



FINAL REPORT

Free Ridership Evaluation for Ontario's Natural Gas Custom C&I DSM Programs

Ontario Energy Board

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EXECUTIVE SUMMARY

To verify the impacts of the Enbridge Gas Distribution, Inc. (Enbridge) demand side management (DSM) programs, the Ontario Energy Board (OEB) undertakes various annual evaluation studies. The Net-to-Gross Evaluation of the 2024 Natural Gas Demand Side Management is summarized in this document.

In 2024, Enbridge delivered ratepayer-funded DSM programs to customers, including custom programs delivered to large volume, commercial, and industrial customers that encouraged them to reduce their energy consumption by providing customer-specific energy efficiency and conservation solutions. The custom programs offered provide financial incentives, technical expertise, and guidance with respect to energy-related decision-making and business justification to help customers prioritize energy efficiency projects against their own internal competing factors. Multifamily buildings – other than low-income buildings, which are dealt with separately – are eligible to participate in Enbridge’s custom commercial programs.

The OEB evaluates the custom commercial and industrial program results annually as the programs have significant OEB-approved savings targets. Based on the results of the utilities’ programs, the utilities may be eligible for performance incentives. The portion of shareholder incentives that come from the custom commercial and industrial programs is based on the amount of verified net natural gas savings achieved by each utility relative to the OEB-approved targets.

- **Verified savings** are utility claimed program savings that are audited and confirmed by an independent third party. The process and results of the verification are described in a separate report. The result of the analysis is a ratio that represents the percentage of utility claimed energy savings that are verified by the auditor.
- **Net savings** are those that are caused, or influenced, by the utility, including attributable (non-free rider) program savings and spillover. The process and results of the net savings assessment are described in three separate reports: this report, the 2023 Natural Gas Demand Side Management Net-to-Gross Evaluation report (published 2024), and the CPSV Participant Spillover Results report (published 2018). The result of the analysis is a ratio that represents the percentage of verified savings that were caused by the utility.

The two ratios are applied to the utility draft savings to produce final verified net natural gas savings according to the equation in the following figure.



This report provides the free-ridership-based attribution ratio which once combined with spillover becomes the net savings ratio. The net savings ratio together with claimed savings and the verification ratio serves as an input used to calculate verified net savings. This process is completed as part of a broad Annual Verification process that spans all Enbridge DSM Programs. The customer program results are combined with the results from other utility programs in a “scorecard.” The utilities’ scorecard results determine overall performance and if the utility is eligible for a shareholder incentive.

The following tables show the free-ridership-based attribution.

All Programs

Custom program	Free-ridership-based attribution
Commercial	77.57%
Industrial	64.45%
Large Volume	14.51%

Commercial program

Segment	Free-ridership-based attribution	Sample customers	Sample measures	± at 90% confidence (FPC on)	Population m ³ savings	Percent population m ³ savings
Commercial	77.25%	18	19	12%	7,424,178	28%
Institutional	96.46%	9	12	5%	10,671,120	40%
Market Rate Multi-Residential	63.78%	12	12	15%	8,664,520	32%
Commercial Program Overall	77.57%	38	43	7%	26,759,818	100%

Industrial program

Segment	Free-ridership-based attribution	Sample customers	Sample measures	± at 90% confidence (FPC on)	Population m ³ savings	Percent population m ³ savings
Agricultural	53.92%	14	20	22%	36,831,702	45%
Industrial	72.72%	17	18	11%	44,551,347	55%
Industrial program overall	64.45%	31	38	13%	81,383,049	100%

Large volume

Segment	Free-ridership-based attribution	Sample customers	Sample measures	± at 90% confidence (FPC on)	Population m ³ savings	Percent population m ³ savings
Large Volume Program Overall	14.51%	6	11	6%	48,089,060	100%

Findings and recommendations

The following table presents a summary of the key findings and recommendations from the study. It shows the party to whom the recommendation applies and its primary beneficial outcome. We classified outcomes into four categories: reduce costs, increase savings, increase (or maintain) customer satisfaction, and decrease risk (multiple types of risk are in this category including risk of adjusted savings, risk to budgets or project schedules, and others). All recommendations address energy savings and program performance.

Table 1-1. Recommendations summary table

#	Energy savings and program performance		Applies to		Primary beneficial outcome			
	Finding	Recommendation	Enbridge	Evaluation	Reduce costs	Increase savings	Customer satisfaction	Decrease risk
1	FR-based attribution in the programs can vary by more than 10 percent across studies for the same program	Evaluate free-ridership for the programs annually and couple the free-ridership evaluation with process evaluation		✓		✓		
2	FR-based attribution for the programs came primarily through acceleration	Consider strategies to have greater impact on increasing efficiency and amount (where applicable) of measures	✓			✓		
3	Many customers with high FR report involving Enbridge late in the process	Consider strategies to reduce customers taking advantage of the rebate for projects that are already fully decided upon.	✓			✓		✓
4	Return on Investment is mentioned consistently by customers and vendors as a key metric	Continue emphasis on ROI effect of incentives with customers. Consider helping to quantify kWh, water and other non-energy benefits of projects to sell projects that do not pass ROI on gas savings alone	✓			✓		
5	Reducing Carbon is a driver for some customers	Continue to leverage Carbon effects as part of the package to motivate customers to participate	✓			✓		
6	The Large Volume program has high free ridership	Consider the high free-ridership within the context of the cost effectiveness of the program. High free rider programs can still deliver meaningful cost-effective net savings.						
		Conduct a process evaluation to improve Large Volume influence on customer projects	✓			✓	✓	✓
		Consider limiting the measure types or payback periods that are eligible for Large Volume incentives	✓			✓	✓	✓
7	Vendor attribution increased program attribution significantly for the Enbridge Commercial and Multifamily Segments	Consider expanding approaches to market for other programs that leverage third-party vendors.	✓		✓	✓		
8	Vendor attribution data collection resulted in fewer completed interviews than desired (due to small sample size).	Consider interviewing participating vendors independent of the participating customer sample and recruitment.		✓		✓		✓

#	Energy savings and program performance		Applies to		Primary beneficial outcome			
	Finding	Recommendation	Enbridge	Evaluation	Reduce costs	Increase savings	Customer satisfaction	Decrease risk
9	In the attribution scoring methodology, timing assumptions, specifically the number of years assumed for “never would have implemented” have a significant effect on FR-based attribution.	Consider studying the typical planning horizons for each of the customer segments. The assumed planning horizon for companies is used in the scoring to determine at what point the program receives full influence credit for accelerating a measure’s implementation.		✓				✓



1 INTRODUCTION

On behalf of the Ontario Energy Board (OEB), DNV carried out the Net-to-Gross Study of Enbridge Gas Inc.'s (Enbridge) natural gas demand-side management (DSM) programs delivered in 2024. The study produced free-ridership (FR) ratios for the set of Enbridge custom programs examined, shown in Table 1-1.

Table 1-1. FR by program, 2024

Program	2024 FR
Large Volume	✓
Commercial*	✓
Industrial	✓
Affordable Housing Multi-Residential	

*Custom Market-Rate Multi-Residential (Multifamily) projects are expected to be included as a part of this program.

1.1 Evaluation objectives and approach

The overall objectives of this study were to:

- Develop appropriate free-ridership rates for Enbridge custom projects (excluding low-income) carried out in 2024, with disaggregated rates within these groups.
- Establish and maintain transparency throughout the project
- Follow industry best practices

The methodology selected for the FR evaluation relied on end-user self-report surveys and interviews. The end-user self-reports were supplemented by project-specific interviews with vendors to capture the indirect effects of the programs on end-user decision-making. Surveys and interviews were collected from the most recent (2024) program year in order to create FR factors (later to be combined with spillover (SO) factors to create NTG factors ahead of 2024 verification activities) that will be most meaningful for future years.

1.2 Study background

To encourage Enbridge Gas Distribution, Inc. (Enbridge) to implement public benefits programs designed to reduce overall energy use, called conservation demand-side management (DSM) programs, the Ontario Energy Board (OEB) reimburses them for the cost of program implementation and provides an incentive, called the shareholder incentive, that reflects the utilities' performance against pre-determined targets. The OEB also compensates the utilities for the revenue lost as a result of the lower natural gas sales.

In the 2024 calendar year, programs delivered by Enbridge targeted all natural gas ratepayers, including residential, multifamily, low income, commercial, and industrial customers. This study is part of an overall conservation program cycle as shown in the following figure. This study is part of step 4.



Figure 1-1. Conservation program cycle



To verify the impacts of the Enbridge DSM programs, the OEB sponsors studies to verify the energy savings achieved. Specifically, this study researched attribution rates, which are estimates of the influence the utility had on the energy efficiency projects that were installed and measured as a percentage of the savings “attributable” to the utility. As part of the annual verification report, the results of this study are combined with the results of three other studies^{1,2,3} to produce verified net cumulative gas savings for the utilities’ 2024 Custom programs. This study was completed with the intent that its results would be combined with free-ridership rates from the 2023 Custom programs in the Annual verification.

The remainder of this report references the following industry terms. Additional definitions are found in the glossary in APPENDIX A.

- **Free rider:** a customer who would install the same energy efficiency measure without intervention from the utility.
- **Free-ridership:** the portion of a program’s verified energy savings that would naturally occur without intervention from the utility.
- **Spillover:** energy savings that occur as a result of the utility’s intervention, but are not part of the utility’s verified savings. For example, if the utility identifies (and the customer implements) an energy efficiency measure that does not require payment to a vendor for equipment or servicing, the customer would not receive an incentive and the utility would not claim those energy savings. The energy savings are considered spillover.
- **Attribution:** the portion of a program’s verified energy savings that the utility influenced, including the effects of free-ridership and spillover. When multiplied by the utility’s claimed savings, the attribution ratio produces the volume of energy saved as a result of program implementation.
- **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).

¹ CPSV Participant Spillover Results. Prepared for The Ontario Energy Board by DNV, May 23, 2018.

² 2023 Natural Gas Demand Side Management Custom Savings Verification. Prepared for The Ontario Energy Board by DNV, November 25, 2024.

³ 2023 Natural Gas Demand Side Management NTG Evaluation, DNV for the Ontario Energy Board, November 8, 2024.



2 COMMERCIAL CUSTOM PROGRAM

Enbridge's custom DSM program for commercial customers encourages customers to reduce their natural gas consumption by recommending and incentivizing energy saving projects and actions.

This custom program differs from the prescriptive programs by providing additional technical support for projects and financial incentives based on overall natural gas savings realized by the customer rather than a per-unit incentive.⁴

A subset of the projects in this program is part of the multi-residential segment. The free-ridership (FR)-based attribution study included custom projects from the Market-Rate Multifamily (MR MF) section of the program. Under the DSM framework,⁵ low-income projects use a deemed (pre-determined) value for Low Income Multifamily (LI MF) free-ridership, so the LI MF segment was not included in the free-ridership-based attribution evaluation.

All non-LI MF projects implemented as part of these programs and claimed in 2024 as custom projects are included in the scope of the FR study.

2.1 Free-ridership-based attribution rate

The FR-based attribution ratio represents the ratio of the savings influenced by the utility (considering only free-ridership, not spillover) to the program savings, as shown in the following equation. The methods used to determine evaluation verified savings are presented in a separate report.⁶ A 90% FR-based attribution ratio means the utility-influenced savings (considering only free-ridership) were 90% of the program savings.

$$\text{free – ridership – based attribution} = \frac{\text{Utility influenced savings considering only free – ridership, not spillover}}{\text{Program savings}}$$

Table 2-1 shows the FR-based attribution ratio by domain for the Enbridge Commercial Custom program. The table shows the FR-based attribution ratio, statistical precision at the 90% confidence interval, the program-claimed population first year meters cubed (m³) savings, and percent of program savings for each customer segment. The percent of program savings represents the relative contribution that each customer segment makes to the overall result.

The ratio result is based on an overall sample size of 38 customers and 43 measures. Additional details on stratification, sample size, and population size are provided in APPENDIX C. Additional statistical details for the results are provided in APPENDIX E.

The Commercial free-ridership-based attribution rate includes the effect of indirect utility influence on non-institutional projects through vendors. Vendor attribution was studied for non-institutional commercial projects due to the design of the program for these segments, which included significant vendor outreach and efforts to influence vendor business practices to increase sales of gas saving measures. APPENDIX F provides more detail on the vendor attribution. Influence on projects through vendors increased the Commercial measure type free-ridership-based attribution rates by 6 percentage points (from 71% to 77%), and increased Market Rate Multifamily free-ridership-based attribution by 8 percentage points (from 56% to 64%).

⁴ Enbridge's Annual Report provides a more detailed description of the program and can be found here: <https://www.oeb.ca/sites/default/files/OEB-Annual-Report-2022-2023-EN.pdf>

⁵ EB-2021-0002, OEB Decision, November 15, 2022, Schedule E.

⁶ 2023 Natural Gas Demand Side Management Custom Savings Verification. Prepared for The Ontario Energy Board by DNV, November 25, 2024.



Table 2-1. Free-ridership-based attribution ratio for Commercial custom program*

Segment	Free-ridership-based attribution	Sample customers	Sample measures	± at 90% confidence (FPC on)	Population m ³ savings	Percent population m ³ savings
Commercial	77.25%	18	19	12%	7,424,178	28%
Institutional	96.46%	9	12	5%	10,671,120	40%
Market Rate Multifamily	63.78%	12	12	15%	8,664,520	32%
Commercial Program Overall	77.57%	38	43	7%	26,759,818	100%

* The table shows statistical precision (± at 90% confidence factor) that does include the effects of a finite population correction factor. See Appendix B for more information.

2.2 Components of free-ridership-based attribution

The FR-based attribution rate for each measure is calculated based on participant survey responses to questions regarding the utility's influence on the timing, quantity, and efficiency of the measure installed. This section reports the program's effect on each component and provides an indication of which aspects of the projects show the greatest utility influence.

- **Timing** questions help us understand the impact programs had on when project installations took place by asking participants if they would have implemented measures earlier, later, or at the same time without program assistance.
- **Efficiency** questions are geared towards understanding if the equipment had been installed without program incentives and influence, would this equipment have been more or less efficient compared to what ended up getting installed through the program.
- **Quantity** questions delve into the program's influence on how many measures were installed as part of the project (if applicable based on measure type) compared to how many would have been installed without the program's influence.

The total utility effect on the measure (free ridership based attribution) is calculated by combining the scores on the three components above by multiplying the free ridership on each component (the percent not influenced) and subtracting it from one (100%) as shown in the below equation.

$$\text{Free ridership based attribution} = 100\% - (FR_{\text{Timing}} \times FR_{\text{Efficiency}} \times FR_{\text{Quantity}})$$

Throughout this section, a "Null" value in the table reflects less than five customer responses. For confidentiality reasons, results for less than five responses are not displayed. Customers with more than one installed measure and different survey responses by measure will appear multiple times in the table, resulting in a customer total greater than the number of customers interviewed.

The free-ridership-based attribution ratios shown in Table 2-1 above include vendor influence for the commercial and multifamily segments. In the section below, the tables do not incorporate vendor influence in order to provide insight into participant responses in isolation.

