 2 sample	RR	Fractional Savings
AHU	Flag for presence of AHU in baseline or proposed	28.4%	67.6%	17.4%
SH_LL	Flag for proposed lead-lag control in space heating system	13.4%	59.5%	15.7%
Comb_New	Flag for proposed combined space heating and domestic hot water systems	17.8%	66.3%	18.6%

3.10 Interactivity with evaluation adjustments

In the Custom Program Savings Verification (CPSV) evaluations, 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.

$$gross\ realization\ rate = \frac{Evaluation\ verified\ savings}{Utility\ reported\ savings}$$

The gross realization rate in CPSV has historically included adjustments for findings (related to characteristics and control settings of the existing or efficient boiler systems) that in theory would also affect the results of the billing analysis, which creates a risk of double counting of adjustments if a realization rate from this study were also applied. DNV investigated this potential double counting between billing analysis findings and previous adjustments from past evaluations. There were two potential pathways available.

- Plan A: focus on CPSV sites that overlapped with the eTools billing analysis sample
- Plan B: review all historic CPSV sites and separate out adjustments that would be captured by billing analysis

After investigation, Plan B was selected as the optimal path forward, because the estimated overlap of CPSV sites with eTools study sample was approximately 3%. The estimate was based on finding only 41 commercial boiler projects from the

past three rounds of CPSV (2015-2018 program years), and that the eTools study used only 25% of the original population of sites.

For Plan B, each of the previously evaluated 41 eTools commercial boiler projects from 2015-2018 were reviewed and the CPSV adjustments were categorized into: those that billing analysis would capture, i.e., most adjustments to the characterization and control settings on the existing or efficient boilers and those that billing analysis would NOT capture, such as most adjustments solely to the “standard” boiler characteristics, changes to advancement period length, or measure life. After categorizing the adjustments, the CPSV realization rates for each project were updated to reflect only the adjustments that do not overlap with billing analysis. Sixteen projects required adjustments to CPSV RR, shown in Table 3-3. The other 25 projects had no adjustments (100% RR).

Table 3-3. CPSV RR adjustments

Year	Measure ID	Measure Description	Adjustment Category	CPSV RR	Without Double Counting RR
2016	RA.LC.MR.145.16	Boiler - Hydronic Condensing	Existing, Installed	89%	100%
2016	RA.LC.MR.215.16M	DHW boiler	Existing, Installed	142%	100%
2016	RA.LC.MR.191.16A	Space heat and DHW boiler	Interactivity	111%	100%
2016	RA.LC.COM.OTHER.003.16M	Space heating boiler	Existing	136%	100%
2017-2018	RA.CT.18.0335	SH Boiler replacement	Existing, Installed	131%	100%
2016	RA.LC.MR.202.16	Space heating boiler	Installed	100.20%	98.30%
2017-2018	RA.CT.18.0191	High-efficiency space heating boilers	Installed	97%	100%
2017-2018	RA.CT.18.0330	DHW boiler replacement	Installed	137%	100%
2017-2018	LW.CT.18.0008	DHW Boiler Replacement	Installed	90%	100%
2017-2018	RA.CT.18.0215	Conversion from separate to combined SH/DHW boiler	Installed	94%	100%
2017-2018	RA.CT.17.211	High-efficiency, space-heating boiler replacements	Installed	94%	100%
2016	RA.LC.MR.172.16M	Boiler - Hydronic High Efficiency	Installed	144%	123%
2016	RA.LC.MR.204.16	Space heating boiler	Installed	100.20%	101.2%
2017-2018	RA.CT.18.0303	Replaced separate SH and DHW boilers with boilers that serve both loads	Installed	98%	100%
2017-2018	RA.CT.18.0589	Replacement of 2 SH boilers	Installed	93%	100%
2017-2018	RA.CT.17.422	Upgrade to two condensing space-heating boilers	Installed	119%	100%

After separating the adjustments for the 41 sites DNV expanded the results to the population using ratio estimation, which is the standard approach used for sample expansion in CPSV. The ratios estimated are described in the formulas below.

