XCEL ENERGY

MN Residential Cooling Product Impact & Process Evaluation

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PRESENTED TO:

Nicholas Minderman
DSM Policy & Strategy Consultant
Xcel Energy
414 Nicollet Mall
Minneapolis, MN 55401

PRESENTED BY:

Jeremy Kraft
Project Director
EMI Consulting
83 Columbia St. Suite 400
Seattle, WA 98104

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Introduction

Xcel Energy contracted with EMI Consulting to evaluate the 2018 Residential Cooling Product in Minnesota. The product offers prescriptive cooling equipment rebates to Xcel Energy residential electric customers who install qualifying cooling equipment in existing or new buildings. Rebates help lower the upfront premium costs of energy-efficient central air conditioners (CACs), air-source heat pumps (ASHPs), ground-source heat pumps (GSHPs), and mini-split heat pumps. For CACs and ASHPs, Quality Installation in accordance with Air Conditioning Contractors of America (ACCA) standards is also required to receive the rebate.

As part of the process evaluation, EMI Consulting assessed customer and trade partner motivations and barriers to participation in the product, customer satisfaction, as well as participation in related programs, use of heat pumps, and heating fuel type. For the impact evaluation, EMI Consulting assessed the net-to-gross ratio (NTGR) for equipment, Quality Installation, and the product as a whole. This summary includes the key findings and recommendations from our evaluation.

Methods

Participating Customer Survey (n=141)

Non-Participating Customer Survey (n=130)

Trade Partner Interviews (n=19)

Peer Benchmarking Interviews (n=10)

Fielding:
Oct. 2019 – Jan. 2020

Summary of Findings

The evaluation team estimated a **retrospective NTGR of 0.62 (0.71 for equipment, 0.54 for QI)** and recommends that Xcel Energy implements a number of actions that could presumably result in a **prospective NTGR of 0.80** or higher. These ratios are based on participating customer and trade partner responses.

There are **opportunities to claim heating savings for heat pumps** displacing other electric heating sources, as 38% of non-participating customers use electricity as a primary or secondary heat source.

Customers and trade partners are **satisfied with their experience in the program**. Customers have been particularly satisfied with both the contractor that installed the equipment and with the installation and performance of the equipment

Both customers and trade partners could **benefit from additional education and training** from Xcel Energy. Most non-participating customers were not aware of the Residential Cooling Product rebates, and some trade partners did not recognize the term "Quality Installation".

Net-to-Gross Estimation

EQUIPMENT

7.9 out of 10 **Contractor influence** on customer's decisions to purchase energy-efficient cooling **equipment**, where 0 was Not at All Influential and 10 was Extremely Influential.

8.2 out of 10 Customer-reported likelihood to purchase the **exact same equipment** if the incentive, information, and support from the product were not available. However, trade partner interviews led to the conclusion that the product had more influence on decision-making than customers realized.

QUALITY INSTALLATION

70% Proportion of participating customers that were **not aware that they had received QI** and thus could not be asked the attribution questions.

0.50 Free ridership score assigned to customers unaware of QI. Trader partners reported that **QI is standard practice**, the **program did not influence their installation practices**, and they are generally **not promoting QI** to their customers.

EXECUTIVE SUMMARY

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Product Experience & Participation in Related Programs

PRODUCT EXPERIENCE AND SATISFACTION

Customers and trade partners are satisfied with their experience in the program. Overall customer product satisfaction was rated a 4.5 out of 5. Eight of ten trade partners interviewed rated their satisfaction with the product either a 4 or 5 out of 5.

Performance, quietness, and **comfort** were the top non-energy benefits reported by participating customers.

4.8

Participating customers were **highly satisfied with both the contractor that installed the equipment and with the installation and performance of the equipment**, with an average rating of 4.8 out of 5 for each.

PARTICIPATION IN RELATED PRODUCTS

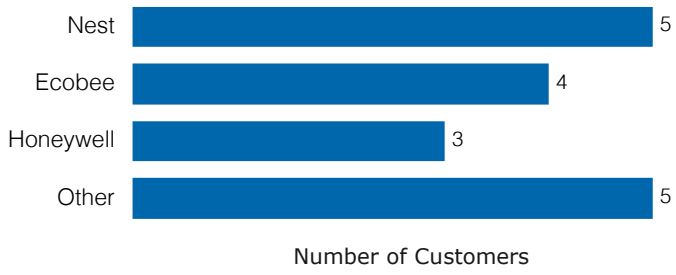
47%

of participants reported also participating in **Saver's Switch.**

26%

of participants installed a **new smart thermostat** along with their new cooling equipment.

Brands of Smart Thermostats Reported by Participating Customers



Use of Heat Pumps & Opportunity for Heating Savings

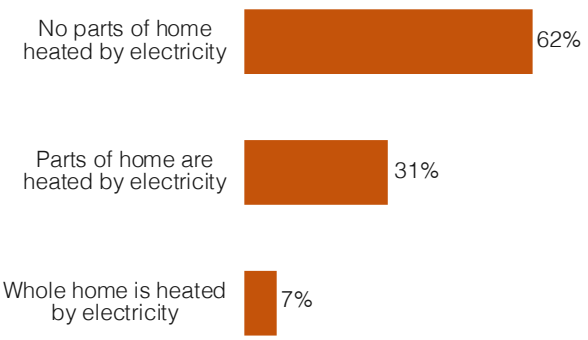
26%

of participating customers used electricity as their primary heat source before their heat pump was installed.

38%

of non-participating customers use electricity as a primary (7%) or secondary (31%) heat source.

Portion of Home Heated by Electricity Among the General Population of Non-Participating Customers



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Awareness & Barriers to Participation

AWARENESS

16%

Awareness of cooling rebates among the general population of non-participants. Many customers would consider upgrading their cooling equipment in the next year if they knew that a rebate for higher efficiency equipment and optimized installation would be available.

27%

Awareness of heat pumps among non-participating customers.

Awareness of Cooling Rebates among Non-Participating Customers

Awareness of Heat Pumps among Non-Participating Customers

Of the 19 trade partners interviewed, roughly half (n = 9) were aware of the term "Quality Installation." In some cases, they do not distinguish between the rebates for QI and rebates for equipment.

Awareness of QI is low among both participating (18%) and non-participating customers (15%).

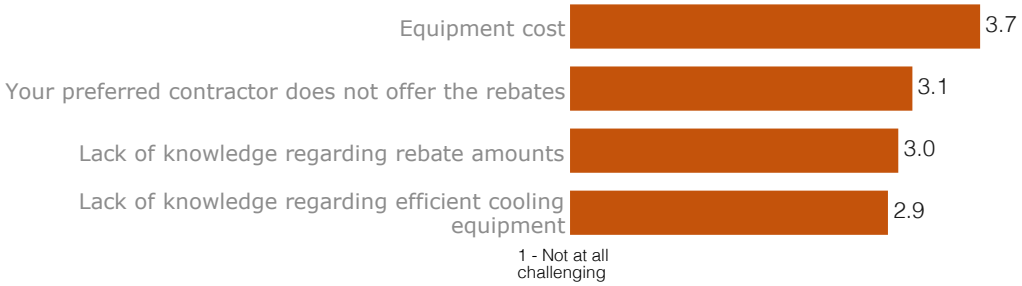
BARRIERS

Non-participating customers reported that the **cost** of the equipment and **lack of knowledge regarding equipment and rebates** were the largest barriers to participation. There was also a perception that their contractors do not offer rebates.

Cost concerns revolved around the **upfront cost** of equipment but also the perceived value of that equipment in the **short cooling season** in Minnesota. Trade partners reported that the rebates help make efficient cooling equipment more attractive despite the short cooling season.

61% of non-participating customers with an older CAC or ASHP, who had made recent heating upgrades, have yet to replace their cooling equipment because they perceive **no need**.

Challenges to Upgrading Equipment among Non-Participating Customers



2019 Residential Cooling Product Evaluation

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Conclusions & Recommendations

The overall retrospective NTGR is 0.62. Separated by product component, the NTGR for equipment is 0.71, while the NTGR for Quality Installation (QI) is 0.54.	**If the product design remains the same, the evaluation team recommends using a prospective NTGR of 0.62. If Xcel Energy implements a number of actions, this could presumably result in a prospective NTGR of 0.80 or higher.** To significantly improve the influence of the program, the evaluation team recommends diluting free-riders by increasing awareness and understanding of QI.
Contractors report that they are conducting QI as part of their standard practice, while most customers do not know what QI is.	**Incorporate QI into the name of the measure and include a description of QI requirements within the table showing incentives on the application.** This would make QI part of the conversation trade partners have with customers. **Provide further training to contractors regarding the term "Quality Installation."** Provide further information on the application and other materials about what QI entails. **Provide a separate incentive to contractors completing QI.** **Require a small percentage of QIs to be verified.** **Require training for all participating trade partners reminding them of the QI process, its name, specific incentives, and how to market it to customers.** **Educate consumers about QI to increase awareness and help drive demand.**
Cost and lack of awareness present the greatest challenges to participation.	**Target customers during critical decision-making moments.** For example, Xcel Energy could target customers with new accounts who have purchased an existing home that may need upgrades.
There appear to be opportunities for marketing the Residential Cooling Product rebates alongside related programs.	**Market smart thermostats and demand response (DR) along with the Residential Cooling Product rebates.** **Combine the Residential Cooling and Heating products so they are one seamless experience for customers and contractors.**
There are opportunities to claim heating savings for heat pumps displacing other electric heat sources.	**Promote mini-split heat pumps to customers who are currently using electricity as a secondary heat source.** Savings could be claimed not just for the cooling season but also for a portion of the heating season. **Work with third-party research organizations to conduct more detailed research to determine heating hours of use for heat pumps to better understand potential energy savings.**
While the program passes cost-effectiveness tests, staff would like to see it pass by a wider margin.	**Explore the value of non-energy benefits (NEBs) to reduce incremental costs.** Once the value of NEBs is estimated, that portion of the incremental costs associated with higher efficiency equipment can be considered when calculating cost-effectiveness.

1. INTRODUCTION

Xcel Energy offers a comprehensive array of energy services and products to its customers, including demand side management (DSM). Xcel Energy seeks to understand the role each product plays in changing the marketplace, to analyze that influence on customer choices, and to use the findings to improve customer experience and ensure industry-leading product performance. To accomplish this, Xcel Energy contracted with EMI Consulting to evaluate five products offered in Colorado and Minnesota in 2019.[1] This included the Residential Cooling Product in Minnesota, discussed in this report. This introduction includes an overview of the product and the evaluation approach, and describes the organization of this report.

1.1 PRODUCT OVERVIEW

The Residential Cooling Product in Minnesota offers three kinds of rebates to Xcel Energy residential customers who install qualifying cooling equipment in their homes. First, rebates are available to customers who purchase ground source heat pumps (GSHPs) and mini-split heat pumps (MSHPs), with no opportunities for an installation rebate. Second, rebates are available for the purchase and quality installation (QI)[2] of central air conditioners (CACs) and air-source heat pumps (ASHPs). To receive this second type of rebate, trade partners must prove the equipment was installed in accordance with standards set by the Air Conditioning Contractors of America (ACCA). And third, rebates are available for CACs and ASHPs that meet both the federal minimum SEER requirements and meet the QI standards. This rebate is solely for the QI and not for the equipment. In 2018, the Residential Cooling Product claimed over 5.7 GWh in energy savings from prescriptive rebates provided in Minnesota (Table 1-1).

[1] The products selected for evaluation in 2019 include: Heating Efficiency (CO), Motors and Drives (CO), Single Family Weatherization (CO), Energy Efficient New Homes (MN), Residential Cooling (MN).
[2] Quality Installation criteria defined by product staff follows ACCA Standards.

Table 1-1. MN Residential Cooling Savings by Measure, January-December 2018

Measure	Units		kWh		kW	
	Quantity	% of total	Quantity	% of total	Quantity	% of total
13.0+ SEER (AC)[a]	8,989	48%	1,705,031	29%	2,690	30%
14.0+ SEER (ASHP)[a]	32	< 1%	6,271	< 1%	11	< 1%
16.0+ SEER; 13.0+ EER (AC)[b]	6,058	32%	2,462,040	43%	3,830	43%
15.0+ SEER; 12.5+ EER (AC)[b]	2,590	14%	994,333	17%	1,543	17%
17.0+ SEER; 13.0+ EER (AC)[b]	459	2%	233,477	4%	343	4%
16.0+ SEER; 13.0+ EER (ASHP)[b]	20	< 1%	5,968	< 1%	10	< 1%
15.0+ SEER; 12.5+ EER (ASHP)[b]	12	< 1%	3,817	< 1%	6	< 1%
17.0+ SEER; 13.0+ EER (ASHP)[b]	6	< 1%	2,739	< 1%	4	< 1%
Mini-Split Heat Pump (15-20 SEER, 9-16 HSPF)[c]	330	2%	216,254	4%	312	3%
Mini-Split Heat Pump (21-26 SEER, 9-16 HSPF) [c]	202	1%	136,791	2%	144	2%
Ground Source Heat Pump [c]	26	< 1%	23,298	< 1%	56	1%
Total	18,724	100%	5,789,042	100%	8,947	100%

Note: This is the population of participating customers receiving rebates between January and December 2018. These numbers are based on aggregated data provided to EMI Consulting in July 2019.
a. Rebate is for quality installation only, as the equipment is standard efficiency.
b. Rebate is for efficient equipment and quality installation of that equipment.
c. Rebate is for equipment only (no quality installation).

Xcel Energy staff administer the product via trade partners, who promote the product and install the equipment. To register to participate in the product, trade partners must either (1) pass an online assessment administered through a third party; (2) hold a North American Technical Excellence (NATE) certification, including the core test and one of four specialty tests; or (3) hold a city-administered competency card.