Table 2-2 represents the possible combinations of timing, efficiency, and quantity attribution. A "yes" in the timing, efficiency, or quantity column indicates partial or full FR-based attribution for that source. A "no" indicates no FR-based attribution for that source. For example, the row that has "yes" for timing, efficiency, and quantity reports the portion of the sample that indicated that the program had at least partial influence on the timing, efficiency, and quantity for that measure. For some measures, efficiency or quantity may not be applicable questions; for the purposes of this table, the not applicable measures are included as "no" on the non-applicable dimension.

The table shows the number of customers, measures, and savings that fall into each timing, efficiency, and quantity combination. The percentage of sample-weighted m³ savings shows the portion of population annual m³ savings represented by that category.



The table shows that a majority (93%) of program savings were at least partially influenced by the utility (excluding those customers influence through a vendor). Timing is the most common reflection of program influence, with respondents reporting that approximately 90% of the program savings were accelerated by the program. Efficiency affects approximately 13% of the program savings, and the program influenced quantity for approximately 19% of program savings.

Table 2-2. Overview of the sources of attribution for Commercial custom program, excluding vendor-based attribution*

Timing	Efficiency	Quantity	Sample Custs	Sample Meas	Percent of Weighted M3
Yes	Yes	Yes	Null	Null	4%
		No	6	6	7%
	No	Yes	6	7	13%
		No	18	19	66%
No	Yes	No	Null	Null	2%
	No	Yes	Null	Null	2%
		No	8	8	7%

■ Partial or Full Attribution ■ No Attribution

* Because of confidentiality reasons and "Null" table entries, the sum of sample customers and sample measures in this table may not match the sum of sample customers and sample measures in other tables.

2.2.1 Timing component

Respondents answered a sequence of questions that addresses the timing of the equipment installation. (See APPENDIX H for the full survey instrument.) First, respondents answered the likelihood of installing the same type of equipment at the same time without the program (DAT1a). Respondents who answered "Later" specified the number of months later in the next question (DAT1b).⁷ During the acceleration period, the energy savings for early replacement installations includes additional savings credit which reflects the utility-influenced replacement of older, less efficient equipment.

More than 10 customers, accounting for 11% of program savings, said they would have installed their measure(s) at the same time. Projects representing approximately 48% of savings received full attribution by answering that they either never would have installed the measure (20% of savings), would have delayed the project by 48 months or more (15% of savings), or would have delayed the project by between 24 months and 48 months (13%). The remaining 42% of savings received partial timing attribution (Table 2-3).

⁷ See the Scope of Work attached in APPENDIX H for the detailed scoring algorithm.



Table 2-3. Determining the acceleration period, Commercial custom program, excluding vendor-based attribution *†

DAT1a. Without the utility when would you have performed the measure?

DAT1b. Approximately how much later?

DAT1a	DAT1b	Timing Attribution	Sample Custs	Sample Meas	Percent of Weighted M3
Same Time	N/A	0%	10	10	11%
Later	Months <24	ER baseline credit for months accelerated	11	11	31%
	24≤ Months <48	100% ER baseline credit	Null	Null	13%
	Months ≥48	100% ER baseline credit	7	9	15%
	Don't Know/Refused	ER baseline credit for avg. of DAT1b	Null	Null	10%
Never	N/A	100%	Null	Null	20%
Don't Know/Refused	N/A	ER baseline credit for avg. of DAT1a	Null	Null	1%

■ No Timing Attribution

■ Full or Partial Timing Attribution

* Because of confidentiality reasons and "Null" table entries, the sum of sample customers and sample measures in this table may not match the sum of sample customers and sample measures in other tables.

†ER is an acronym for early replacement. N/A represents not applicable.

2.2.2 Efficiency component

Respondents answered a sequence of questions that address the utility's influence on the efficiency level of the installed equipment. (See APPENDIX H for the full survey instrument.) First, respondents were asked whether they would have installed the same level of efficiency without the utility (DAT2a). Respondents who answered that they would have installed a less efficient option answered two follow-up questions: first, "What would you have installed?" (DAT2c), followed by the scored follow-up question (DAT2b) to put their answer into a predetermined category. DAT2c was used to confirm the responses to DAT2b.

The utility had limited influence on efficiency (Table 2-4). Most of the survey respondents (59% of savings) said the utility had no influence on the efficiency level of the equipment installed. Respondents who indicated the utility improved the efficiency level of their measures accounted for approximately 12% of program savings. The remaining respondents, accounting for 29% of program savings, either did not know or did not respond to efficiency attribution.



Table 2-4. Determining efficiency attribution, Commercial custom program, excluding vendor-based attribution*†

DAT2a. Without the utility, would you have installed the same efficiency, lesser or greater?

DAT2b. What efficiency would you have installed?

DAT2a	DAT2b	Efficiency Attribution	Sample Custs	Sample Meas	Percent of Weighted M3
Same	N/A	0%	20	21	59%
Lower	Baseline Efficiency	100%	Null	Null	6%
	Between Baseline and Installed Efficiency	50%	Null	Null	3%
	Don't Know/Refused	Average of Dat2b	Null	Null	3%
Not Applicable	N/A	Not Asked	11	14	29%

■ No Efficiency Attribution

■ Full or Partial Efficiency Attribution

* Because of confidentiality reasons and "Null" table entries, the sum of sample customers and sample measures in this table may not match the sum of sample customers and sample measures in other tables.

† N/A represents not applicable.

2.2.3 Quantity component

Respondents answered a sequence of questions that addressed the utility's effects on the quantity or size of the equipment installed. (See APPENDIX H for the full survey instrument.) First, respondents were asked whether they would have installed the same amount of equipment (or capacity for measures for which quantity is less relevant, such as boilers) without the utility (DAT3a). Respondents who answered that they would have installed less (or in some cases more/larger) equipment answered a follow-up question (DAT3b) to specify how the utility changed the amount/size that they installed.

The program had limited influence on the quantity of measures installed. Twenty customers, accounting for 49% of program savings, said they would have purchased the same quantity of equipment without the program (Table 2-5). Customers representing 4% of program savings received partial attribution. Another 33% of savings were from measures for which quantity is not applicable. Examples of not applicable measures include building automation systems, a roof, or a system optimization.



Table 2-5. Determining quantity/size attribution, Commercial custom program, excluding vendor-based attribution*†

DAT3a. Without the utility would you have installed the same amount, more or less?

DAT3b. What amount would you have installed?

DAT3a	DAT3b	Quantity Attribution	Sample Custs	Sample Meas	Percent of Weighted M3
Same	N/A	0%	20	20	49%
Less/Fewer/Smaller	Don't Know/Refused	Average of dat3b	Null	Null	1%
	Partial change	0%<Value<100%	Null	Null	3%
None	N/A	100%	Null	Null	14%
Not Applicable	N/A	Not Asked	14	14	33%

■ No Quantity Attribution

■ Full or Partial Quantity Attribution

* Because of confidentiality reasons and "Null" table entries, the sum of sample customers and sample measures in this table may not match the sum of sample customers and sample measures in other tables.

† N/A represents not applicable.

2.3 Vendor attribution

Evaluation interviews with the Enbridge program teams indicated that the program design for the Commercial and Multi-Residential segments focuses on working with and influencing vendors who in turn influence customers in their DSM project decisions. Since the other programs and segments are focused on selling DSM directly to customers, not through influencing vendors, it was decided in consultation with the EAC to focus vendor survey resources on designing an approach specific to these Enbridge segments.

The FR participant interviews included a series of framing questions that served to help respondents think through the decision-making process for their projects. Through the responses to these questions, the interview was able to identify projects where a vendor played a role in the decision making. This data was collected for each program and was used to trigger vendor interviews.

Across all programs and segments, vendors play a role in the decision making for most projects. This indicates that there could be opportunity for programs to increase net savings through proactively working with vendors as is the case with these segments' program strategy.

The tables below show the results for the data collected from vendors associated with 2024 program participation. Due to low sample sizes these data were combined with data collected from vendors associated with 2023 program participation to impute vendor attribution for 2024 sampled measures that had vendor effect, but no vendor interview was completed with the vendor for that measure.

Table 2-6 shows that more than half the sampled participants in the Institutional segment indicated that a vendor was involved in their decision making on the project.



Table 2-6. Vendor interviews for Custom Commercial – Institutional program

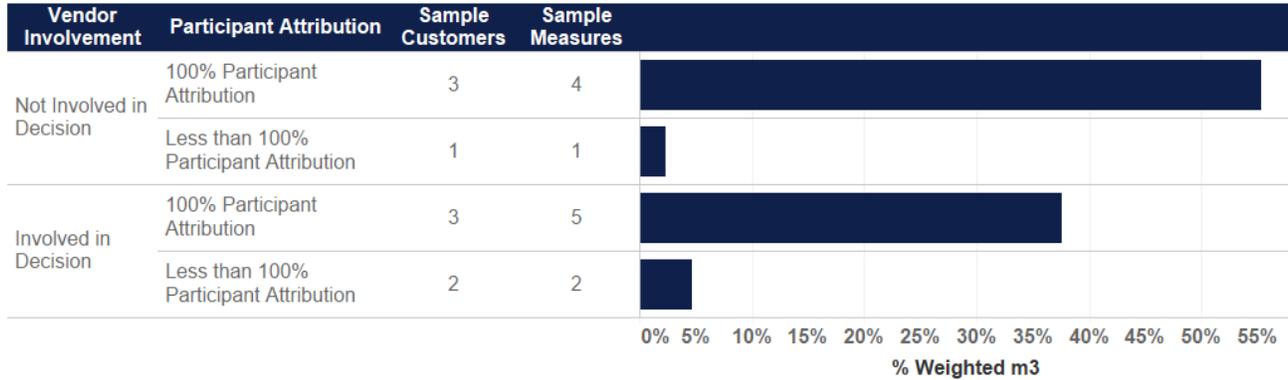


Table 2-7 and Table 2-8 show that more than half the sampled measures in the Commercial and Multi-Residential segments had vendor involvement in project decision making.

Table 2-7. Vendor interviews for Custom Commercial – Commercial program

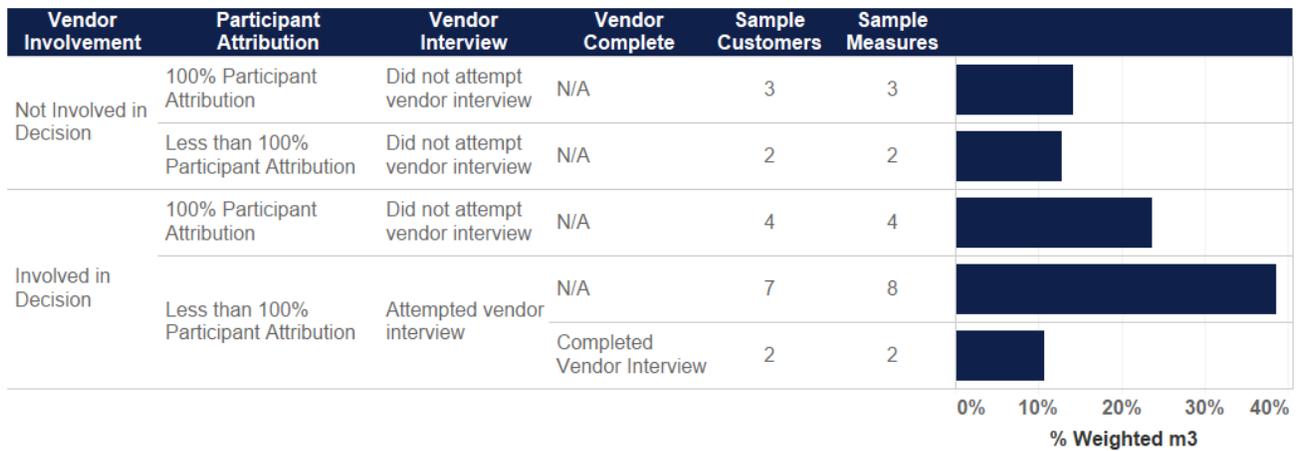


Table 2-8. Vendor interviews for Custom Commercial – Market Rate Multi-Residential program



Table 2-9 shows that vendor attribution increased attribution by 6 percentage points for the Commercial segment and by 8 percentage points for the Multi-Residential segment. The results for these segments indicate that Enbridge is affecting



vendor recommendations and that customers, particularly in the multifamily segment, rely on vendor involvement in making equipment and maintenance decisions.

Table 2-9. Free-ridership-based attribution with and without vendors for Commercial and Multi-Residential segments

Segment	Approach	Free-ridership based-attribution	Lower bound at 90% confidence	Upper bound at 90% confidence
Commercial	Vendor Included	77%	66%	89%
	Without Vendor	71%	58%	85%
Market Rate Multi-Residential	Vendor Included	64%	49%	79%
	Without Vendor	56%	40%	73%

Table 2-10 and Table 2-11 shows the dimensions of attribution where Enbridge’s effect on vendors had the most impact. Efficiency was the most common dimension affected, which is the expected result: vendors cannot affect timing for replace on burnout measures and quantity/size is often pre-determined by site needs as well. Many measures received no increase (8 commercial and 6 multi residential) as the vendor effect was lower than the direct Enbridge attribution on the dimensions where Enbridge affected their vendor.

Table 2-10. Overview of the sources of vendor attribution – Commercial program

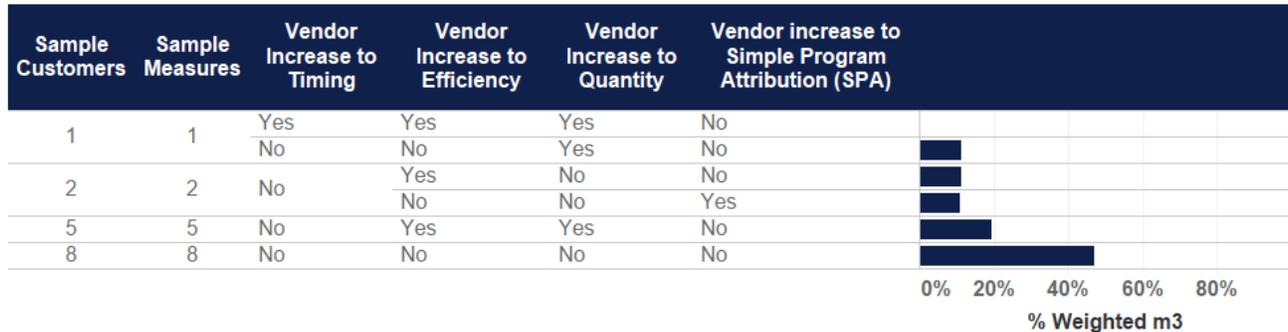
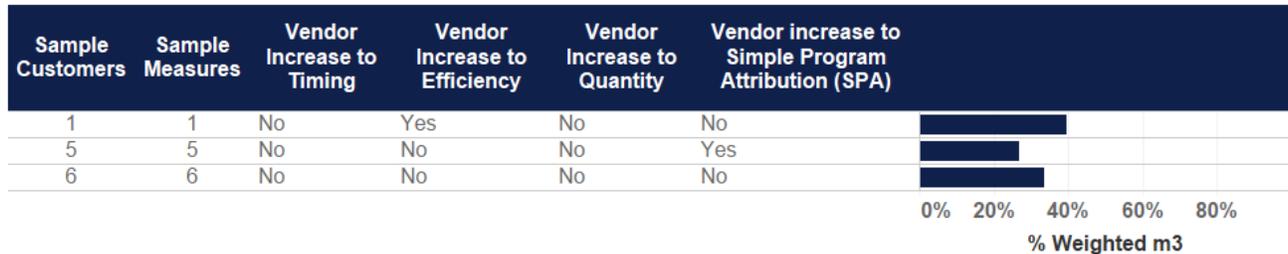


Table 2-11. Overview of the sources of vendor attribution – Market Rate Multi-Residential program





3 INDUSTRIAL CUSTOM PROGRAM

Enbridge’s custom DSM program for industrial customers encourages customers to reduce their natural gas consumption by recommending and incentivizing energy saving projects and actions.