Notation: The following terms are used in calculating the adjustment factors:

G_{Tj} = tracking estimate of gross savings for measure *j*

G_{T8j} = eTools version e8-00 tracking estimate of gross savings for measure *j*

G_{Fj} = full engineer verified estimate of gross savings looking at all adjustments for measure *j*,

G_{NBj} = engineer verified estimate of gross savings looking at only adjustments that do not overlap with billing analysis for measure *j*,

w_{Vj} = weighting factor for measure *j* used to expand the CPSV sample to the full population

V = number of measures in the CPSV sample

G_T = tracking estimate of gross savings for the population of boilers studied

G_V = verified estimate of gross savings for the population of boilers studied

R_E = billing analysis adjustment estimated in phase 2 of this study

The Full CPSV gross realization rate R_F is calculated directly:

$$R_F = \frac{\sum_{j=1}^{V} G_{Fj} w_j}{\sum_{j=1}^{V} G_{Tj} w_j}$$

The overlap factor R_O is calculated as a ratio of non billing analysis verified savings and full CPSV verified savings:

$$R_O = \frac{\sum_{j=1}^{V} G_{NBj} w_j}{\sum_{j=1}^{V} G_{Fj} w_j}$$

To calculate verified savings we can multiply the three realization rates R_E, R_F, and R_O with the gross tracking savings

$$G_V = G_T \times R_E \times R_F \times R_O$$

Alternatively, we can calculate the non-billing realization rate R_{NB} as a ratio of non billing analysis verified savings and tracking savings:

$$R_{NB} = \frac{\sum_{j=1}^{V} G_{NBj} w_j}{\sum_{j=1}^{V} G_{Tj} w_j}$$

And then to calculate verified savings we can multiply R_E and R_{NB} with the gross tracking savings

$$G_V = G_T \times R_E \times R_{NB}$$

The first formula is preferred if the evaluator and the EAC choose to use the overlap factor (R_O) from this study rather than calculate from the CPSV sample itself. For example, if future CPSV sample of commercial boilers is small then this formula may be preferable.

The second formula is preferred if the evaluator and the EAC choose to rely solely on the CPSV sample and not use the overlap factor (R_O) from this study. Assuming the CPSV engineering data collection is conducted in a manner consistent

with historical precedent, then the additional marginal cost for calculating the overlap factors during future CPSV are negligible in comparison. This formula is preferred if sample sizes are large enough that the evaluation team and EAC feel comfortable that the result will be reliable.

This study's results are applicable to eTools version e8-00. As the program moves into more modern versions of eTools beyond e8-00 it will be necessary to calibrate the new version(s) of the tool to e8-00 as well to ensure major calculation changes between versions do not result in double counting. This calibration factor is not included in the above formulas, but would also be a multiplier in calculating G_V , based on CPSV sample/backup sites and calculated as the ratio of e8-00 savings to the savings from the more modern tool. In this scenario both tracking and evaluation use the modern version of the tool throughout and a correction factor for updated eTools version is calculated:

$$R_{V8} = \frac{\sum_{j=1}^{V} G_{T8j} w_j}{\sum_{j=1}^{V} G_{Tj} w_j}$$

Table 3-4 shows the Full CPSV gross realization rate (R_F), overlap factor (R_O), and non-billing realization rate (R_{NB}) calculated using the 41 boilers that were in the previous 3 rounds of CPSV. The case weights from the original studies were used and are interpreted as the number of projects that a sampled site represents in the population studied. Precisions provided are not finite population corrected (FPC Off), which is appropriate for ratios that are intended to apply to a future population rather than the specific population studied.