To receive a rebate for a measuring requiring QI, customers must use a registered trade partner for installation and application submission[3]. Applications can be submitted either via mail, email, or through submitting the information using an online form on the Xcel Energy website. The product provides rebate checks to the customer, unless the customer has signed over the incentive to the trade partner. The product rebate is sent to customers in the form of a check, but later this year, customers will have the option of getting a bill credit or a direct deposit.

The multi-tiered prescriptive rebate is based on the product type, efficiency level, and whether QI was performed (Table 1-2).

Table 1-2. Rebates Offered for the MN Residential Cooling Product

Equipment	QI Incented?	Rebate Amounts	Baseline
Central Air Conditioning (CAC)	Yes	• SEER 13: $150 • SEER 15/EER 12.5: $350 • SEER 16/EER 13: $450	• SEER 13: standard installation for QI only. • SEER 15 & SEER 16: Use SEER 13 CAC as baseline equipment and standard installation for QI.
Air Source Heat Pump (ASHP)	Yes	• SEER 14: $150 • SEER 15/EER 12.5: $350 • SEER 16/EER 13: $450	• SEER 14: standard installation for QI only. • SEER 15 & SEER 16: Minimum federal efficiency for ASHP and standard installation for QI
Ground Source Heat Pump (GSHP)	No	• 14.1 EER: $150 per ton up to 5 tons	• 13 SEER CAC
Mini-Split Heat Pump	No	• 15 EER, 9 HSPF: $200	• Minimum federal efficiency for mini-split HP

The product is also considering several possible modifications for future cycles:

- Reevaluation of rebate tiers by dropping the highest tier equipment and increasing the rebate dollar amount for mini split heat pumps.
- Offering a higher rebate to customers installing a heat pump who have electric resistance heating.
- Offering new additional savings on multi-zone systems.
- Increased targeting of multi-family buildings.
- Simplifying the application, (i.e., removing the QI documentation requirement. This has already gone into effect).

[3] Although GSHPs or mini-split heat pumps are frequently installed by trade partners, customers do not need to use a registered trade partner for these measures, because there is no QI portion for them.

Additionally, the program will most likely experience increased challenges to meet cost-effectiveness in the next plan cycle due to a reduction in avoided revenue requirements relative to previous plan cycles. While the program currently passes cost-effectiveness tests, staff would like to see it pass by a wider margin.

The Residential Cooling Product relies heavily on trade partners, who promote the product and install the equipment. Internally, Xcel Energy relies on channel managers to maintain the relationships with participating trade partners. Other marketing for the program includes bill "onserts," small advertisements that can be found on mailed bills, that go out during the summer.

1.2 EVALUATION OVERVIEW

The evaluation team designed a comprehensive evaluation of the Residential Cooling Product to provide information on seven key research topics:

- Product influence (net-to-gross ratio)
- Product perceptions and awareness
- Customer decision-making and barriers
- Product experience and satisfaction
- Participation in related programs
- Heating fuel type
- Use of heat pumps

Table 1-3 presents an overview of the research topics and data sources used in this evaluation of the Residential Cooling Product. For more information, please refer to the Evaluation Plan in Appendix A.

Table 1-3. Evaluation Objectives & Methods

Evaluation Objective	Impact or Process Objective	Participant Survey n = 141	Non-Participant Survey n = 130	Trade Ally Interviews n = 19
Perceptions/Awareness	Process	✓	✓	✓
Customer Decision-Making and Barriers	Process	✓	✓	✓
Product Experience/Satisfaction	Process	✓		✓
Participation in Related Programs	Process	✓		
Use of Heat Pumps	Process	✓		✓
Heating Fuel Type	Process		✓	
NTG Impacts	Impact	✓	✓	✓

1.3 REPORT ORGANIZATION

The following chapters organize the evaluation findings into two components: process and impact evaluation results. Chapter 2 reviews the approach and results of the net impact evaluation and the attribution of product impacts using a standard net-to-gross ratio (NTGR) analysis. Chapter 3 discusses the process evaluation components, which address customer and trade partner perceptions and awareness, customer decision-making and barriers, product experience and satisfaction, participation in related programs, use of heat pumps, and heating fuel type. Conclusions and recommendations are presented in Chapter 4. Detailed, descriptive methodology information, evaluation plans, and survey instruments can be accessed in this report's appendices.

2. IMPACT FINDINGS

A key component of this evaluation was the estimation of the net-to-gross ratio (NTGR) for the Xcel Energy Residential Cooling Product in Minnesota. For demand-side management (DSM) programs, the NTGR is a metric that estimates the influence of the product on the target market. It is used as a benchmarking indicator of product effectiveness and to increase understanding of customer motivations to participate in programs. NTGR results can indicate opportunities for Xcel Energy to adjust the design and implementation of its products to increase the cost-effectiveness of individual products and the entire portfolio. The NTGR includes several factors that create differences between gross and net savings, such as free-ridership and spillover. The evaluation team estimated a retrospective NTGR based on data provided by customers and trade partners, and then recommended a prospective NTGR based on potential changes to the product's design. Note that, while a NTGR of 1.0 is often seen as desirable, it may not be appropriate for all product designs depending on a variety of factors (including the maturity of the product and the technologies it promotes, product intervention strategies, and cross-product coordination strategies). The evaluation team has taken care to present our NTGR results with this context in mind.

The objective of the impact evaluation of the Residential Cooling Product was to develop an NTGR documenting the extent to which product activities influenced customer purchasing decisions. The evaluation team used the participating customer and non-participating customer self-report surveys as well as trade partner interviews to estimate the Residential Cooling Product NTGR (both retrospective and prospective). Accordingly, the **objectives of the impact evaluation** were to:

- Estimate an overall NTGR, documenting the product's influence on customers' decisions.
- Determine a NTGR separately for equipment purchase and QI.
- Identify major drivers of free-ridership.
- Assess participating customer and non-participating customer spillover.
- Assess market effects of the Residential Cooling Product.

Methodology for the Net-to-Gross Ratio

For the participating customer survey, used to calculate the NTGR, the evaluation team focused on those customers who had completed projects in 2018 and in the first two quarters of 2019. As shown in Table 2-1, the evaluation team stratified the participating customer survey by rebate type, with particular focus on whether a QI was performed alone or in combination with high-efficiency equipment, as well as whether a rebate was received for high efficiency equipment only. These groups allowed comparison of responses to attempt to isolate the attribution for QI from that of efficient equipment upgrades. Accordingly, the goal for completed surveys with the QI-only strata was 70 completed surveys so that results could be reported at the 90% confidence +/- 10 percentage points precision level for QI separately

from equipment purchase. Additionally, the team oversampled mini split heat pumps (MSHPs) and ground source heap pumps (GSHPs) to obtain responses from customers who installed efficient equipment only. The data for all three strata were weighted to provide results that are representative of the Xcel Energy Minnesota Residential Cooling Product participant population.

Table 2-1. Stratification of Sample for the Participating Customer Survey

Strata	Measure	Population Size	n
QI only	13+ SEER Central Air Conditioning (CAC)	8,989	70[a]
	14+ SEER Air Source Heat Pump (ASHP)	32	
Efficient Equipment + QI	15+, 16+ 17+ SEER CAC	9,107	35[b]
	15+, 16+ 17+ ASHP	38	
Efficient Equipment only	Mini-split Heat Pump (MSHP)	532	36[c]
	Ground Source Heat Pump (GSHP)	26	

[a] *The QI-only stratum was made up of 69 CACs and 1 ASHP.*
[b] *The Efficient Equipment + QI stratum was made up of 32 CACs and 3 ASHPs.*
[c] *The Efficient Equipment-only stratum was made up of 34 MSHPs and 2 GSHPs.*

This chapter presents:

- **Key impact findings –** The key findings section presents the recommended NTGR based on the evaluation team's synthesis of findings from market actors.
- **Net-to-gross approach –** The approach section presents an overview of the evaluation team's methods for calculating the recommended NTGR.
- **Net-to-gross ratio inputs –** This section presents qualitative and quantitative data that support the NTGR calculations.

2.1 KEY IMPACT FINDINGS

This section presents key findings from the impact evaluation of the Minnesota Residential Cooling Product, including the retrospective NTGR and recommended prospective NTGR. The evaluation team first estimated separate NTGRs for participating customers who received equipment rebates and those who received rebates for QI. Then, the evaluation team weighted and combined those ratios to reach a final, overall NTGR for the product. These retrospective NTGRs are based on the quantitative and qualitative results of the customer and trade partner research. The team then recommended a prospective NTGR based on proposed changes to the product design.

RETROSPECTIVE NET-TO-GROSS RATIO

The evaluation team estimated a retrospective NTGR of 0.62 for the Minnesota Residential Cooling Product, based on results from customer and trade partner responses, this is covered in detail in Equation 2. To estimate this NTGR, the evaluation team took the following steps:

- The evaluation team first estimated a free-ridership ratio for equipment at 0.30 and for Quality Installation (QI) at 0.47, based on participating customer surveys, follow-up interviews with participating customers, and interviews with trade partners (to determine whether to classify factors as related to the product).
- The evaluation team estimated .01 spillover for equipment and no spillover for QI.
- The evaluation team was unable to identify evidence of market effects during the trade partner interviews for the equipment rebates; a .01 market effects adder was added to the QI NTGR.
- We took the inverse of free-ridership, and then added spillover and market effects, to estimate the final NTGR was 0.71 for equipment and 0.54 for QI.
- Those scores were weighted and combined for an overall NTGR of 0.62.

PROSPECTIVE NET-TO-GROSS RATIO

The evaluation team recommends that Xcel Energy implements a number of actions that could presumably result in a prospective NTGR of .80 or higher. Specifically, to increase the product's influence on the marketplace, the evaluation team recommends:

- Increasing the understanding of QI for all program actors (customers and trade partners). This may be achieved by:
    - Clarifying program requirements and terminology through improved product materials and required contractor trainings
    - Educating the public about QI through marketing collateral and/or trade partner education
    - Requiring verification of QI
    - Providing a separate incentive to trade partners for completing QI
- Increasing the awareness of Xcel Energy rebates. This may be achieved by:
    - Ensuring contractors explain the rebates to customers when presenting equipment choices
    - Educating the public about equipment rebates by marketing at critical moments
    - Increasing rebates and increasing marketing for heat pumps

2.2 NET-TO-GROSS APPROACH

The evaluation team developed the NTGR for the Residential Cooling Product using a self-report approach, based on participating customer survey results in combination with additional research data inputs. The methodology used in this evaluation was built from the Residential Prescriptive Rebate (With No Audit) Protocol in the *2019 Illinois Statewide Technical Reference Manual for Energy Efficiency Version 6.0*, in *Attachment A of Volume 4: Cross-Cutting Measures and Attachments*.

The data inputs to the NTGR analysis included:[4]

- Participating customer surveys – focused on project-level effects, including free-ridership and participating customer spillover
- Non-participating customer surveys – focused on spillover
- Follow-up interviews with participating customers survey respondents – sought to clarify any conflicting information in the original surveys
- Two rounds of trade partner interviews
    - The first focusing on overall market effects
    - The second serving as a participating customer interview follow-up for free-ridership clarification
- Benchmarking interviews – compared the NTGR to industry averages
- Known product changes in upcoming years –accounted for any known implications of future changes in product design

The evaluation team used self-reported data from participating customers to develop an initial NTGR. In order to achieve the goal of having an NTGR for both equipment and QI, the participating customers were asked the NTGR questions about equipment first, and then about Quality Installation, as applicable. Those results were then aggregated (and weighted according to the proportion of savings in the population) to create the overall program NTGR. Data from the additional sources listed above were then used in constructing a logical narrative of product attribution and in finalizing the prospective NTGR for the product.

FREE-RIDERSHIP

Free-ridership is a measure of the amount of a product's claimed savings that would have occurred in the absence of the product. Free-ridership is assessed on a scale from 0 to 1, where 1 indicates that the product had 100% free-ridership and all product savings would have occurred without any of the product's rebates or assistance.

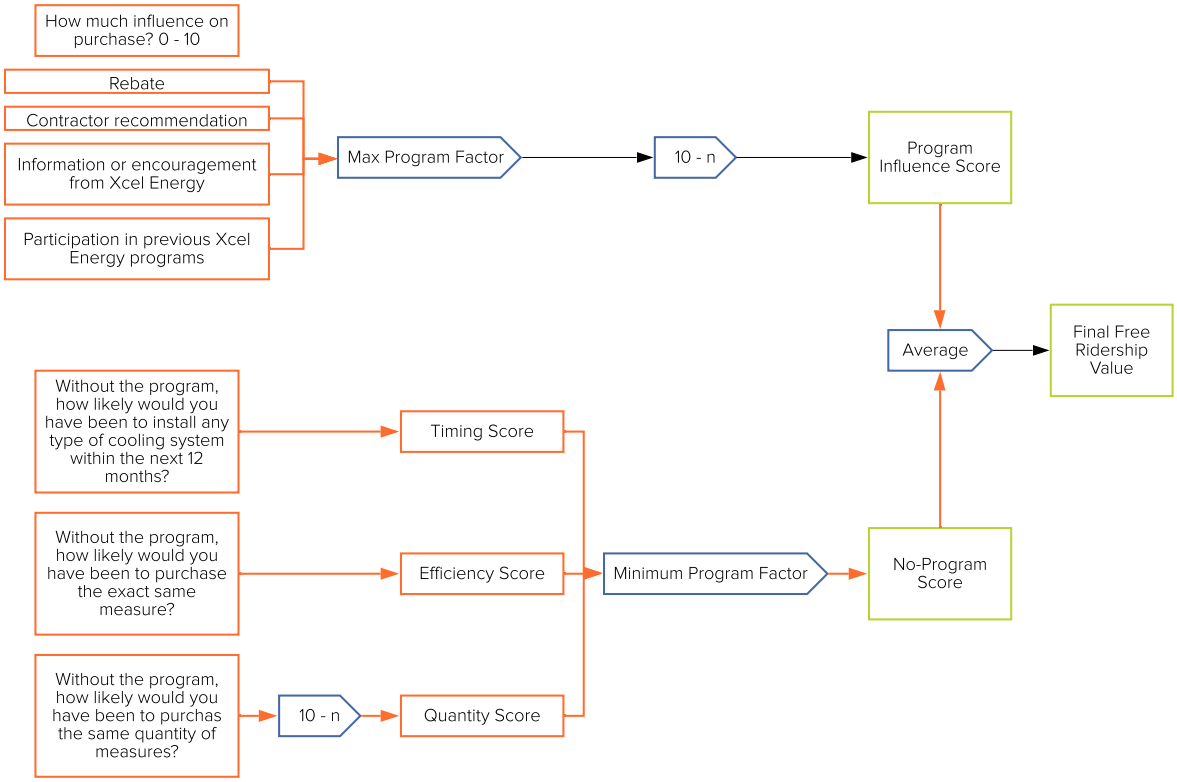
To determine free-ridership, the evaluation team started with the Residential Prescriptive Rebate (With No Audit) Protocol from the Illinois TRM, and wrote specific questions to assess two free-ridership components:

[4] Additional descriptive detail on these research activities appears in Chapter 3 and in the appendices.

