



# 2017 C&I PRESCRIPTIVE VERIFICATION

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## TERMINOLOGY

This section defines several key concepts that will be used throughout this report, using the definitions from the Ontario DSM Guidelines for spillover and free rider.

A *free rider* is “a program participant who would have installed a measure on his or her own initiative even without the program.”<sup>1</sup>

*Free-ridership rate*: Ratio of savings claimed from participants that were not influenced by the utility program.

*Gross Realization Rate (Gross RR)*: Adjustment factor used to multiply tracked savings to arrive at verified gross savings estimate, or “ex-post” savings estimate; disaggregated by measure type and utility. Each gross RR is developed through data collected during the gross impact portion of the C&I Prescriptive program verification efforts, which will verify program-achieved gross savings for measures at a sample of sites. It is the ratio of the verified gross savings to the tracking estimate of gross savings for installed measures, and includes corrections to the numbers of units installed, eligibility criterion (as listed in the measure Sub Docs), etc. (as detailed in section 2.2.2 of the workplan in Appendix A). The Gross RR is derived through the participant survey data collection (either via phone or an on-site), which confirms that the reported equipment / measure was installed and is currently operational at the facility.

*Gross savings* are “the changes in energy consumption and/or demand that result directly from program-related actions taken by participants in an efficiency program, regardless of why they participated.”<sup>2</sup>

*In-Depth Interviews (IDIs)* are structured interviews administered by evaluation engineers (for gross impact verification and SO follow-up data collection) and market researchers/project analysts (for FR and SO data collection) either in person or, more frequently, over the phone.

*Net-to-Gross Ratio (NTGR)*: Ratio that accounts for effects such as attribution, free riders, and the spillover effects (if any); disaggregated by measure type and utility.

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<sup>1</sup> Ontario Energy Board Demand Side Management Guidelines for Natural Gas Utilities, EB-2008-0346, June 2011, Chapter 7.

<sup>2</sup> SEE Action, Energy Efficiency Program Impact Evaluation Guide: Evaluation, Measurement, and Verification Working Group, DOE/EE-0829, December 2012.  
[https://www4.eere.energy.gov/seeaction/sites/default/files/pdfs/emv\\_ee\\_program\\_impact\\_guide\\_1.pdf](https://www4.eere.energy.gov/seeaction/sites/default/files/pdfs/emv_ee_program_impact_guide_1.pdf), page xiv



*Priority Measure Groups:* Per the final workplan, the evaluation addressed the top four Priority Measure Groups for each utility. See Appendix A (workplan) for complete details.

*Spillover(SO)* “refers to effects of customers that adopt energy efficiency measures because they are influenced by a utility’s program-related information and marketing efforts, but do not actually participate in the program.”<sup>3</sup> We considered both inside and outside, and both like and unlike spillover through this project.

- Inside spillover refers to non-incented measures that were installed within the same facility.<sup>4</sup>
- Outside spillover refers to measures for which the customer did not receive an incentive adopted in an outside location for a participating customer.<sup>5</sup>
- Like spillover refers to non-incented measures of the same type as incented measures.<sup>6</sup>
- Unlike spillover refers to non-incented measures of a different type as incented measures.<sup>7</sup>

*Telephone Supported Engineering Reviews (TSERs)* are desk reviews, entailing a phone interview with program participants (typically the person(s) most knowledgeable about the measure in question), conducted for those projects outside the on-site sample points, to verify measure installation and operation.

*Tracked Savings:* Gross natural gas savings claimed by each utility (in CCM) for each measure, or “ex-ante” savings estimate.

*Verified Savings:* Gross natural gas savings by each utility (in CCM) for each measure, verified by the evaluation team, or “ex-post” savings estimate.

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<sup>3</sup> Ontario Energy Board Demand Side Management Guidelines for Natural Gas Utilities, EB-2008-0346, June 2011, Chapter 7.

<sup>4</sup> Ontario Energy Board Demand Side Management Guidelines for Natural Gas Utilities, EB-2008-0346, June 2011, Chapter 7.

<sup>5</sup> Ontario Natural Gas Technical Evaluation Committee (TEC), Request for Proposal: Measurement of Net-to-Gross (NTG) Factors for Ontario’s Natural Gas Custom Commercial and Industrial Demand Side Management (DSM) Programs, RFP-002-2013 (2), December 2013, Section 2.

<sup>6</sup> NREL, Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures, December 2014. <http://www.nrel.gov/docs/fy14osti/62678.pdf>

<sup>7</sup> Ibid



*Vendors* are program trade allies, business partners, service providers, contractors and suppliers who work with program participants to implement energy saving measures.

*+/- or Absolute Precision:* If the evaluation were repeated several times selecting samples from the same population, 90% of the time the ratio would be within this range of the ratio.

*Confidence interval:* The upper bound is defined by the ratio plus the absolute precision. the lower bound is defined by the ratio minus the absolute precision.

*Relative Precision* is calculated as the absolute precision divided by the ratio itself. By convention, relative precisions are the statistic that are targeted in sampling (i.e., 90/10 is a relative precision metric).

*Coefficient of Variation (CV):* is a statistical measure of the dispersion of data points in a data series around the mean. The coefficient of variation represents the ratio of the standard deviation to the mean.

*Finite population correction (FPC)* is a factor that reduces the measured error of samples drawn from small populations (less than 300). FPC applies when the ratio is applied to the same population from which the sample was drawn.<sup>8</sup>

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<sup>8</sup> Results from this study with FPC will be applied to the lost revenue calculations for the 2017 program. Those without FPC will be applied to future study year shareholder incentive and lost revenue calculations.



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# 1 EXECUTIVE SUMMARY

This report has been prepared for the Ontario Energy Board (OEB) and provides the results of the gross savings verification and net-to-gross ratios (NTGRs), by Priority Measure Group, for the commercial and industrial prescriptive programs in Enbridge Gas Distribution Inc.'s (Enbridge) and Union Gas Limited's (Union) natural gas demand-side management (DSM) portfolio delivered in 2017. The combined study produced gross impact verification, free ridership (FR) and participant spillover (SO) ratios.<sup>9</sup>

## 1.1 EVALUATION OBJECTIVES

The overall goals of the combined evaluation were to develop:

- Verified gross and net ratios for a selected set of Priority Measure Group projects (designed to meet 90/10 statistical confidence and relative precision levels) from the 2017 prescriptive commercial and industrial programs
- Participant spillover factors applicable to commercial and industrial prescriptive projects, for a selected set of Priority Measure Groups, based on projects installed in 2017

## 1.2 EVALUATION APPROACH

At a high level, the gross savings verification and NTG study employed the following methodology:

- Receive program data and documentation.
- Design and select the sample.
- Collect data.
- Analyze the results.
- Report the results.

The methodology selected for the gross impact portion of the study consisted of telephone supported engineering reviews (TSERs) and on-site verification visits to aid in calculation of the ex-post gross savings. The methodology selected for the NTG evaluation relied on end-user self-report surveys and interviews.

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<sup>9</sup> Free-ridership rate: Ratio of savings claimed from participants that were not influenced by the utility program.



The end user self-reports were supplemented by interviews with vendors to capture their and the program’s influence on end-user decision making. The NTG analysis also considered spillover savings due to the programs.

## 1.3 RESULTS

The following section presents the results from gross impact verification and NTG research study for Enbridge and Union. Table 1-1 and Table 1-2 show the Enbridge gross verification and NTG results, respectively. Itron did not find any participant spillover results for Enbridge or Union.

The Enbridge results show that the program’s gross savings estimates are accurate and confirm with the specifications in the technical reference manual (TRM) and subdocuments (subdocs) describing savings calculations.

**TABLE 1–1: ENBRIDGE GROSS IMPACT RESULTS SUMMARY**

Priority Measure Group	Gross Verification Realization Rate	90% Confidence Interval			Relative Precision
		(+ / -)	Lower Bound	Upper Bound	
Boilers	100%	0%	100%	100%	0%
Kitchen Ventilation	103%	3%	100%	106%	3%
Infrared Heating	103%	6%	97%	109%	6%
DCV	104%	2%	102%	106%	2%

The NTG results show that the program is influencing installations that represent less than 62% of the energy savings reported by the program, with a very minimal influence on the DCV Priority Measure Group.



**TABLE 1-2: ENBRIDGE NET-TO-GROSS RESULTS**

Priority Measure Group	Free Ridership Rate	Spillover	NTGR	90% Confidence Interval			Absolute Precision (w/ FPC) (+/-)	Absolute Precision (w/o FPC) (+/-)
			= [(1-FR) + SO]	+/-	Lower Bound	Upper Bound		
Boilers	70%	0%	30%	20%	10%	50%	17%	21%
Kitchen Ventilation	38%	0%	62%	24%	38%	86%	24%	26%
Infrared Heating	89%	0%	11%	9%	2%	20%	9%	10%
DCV	92%	0%	8%	17%	0%	25%	13%	21%

Table 1-3 and Table 1-4 show the Union gross verification and NTG results, respectively.

The Union results show that the program’s gross savings estimates are accurate and confirm with the specifications in the TRM and subdocs describing savings calculations.

**TABLE 1-3: UNION GROSS IMPACT RESULTS SUMMARY**

Priority Measure Group	Gross Verification Realization Rate	90% Confidence Interval			
		(+/-)	Lower Bound	Upper Bound	Relative Precision
Boilers	102%	1%	100%	103%	1%
ERV	100%	1%	99%	100%	1%
Infrared Heating	103%	3%	99%	106%	3%
Air Curtains	100%	0%	100%	100%	0%

The NTG results show that the program is influencing installations that represent less than 50% of the energy savings reported by the program, with a very minimal influence on the Infrared Heating Priority Measure Group.



**TABLE 1-4: UNION NET-TO-GROSS RESULTS**

Priority Measure Group	Free Ridership Rate	Spillover	NTGR	90% Confidence Interval		Absolute Precision (w/ FPC) (+/-)	Absolute Precision (w/o FPC) (+/-)	
			= [(1-FR) + SO]	+/-	Lower Bound			Upper Bound
Boilers	76%	0%	24%	9%	15%	32%	9%	9%
ERV	70%	0%	30%	13%	17%	43%	8%	13%
Infrared Heating	93%	0%	7%	6%	1%	13%	6%	6%
Air Curtains	50%	0%	50%	22%	29%	72%	19%	24%

## 1.4 FINDINGS & RECOMMENDATIONS SUMMARY

Key findings and recommendations from the study are presented in Table 1-5 below.

**TABLE 1-5: 2017 C&I PRESCRIPTIVE PROGRAM VERIFICATION: FINDINGS & RECOMMENDATIONS**

Finding	Recommendation	Applicable Entity
Free-ridership levels for Enbridge ranged from 38% to 92% and from 50% to 93% for Union.	The utilities should consider evaluating free-ridership for the programs annually and consider coupling the free-ridership evaluation with process evaluation to better understand how the utilities are influencing the vendors and their outreach to the end-users.	Enbridge & Union
Both utilities had high ex-post gross realization rates, implying that the utilities are accurately estimating the ex-ante savings based on the measure sub-docs and/or the TRM.	GRRs were close to 100% for all evaluated Priority Measure Groups; <b>no action recommended.</b>	Enbridge & Union
There was no participant spillover for either utility.	<ul style="list-style-type: none"> <li>The utilities should work with the vendors to find out their protocol on recommending the installation of program measures at customers' facilities. This would enable the utilities to better understand the influence the programs have on the customers' behavior, especially in the context of spillover.</li> </ul>	Enbridge & Union



Finding	Recommendation	Applicable Entity
	<ul style="list-style-type: none"> <li>■ The utilities should also consider conducting a market study to quantify any nonparticipant spillover, contingent on EAC and EC consideration.</li> </ul>	
<p>Union could benefit from investing in a modern program tracking database with document storage capabilities as most of the participant and vendor contact information had to be extracted by the verification team.</p>	<ul style="list-style-type: none"> <li>■ Digitize and file project documentation for all projects as they are completed and paid during project closeout.</li> <li>■ Track contacts associated with projects in the program tracking database.</li> <li>■ Strongly consider investing in relational program tracking databases.</li> </ul>	<p>Union; however, it must be noted that Union has indicated the presence of an online tracking database for their 2018 programs</p>
<p>Vendor surveys had very low response rates</p>	<ul style="list-style-type: none"> <li>■ Incentives to complete survey</li> <li>■ Recommendation for utilities to communicate with vendors regarding the importance of this evaluation step during future NTG studies</li> </ul>	<p>Enbridge &amp; Union and Verification Team</p>
<p>Participants were generally receptive in responding to surveys. The response rate for participants was around 50% for the first few months. After the first wave of customers were contacted, the more difficult corporate customers and unresponsive customers were attempted to be reached. By the end, after many attempts and exhausting the sample, the overall response rate was about 30% overall for participants.</p>	<ul style="list-style-type: none"> <li>■ Incentives to complete survey</li> <li>■ Recommendation for Utility to communicate with customers about the importance of this evaluation steps during future NTG studies</li> </ul>	<p>Enbridge &amp; Union and Verification Team</p>

## 2 INTRODUCTION

This report has been prepared for the Ontario Energy Board (OEB) and provides the results of the gross savings verification and net-to-gross ratios (NTGRs), by Priority Measure Group, for the commercial and industrial prescriptive programs in Enbridge Gas Distribution Inc.'s (Enbridge) and Union Gas Limited's (Union) natural gas demand-side management (DSM) portfolio delivered in 2017. The combined study produced gross impact verification, free ridership (FR) and participant spillover (SO) ratios.

### 2.1 EVALUATION OBJECTIVES

The overall goals of the combined evaluation were to develop:

- Verified gross and net ratios for a selected set of Priority Measure Group projects (designed to meet 90/10 statistical confidence and relative precision levels) from the 2017 prescriptive commercial and industrial programs
- Participant spillover factors applicable to commercial and industrial prescriptive projects, for a selected set of Priority Measure Groups, based on projects installed in 2017

The programs and projects included in each portion of the study are shown in Table 2-1.



**TABLE 2-1: 2017 C&I PRESCRIPTIVE VERIFICATION – GROSS IMPACT, NTG AND SO ACTIVITIES BY PROGRAM**

Utility	Scorecard	Program Offering	Gross Impact	NTG	SO
Enbridge	Resource Acquisition	Commercial and Industrial Prescriptive Offer (including both pure and quasi- prescriptive projects)	✓	✓	✓
Union	Resource Acquisition	Commercial /Industrial Prescriptive Offering (including both pure and quasi- prescriptive projects)	✓	✓	✓

## 2.2 BACKGROUND

Customers receive an incentive through Enbridge and Union C&I prescriptive programs for installing eligible high efficiency pure prescriptive or quasi-prescriptive gas-saving equipment. Prescriptive programs offer fixed incentives that offset the cost of installing energy efficient equipment for a set of technologies. Due to the general nature of prescriptive programs, it is not uncommon for prescriptive programs to remain cost-effective while having higher free-ridership rates. Vendors and distributors also receive an incentive through Enbridge and Union C&I prescriptive programs to offset the increased cost of participating in the program. Vendors receive \$100 per application while distributors received \$50; these values are nominal compared to the customer incentives, which range from \$100 to \$8,500 per unit, depending on the measure. Customer eligibility is dependent on TRM/subdocs requirements as well as measure-level technical requirements. Both Enbridge and Union also provide vendors with marketing and technical tools to educate them on the high efficiency equipment.

## 2.3 EVALUATION APPROACH

At a high level, the gross savings verification and NTG study employed the following methodology:

- **Receive program data and documentation.** The evaluation started with a review of the program tracking data, which formed the basis of the sample, and an initial review of the program documentation. Once the sample was selected, additional documentation was provided by the program to describe the energy efficiency measures and support the tracking savings estimates, also called the ex-ante estimates.
- **Design and select the sample.** The tracking data was used to design and select a sample for the Priority Measure Groups (the top four measure groups contributing to the two programs' CCM in



2017). Full documentation and contact information was requested for all sites within the sample. The gross impact sample was designed as a subset of the NTG sample.

- **Collect data.** Data was collected (via onsite and telephone) to verify the ex-ante energy savings and estimate NTG ratios at the Priority Measure Group level.
- **Analyze the results.** The collected data was used to verify the gross savings and estimate NTG ratios at the Priority Measure Group level.
- **Report the results.** The final step was to report the results, presented in Section 4 below.

The methodology selected for the gross impact portion of the study consisted of telephone supported engineering reviews (TSERs) and on-site verification visits to aid in calculation of the ex-post gross savings. Full details of the gross impact methodology can be found in the embedded workplan in Appendix A (Task 2; pages 2-9 to 2-23). Gross Realization Rate (Gross RR) is the adjustment factor used to multiply tracked savings to arrive at verified gross savings estimate, or “ex-post” savings estimate; disaggregated by Priority Measure Group and utility. Gross RR is the ratio of the verified gross savings to the tracking estimate of gross savings for installed measures, and includes corrections to the numbers of units installed, eligibility criterion (as listed in the measure Sub Docs), etc. (as detailed in section 2.2.2 of the embedded workplan in Appendix A). This ratio can be applied to the tracking savings to produce verified gross savings within the Priority Measure Group.