This custom program differs from the prescriptive programs by providing additional technical support for projects and financial incentives based on overall natural gas savings realized by the customer rather than a per-unit incentive.⁸

3.1 Free-ridership-based attribution rate

The FR-based attribution ratio represents the ratio of the savings influenced by the utility (considering only free-ridership, not spillover) to the program savings, as shown in the following equation. The methods used to determine evaluation-verified savings are presented in a separate report.⁹ A 90% FR-based attribution ratio means the utility-influenced savings (considering only free-ridership) were 90% of the evaluation verified savings.

$$\text{free – ridership – based attribution} = \frac{\text{Utility influenced savings considering only free – ridership, not spillover}}{\text{Program savings}}$$

Table 3-1 shows the FR-based attribution ratio by domain for the Enbridge Custom Industrial programs. The table shows the FR-based attribution ratio, statistical precision at the 90% confidence interval, the program-claimed population first year m³ savings, and percent of program savings for each customer segment. The percent of program savings represents the relative contribution that each customer segment makes to the overall result.

The ratio result is based on an overall sample size of 31 customers and 38 measures. Additional details on stratification, sample size, and population size are provided in APPENDIX C. Additional statistical details for the results are provided in APPENDIX E. The Enbridge free-ridership-based attribution rate is 54% for the Agricultural segment and 73% for the Industrial segment.

Vendor attribution was studied for Agricultural projects due to the design of the program for this segment, which included significant vendor outreach and efforts to influence vendor business practices to increase sales of gas saving measures. Vendor attribution was not studied for the industrial segment as the program design did not include similar vendor efforts. APPENDIX F provides more detail on the vendor attribution. For the Agricultural segment, we did not find any Enbridge effect on vendors. Despite attempting a census of the 4 triggered vendors, our completed sample only included one vendor and one measure, which is too small of a sample to draw any long-term conclusions as to the broader Enbridge effect on vendors for this segment.

Table 3-1. Free-ridership-based attribution ratio for Industrial custom program*

Segment	Free-ridership-based attribution	Sample customers	Sample measures	± at 90% confidence (FPC on)	Population m ³ savings	Percent population m ³ savings
Agricultural	53.92%	14	20	22%	36,831,702	45%
Industrial	72.72%	17	18	11%	44,551,347	55%
Industrial program overall	64.45%	31	38	13%	81,383,049	100%

* The table shows statistical precision (± at 90% confidence factor) that does include the effects of a finite population correction factor. See Appendix B for more information

⁸ Enbridge’s Annual Report provides a more detailed description of the program and can be found here: <https://www.oeb.ca/sites/default/files/OEB-Annual-Report-2022-2023-EN.pdf>

⁹ 2023 Natural Gas Demand Side Management Custom Savings Verification. Prepared for The Ontario Energy Board by DNV, November 25, 2024.



3.2 Components of free-ridership-based attribution

The FR-based attribution rate for each measure is calculated based on participant survey responses to questions regarding the utility's influence on the timing, quantity, and efficiency of the measure installed. This section reports the program's effect on each component and provides an indication of which aspects of the projects show the greatest utility influence.

- **Timing** questions help us understand the impact programs had on when project installations took place by asking participants if they would have implemented measures earlier, later, or at the same time without program assistance.
- **Efficiency** questions are geared towards understanding if the equipment had been installed without program incentives and influence, would this equipment have been more or less efficient compared to what ended up getting installed through the program.
- **Quantity** questions delve into the program's influence on how many measures were installed as part of the project (if applicable based on measure type) compared to how many would have been installed without the program's influence.

The total utility effect on the measure (free ridership based attribution) is calculated by combining the scores on the three components above by multiplying the free ridership on each component (the percent not influenced) and subtracting it from one (100%) as shown in the below equation.

$$\text{Free ridership based attribution} = 100\% - (FR_{\text{Timing}} \times FR_{\text{Efficiency}} \times FR_{\text{Quantity}})$$

Throughout this section, a "Null" value in the table reflects less than five customer responses. For confidentiality reasons, results for less than five responses are not displayed. Customers with more than one installed measure and different survey responses by measure will appear multiple times in the table, resulting in a customer total greater than the number of customers interviewed.

The Free-ridership-based attribution ratios shown in Table 3-1 above include vendor influence for the Agricultural segment. In the section below, the tables do not incorporate vendor influence in order to provide insight into participant responses in isolation.

Table 3-2 represents the possible combinations of timing, efficiency, and quantity attribution. A "yes" in the timing, efficiency, or quantity column indicates partial or full FR-based attribution for that source. A "no" indicates no FR-based attribution for that source. For example, the row that has "yes" for timing, efficiency, and quantity reports the portion of the sample that indicated that the program had at least partial influence on the timing, efficiency, and quantity for that measure. For some measures, efficiency or quantity may not be applicable questions; for the purposes of this table, the not applicable measures are included as "no" on the non-applicable dimension.

The table shows the number of customers, measures, and savings that fall into each timing, efficiency, and quantity combination. The percentage of sample-weighted m³ savings shows the portion of population annual m³ savings represented by that category.

The table shows that approximately the majority (74%) of program savings were at least partially influenced by the utility. Timing is the most common reflection of program influence, with respondents reporting that approximately 58% of the program savings were accelerated by the program. Efficiency affects approximately 46% of the program savings, and the program influenced quantity for approximately 29% of program savings.

Table 3-2. Overview of the sources of attribution for Industrial custom program*†

Timing	Efficiency	Quantity	Sample Custs	Sample Meas	Percent of Weighted M3
Yes	Yes	Yes	Null	Null	11%
		No	6	8	21%
	No	Yes	Null	Null	6%
		No	7	7	20%
No	Yes	Yes	Null	Null	10%
		No	Null	Null	4%
	No	Yes	Null	Null	2%
		No	8	10	26%

■ Partial or Full Attribution ■ No Attribution

* Because of confidentiality reasons and “Null” table entries, the sum of sample customers and sample measures in this table may not match the sum of sample customers and sample measures in other tables.

† The study team attempted to explore vendor influence for Ag, but the completed sample was too small to draw any conclusions from.

3.2.1 Timing component

Respondents answered a sequence of questions that addresses the timing of the equipment installation. (See APPENDIX H for the full survey instrument.) First, respondents answered the likelihood of installing the same type of equipment at the same time without the program (DAT1a). Respondents who answered “Later” specified the number of months later in the next question (DAT1b).¹⁰ During the acceleration period, the energy savings for early replacement installations includes additional savings credit, which reflects the utility-influenced replacement of older, less efficient equipment.

The timing component was strongly influenced by the utility. Respondents representing 57% of savings indicated they would never have installed the measure or would have done so later. Twelve (12) customers, accounting for 42% of program savings, said they would have installed their measure(s) at the same time. Projects representing approximately 36% of savings received full attribution by answering that they either never would have installed the measure (22% of savings), would have delayed the project by 48 months or more (2% of savings), or would have delayed the project by between 24 months and 48 months (12%). The remaining 21% of savings received partial timing attribution (Table 3-3).

¹⁰ See the Scope of Work attached in APPENDIX H for the detailed scoring algorithm.



Table 3-3. Determining the acceleration period, Industrial custom programs*†‡

DAT1a. Without the utility when would you have performed the measure?

DAT1b. Approximately how much later?

DAT1a	DAT1b	Timing Attribution	Sample Custs	Sample Meas	Percent of Weighted M3
Same Time	N/A	0%	12	14	42%
Later	Months <24	ER baseline credit for months accelerated	Null	Null	15%
	24≤ Months <48	100% ER baseline credit	Null	Null	12%
	Months ≥48	100% ER baseline credit	Null	Null	2%
	Don't Know/Refused	ER baseline credit for avg. of DAT1b	Null	Null	6%
Never	N/A	100%	10	13	22%

■ No Timing Attribution

■ Full or Partial Timing Attribution

* Because of confidentiality reasons and "Null" table entries, the sum of sample customers and sample measures in this table may not match the sum of sample customers and sample measures in other tables.

†ER is an acronym for early replacement. N/A represents not applicable.

‡ The study team attempted to explore vendor influence for Ag, but the completed sample was too small to draw any conclusions from.

3.2.2 Efficiency component

Respondents answered a sequence of questions that address the utility's influence on the efficiency level of the installed equipment. (See APPENDIX H for the full survey instrument.) First, respondents were asked whether they would have installed the same level of efficiency without the utility (DAT2a). Respondents who answered that they would have installed a less efficient option answered two follow-up questions: first "what would you have installed," (DAT2c) followed by the scored follow-up question (DAT2b) to put their answer into a predetermined category. DAT2c was used to confirm the responses to DAT2b.

The utility's influence on efficiency is shown in Table 3-4. Respondents representing 36% of savings said the utility had no influence on the efficiency level of the equipment installed. Respondents who indicated the utility improved the efficiency level of their measures accounted for approximately 43% of program savings.



Table 3-4. Determining efficiency attribution, Industrial custom program*†‡

DAT2a. Without the utility, would you have installed the same efficiency, lesser or greater?

DAT2b. What efficiency would you have installed?

DAT2a	DAT2b	Efficiency Attribution	Sample Custs	Sample Meas	Percent of Weighted M3
Same	N/A	0%	10	11	36%
Lower	Baseline Efficiency	100%	Null	Null	13%
	Between Baseline and Installed Efficiency	50%	7	8	30%
Don't Know/Refused	N/A	Average of dat2a	Null	Null	4%
Not Applicable	N/A	Not Asked	11	11	17%

■ No Efficiency Attribution

■ Full or Partial Efficiency Attribution

* Because of confidentiality reasons and "Null" table entries, the sum of sample customers and sample measures in this table may not match the sum of sample customers and sample measures in other tables.

† N/A represents not applicable.

‡ The study team attempted to explore vendor influence for Ag, but the completed sample was too small to draw any conclusions from.

3.2.3 Quantity component

Respondents answered a sequence of questions that addressed the utility's effects on the quantity or size of the equipment installed. (See APPENDIX H for the full survey instrument.) First, respondents were asked whether they would have installed the same amount of equipment (or capacity for measures for which quantity is less relevant, such as boilers) without the utility (DAT3a). Respondents who answered that they would have installed less (or in some cases more/larger) equipment answered a follow-up question (DAT3b) to specify how the utility changed the amount/size that they installed.

The program had some influence on the quantity of measures installed. Customers representing 29% of program savings received either partial attribution (6% of savings) or full attribution (23%). Eight customers, accounting for 17% of program savings, said they would have purchased the same quantity of equipment without the program (Table 3-5). Another 55% of savings were from measures for which quantity is not applicable. Examples of not applicable measures include building automation systems, a roof, or a system optimization.

Table 3-5. Determining quantity/size attribution, Industrial custom program*†‡

DAT3a. Without the utility would you have installed the same amount, more or less?

DAT3b. What amount would you have installed?

DAT3a	DAT3b	Quantity Attribution	Sample Custs	Sample Meas	Percent of Weighted M3
Same	N/A	0%	8	8	17%
Less/Fewer/Smaller	Don't Know/Refused	Average of dat3b	Null	Null	2%
	Partial change	0%<Value<100%	Null	Null	4%
None	N/A	100%	6	8	23%
Not Applicable	N/A	Not Asked	16	19	55%

■ No Quantity Attribution

■ Full or Partial Quantity Attribution

* Because of confidentiality reasons and "Null" table entries, the sum of sample customers and sample measures in this table may not match the sum of sample customers and sample measures in other tables.

† N/A represents not applicable.

‡ The study team attempted to explore vendor influence for Ag, but the completed sample was too small to draw any conclusions from.

3.3 Vendor attribution

Evaluation interviews with the Enbridge program teams indicated that the program design for the Agricultural segment focuses on working with and influencing vendors who in turn influence customers in their DSM project decisions. Since the Industrial segment is focused on selling DSM directly to customers, not through influencing vendors, it was decided in consultation with the EAC to focus vendor survey resources on designing an approach specific to the Agricultural segment.

The FR participant interviews included a series of framing questions that served to help respondents think through the decision-making process for their projects. Through the responses to these questions, the interview was able to identify projects where a vendor played a role in the decision making. This data was collected for each program and was used to trigger vendor interviews in the Agricultural segment.

Across all programs and segments, vendors play a role in the decision making for most projects. This indicates that there could be opportunity for programs to increase net savings through proactively working with vendors as is the case with these segments' program strategy.

Table 3-6 and Table 3-7 show the vendor interview triggers for Industrial program segments.