- A **Program Influence Score**, based on the participating customer's perception of the importance of various product components in their decision to carry out the energy-efficient project
- A **No-Program Score**, based on the participating customer's intention to carry out the energy-efficient project without product funds[5]

When scored, these components assess the likelihood of free-ridership on a scale of 0 to 10, with the two scores averaged to create a final free-ridership score. Figure 2-1 outlines the steps for the equipment free-ridership calculations.

Figure 2-1. Free-Ridership Calculation Methodology for Equipment

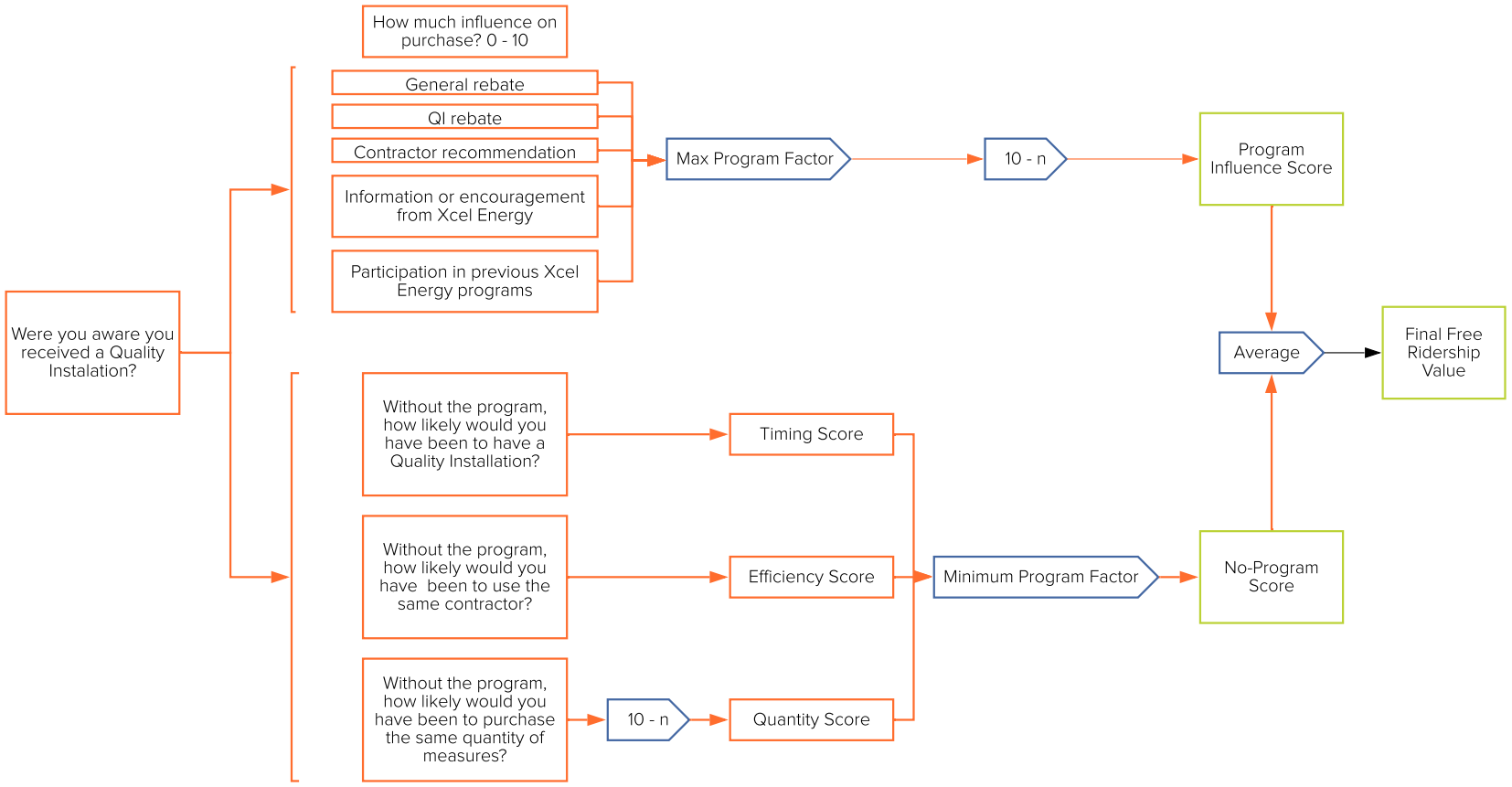


((Program Influence Score) + (No-Program Score)) / 2

The calculations for QI had three differences: (1) there was an added question at the beginning to determine if the participating customer had been aware that they had received QI; (2) there were separate questions about the rebate overall and the rebate specifically for QI for the Program Influence Score; and (3) the No-Program Score questions were altered to be relevant for QI, as seen in Figure 2-2.

[5] Throughout the report, when referring to scores factoring into the NTGR, the evaluation team follows the nomenclature of the 2019 Illinois TRM (i.e., using the terms like "Program Score", even though Xcel Energy practice is to use the term "product.") In the context of discussing aspects of NTGR, the terms "product" and "program" can be interpreted interchangeably.

Figure 2-2. Free-Ridership Calculation Methodology for Quality Installation



((Program Influence Score) + (No-Program Score)) / 2

SPILLOVER

Spillover is a measure of the amount of energy savings that occur due to the product that are *not* captured in the product's claimed energy savings.

To capture participating customer spillover, the evaluation team asked participating customers for information about any additional efficient cooling equipment or other efficient equipment installed outside of the product (for which they did not receive a rebate). The surveys also probed for information on the importance of the Residential Cooling Product in participating customers' installation decisions and the likelihood that the measures would have been installed if customers had not participated in the product. The evaluation team computed savings estimates for all identified spillover equipment and the product's spillover ratio was calculated by dividing the total spillover savings by the product's total energy savings.

To capture non-participating customer spillover, the evaluation team asked about cooling projects that customers installed outside of the Residential Cooling Product. Then, the evaluation team assessed the degree of influence the product had on their decision to complete the project.

DETERMINATION OF NET-TO-GROSS RATIO

The evaluation team estimated the product's initial NTGR using the following formula:

Equation 1. Product Net-to-Gross Ratio

$$Product\ NTGR = 1 - (Free - Ridership\ Ratio) + (Participant\ Spillover\ Ratio) + (Market\ Effects\ Adder)$$

Finally, the evaluation team utilized all the information collected about the product (through participating customer surveys and follow-up interviews, trade partner interviews, and known product changes) to construct a logical, internally consistent, and coherent narrative of product attribution that attempts to identify all possible pathways of Xcel Energy influence. In addition to free-ridership and participating customer spillover, the evaluation team also considered whether any adjustment was warranted due to the presence of market effects. Based on these results, the evaluation team recommended a final summative NTGR value that is consistent with this narrative.

2.3 NET-TO-GROSS RATIO INPUTS

As described in the approach section, the recommended NTGR is based on three primary data inputs: free-ridership, spillover, and market effects. This section explores each of these results in more detail, including qualitative data that support

the results. The first sub-section reviews the NTGR inputs for the equipment, followed by the NTGR inputs for QI.

EQUIPMENT FREE-RIDERSHIP RESULTS

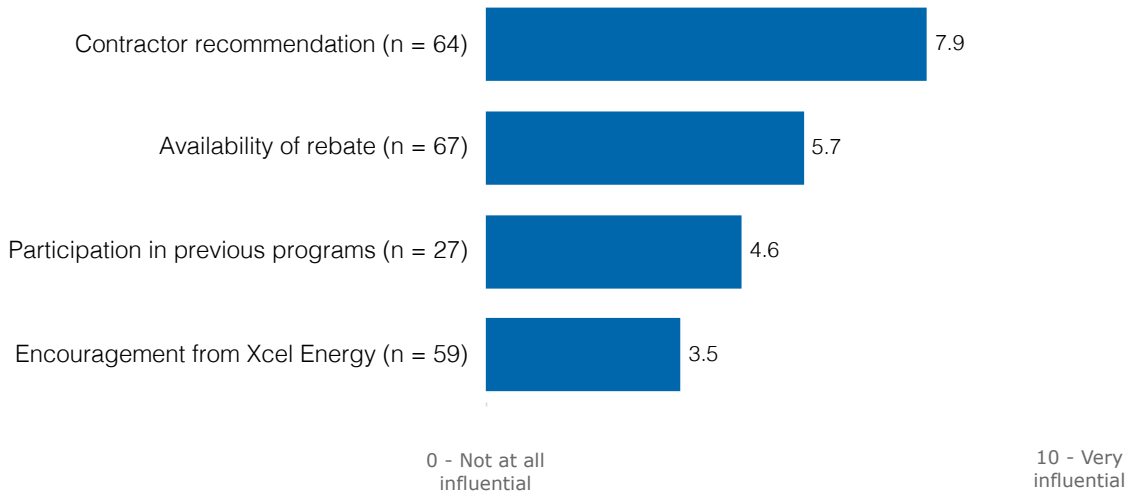
The evaluation team estimated two metrics for equipment free-ridership, a **Program Influence Score**, and a **No-Program Score**. For more details on what those scores represent, please refer to Section 2.2.

EQUIPMENT PROGRAM INFLUENCE SCORE

The Program Influence Score for the Residential Cooling Product for equipment was 0.21. Scores closer to 0 indicate the product has a high level of influence. Because customers are not asked about what would have happened in the absence of the product, Program Influence Scores typically underestimate free-ridership and are balanced by the No-Program Score, described in the Equipment No-Program Score section.

To determine the Program Influence Score, the evaluation team asked participating customers to rate the influence of a variety of factors upon their decision to install energy-efficient cooling equipment. As seen below in Figure 2-3, those factors were: (1) contractor recommendation, (2) availability of the rebate, (3) participation in previous programs, and (4) encouragement from Xcel Energy. Of these factors, participating customers rated the contractor recommendation as the most influential factor, at an average of 7.9 out of 10. The next most influential factor, availability of the rebate, was rated more than two points lower on average (score of 5.7 out of 10).

Figure 2-3. Equipment Program Influence Score Components



To calculate the Program Influence Score, the evaluation team took the product factor attributed with the most influence from each participant, averaged these

scores across participants, and re-scaled the result to be between 0 and 1, resulting in a score of 0.21.

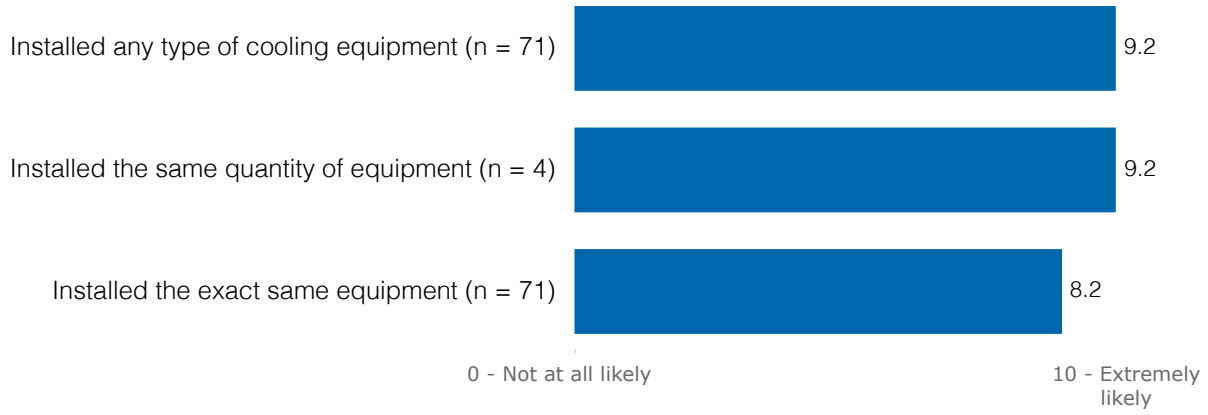
Equipment No-Program Score

The No-Program Score for the Residential Cooling Product for equipment was 0.77. Scores closer to 1 indicate the participants in the product would have taken the same action without the product.

In contrast to the Program Influence Score, which asks how influential the product was on a customer's decision to install efficient cooling equipment, the No-Program Score asks whether the decision to install identical equipment would have been different absent the product.

Respondents were asked to rate the likelihood that they would have installed any type of cooling equipment without the incentive, information, and support from the Residential Cooling Product. They were asked to use a rating scale from 0 to 10, where 0 is Not at All Likely and 10 is Extremely Likely. As shown in Figure 2-4, participating customers provided a mean rating of 9.2. The same mean rating, 9.2, was provided for the likelihood of installing the same quantity of equipment, for the few respondents who had multiple QIs. When asked if they would have installed the exact same equipment, customers reported an average score of 8.2.