### FOR A PRESCRIPTIVE PROJECT:

*Verified project savings* =

$$\text{Claimed project savings} \times \frac{\# \text{ Verified } \mathbf{eligible} \text{ units}}{\# \text{ Claimed units}} \times \frac{\text{Verified prescr savings value from subdoc}}{\text{Claimed prescr savings value}}$$

### FOR A QUASI-PRESCRIPTIVE PROJECT:

*Verified project savings* =

$$\text{Claimed project savings} \times \frac{\# \text{ Verified } \mathbf{eligible} \text{ units}}{\# \text{ Claimed units}} \times \frac{\text{Verified prescr savings rate from subdoc}}{\text{Claimed prescr savings rate}} \times \frac{\text{Verified quasi input}}{\text{Claimed quasi input}}$$

Gross savings realization rates are then calculated for each measure sampled as follows:

$$\text{Gross RR} = \frac{\text{Verified project savings}}{\text{Claimed project savings}}$$





The methodology selected for the NTG evaluation relied on end-user self-report surveys and interviews. These surveys produce a score based on the participants' responses to questions pertaining to the program's influence on their decision to install energy efficient equipment. This type of influence, of the utility directly on the participant, is called direct influence. These end-user self-reports were supplemented by interviews with vendors to capture the utility's influence on vendor actions when selling the equipment. This indirect utility influence cannot be seen by the customer and therefore cannot be captured in customer surveys. Again, the surveys produce a score based on the vendors' responses to the questions. The NTG analysis also considered participant spillover savings due to the programs. The final free-ridership for each project is the minimum of vendor and customer free-ridership scores. The NTG analysis also considered participant spillover savings due to the programs, which is added to the complement of free ridership to produce the overall net-to-gross ratio. Full details of the NTG methodology can be found in the embedded workplan in Appendix A (Task 3; pages 2-23 to 2-36). This ratio can be applied to the verified gross savings to produce net savings within a priority measure group.

$$NTGR = (1 - \min(FR_{participant}, FR_{vendor})) + SO$$

# 3 SAMPLE DISPOSITION

Table 3-1 and Table 3-2 summarize the data collection efforts of both participant and vendor surveys. The targeted number of projects, the completed number of projects, the number of unique customers, the associated savings, and the vendor surveys are displayed below for each Priority Measure Group.

**TABLE 3-1: SUMMARY OF ENBRIDGE NTG DATA COLLECTION**

Priority Measure Group	Target	Completed			
	Number of Projects	Number of Projects	Number of Unique Customers	Lifecycle Verified CCM of Survey Completes	Vendor Survey Completes
Boilers	31	19	13	4,836,281	0
Kitchen Ventilation	32	16	11	2,716,072	6
Infrared Heating	32	12	12	1,123,778	3
DCV	26	23	4	2,862,741	1
Total	121	70	40	11,538,872	10

**TABLE 3-2: SUMMARY OF UNION NTG DATA COLLECTION**

Priority Measure Group	Target	Completed			
	Number of Projects	Number of Projects	Number of Unique Customers	Lifecycle Verified CCM of Survey Completes	Vendor Survey Completes
Boilers	44	41	32	12,624,586	5
ERV	40	45	30	13,754,494	11
Infrared Heating	43	28	28	4,024,533	5
Air Curtains	19	13	10	6,614,880	4
Total	146	127	100	37,018,493	25

# 4 RESULTS

The outcome of the 2017 C&I Prescriptive Verification project produced verified gross and net ratios for the 2017 programs. Section 4.1 below presents the results of this study for Enbridge while Section 4.2 presents the results for Union.

## 4.1 2017 C&I PRESCRIPTIVE VERIFICATION RESULTS – ENBRIDGE

### 4.1.1 Enbridge Gross Impact Results

A summary of the measure specific gross realization rates for Enbridge’s 2017 C&I Prescriptive program is provided below.

**TABLE 4-1: ENBRIDGE GROSS IMPACT RESULTS SUMMARY**

Priority Measure Group	Gross Verification Realization Rate	90% Confidence Interval			Relative Precision
		(+/-)	Lower Bound	Upper Bound	
Boilers	100%	0%	100%	100%	0%
Kitchen Ventilation	103%	3%	100%	106%	3%
Infrared Heating	103%	6%	97%	109%	6%
DCV	104%	2%	102%	106%	2%

The gross verification realization rates for Enbridge’s 2017 C&I Prescriptive programs indicate that the program’s ex-ante gross savings estimates are accurate and conform with TRM/ subdoc stipulations. The measure specific gross impact reports, which present detailed findings for each of the evaluated Priority Measure Groups, are presented in Appendix C. The small relative precisions indicate that the verified savings for most projects were close to the reported savings. While there were a few adjustments, they were not large.



## 4.1.2 Enbridge NTG Results

### Enbridge NTG Ratios

Table 4-2 summarizes Enbridge NTG ratios along with confidence interval and absolute precision statistics. The free-ridership ratio is 70% for the Boilers measure group, 38% for the Kitchen Ventilation measure group, 89% for the Infrared Heating measure group, and 92% for the DCV measure group. Based on the participant IDIs, Itron found no evidence of participant spillover. Therefore, the NTG ratios are 30%, 62%, 11%, and 8% respectively for Boilers, Kitchen Ventilation, Infrared Heating, and DCV.

Absolute precisions are calculated with and without finite population correction (FPC).<sup>10</sup> The absolute precisions with FPC are 17%, 24%, 9%, and 13% respectively for Boilers, Kitchen Ventilation, Infrared Heating, and DCV. The absolute precisions without FPC are 21%, 26%, 10%, and 21% respectively for Boilers, Kitchen Ventilation, Infrared Heating, and DCV. The absolute precisions of the study were in line with the study objectives, but the low NTG ratios resulted in lower than planned relative precisions. While the absolute precisions are not always in compliance with the standards set forth for applying ratios to produce verified savings in other programs such as the Custom Program Savings Verification (CPSV), the results presented here are indicative of program performance based on data collected during the NTG interviews.

The free-ridership rates in the NTG results are the ratio of savings claimed from participants that were not influenced by the utility program. NTG ratios are an estimation statistic of the true population net to gross value. Unlike the variations seen with the gross realization rates, the variations seen with the NTGRs are higher due to the larger ranges of customer responses regarding program influence. For example, the variation seen with Infrared Heating Priority Measure Group interview responses is lower than the variation of interview responses for other Priority Measure Groups. This indicates that customers generally had similar interview responses, where the NTGR for each project remained +/- nine percent within the average NTGR value of eleven percent.

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<sup>10</sup> Results from this study with FPC will be applied to the lost revenue calculations for the 2017 program. Those without FPC will be applied to future study year shareholder incentive and lost revenue calculations.



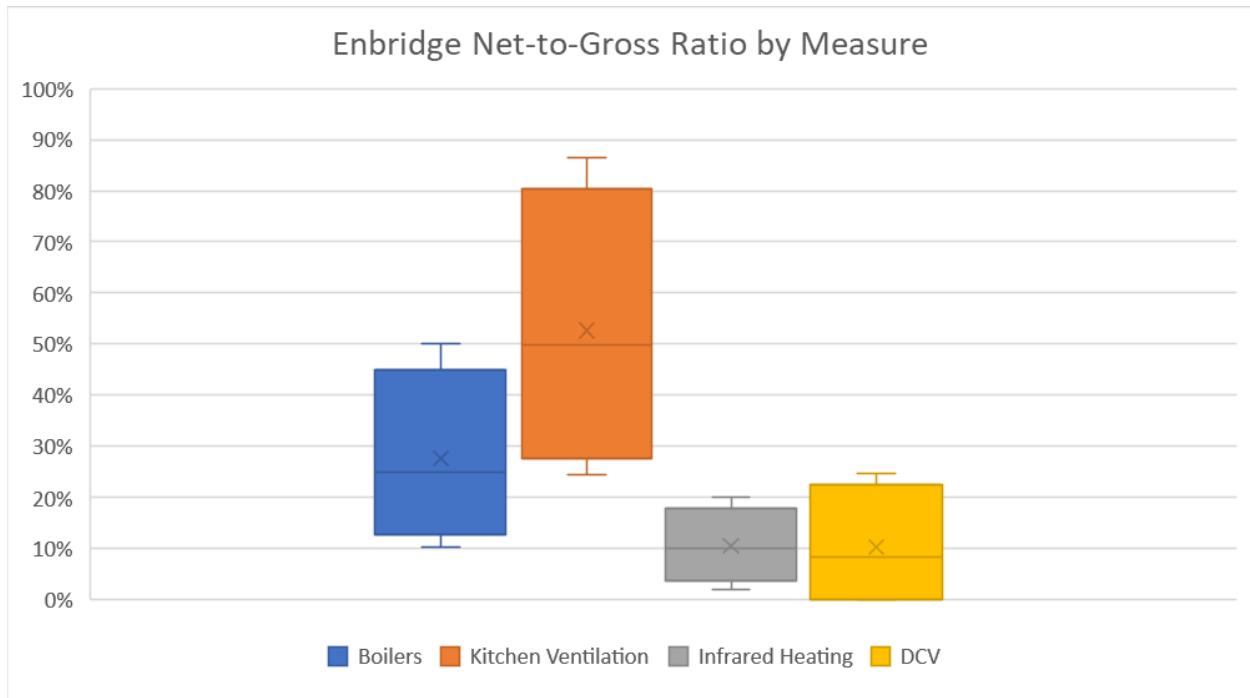
**TABLE 4-2: ENBRIDGE NET-TO-GROSS RESULTS**

Priority Measure Group	Free Ridership Rate	Spillover	NTGR	90% Confidence Interval			Absolute Precision (w/ FPC) (+/-)	Absolute Precision (w/o FPC) (+/-)
			= [(1-FR) + SO]	+/-	Lower Bound	Upper Bound		
<b>Boilers</b>	70%	0%	<b>30%</b>	20%	10%	50%	17%	21%
<b>Kitchen Ventilation</b>	38%	0%	<b>62%</b>	24%	38%	86%	24%	26%
<b>Infrared Heating</b>	89%	0%	<b>11%</b>	9%	2%	20%	9%	10%
<b>DCV</b>	92%	0%	<b>8%</b>	17%	0%	25%	13%	21%



Figure 4-1 displays the results at 90% confidence, meaning that the probability that the true NTGR is within the confidence interval range is 90%.

**FIGURE 4-1: ENBRIDGE NET-TO-GROSS RESULTS**



These NTG results are indicative of the program influence on the participants' decision-making. For example, the free-ridership ratio of 70% for the Boilers Priority Measure Group indicates that the program is influencing 30% of the energy savings they report.

## Enbridge Vendor Surveys

The decision to pursue a vendor interview is dependent on participant questions VT1 and VT2, listed below.

Now, I am going to ask you some questions about factors that influenced your decision-making process. If you were to allocate 100 points among the various factors that influenced your decision to install the equipment you did, how many 'influence points' would you give to:

- VT1. <Vendor> recommendation regarding equipment selection?
  - VT1a. What specific recommendations did <Vendor> provide that influenced your decision to purchase the equipment?



- VT2. Price of the equipment
  - VT2x. I would like to get a sense of your price sensitivity for the equipment. Let's say the project would have cost <20% vendor rebate in dollars> more, would you have still done it? What about <40% vendor rebate in dollars>? What about <60% vendor rebate in dollars>? <80% vendor rebate in dollars>? <100% vendor rebate in dollars>?

When the sum points of VT1 and VT2 are greater than 50%, given that VT1>0 and/or VT2x is valid (participant indicates that the amount more they would spend on the equipment is equal to or less than the vendor rebate), then that vendor is given priority to be contacted for an interview. These vendors are prioritized by being the first group of vendors to dial, with more allotted calling attempts (6 attempts). Participants that allocate VT1+VT2 with less points are also contacted after the high priority vendors are contacted. Participant VT1+VT2 scores ranked less than 30% are generally not contacted, unless this vendor happens to overlap with a vendor of a different customer with a high score. Please note that any participant interviews that were conducted in the last few days of data collection did not warrant enough time to schedule vendor interviews. Vendor interviews are scheduled the week after the data collection for the participant interview is completed. Also, if the participant NTG ratio was already 1.0, then the vendor was not contacted for an interview. The 5 vendors that were not contacted belonged to two boiler projects, two kitchen ventilation projects, and an infrared heating project.

A total of 30 vendor IDIs were attempted and 10 completed, as shown in Table 4-3 below. One vendor interview can apply to more than one project. There were five participants that did not purchase the program qualifying equipment through a vendor.

**TABLE 4-3: ENBRIDGE VENDOR SURVEY DATA COLLECTION – COMPLETES**

	# Vendors	# Projects
Completed	10	14

There were five vendors where Itron did not attempt an interview due to varying reasons such as participant score being 1.0, or if the VT1+VT2 scores were <30%, or due to the timing of the interview. Table 4-4 provides the summary of the data collection disposition of vendor surveys that we could not complete.



**TABLE 4-4: ENBRIDGE VENDOR SURVEY DATA COLLECTION - NOT COMPLETED**

	<b>No Vendor</b>	<b>Attempted, Not Completed # Vendors in Participant Sample</b>	<b>Not Attempted # Vendors in Participant Sample</b>
Not Completed	5	20	5





Table 4-5 shows the percentage of program savings broken up by the VT1 score, which asks the customer to allocate a certain amount of points to the vendor recommendation. Customers representing 2% of savings gave the vendor recommendation 100 influence points. Customers representing another 2% of savings gave the vendor recommendation between 76-99 influence points. Customers representing another 4% of savings gave the vendor between 51-75 influence points. Customers representing another 64% of savings gave the vendor between 1-50 influence points. Customers representing another 28% of savings gave the vendor 0 influence points.

**TABLE 4-5: PERCENTAGE OF SAVINGS OF ENBRIDGE PROJECTS WITH VENDOR TO PARTICIPANT INFLUENCE**

<b>Level of Influence</b>	<b>% Energy Savings Influenced by Vendor</b>
Fully Influenced (VT1 100%)	2%
High Influence (VT1 76-99%)	2%
Moderate Influence (VT1 51-75%)	4%
Low Influence (VT1 1-50%)	64%
No Influence (VT1 0%)	28%

## **Enbridge Spillover**

Based on the participant IDIs, we found no evidence of spillover in the analysis for Enbridge. To determine spillover, Itron asked participants to identify projects they installed as a result of their participation in the Enbridge prescriptive program. Five customers responded with something that they considered as inside spillover, while four customers responded to what they considered was outside spillover. To confirm that these were spillover projects, Itron followed up with questions about the installed equipment, such as if a rebate was received, what fuel type did the equipment use, and if the equipment was purchased under a different program, etc. Using the results of that activity, Itron confirmed that these projects were not spillover because the potential spillover action was either incentivized, performed under another Enbridge/Union program, was performed under an electric utility program, or was not influential on the customer. Therefore, we found no evidence of spillover in the analysis for Enbridge. Greater detail on the participant responses and subsequent analysis of the spillover battery of question is provided in Appendix D.4 of this report.



## 4.2 2017 C&I PRESCRIPTIVE VERIFICATION RESULTS – UNION

### 4.2.1 Union Gross Impact Results

A summary of the measure specific realization rates for Union’s 2017 C&I Prescriptive program is provided below.

**TABLE 4–6: UNION GROSS IMPACT RESULTS SUMMARY**

Priority Measure Group	Gross Verification Realization Rate	90% Confidence Interval			
		(+ / -)	Lower Bound	Upper Bound	Relative Precision
Boilers	102%	1%	100%	103%	1%
ERV	100%	1%	99%	100%	1%
Infrared Heating	103%	3%	99%	106%	3%
Air Curtains	100%	0%	100%	100%	0%

The gross verification realization rates for Union’s 2017 C&I Prescriptive programs indicate that the program’s ex-ante gross savings estimates are accurate and conform with TRM/ subdoc stipulations. The measure specific gross impact reports, which present detailed findings for each of the evaluated Priority Measure Groups, are presented in Appendix D. The small relative precisions indicate that the verified savings for most projects were close to the reported savings. While there were a few adjustments, they were not large.

### 4.2.2 Union NTG Results

#### Union NTG Ratios

Table 4-7 summarizes Union NTG ratios along with confidence interval and absolute precision statistics. The free-ridership ratio is 76% for Boilers measure group, 70% for the ERV measure group, 93% for the Infrared Heating measure group, and 50% for the Air Curtains measure group. Based on the participant IDIs, Itron found no evidence of spillover. Therefore, the NTG ratios are 24%, 30%, 7%, and 50% respectively for Boilers, ERV, Infrared Heating, and Air Curtains.



Absolute precisions are calculated with and without FPC.<sup>11</sup> The absolute precisions with the FPC are 9%, 8%, 6%, and 19% respectively for Boilers, ERV, Infrared Heating, and Air Curtains. The absolute precisions without the FPC are 9%, 13%, 6%, and 24% respectively for Boilers, ERV, Infrared Heating, and Air Curtains. The absolute precisions of the study were in line with the study objectives, but the low NTG ratios resulted in lower than planned relative precisions. While the absolute precisions are not always in compliance with the standards set forth for applying ratios to produce verified savings in other programs such as the Custom Program Savings Verification (CPSV), the results presented here are indicative of program performance based on data collected during the NTG interviews.