Table 3-6. Vendor interview trigger for Custom Industrial – Agricultural programs

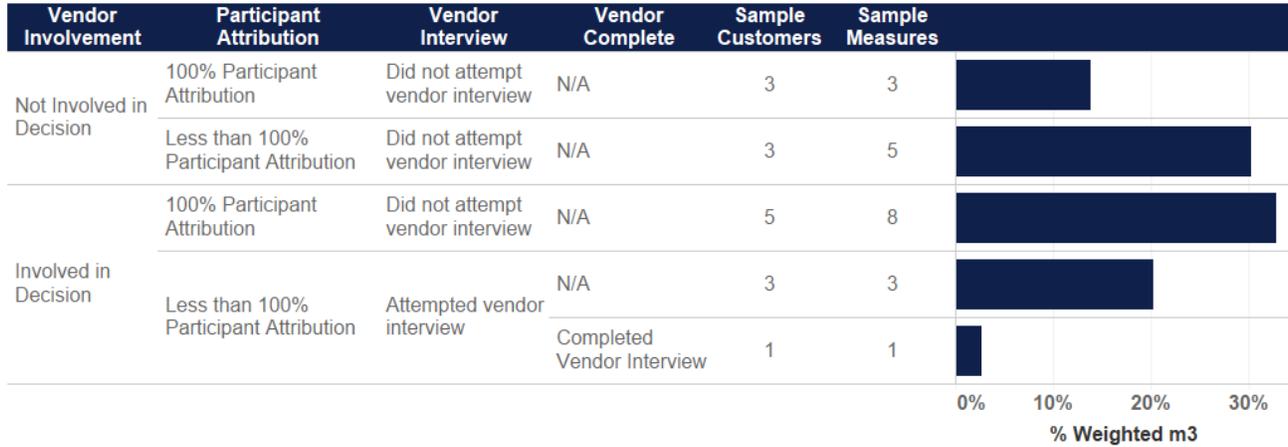
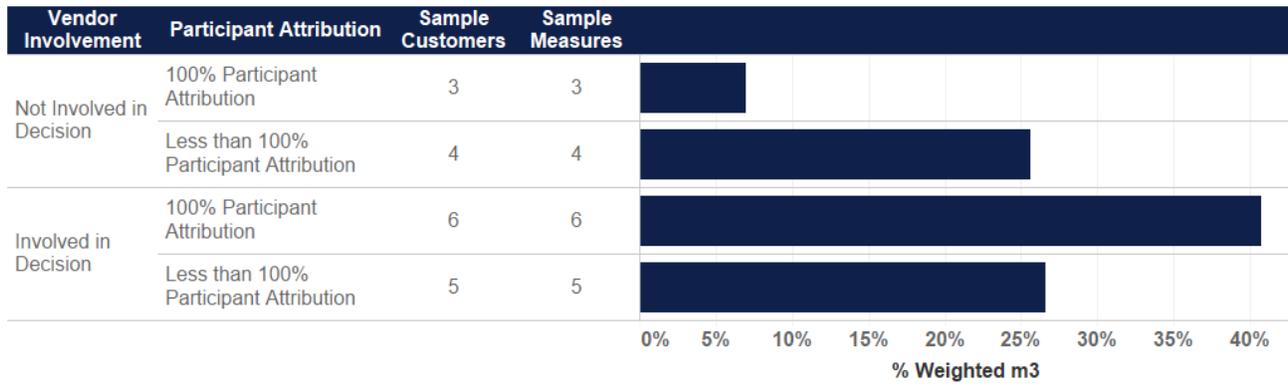


Table 3-7. Vendor interview trigger for Custom Industrial – Industrial program



Due to low sample sizes, the data collected from vendors associated with 2024 program participation were combined with data collected from vendors associated with 2023 program participation. However, neither study found any Enbridge effect on vendors for the Agricultural segment. Despite attempting a census of the triggered vendors in the 2024 sample, our completed sample only included one vendor and one measure. This vendor and the vendors interviewed in 2023 all reported no Enbridge effect.

Five vendors is too small of a sample to draw any long-term conclusions as to the broader Enbridge effect on vendors for this segment. The results of these surveys did not affect the FR rate for the Agricultural segment.



4 LARGE VOLUME

Enbridge encourages the adoption of energy efficient equipment, technologies, and actions via its Large Volume program. The Large Volume program in 2024 was applicable to customers in Rate T2/Rate 100 in the Union rate zones.

The program uses a direct access budget mechanism for the customer incentive budget process. This mechanism collected funds from each customer through rates. Customers must use these funds to identify and implement energy efficiency projects, or the funds can be used by other customers in the same rate class. This “use it or lose it” approach ensures each customer has first access to the amount of incentive budget funded by their rates. The Large Volume program is the only “direct access” program offered in Ontario.¹¹

Custom projects implemented as part of this program and claimed in 2024 were included in this study.

4.1 Free-ridership-based attribution rate

The FR-based attribution ratio represents the ratio of the savings influenced by the utility (considering only free-ridership, not spillover) to the program savings, as shown in the following equation. The methods used to determine evaluation verified savings are presented in a separate report.¹² A 90% FR-based attribution ratio means the utility influenced savings (considering only free-ridership) were 90% of the evaluation verified savings.

$$\text{free – ridership – based attribution} = \frac{\text{Utility influenced savings considering only free – ridership, not spillover}}{\text{Program savings}}$$

Table 4-1 shows the FR-based attribution ratio for the Large Volume program. The table shows the FR-based attribution ratio, statistical precision at the 90% confidence interval, the program-claimed population first year m³ savings, and percent of program savings.

The ratio result is based on an overall sample size of 6 customers and 11 measures. Additional details on stratification, sample size, and population size are provided in APPENDIX C. Additional statistical details for the results are provided in APPENDIX E.

The Large Volume program had the lowest FR-based attribution among the three programs. This program faces unique challenges to increasing attribution, including the direct access budget mechanism, low gas rates for participating customers, and measures that typically address maintenance concerns. The result is often projects with very low or very high simple payback periods, which often have low FR-based attribution.

Table 4-1. Free-ridership-based attribution ratio for Large Volume *

Segment	Sample customers	Sample measures	Free-ridership-based attribution	± at 90% confidence (FPC on)	Population m ³ savings	Percent population m ³ savings
Large Volume Program Overall	14.51%	6	11	6%	48,089,060	100%

* The table shows statistical precision (± at 90% confidence factor) that does not include the effects of a finite population correction factor. See APPENDIX B for more information.

¹¹ Enbridge’s Annual Report provides a more detailed description of the program and can be found here: <https://www.oeb.ca/sites/default/files/OEB-Annual-Report-2022-2023-EN.pdf>

¹² 2023 Natural Gas Demand Side Management Custom Savings Verification. Prepared for The Ontario Energy Board by DNV, November 25, 2024.

4.2 Components of free-ridership-based attribution

The FR-based attribution rate for each measure is calculated based on participant survey responses to questions regarding the utility’s influence on the timing, quantity, and efficiency of the measure installed. This section reports the program’s effect on each component and provides an indication of which aspects of the projects show the greatest utility influence.

- **Timing** questions help us understand the impact programs had on when project installations took place by asking participants if they would have implemented measures earlier, later, or at the same time without program assistance.
- **Efficiency** questions are geared towards understanding if the equipment had been installed without program incentives and influence, would this equipment have been more or less efficient compared to what ended up getting installed through the program.
- **Quantity** questions delve into the program’s influence on how many measures were installed as part of the project (if applicable based on measure type) compared to how many would have been installed without the program’s influence.

The total utility effect on the measure (free ridership based attribution) is calculated by combining the scores on the three components above by multiplying the free ridership on each component (the percent not influenced) and subtracting it from one (100%) as shown in the below equation.

$$\text{Free ridership based attribution} = 100\% - (FR_{\text{Timing}} \times FR_{\text{Efficiency}} \times FR_{\text{Quantity}})$$

Throughout this section, a “Null” value in the table reflects less than five customer responses. For confidentiality reasons, results for less than five responses are not displayed. Customers with more than one installed measure and different survey responses by measure will appear multiple times in the table, resulting in a customer total greater than the number of customers interviewed.

Table 4-2 represents the possible combinations of timing, efficiency, and quantity attribution. A “yes” in the timing, efficiency, or quantity column indicates partial or full FR-based attribution for that source. A “no” indicates no FR-based attribution for that source. For example, the row that has “yes” for timing, efficiency, and quantity reports the portion of the sample that indicated that the program had at least partial influence on the timing, efficiency, and quantity for that measure. For some measures, efficiency or quantity may not be applicable questions; for the purposes of this table, the not applicable measures are included as “no” on the non-applicable dimension.

The table shows the number of customers, measures, and savings that fall into each timing, efficiency, and quantity combination. The percentage of sample-weighted m³ savings shows the portion of population annual m³ savings represented by that category.

The table shows that about one-third of program participation (~30% of savings) was at least partially influenced by the utility. Timing is the most common reflection of program influence, with respondents reporting that approximately 10% of the program savings were accelerated by the program. The utility influenced the quantity/size of approximately 20% of the savings but had no influence on the efficiency levels.

Table 4-2. Overview of the sources of attribution for Large Volume*

Timing	Efficiency	Quantity	Sample Custs	Sample Meas	Percent of Weighted M3
Yes	No	No	Null	Null	10%
No	No	Yes	Null	Null	20%
		No	Null	Null	70%

■ Partial or Full Attribution ■ No Attribution

* Because of confidentiality reasons and “Null” table entries, the sum of sample customers and sample measures in this table may not match the sum of sample customers and sample measures in other tables.

4.2.1 Timing component

Respondents answered a sequence of questions that address the timing of the equipment installation. (See APPENDIX H for the full survey instrument.) First, respondents answered the likelihood of installing the same type of equipment at the same time without the utility (DAT1a). Respondents who answered “Later” specified the number of months later in the next question (DAT1b).¹³ During the acceleration period, the energy savings for early replacement installations includes additional savings credit which reflects the utility-influenced replacement of older, less efficient equipment.

The vast majority surveyed customers, accounting for 90% of program savings, said they would have installed their measure(s) at the same time. Customers representing approximately 10% of savings indicated some amount of utility acceleration on at least one measure but didn’t know how much (Table 4-3).¹⁴

Table 4-3. Determining the acceleration period, Large Volume*†

DAT1a. Without the utility when would you have performed the measure?
 DAT1b. Approximately how much later?

DAT1a	DAT1b	Timing Attribution	Sample Custs	Sample Meas	Percent of Weighted M3
Same Time	N/A	0%	Null	Null	90%
Later	Don't Know/Refused	ER baseline credit for avg. of DAT1b	Null	Null	10%

■ No Timing Attribution ■ Full or Partial Timing Attribution

* Because of confidentiality reasons and “Null” table entries, the sum of sample customers and sample measures in this table may not match the sum of sample customers and sample measures in other tables.

†ER is an acronym for early replacement. N/A represents not applicable.

4.2.2 Efficiency component

Respondents answered a sequence of questions that address the utility’s influence on the efficiency level of the installed equipment. (See APPENDIX H for the full survey instrument.) First, respondents were asked whether they would have installed the same level of efficiency without the utility (DAT2a). Respondents who answered that they would have installed

¹³ See the Scope of Work attached in APPENDIX H for the detailed scoring algorithm.

¹⁴ None of the sites with acceleration knew how much later the measure would have been performed. In these cases, DNV imputed the average from the 2023 NTG study.



a less efficient option answered two follow-up questions: first “what would you have installed,” (DAT2c) followed by the scored follow-up question (DAT2b) to put their answer into a predetermined category. DAT2c was used to confirm the responses to DAT2b.

The utility had no influence on efficiency, affecting none of the program savings (Table 4-4).

Table 4-4. Determining efficiency attribution, Large Volume*†

DAT2a. Without the utility, would you have installed the same efficiency, lesser or greater?
 DAT2b. What efficiency would you have installed?

DAT2a	DAT2b	Efficiency Attribution	Sample Custs	Sample Meas	Percent of Weighted M3
Same	N/A	0%	Null	Null	68%
Not Applicable	N/A	Not Asked	Null	Null	32%

■ No Efficiency Attribution

* Because of confidentiality reasons and “Null” table entries, the sum of sample customers and sample measures in this table may not match the sum of sample customers and sample measures in other tables.
 † N/A represents not applicable.

4.2.3 Quantity component

Respondents answered a sequence of questions that addressed the utility’s effects on the quantity or size of the equipment installed. (See APPENDIX H for the full survey instrument.) First, respondents were asked whether they would have installed the same amount of equipment (or capacity for measures for which quantity is less relevant, such as boilers) without the utility (DAT3a). Respondents who answered that they would have installed less (or in some cases more/larger) equipment answered a follow-up question (DAT3b) to specify how the utility changed the amount/size that they installed.

The utility had little influence on the quantity of measures installed, only partially affecting 20% of the program savings (Table 4-5). Projects representing 80% of program savings received no quantity attribution by answering that they would have installed the same quantity (49% of savings) or were from measures for which quantity is not applicable (31% of savings). Examples of not applicable measures include building automation systems, a roof, or a system optimization.



Table 4-5. Determining quantity/size attribution, Large Volume*†

DAT3a. Without the utility would you have installed the same amount, more or less?

DAT3b. What amount would you have installed?

DAT3a	DAT3b	Quantity Attribution	Sample Custs	Sample Meas	Percent of Weighted M3
Same	N/A	0%	Null	Null	49%
Less/Fewer/Smaller	Don't Know/Refused	Average of dat3b	Null	Null	19%
	Partial change	0%<Value<100%	Null	Null	0%
Not Applicable	N/A	Not Asked	Null	Null	31%

■ No Quantity Attribution

■ Full or Partial Quantity Attribution

* Because of confidentiality reasons and "Null" table entries, the sum of sample customers and sample measures in this table may not match the sum of sample customers and sample measures in other tables.

† N/A represents not applicable.

4.3 Vendor attribution

Evaluation interviews with the Enbridge program teams indicated that the program design for the Large Volume segment does not focus on working with and influencing vendors who in turn influence customers in their DSM project decisions. Vendor surveys were not completed for this Large Volume customers.

Across all programs and segments, vendors play a role in the decision making for most projects. This indicates that there could be opportunity for programs to increase net savings through proactively working with vendors as is the case with these segments' program strategy.

Table 4-6 shows that most projects in the Large Volume program indicated that a vendor was involved in their decision making on the project.

Table 4-6. Vendor interview trigger for Large Volume

Vendor Involvement	Participant Attribution	Sample Customers	Sample Measures										
Not Involved in Decision	Less than 100% Participant Attribution	1	2										
Involved in Decision	Less than 100% Participant Attribution	5	9										
				0%	10%	20%	30%	40%	50%	60%	70%	80%	90%
				% Weighted m3									

5 FINDINGS AND RECOMMENDATIONS

Table 5-1 presents the key findings and recommendations from the study. The table shows the party to whom the recommendation applies and the primary beneficial outcome of the recommendation. We classified outcomes into four categories: reduce costs, increase savings, increase (or maintain) customer satisfaction, and decrease risk (multiple types of risk are in this category including risk of adjusted savings, risk to budgets or project schedules, and others). Details of the findings, recommendations, and outcomes follow the table. All recommendations address energy savings and program performance.

Table 5-1. Recommendations summary table

#	Energy savings and program performance		Applies to		Primary beneficial outcome			
	Finding	Recommendation	Enbridge	Evaluation	Reduce costs	Increase savings	Customer satisfaction	Decrease risk
1	FR-based attribution in the programs can vary by more than 10 percent across studies for the same program	Evaluate free-ridership for the programs annually and couple the free-ridership evaluation with process evaluation		✓		✓		
2	FR-based attribution for the programs came primarily through acceleration	Consider strategies to have greater impact on increasing efficiency and amount (where applicable) of measures	✓			✓		
3	Many customers with high FR report involving Enbridge late in the process	Consider strategies to reduce customers taking advantage of the rebate for projects that are already fully decided upon.	✓			✓		✓
4	Return on Investment is mentioned consistently by customers and vendors as a key metric	Continue emphasis on ROI effect of incentives with customers. Consider helping to quantify kWh, water and other non-energy benefits of projects to sell projects that do not pass ROI on gas savings alone	✓			✓		
5	Reducing Carbon is a driver for some customers	Continue to leverage Carbon effects as part of the package to motivate customers to participate	✓			✓		
6	The Large Volume program has high free ridership	Consider the high free-ridership within the context of the cost effectiveness of the program. High free rider programs can still deliver meaningful cost-effective net savings.						
		Conduct a process evaluation to improve Large Volume influence on customer projects	✓			✓	✓	✓
		Consider limiting the measure types or payback periods that are eligible for Large Volume incentives	✓			✓	✓	✓

#	Energy savings and program performance		Applies to		Primary beneficial outcome			
	Finding	Recommendation	Enbridge	Evaluation	Reduce costs	Increase savings	Customer satisfaction	Decrease risk
7	Vendor attribution increased program attribution significantly for the Enbridge Commercial and Multifamily Segments	Consider expanding approaches to market for other programs that leverage third-party vendors.	✓		✓	✓		
8	Vendor attribution data collection resulted in fewer completed interviews than desired (due to small sample size).	Consider interviewing participating vendors independent of the participating customer sample and recruitment.		✓		✓		✓
9	In the attribution scoring methodology, timing assumptions, specifically the number of years assumed for “never would have implemented” have a significant effect on FR-based attribution.	Consider studying the typical planning horizons for each of the customer segments. The assumed planning horizon for companies is used in the scoring to determine at what point the program receives full influence credit for accelerating a measure’s implementation.		✓				✓

Finding 1: FR-based attribution for the programs can vary by more than 10 percent across studies for the same program .