Figure 2-4. No-Program Score Components



Next, the evaluation team averaged the Program Influence Score and the No-Program Score for each participant, then assessed that score based on open ended responses, as described in the next sub-section.

Equipment Free-Ridership Adjustments

At this point, the evaluation team did a consistency check by reviewing open-ended responses where the participating customer described the influence of the product on their decision-making and compared their answers to their free-ridership score. Participating customers provided wide-ranging answers, including, "*It wasn't a*

factor because I wasn't sure there were rebates at the time," and "*If there was no rebate, I would not have purchased it.*" The responses often provided a better picture of the decision-making process than the individual components. In cases where the responses were very inconsistent with the score, the evaluation team called those participating customers for follow-up interviews to receive further clarification. The evaluation team also completed interviews with trade partners to better understand their influence on the customer's decision-making.

Most scores the evaluation team investigated were due to the respondent saying they were very likely to install the same equipment, but also that the contractor had a high influence on their decision to install the equipment. The completed interviews included:

- 5 follow-up interviews with participating customers, and
- 9 of the 19 total interviews with trade partners were completed specifically with trade partners who were influential on equipment purchases, as reported by participating customers.

Findings from these interviews led the evaluation team to conclude that the product had more of an effect on decision-making than participating customers realized. Though customers were not always aware of it, contractors reported changing their sales practices due to the program. In these cases, the contractor was influential on participating customers' decision to install the equipment.

To correct for this finding, the evaluation team reviewed all scores where the contractor had the highest influence on the participating customer's decision and decreased free-ridership scores by half (e.g., a score of 0.50 was reduced to 0.25). The scores were then weighted according to the proportion of savings across the survey strata. Based on the equipment sampling weights below in Table 2-2, the overall adjusted free-ridership score for equipment was 0.30.

Table 2-2. Free-Ridership Calculation Based on kWh by Strata for Equipment

Sample Strata	Equipment Average FR Score	Equipment kWh Population Savings	Equipment kWh Population %	Equipment Weighted FR Score
Equipment + QI	0.29	2,645,607	83%	0.30
Equipment Only	0.41	527,568	17%	

EQUIPMENT SPILLOVER RESULTS

Spillover is a measure of the amount of energy savings that occur due to the product that are *not* captured in the product's claimed energy savings. To be eligible for spillover, customers must have:

1. Installed additional efficient equipment after participating in the product[6];
2. Not received rebates for this equipment (and not be in the process of applying for rebates); and
3. Been influenced to install this equipment by the Minnesota Residential Cooling Product.

Only one participant was eligible for spillover and the estimated savings from spillover equipment resulted in a spillover score of 0.01.

EQUIPMENT MARKET EFFECTS RESULTS

The evaluation team did not identify evidence of market effects and, therefore, did not assign market effects to the equipment NTGR for two reasons:

- Trade partners said they would offer less efficient equipment in absence of the program.
- The influence of the program on trade partners' sales practices was accounted for in adjustments to participating customers' NTG ratios.

EQUIPMENT RETROSPECTIVE NTGR

Overall, the evaluation team found that the product impacted participating customers' decisions. We determined an equipment NTGR of 0.71 using the generalized formula below (Equation 2).

Equation 2. Generalized Net-to-Gross Ratio

$$NTGR = 1 - (Free\text{-}Ridership\ Ratio) + (Spillover\ Ratio) + (Market\ Effects\ Adder)$$

Using this formula, the equipment NTGR is shown in Equation 3. Participating customers reported that the contractor was most influential in their decision to participate in the product. Many participants were influenced by their contractors and (to a lesser extent) the rebate, but at the same time many said they would have purchased the same equipment without the rebate, resulting in a free-ridership ratio of 0.30.

Equation 3. Equipment Net-to-Gross Ratio

$$NTGR = 1 - (0.30) + (0.01) + (0.00) = 0.71$$

QUALITY INSTALLATION FREE-RIDERSHIP RESULTS

The QI free ridership battery followed the same Program Influence Score and No-Program Score components as the equipment free-ridership battery. Please refer to

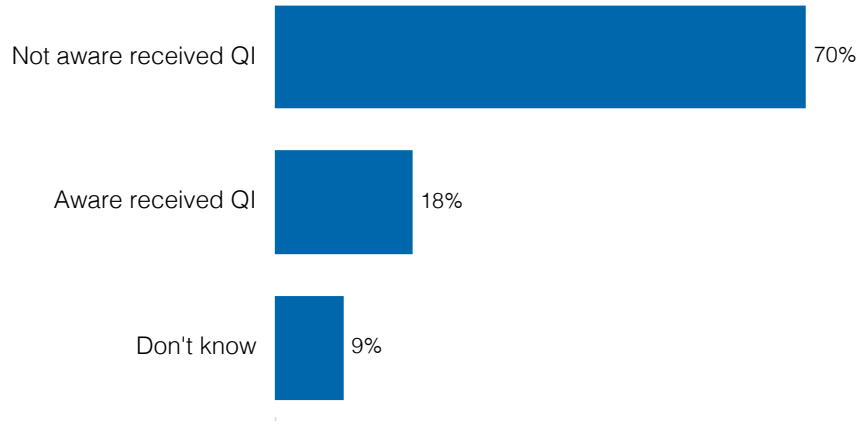
[6] Efficient residential equipment was defined as equipment that would qualify for rebates from any residential Xcel Energy product.

Figure 2-2 for specific differences. The participating customers that received Quality Installation were asked this question first:

> "To qualify for a rebate, your contractor installed (measure type) using an enhanced installation process, known as a "Quality Installation." The Quality Installation process does not describe the equipment itself; rather, it is a specific process for how the equipment is installed in your home. Were you aware that you received this enhanced installation?"

As shown in Figure 2-5, 70% of the participating customers that received QI were not aware of it, and were thus not asked follow-up questions about the process. Participating customers who said they were aware, or were unsure if they were aware they received QI, were asked the QI Program Influence Score and No-Program Score questions. Notably, there were several trade partners who also demonstrated limited understanding of the QI requirement. This will be discussed more in the "Quality Installation No Program Score" section.

Figure 2-5. Awareness of Quality Installation among Participating Customers



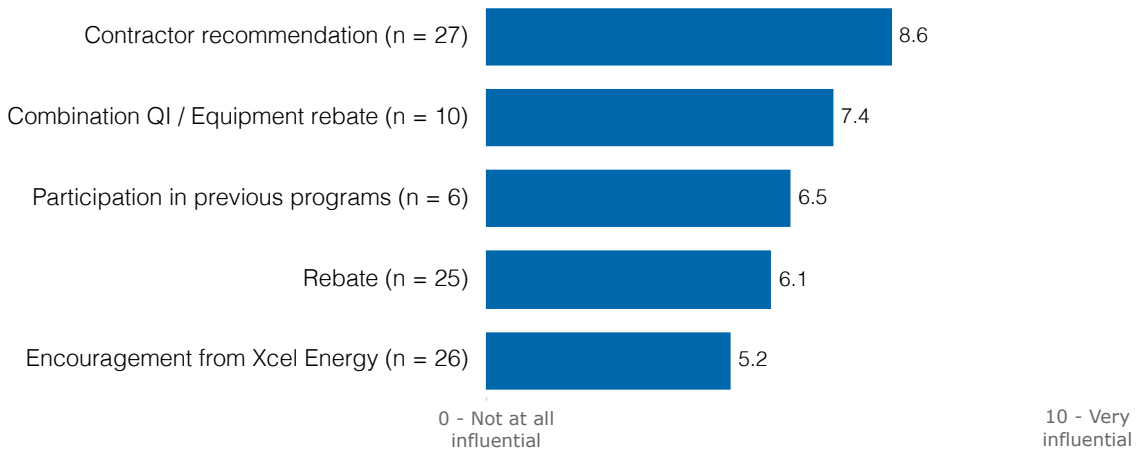
Quality Installation Program Influence Score

The Program Influence Score for the Residential Cooling Product for QI was 0.09; however, this is an incomplete picture of the product's influence, because this score does not include the 70% of participants who were unaware that they received QI. Scores closer to 0 indicate the product has a high level of influence. Because customers are not asked about what would have happened in the absence of the product, Program Influence Scores typically underestimate free-ridership and are balanced by the No-Program Score, described in the next section.

To determine the Program Influence Score, the evaluation team asked participating customers who received QI (and were either aware they received it or were not sure) to rate the influence of a variety of factors upon their decision to install energy-efficient cooling equipment. As seen below in Figure 2-6, those factors were

(1) contractor recommendation, (2) the combination QI/Equipment rebate, (3) participation in previous programs, (4) the rebate for just the QI, and (5) encouragement from Xcel Energy. Of these factors, participating customers rated the contractor recommendation as the most influential factor, at an average of 8.6 out of 10.

Figure 2-6. QI Program Influence Score Components



To calculate the Program Influence Score, the evaluation team took the product factor attributed with the most influence from each participant, averaged these scores across respondents, and re-scaled the result to be between 0 and 1, resulting in a Program Influence Score of 0.09.

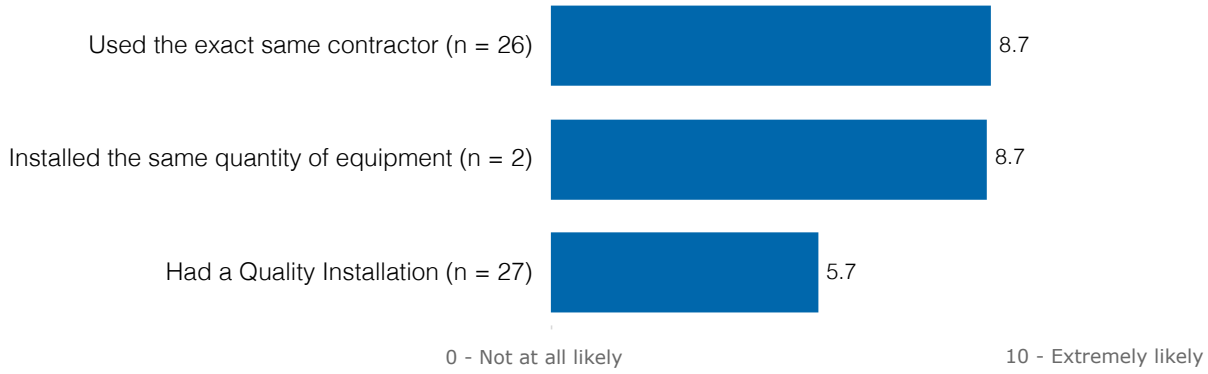
Quality Installation No-Program Score

The Minnesota Residential Cooling No-Program Score for QI was 0.57; however, this is an incomplete picture of the product's influence because this score does not include the 70% of participants who were unaware that they received QI.

As a reminder, the No-Program Score is a measure of how likely customers are to have had a Quality Installation without the influence of the product. In contrast to the Program Influence Score, which asks how influential the product was on a customer's decision to have a QI, the No-Program Score asks whether that decision would have been different if the product had never existed.

First, the evaluation team looked at participating customers who were aware or unsure of the QI installation. Those customers were likely to report that they would have used the exact same contractor without the product, with a mean rating of 8.7 on a scale from 0 to 10, where 0 is Not at All Likely and 10 is Extremely Likely, as shown in Figure 2-7. Similarly, the two customers who had QIs for multiple pieces of equipment were likely to report they would have installed the same quantity of equipment without the product. When asked the likelihood that they would have had a QI without the product, participating customers reported an average score of 5.7.

Figure 2-7. QI No-Program Score Components



Quality Installation Free-Ridership Adjustments

The evaluation team performed the same consistency checks as with the equipment scores, reviewing the open-ended responses about their decision-making in comparison to their free-ridership scores. The open-ended responses were consistent with the scores, so no adjustments were made. In addition, only one participating customer listed a non-qualified contractor as part of their bidding process (meaning that most customers received bids exclusively from qualified trade partners).

Next, the evaluation team reviewed the responses of the participating customers who were not aware that they received QI (n = 105) and, therefore, could not be asked the attribution questions. Rather than assuming a free-ridership of 1.0, indicating the program had no influence on these customers' decisions to have a Quality Installation, the trade partner interviews were used to determine the influence of the program on installation practices. The 19 interviews with trade partners included:

- 10 initial interviews
- 9 additional interviews specifically with trade partners who were influential on equipment purchases, as reported by participating customers.

These interviews indicated that:

- According to trade partners, QI is part of their standard practices. They reported that they do not offer "standard," non-quality installation.
- Trade partners reported that they did not change their installation practices to accommodate QI when enrolling in the product.
- Trade partners are generally not promoting QI to their customers.

While we were unable to document any influence of the product on trade partner's installation practices, it is possible that trade partners are reluctant to admit doing less than "quality" work. Additionally, trade partners do not associate the term

"quality installation" with this program because that is not how it is labelled during Xcel Energy trainings or in the application. Due to this confusion about the QI rebates, it is possible that trade partners themselves do not completely understand the influence of the program on their own practices. Finally, because the product has been offering QI rebates since 2007, recall of the program influence at the time they joined the program may present a challenge. Thus, rather than assigning the respondents not aware of QI a free-ridership score of 1.0, the evaluation team decreased their scores by half, meaning that respondents who were not aware that they received QI were assigned a QI free-ridership score of 0.5. After weighting the scores according to the proportion of savings across the survey strata, **the adjusted free-ridership score for the Minnesota Residential Cooling Product for QI was 0.47.**

QUALITY INSTALLATION SPILLOVER

Again, spillover is a measure of the amount of energy savings that occur due to the product that are *not* captured in the product's claimed energy savings. To be eligible for spillover, customers must have:

1. Installed additional efficient equipment after participating in the product[7];
2. Not received rebates for this equipment or installation (and not be in the process of applying for rebates); and
3. Been influenced to install this equipment by the Minnesota Residential Cooling Product.