The free-ridership rates in the NTG results are the ratio of savings claimed from participants that were not influenced by the utility program. NTG ratios are an estimation statistic of the true population net to gross value. Unlike the variations seen with the gross realization rates, the variations seen with the NTGR are higher due to the larger range of customer responses regarding program influence. For example, the variation seen with Infrared Heating Priority Measure Group interview responses is lower than the variation of interview responses for other Priority Measure Groups. This indicates that customers generally had similar interview responses, where the NTGR for each project remained +/- six percent within the average NTGR value of seven percent.

**TABLE 4-7: UNION NET-TO-GROSS RESULTS**

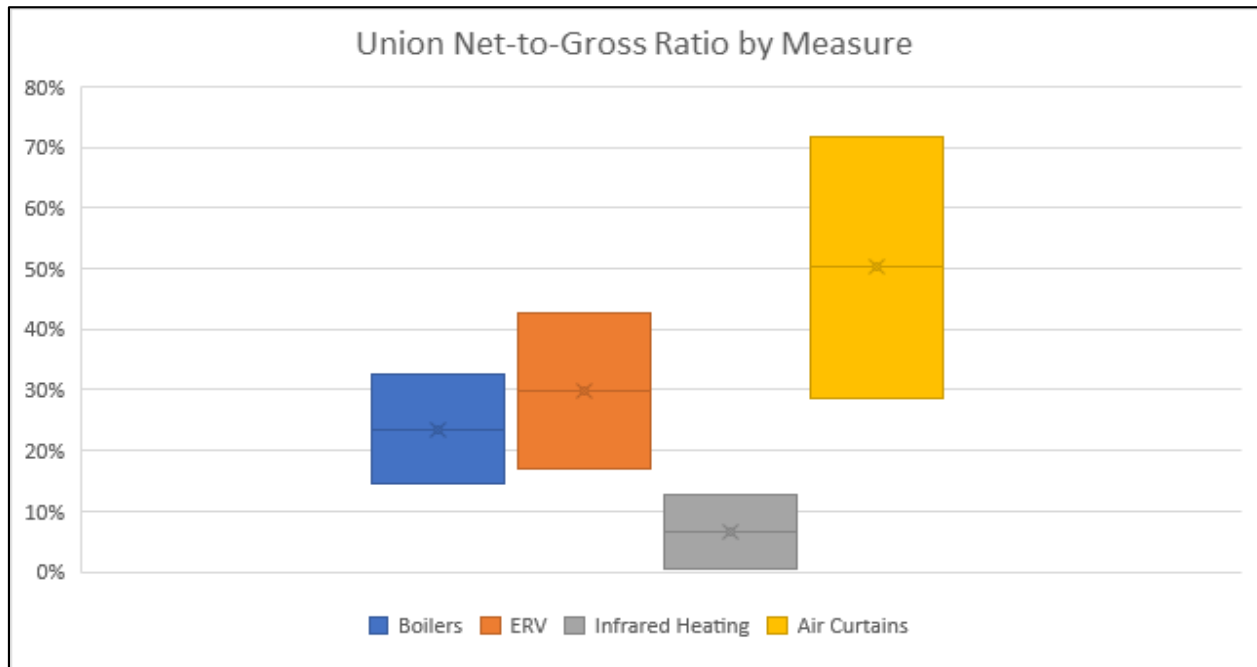
Priority Measure Group	Free Ridership Rate	Spillover	NTGR = [(1 - FR) + SO]	90% Confidence Interval		Absolute Precision (w/ FPC) (+/-)	Absolute Precision (w/o FPC) (+/-)
				+/-	Lower Bound Upper Bound		
Boilers	76%	0%	<b>24%</b>	9%	15% 32%	9%	9%
ERV	70%	0%	<b>30%</b>	13%	17% 43%	8%	13%
Infrared Heating	93%	0%	<b>7%</b>	6%	1% 13%	6%	6%
Air Curtains	50%	0%	<b>50%</b>	22%	29% 72%	19%	24%

Figure 4-2 displays the results at 90% confidence, meaning that the probability that the true NTGR is within the confidence interval range is 90%.

<sup>11</sup> Results from this study with FPC will be applied to the lost revenue calculations for the 2017 program. Those without FPC will be applied to future study year shareholder incentive and lost revenue calculations.



**FIGURE 4-2: UNION NET-TO-GROSS RESULTS**



These NTG results are indicative of the program influence on the participants' decision-making. For example, the free-ridership ratio of 76% for the Boilers Priority Measure Group indicates that the program is influencing 24% of the energysavings they report.

## Union Vendor Surveys

The decision to pursue a vendor interview is dependent on participant questions VT1 and VT2, listed below.

Now, I am going to ask you some questions about factors that influenced your decision-making process. If you were to allocate 100 points among the various factors that influenced your decision to install the equipment you did, how many 'influence points' would you give to:

- VT1. <Vendor> recommendation regarding equipment selection?
  - VT1a. What specific recommendations did <Vendor> provide that influenced your decision to purchase the equipment?
- VT2. Price of the equipment
  - VT2x. I would like to get a sense of your price sensitivity for the equipment. Let's say the project would have cost <20% vendor rebate in dollars> more, would you have still



done it? What about <40% vendor rebate in dollars>? What about <60% vendor rebate in dollars>? <80% vendor rebate in dollars>? <100% vendor rebate in dollars>?

When the sum points of VT1 and VT2 are greater than 50%, given that VT1>0 and/or VT2x is valid (participant indicates that the amount more they would spend on the equipment is equal to or less than the vendor rebate), then that vendor is given priority to be contacted for an interview. These vendors are prioritized by being the first group of vendors to dial, with more allotted calling attempts (6 attempts). Participants that allocate VT1+VT2 with less points are also contacted after the high priority vendors are contacted. Participant VT1+VT2 scores ranked less than 30% are generally not contacted, unless this vendor happens to overlap with a vendor of a different customer with a high score. Please note that any participant interviews that were conducted in the last few days of data collection did not warrant enough time to schedule vendor interviews. Vendor interviews are scheduled the week after the data collection for the participant interview is completed. Also, if the participant NTG ratio was already 1.0, then the vendor was not contacted for an interview. The 15 vendors that were not contacted belonged to five ERV projects, six boiler projects, and four infrared heating projects.

A total of 79 vendor IDs were attempted and 25 completed as shown in Table 4-8 below. One vendor interview can apply to more than one project. There were five participants that did not purchase the program qualifying equipment through a vendor.

**TABLE 4-8: UNION VENDOR SURVEY DATA COLLECTION – COMPLETED**

	# Vendors	# Projects
Completed	25	32

There were 15 vendors where Itron did not attempt an interview due to varying reasons such as participant score being 1.0, or if the VT1+VT2 scores were <30%, or due the timing of the interview. Table 4-9 provides the summary of the data collection disposition of vendor surveys that we could not complete.

**TABLE 4-9: UNION VENDOR SURVEY DATA COLLECTION – NOT COMPLETED**

	No Vendor	Attempted, Not Completed # Vendors in Participant Sample	Not Attempted # Vendors in Participant Sample
Not Completed	5	54	15

Table 4-10 shows the percentage of program savings broken up by the VT1 score, which asks the customer to allocate a certain amount of points to the vendor recommendation. Customers representing 8% of savings gave the vendor recommendation 100 influence points. Customers representing another 5% of



savings gave the vendor recommendation between 76-99 influence points. Customers representing another 14% of savings gave the vendor between 51-75 influence points. Customers representing another 60% of savings gave the vendor between 1-50 influence points. Customers representing another 14% of savings gave the vendor 0 influence points.

**TABLE 4–10: PERCENTAGE OF SAVINGS OF UNION PROJECTS WITH VENDOR TO PARTICIPANT INFLUENCE**

<b>Level of Influence</b>	<b>% Energy Savings Influenced by Vendor</b>
Fully Influenced (VT1 100%)	2%
High Influence (VT1 76-99%)	2%
Moderate Influence (VT1 51-75%)	4%
Low Influence (VT1 1-50%)	64%
No Influence (VT1 0%)	28%

## Union Spillover

Based on the participant IDIs, we found no evidence of spillover in the analysis for Union. To determine spillover, Itron asked participants to identify projects they participated in outside if the Enbridge and Union prescriptive programs. Seven customers responded with something that they considered as inside spillover, while one of the customers responded to what they considered was outside spillover. To confirm that they were spillover, Itron followed up with questions about the equipment, such as if a rebate was received, and the equipment was purchased under a different program. Using the results of that activity, Itron confirmed that these projects were not spillover because the potential spillover action was either incentivized, performed under another Enbridge/Union program, was performed under an electric utility program, or was not influential on the customer. Therefore, we found no evidence of spillover in the analysis for Union. Greater detail on the participant responses and subsequent analysis of the spillover battery of question is provided in Appendix F.4 of this report.



# 5 FINDINGS & RECOMMENDATIONS

Key findings and recommendations from the study are presented in Table 4-11 below.

**TABLE 5-1: 2017 C&I PRESCRIPTIVE PROGRAM VERIFICATION: FINDINGS & RECOMMENDATIONS**

Finding	Recommendation	Applicable Entity
Free-ridership levels for Enbridge ranged from 38% to 92% and from 50% to 93% for Union.	The utilities should consider evaluating free-ridership for the programs annually and consider coupling the free-ridership evaluation with process evaluation to better understand how the utilities are influencing the vendors and their outreach to the end-users.	Enbridge & Union
Both utilities had high ex-post gross realization rates, implying that the utilities are accurately estimating the ex-ante savings based on the measure sub-docs and/or the TRM.	GRRs were close to 100% for all evaluated Priority Measure Groups; <b><i>no action recommended.</i></b>	Enbridge & Union
There was no participant spillover for either utility.	<ul style="list-style-type: none"> <li>■ The utilities should work with the vendors to find out their protocol on recommending the installation of program measures at customers' facilities. This would enable the utilities to better understand the influence the programs have on the customers' behavior, especially in the context of spillover.</li> <li>■ The utilities should also consider conducting a market study to quantify any nonparticipant spillover, contingent on EAC and EC consideration.</li> </ul>	Enbridge & Union
Union could benefit from investing in a modern program tracking database with document storage capabilities as most of the participant and vendor contact information had to be extracted by the verification team.	<ul style="list-style-type: none"> <li>■ Digitize and file project documentation for all projects as they are completed and paid during project closeout.</li> <li>■ Track contacts associated with projects in the program tracking database.</li> <li>■ Strongly consider investing in relational program tracking databases.</li> </ul>	Union; however, it must be noted that Union has indicated the presence of an online tracking database for their 2018 programs



Finding	Recommendation	Applicable Entity
Vendor surveys had very low response rates	<ul style="list-style-type: none"> <li>■ Incentives to complete survey</li> <li>■ Recommendation for Utility to communicate with vendors regarding the importance of this evaluation step during future NTG studies</li> </ul>	Enbridge & Union and Verification Team
Participants were generally receptive in responding to surveys. The response rate for participants was around 50% for the first few months. After the first wave of customers were contacted, the more difficult corporate customers and unresponsive customers were attempted to be reached. By the end, after many attempts and exhausting the sample, the overall response rate was about 30% overall for participants.	<ul style="list-style-type: none"> <li>■ Incentives to complete survey</li> <li>■ Recommendation for utilities to communicate with customers about the importance of this evaluation steps during future NTG studies</li> </ul>	Enbridge & Union and Verification Team
Scoring methodology for participant's responses to efficiency questions "between standard and high" was sometimes not clear.	<ul style="list-style-type: none"> <li>■ This item should be re-visited during subsequent NTG studies contingent on EAC and EC discussion. One alternative is that if a respondent indicates that they would have used an efficiency between standard and high without the program, but cannot answer the follow up question of the efficiency level they would use, instead of taking the average "between standard and high" responses for the measure, use the scoring for "standard efficiency" instead. The logic behind this is that if the customer does not know the efficiency level, it is likely that they may not have equipment at this efficiency.</li> </ul>	Verification Team



# 6 APPENDICES

This section presents the appendices for this report.

# APPENDIX A – WORKPLAN

This appendix provides the final workplan for the combined C&I Prescriptive Gross and NTG Ratios measurement project. It provides complete details on the program background, the evaluation objectives, sampling details and gross and NTG methodologies.



OEB\_2017\_CIPMSV  
Workplan\_Sent\_To\_I

# APPENDIX B – NTG METHODOLOGY SUMMARY

In addition to providing full details on the NTG methodology in Appendix A (Workplan; Task 3; pages 2-23 to 2-36), we present an overview of the NTG methodology employed for this study in this section. The evaluation team used an end-user self report approach (SRA) to estimate net-to-gross ratios, which is the most commonly used approach for this type of program, and relies on participating customer survey results.

The free-ridership (FR) and participant spillover (SO) scores for each Priority Measure Group are developed using data collected from participant and vendor interviews. FR data is collected via in-depth telephone surveys. For the FR determination, a specific project completed by a customer for each Priority Measure Group (identified by unique *contract account numbers* for Enbridge and by *Customer IDs* and *measure name* for Union) as listed within the program tracking databases is defined as one sampling unit.

A minimum CV of 0.8 was used to determine the net-to-gross sample size, which yielded 121 participants for Enbridge and 146 participants for Union. Full details on NTG sampling can be found in Appendix A (Workplan; pages 2-24 and 2-25). Greater detail on the number of attempted and achieved completes is provided in Appendix D for Enbridge and in Appendix F for Union.

The free-ridership portion of the customer-decision maker survey was divided into three sections: timing, efficiency, and quantity. Timing questions determine the free-ridership during the acceleration period,<sup>12</sup> where applicable, and efficiency and quantity determine the free-ridership during the post-acceleration period.

## B.1 NOTATION

AE = Efficiency Attribution

AQ = Quantity (size) Attribution

fE = Efficiency free ridership

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<sup>12</sup> Program causes the participant to install a piece of equipment (not necessarily high efficiency) sooner than they would have otherwise



$fQ$  = Quantity (size) free ridership

$NS_A$  = Net Acceleration Period Savings

$NS_L$  = Net Lifetime Savings

$NS_p$  = Net Post-Acceleration Period Savings

$SPA$  = Simple Program Attribution (function of efficiency and quantity free ridership, not timing)

$VGS_E$  = Verified Gross Savings based on pre-existing equipment baseline (annual)

$VGS_S$  = Verified Gross Savings based on ISP or code efficiency equipment baseline (annual)

$VGS_L$  = Verified Gross Lifetime Savings

$Y_A$  = Years Accelerated

## B.2 INTRODUCTION

### B.2.1 What is Net-to-Gross?

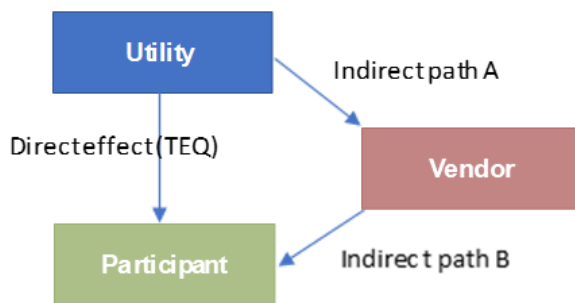
Net-to-gross is a ratio that measures the portion of program gross savings that were installed because of utility influence. These are energy savings that would not have happened if there wasn't a utility energy efficiency program. This included analyzing reasons for participation and investigating various program related factors that influenced the customers' decision to participate in the Enbridge and Union energy efficiency C&I prescriptive programs. NTG measures the utilities' influence on the customer's decision to install high efficiency priority measures.

There are two main channels of influence that were studied. Direct influence occurs when the utility directly influences the customers' decision to install energy efficient equipment. Indirect influence is when the utility influences the actions of the vendor, and the new vendor actions influence the customer's decision to install energy efficient equipment.



The relationship between utility, participant, and vendor is shown in the flow chart below.<sup>13</sup> The influence the utility has on the customer is a direct effect because the influence is “seen” by the customer and can be measured using the customer self-report survey. There is also an indirect influence that we must account for: the influence of the utility on the participant through the vendor. The customer does not see how the utility influenced the vendor in ways that influenced the customer. In the customer self-report survey, any such indirect influence would be attributed to the vendor. Therefore, vendor surveys are necessary to complete the picture and fully recognize the utility’s impact.

**FIGURE B-1 : INDIRECT INFLUENCE PATHWAY**



To capture indirect influence, two pathways are examined. Utility to vendor influence is assessed through vendor interviews (Indirect path A), while vendor to participant influence is assessed through participant interviews (Indirect path B).

Both upselling and price were factors analyzed in determining indirect influence. Upselling occurs when the utility gives the vendor marketing materials, education on energy efficiency benefits, selling tools, etc., which the vendor then uses to influence the customers’ purchasing decision. Indirect influence due to price occurs when the incentive from the utility to the vendor is passed on to the customer.