Table 3-4. CPSV RR and CPSV RR adjustment factor

Ratio	n Measures	Ratio	+/- at 90% Confidence, FPC Off	Relative Precision at 90% Confidence, FPC Off
Full CPSV gross realization rate (R_F) (for reference)	41	102.16%	5.1%	5.0%
Overlap Factor (R_O)	41	97.39%	3.6%	3.7%
Non-billing realization rate (R_{NB}) (for reference)	41	99.50%	3.8%	3.9%

3.11 Phase 2 results

The impacts of the adjustments and investigations described in Phase 2 were as follows:

- Updating all sampled projects to version 7 resulted in an increased RR of 75%.
- Switching to comparing to only Advancement Savings resulted in a decreased RR of 55%.
- Re-setting the default existing boiler efficiency to values of 80.1% for SH and 81.8% for DHW resulted in an increased RR of 70%.
- Re-setting the proposed boiler controls to existing settings resulted in an increased RR of 79%.
- eTools departs from standard practices in several ways with respect to weather normalization, the exact impact of the weather normalization process on eTools results is difficult to quantify but appears to be limited.
- The multivariate regression analysis did not identify any further specific variables that explain the remaining difference between eTools estimates savings and evaluated savings.
- The analysis of NREs did not identify any systematic impact of NREs.

The remaining unexplained difference between eTools estimates and evaluated savings is an 11 percentage point difference between evaluated fraction saved and eTools v7 advancement fraction saved, Figure 3-4. That is, with the adjustments to eTools described above, and using the most up to date eTools version, eTools still overestimates savings relative to evaluated savings by 2.1 million cubic meters, or 27%, based on the most recently audited year, 2020.

The final sample for Phase 2 was 321 accounts, a sub-set of the Phase 1 accounts whose eTools projects were able to be successfully updated to the latest eTools version. Figure 3-3 displays the realization rates, reported savings, and advancement savings across the various eTools versions (and iterations) from this study. The "…All Savings" columns incorporate a mix of baselines, existing and standard. Columns labelled "…All Advancement" use only the existing baseline which is a more apt comparison for the billing analysis results which use the existing baseline. The columns containing "…+ Efficiency" incorporate the default efficiency changes explained in Section 3.5, and the column containing "…& Controls" also incorporates the system controls changes explained in Section 3.6. Retrospectively, without the recommended parameter updates, the RR is 55%. With the recommended parameter changes, a forward-looking RR of 79% is appropriate.