None of the customers participating in the survey qualified for spillover, therefore the evaluation team could not document spillover for QI.

QUALITY INSTALLATION MARKET EFFECTS

Despite trade partners reporting that QI is their standard practice, the evaluation team believes that without the incentives and trainings, some trade partners would likely not continue the exact same practices. In particular, when installations are completed during cold weather, trade partners may not go back to the customer's home to test the installation when temperatures warm up to the required minimum of 55°. However, they may still continue to do testing at the same time during warmer-weather installations. Thus, we believe a modest market effects adder of 0.01 is well-justified in this likely scenario. Further investigation of the trade partners' performance of Quality Installation to uncover greater market effects was not possible without on-site data collection and/or more rigorous post-installation measurement and verification, as will be detailed in the prospective NTGR section below.

[7] Efficient residential equipment was defined as equipment that would qualify for rebates from any residential Xcel Energy product.

QUALITY INSTALLATION RETROSPECTIVE NTGR

Overall, the evaluation team was able to document that the product impacted participating customers' decisions, but to a limited extent. Using the generalized formula shown above in Equation 2 (in the Determination of Net-to-Gross Ratio section), we estimated a QI NTGR of 0.54.

The QI NTGR is shown below in Equation 4. Participating customers who participated in this survey effort reported that the contractor was most influential in their decision to participate in the product, while the influence of the rebate was only moderate. The free-ridership ratio of 0.47 is influenced by many participating customers reporting that they would have purchased the exact same equipment that required QI without the program.

Equation 4. Quality Installation Net-to-Gross Ratio

$$NTGR = 1 - (0.47) + (0.00) + (0.01) = 0.54$$

Table 2-3. Free Ridership Calculation Based on kWh by Strata for QI

Sample Strata	QI Average FR Score	QI kWh Population Savings	QI kWh Population %	QI Weighted FR Score
Equipment + QI	0.47	2,127,028	51%	0.47
QI Only	0.46	2,062,329	49%	

OVERALL PRODUCT RETROSPECTIVE NTGR

After calculating the NTGR for both equipment and QI separately, the evaluation team aggregated these scores to determine the overall product NTGR. The NTGRs for QI and Equipment were weighted proportional to kWh savings in the population for these two product components, as shown in Table 2-4. After weighting according to kWh representation, **the retrospective NTGR for the Minnesota Residential Cooling Product is 0.62.**

Table 2-4. Product-Level NTGR Calculation Based on Population kWh for QI and Equipment

Sample Strata	Average NTGR	kWh Population Savings	kWh Population %	Product-Level Weighted NTGR
QI	0.54	4,169,887	57%	0.62
Equipment	0.71	3,192,644	43%	

PEER UTILITY NTGR

The peer utilities interviewed for this evaluation that calculate NTGRs had equivalent or higher NTGRs, but none had programs identical to the Xcel Energy program, as discussed in Appendix C.5.

Table 2-5. Peer Utility Net-to-Gross Ratios for Residential Cooling Program

Utility	Program Overall	Central Air Conditioner	Air Source Heat Pump	Mini-Split Heat Pump
Xcel Energy	0.62			
Utility A	N/A			
Utility B	0.97	0.78	0.87	0.91
Utility C[QI]	1.0			
Utility D	N/A			
Utility E	0.9			
Utility F	N/A			
Utility G[QI]		0.67	0.60	0.77
Utility H[QI]				
Utility I	0.62			
Utility J[QI]	State 1: 0.77 State 2: 0.91 State 3: 0.81			

Note: Utilities A and D claim gross savings only. Utility F did not provide NTGRs. The NTGR for Utility B includes several other measures not shown here. The NTGR for Utility C is stipulated at 1.0. The NTGR for Utility E is for all residential programs.
[QI] denotes utilities with some level of enhanced installation (C, G, H, J). Utility I offers Quality Maintenance.

3. PROCESS EVALUATION

The evaluation team conducted a process evaluation to determine how Xcel Energy can optimize the design and delivery of the Minnesota Residential Cooling Product to its customers. Specific research objectives of the process evaluation are listed in the bullets below:

- **Perceptions/Awareness:** The evaluation team assessed customer perceptions and awareness of the Residential Cooling Product to identify opportunities for greater product participation. We also determined if customers understood the benefits of QI.
- **Customer Decision-Making and Barriers:** The evaluation team assessed the motivations for installing new equipment and having QI completed as well as barriers to pursuing efficient upgrades, new equipment installation, or having QI completed. We also asked about the perceived value associated with other non-energy benefits of high efficiency equipment.
- **Product Experience/Satisfaction:** The evaluation team discussed customers' experience and satisfaction with the product, including ease of locating a qualified trade partner and satisfaction with trade partners. We also assessed timeliness of the rebates (e.g., were they able to test their equipment right away or did they have to wait for warmer temperatures and therefore their rebate?) and if customers received the rebate they expected to receive. We examined customers' satisfaction with their equipment and installation and what benefits (energy and non-energy) customers have experienced, and the relative value placed on these benefits.
- **Participation in Related Programs:** The evaluation team determined customer participation in other products and the installation of other efficient equipment, specifically: (1) the extent to which participating customers are also installing smart thermostats, and (2) the extent to which participating customers are participating in the demand response (DR) programs for air conditioning.[8] And, if the customers participated in DR, did the installation of their new cooling equipment result in the disconnection of their switch?
- **Use of Heat Pumps:** The evaluation team determined how mini-split heat pumps were being used. Are mini-split heat pumps displacing electric baseboard heat or gas heat? Or are customers turning heat pumps off during the winter and using their previous heat source?

To accomplish these objectives, the evaluation team elicited feedback from product staff, participating customers, non-participating customers, trade partners (i.e., participating contractors), and other utilities with similar products. This chapter first presents key findings from the process evaluation, then follows with the evaluation team's approach to conducting the process evaluation and the specific findings relating to each process evaluation objective. These findings, along with findings

[8] The evaluation team also collected information on the brand of smart thermostat customers installed.

from the impact evaluation, inform the conclusions and recommendations presented in the final chapter.

3.1 KEY FINDINGS

The evaluation team found that, overall, customers and trade partners are very satisfied with current product operations, and staff report product processes are running smoothly. Customers and trade partners both noted that the product was easy to participate in, and that they were happy with their experiences. Additional key findings from the process evaluation research included:

- **Overall, participating customers and trade partners are satisfied with the program.** Participating customers provided a mean satisfaction rating of 4.5 out of 5. Trade partners were also generally satisfied with the program, with only 1 of 10 giving a rating of less than 4.
- **Opportunities exist for cooling upgrades in Minnesota.** Of non-participating customers who use cooling equipment, 54% installed equipment more than 10 years ago and, of those, 47% said they would be willing to consider an upgrade if they knew that a rebate would be available.
- **Opportunities exist to increase awareness among residential customers.** Only about one-quarter of the general population of non-participating customers interviewed are aware of the Residential Cooling rebates. Awareness of heat pumps among non-participating customers is also low, at less than 30%. Similarly, awareness of QI is low for both participating customers (18%) and non-participating customers (15%), and many trade partners do not recognize the term "Quality Installation."
- **Opportunities exist to claim heating savings for heat pumps that displace other electric heat sources.** Although only 7% of non-participating customers use electricity as their primary heat source, an additional 31% use electricity as a secondary heat source in a variety of types of rooms (most commonly basements, sunrooms, bedrooms, and living rooms). Among participants who installed mini-split heat pumps, about 1/4 replaced electric heating, and 2/3 of mini-splits are used for at least a portion of the winter.
- **Opportunities exist to cobrand the Residential Cooling Product with smart thermostat rebates and the Saver's Switch demand response product** Of Residential Cooling Product participating customers, 61% installed a thermostat along with their cooling equipment. Almost half (47%) of customers who participated in the product reported they also participated in Saver's Switch.
- **Many peer utilities offer cooling and heating rebates under one program and have an installation process different than Xcel Energy.** Four of ten utilities offer an 'enhanced installation' component with varying levels of the QI requirements, however none seem to have as many tests as Xcel Energy. None provide additional customer incentives like the QI provided by Xcel Energy. One utility provides enhanced installation as an option to the customer and provides an incentive to the contractor.

In Section 3.2, we describe the overall approach used for the process evaluation research activities and, beginning in Section 3.3, we provide detailed results from each of these activities.

3.2 APPROACH

To accomplish the evaluation objectives for the Minnesota Residential Cooling Product, the evaluation team completed a suite of intersecting and complementary research activities in 2019. Detailed information on the sampling approach used for the research can be accessed in Appendix A. The following discussion highlights the research topics addressed by each research activity: staff interviews, participating and non-participating customer surveys, trade partner interviews, and peer utility benchmarking interviews.

STAFF INTERVIEWS

The evaluation team conducted six in-depth group interviews with seven Xcel Energy personnel involved with the Residential Cooling Product early in the course of this evaluation, including one Product Manager, one Channel Manager, one Engineer, one Rebate Operations team member, one Call Center Energy Expert team member, and two Regulatory Department staff. The staff interviews covered the following objectives:

- Assess the extent to which product design supports product objectives and customer service/satisfaction objectives.
- Determine the degree to which product resources are sufficient to conduct product activities with fidelity to the implementation plan.
- Collect staff feedback on implementation successes and challenges.

Appendix B.1 presents the interview guide used for these discussions.

PARTICIPATING CUSTOMER SURVEYS

The evaluation team conducted two telephone surveys, one with participating customers and one with non-participating customers. The research addressed the following process objectives:

- Assess customer and trade partner perceptions and awareness of efficient cooling technology and QI.
- Understand customer decision-making and barriers to installing efficient equipment and having QI completed.
- Assess product experience and satisfaction, among both customers and trade partners. Determine perceived non-energy benefits of high efficiency equipment.
- Understand customer participation in related programs that could be marketed together (smart thermostat rebates and demand response).
- Confirm the use of heat pumps and what equipment they are replacing.

The methodology of the participating customer survey was discussed in the section: Methodology for the Net-to-Gross Ratio. As a reminder, the evaluation team stratified the participating customer survey by rebate type, with particular focus on whether a QI was performed alone or in combination with high-efficiency equipment, as well as whether a rebate was received for high efficiency equipment only, as seen in Table 2-1. The goal for completed surveys with the QI-only strata was 70 completed surveys so that results could be reported at the 90% confidence +/- 10 percentage points precision level for QI separately from equipment purchase. The data for all three strata were weighted to provide results that are representative of the Xcel Energy Minnesota Residential Cooling Product participant population.

NON-PARTICIPATING CUSTOMER SURVEYS

The evaluation team utilized non-participating customer telephone surveys to meet impact and process objectives. These surveys were conducted over the phone and focused on the following four topics: perceptions/awareness of Xcel Energy rebates, decision-making and barriers to upgrading cooling equipment, heating fuel type, and spillover.

The evaluation team completed 130 total surveys with non-participating customers. The sample excluded gas-only customers, as they are ineligible for Residential Cooling Product rebates. The sample also excluded multifamily customers, as these customers are frequently not the decision-makers for cooling upgrades. Non-participating customers were defined as those customers who have no record of completing a Residential Cooling Product project in Xcel Energy's Salesforce system (i.e., since 2012). This general population of non-participating customers allowed the evaluation team to estimate the proportion of customers with electric heating (including primary and secondary sources). In addition to standard non-participating customers, the survey included a stratum of non-participating customers who completed a furnace or ECM (electronically commutated motor) upgrade, but no cooling upgrade, as shown in Table 3-1. These customers were included to address questions about barriers to participating in the Residential Cooling Product, since they upgraded heating but not cooling equipment.

Table 3-1. Stratification of Sample for the Non-Participating Customer Survey

Strata	n
Non-participating customer, general population	65
Non-participating customer who have completed a furnace or ECM upgrade	65

Appendix B.2 contains the questionnaire used for the participant survey, and Appendix B.3 contains the non-participant survey questionnaire.

TRADE PARTNER INTERVIEWS

In addition to the surveys with participating customers, the evaluation team conducted in-depth interviews with trade partners (i.e., participating contractors) and follow-up interviews with trade partners of participating customers who had a high level of contractor influence but still said they would have purchased the equipment anyway. The trade partner research addressed the following process topics:

- Assess customer and trade partner perceptions and awareness of efficient cooling technology and QI.
- Understand customer decision-making and barriers to installing efficient equipment and completing QI. Determine perceived non-energy benefits of high-efficiency equipment.
- Assess product experience and satisfaction, among both customers and trade partners.
- Confirm the use of heat pumps and what equipment they are replacing.

To ensure a range of viewpoints, the evaluation team split the sample between high- and low-participating trade partners, as shown in Table 3-2.

Table 3-2. Trade Partner Target Interviews, by Interview Strata

Trade Partner Interview Strata	Population	n
Highly active (16 or more applications)	261	5
Less active (1 – 15 applications)	220	5
Follow-ups from participating customer survey	N/A[a]	9
Total	**481**	**19**

Note: Less active trade partners were screened to verify they perform work with residential customers and regularly serve customers in the Xcel Energy service territory, to ensure that any barriers to participation identified in the interviews are meaningful feedback for Xcel Energy.
[a] The population of 29 trade partner follow-ups from 33 customer surveys overlapped with the highly active and less active trade partner populations.

Appendix B.4 presents the interview guides used for the trade partner research.

BENCHMARKING INTERVIEWS

The objective of the peer utility benchmarking task was to understand how peer utilities are approaching key issues related to implementing residential cooling programs.

To ensure Xcel Energy had an "apples-to-apples" comparison, the evaluation team selected utilities with comparable to the Xcel Energy Residential Cooling Products in Minnesota. We recruited staff in key management roles related to residential cooling programs at 10 of these peer utilities. Table 3-3 shows the characteristics of the interviewed utilities.