## B.2.2 NTG – Spillover & Free-Ridership

The Net-to-Gross calculation is the sum of spillover and (1-freeridership).

$$NTGR = (1 - FR) + SO$$

<sup>13</sup> Infographic developed by DNV GL and used with permission



## B.2.3 Free-Ridership – Relation between Participant and Vendor Result

The overall customer level free-ridership ratio is the minimum free-ridership ratio of the vendor and participant. Ratios are calculated at the customer/measure level, where each customer/measure has one free-ridership value. Then, results are aggregated to a utility/measure level final ratio.

$$FR = \min(FR_{participant}, FR_{vendor})$$

## B.2.4 Data Collection & Self-Reported Surveys

Data used to calculate the NTGR was obtained through two sources: the participant survey, and the vendor survey. The participant survey provided responses to direct influence (TEQ), vendor trigger (Indirect path B), and spillover. The vendor survey provided responses to the utility to vendor influence (Indirect path A).

## B.2.5 Final Net-to-Gross Calculation

$$NTGR = (1 - \min(FR_{participant}, FR_{vendor})) + SO$$

# B.3 FREE-RIDERSHIP

## B.3.1 Participant Free-Ridership (TEQ)

The terms direct attribution and participant free-ridership are used interchangeably as compliments of one another. Direct attribution is determined by responses to the timing, efficiency, and quantity (TEQ) questions. The period of time the program accelerated the measure is called the acceleration period, and is calculated from the timing questions. The post-acceleration period is the effect of efficiency and quantity. The participant survey is also used to assess vendor trigger, if a customer reports that the vendor recommendation (upselling) or price had influenced their decision.

### Timing

The acceleration period is dependent on question DAT1 in the survey, which asks:



1. DAT1a: “Without <the program>, would you have <installed, performed> <measure> at the same time, earlier, later, or never?”
  - DAT1a\_O: “Why do you say that?”
2. DAT1b: “Approximately how many months later?” (DAT1b is only asked if DAT1a is “Later.”)

Savings within the acceleration period are calculated as the difference in energy use of the replaced equipment and the rebated equipment.

$$NSA = VGSE \times Y_A$$

If the respondent answers DAT1 saying that they would “Never” have installed the measure without the program, or if the acceleration period is greater than four years, then the program attribution is 100% and free-ridership is 0%.

Four years is the time horizon beyond which we assume the respondent cannot answer with certainty. Anything answer to Dat1b of beyond four years ( $Y_A \geq 4$ ) is treated as a “never would have installed” response (100% attributable), rather than an accelerated measure.

If the respondent answers DAT1 with the response of “Don’t know” or “Refused”, and the efficiency and quantity parameters are valid, then the weighted average of DAT1 responses that are not “Don’t know” or “Refused” for that measure is used. If the respondent indicates, however, that without the program they would have installed the measure at a later time, but consequentially don’t know or refuse how much time later, then the average free-ridership for the accelerated measures within the same Priority Measure Group is applied.

## Efficiency

The efficiency attribution (AE) is determined by question DAT2:

1. DAT2a: “Without <the program>, would you have installed the same efficiency as what you installed, lower efficiency, or higher efficiency?”
2. DAT2b: “Without <the program>, would you have installed <measure> that was “< baseline> efficiency,” or “between <baseline> efficiency and the efficiency that you installed?” (DAT2b is only asked if DAT2a is “Lesser.”)



If the respondent indicates that they would have installed equipment of lesser efficiency without the program, then if the equipment installed would have been standard efficiency, the efficiency attribution is 100%. If the equipment installed would have been between standard efficiency and the efficiency of the equipment that was installed, the efficiency attribution is 50%.

If the respondent answers DAT2 with the response of “Don’t know” or “Refused”, and the timing and quantity parameters are valid, then the weighted average of DAT2 responses that are not “Don’t know” or “Refused” for that measure is used. If the respondent indicates, however, that they would have installed a lesser efficiency without the program, and don’t know if it would be at baseline efficiency or between baseline and standard efficiency, then the average score for the measures with response of DAT2a of lesser efficiency is applied.

## Quantity

The quantity attribution (AQ) is determined by question DAT3:

1. DAT3a: “Without <the program>, how different would the <number/size> of the <equipment type> have been? Would you say you would have installed the same amount, less, more, or not have installed anything?”
2. DAT3b: “By what percentage did you change the amount of <equipment type> installed because of <the program>?” (DAT3b is only asked if DAT3a is “Less” or “More.”)

If the respondent would have installed less of the equipment without the program, the quantity attribution would be the percent decrease/(1+percent decrease). If more equipment would have been installed without the program, the quantity attribution is the percent increase. *(Note that the workplan mistakenly states the opposite effect, corrected here and within the analysis based on EC team’s review).*

If the respondent answers DAT3 with the response of “Don’t know” or “Refused”, and the timing and efficiency parameters are valid, then the weighted average of DAT3 responses that are not “Don’t know” or “Refused” for that measure is used. If DAT3 is answered with “None”, then the quantity attribution is 100%. If the respondent indicates, however, that they would have installed a different quantity (less/more) without the program, and don’t know the quantity they would have installed, then the average score for the measures with response of DAT3a of “less” quantity is applied to DAT3a “less” responses, and DAT3a of “more” is applied to DAT3a “more” responses.





## Direct Attribution Score

Simple Program Attribution (SPA) measures the portion of the post-acceleration period gross savings due to the influence of the program and is based on efficiency and quantity. SPA is equal to 100% when the DAT1 response is “Never”. The following equations show how SPA is calculated.

$$fE = 1 - AE$$

$$fQ = 1 - AQ$$

$$SPA = 1 - fQ fE$$

For measures without baseline efficiency, also termed “add-on measures”, the SPA score is solely a function of quantity.

$$fQ = 1 - AQ$$

$$SPA = 1 - fQ$$

The final estimate of lifetime net savings ( $NS_L$ ) is:

$$NS_L = VGS_E \times Y_A + VGS_S \times SPA \times (Y_{V.EUL} - Y_A)$$

The net and gross savings for each sample point within a Priority Measure Group are summed, and the participant attribution is:

$$Direct\ Attribution = \frac{NS_L}{VGS_L}$$

## How Participant Surveys Trigger Vendor Surveys

The decision to pursue a vendor interview is dependent on participant questions VT1 and VT2. VT1, VT2, and VT3 are the participant’s scores for upselling, price, and other influence respectively. Combined, all three scores total to 100%. VT1, VT2, and VT3 ask the following:



Now, I am going to ask you some questions about factors that influenced your decision-making process. If you were to allocate 100 points among the various factors that influenced your decision to install the equipment you did, how many 'influence points' would you give to:

- VT1. <Vendor> recommendation regarding equipment selection?
  - VT1a. What specific recommendations did <Vendor> provide that influenced your decision to purchase the equipment?
- VT2. Price of the equipment
  - VT2x. I would like to get a sense of your price sensitivity for the equipment. Let's say the project would have cost <20% vendor rebate in dollars> more, would you have still done it? What about <40% vendor rebate in dollars>? What about <60% vendor rebate in dollars>? <80% vendor rebate in dollars>? <100% vendor rebate in dollars>?
- VT3. All other influences
  - VT3a. What other factors influenced your decision to purchase the equipment?



When the sum points of VT1 and VT2 are greater than 50%, given that  $VT1 > 0$  and/or  $VT2x$  is valid (participant indicates that the amount more they would spend on the equipment is equal to or less than the vendor rebate), then that vendor is given priority to be contacted for an interview. These vendors are prioritized by being the first group of vendors to dial, with more allotted calling attempts (6 attempts). Participants that allocate  $VT1+VT2$  with less points are also contacted after the high priority vendors are contacted. Participant  $VT1+VT2$  scores ranked less than 30% are generally not contacted, unless this vendor happens to overlap with a vendor of a different customer with a high score. Please note that any participant interviews that were conducted in the last few days of data collection did not warrant enough time to schedule vendor interviews. Vendor interviews are scheduled the week after the data collection for the participant interview is completed. Also, if the participant NTG ratio was already 1.0, then the vendor was not contacted for an interview. Total indirect influence scores are the product of indirect path A and indirect path B and represents the influence of the utility on the participant through the vendor.

Note that although participant surveys are asked at a project level, vendor surveys are not specific to the customer or project but based on general questions on the vendor's behavior for each measure as a result of the program. The actual scoring, however, is at the customer level, where the vendor attribution from vendor responses is applied by customer.

### B.3.2 Vendor Free-Ridership

The terms indirect attribution and vendor free-ridership are used interchangeably as compliments of one another. Indirect attribution is determined by upselling and price. A vendor interview is triggered if a customer reports that the vendor recommendation (upselling) or price had influenced their decision (Indirect path B). Then, the vendor is also asked questions regarding upselling and price (Indirect path A). Indirect attribution from both path A and path B are used in the final indirect attribution score.

### Upselling

Upselling refers to the influence of the vendor on the customer due to the vendor's recommendation to consider program qualifying equipment over other options, like less efficiency equipment or doing nothing at all, in the case of add-on measures. If the customer allocates any points to upselling, the customer is asked to explain the recommendations the vendor provided to assist their decision. If the vendor interview is triggered, the following questions are asked of the vendor:

1. U2: "In situations where you are selling <project\_n>, about what percent of the time are you recommending the high-efficiency equipment?"



2. U4: “For <project\_n> measure, what percent of the time would you recommend the high-efficiency equipment option without the program?”

Therefore, the total vendor upselling score is a combination of a few components.

- Part 1- Customer Allocation Upselling % (VT1)
- Part 2- Vendor Response =  $(U2-U4)/U2$
- Total Vendor Upselling= Part1\*Part2

## Price

The purpose of this question is to see if any vendor rebate passed onto the customer has an influence on the customer’s decision to participate in the program. If the customer allocates any points to pricing, follow up questions are asked, where the customer must identify if their involvement in the project would change due to increase in cost by incremental amounts of the vendor incentive – either by 20%, 40%, 60%, 80% or 100% of the vendor incentive.

If the vendor interview is triggered, then the vendor is asked the following question:

1. P5: “On average, what percent of the rebate is passed on to the buyer for <project\_n>, either directly or indirectly?”

A dollar amount is calculated by multiplying the total vendor incentive amount by the response of P5. If this dollar amount of passed on rebate is greater than the customer’s dollar threshold level, a pricing score of 1 is given.

Therefore, the total pricing score is a combination of a few components.

- Part 1- Customer Allocation Pricing % (VT2)
- Part 2- Binary (0/1) Response dependent on Customer Threshold and Amount Vendor Rebate Passed On
- Total Price= Part1\*Part2



## Other Influence

If there are other significant influences that are not accounted for by upselling and price, then this other influence will be asked of the customer. There is an open-end follow up that is used to identify the other factors. The other influence score is the percent allocation the customer gives to this influence. This other influence is not used in the indirect influence score. It is used to give opportunity to other areas of influence that may not be directly asked from other questions. The reason behind "other influence" is to allow the customer to rank all of their influences fairly, and if the main source of influence was not due to upselling or price, then this question allows for an unbiased point distribution. After careful review of 'other influence' responses, none of these responses warrant another form of indirect influence that was not already captured by upselling, price, or TEQ.

All 'other influence' open-ended responses have been post-coded and are presented in the word cloud below. The larger words indicate more common responses from the customers.

**FIGURE B-2: OPEN-END RESPONSE WORD CLOUD FOR "OTHER INFLUENCE"**





## B.3.3 Overall Free-Ridership

### Determining Overall Free-Ridership

The total indirect influence score is the sum of Total Vendor Upselling and Total Price. The total vendor free-ridership is (1-indirect influence score). The minimum vendor free-ridership and participant/TEQ free-ridership score is used as the final free-ridership for that customer/measure level.

$$FR_{participant} = 1 - \frac{NSL}{VGS_L}$$

$$Total\ Vendor\ Upselling = VT1 * (U2 - U4)/U2$$

$$Total\ Price\ (if\ vendor\ passed\ incentive) = VT2$$

$$FR_{vendor} = Total\ Vendor\ Upselling + Total\ Price$$

$$FR_{overall}\ (at\ customer/measure\ level) = (\min(FR_{participant}, FR_{vendor}))$$

## B.4 SPILLOVER

### B.4.1 Initial Data Collection

The participant spillover estimate will be developed through data collected from participant and vendor surveys, and a follow-up participant interview. Spillover is present when any of the following conditions are met:

- A non-program measure is installed outside the program after initial program participation by the participant
- A program measure is installed that does not receive a program incentive
- The original measure was attributable to the program and the spillover measure is at least partially attributable to the participant's experience with the program



## B.4.2 Confirmation of Spillover

Potential participant spillover savings are identified through a separate battery of spillover questions in the participating customer survey. The survey collects initial general information on what was installed and the degree to which the installed measure was influenced by their previous participation in the program. The findings are then analyzed to confirm attribution and to validate that the measure is indeed spillover and did not receive an incentive through the program. Once a causal link is established between the program and the project, a separate follow-up interview is conducted by the engineer responsible for the energy savings calculation and the collected data are used to develop an estimate of spillover savings for each pertinent project. This produces a more accurate savings estimate than if the customer were asked to provide an estimate themselves.

## B.4.3 Follow-up Data & Spillover Estimation

Attribution of claimed spillover is based on the following question: “If you had not made the earlier energy-efficiency improvements I just listed, how likely would you have been to make this additional energy efficiency improvement?”



The Attribution Factor is assigned in the following way:

1. Not likely at all- Attribution Factor=1.00
2. Not very likely- Attribution Factor=0.90
3. Somewhat likely- Attribution Factor=0.55
4. Very likely- Attribution Factor=0.00

Spillover Savings = Estimate Spillover Measure Savings X Attribution Factor

The NTG calculator produces measure-level ratios of spillover cumulative m<sup>3</sup> to tracked or verified cumulative m<sup>3</sup>, which are the source data for the Workplan's Task 4 (expansion process).



# APPENDIX C – ENBRIDGE GROSS IMPACT REPORTS

## C.1 BOILERS



Enbridge\_Boilers\_Final.pdf

## C.2 DEMAND CONTROLLED KITCHEN VENTILATION



Enbridge\_Kitchen  
Ventilation\_Final.pdf

## C.3 INFRARED HEATING



Enbridge\_Infrared  
Heating\_Final.pdf

## C.4 DEMAND CONTROLLED VENTILATION



Enbridge\_DCV\_Final.pdf

# APPENDIX D – ENBRIDGE NTG STUDY DETAILS

## D.1 ENBRIDGE NET-TO-GROSS DATA COLLECTION

The Net-to-Gross analysis for Enbridge was conducted for the following four Priority Measure Groups:

- Boilers
- Kitchen Ventilation
- Infrared Heating
- DCV

The number of targeted completes for Enbridge NTG data collection (121) was determined using a 90/10 relative precision with a CoV of 0.8, as detailed on pages 2-24 and 2-25 of the embedded workplan in Appendix A. Due to lower than expected response rates, a total of 70 of the targeted 121 projects completed NTG interviews.

Some customers represented multiple projects. The 70 completed NTG interviews entailed 40 customers. Of the data collection not completed, 83 projects attempted an NTG interview without success, while dialing was attempted on the entire population.

The verified lifecycle savings of projects with completed NTG data collection represents a total of 11,538,872 CCM, which is approximately 30% of total population savings in 2017, on a lifecycle CCM basis.

Across all four Enbridge Priority Measure Groups, vendors for 10 projects completed a vendor NTG survey. Table D-1 summarizes Enbridge NTG data collection.



**TABLE D-1: ENBRIDGE NET-TO-GROSS DATA COLLECTION ACTIVITIES**

Priority Measure Group	Total Pop			Target	Completed				Not Completed	
	Number of Projects	Number of Unique Customers	Lifecycle Verified CCM of Population	Number of Projects	Number of Projects	Number of Unique Customers *	Lifecycle Verified CCM of Survey Completes	Vendor Survey Completes (# Projects) **	Attempted, Not Completed # Projects	Not Attempted # Projects
<b>Boilers</b>	59	34	14,615,201	31	19	13	4,836,281	0	40	0
<b>Kitchen Ventilation</b>	72	61	10,789,773	32	16	11	2,716,072	6	56	0
<b>Infrared Heating</b>	85	81	10,040,821	32	12	12	1,123,778	3	73	0
<b>DCV</b>	29	6	4,410,209	26	23	4	2,862,741	1	6	0
<b>Total</b>	245	182	39,856,003	121	70	40	11,538,872	10	175	0

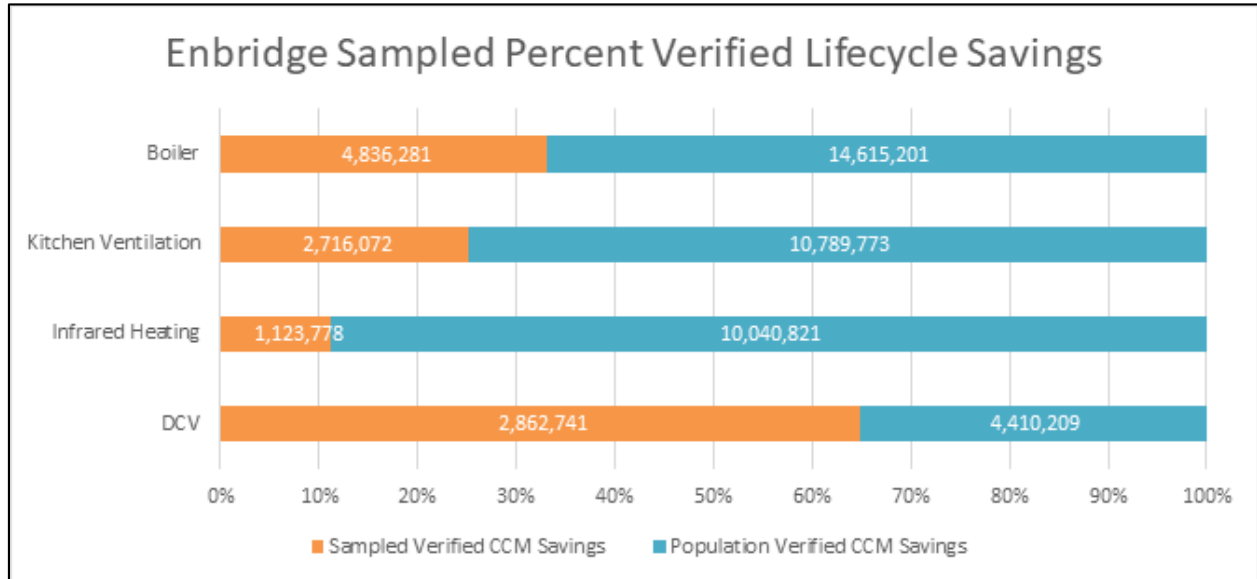
\* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

\*\* A vendor can appear multiple times if their responses varied by measures, resulting in a total greater than the number of vendors interviewed.