Figure 3-3. eTools version, advancement, and parameter update savings comparison

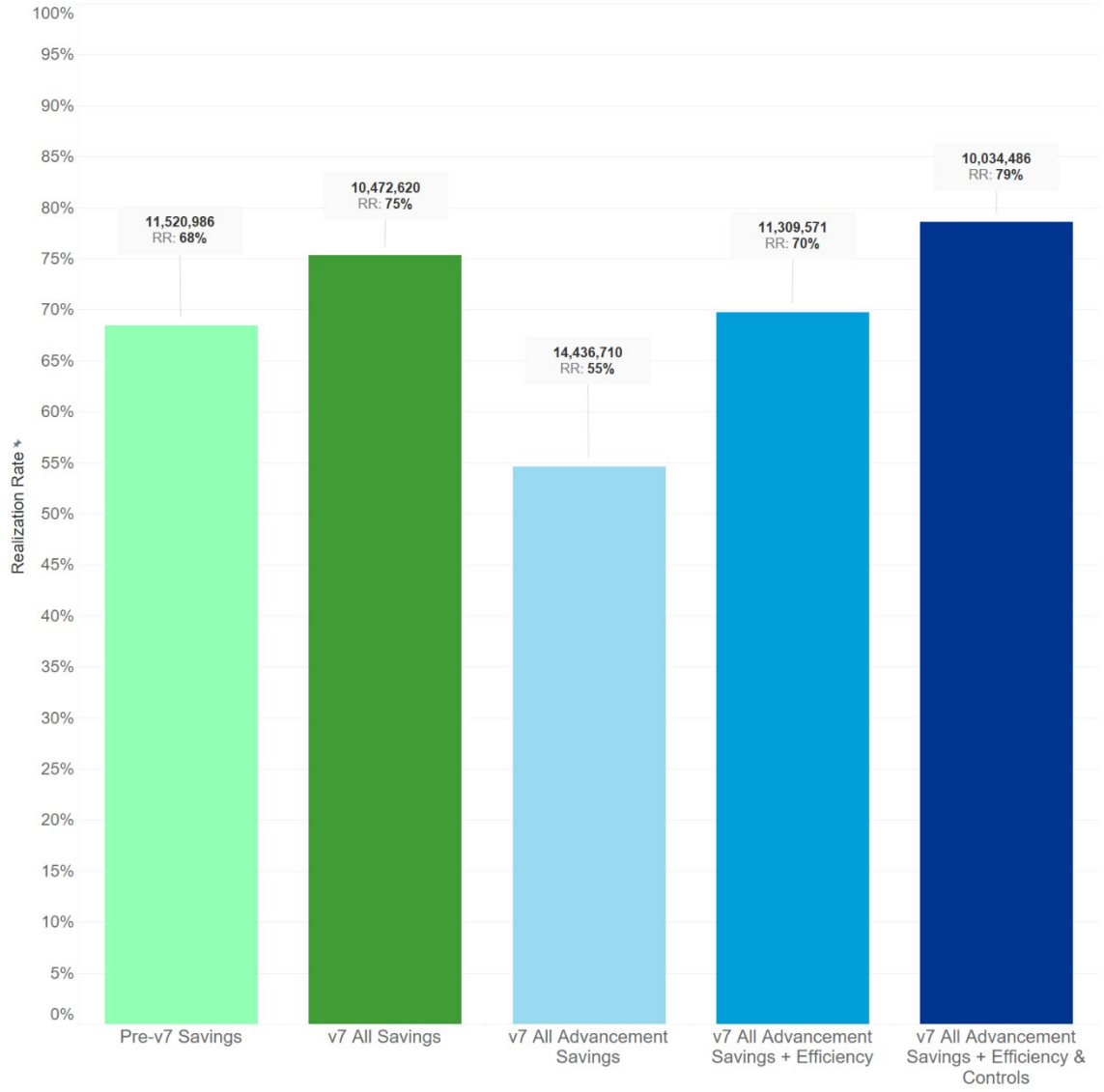
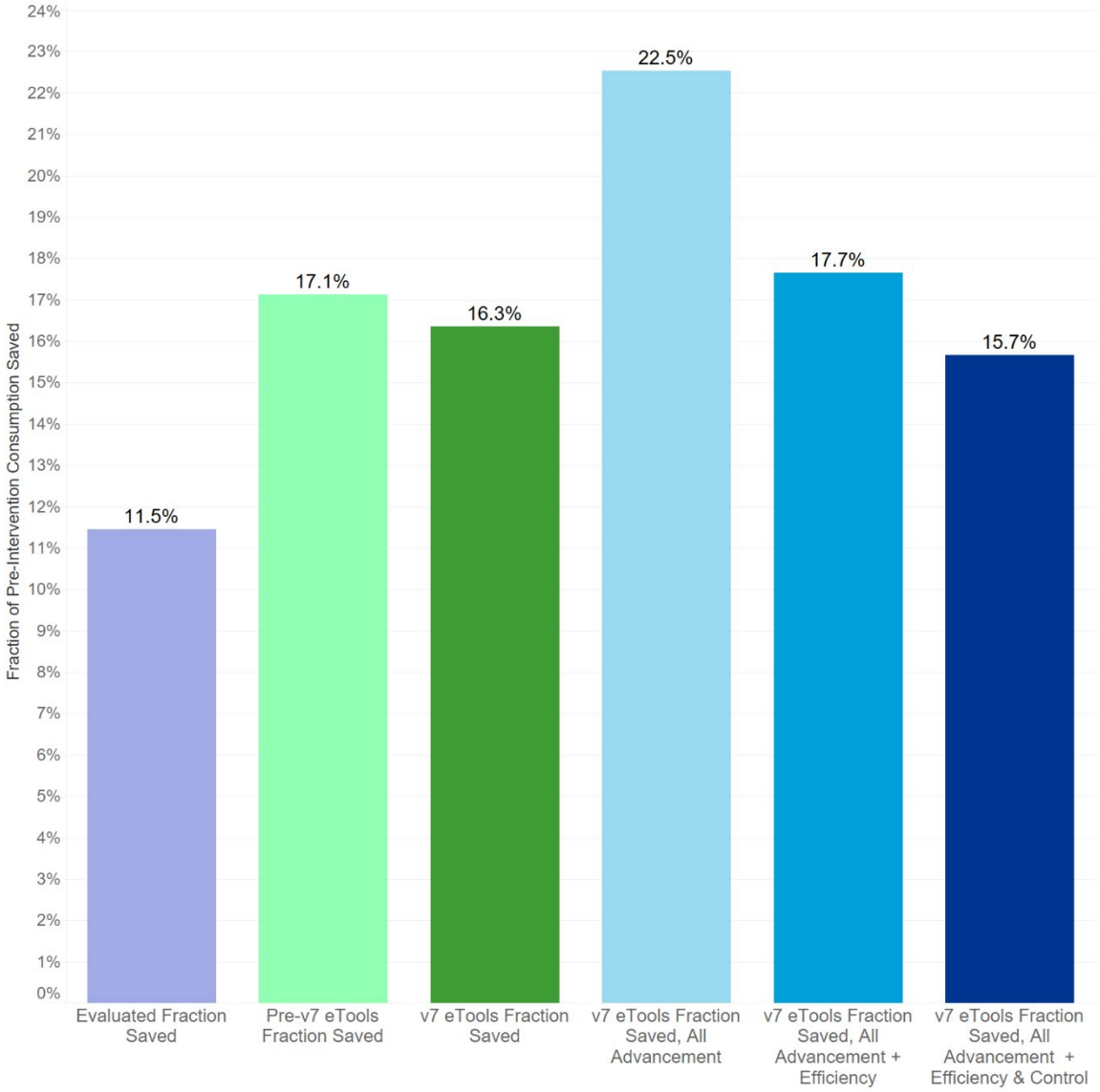