- **Recommendation 1:** Consistent evaluation of free-ridership coupled with process evaluation will help identify specific ways for each program to manage and reduce free-ridership. Consistent measurement of free-ridership early in the next DSM framework can help Enbridge and stakeholders to understand what is working to drive net savings and provide lessons for continuous improvement.
- **Outcome 1:** Effective free-ridership management will allow the programs to continue to increase their net savings in future years.

Finding 2: FR-based attribution for the programs (with the exception of Large Volume) came primarily through acceleration rather than changes in efficiency or quantity. Acceleration periods tend to be considerably shorter than the estimated useful life (EUL) of a measure which has a significant effect on net cumulative gross savings even if it is less detrimental to the current framework’s first year gas savings goals. Acceleration of measures is less valuable to societal and provincial goals than changes in efficiency and quantity due to its short-term effect.

- **Recommendation 2:** Program goals in the current framework are first-year gas savings rather than cumulative savings, so this recommendation will not have significant effect on stated program goals on which shareholder incentives are based, but will have significant effect on the overall value of the program impacts. To ensure the programs continue to deliver significant cumulative net savings and to mitigate risk of a low weighted average measure life (WAML), the utilities should continue to:
 - Identify unique solutions that save energy at customer plants
 - Expand promotion of energy efficiency measures with low market penetration

- Motivate customers to increase the scope of their projects. Some options include multi-measure bonuses or escalating incentive structures that pay more for doing more.
 - Promote long life measures and consider discontinuing the promotion of short-lived measures
 - Proactively upsell equipment purchases from standard to efficient products
 - Target hard -to-reach customers who have not participated in the past
 - Adopt lessons learned from the Enbridge Commercial and Multifamily approach to market, working proactively with vendors
 - Focus on promoting novel energy energy-saving solutions to industrial and agriculture customer problems. Several customers indicated that the project would not have happened without the utility because a utility representative identified a solution that they had not considered
 - Eliminating incentives for standard efficiency products in non-replace on burnout situations.
- **Outcome 2:** Additional effect on efficiency and quantity of measures will increase net savings and hedge against regulatory risk if future frameworks revert to cumulative savings metrics.

Finding 3: Some customers with high FR report involving Enbridge late in the process.

- **Recommendation 3:** Consider strategies to reduce customers taking advantage of the rebate for projects that are already fully decided upon. The program has established proactive marketing and engagement strategies in place to be involved early in the process with many of the largest customers, which helps mitigate this risk. Increasing efforts and resources in order to expand these efforts to the broader mid-size customers could be an option.
- **Outcome 3:** Continuing to enhance and expand proactive engagement approaches will reduce the percentage of free riders in the program and increase gross savings.

Finding 4: Return on Investment is mentioned consistently by customers and vendors as a key metric.

- **Recommendation 4:** Continue emphasis on ROI effect of incentives with customers. Consider increasing efforts to quantify kWh, water, and other non-energy benefits of projects to sell projects that do not pass ROI on gas savings alone.
- **Outcome 4:** Adding additional quantifiable impacts to sales pitches can help increase net savings, both through increased volume of gross savings and through more visible and memorable Enbridge support for making business case for DSM projects.

Finding 5: Reducing Carbon is a driver for some customers, due to federal, provincial or customer policies.

- **Recommendation 5:** Continue to leverage Carbon effects as part of the package to motivate customers to participate. Carbon mitigation policies will persist at many companies agnostic of government policies.
- **Outcome 5:** Leveraging Carbon and other benefits beyond gas and direct gas bill savings can help to increase and speed sales.

Finding 6: The Large Volume program has high free-ridership.

- **Recommendation 6a:** Consider the high free-ridership within the context of the cost effectiveness of the program. High free rider programs can still deliver meaningful, cost-effective net savings.
- **Outcome 6a:** The Large Volume program delivers significant net savings
- **Recommendation 6b:** Conduct a process evaluation to improve Large Volume influence on customer projects
- **Outcome 6b:** A process evaluation may uncover ways for Enbridge to drive net savings at Large Volume sites with less free-ridership.

- **Recommendation 6c:** Consider limiting the measure types or payback periods that are eligible for Large Volume incentives. Continuous maintenance projects and projects where payback is single digit months are projects that will generally get priority without program funds. Eliminating high potential free-ridership projects will enable additional funds to be targeted toward projects that require funding to get done. From a customer service standpoint, it is difficult for utilities to deny incentives to customers unless they have pre-established rules to point to. Clear rules can allow Enbridge to reject potentially poor projects without a large effect on customer satisfaction.
- **Outcome 6c:** Reducing free-rider projects will increase net savings.

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

- **Recommendation 7:** The utilities should consider what lessons can be learned from the Enbridge multifamily approach to market that is applicable to other segments. Other segments may have opportunities to leverage third-party vendors. A process evaluation that includes vendor interviews might uncover specific opportunities and approaches that would help in transferring the Enbridge multifamily lessons to other segments.
- **Outcome 7:** Effective leveraging of vendors could both increase FR-based attribution and program uptake.

Finding 8: Vendor attribution recruitment resulted in fewer completed interviews than desired.

- **Recommendation 8:** Consider interviewing participating vendors independent of the participating customer sample and recruitment. The current evaluation practice is to interview vendors that are identified as influential on customers through the participant interview, which ties the vendor and customer responses together, but also creates a challenge in project delivery since the vendor interviews cannot be started until late in participant data collection. An alternative approach would be to have an independent sample of projects to ask vendors about that could be completed in parallel with participant data collection.
- **Outcome 8:** Larger completed samples of vendors allowing for more robust estimates of Enbridge effect on vendor actions.

Finding 9: In the attribution scoring methodology, timing assumptions, specifically the number of years assumed for “never would have implemented” have a significant effect on FR-based attribution.

- **Recommendation 9:** Consider studying the typical planning horizons for Ontario businesses in each segment. Currently, the two-year and four-year assumptions offered are based more on anecdotal evidence than on data. The assumed planning horizon for companies is used in the scoring to determine at what point the program receives full influence credit for accelerating a measure’s implementation.
- **Outcome 9:** More accuracy and confidence in free-ridership-based attribution results.

APPENDIX A. GLOSSARY OF TERMS AND KEY 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.

Term	Description
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.
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."

Term	Description
Maintenance (Maint.)	Repair, maintain, or restore to prior efficiency.
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.

Term	Description
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.
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.



Term	Description
TRM	Technical Resource Manual, which is a document that identifies standard methodologies and inputs for calculating energy savings.
TSER	Telephone-supported engineering review.
Unit of analysis	The level at which the data are analyzed, which in 2024 FR study was 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.



APPENDIX B. TECHNICAL INTRODUCTION

This study provides free-ridership-based attribution ratios from Enbridge's natural gas DSM programs delivered in 2024. The programs included are shown in Table B-1. In free-ridership-based attribution studies, Custom Market-Rate Multi-Residential (Multifamily) projects are included, but custom low-income multifamily (LI MF) projects are not. LI MF uses a deemed value for free-ridership.

Table B-1. FR by program, 2024

Program	2024 FR
Large Volume	✓
Commercial*	✓
Industrial	✓

Affordable Housing Multi-Residential

*Custom Market-Rate Multi-Residential (Multifamily) projects are expected to be included as a part of this program.

Evaluation background

Enbridge delivers energy efficiency programs under the Demand Side Management Framework¹⁵ developed by the OEB. The OEB hired an Evaluation Contractor (EC) team led by DNV to develop an overall evaluation, measurement, and verification (EM&V) plan. The objectives of the plan were to:

- Assess portfolio impacts to determine annual savings results, shareholder incentive and lost revenue amounts, and future year targets.
- Assess the effectiveness of energy efficiency programs on their participants and/or market, including results on various scorecard items.
- Identify ways in which programs can be changed or refined to improve their performance.

Under the plan, the DNV team determined free-ridership-based attribution for custom projects implemented as part of the 2024 program year. This report is a result of that study.

The EAC consists of representatives from Enbridge as well as representatives from non-utility stakeholders, independent experts, staff from the Independent Electricity System Operator (IESO), and observers from the Environmental Commissioner of Ontario and the Ministry of Energy. The DNV team worked closely with the EAC throughout this study and received comment, advice, and input on methodology and results. We thank them for their involvement.

Methodology summary

The results presented in this report are based on data collection from the following four primary sources:

- Enbridge tracking databases
- Enbridge project documentation
- In-depth telephone interviews with a sample of participating customers
- In-depth telephone interviews with a sample of participating vendors

¹⁵ EB-2021-0002, OEB Decision, November 15, 2022, Schedule E.



The data collection with samples of participating customers and vendors included telephone interviews focused on assessing free-ridership. Table B-2 shows the targeted and completed data collection activities.

Table B-2. Data collection activities*

Target Group	Activity	Targeted Measures	Completed Measures
Enbridge			
Participating Customers	In-Depth Interview	99	92
Participating Vendors	In-Depth Interview	Census of Triggered Comm & Multi-Res. And Ag Segments	7

*This table reports the number of measures targeted and completed as measures were used to design the sample before customers and sites had been identified.

At a high level, the FR study employed the following methodology:

- **Receive program data and documentation.** The evaluation started with a review of the program tracking data, which formed the basis of the sample.
- **Design and select the sample.** The tracking data was used to design and select a sample. Once the sample was selected, additional documentation was provided by the program to describe the energy efficiency measures to customers.
- **Collect data.** Data was collected to estimate FR-based attribution ratios.
- **Analyze the results.** The collected data was used to estimate FR-based attribution ratios at each site and expand the results to the population.
- **Report the results.** The final step was to report the results.

Key features of the methodology include:

- The **sample design** employed a stratified random sample that targeted 17% relative precision with 90% confidence at the program level. Details of the sampling methods are presented in the sample design memo in APPENDIX H. Final sample achievements are provided in APPENDIX C.
- **Ratio estimation** was used to expand sample results to the population. The evaluation collected data on all sampled or backup projects that a customer contact could speak to rather than only the first selected. In our calculation of sampling error (\pm , confidence intervals, relative precision and error ratios), we used two-tailed 90% confidence limits and clusters defined by customers to appropriately estimate error when multiple units are collected from a single source.¹⁶ The approach used is described in the scope of work in APPENDIX H.
- The **FR methodology** included data collection from participating customers and vendors. The data collection instruments and free-ridership scoring methods are provided with the scope of work in APPENDIX H. The results of this study are intended to be combined with the FR-based attribution portion of the net to gross (NTG) study performed on the 2023 programs and with future FR evaluations of custom projects.¹⁷

Key methodological changes from the 2023 NTG study

The evaluation followed the same framework as the 2023 NTG study, with only one methodological change. The only change was to average vendor scores from both the 2023 and 2024 studies to use in scoring for customers who were influenced by vendors, had less than 100% attribution and where DNV could not complete an interview with their vendor. We

¹⁶ Where a single site had two contacts, the site was used as a cluster to ensure conservative (higher) error estimates.

¹⁷ 2023 Natural Gas Demand Side Management NTG Evaluation, DNV for the Ontario Energy Board, November 8, 2024.



included the 2023 scores in the average because none of the three segments where vendor interviews are conducted had more than four completes in 2024.

Understanding statistical error

Statistical error is reported for all ratio results in this report. The studies were designed with sample designs targeting 10% relative precision with 90% confidence (90/10) over three studies based on the best available assumptions at the start of the evaluation. Table B-3 describes each of the statistics provided in this report.

Table B-3. Relevant statistics

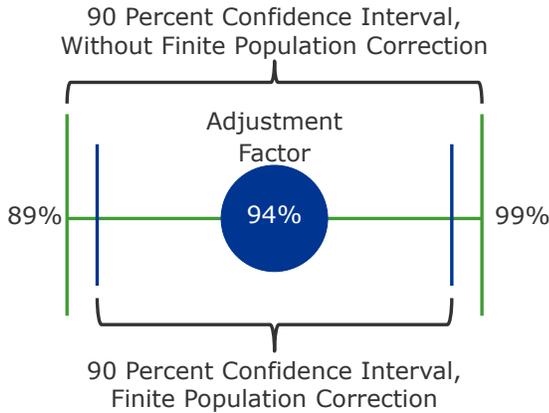
Term	Definition
Ratio/Adjustment factor	A point estimate of the evaluation findings expressed as a percent.
± or Absolute Precision	If the evaluation were repeated several times, selecting samples from the same population, 90% ¹⁸ of the time the ratio would be within this range of the ratio
Confidence interval	The upper bound is defined by the ratio plus the absolute precision. The lower bound is defined by the ratio minus the absolute precision.
Relative Precision	The relative precision is calculated as the absolute precision divided by the ratio itself. By convention, relative precisions are the statistic that are targeted in sampling (i.e., 90/10 is a relative precision metric)
Error Ratio	The error ratio is an approximation of the coefficient of variation (CV) that is used in sample design. It is calculated as a function of relative precision.
Finite population correction (FPC)	FPC is a factor that reduces the measured error of samples drawn from small populations (less than 300). FPC applies when the ratio is applied to the same population from which the sample was drawn. Statistics reported in the body of this report do not apply the FPC factor because this study is intended to support application of results to more than just the 2024 program year.

Figure B-1 shows an example of:

- The adjustment factor (ratio) as a blue point
- The 90% confidence interval *with finite population correction* (blue)
- The 90% confidence interval *without finite population correction* (green)

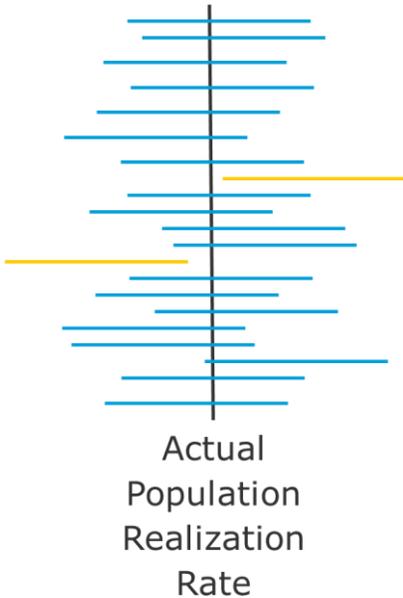
¹⁸ 90% is the confidence limit that we are using.