Figure D-1 displays the proportion of sampled verified lifecycle CCM savings in relation to the population verified lifecycle CCM savings for Enbridge. NTG survey data encompasses ~35% of Boiler population savings, ~25% of Kitchen Ventilation population, ~11% of Infrared Heating population, and ~65% of DCV population savings.



**FIGURE D-1: ENBRIDGE NET-TO-GROSS SAMPLED PERCENT VERIFIED LIFECYCLE SAVINGS**

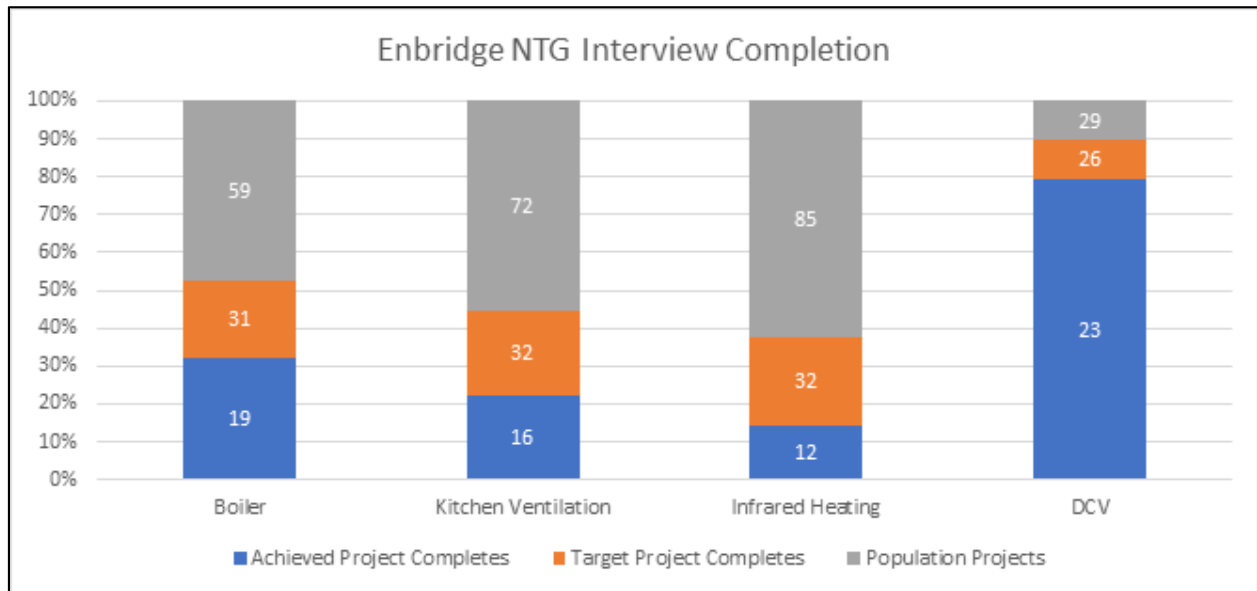


In Figure D-2 the achieved NTG survey completes are compared to targets in relation to the overall population.

- The target number of completed Boilers Priority Measure Group NTG IDIs was 31, while 19 were achieved. Approximately 32% of the population of Boiler projects was sampled.
- The target number of completed Kitchen Ventilation NTG IDIs was 32, while 16 were achieved. Approximately 22% of the population of Kitchen Ventilation projects was sampled.
- The target number of completes for Infrared Heating NTG IDIs was 32, while 12 were achieved. Approximately 14% of the population of Infrared Heating projects was sampled.
- The target number of completes for DCV was 26, while 23 were achieved. Approximately 80% of the population of DCV projects was sampled.



**FIGURE D-2: ENBRIDGE NET-TO-GROSS INTERVIEW COMPLETION**



\* Note that the project counts in the figure above are cumulative, where the top value includes the counts of the bottom value.

## D.2 ENBRIDGE NET-TO-GROSS RATIOS

Table D-2 summarizes Enbridge NTG ratios along with confidence interval and absolute precision statistics. The free-ridership ratio is 70% for the Boilers measure group, 38% for the Kitchen Ventilation measure group, and 89% for the Infrared Heating measure group, and 92% for the DCV measure group. Based on the participant IDIs, Itron found no evidence of spillover. Therefore, the NTG ratios are 30%, 62%, 11%, and 8% respectively for Boilers, Kitchen Ventilation, Infrared Heating, and DCV.

Absolute precisions are calculated with finite population correction (FPC), and without FPC<sup>14</sup>. The absolute precisions with FPC are 17%, 24%, 9%, and 13% respectively for Boilers, Kitchen Ventilation, Infrared Heating, and DCV. The absolute precisions without FPC are 21%, 26%, 10%, and 21% respectively for Boilers, Kitchen Ventilation, Infrared Heating, and DCV.

<sup>14</sup> Results from this study with FPC will be applied to the lost revenue calculations for the 2017 program. Those without FPC will be applied to future study year shareholder incentive and lost revenue calculations.



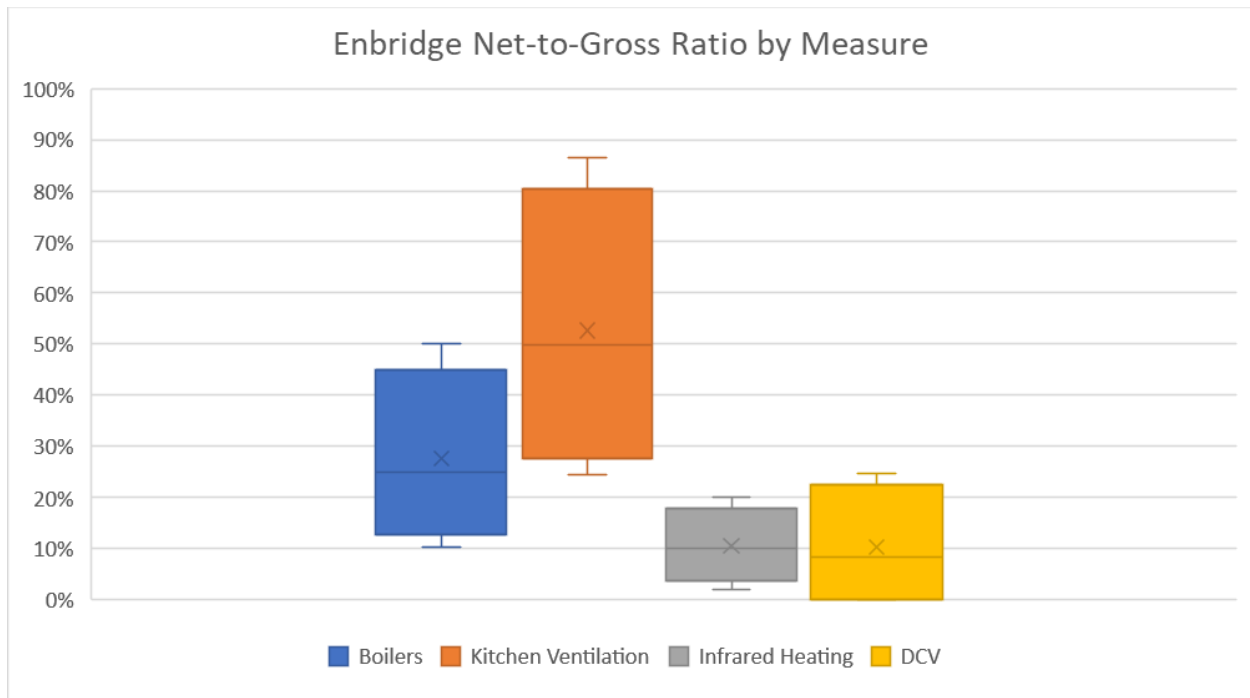
**TABLE D-2: ENBRIDGE NET-TO-GROSS RESULTS**

Priority Measure Group	Free Ridership Rate	Spillover	NTGR	90% Confidence Interval		Absolute Precision (w/ FPC) (+/-)	Absolute Precision (w/o FPC) (+/-)	
			= [(1-FR) + SO]	+ / -	Lower Bound			Upper Bound
Boilers	70%	0%	<b>30%</b>	20%	10%	50%	17%	21%
Kitchen Ventilation	38%	0%	<b>62%</b>	24%	38%	86%	24%	26%
Infrared Heating	89%	0%	<b>11%</b>	9%	2%	20%	9%	10%
DCV	92%	0%	<b>8%</b>	17%	0%	25%	13%	21%

The NTG ratios along with their confidence intervals are presented in Figure D-3, which displays the results at 90% confidence, meaning that the probability that the true NTGR is within the confidence interval range is 90%. Unlike the variation seen with the gross realization rates, the variation seen with the NTGR are higher due to the larger range of customer responses regarding program influence. For example, the variation seen with infrared heating interview responses is lower than the variation of interview responses for other measures. This indicates that customers generally had similar interview responses, where the NTGR for each project remained +/- 9% within the average NTGR value of 8%.



**FIGURE D-3: ENBRIDGE NET-TO-GROSS RESULTS**



The breakdown of the components of the NTG score is summarized below in Table D-3. Not all measures have the efficiency component. Only customers with Boiler projects were asked the efficiency questions.

Of the sampled group of projects, 47% responded that timing, efficiency, and quantity had no influence on their decision to purchase the equipment under the Enbridge Prescriptive Program. Of the remaining 53%, 89% indicated that they were influenced by timing, and 24% indicated that they were influenced by quantity. Of the Boilers Priority Measure Group respondents that were asked the efficiency question, 16% indicate that efficiency was a factor of influence.



**TABLE D-3: ENBRIDGE TEQ OVERVIEW**

Timing	Efficiency*	Quantity	Customers**	Projects
YES	YES	YES	0	0
YES	YES	NO	2	2
YES	NO	YES	0	0
YES	NO	NO	2	4
NO	YES	YES	0	0
NO	YES	NO	1	1
NO	NO	YES	1	3
NO	NO	NO	7	9
YES	NA	YES	2	6
YES	NA	NO	10	21
NO	NA	YES	0	0
NO	NA	NO	15	24
<b>Total</b>			<b>40</b>	<b>70</b>

\* Efficiency levels not asked for all measures.

\*\* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

An overview of the Enbridge timing, efficiency, and quantity data collection responses are listed below in Table D-4, Table D-5, and Table D-6 respectively. Detailed results by Priority Measure Group are presented in the subsequent tables (Table D-7 through Table D-15).

Based on table values, Enbridge had the most impact on helping customers accelerate their purchases, increasing the scope of the project, or right-sizing the equipment, while Enbridge had much less impact on the efficiency of the equipment.

Of the technologies Enbridge influenced, Kitchen Ventilation had a substantial number of sampled projects that were influenced by timing, and quantity, where ~38% of sampled projects would not have taken place at all without the influence of the program (full attribution). Regarding the timing question, ~42% of infrared heaters, and ~52% of DCV sampled projects would have installed the equipment at a later time without the program. The Boilers Priority Measure Group did not show as much influence as the other measure groups in regard to the timing question, where only ~26% of sampled projects were accelerated.





**TABLE D-4: ENBRIDGE TIMING OVERVIEW**

**Dat 1 a. Without the utility, how different would the timing have been?**

**Dat 1 b. Approximately how many months later?**

Dat1a	Dat1b	Customers*	Projects	Timing Attribution
Same Time	NA	24	37	None
Later	Months (Cap at 48 mo.)	11	23	0-4 (mo. Converted to years)
	Don't Know/ Refused	2	3	Timing Attribution of avg. of DAT1b
Never	NA	2	6	Full
Don't Know/Refused	NA	1	1	Timing Attribution of avg. of DAT1a

\* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

**TABLE D-5: ENBRIDGE EFFICIENCY OVERVIEW**

**Dat2a. Without the utility, would you have installed the same, higher, or lower efficiency?**

**Dat2b. Without the utility, what efficiency would you have installed?**

Dat2a	Dat2b	Customers*	Projects	Efficiency Attribution
Same	NA	10	16	None
Lower	Standard Efficiency	3	3	Full
	Between Standard and High	0	0	Half
	Don't know / Refused	0	0	Average of Dat2b
Don't Know/Refused	NA	0	0	Average of Dat2a
Not Applicable	NA	27	51	Not Asked

\* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

**TABLE D-6: ENBRIDGE QUANTITY OVERVIEW**

**Dat3a. Without the utility, how different would the quantity/size have been?**

**Dat3b. By what percentage did you change the amount installed because of the utility?**

Dat3a	Dat3b	Customers*	Projects	Quantity Attribution
Same	NA	30	52	None



Less	% Less	2	4	(% Less)/(1 + % Less)
	Don't know / Refused	2	3	Average of DAT3a
More	% More	1	2	% More
	Don't know / Refused	2	2	Average of DAT3a
None	NA	2	6	Full
Don't Know/Refused	NA	1	1	Average of DAT3
Not Applicable	NA	0	0	Not Asked

\* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

## D.2.1 Enbridge Boilers: Timing, Efficiency, Quantity Response Summary

**TABLE D-7: TIMING ENBRIDGE BOILERS**

**Dat 1 a. Without the utility, how different would the timing have been?**

**Dat 1 b. Approximately how many months later?**

Dat1a	Dat1b	Customers*	Projects	Timing Attribution
Same Time	NA	9	13	None
Later	Months (Capat 48 mo.)	3	5	0-4 (mo. Converted to years)
	Don't Know/ Refused	0	0	Timing Attribution of avg. of DAT1b
Never	NA	0	0	Full
Don't Know/Refused	NA	1	1	Timing Attribution of avg. of DAT1a

\* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

**TABLE D-8: EFFICIENCY ENBRIDGE BOILERS**

**Dat2a. Without the utility, would you have installed the same, higher, or lower efficiency?**

**Dat2b. Without the utility, what efficiency would you have installed?**

Dat2a	Dat2b	Customers*	Projects	Efficiency Attribution
Same	NA	10	16	None
Lower	Standard Efficiency	3	3	Full
	Between Standard and High	0	0	Half
	Don't know / Refused	0	0	Average of Dat2b
Don't Know/Refused	NA	0	0	Average of Dat2a



Not Applicable	NA	0	0	Not Asked
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\* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

**TABLE D-9: QUANTITY ENBRIDGE BOILERS**

**Dat3a. Without the utility, how different would the quantity/size have been?**

**Dat3b. By what percentage did you change the amount installed because of the utility?**

Dat3a	Dat3b	Customers*	Projects	Quantity Attribution
Same	NA	11	15	None
Less	% Less	1	3	(% Less)/(1 + % Less)
	Don't know/Refused	0	0	Average of DAT3a
More	% More	0	0	% More
	Don't know/Refused	1	1	Average of DAT3a
None	NA	0	0	Full
Don't Know/Refused	NA	0	0	Average of DAT3
Not Applicable	NA	0	0	Not Asked

\* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.



## D.2.2 Enbridge Kitchen Ventilation: Timing, Quantity Response Summary

**TABLE D-10: TIMING ENBRIDGE KITCHEN VENTILATION**

**Dat 1a. Without the utility, how different would the timing have been?**

**Dat 1b. Approximately how many months later?**

Dat1a	Dat1b	Customers*	Projects	Timing Attribution
SameTime	NA	6	6	None
Later	Months (Capat 48 mo.)	1	1	0-4 (mo. Converted to years)
	Don't Know/ Refused	2	3	Timing Attribution of avg. of DAT1b
Never	NA	2	6	Full
Don't Know/Refused	NA	0	0	Timing Attribution of avg. of DAT1a

\* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

**TABLE D-11: QUANTITY ENBRIDGE KITCHEN VENTILATION**

**Dat3a. Without the utility, how different would the quantity/size have been?**

**Dat3b. By what percentage did you change the amount installed because of the utility?**

Dat3a	Dat3b	Customers*	Projects	Quantity Attribution
Same	NA	7	7	None
Less	% Less	0	0	(% Less)/(1 + % Less)
	Don't know / Refused	1	2	Average of DAT3a
More	% More	0	0	% More
	Don't know / Refused	1	1	Average of DAT3a
None	NA	2	6	Full
Don't Know/Refused	NA	0	0	Average of DAT3
Not Applicable	NA	0	0	Not Asked

\* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.