Figure 3-4 focuses on the fractional savings, i.e., savings as a percentage of pre-intervention consumption. The final difference between the fractions saved for evaluated (billing analysis), and eTools v7 advancement + efficiency & control changes is only 4.2% of consumption. If NREs are the cause of the difference between the two methods (evaluated and eTools) then they would have to account for an increase in consumption of 4.2% of pre-intervention consumption across all sites in the Phase 2 sample.

Figure 3-4. eTools version, advancement, and parameter update fractional savings comparison



EGI contracted with evaluation consultant Demand Side Analytics to perform a comparison group analysis to assess trends and NREs. Such a study intends to determine if there exists a general trend in consumption that would bias billing analysis results. Such a trend, as estimated from non-participant changes in consumption, would provide an estimate of the effect of general trends in usage as well as of all kinds of NREs except those participant NREs associated with program participation (but not tracked) which would remain unaddressed in this attempt to address potential NRE bias. The analysis involved identifying a group of similar non-participant sites, finding a match for each participant among those non-participants based on pre-period consumption and then looking at the change in non-participant consumption pre- to post- based on the participant installation date. DSA replicated the process on random subsets of the overall identified non-participant population to develop a distribution of possible consumption changes over time from different comparison group compositions. The results of this billing analysis of program non-participants (Appendix #) by EGI found consumption increases between 0.3-1.2% of weather normalized pre-period consumption with a mid-point of 0.8%. If the findings of the EGI study are assumed to hold true for the sample of accounts utilized in this study then the difference in fraction saved

would decrease from 4.2% to 3.4%, a reduction of 19%. If the increase in post-period consumption from EGI's study is incorporated into this study's evaluation results the Phase 2 RR increases from 0.79 to 0.84. In summary, it is unlikely that any additional studies of consumption trends will find an increase in gas consumption large enough to conclude that NREs account for the remaining difference between billing analysis and eTools results.