Table 3-3. Background Information by Utility

Utility	Energy Type	Location	Separate Heating Program?	QI Status
Xcel Energy	Electric & Gas	Minnesota	Yes	QI required, customer incentivize
Utility A	Electric	Midwest	N/A	None
Utility B	Electric & Gas	Midwest	No	None
Utility C	Electric	Southwest	N/A	Required QI, no incentive
Utility D	Electric & Gas	Midwest	No	None
Utility E	Electric & Gas	Midwest	No	None
Utility F	Electric & Gas	Southeast / Midwest	No (but internally separate electric & gas programs)	Removed from program
Utility G	Electric & Gas	Northeast	No (but internally they have different budgets and managers)	Optional QI, contractor incentive
Utility H	Electric & Gas	Northeast	No	
Utility I	Electric & Gas	West	Moved to combo program in 2019	Quality Maintenance
Utility J	Electric	West	No	Require QI, no incentive

The peer interviews focused on the same discussion topics that were explored in the interviews with Xcel Energy participating customers and trade partners, but also emphasized the following research objectives specific to peer benchmarking:

- Identify the equipment baselines that other utilities use and how savings are calculated, particularly for heat pumps. Determine if other utilities differentiate savings when only one room has a mini-split heat pump.
- Identify how peer utilities handle replacement of gas heating systems with electric heat pumps.
- Identify successful methods of engaging multifamily customers, noting any differences between new construction and renovations.[9]
- Understand how peer utilities structure their requirements for QI (e.g., certification requirements, verification that QI was performed, testing performed during certain temperatures vs. year-round). Is QI possible with ductless equipment? Are the requirements different for HP vs. CAC?
- Determine the structure of peer programs. Do peer utilities have separate residential heating and cooling programs, or are they grouped together in

[9] The peer utilities were not familiar with successful methods to engage multifamily buildings, more information can be found in Appendix C.5.

one program? Do they advertise smart thermostats and DR programs along with cooling measures? How do utilities minimize switch disconnections for DR participating customer when their cooling equipment is upgraded?

Appendix B.5 contains the interview guide used for the benchmarking interviews.

Data on all of the process evaluation topics are presented below. Results are divided into three categories: (1) program experience, (2) decision-making and barriers, and (3) use of heat pumps. All of the topics include data from participating customer and non-participating customer surveys, as well as trade partner and peer utility benchmarking research activities to highlight consistencies between the groups. The synthesis of findings places an emphasis on helping Xcel Energy interpret customer and trade partner perspectives and identifying actionable opportunities for improving product operations and marketing.

3.3 PROGRAM EXPERIENCE

Results related to program experience are divided into two categories: (1) product experience and satisfaction and (2) participation in related programs.

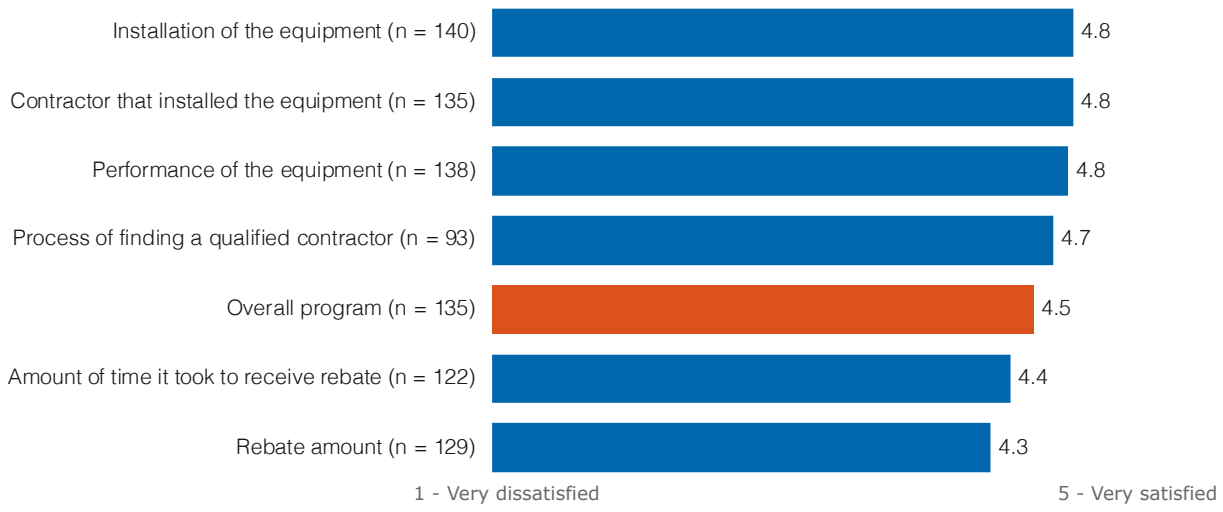
PRODUCT EXPERIENCE & SATISFACTION

The first process evaluation research objectives relate to customer experiences and satisfaction with the product. Specific objectives included (1) assessing customer experience and satisfaction with the product, and (2) documenting benefits (energy and non-energy) customers have experienced. This section discusses the evaluation results from the surveys and interviews to highlight experiences holistically rather than limiting results to a single research method.

Overall, our research indicates that experiences with the product are positive. Participating customers provided a mean rating of greater than 4 for all program process satisfaction elements, using a scale of 1 to 5, where 1 means "Very Dissatisfied" and 5 means "Very Satisfied." Trade partners were similarly satisfied. Of the ten trade partners interviewed, eight rated their satisfaction with the product either a 4 or 5, and none gave a rating of less than 3. Throughout the participating customer survey, respondents gave positive ratings of the various product elements and provided only a few dissatisfied responses.

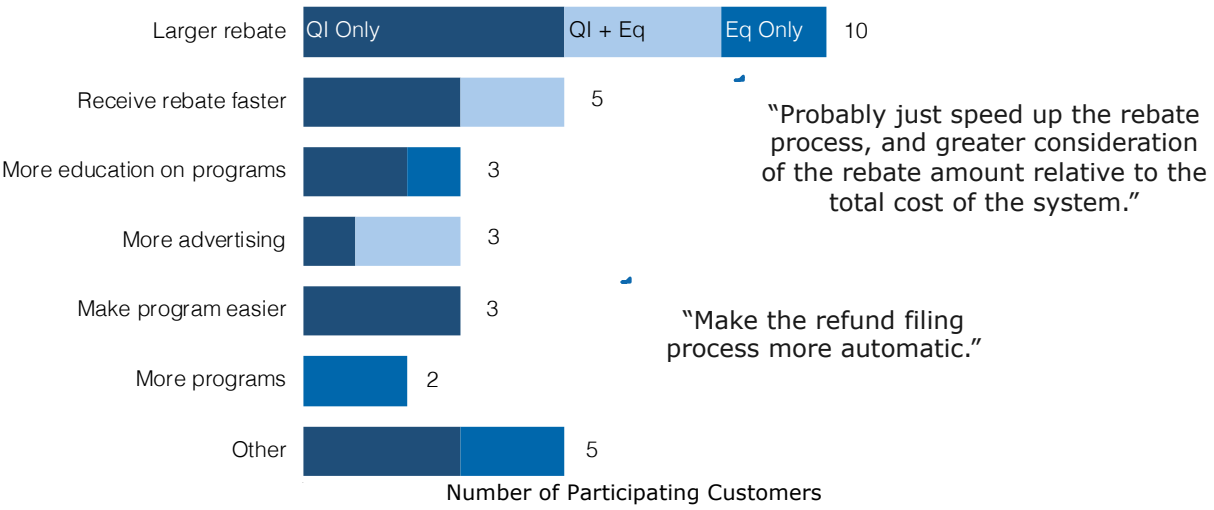
Participating customers were highly satisfied with the installation and performance of the equipment, as well as with the contractor that installed the equipment, giving an average rating of 4.8 out of 5 for each. Satisfaction with the Residential Cooling Product overall was also high, with an average of 4.5 out of 5 and only one dissatisfied rating (defined as a rating of 1 or 2). Figure 3-1 shows average ratings for specific product elements by respondents. There were no significant differences between survey strata; the figure below displays aggregated participating customer results.

Figure 3-1. Participating Customer Satisfaction with Product Elements



Although average ratings were all high, the two lowest rated elements were timeliness and amount of the rebate. One customer remarked that it was too cold at the time of the installation to complete the required testing, thus delaying the timeline of their rebate. Larger and faster rebates were also the most common suggestion for improving satisfaction in an open-ended question, as shown in Figure 3-2.

Figure 3-2. Participating Customer Suggestions to Improve the Residential Cooling Product

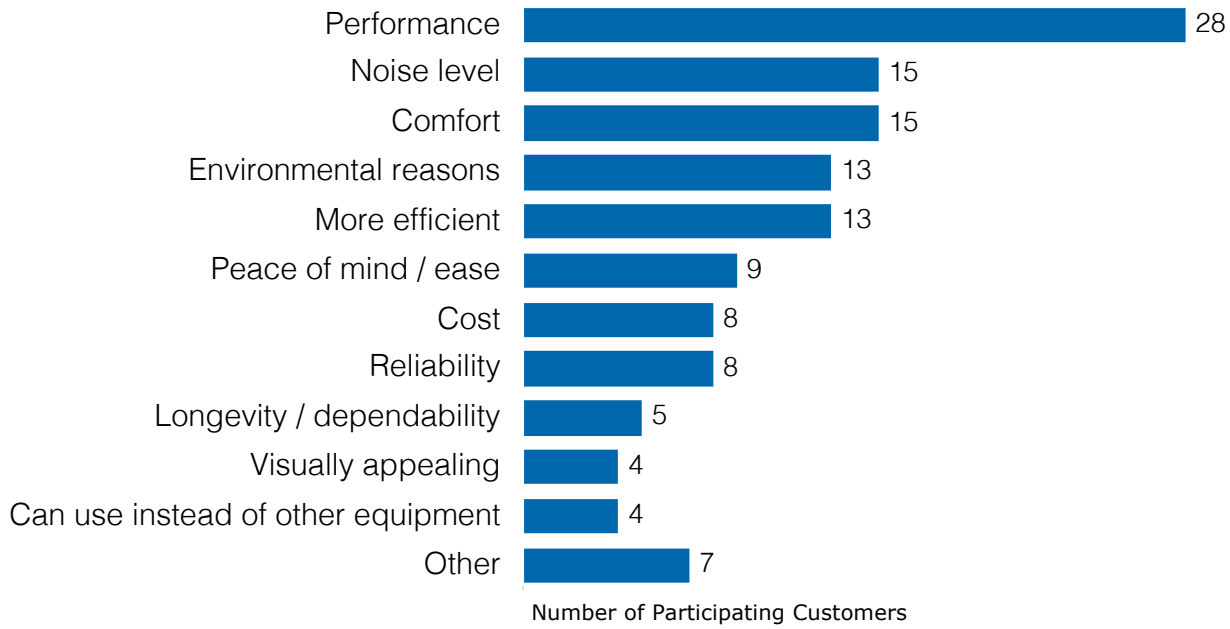


Note: "QI Only" = respondents who received rebates for QI only (i.e., 13 SEER CAC or 14 SEER ASHP). "QI + Eq" = respondents who received rebates for both QI and efficient equipment. "Eq Only" = respondents who received rebates for efficient equipment without QI.

In an open-ended question, participating customers reported that performance was the biggest non-energy benefit provided by the equipment installed, as opposed to other less efficient equipment. Other examples included noise level, comfort, and

environmental reasons. There were no significant differences between strata; Figure 3-3 displays aggregated participant results.

Figure 3-3. Participating Customers' Reported Non-Energy Benefits



Note: Figure shows responses to question E1, "Other than saving energy and saving money on your utility bills, what would you say is the biggest benefit provided by the specific cooling equipment you installed, as opposed to other less efficient equipment you may have considered?"

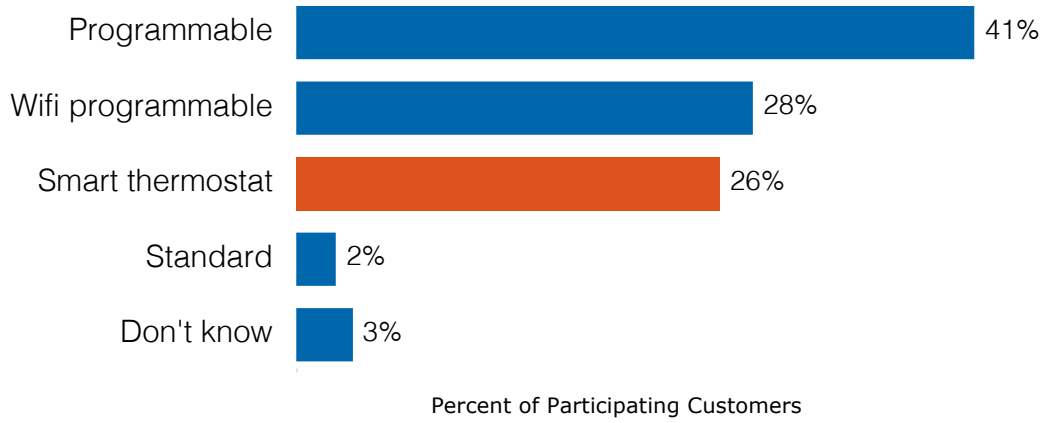
PARTICIPATION IN RELATED PROGRAMS

One evaluation goal was to understand participation in related programs, specifically the installation of smart thermostats and participation in the Saver's Switch DR program.[10] The evaluation team found that a fair number of customers participating in the Residential Cooling Product are also installing smart thermostats, and there are a substantial proportion of customers participating in the Saver's Switch product. This indicates overlapping marketing campaigns could hit the right target.