## D.2.3 Enbridge Infrared Heating: Timing, Quantity Response Summary

**TABLE D-12: TIMING ENBRIDGE INFRARED HEATING**

**Dat 1a. Without the utility, how different would the timing have been?**

**Dat 1b. Approximately how many months later?**

Dat1a	Dat1b	Customers*	Projects	Timing Attribution
Same Time	NA	7	7	None
Later	Months (Capat 48 mo.)	5	5	0-4 (mo. Converted to years)
	Don't Know/ Refused	0	0	Timing Attribution of avg. of DAT1b
Never	NA	0	0	Full
Don't Know/Refused	NA	0	0	Timing Attribution of avg. of DAT1a

\* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

**TABLE D-13: QUANTITY ENBRIDGE INFRARED HEATING**

**Dat3a. Without the utility, how different would the quantity/size have been?**

**Dat3b. By what percentage did you change the amount installed because of the utility?**

Dat3a	Dat3b	Customers*	Projects	Quantity Attribution
Same	NA	9	9	None
Less	% Less	1	1	(% Less)/(1 + % Less)
	Don't know / Refused	1	1	Average of DAT3a
More	% More	0	0	% More
	Don't know / Refused	0	0	Average of DAT3a
None	NA	0	0	Full
Don't Know/Refused	NA	1	1	Average of DAT3
Not Applicable	NA	0	0	Not Asked

\* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.



## D.2.4 Enbridge DCV: Timing, Quantity Response Summary

**TABLE D-14: TIMING ENBRIDGE DCV**

**Dat 1 a. Without the utility, how different would the timing have been?**

**Dat 1 b. Approximately how many months later?**

Dat1a	Dat1b	Customers*	Projects	Timing Attribution
Same Time	NA	2	11	None
Later	Months (Capat 48 mo.)	2	12	0-4 (mo. Converted to years)
	Don't Know/ Refused	0	0	Timing Attribution of avg. of DAT1b
Never	NA	0	0	Full
Don't Know/Refused	NA	0	0	Timing Attribution of avg. of DAT1a

\* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

**TABLE D-15: QUANTITY ENBRIDGE DCV**

**Dat3a. Without the utility, how different would the quantity/size have been?**

**Dat3b. By what percentage did you change the amount installed because of the utility?**

Dat3a	Dat3b	Customers*	Projects	Quantity Attribution
Same	NA	3	21	None
Less	% Less	0	0	(% Less)/(1 + % Less)
	Don't know / Refused	0	0	Average of DAT3a
More	% More	1	2	% More
	Don't know / Refused	0	0	Average of DAT3a
None	NA	0	0	Full
Don't Know/Refused	NA	0	0	Average of DAT3
Not Applicable	NA	0	0	Not Asked

\* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.



## D.3 ENBRIDGE INDIRECT INFLUENCE

### D.3.1 Vendor to Participant Influence

The decision to pursue a vendor interview is dependent on participant questions VT1 and VT2. VT1, VT2, and VT3 are the participant's scores for upselling, price, and other influence respectively. Combined, all three scores total to 100%. VT1, VT2, and VT3 ask the following:

Now, I am going to ask you some questions about factors that influenced your decision-making process. If you were to allocate 100 points among the various factors that influenced your decision to install the equipment you did, how many 'influence points' would you give to:

- VT1. <Vendor> recommendation regarding equipment selection?
  - VT1a. What specific recommendations did <Vendor> provide that influenced your decision to purchase the equipment?
- VT2. Price of the equipment
  - VT2x. I would like to get a sense of your price sensitivity for the equipment. Let's say the project would have cost <20% vendor rebate in dollars> more, would you have still done it? What about <40% vendor rebate in dollars>? What about <60% vendor rebate in dollars>? <80% vendor rebate in dollars>? <100% vendor rebate in dollars>?
- VT3. All other influences
  - VT3a. What other factors influenced your decision to purchase the equipment?

### How Participants Trigger Vendor Interviews

When the sum points of VT1 and VT2 are greater than 50%, given that VT1>0 and/or VT2x is valid (participant indicates that the additional amount they would spend on the equipment is equal to or less than the vendor rebate), then that vendor is given priority to be contacted for an interview.

These vendors are prioritized by being the first group of vendors to dial, with more allotted calling attempts (6 attempts). Participants that allocate VT1+VT2 with less points are also contacted after the high priority vendors are contacted.

Vendors with participant VT1+VT2 scores ranked less than 30% were generally not contacted, unless those vendors happened to overlap with a vendor of a different customer with a high score. Vendor interviews



were scheduled after the NTG IDI is completed. Also, if the participant NTG ratio was already 1.0, then the vendor was not contacted for an interview.

## Distribution of Participant Responses on Upselling and Price (VT1 & VT2)

The distribution of VT1 and VT2 responses are displayed in Table D-16 and Table D-17. Of VT1 upselling responses, 92% of sampled projects allocate 50% or less points to upselling.

**TABLE D-16: ENBRIDGE CUSTOMER DISTRIBUTION OF VT1, VT2, & VT3 POINT ALLOCATION**

	VT1	VT2	VT3
0-10%	7	5	15
11-20%	4	3	8
21-30%	6	10	5
31-40%	5	11	3
41-50%	9	9	8
51-60%	6	0	1
61-70%	0	1	0
71-80%	1	1	0
81-90%	0	0	0
91-100%	2	0	0
<b>Total Customers</b>	<b>40</b>	<b>40</b>	<b>40</b>





**TABLE D-17: PERCENT OF SAVINGS OF ENBRIDGE PROJECTS WITH VENDOR TO PARTICIPANT INFLUENCE (VT1)**

	<b>% Energy Savings Influenced by Vendor</b>
Fully Influenced (VT1 100%)	2%
High Influence (VT1 76-99%)	2%
Moderate Influence (VT1 51-75%)	4%
Low Influence (VT1 1-50%)	64%
No Influence (VT1 0%)	28%

In order to receive price attribution, the additional amount that the customer would spend on the energy efficient equipment must be less than the amount of vendor rebate that the vendor passes to the customer. Once these criteria are met, the price attribution is VT2, the amount of points the participant allocates to price.

The following eight customers represented in Table D-18 indicated that the additional amount they would spend was equal to or less than the vendor rebate. The vendors for these customers were given high priority contact for an interview. However, if there was no vendor, or the participant already received full attribution from the TEQscore, then the vendor was not contacted.

**TABLE D-18: ENBRIDGE VT2 PRICE RESPONSES**

**Questions to customers:**

**If you were to allocate 100 points among the various factors that influenced your decision to install the equipment you did, how many ‘influence points’ would you give to:**

**VT1. <Vendor> recommendation regarding equipment selection?**

**VT2. Price of the equipment**

**VT3. Other**

<b>VT2</b>	<b>Customers*</b>	<b>Average Vendor Rebate (\$)</b>	<b>Avg Additional Amount Customer Would Spend (\$)</b>	<b>Average VT1 Score</b>
0-20%	1	200	160	0.8
21-40%	6	415	220	0.44



41-60%	1	100	20	0.5
61-80%	0	-	-	-
81-100%	0	-	-	-

### D.3.2 Utility to Vendor Influence

#### Vendor Surveys Data Collection

Ten Enbridge vendors completed interviews representing 14 projects. There were five participants that did not purchase program qualifying equipment through a vendor. Twenty vendors were contacted without success. Five vendors were not contacted.

**TABLE D-19: ENBRIDGE VENDOR SURVEY DATA COLLECTION – COMPLETES**

	# Vendors	# Projects
Completed	10	14

There were five vendors where Itron did not attempt an interview due to varying reasons such as participant score being 1.0, or if the VT1+VT2 scores were <30%, or due to the timing of the interview. Table D-20 provides the summary of the data collection disposition of vendor surveys that we could not complete.

**TABLE D-20: ENBRIDGE VENDOR SURVEY DATA COLLECTION – NOT COMPLETED**

	No Vendor	Attempted, Not Completed # Vendors in Participant Sample	Not Attempted # Vendors in Participant Sample
Not Completed	5	20	5

#### Vendor Survey Questions & Responses

A vendor interview is triggered if a customer reports that the vendor recommendation(upselling) or price had influenced their decision (Indirect path B). Then, the vendor is also asked questions regarding



upselling and price (Indirect path A). Indirect attribution from both path A and path B are used in the final indirect attribution score.

## Upselling

Upselling refers to the influence of the vendor on the customer due to the vendor's recommendation to consider program qualifying equipment over other options, like less efficiency equipment or doing nothing at all, in the case of add-on measures. If the customer allocates any points to upselling, the customer is asked to explain the recommendations the vendor provided to assist their decision. If the vendor interview is triggered, the following questions are asked of the vendor:

3. U2: "In situations where you are selling <project\_n>, about what percent of the time are you recommending the high-efficiency equipment?"
4. U4: "For <project\_n> measure, what percent of the time would you recommend the high-efficiency equipment option without the program?"

## Price

The purpose of this question is to see if any vendor rebate passed onto the customer has an influence on the customer's decision to participate in the program. If the customer allocates any points to pricing, follow up questions are asked, where the customer must identify if their involvement in the project would change due to increase in cost by incremental amounts of the vendor incentive – either by 20%, 40%, 60%, 80% or 100% of the vendor incentive.

If the vendor interview is triggered, then the vendor is asked the following question:

2. P5: "On average, what percent of the rebate is passed on to the buyer for <project\_n>, either directly or indirectly?"

The responses of ten participants with vendors that completed an interview are listed in Table D-21. Five of the ten participants received positive vendor attribution scores, with one participant receiving a score of 1.0. Only one score received price attribution, while the source of the other scores were from upselling.



**TABLE D-21: ENBRIDGE VENDOR COMPLETES RESPONSES AND RESULTS**

<i>Questions to customers:</i>								
If you were to allocate 100 points among the various factors that influenced your decision to install the equipment you did, how many 'influence points' would you give to:								
VT1. <Vendor> recommendation regarding equipment selection?								
VT2. Price of the equipment								
VT3. Other								
<i>Questions to vendors:</i>								
U2: "In situations where you are selling <project_n>, about what percent of the time are you recommending the high-efficiency equipment?"								
U4: "For <project_n> measure, what percent of the time would you recommend the high-efficiency equipment option without the program?"								
P5: "On average, what percent of the rebate is passed on to the buyer for <project_n>, either directly or indirectly?"								
Priority Measure Group	VT 1.	VT 2.	U 2	U 4	P5	Upselling Attribution (VT1 * (U2-U4)/U4)	Price Attribution (if P5 * Vendor Rebate > Amt more cust would pay, then VT2)	Vendor Indirect Attribution
Kitchen Ventilation	1	0	1	0	1	1	0	1
Kitchen Ventilation	0.5	0.3	0.8	0.5	NA	0.1875	0	0.1875
Infrared	0.6	0.3	1	1	1	0	0.3	0.3
Kitchen Ventilation	0.25	0.5	1	0	1	0.25	0	0.25
Kitchen Ventilation	0.5	0.3	1	1	0	0	0	0
DCV	0.2	0.2	0.8	1	NA	0	0	0
Kitchen Ventilation	0.5	0.5	0.1	0.1	REF	0	0	0
Infrared	0.1	0.4	0	0	DK	0	0	0
Infrared	0.6	0	0.5	0.5	0	0	0	0
Kitchen Ventilation	0.2	0.3	0.8	0.5	NA	0.075	0	0.075

## D.4 ENBRIDGE SPILLOVER

Participants were asked the spillover battery of questions, of which the responses for five participants indicated possible spillover. Upon further inquiries (based on the skip patterns in the survey guide), it was evident that none of the spillover responses were indicative of actual spillover. This was either due to the participants receiving (or being in the process of applying for) an incentive for a completed measure(s), or



due to them indicating that participating in the 2017 C&I prescriptive program had no influence on their pursuit of the completed measure(s). None of these five participants needed an engineer's call-back to quantify the effect of spillover.

Only one respondent indicated that they did not receive any incentives for a completed measure, triggering both inside and outside spillover probes. When asked about the likelihood of pursuing this additional energy efficiency measure, the customer responded, "very likely", which implied an attribution factor=0.00 for participant spillover; therefore, we did not pursue a call-back to quantify the effect of spillover for this respondent.

Attribution of claimed spillover is based on the following question: "If you had not made the earlier energy-efficiency improvements I just listed, how likely would you have been to make this additional energy efficiency improvement?"

The Attribution Factor is assigned in the following way:

1. Not likely at all- Attribution Factor=1.00
2. Not very likely- Attribution Factor=0.90
3. Somewhat likely- Attribution Factor=0.55
4. Very likely- Attribution Factor=0.00

Spillover Savings = Estimate Spillover Measure Savings X Attribution Factor

The findings from spillover battery are provided below in Table D-22 for inside spillover responses and in Table D-23 for outside spillover responses.



**TABLE D-22: ENBRIDGE INSIDE SPILLOVER RESPONSES**

Enbridge Program with Incentive	Incentive Through Electric Utility	Not a Source of Spillover	Action Inside Spillover	Timing Inside Spillover	Incentive Inside Spillover	Source Inside Spillover	Score Inside Spillover
1	0	0	HVAC and Boiler	2017	Yes	Enbridge	2
0	1	0	Lighting	2018	Yes	Electric Utility	4
0	1	0	HVAC	2018	Yes	Electric Utility	4
1	0	0	Boiler	2018	In progress	Enbridge	4
0	0	1	Envelope	2017	No		NA

**TABLE D-23: ENBRIDGE OUTSIDE SPILLOVER RESPONSES**

Enbridge Program with Incentive	Incentive Through Electric Utility	Not a Source of Spillover	Action Outside Spillover	Timing Outside Spillover	Incentive Outside Spillover	Source Outside Spillover	Score Outside Spillover
1	0	0	DCKV	2018	Yes	Enbridge	0
0	0	1	Water Conservation				0
1	0	0	Envelope	2018	In progress	Enbridge	NA
0	0	1	Envelope	2017	No		NA

# APPENDIX E – UNION GROSS IMPACT REPORTS

## E.1 BOILERS



Union\_Boilers\_Final  
.pdf

## E.2 ENERGY RECOVERY VENTILATION



Union\_ERV\_Final.p  
df

## E.3 INFRARED HEATING



Union\_Infrared  
Heating\_Final.pdf

## E.4 AIR CURTAINS



Union\_Air  
Curtains\_Final.pdf

# APPENDIX F – UNION NTG STUDY DETAILS

## F.1 UNION NET-TO-GROSS DATA COLLECTION

The Net-to-Gross analysis for Union was conducted for the following four Priority Measure Groups:

- Boilers
- ERV
- Infrared Heating
- Air Curtains

The number targeted completes for Union NTG data collection (146) was determined using a 90/10 relative precision with a CoV of 0.8, as detailed on pages 2-24 and 2-25 of the embedded workplan in Appendix A. Due to lower than expected response rates, a total of 127 of the targeted 146 projects completed NTG interviews.

Some customers represented multiple projects. The 127 completed NTG interviews entailed 100 customers. Of the data collection not completed, 130 projects attempted a NTG interview without success, while dialing was not attempted on 255 boiler and infrared heating projects.

The verified lifecycle savings of projects with completed NTG data collection represents a total of 37,018,493 CCM, which is approximately 20% of total population savings in 2017, on a lifecycle CCM basis.

Across all four Union Priority Measure Groups, vendors for 25 projects completed a vendor NTG survey. Table F-1 summarizes Union NTG data collection.