Table 3-5 displays the pre-intervention consumption values used in the preceding figure. The eTools consumption values decreased from pre-v7 to v7 because the weather normals were updated to utilize more recent data.

Table 3-5. Pre-intervention consumption for fractional savings

Source	Pre-Intervention Consumption (m3)	Notes
Evaluated (Billing Analysis)	68.84MM	-
eTools pre-v7 (Original Reported Savings)	67.29MM	Weather normals from 1971-2000
eTools v7	63.53MM	Weather normals from 1981-2010

3.12 Phase 2 conclusions

The results of this study show that, after key engineering assumptions are refined, eTools can provide a reasonably accurate estimate of aggregate advancement savings. The study did not address factors external to the eTools calculator that could cause deviations from savings estimates and whose impacts could be studied, such as:

- Contractor equipment installation processes
- Boiler system commissioning processes
- End user operation and maintenance of boiler systems

eTools is a sophisticated engineering-based estimation calculator that exceeds industry standard practice and generates local knowledge of implementation practices. There are no other boiler savings estimation models that are known to be more accurate, nor any known to be in development. Changing tools for evaluation will introduce additional uncertainty as to the causes of differences in verified vs. claimed savings.

Performance gaps in energy efficiency performance simulation software persist across all kinds in jurisdictions around the world. Despite significant performance gaps found in building energy conservation measures, for both new and retrofit buildings, no jurisdiction has discarded their performance simulation software. EnergyPlus, 3E Plus, Integrated Engineering Software, etc. are all used to provide forecasted savings in buildings even those these are seldom fully realized.

3.12.1 eTools and implementation recommendations

1. eTools advancement projects should not utilize the current 73% thermal efficiency default value, it should utilize site specific values, supported by documentation. If no defensible site-specific values are available the efficiency values identified in this study, 80.1% for space heating and 81.8% for domestic hot-water heating, should be utilized.
2. Site specific documentation verifying any anticipated controls or setpoint changes should be gathered by Enbridge after boiler system commissioning. If documentation verifying control changes are unavailable, then the installed systems should be assumed to utilize the same controls and setpoints as the existing systems.

3. Improve upon the weather normalization method for consumption data through adopting industry standard practices (ASHRAE, IPMVP, etc.) and thoroughly documenting the rationale for any deviations from those standards. Given the upward trend in temperatures, eTools should utilize weather normal values based on the 10 most recent years of data.
4. Investigate potential sources of bias in savings estimates associated with Air Handlers, Lead-lag installations, and combined systems. While the evaluation was not able to test changes to these settings in eTools, the multivariate analysis found that these characteristics were associated with errors in estimated savings.
5. More rigorous data collection for existing and new boiler systems to capture empirical information to refine values for the various eTools' parameters that impact boiler performance, such as:

    a. Impacts of insulation on boiler shell heat losses
    b. Boiler purge frequency and associated heat losses
    c. Hot water load of combined systems
    d. Percentage of load served by lead boilers in lead lag systems

3.12.2 Evaluation recommendations

The recommendation for OEB and EAC's consideration for future eTool commercial boiler evaluations are:

1. Continue using eTools for implementation and evaluation. eTools is a sophisticated engineering-based estimation calculator that exceeds industry standard practice and generates local knowledge of implementation practices. There are no other boiler savings estimation models that are known to be more accurate, nor any known to be in development. Changing tools for evaluation will introduce additional uncertainty as to the causes of differences in verified vs. claimed savings. The use of this modelling software is akin to other building simulation software which contains known performance gaps in energy efficiency measures that persist across all kinds of jurisdictions around the world. Despite these performance gaps, no jurisdiction has discarded their performance simulation software. EnergyPlus, 3E Plus, Integrated Engineering Software, etc. are all used to provide forecasted savings in buildings despite rarely being accurate for an individual building.