Just under two-thirds (n = 75, 61%) of participating customers installed a thermostat along with their cooling equipment. Of these, 26% of customers reported they installed smart thermostats. There were no significant differences between strata; Figure 3-4 below displays aggregated participating customer results, among those who installed thermostats.

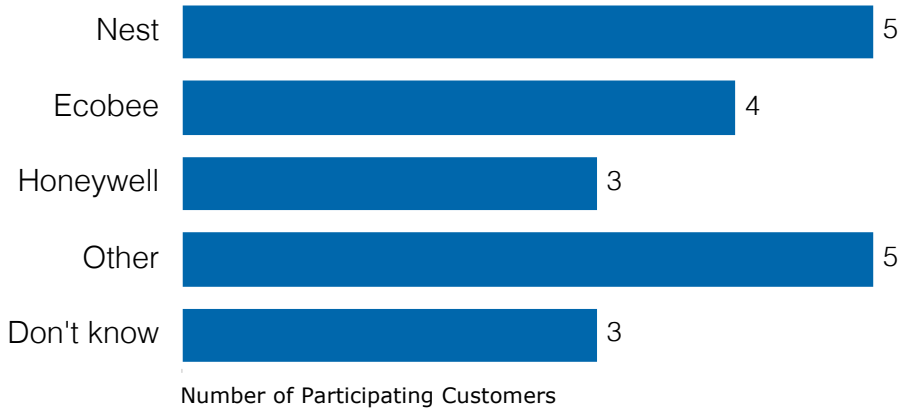
[10] Saver's Switch is an Xcel Energy product where customers can have a device installed on their air conditioner that Xcel Energy can control to help mitigate peak demand.

Figure 3-4.Types of Thermostat Installed by Participating Customers



The majority of smart thermostat brands were Nest and Ecobee, as seen in Figure 3-5.

Figure 3-5. Brands of Smart Thermostats that Participating Customers Installed



Note: "Other" brands reported were Carrier (n = 2), Mitsubishi, Emerson, and Train.

Nearly half (47%) of respondents reported that they participated in the Saver's Switch DR product. Of those, 18% (n = 12) reported that the switch was disconnected and then later reconnected to their new cooling equipment. The timeline for reconnecting the switch was polarized, from within a week (n = 4) to a few months (n = 3), with no respondents experiencing anything in between.[11] Only three respondents noticed a lag in the time between the new equipment installation and the switch reconnection, meaning it is likely not a prevalent issue, but there is still room for improvement.

Like Xcel Energy, no peer utilities run their DR programs through their cooling programs, as energy efficiency and demand response operate independently within

[11] There were five respondents who were not sure.

the utilities. These utilities generally did not report major issues with the DR programs, however most could not speak to it because it is not under their jurisdiction.

Seven of the ten utilities interviewed have programs similar to Saver's Switch. One additional utility currently has a pilot program.

- Utilities A, B, and C run their programs using smart thermostats for controls.
- Utility G is currently running a pilot program that uses smart thermostats for controls.
- Utility E uses direct load control with a switch installed on the cooling equipment.
- Utilities D, F, and J were unable to provide details of their demand response programs.
- Utility H and Utility I have no programs similar to Saver's Switch.

Utility E has encountered the issue where switches were not reinstalled after equipment upgrades. This utility has separate contractors for the equipment and the switch, so they expect a lag between the time of the new equipment installation and the reconnection of the switch. The contractors communicate between themselves to get the new switch set up after equipment installation. Utility E also mentioned a specific issue where customers and contractors are blaming issues with their system on the switch but, when the technicians come out, they find it working properly. They have provided education with their customer service agents specifically to mitigate this.

Utility E also discussed a coordinated marketing campaign that promoted both cooling equipment rebates and the DR program. They sent marketing materials to all customers who installed new cooling equipment that congratulated them on their new air conditioner and informed them about the switch that could help them save even more. They also worked with the DR program to encourage customers to get a tune-up or new thermostat at the same time.

3.4 AWARENESS & BARRIERS TO PARTICIPATION

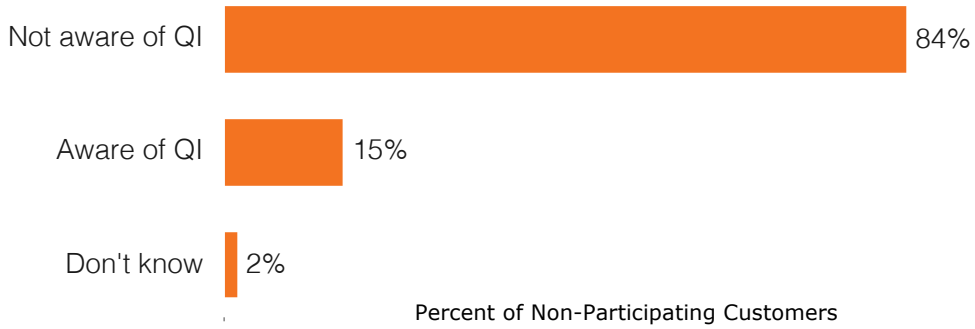
The participating customer survey, the non-participating customer survey, and the trade partner interviews were used to assess awareness of and barriers to participating in the Residential Cooling Product.

PARTICIPANT & NON-PARTICIPANT AWARENESS OF QI

The goal of the awareness section was to gauge the level of understanding of QI for participating customers and non-participating customers. The evaluation team encountered confusion across participating customers, non-participating customers, and trade partners, about what the term "Quality Installation" means.

The non-participating customers were asked if they had heard of enhanced installation products.[12] Only 15% of non-participating customer respondents had heard of QI; this is similar to the 18% of participating customers who were aware they received QI, as discussed in the Quality Installation Free-Ridership Results section. Conversely, 84% of non-participating customers and 73% of participating customers were not aware of QI. This suggests there is room to inform and educate customers about the benefits of a Quality Installation. There were no significant difference between strata; Figure 3-6 displays aggregated non-participating customer results.

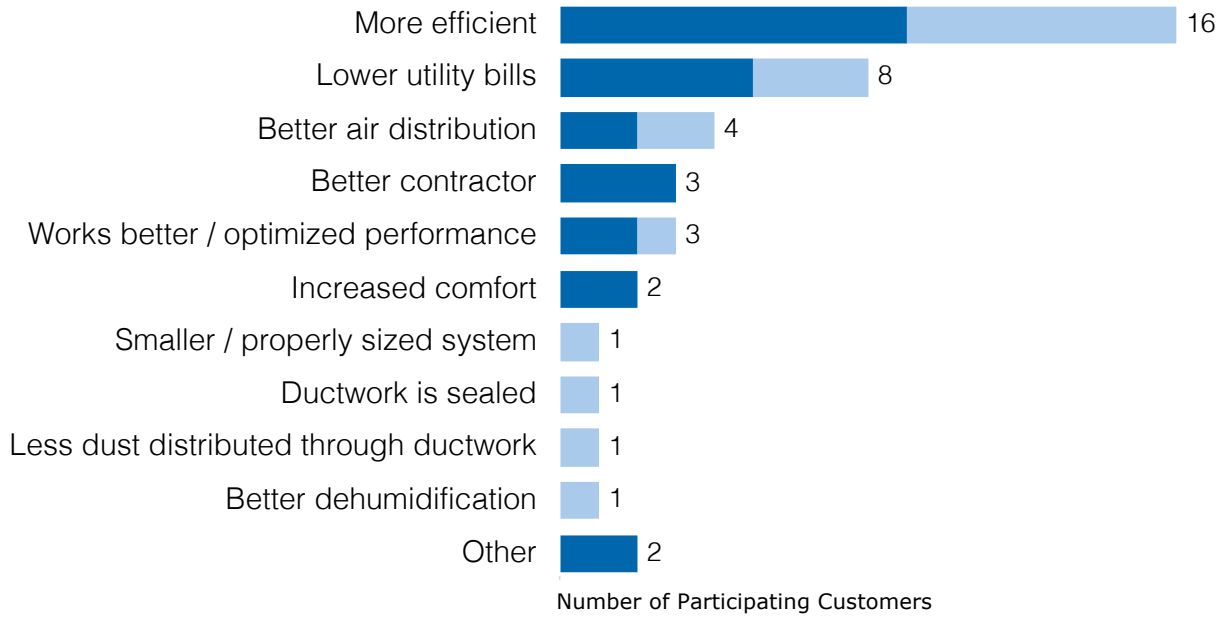
Figure 3-6. Non-Participating Customer Awareness of QI



On the other hand, the participating customers who *were* aware of QI were also aware of the benefits of the enhanced installation process. Most respondents who were aware that they received QI identified energy efficiency as a benefit of a QI, and some respondents were aware of some of the technical benefits of the process, as seen in Figure 3-7. There were no significant differences between strata.

[12] For exact question text please refer to Appendix B.3 for the non-participant survey instrument.

Figure 3-7. Benefits of QI Reported by Participating Customers



Both participating customers (85%) and non-participating customers (71%) who had heard of QI heard about it through their contractors. While no trade partners reported explicitly promoting QI, these results suggest that some trade partners are educating their customers about it. The interviewed trade partners who stated that they mention installation in their sales discussions reported that, rather than promoting Xcel Energy's requirements, they promote the high quality of their company's installation practices.

TRADE PARTNER AWARENESS OF QI

To understand trade partner awareness of Quality Installation, the evaluation team asked a series of questions:

1. To qualify for some of Xcel Energy's cooling rebates, an enhanced installation process, known as a "Quality Installation" is required. Are you familiar with this term?
    a. For those unfamiliar: A Quality Installation follows specifications documented in ACCA Standard 5 and is required to receive Xcel Energy rebates for central air conditioners and air source heat pumps.
2. How do you define Quality Installation?
3. Does your company offer both standard installation and Quality Installation?

Of the 19 trade partners interviewed, roughly half (n = 9) were aware of the term "Quality Installation." Trade Partners reported they are conducting QI, even though they do not recognize the term by name. After the requirements were explained, one contractor stated, "I've done those the last 10 years…I didn't know there was a real technical term for it."

In some cases, trade partners did not distinguish between the rebates for QI and rebates for equipment. With no prompting, 4 of the 19 trade partners interviewed brought up that they believed that QI rebates for 13 SEER CAC or 14 SEER ASHP incented minimum-efficiency equipment. Below are statements from trade partners that illustrate this finding:

> *"…it's not like we can offer them anything lower than [SEER] 13 anyways. So, it really doesn't make a whole lot of sense to even offer a rebate for a 13 just because you're really not giving them any more incentive to buy the upper end stuff."*
>
> *"Why incentivize something that you have to do as a minimum anyhow? [The higher efficiency equipment] is where you should incentivize it."*

The evaluation team investigated this finding further by looking at the application. We confirmed the application does not clearly show that the rebate for SEER 13 CAC's and SEER 14 ASHP's is solely for QI and not for the equipment (Figure 3-8).

Ten of eleven trade partners who were asked about how their installation practices compared to QI reported that they do not change installation practices in order to comply with the Xcel Energy product requirements. Trade partners did not specify whether they would conduct the same installation as required by ACCA Standard 5.

Figure 3-8. Xcel Energy 2020 Residential Cooling CAC/ASHP Product Application Form Rebate Table

cCe	SEER rating	EER	Rebate
Central AC	13	Any EER	$150
ASHP	14	Any EER	$150
Central AC/ASHP	15	12.5	$350
Central AC/ASHP	16	13	$450

PEER UTILITY QI PROGRAMS

None of the peer utilities have a QI program identical to Xcel Energy's product. Five utilities do not specify enhanced installation procedures at all, and Utility F removed their program in 2018, leaving four utilities who offer program components that are similar to the QI component of the Xcel Energy product.

- Utility G provides contractors a $135 incentive for optional enhanced installation. The installation includes checking refrigerant charge and a voltage check.

    - To incentivize the customers, they must have enhanced installation completed to qualify for a 0% interest loan to complete the project, if they do not want a loan, there is no alternative incentive.
    - This utility markets the enhanced installation to contractors as a tool for them to increase customer satisfaction. To qualify, the contractors have to attend a training (offered through a subcontractor) and pass four initial installation inspections.
    - This utility has recently developed a mini-split heat pump enhanced installation process that measures the volts and amperage to determine if it is working properly.
    - This utility has encountered issues with outside temperatures causing delays and frustration with testing timelines.
- Utility H provides an optional enhanced installation but no contractor incentive. The process is based on ACCA standards, and to ensure compliance Utility H inspects 10% of the installations.
- Two utilities require enhanced installation but do not incentivize it
    - Utility C has enhanced installation requirements as part of the trade partner agreement including proper sizing and Manual J. To ensure compliance, they conduct inspection of up to 10% of installations. They also have software that helps identify underperforming systems to monitor trade ally practices.
    - In the past, Utility J incentivized enhanced installation, but they now require it without providing incentives. Trade allies are required to follow a manual written by Utility J, and Utility J inspects up to 5% of installations.

Utility F stopped offering a $75 customer incentive for QI in 2018. During evaluation of their program, the utility could not prove that (1) the QI was done correctly and that the equipment passed the tests, or that (2) the customers were specifically asking for the QI and were not free riders. In addition, Utility F reported that contractors were telling customers they were performing "quality installation" regardless if the installation met the QI program requirements. Utility F tried providing contractors with a $100 incentive to confirm equipment was working properly, but none of the contractors took the few minutes to perform the extra steps. Ultimately, the utility struggled to convince contractors to change the way they worked and performed poorly in Evaluation, Measurement & Verification (EM&V), which led to the final decision to cut the program.