**TABLE F-1: UNION NET-TO-GROSS DATA COLLECTION**

Priority Measure Group	Total Pop			Target	Completed				Not Completed	
	Number of Projects	Number of Unique Customers	Lifecycle Verified CCM of Population	Number of Projects	Number of Projects	Number of Unique Customers*	Lifecycle Verified CCM of Survey Completes	Vendor Survey Completes (# Projects)**	Attempted, Not Completed # Projects	Not Attempted # Projects
<b>Boiler</b>	380	350	117,731,013	44	41	32	12,624,586	5	63	276
<b>ERV</b>	53	49	33,381,798	40	45	30	13,754,494	11	8	0
<b>Infrared Heating</b>	184	179	18,298,967	43	28	28	4,024,533	5	34	122
<b>Air Curtains</b>	28	26	16,351,950	19	13	10	6,614,880	4	15	0
<b>Total</b>	645	604	185,763,728	146	127	100	37,018,493	25	120	398

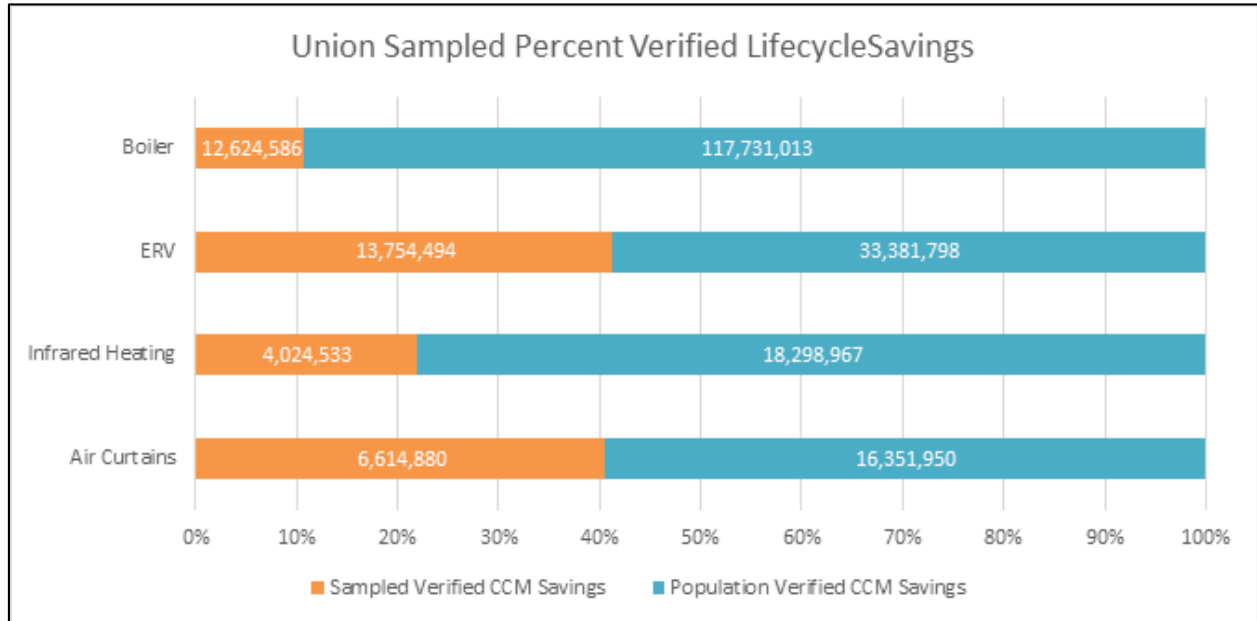
\* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

\*\* A vendor can appear multiple times if their responses varied by measures, resulting in a total greater than the number of vendors interviewed.

Figure F-1 displays the proportion of sampled verified lifecycle CCM savings in relation to the population verified lifecycle CCM savings for Union. NTG survey data encompasses ~11% of Boiler population savings, ~41% of ERV population savings, ~22% of Infrared Heating population savings, and ~40% of Air Curtain population savings.



**FIGURE F-1: UNION NET-TO-GROSS SAMPLED PERCENT VERIFIED LIFECYCLE SAVINGS**

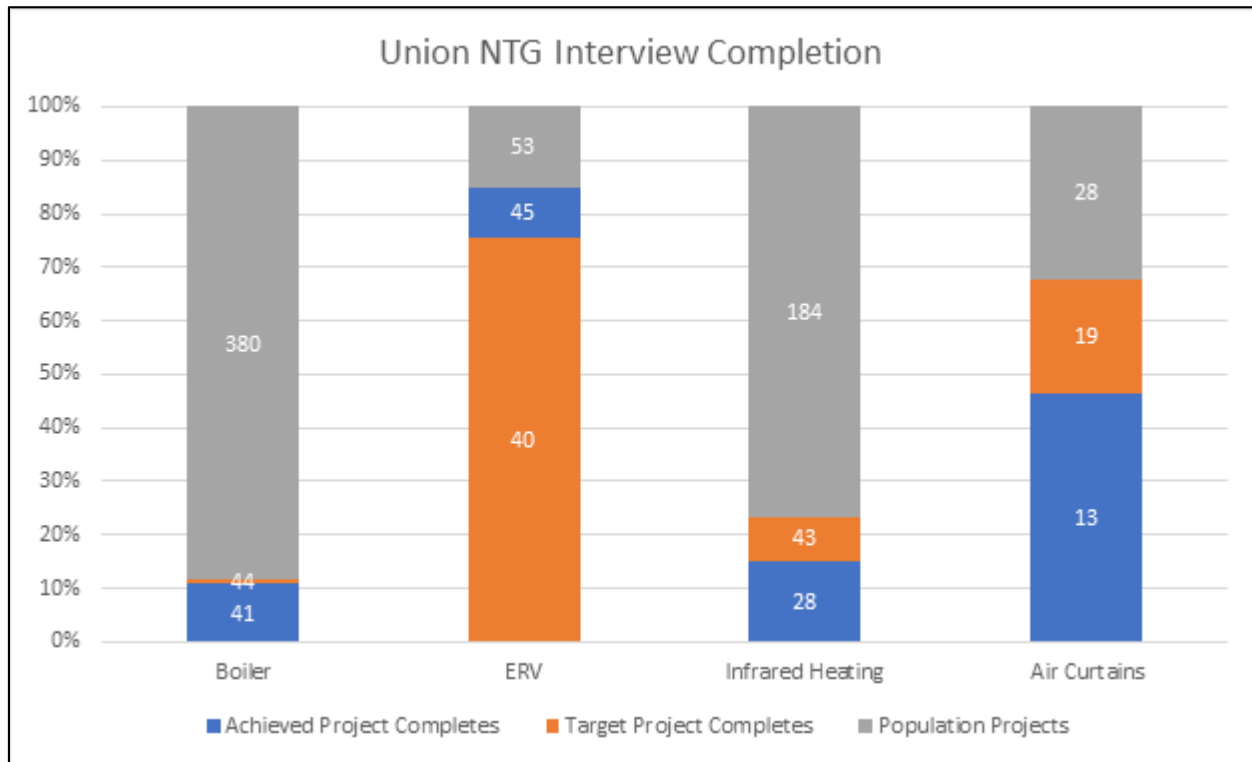


In Figure F-2, the achieved NTG survey completes are compared to targets in relation to the overall population.

- The target number of completed Boiler surveys was 44, while 41 were achieved. Approximately 11% of the population of Boiler projects was sampled.
- The target number of completed ERV surveys was 40, while 45 were achieved. Approximately 85% of the population of ERV projects was sampled.
- The target number of completed Infrared Heating surveys was 43, while 28 were achieved. Approximately 15% of the population of Infrared Heating projects was sampled.
- The target number of completed Air Curtain surveys was 19, while 13 were achieved. Approximately 50% of the population of Air Curtain projects was sampled.



**FIGURE F-2: UNION NET-TO-GROSS INTERVIEW COMPLETION**



\*Note that the project counts in the figure above are cumulative, where the top value includes the counts of the bottom value.

## F.2 UNION NET-TO-GROSS RATIOS

Table F-2 summarizes Enbridge NTG ratios along with confidence interval and absolute precision statistics. The free-ridership ratio is 76% for Boilers measure group, 70% for the ERV measure group, 93% for the Infrared Heating measure group, and 50% for the Air Curtains measure group. Based on the participant IDs, no evidence of spillover was found in the analysis. Therefore, the Net-to-Gross ratios are 24%, 30%, 7%, and 50% respectively for Boilers, ERV, Infrared Heating, and Air Curtains.



Absolute precisions are calculated with and without FPC<sup>15</sup>. The absolute precisions with the FPC are 9%, 8%, 6%, and 19% respectively for Boilers, ERV, Infrared Heating, and Air Curtains. The absolute precisions without the FPC are 9%, 13%, 6%, and 24% respectively for Boilers, ERV, Infrared Heating, and Air Curtains.

**TABLE F-2: UNION NET-TO-GROSS RESULTS**

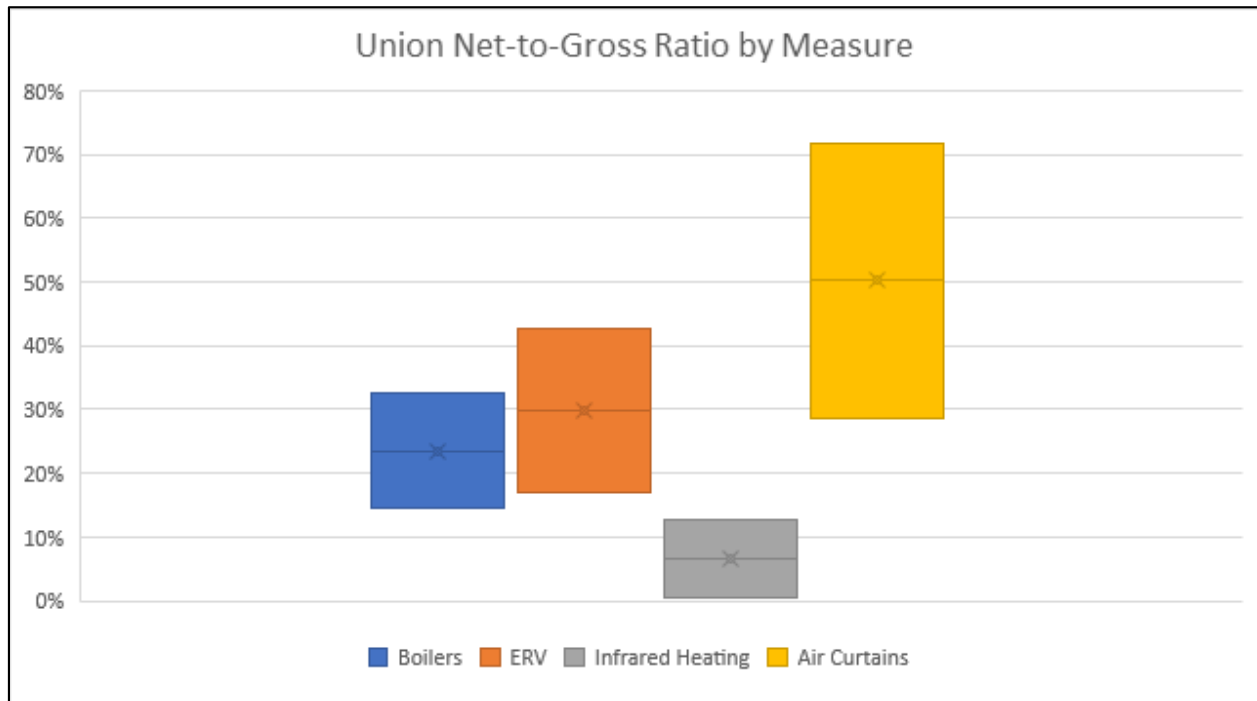
Priority Measure Group	Free Ridership Rate	Spillover	NTGR	90% Confidence Interval		Absolute Precision (w/ FPC) (+/-)	Absolute Precision (w/o FPC) (+/-)	
			= [(1 - FR) + SO]	+/-	Lower Bound			Upper Bound
Boilers	76%	0%	<b>24%</b>	9%	15%	32%	9%	9%
ERV	70%	0%	<b>30%</b>	13%	17%	43%	8%	13%
Infrared Heating	93%	0%	<b>7%</b>	6%	1%	13%	6%	6%
Air Curtains	50%	0%	<b>50%</b>	22%	29%	72%	19%	24%

The Net-To-Gross results along with their confidence intervals are presented in Figure F-3, which displays the results at 90% confidence, meaning that the probability that the true NTGR is within the confidence interval range is 90%. Unlike the variation seen with the gross realization rates, the variation seen with the NTGR are higher due to the larger range of customer responses regarding program influence. For example, the variation seen with infrared heating interview responses is lower than the variation of interview responses for other measures. This indicates that customers generally had similar interview responses, where the NTGR for each project remained +/- 6% within the average NTGR value of 7%.

<sup>15</sup> Results from this study with FPC will be applied to the lost revenue calculations for the 2017 program. Those without FPC will be applied to future study year shareholder incentive and lost revenue calculations.



**FIGURE F-3: UNION NET-TO-GROSS RESULTS**



The breakdown of the components of the NTG score is summarized below in Table F-3. Not all measures have the efficiency component on a bracketed basis (i.e., providing actual range of values). Only customers with Boilers and some ERV projects were asked the bracketed efficiency questions.

Of the sampled group of projects, 60% responded that timing, efficiency, and quantity had no influence on their decision to purchase the equipment under the Union Prescriptive Program. Of the remaining 40%, 78% indicate that they were influenced by timing, and 8% indicate that they were influenced by quantity. Of the Boilers and ERV Priority Measure Group respondents that were asked the efficiency question that had program influence, 26% indicate that efficiency was a factor of influence.



**TABLE F-3: UNION TEQ OVERVIEW**

Timing	Efficiency*	Quantity	Customers**	Projects
YES	YES	YES	1	1
YES	YES	NO	6	7
YES	NO	YES	1	1
YES	NO	NO	11	16
NO	YES	YES	0	0
NO	YES	NO	7	11
NO	NO	YES	0	0
NO	NO	NO	30	38
YES	NA	YES	2	2
YES	NA	NO	10	13
NO	NA	YES	0	0
NO	NA	NO	32	38
<b>Total</b>			<b>100</b>	<b>127</b>

\* Efficiency not asked for all measures.

\*\* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

An overview of the Union timing, efficiency, and quantity data collection responses are listed below in Table F-4, Table F-5, and Table F-6, respectively. Detailed results by Priority Measure Group are presented in the subsequent tables (Table F-7 through Table F-16). Based on table values, Union influenced ~27% of sampled projects overall with regards to timing, ~15% of sampled projects in regard to efficiency, and ~10% of sampled projects with regards to quantity. Boilers and air curtains were influenced the most by Union. Regarding the timing question, ~46% of boilers, and ~69% of air curtain sampled projects would have installed the equipment at a later time without the program.

**TABLE F-4: UNION TIMING OVERVIEW**

**Dat 1 a. Without the utility, how different would the timing have been?**

**Dat 1 b. Approximately how many months later?**

Dat 1 a	Dat 1 b	Customers*	Projects	Timing Attribution
Same Time	NA	69	87	None
Later	Months (Capat 48 mo.)	16	20	0-4 (mo. Converted to years)
	Don't Know/ Refused	3	3	Timing Attribution of avg. of DAT1b
Never	NA	7	11	Full
Don't Know/Refused	NA	5	6	Timing Attribution of avg. of DAT1a



\* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

### TABLE F-5: UNION EFFICIENCY OVERVIEW

**Dat2a. Without the utility, would you have installed the same, higher, or lower efficiency?**

**Dat2b. Without the utility, what efficiency would you have installed?**

Dat2a	Dat2b	Customers*	Projects	Efficiency Attribution
Same	NA	36	46	None
Lower	Standard Efficiency	4	5	Full
	Between Standard and High	4	5	Half
	Don't know / Refused	6	9	Average of Dat2b
Don't Know/Refused	NA	6	9	Average of Dat2a
Not Applicable	NA	44	53	Not Asked

### TABLE F-6: UNION QUANTITY OVERVIEW

**Dat3a. Without the utility, how different would the quantity/size have been?**

**Dat3b. By what percentage did you change the amount installed because of the utility?**

Dat3a	Dat3b	Customers*	Projects	Quantity Attribution
Same	NA	79	99	None
Less	% Less	5	6	(% Less)/(1 + % Less)
	Don't know / Refused	3	3	Average of DAT3a
More	% More	3	3	% More
	Don't know / Refused	0	0	Average of DAT3a
None	NA	1	1	Full
Don't Know/Refused	NA	9	15	Average of DAT3
Not Applicable	NA	0	0	Not Asked

\* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.



## F.2.1 Union Boilers: Timing, Efficiency, Quantity Response Summary

**TABLE F-7: TIMING UNION BOILERS**

**Dat1a. Without the utility, how different would the timing have been?**

**Dat1b. Approximately how many months later?**

Dat1a	Dat1b	Customers*	Projects	Timing Attribution
Same Time	NA	20	27	None
Later	Months (Capat 48 mo.)	8	9	0-4 (mo. Converted to years)
	Don't Know/ Refused	1	1	Timing Attribution of avg. of DAT1b
Never	NA	2	3	Full
Don't Know/Refused	NA	1	1	Timing Attribution of avg. of DAT1a

\* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

**TABLE F-8: EFFICIENCY UNION BOILERS**

**Dat2a. Without the utility, would you have installed the same, higher, or lower efficiency?**

**Dat2b. Without the utility, what efficiency would you have installed?**

Dat2a	Dat2b	Customers*	Projects	Efficiency Attribution
Same	NA	22	26	None
Lower	Standard Efficiency	0	0	Full
	Between Standard and High	2	2	Half
	Don't know / Refused	3	5	Average of Dat2b
Don't Know/Refused	NA	5	8	Average of Dat2a
Not Applicable	NA	0	0	Not Asked

\*A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

**TABLE F-9: QUANTITY UNION BOILERS**

**Dat3a. Without the utility, how different would the quantity/size have been?**

**Dat3b. By what percentage did you change the amount installed because of the utility?**

Dat3a	Dat3b	Customers*	Projects	Quantity Attribution
Same	NA	26	32	None
Less	% Less	2	3	(% Less)/(1 + % Less)





	Don't know / Refused	0	0	Average of DAT3a
More	% More	0	0	% More
	Don't know / Refused	0	0	Average of DAT3a
None	NA	0	0	Full
Don't Know/Refused	NA	3	5	Average of DAT3
Not Applicable	NA	1	1	Not Asked

\* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.