    a. eTools advancement projects should not utilize the current 73% thermal efficiency default value, site specific values (supported by documentation) should be utilized. If documented site-specific values are not available the efficiency values identified in this study, 80.1% for space heating and 81.8% for domestic hot-water heating, should be utilized by implementers and evaluators.
    b. Site specific documentation verifying any anticipated controls or setpoint changes should be gathered by Enbridge after boiler system commissioning. If documentation verifying controls changes are unavailable, then the installed systems should be assumed to utilize the same controls and setpoints as the existing systems.
    c. Version e8-00 of eTools was the latest version reviewed during this study and should be utilized by the evaluation team to assess any projects using eTools e8-00 or earlier.
    d. Projects using a version of eTools more modern than e8-00 should use the modern version of eTools in evaluation. A "between version" calibration factor that takes the savings from version e8-00 relative to the new version should be employed to ensure that the changes from one version to another are accounted for without restricting the evaluation to using only version e8-00 prior to re-calibrating the billing analysis (see below in point 5). This calibration can be calculated using the sample plus the backup sample of projects in the evaluation (those that the evaluation requests files for as part of the typical evaluation process).

2. Future evaluations of eTools commercial boiler projects should continue in a manner consistent with Custom Project Savings Verification (CPSV) evaluations from 2015-2018 while updating the model to eTools version e8-00 or more modern. This means updating inputs to eTools based on site-specific data collected through evaluation activities.

3. After implementation of list items 1.a. and 1.b., the recommended realization rate from this study (84%), can be applied to evaluate aggregate eTools boiler gross savings. This recommended realization rate uses that described in 1a) above as well as incorporates the findings from EGI's study of non-participant natural gas consumption trends (APPENDIX A), explained in Section 3.11.
4. A correction factor for the double counting between evaluated gross savings and billing analysis should be utilized. As part of this study, it was found that based on past projects, the adjustment factor was 0.97. An alternative to using this factor is to re-estimate the correction factor based on the sample of projects evaluated in CPSV to apply to that year's CPSV results. The determination of which to use will be made by the evaluation team with input from the EAC and OEB. The primary factor in the decision will be the sample size of boilers evaluated.
5. eTools should be periodically calibrated via billing analysis to improve the accuracy of aggregate savings estimates. The precise cadence/timing of the calibration cannot be defined at this time in part because evaluation budget consideration necessarily have a role in determining the timing. Re-calibrating the billing analysis will be more about changes in use of eTools (defaults, assumptions and data entry choices) and less about the changes in the underlying calculations, which will be captured in the suggested "between version" calibration factor in 1d.
   The OEB and EAC should consider the following key factors when determining whether a billing analysis calibration should be conducted:

   a. Whether EGI's internal user guidelines for eTools have changed in a manner that materially impacts savings estimates produced. As informed by Enbridge's analysis of the impact of its user guideline changes to eTools. Materially in this case would be a change that is expected to change boiler savings by more than 5% in aggregate for boilers in the program. Note that 5% is a starting point to inform the EAC when it is time to start planning the next study.
   b. If newer eTools versions are found to produce savings materially different from the versions evaluated in this study As informed by Enbridge's analysis of the impact of its updates to eTools and/or the calibration factors estimated in 1d above. If calibration factors in 1d exceed 10% it is of higher priority to conduct another calibration. 10% is a starting point, given that 1d is likely based on a relatively small sample, it is prudent to use a higher threshold than 5a. If there is sufficient post-case heating data (minimum of two heating seasons) for the population of sites to be included in the billing analysis
   c. If there is sufficient post-case heating data (minimum of two heating seasons) for the population of sites to be included in the billing analysis

3.13 Additional thoughts

This section covers alternative pathways forward, or potential areas of further inquiry, that are not recommended but were considered as options.