Figure B-1. Ratio diagram example



The plus/minus (\pm) error (%) indicated at the 90% confidence interval is the absolute difference between the estimated percentage and the upper or lower confidence bound. For example, in Figure B-1, the ratio is 94% and the non-FPC 90% confidence interval is ± 5 percentage points (i.e., $94\% \pm 5\%$).¹⁹ Another way of saying this is that there is a 90% probability that the actual ratio for the next year’s program lies between 89% and 99%. Figure B-2 demonstrates this concept by showing twenty hypothetical confidence intervals calculated from twenty different samples of the same population. Eighteen out of twenty (90%) include the true population ratio (overlap the black line representing the true ratio).

Figure B-2. 90% confidence interval



Note: Each horizontal line represents a confidence interval, while the black vertical line is the actual population realization rate. Yellow confidence intervals do not include the actual ratio.

The relative precision of the ratio is calculated as $5\%/94\% = 5.3\%$.

¹⁹ The critical value for calculating the confidence interval \pm for each adjustment factor is determined using Student's t-distribution and $n-1$ for the degrees of freedom, where n is the sample size. For two-tailed estimates (ratios that could be above or below 100%) the appropriate t-stat used to calculate precision from the standard error is close to 1.645.



For low ratios, relative precisions may be quite high, even when the confidence interval around the ratio is quite narrow. Consider a ratio of 5% with the same 5% absolute precision as in the above example. While the absolute precisions are the same, the latter ratio (5%) has a relative precision of $5\%/5\% = 100\%$. In absolute terms, we still are 90% confident the ratio is below 10%, despite the very high (100%) relative precision.

We reported the relative precision in all cases at the 90% confidence level. That is, whether the relative precision is large or small, we have the same 90% confidence that the range defined by the point estimate \pm the absolute error captures the true unknown value. The "midpoint" estimate (the ratio) is the best (statistically most likely) estimate, while the confidence interval is calculated as an interval around that point. Thus, in all cases, we reported the best point estimate, with a symmetric 90% confidence interval (using the t-score for a two-tailed 90% confidence interval).



APPENDIX C. FREE-RIDERSHIP FINAL SAMPLE ACHIEVEMENT

The tables in this appendix show the achieved sample for each stratum in the sample designs. The tables are specific to a program group and show the categorical stratification (grouping) and size strata (larger numbers are bigger projects). Sampling was done at the measure level. The target column shows the number of units we attempted to complete. The complete column shows the number of measures randomly selected and completed. First year natural gas savings (m³) are also included under the header m³. Note that in some cases measures beyond the target were completed. These completed measures were at sites with multiple measures in the sample.

Custom Commercial: Summary of participant data collected

Table C-1 summarizes the FR-based attribution data collection efforts for the Enbridge Custom Commercial program. The table shows the portion of the program that:

- Completed an in-depth interview
- Did not respond to an evaluation attempt at contact
- Was not contacted by the evaluation team²⁰

The data collected in Table C-1 is shown as the number of customers and measures and the first year m³ ex ante natural gas savings. The full sample design and achievement by strata can be found in Table C-2.

The evaluation collected FR-based attribution data for 16% of savings in the programs with a customer response rate of 51%.

Table C-1. Summary of FR data collection for Custom Commercial program

Data collection category	Targeted	Completed		
	# measures	# customers*	# measures	Population m ³
Completed in-depth interview	47	38	43	4,320,719
Attempted contact, not completed		37	41	6,133,974
Not attempted		510	704	16,305,125
Total		545	788	26,759,818

* Customers with multiple installed measures and differing survey responses will appear more than once, resulting in a total count exceeding the number of customers interviewed.

²⁰ Sites, projects, or units of analysis where contact was not attempted were either not selected for contact in sampling or in the backup sample and were not contacted due to strata quotas being met.

Table C-2. FR sample achievement for Custom Commercial program

Segment	Measure Group	Stratum	Max M3	Target	Completed Measures	Completed M3	Population Measures	Total M3
Commercial	Boilers	1	21,997	4	2	21,050	130	1,207,416
		2	159,424	3	4	104,097	35	1,545,672
		3	175,360	1	0	0	1	175,360
	Other Commercial	1	38,995	5	3	43,301	105	1,538,358
		2	275,308	5	6	604,207	21	2,326,088
		3	476,506	1	1	476,506	1	476,506
Steam Traps	1	45,337	1	2	72,655	4	87,282	
	2	67,496	1	1	67,496	1	67,496	
Institutional	Other Institutional	1	243,788	4	6	655,552	40	2,693,104
		2	4,453,979	2	1	1,078,247	2	5,532,226
	Steam Traps	1	341,774	3	4	172,407	21	1,816,105
		2	629,685	1	1	629,685	1	629,685
Market Rate Multi-Family	Boilers	1	154,456	6	6	198,877	241	5,005,858
		2	189,029	1	0	0	1	189,029
	Other Multi-Family	1	26,917	4	4	16,725	145	1,479,203
		2	110,725	4	1	61,245	38	1,871,762
		3	118,668	1	1	118,668	1	118,668
Grand Total					43	4,320,719	788	26,759,818

Custom Industrial: Summary of participant data collected

Table C-3 summarizes the FR-based attribution data collection efforts for the Enbridge Custom Industrial program. The table shows the portion of the program that:

- Completed an in-depth interview
- Did not respond to an evaluation attempt at contact
- Was not contacted by the evaluation team²¹

The data collected in Table C-3 is shown as the number of customers and measures and the first year m³ ex ante natural gas savings. The full sample design and achievement by strata can be found in Table C-4.

The evaluation collected FR-based attribution data for 40% of savings in the programs with a customer response rate of 55%.

Table C-3. Summary of FR data collection for Custom Industrial program

Data collection category	Targeted	Completed		
	# measures	# customers*	# measures	Population m ³
Completed in-depth interview	38	31	38	32,698,905
Attempted contact, not completed		25	29	12,088,165
Not attempted		156	259	36,595,979
Total		181	326	81,383,049

* Customers with multiple installed measures and differing survey responses will appear more than once, resulting in a total count exceeding the number of customers interviewed.

²¹ Sites, projects, or units of analysis where contact was not attempted were either not selected for contact in sampling or in the backup sample and were not contacted due to strata quotas being met.



Table C-4. FR sample achievement for Custom Industrial program

Segment	Measure Group	Stratum	Max M3	Target	Completed Measures	Completed M3	Population Measures	Total M3
Agricultural	Heating or Water System	1	562,554	5	6	1,141,697	54	5,920,197
		2	1,121,486	1	0	0	1	1,121,486
	HVAC	1	329,614	4	4	291,651	92	7,210,971
		2	674,178	4	4	1,960,656	20	9,570,651
		3	1,357,522	3	3	2,436,796	10	9,860,497
		4	1,402,217	1	1	1,402,217	1	1,402,217
		1	456,710	2	2	503,247	4	1,237,533
2	508,150	1	0	0	1	508,150		
Industrial	HVAC	1	928,354	2	2	1,358,895	20	4,835,555
		2	998,840	1	1	998,840	1	998,840
	Process	1	640,031	3	4	498,397	46	5,657,523
		2	2,880,595	2	2	3,947,738	5	7,508,348
		3	6,554,604	3	3	14,877,636	3	14,877,636
	Steam or Hot Water System	1	1,346,777	2	2	71,839	25	3,857,334
		2	1,433,452	1	1	1,433,452	1	1,433,452
	Steam Traps	1	380,624	2	2	88,760	41	3,695,575
		2	1,687,084	1	1	1,687,084	1	1,687,084
Grand Total					38	32,698,905	326	81,383,049

Large Volume: Summary of participant data collected

Table C-5 summarizes the FR data collection efforts for the Large Volume program. The table shows the portion of the program that:

- Completed an in-depth interview
- Did not respond to an evaluation attempt at contact
- Was not contacted by the evaluation team²²

The data collected in Table C-5 is shown as the number of customers and measures and the first year m³ ex ante natural gas savings. The full sample design and achievement by strata can be found in Table C-6.

The evaluation collected FR data for 62% of savings in the program with a customer response rate of 55%. Both values are higher than the other two programs in this study, in part because DNV attempted to collect data with a census of participants.

Table C-5. Summary of FR data collection for Large Volume

Data collection category	Targeted	Completed		
	# measures	# customers*	# measures	Population m ³
Completed in-depth interview	14	6	11	29,798,070
Attempted contact, not completed		5	7	11,177,223
Not attempted		11	12	7,113,767
Total		17	30	48,089,060

* Customers with multiple installed measures and differing survey responses will appear more than once, resulting in a total count exceeding the number of customers interviewed.

²² Sites, projects, or units of analysis where contact was not attempted were either not selected for contact in sampling or in the backup sample and were not contacted due to strata quotas being met.



Table C-6. FR sample achievement for Large Volume

Segment	Measure Group	Stratum	Max M3	Target	Completed Measures	Completed M3	Population Measures	Total M3
Large Volume	Large Volume	1	931,801	3	3	300,502	17	5,945,375
		2	2,525,308	3	2	4,272,728	5	10,752,082
		3	2,756,517	2	1	2,606,469	2	5,362,986
		4	7,179,001	6	5	22,618,371	6	26,028,617
Grand Total					11	29,798,070	30	48,089,060



APPENDIX D. FREE-RIDERSHIP SURVEY RESPONSES

This section presents self-reported responses from the timing, efficiency, and quantity FR question battery where customers were asked “Why do you say that?”

A “yes” in the timing, efficiency, or quantity column indicates partial or full FR-based attribution for that source based on the scored questions (not the responses here). A “no” indicates no FR-based attribution for that source. For example, in the first table, a “yes” in the timing column indicates that the respondent answered the question DAT1a and DAT1b with responses that credited the program with influencing the acceleration of the project. A “no” in the timing column indicates that the respondent did not credit the program with influencing the acceleration of the project. A “no” for timing does not preclude the same respondent indicating the program affected the efficiency or quantity/size of the same project.

Additionally, following the specific timing, efficiency and quantity questions, customers were asked to summarize the program’s effect on the timing, efficiency and amount of the project installed (Dat4). These responses are presented with the scored level of FR-based attribution: full, partial, or none.

None of the responses provided below were used in the direct scoring of surveys. For respondent confidentiality, these responses are isolated from other responses from the interview and do not reflect the full story the respondent conveyed. The responses are provided here to provide insight into how customers describe their decision making on the project relative to the program. Responses are sometimes recorded in the voice of the participant and in other cases in the third person depending on the notation approach of individual interviewers. See the scope of work (APPENDIX H) for details on how FR-based attribution was scored.

Custom Commercial program

Table D-1. Timing verbatim responses for Custom Commercial program

Timing	Dat1a O. Why do you say that?
Yes	Based on the 5 yrs CDM plan, we would have replaced it eventually, the incentives helped to meet the goals
Yes	This would have been a board decision, I can’t speak on behalf of them.
Yes	The design department might have prioritized it later if it became a burden to maintain.
Yes	Hard to say if someone would have suggested it but we weren’t considering it at all
Yes	Hard to say when
Yes	Impossible to say never but very unlikely it would have happened any time soon
Yes	Lots of useful life left
Yes	Maybe closer to never if we wouldn’t eventually have needed it.
Yes	Maybe would have done 1 AHU at a time, and simpler equipment. Incentives make it easier to make the business case with the board. Incentives help offset the overall cost and reduce NG consumption.
Yes	Much later if it hadn’t received the incentives.
Yes	Much less frequently, would be every two years or every other year
Yes	No funding and the calculations to do the analysis are very intense so I couldn’t do it myself
Yes	Same as heat recovery system - We have a difficult time getting any energy projects approved at full price. Enbridge’s assistance is the only way we get stuff done
Yes	The project would have been installed sometime in the future if not for the incentive, since the management would have to approve it and it has to meet key financial metrics, the incentive provides a good business case for installing the project.
Yes	Tight funding



Timing	Dat1a_O. Why do you say that?
Yes	We have a difficult time getting any energy projects approved at full price. Enbridge's assistance is the only way we get stuff done
Yes	We would have needed to do it but it would have taken many years
Yes	We would have upgraded the BAS later when we had more funding and the system is older. The vendor provided incentive estimates which we could only get if we completed the project by a certain date which pushed the project to happen when it did.
Yes	would have deferred it to later.
Yes	Because of the financial constraints
Yes	Due to cost
Yes	The Incentive helps but technical support helps justify to management as well for approval.
Yes	Would be later to secure funding
Yes	probably would have done the project but not sure on timings
Yes	Enbridge said if we could get the project in before October 2024, we could get incentives for the project. After that point, we could not get incentives. This deadline helped push the project to happen.
Yes	Not sure, certain amount of ensurity if you install it.
Yes	We would have installed the upgrades in pieces instead of all at once. This delay is due to high costs, we have to be mindful of their yearly budget. It definitely would have happened eventually but it would have taken longer to do it.
Yes	[Would have installed] in a year because there were changes to our operations team. New team and wouldn't have been on their radar.
Yes	Eventually they need to be replaced at some point
Yes	Project would have been installed anyways since condensing boilers are now mandated. The timing may have differed depending on how dire the need is.
Yes	We want a payback that adds the incentive and helps us
No	Maybe would have taken time to choose between condensing vs non-condensing boilers.
No	since its VFDs
No	Incentive comes after the fact anyway
No	It couldn't be maintained. We had to do it - we needed it
No	It didn't factor into the time. We needed it at that specific time and we already planned to do it. Enbridge provided support after the fact based on the work that we already did
No	They had to go together and same time
No	Timeline would not have been affected in terms of the project's implementation.
No	Would have done more research to do but would have installed it at the same time.

Table D-2. Efficiency verbatim responses for Custom Commercial program

Efficiency	Dat2a_O. Why do you say that?
Yes	Basic controls already existed.
Yes	Because of the funding; the incentives motivated us to install more advanced controls.
Yes	Less or Zero heat recovery capacity because of limited funding.
Yes	No funds
Yes	depends on the company's suggestions.
Yes	Had a steam boiler near the end of its useful life.
Yes	We would have tried to have a balance between the life cycle and energy savings without Enbridge's incentives/technical assistance.
No	We chose the technical specifications we needed for the BAS and this was provided to vendors to quote. We would have chose something with the same technical specs.