## F.2.2 Union ERV: Timing, Efficiency, Quantity Response Summary

**TABLE F-10: TIMING UNION ERV**

**Dat 1a. Without the utility, how different would the timing have been?**

**Dat 1b. Approximately how many months later?**

Dat1a	Dat1b	Customers*	Projects	Timing Attribution
Same Time	NA	22	33	None
Later	Months (Capat 48 mo.)	3	4	0-4 (mo. Converted to years)
	Don't Know/Refused	0	0	Timing Attribution of avg. of DAT1b
Never	NA	4	7	Full
Don't Know/Refused	NA	1	1	Timing Attribution of avg. of DAT1a

\* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

**TABLE F-11: EFFICIENCY UNION ERV**

**Dat2a. Without the utility, would you have installed the same, higher, or lower efficiency?**

**Dat2b. Without the utility, what efficiency would you have installed?**

Dat2a	Dat2b	Customers*	Projects	Quantity Attribution
Same	NA	14	20	None
Lower	Standard Efficiency	4	5	Full
	Between Standard and High	2	3	Half
	Don't know / Refused	3	4	Average of Dat2b
Don't Know/Refused	NA	1	1	Average of Dat2a
Not Applicable	NA	6	12	Not Asked

\* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.



**TABLE F-12: QUANTITY UNION ERV**

**Dat3a. Without the utility, how different would the quantity/size have been?**

**Dat3b. By what percentage did you change the amount installed because of the utility?**

Dat3a	Dat3b	Customers*	Projects	Quantity Attribution
Same	NA	23	37	None
Less	% Less	1	1	(% Less)/(1 + % Less)
	Don't know / Refused	2	2	Average of DAT3a
More	% More	1	1	% More
	Don't know / Refused	0	0	Average of DAT3a
None	NA	1	1	Full
Don't Know/Refused	NA	1	2	Average of DAT3
Not Applicable	NA	1	1	Not Asked

\* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

### F.2.3 Union Infrared Heating: Timing, Quantity Response Summary

**TABLE F-13: TIMING UNION INFRARED HEATING**

**Dat 1 a. Without the utility, how different would the timing have been?**

**Dat 1 b. Approximately how many months later?**

Dat1a	Dat1b	Customers*	Projects	Timing Attribution
Same Time	NA	25	25	None
Later	Months (Cap at 48 mo.)	0	0	0-4 (mo. Converted to years)
	Don't Know/ Refused	0	0	Timing Attribution of avg. of DAT1b
Never	NA	1	1	Full
Don't Know/Refused	NA	2	2	Timing Attribution of avg. of DAT1a

\* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

**TABLE F-14: QUANTITY UNION INFRARED HEATING**

**Dat3a. Without the utility, how different would the quantity/size have been?**

**Dat3b. By what percentage did you change the amount installed because of the utility?**

Dat3a	Dat3b	Customers*	Projects	Quantity Attribution
Same	NA	25	25	None
Less	% Less	1	1	(% Less)/(1 + % Less)



	Don't know / Refused	1	1	Average of DAT3a
More	% More	0	0	% More
	Don't know / Refused	0	0	Average of DAT3a
None	NA	0	0	Full
Don't Know/Refused	NA	1	1	Average of DAT3
Not Applicable	NA	0	0	Not Asked

\* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

## F.2.4 Union Air Curtains: Timing, Quantity Response Summary

**TABLE F-15: TIMING UNION AIR CURTAINS**

**Dat 1 a. Without the utility, how different would the timing have been?**

**Dat 1 b. Approximately how many months later?**

Dat1a	Dat1b	Customers*	Projects	Timing Attribution
Same Time	NA	2	2	None
Later	Months (Capat 48 mo.)	5	7	0-4 (mo. Converted to years)
	Don't Know/Refused	2	2	Timing Attribution of avg. of DAT1b
Never	NA	0	0	Full
Don't Know/Refused	NA	1	2	Timing Attribution of avg. of DAT1a

\* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.

**TABLE F-16: QUANTITY UNION AIR CURTAINS**

**Dat3a. Without the utility, how different would the quantity/size have been?**

**Dat3b. By what percentage did you change the amount installed because of the utility?**

Dat3a	Dat3b	Customers*	Projects	Quantity Attribution
Same	NA	5	5	None
Less	% Less	1	1	(% Less)/(1 + % Less)
	Don't know / Refused	0	0	Average of DAT3a



More	% More	2	2	% More
	Don't know / Refused	0	0	Average of DAT3a
None	NA	0	0	Full
Don't Know/Refused	NA	2	5	Average of DAT3
Not Applicable	NA	0	0	Not Asked

\* A customer may appear multiple times if their responses varied by measures, resulting in a total greater than the number of customers interviewed.



## F.3 UNION VENDOR SURVEYS AND RESULTS

The decision to pursue a vendor interview is dependent on participant questions VT1 and VT2. VT1, VT2, and VT3 are the participant's scores for upselling, price, and other influence respectively. Combined, all three scores total to 100%. VT1, VT2, and VT3 ask the following:

Now, I am going to ask you some questions about factors that influenced your decision-making process. If you were to allocate 100 points among the various factors that influenced your decision to install the equipment you did, how many 'influence points' would you give to:

- VT1. <Vendor> recommendation regarding equipment selection?
  - VT1a. What specific recommendations did <Vendor> provide that influenced your decision to purchase the equipment?
- VT2. Price of the equipment
  - VT2x. I would like to get a sense of your price sensitivity for the equipment. Let's say the project would have cost <20% vendor rebate in dollars> more, would you have still done it? What about <40% vendor rebate in dollars>? What about <60% vendor rebate in dollars>? <80% vendor rebate in dollars>? <100% vendor rebate in dollars>?
- VT3. All other influences
  - VT3a. What other factors influenced your decision to purchase the equipment?

### How Participants Trigger Vendor Interviews

When the sum points of VT1 and VT2 are greater than 50%, given that VT1>0 and/or VT2x is valid (participant indicates that the additional amount they would spend on the equipment is equal to or less than the vendor rebate), then that vendor is given priority to be contacted for an interview.

These vendors are prioritized by being the first group of vendors to dial, with more allotted calling attempts (6 attempts). Participants that allocate VT1+VT2 with less points are also contacted after the high priority vendors are contacted.

Vendors with participant VT1+VT2 scores ranked less than 30% were generally not contacted, unless those vendors happened to overlap with a vendor of a different customer with a high score. Vendor interviews were scheduled after the NTG IDI is completed. Also, if the participant NTG ratio was already 1.0, then the vendor was not contacted for an interview.



## Distribution of Participant Responses on Upselling and Price (VT1 & VT2)

The distribution of VT1 and VT2 responses are displayed in Table F-17 and Table F-18. Of VT1 upselling responses, 74% of sampled projects allocate 50% or less points to upselling.

**TABLE F-17: UNION CUSTOMER DISTRIBUTION OF VT1, VT2, & VT3 POINT ALLOCATION**

	VT1	VT2	VT3
0-10%	16	28	49
11-20%	4	10	18
21-30%	6	24	16
31-40%	15	13	5
41-50%	23	19	5
51-60%	4	1	1
61-70%	8	0	0
71-80%	10	3	2
81-90%	3	2	1
91-100%	11	0	3
<b>Total Customers</b>	<b>100</b>	<b>100</b>	<b>100</b>

**TABLE F-18: PERCENT OF SAVINGS OF UNION PROJECTS WITH VENDOR TO PARTICIPANT INFLUENCE (VT1)**

	% Energy Savings Influenced by Vendor
Fully Influenced (VT1 100%)	8%
High Influence (VT1 76-99%)	5%
Moderate Influence (VT1 51-75%)	14%
Low Influence (VT1 1-50%)	60%
No Influence (VT1 0%)	14%

In order to receive price attribution, the additional amount that the customer would spend on the energy efficient equipment must be less than the amount of vendor rebate that the vendor passes to the



customer. Once these criteria are met, the price attribution is VT2, the amount of points the participant allocates to price.

The following 15 customers represented in Table F-19 indicated that the additional amount they would spend was equal to or less than the vendor rebate. The vendors for these customers were given high priority contact for an interview. However, if there was no vendor, or the participant already received full attribution from the TEQ score, then the vendor was not contacted.

### TABLE F-19: UNION VT2 PRICE RESPONSES

**Questions to customers:**

**If you were to allocate 100 points among the various factors that influenced your decision to install the equipment you did, how many 'influence points' would you give to:**

**VT1. <Vendor> recommendation regarding equipment selection?**

**VT2. Price of the equipment**

**VT3. Other**

VT2	Customers*	Average Vendor Rebate (\$)	Avg Additional Amount Customer Would Spend (\$)	Average VT1 Score
0-20%	6	400	300	0.68
21-40%	6	540	300	0.42
41-60%	2	150	130	0.48
61-80%	0	-	-	-
81-100%	1	1300	1300	0

## F.3.1 Utility to Vendor Influence

### Vendor Surveys Data Collection

Twenty-five Union vendors completed interviews representing 32 projects. There were five participants that did not purchase program qualifying equipment through a vendor. Fifty-four vendors were contacted without success. Fifteen vendors were not contacted.





**TABLE F-20: UNION VENDOR SURVEY DATA COLLECTION – COMPLETED**

	# Vendors	# Projects
Completed	25	32

There were 15 vendors where Itron did not attempt an interview due to varying reasons such as participant score being 1.0, or if the VT1+VT2 scores were <30%, or due to the timing of the interview. Table F-21 provides the summary of the data collection of vendor surveys that we could not complete.

**TABLE F-21: UNION VENDOR SURVEY DATA COLLECTION – NOT COMPLETED**

	No Vendor	Attempted, Not Completed # Vendors in Participant Sample	Not Attempted # Vendors in Participant Sample
Not Completed	5	54	15

## Vendor Survey Questions & Responses

A vendor interview is triggered if a customer reports that the vendor recommendation(upselling) or price had influenced their decision (Indirect path B). Then, the vendor is also asked questions regarding upselling and price (Indirect path A). Indirect attribution from both path A and path B are used in the final indirect attribution score.

### Upselling

Upselling refers to the influence of the vendor on the customer due to the vendor’s recommendation to consider program qualifying equipment over other options, like less efficiency equipment or doing nothing at all, in the case of add-on measures. If the customer allocates any points to upselling, the customer is asked to explain the recommendations the vendor provided to assist their decision. If the vendor interview is triggered, the following questions are asked of the vendor:

5. U2: “In situations where you are selling <project\_n>, about what percent of the time are you recommending the high-efficiency equipment?”
6. U4: “For <project\_n> measure, what percent of the time would you recommend the high-efficiency equipment option without the program?”



## Price

The purpose of this question is to see if any vendor rebate passed onto the customer has an influence on the customer’s decision to participate in the program. If the customer allocates any points to pricing, follow up questions are asked, where the customer must identify if their involvement in the project would change due to increase in cost by incremental amounts of the vendor incentive – either by 20%, 40%, 60%, 80% or 100% of the vendor incentive.

If the vendor interview is triggered, then the vendor is asked the following question:

3. P5: “On average, what percent of the rebate is passed on to the buyer for <project\_n>, either directly or indirectly?”

The responses of 25 participants with vendors that completed an interview are listed in Table F-22. Three of the 25 participants received positive vendor upselling attribution scores. None of the respondents received a price attribution score.

**TABLE F-22: UNION VENDOR RESPONSES AND RESULTS**

<i>Questions to customers:</i>								
If you were to allocate 100 points among the various factors that influenced your decision to install the equipment you did, how many ‘influence points’ would you give to:								
VT1. <Vendor> recommendation regarding equipment selection?								
VT2. Price of the equipment								
VT3. Other								
<i>Questions to vendors:</i>								
U2: “In situations where you are selling <project_n>, about what percent of the time are you recommending the high-efficiency equipment?”								
U4: “For <project_n> measure, what percent of the time would you recommend the high-efficiency equipment option without the program?”								
P5: “On average, what percent of the rebate is passed on to the buyer for <project_n>, either directly or indirectly?”								
Priority Measure Group	VT1.	VT2.	U2	U4	P5	Upselling Attribution (VT1 * (U2-U4)/U4)	Price Attribution (if P5 * Vendor Rebate > Amt more cust would pay, then VT2)	Vendor Indirect Attribution
Infrared	0.5	0.25	0.5	0.5	NA	0	0	0
Air Curtains	0.25	0.25	0.05	0.5	NA	0	0	0
ERV	0.5	0.25	1	0.75	0	0.125	0	0.125
ERV	0.3	0.4	0.8	0.5	NA	0.1125	0	0.1125



Priority Measure Group	VT1.	VT2.	U2	U4	P5	Upselling Attribution (VT1 * (U2-U4)/U4)	Price Attribution (if P5 * Vendor Rebate > Amt more cust would pay, then VT2)	Vendor Indirect Attribution
ERV	0.9	0.1	0.7	0.7	NA	0	0	0
ERV	0.9	0.1	1	1	1	0	0	0
Boiler	1	0	1	1	DK	0	0	0
ERV	0.5	0.3	0.5	1	NA	0	0	0
Boiler	0.6	0.4	1	1	1	0	0	0
Boiler	0.5	0.5	1	DK	NA	0	0	0
Air Curtains	0.4	0.4	1	1	0	0	0	0
Infrared	0	0.25	0	0	NA	0	0	0
Infrared	0.8	0	0	0	0.5	0	0	0
Air Curtains	0	0	1	1	0	0	0	0
ERV	0.6	0.2	0.5	0.5	0	0	0	0
Air Curtains	1	0	1	1	0	0	0	0
Boiler	0	0	0.7	0.7	NA	0	0	0
Boiler	1	0	0.95	0.95	NA	0	0	0
Infrared	0.6	0.3	1	1	DK	0	0	0
Infrared	1	0	0	0	NA	0	0	0
ERV	0.95	0	0.7	0.7	NA	0	0	0
ERV	0.75	0	0.7	0.7	NA	0	0	0
ERV	0.7	0.2	1	0.85	DK	0.105	0	0.105
ERV	0.5	0.25	1	1	1	0	0	0
ERV	0.33	0.33	0.75	0.75	NA	0	0	0

## F.4 UNION SPILLOVER

Participants were asked the spillover battery of questions, of which the responses for seven participants indicated possible spillover. Upon further inquiries (based on the skip patterns in the survey guide), it was evident that none of the spillover responses were indicative of actual spillover. This was either due to the participants receiving (or being in the process of applying for) an incentive for a completed measure(s), or due to the completed measure(s) being an electric fuel measure. None of these seven participants needed an engineer’s call-back to quantify the effect of spillover.

Only one respondent indicated that they did not receive any incentives for a completed measure, triggering both inside and outside spillover probes. When asked about the completed measure, the



customer responded that the measure is electric powered, which implied an attribution factor=0.00 for participant spillover; therefore, we did not pursue a call-back to quantify the effect of spillover for this respondent.

Attribution of claimed spillover is based on the following question: “If you had not made the earlier energy-efficiency improvements I just listed, how likely would you have been to make this additional energy efficiency improvement?”

The Attribution Factor is assigned in the following way:

1. Not likely at all- Attribution Factor=1.00
2. Not very likely- Attribution Factor=0.90
3. Somewhat likely- Attribution Factor=0.55
4. Very likely- Attribution Factor=0.00

Spillover Savings = Estimate Spillover Measure Savings X Attribution Factor

The findings from spillover battery are provided below in Table F-23 for inside spillover responses and in Table F-24 for outside spillover responses.



**TABLE F-23: UNION INSIDE SPILLOVER RESPONSES**

Union Program with Incentive	Incentive Through Electric Utility	Not a Source of Spillover	Action Inside Spillover	Timing Inside Spillover	Incentive Inside Spillover	Source Inside Spillover	Score Inside Spillover
1	0	0	Boiler and HVAC	2018	In progress	Union	2
0	1	0	Lighting	Ongoing	Yes	Electric Utility	4
1	0	0	Lighting	NA	Yes	Union	NA
1	0	0	HVAC Controls	2018	Yes	Union	3
1	0	0	Furnace	2017	Yes	Union	3
0	0	1	Plug-Ins	2016	No		4
0	1	0	Furnace	2018	Yes	Electric Utility	4

**TABLE F-24: UNION OUTSIDE SPILLOVER RESPONSES**

Union Program with incentive	Incentive through electric utility	Not a source of spillover	Action Outside spillover	Timing Outside Spillover	Incentive Outside Spillover	Source Outside Spillover	Score Outside Spillover
1	0	0	HVAC and Boiler	2018	Yes	Union	4

## APPENDIX G – DATA COLLECTION INSTRUMENTS

The embedded documents below are the interview guides used for participant and vendor data collection for the NTG portion of the evaluation.



2017 CIPMSV  
Participant Survey In



2017 CIPMSV  
Vendor Survey Instru