3.13.1 Alternatives to using eTools

The only reasonable alternative to using eTools for ex ante estimates and correcting the models with ex post information, from CPSV evaluation or regularly conducted billing analysis, is to change the program structure to a pay-for-performance program. DNV has yet to come across a modelling software that attempts to model savings from boiler ECMs as granularly as eTools. Most other efficiency programs utilize rudimentary prescriptive algorithms to determine boilers savings that would likely have worse RRs than eTools if they were checked against billing analysis results. Additionally, performance gaps in energy efficiency measures persist across all kinds in jurisdictions around the world. Despite significant performance gaps found in building energy conservation measures, for both new and retrofit buildings, no jurisdiction has discarded their performance simulation software (EnergyPlus, 3E Plus, Integrated Engineering Software, etc.) are all used to provide

forecasted savings in buildings even those that are seldom fully realized. If eTools is discarded then the program structure will likely need to be changed to a pay-for-performance program, there will be new risks because:

- Only billing analysis (which has its complexities and risks) could be utilized for the evaluation of such a program.
- Quality and consistency of pre- and post- project documentation could diminish, leading to a lack of transparency into the ECMs that were implemented, and increasing the difficulty of interpreting and contextualizing the billing analysis results.
- Identification of potential NREs would become more important, and the methods to identify them (described in Section 3.13) introduce their own complexities and risk.
- Program participation could suffer due to reduced or eliminated upfront incentives.
- Differences in contractor equipment installation processes
- Differences in boiler system commissioning processes
- Differences in end user operation and maintenance of boiler systems

3.13.2 Control group study

A control group study was initially proposed to attempt to quantify possible population wide consumption trends or NREs (discussed in earlier parts of this report) that may be conflated with and included in the billing analysis estimates. EGI contracted with another evaluator, Demand Side Analytics, to perform a control group study similar to the study we would provide. The results from that analysis were consistent with the methodology DNV would employ and provided evidence of a trend of minor increases in consumption that would lead to a slight downward bias on billing analysis savings estimates. Having reviewed the DSA study carefully, DNV does not believe further control group study is justified and, we have incorporated those estimates into our discussion to demonstrate that they have limited effect on the overall findings of the analysis.

3.13.3 Customer NRE surveys

Investigation of NREs based on customer reported information to be utilized in adjusting eTools project savings is typically reserved for CPSV evaluations. However, there is potential value to the qualitative information that could be gained in a focused survey of the sites sampled for Phase1 and Phase 2 of this study. There are a few areas of concern to consider prior to pursuing a customer survey to learn about potential NREs:

1. Many of the projects were completed over 5 years ago, before 2017. Getting accurate information about events that far back will require a carefully crafted survey instrument with stakeholder input.
2. The desired use case for qualitative information acquired about customers' NREs is unclear and will have to be discussed amongst stakeholders to inform the design of a robust survey instrument.
3. Even if all the points above are addressed and agreed upon by stakeholders, the surveys could still result in low response rates or insufficient information. As a point of comparison, the discovery of potential NREs in the population of sites that implemented boiler projects in CPSV EY2019 was ≤11%.
4. As there continues to be pressure from all levels of government and the public for customers to reduce their fossil fuel use, data on NREs from past years may become increasingly out of date and misleading.

These risks should be carefully considered and properly mitigated in the scoping of customer surveys targeted at identifying NREs.

APPENDIX A. ENBRIDGE NON-PARTICIPANT BILLING ANALYSIS

Demand Side Analytics
DATA DRIVEN RESEARCH AND INSIGHTS

Preliminary Report

Non-Participant Billing Analysis

Prepared for: Enbridge Gas Inc.
By: Demand Side Analytics
February 2022

About DNV

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