Efficiency	Dat2a_O. Why do you say that?
No	We want to go with something as efficient and technology is moving that way.
No	as efficient as possible, close to condensing.
No	maximum efficient
No	same efficiency but would have done it a lot later, probably 2030, technology needs and more energy efficient.
No	Not sure, a lot of it depends on the outside technical expertise
No	<vendor> would have recommended the same thing.
No	Not the driving force of the project, the outside consultant engineers that work for our company picked the design. It was not based on efficiency upgrades, it was based on what we needed for our site.
No	That's what was needed
No	We chose the system based on our vendor's recommendation which would have stayed the same. It cannot be less advanced due to environmental control regulations.
No	More efficiency looking at the payback period. No different than lighting, it's based on the payback
No	Project would have been installed anyways since condensing boilers are now mandated.
No	Since we are focused on 2030, 2050 goals- we would have really focused on natural gas use
No	We select a system that works with our boilers.
No	We go with what's up to our standard
No	Because of the plant's requirement and also company's requirement of needing the boiler's under certain capacity.
No	Because the scope of the work was already determined without Enbridge's support. The work was what it was and we qualified for an incentive with the part that we wanted to take.
No	Same energy efficient to have more lifetime on the equipment, and what <name> would have suggested.
No	The design department would have recommended the high efficiency option anyway, it's part of our guidelines
No	Would not have altered here and hasn't happened very often. We reach out to Enbridge on option a vs b and get a higher rebate. Didn't happen here.

Table D-3. Quantity verbatim responses for Custom Commercial program

Quantity	Dat3a_O. Why do you say that?
Yes	Maybe fewer or not installed any, the funding provided by Enbridge drove that project.
Yes	Might have been a little less, earlier boiler was a little oversized.
Yes	Still because of money
Yes	We need <vendor> and Enbridge's money and help
Yes	same - no funding
Yes	same- hard time getting funding without assistance
Yes	Due to cost
Yes	Around 20 VFDs were installed. Looking at the size of the pumps, few VFDs would have been installed. 2 are for heating in the winter and third was for a pool/domestic hot water. We try to install a third small boiler to run in the summer time to increase the useful life of all 3.
No	Need to fulfill building demand for hot water. Old boiler might have been oversized.
No	The equipment was there so we didn't make a decision for anything else. It was either going to be completed as is or left as the status quo.
No	We would have replaced the failed steam trap but the incentive helps us put it an even better, more efficient trap
No	always installed 2 for redundancy, since we need backup
No	needed to replace the existing system for the building requirements.

Quantity	Dat3a_O. Why do you say that?
No	Would have done them all but would have pushed
No	A lot of it depends on outside technical expertise since its a bit complex system
No	We wanted to install the units on our 2 dehydrators
No	We would have still done both boilers, same size to meet site requirements
No	would have made the safe bet and had gone for <#> Boiler(s) because that's what the building is designed for, and we wouldn't have risked it.
No	Scope of the project. Project would have been installed anyways since condensing boilers are now mandated.
No	needs of the building
No	Because of the plant's and company's requirement
No	Just because of the requirement of the building
No	Needed to get done all at the same time during the summer
No	Our design engineer dictated the capacity of the system. We explored shifting our seasonal load but couldn't due to construction logistics.
No	The number of steam traps to be installed was based on steam trap survey and it would be immaterial of Enbridge's technical or financial assistance.
No	We needed what we needed

Table D-4. Dat4 verbatim responses for Custom Commercial program

Attribution	Dat4. Summarize the program's effect on the timing, efficiency, and amount that you installed.
Full	<vendor> and Enbridge are great and we really couldn't do it without their assistance. 50/50 likelihood of installing the boiler, might have been later but about 3-4 years later even though the boiler had 6-7 years left on it. Costs might have resulted in it being replaced before those 6-7 years. We needed 3 boilers, 2 for winter heating needs and a third smaller for summer hot water needs such as a pool.
Full	75% likely to have been installed but later(about 3- years).
Full	Enbridge was good to work with, very proactive, very timely, and very responsive, and overall very helpful.
Full	The Enbridge process was very smooth, the timing was good, and financial and technical expertise were really good as well.
Full	Without it it was not very likely to have been completed, maybe in 6-8 years but we would have installed a similar piping upgrade with the existing equipment
Full	Without the assistance, it would have been maybe 50/50 that we completed the replacement, we would do it less frequently, maybe every other year or wait 2 years. We would still replace the same number of failing steam traps but the incentive allows for a better steam trap.
Full	Would have been less likely to have been replaced (30%) because the boiler had 10 years of useful life on it. It might have been replaced before those 10 years were up but that would have been determined by design team or maintenance staff. The incentive helped move it up to sooner. Might have installed a boiler with less capacity to meet the building needs.
Full	they were a key partner in making it come about. we wouldn't have been able to get it at the same time, amount or efficiency without them.
Partial	Enbridge helped with the rebate; no rebates for another heat pump project.
Partial	The only reason for delays, less amount, etc is due to the cost of replacing the steam traps. We had a 50% likelihood of still doing the project, and would have replaced only about half of the amount without the funding from Enbridge at a later time. The only reason is the cost.
Partial	Without the incentive, would have been about 50/50 that we would have installed them. Might have delayed it a year but we still would have installed the VFDs. We would have installed all 3 but it might have been pushed out where we're only doing one every year.
Partial	Bunch of diff discussions on what was going in, some of the decision making happened before she joined in, was funded for the feasibility study,

Attribution	Dat4. Summarize the program's effect on the timing, efficiency, and amount that you installed.
Partial	It has been a really good relationship with Enbridge for years. We meet with the Enbridge rep once a year and discuss the potential projects. The timing was good; there has never been a delay with the project. It includes a lot of work and communication. The timing and efficiency have been great.
Partial	The only impact Enbridge had on the project is the timing. We knew the boilers needed to be replaced because they were at end of life, but Enbridge said if they can do it by October 2024, then you can get rebates, if later, no rebates. This helped push the project to happen at the time.
Partial	Project would have been installed anyways since condensing boilers are now mandated.
Partial	The incentive lowers the payback period, didn't change the design but we wanted to get the incentive.
Partial	The funding was helpful for the VFDs project, verification and confirmation in terms of technical expertise was really helpful,
None	Enbridge's technical assistance/incentives played a limited role, because the steam trap replacements are part of an annual preventative maintenance.
None	It was enticing to get the incentives, but either way the project was needed to be done.
None	It's always nice to have a rebate - it pushes you to do it and it's a good thing to do. It's actually making me consider changes in my home. But for this project there wasn't any impact on the timing, efficiency or amount. We needed to do the replacement at that time, at that efficiency level and with that amount.
None	The availability of rebates encouraged us to move forward with the project. The rebates helped offset the project's cost and aided in the decision-making process.
None	The steam trap replacement was part of an annual preventative maintenance program that the site conducts every year. We would be installed irrespective of the financial/technical assistance provided by Enbridge. The steam trap survey determined the number of traps to be replaced.
None	Without Enbridge, it would have been likely that we would have installed the boilers at the same time and with similar efficiency. The hot water needs of the building are set and need to be met by the boiler.
None	Without the assistance, the boiler were very likely to have been installed at the same time with the <#> that were needed. It wouldn't have made much sense to do the install piecemeal (like <#> boilers at a time). Incentives might cover 10% of project cost at most and that's usually not enough to impact our decision.

Custom Industrial program

Table D-5. Timing verbatim responses for Custom Industrial program

Timing	Dat1a O. Why do you say that?
Yes	Enbridge was involved in the start of the project
Yes	Enbridge's financial assistance sped the timeline up, we would have still installed it at some date.
Yes	I wouldn't say never. It may have come through in a different audit as the equipment was installed in 2018 so we would have needed an audit eventually. It wasn't like it was installed a few months before.
Yes	Maybe later if at all. Due to cost which is due to increase in fertilizer, water usage, plant costs
Yes	Project would have been delayed until the right conditions were met.
Yes	Sooner or later we would have installed it because we would have needed it. The incentives helped the financial people approve. In this economy we would have had to wait longer than 2 years to install because it wouldn't have made financial sense for us
Yes	The project would not have been installed as-is, but the project may have been installed with drastically reduced scope.
Yes	This wouldn't have been on my priority list. Can't figure out the ROI and, without technical expertise cant quantify the benefit for the farm.
Yes	We didn't have the kind of money and technical support to execute... It was nice how much Enbridge got involved - more than typical third parties do. They gave so much engineering support.
Yes	Without ROI, there would have been no motivation to do the project. Enbridge helps with the rate of approval of the project.
Yes	Later. Maybe not implemented at all since the scope would not have been adhered to if the project was completed at a later date without Enbridge's incentive.
Yes	Enbridge's involvement with providing the optimal thickness and the cost/energy savings definitely influenced the timeline of the project. We were replacing the drum itself and decided to have it insulated

Timing	Dat1a O. Why do you say that?
	directly by the manufacturer at time of purchase. If no assistance, it would have been later by a local company after the drum was installed.
Yes	Later because we didn't have the money at the time and it was still a need identified because of the natural gas savings and we are a green company - we never cut down a tree. However if we waited till now and we saw the way the economy it would have been even much later or we would have said never.
Yes	Might have delayed it by a year, so would have installed in fall of 2024
Yes	The industry and carbon taxes have been steering us towards that direction. Enbridge motivated to reduce gas consumption.
No	The equipment we put in was required for the process.
No	As they failed, we would have replaced them. 40% that we would have done it right away, but 60% of experiencing issues
No	Project could not have been delayed.
No	Same time. The installation has to be done during the interval between crop cycles.
No	Incentive amount was low in terms of the scope of the project. Would not make a difference to equipment spec or timeline.
No	It's what we know
No	No change in timing. The project is critical to growing lettuce, so the incentive was seen as a "nice-to-have" but not key to the implementation of the project.
No	Same time due to needing to meet emissions reduction goals, we had a company meeting to identify energy savings projects where this one was proposed.
No	Small project, incentive does not play a key role.
No	The project was part of a barn expansion, would have installed ventilation equipment at the same time
No	Wanted to save on energy savings; CO2 emissions reduction was the goal
No	We planned to do a project, and didn't have to wait on Enbridge for incentives to go ahead and start

Table D-6. Efficiency verbatim responses for Custom Industrial program

Efficiency	Dat2a O. Why do you say that?
Yes	Enbridge made the payback more attractive and the technical support made the difference
Yes	Financially we wouldn't have been able to afford one that is so thick
Yes	Less extensive and less efficient
Yes	Scope would have been reduced without Enbridge's incentive.
Yes	Wouldn't have done it without the Enbridge support.
Yes	Reduced scope of work without the incentive
Yes	Enbridge provided us with the optimal insulation thickness of 2 inches. Without their help, we would have taken the manufacturer or local insulation company recommendation. I am unsure what they would have recommended.
Yes	The incentive was important because it helped offset the costs for the high efficient equipment. If there was no incentive, the project would have been installed but with a lower spec energy curtain.
No	To meet industry efficiency standards, what would be installed if it was a new construction facility
No	Might have been different format/layout but ultimately we would have done something similar.
No	We went with the most basic system that we could find. We've could do some upgrades inn the future. We got more sensors, more advance sensors. Future proofing it for new systems.
No	Already knew the equipment and its specs and knew that this was the appropriate equipment for the capacity expansion project.
No	Designed to meet our facility's needs, our capacity is based on largest amount they can get out of the system.
No	Same would have selected the same set of controls
No	Still tried to install the same equipment; being able to capture the CO2 for our plant use and also be able to capture the heat

Efficiency	Dat2a O. Why do you say that?
No	To meet industry standards, they have other similar insulated steam piping around the facility which they matched.
No	We installed what we had at our existing greenhouse for this new one.
No	We were familiar with the company that provided the ventilation units and have their equipment in other spaces. We chose to go with the same company with the heat recovery capacity. We would have not changed the type of equipment or the capacity even if no funding or assistance.

Table D-7. Quantity verbatim responses for Custom Industrial program

Quantity	Dat3a O. Why do you say that?
Yes	Also for financial reasons. There may have also been the likelihood we don't install anything
Yes	Because of the limited expertise in designing the system.
Yes	Enbridge incentive was key to installing the project. Without the incentive, the project would not have been installed.
Yes	Only had been doing small trials, would probably not have done the project at all due to cost
Yes	Project would not have been installed if not for the incentive from Enbridge.
Yes	The project would not have been installed without Enbridge's incentive. Enbridge's incentive was key to the project moving forward.
Yes	We wouldn't have known about the issue. If we eventually did learn about it, it would have been the same.
Yes	Yearly/monthly - within 2 years - based on the funds available;
Yes	Would have replaced them but would have been delayed. Might have been 1 trap at a time per month over the course of a year. So, 12 traps replaced per year without the assistance.
No	To meet industry efficiency standards, what would be installed if it was a new construction facility
No	The energy curtain had to be installed because the pre-existing one was at the end of life.
No	For the plant requirement
No	Requirements of the project. The project was a capacity expansion project and required additional boiler capacity to serve new areas of greenhouse. Additionally, new boiler would serve as redundancy.
No	Small project, incentive does not play a key role. Would have done the project anyways.
No	To meet industry standards and emissions reduction, we insulated all the steam piping which was uninsulated. We had no reason to leave anything uninsulated.
No	its what we know and needed at the site

Table D-8. Dat4 verbatim responses for Custom Industrial program

Attribution	Dat4. Summarize the program's effect on the timing, efficiency, and amount that you installed.
Full	Enbridge's incentive and assistance were the reason why the project was installed as described.
Full	Enbridge's incentive was key to the project moving forward.
Full	Enbridge's only affect was the timing of the project, we would have installed the same thing and the same amount to meet industry efficiency standards. The financial assistance helped them install the project sooner.
Full	Everything was great. <vendor> was quick in getting the questions and key things needed which made the go ahead faster. There wasn't a hold up on our timeline. But none of this would have happened without Enbridge noticing an issue existed so they set the time, efficiency and quantity and gave us the info.
Full	Project would not be financially viable without the incentive owing to high capital costs involved and this would be feasible only with the incentive.
Full	The incentive helped approve the project with our finance team and made it happen at the desired timing, efficiency and size.
Full	There was no impact in the overall project. This is the most efficient plant that we have because of the expertise and the funding provided by Enbridge.
Full	There were a lot of condensate and steam losses due to inefficient steam traps. Enbridge calculated the amount we were losing because of the steam loss on a yearly basis. Enbridge suggested different

Attribution	Dat4. Summarize the program's effect on the timing, efficiency, and amount that you installed.
	scenarios and introduced the program of financial support. They continuously send the report every week to make sure we are aligned. They specified the start and the end date, and after the project completion, they did a site visit to verify the steam traps. They verified invoices, took photos, and after checking everything, the incentives were provided. The Enbridge involvement was at the beginning of 2021, and then we got to the point where condensate return was dropped to 20%, per Enbridge's advice they started the process quickly followed by *** survey in May 2024, followed by the decision to do the project was made in August 2024, and the project was completed by mid-November 2024. The whole process was very smooth.
Full	We have previously only trialed this increased plant density in small quantities. Enbridge provided the push to do it at a large scale due to their incentives. We would probably still be doing trials right now without receiving help from Enbridge.
Partial	Without the assistance, it wouldn't have been likely that we complete the steam trap replacement. We might have replaced failing traps about 8 months later or so and we would have only replaced about 1 trap per month. A steam trap leak audit might be useful and this plant deals with those leaks. It would help us identify those leakage problem, not a steam trap audit if those incentives existed.
Partial	Enbridge's incentive was important for installing the project since it helped offset the total cost.
Partial	The incentive was important because it helped offset the costs for the high efficient equipment. If there was no incentive, the project would have been installed but with a lower spec energy curtain.
None	The incentive/assistance provided by Enbridge had minimal impact n the project's installation. This is because this was a large capacity expansion project worth over 4 million dollars and this project alone was about 600K. The incentive provided by Enbridge was very small compared to the scope of the project. Also, I have many years of experience in the industry and am familiar with equipment and best practices. So the choice of equipment and the timing of the installation would have remained the same irrespective of the incentive.
None	The project was started based on needing to meet our company's emission reduction goals. We had a meeting with a global leader where they identified energy savings projects, where this one was proposed. We would have installed the exact same insulation, at the same time, regardless of the assistance from Enbridge. The assistance was nice to have, but they were mostly focused on their company's goals.
None	Without the assistance, we would have 100% installed the boilers at the same time with a similar set of 3 efficient boilers
None	Working with Enbridge was very helpful, didn't delay on any of our project, It worked v well overall.

Large Volume

Table D-9. Timing verbatim responses for Large Volume

Timing	Dat1a O. Why do you say that?
Yes	Enbridge incentives would help move the projects higher in the priority list of projects. I think it probably gets bumped up in the priority when we know we have the backing and assistance of companies like Enbridge.
No	Timing of cleanings is independent of Enbridge
No	Would have done something right away due to safety concerns and loss of condensate but maybe not as many steam traps without Enbridge assistance. Without Enbridge we probably would have replaced the <#> more critical ones right away and left the others for later
No	Enbridge is not influencing our decision that much for the cleaning and the potential energy savings is much bigger than the incentives. Also the springtime is ideal for doing these projects because summer the plant needs to be at max capacity
No	Regardless of Enbridge support, we do the steam trap replacement, this is a proceduralized project
No	Same reasons as before - greenhouse gas reduction and reduced operating costs
No	The cleanings are triggered by an efficiency and safety assessment and so the incentives do not influence these decisions
No	The energy savings and unit throughput benefits were compelling enough on their own
No	There were safety and financial reasons. We also do the steam replacements in the spring when its warmer.
No	We had done the analysis including financial to justify the project going forward

Table D-10. Efficiency verbatim responses for Large Volume

Efficiency	Dat2a O. Why do you say that?
No	The <list of equipment> etc are all one system. One piece won't work without the others. You're all in or nothing. You can't put in half of it but not the other half.
No	We don't plan for the incentives to approve the scale of the cleaning
No	Cleanings are required to be complete not partial
No	Cleanings would have to be complete not partial
No	Safety, efficiency, and cost savings were the drivers determining how many heat exchangers they do.
No	The incentives do not influence these decisions.
No	Safety, efficiency, and cost savings were the drivers determining how many heat exchangers we do. The incentives do not influence these decisions.
No	The <> cleaning scope was determined based on need and they would have done regardless of Enbridge

Table D-11. Quantity verbatim responses for Large Volume

Quantity	Dat3a O. Why do you say that?
Yes	The incentives help us to do more cleanings than otherwise.
Yes	Without the Enbridge incentives they probably would have only replaced the <#> most leaky steam traps right away and delayed the replacement of the <#> less critical steam traps until later
No	Our monthly monitoring of the heat exchangers drives the decision to clean the heat exchangers based on safety, efficiency, and cost drivers.
No	The quantity was already funded regardless of the Enbridge assistance
No	The reason they would have done the same amount b/c the decisions to clean are based on safety, efficiency, and cost considerations and so the rebate was not a driver for quantity
No	We do these steam trap replacement first and then we fill out the Enbridge applications. The Enbridge incentives are a nice bonus, but they would have done the same number anyway to meet operational standards.
No	When they do the analysis of the heat exchangers to be cleaned, they don't consider the availability of the Enbridge incentives. The number of cleanings is based on other considerations besides Enbridge support.
No	When we do the analysis of the heat exchangers to be cleaned, we don't consider the availability of the Enbridge incentives. The number of cleanings is based on other considerations besides Enbridge support.

Table D-12. Dat4 verbatim responses for Large Volume

Attribution	Dat4. Summarize the program's effect on the timing, efficiency, and amount that you installed.
Partial	The Enbridge incentives allowed us to replace more of the steam traps sooner. If the incentives and tech assistance had not been available, we probably would have only replaced 6 of the more leaky steam traps right away and then delayed the replacements of the other less critical steam traps until later.
Partial	The Enbridge support had no impact on the likelihood of the cleaning, or the timing of the cleaning, or the extent of the cleaning. However, the Enbridge support did allow the company to do more heat exchanger cleanings otherwise.
None	The Enbridge assistance didn't impact the likelihood of the steam replacements, nor the timing, nor the quantity.
None	We would have done the same # of steam traps at the same time
None	We would have done the same number of heat exchanger cleanings at the same time as they did without the Enbridge assistance b/c efficiency, safety, and cost considerations drive the cleaning decisions.
None	We would have done the same number of heat exchanger cleanings at the same time without the Enbridge assistance. The rebates are nice but they don't influence the project decision-making



None

We would have done the same timing, efficiency, and size of heat exchangers without Enbridge. However, we could inform the contact engineers about the Enbridge incentives which might prompt them to plan more heat exchangers, but it's not something that we have done so far.

APPENDIX E. ATTRIBUTION RESULTS WITH ADDITIONAL STATISTICS

The results in this section are not applied to calculate savings totals. These results are different aggregations of the data that provide additional information to the programs and stakeholders. In the tables, results with less than five completes or absolute precision (\pm) greater than 35% are not shown, but the categories remain in the table to provide context for the results that can be reported.

The final table in each section has the application domain, Segment, which is the same domain as in the body of the report. Unlike the body of the report, these values are reported both with and without finite population corrected (FPC) errors. FPC errors provide a more appropriate estimate of error for applying results onto populations that were part of the sample frame, i.e. the 2024 program year.

Overall ratios in these tables are the sample weighted average and not used in calculating net savings for the programs.

Custom Commercial Program

Table E-1. Applied domains with additional statistics for Custom Commercial program

Segment	Free-ridership-based attribution	Sample customers	Sample measures	\pm FPC on	\pm FPC off	Population measures	Percent population m ³ savings
Commercial	77%	18	19	12%	12%	298	28%
Institutional	96%	9	12	5%	6%	64	40%
Market Rate Multi-Residential	64%	12	12	15%	16%	426	32%
Custom Commercial - Overall	78%	38	43	7%	7%	788	100%

Table E-2. Targeted sample domain for Custom Commercial program

Segment	Free-ridership-based attribution	Sample customers	Sample measures	\pm FPC on	\pm FPC off	Population measures	Percent population m ³ savings
Commercial - Boilers	87%	6	6	24%	24%	166	11%
Commercial - Other Commercial	74%	9	10	11%	12%	127	16%
Commercial - Steam Traps	***	3	3	0%	0%	5	1%
Institutional - Other Institutional	97%	5	7	6%	6%	42	31%
Institutional - Steam Traps	94%	5	5	9%	10%	22	9%
Market Rate Multi-Residential - Boilers	56%	6	6	16%	17%	242	19%
Market Rate Multi-Residential - Other	83%	6	6	30%	31%	184	13%
Custom Commercial - Overall	78%	38	43	7%	7%	788	100%

Custom Industrial Program

Table E-3. Applied domains with additional statistics for Custom Industrial program

Segment	Free-ridership-based attribution	Sample customers	Sample measures	± FPC on	± FPC off	Population measures	Percent population m ³ savings
Agricultural	54%	14	20	22%	25%	183	45%
Industrial	73%	17	18	11%	22%	143	55%
Custom Industrial - Overall	64%	31	38	13%	18%	326	100%

Table E-4. Targeted sample domain for Custom Industrial program

Segment	Free-ridership-based attribution	Sample customers	Sample measures	± FPC on	± FPC off	Population measures	Percent population m ³ savings
Agricultural - Heating or Water System	25%	6	6	32%	36%	55	9%
Agricultural - HVAC	66%	8	12	28%	31%	123	34%
Agricultural - Process	***	2	2	61%	79%	5	2%
Industrial - HVAC	***	3	3	0%	0%	21	7%
Industrial - Process	63%	9	9	13%	30%	54	34%
Industrial - Steam or Hot Water System	***	3	3	61%	66%	26	7%
Industrial - Steam Traps	***	3	3	24%	25%	42	7%
Custom Industrial - Overall	64%	31	38	13%	18%	326	100%

Large Volume

Table E-5. Applied domains with additional statistics for Large Volume

Segment	Free-ridership-based attribution	Sample customers	Sample measures	± FPC on	± FPC off	Population measures	Percent population m ³ savings
Large Volume	15%	6	11	6%	12%	30	100%

APPENDIX F. FREE RIDERSHIP SENSITIVITY ANALYSIS

Consistent with the 2023 study, five sensitivity analyses were performed to assess the influence of DNV assumptions in the participant FR scoring method. These scores are not intended for application in determining program net savings. We grouped the five sensitivity tests into three dimensions, two of which we tested in two ways:

1. What is the sensitivity of the attribution score to our assumption of 2 years for the acceleration period? We tested this two ways:

1a. Using an assumption of 1 year rather than 2 years when the acceleration period is equivalent to a “never would have implemented” response (100% FR-based attribution) for all measures in all programs. Mathematically, this increases attribution and helps inform us how much the assumption matters.

1b. Using an assumption of 4 years rather than 2 years when the acceleration period is equivalent to a “never would have implemented” response (100% FR-based attribution) for all measures in all programs. Mathematically, this decreases attribution and helps inform us how much the assumption matters.

2. What is the sensitivity of the attribution score to the scoring approach for efficiency?

2. Giving 100% FR-based attribution to programs for customers who say they would have done a different efficiency than what they did, rather than FR-based attribution that ranges from partial to full based on a later response. Mathematically, this increases attribution and informs us how much the assumption matters.

3. What is the sensitivity of the attribution score to the scoring methodology change from previous studies to the current study? We tested this two ways:

3a. Calculate results using the life cycle net savings (LCNS) scoring method. This will test the sensitivity of results to the combined effect of measure life weighting of results and the different treatment of acceleration period savings.

3b. Calculate results using the life cycle net savings (LCNS) scoring method and include vendor attribution. This is the same as 3a but adds back in vendor effect. This will test the sensitivity of different methodologies for participant scoring to adding in vendor effect.

Across the programs, the high-level findings from each test are described below. Due to the small sample sizes in this study it is best to track the patterns in the sensitivity analysis over multiple studies to understand if the effect is consistent.

1: Tests 1a and 1b indicate that changing the “never would have implemented” assumption would have a significant effect on the industrial and large volume segments, suggesting that we should include future research to verify the assumed planning horizon for these projects. Changing the assumption from 2 years to 4 years had a smaller effect than changing from 2 years to 1 year, though the magnitude of ratio changes were comparable.

2: Test 2 indicates that the specific scoring of the efficiency question has an effect on any commercial scores, which was not seen in the 2023 study.

3: Test 3a shows a large effect for each segment. The primary difference in the approaches is the incorporation of measure life both in the weighting of results and the individual measure free-ridership score.

Test 3b provides a way for readers to see how comparable the LCNS results are for the full standard approach including vendor surveys, which is the likely approach that would have been taken if CCM remained the key metric for program goal achievement.



In Table F-1, the first column (standard approach, vendor) is the official free-ridership based attribution that corresponds to the body of the report, shown here at the segment level. To ascertain the results of the sensitivity analysis, the reader should compare columns (standard approach 1 year, standard approach 4 year, no partial efficiency, and LCNS no vendor) to the second column (standard approach, no vendor):

- The first column (standard approach, vendor) to the second column (standard approach, no vendor), to show the effect of including the results of the vendor survey.
- The second column (standard approach, no vendor) to the next four columns (Test 1a, Test 1b, Test 2, and Test 3a) to show the effect of the sensitivity analysis.
- The final column (test 3b) to the adjacent column (test 3a) to see the effect of including the results of the vendor survey in the LCNS method.
- The final column (test 3b) to the first column (standard approach, vendor) to see the relatively apples to apples comparison of the 2024 standard approach and the LCNS method when both include the results of the vendor survey.

Table F-1 shows the results of the sensitivity analysis by sector for the programs. Three tests showed statistically significant sensitivity, The Multi-family test 1a, and the Industrial and Large Volume test 3 (both a and b).

Table F-1 Sensitivity analysis for Enbridge custom program segments

Program	Segment	Standard Approach: Year 1 Net Savings, Vendor	Standard Approach: Year 1 Net Savings	Test 1a: 1 year acceleration = Never	Test 1b: 4 year+ acceleration = Never	Test 2: No Partial Efficiency Score	Test 3a: Lifecycle Net Savings Method	Test 3b: Lifecycle Net Savings Method, Vendor
Commercial	Commercial	77%	71%	86%	63%	79%	63%	70%
	Institutional	96%	96%	98%	95%	96%	96%	96%
	Market Rate Multi-Family	64%	56%	85%	29%	56%	19%	33%
Industrial	Agricultural	54%	54%	60%	50%	55%	40%	40%
	Industrial	73%	73%	81%	64%	77%	57%	57%
Large Volume	Large Volume	15%	15%	19%	12%	15%	3%	3%



APPENDIX G. FREE-RIDERSHIP SURVEY DATA QUALITY CONTROL

This appendix includes summaries of survey responses used to conduct quality control (QC) on the scored FR-based attribution responses. The QC process involves comparison of scored question responses to responses to other questions in the same interview. Interviews with potentially conflicting responses are reviewed by the project manager (PM), who reads the entire interview before determining if an adjustment to a score is required. The options for adjusting a score include:

- Drop the measure from the sample – for very muddled responses
- Replace the inconsistent response with a “Don’t Know” (effectively using the average if it is clear that there should be some FR-based attribution for the component, but unclear how much)
- Adjust the flagged score to more accurately reflect the intent of the respondent (employed in cases where there is overwhelming evidence of intent; for instance, the open-ended response says clearly what the score should be)

Table G-1 provides the count of measures adjusted for each utility and whether the adjustment increased (Inc) or decreased (Dec) FR-based attribution for that measure. In total, 5 out of 95 FR-based attribution scores were adjusted through this process. The percent of adjusted scores (5%) is consistent with the prior studies.

Table G-1. PM quality assurance adjustments

PM Quality Assurance Status		Overall			
		Inc	Dec	Total	
Total Measures Completed from FR IDIs				95	
Not Adjusted				90	
PM Adjustments from QA	Dropped			0	
		Timing	0	0	0
	Assign “Don’t Know” Attribution due to unclear amount.	Efficiency	1	0	1
		Quantity/Size	0	0	0
	Adjust Score Attribution Clear based on open, conflicted with scored response	Timing	1	1	2
		Efficiency	1	0	1
Quantity/Size		0	1	1	

APPENDIX H. KEY DOCUMENTS

Four key documents previously reviewed by the EAC preceded this final report: the scope of work, which includes details on the methodologies and scoring used; the sample design memo; and the interview guides for participants and vendors.

Sample design memo



Ontario Gas FR 2024 -
FR Sample Design Memo

Participant IDI guide



Ontario Gas FR
Participant IDI

Vendor IDI guide



Ontario Gas FR
Vendor IDI Guide



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