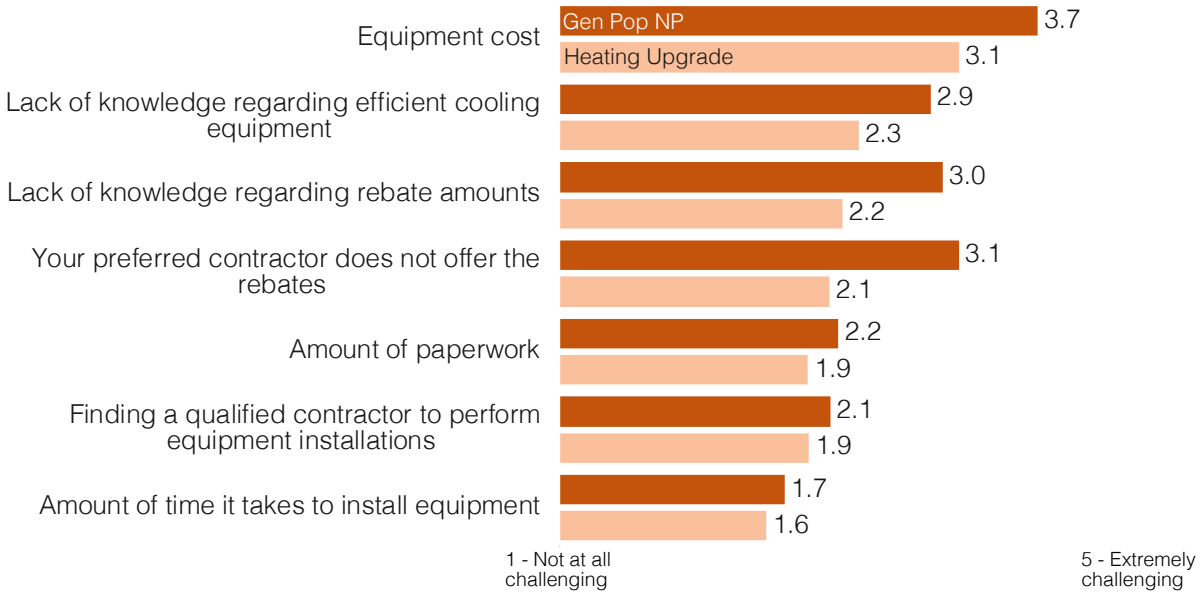
DECISION-MAKING & BARRIERS

When looking at decision-making and barriers to participating, the evaluation team surveyed non-participating customers from both the general population as well as those who had recently upgraded their heating equipment. Both groups were asked about the barriers they face to upgrading their cooling equipment and, overall, both stated cost was the biggest barrier.

Although there are no significant differences between the responses from the two groups, the strata made up of general population customers did perceive a somewhat greater challenge to participating in the Residential Cooling Product compared to those who had completed a recent heating upgrade, as seen in Figure 3-9. This was expected, as the recent heating upgrade strata had already participated in the Heating Efficiency Product, so they were more familiar with Xcel Energy products and likely had fewer barriers to program participation.

Cost was the largest challenge for both non-participating customer groups for installing energy-efficient cooling equipment, as seen in Figure 3-9. When asked why they did not upgrade their cooling equipment, respondents explained cost challenges in detail, first mentioning upfront sticker price of the equipment, and second, discussing the value of the equipment to them (e.g., the short cooling season in Minnesota made the equipment seem less necessary to upgrade compared to heating equipment). Trade partners and peer utilities from cold climates reflected this sentiment regarding the shorter cooling season in their interviews as well. One trade partner remarked, "I barely believe in a high-efficient air conditioner in our climate. It's about a 27-year payback." Other common challenges included lack of awareness of efficient equipment and rebate amounts.

Figure 3-9. Challenges for Participation in the Residential Cooling Product for Non-Participating Customers



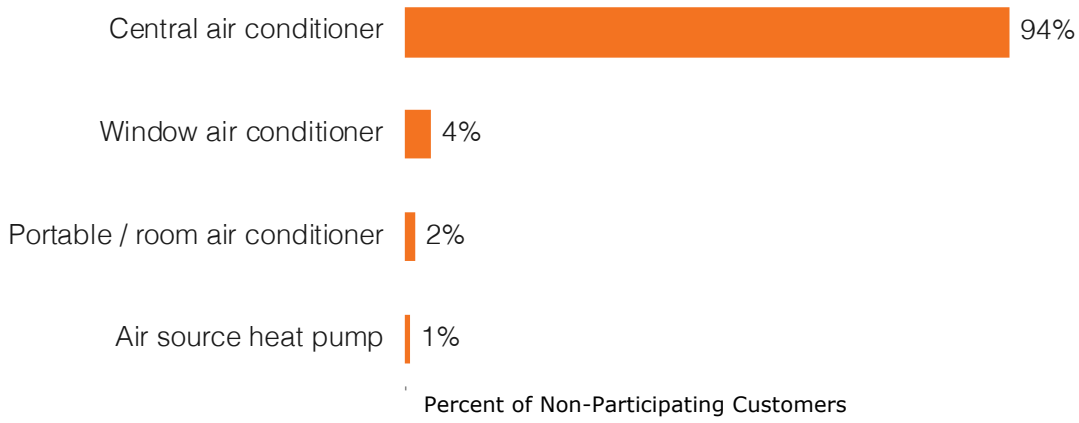
Note: "Gen Pop NP" = General Population of Non-Participating customer, defined as any Minnesota residential electric customer who has no record of participating in a residential cooling project in Xcel Energy's Salesforce system (i.e., since 2012). "Heating Upgrade" = Recent Heating Upgrade Participating customer, defined as any Minnesota residential electric customer who completed a furnace or ECM upgrade, but not a recorded cooling upgrade.

Of the non-participating customers surveyed from the general population who had a CAC or ASHP 10 years old or older in their home, 52% (n = 14) reported their current cooling equipment works fine and did not need replacing. Of those with a

recent heating upgrade, with an older CAC or ASHP, 61% (n = 23) had yet to replace their equipment because they perceived no need. Cost continued to be a prominent challenge for the non-participating customers, a sentiment that trade partners iterated. All surveyed non-participating customers (n = 7) said that cost was the main reason for not upgrading from a window or portable AC to a central air conditioner or heat pump.

Although the lack of use delays upgrades, 97% of non-participant respondents (n = 123) said that they use some type of air conditioning equipment when the weather is hot. Of those who use air conditioning equipment, customers most commonly use a central air conditioner (94%), displayed below in Figure 3-10. There were no significant differences between strata; the table below displays aggregated participant results.

Figure 3-10. Non-Participating Customer Air Conditioning Equipment Use

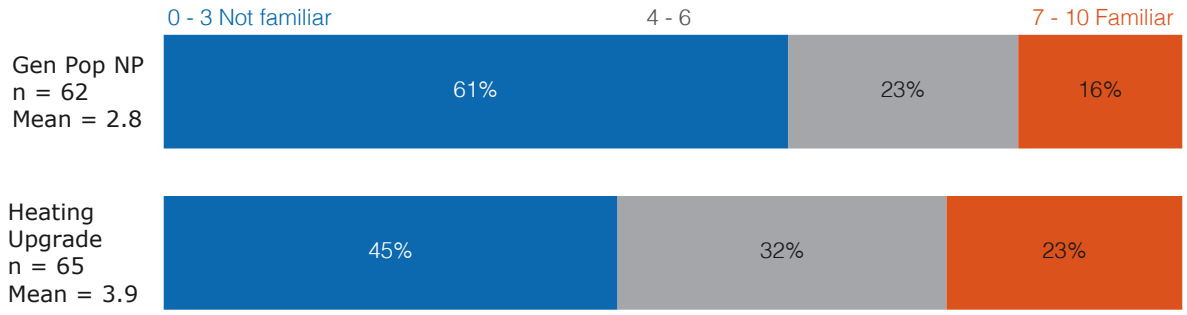


Note: Figure shows type of cooling equipment used among the 97% of non-participating customers who indicated they use air conditioning equipment when the weather is hot.

Just over half (54%) of non-participating customers who use cooling equipment installed that equipment more than 10 years ago, indicating a substantial amount of older equipment that could be targeted for upgrades. Furthermore, 44% (n = 29) of this group have considered upgrading their equipment to be more energy efficient.

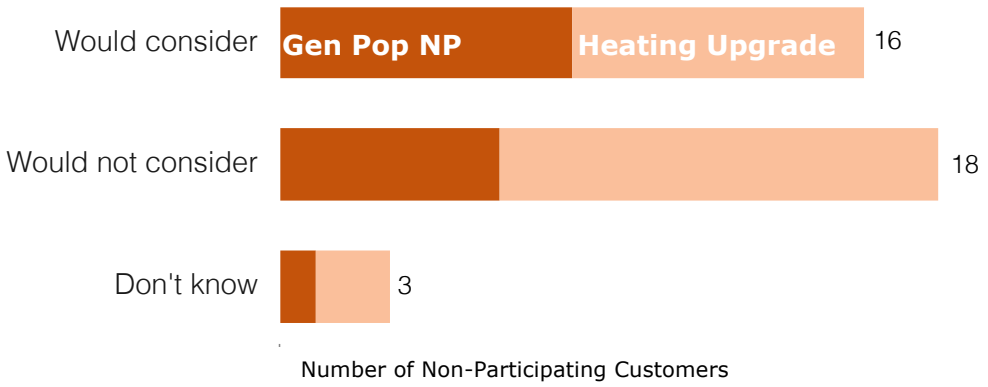
Despite this potential for equipment upgrades, there is a lack of knowledge prevalent among the non-participating customers. With only 16% reporting they were familiar with Residential Cooling Product rebates (Figure 3-11), there appears to be ample opportunity to increase awareness of the product.

Figure 3-11. Non-Participating Customer Awareness of Cooling Rebates



Sixteen of the respondents who had not considered upgrading their equipment to be more energy efficient would consider upgrading their cooling equipment in the next year if they knew that a rebate for higher efficiency equipment and optimized installation would be available, as seen in Figure 3-12.

Figure 3-12. Non-Participating Customers Willingness to Consider Upgrade with Rebate



Overall there are significant barriers to upgrading cooling equipment in Minnesota homes. The most challenging barriers to overcome were cost and lack of knowledge regarding rebates and equipment. However, there are opportunities for upgrades of older units, and non-participating customers reported willingness to consider upgrading if they knew about the rebates.

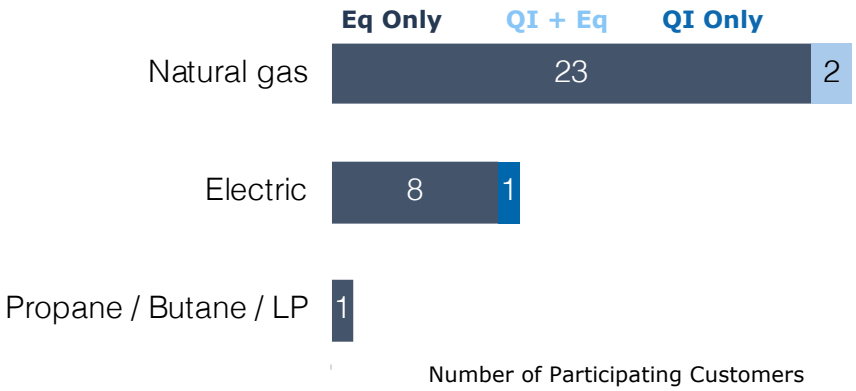
3.5 USE OF HEAT PUMPS

The participating customer survey included questions to confirm the use of heat pumps and what equipment was replaced. The evaluation team also assessed the proportion of non-participating customers with electric heating to better understand the potential for heat pump technology. What was found was that while electric heating is not the most prevalent heating energy source, there are customers who heat their home with electricity who would be good candidates for heat pumps. There are even some participating customers who installed heat pumps who had electric heat before their new equipment was installed. This suggests that, in

addition to cooling savings, the program may be able to claim a portion of heating savings for displacing other less efficient electric heating equipment without the risk of promoting fuel-switching.

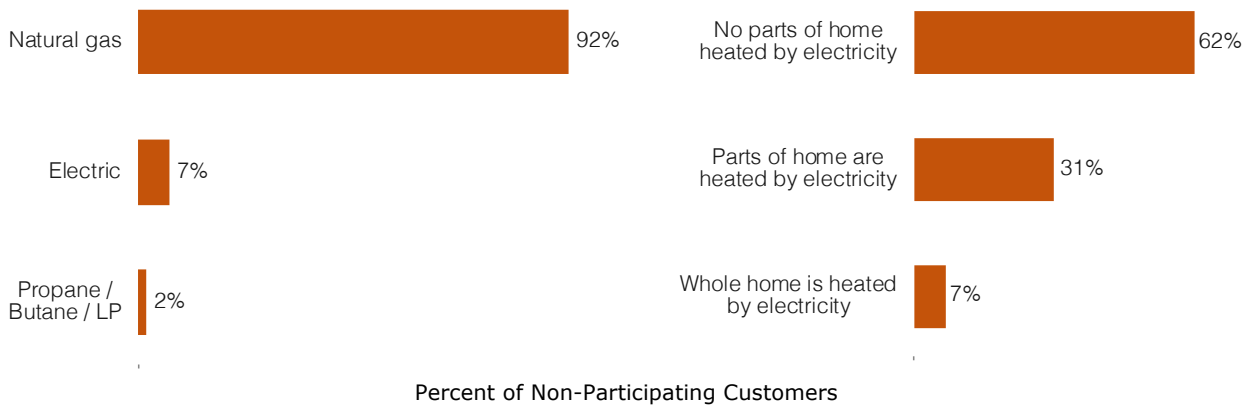
Before their heat pump was installed, most surveyed participating customers used natural gas as their primary heat source (Figure 3-13), however, 9 (26%) used electricity.

Figure 3-13. Heating Energy Source Prior to Heat Pump Installation Among Participating Customers



Only 7% (n = 4) of the surveyed general population of non-participating customers use electricity as their primary energy source for heating, as seen in the left graph in Figure 3-14. However, an additional 31% use electricity as a secondary heat source, indicating potential for mini-split heat pump systems to replace existing secondary heating systems, seen on the right in Figure 3-14.

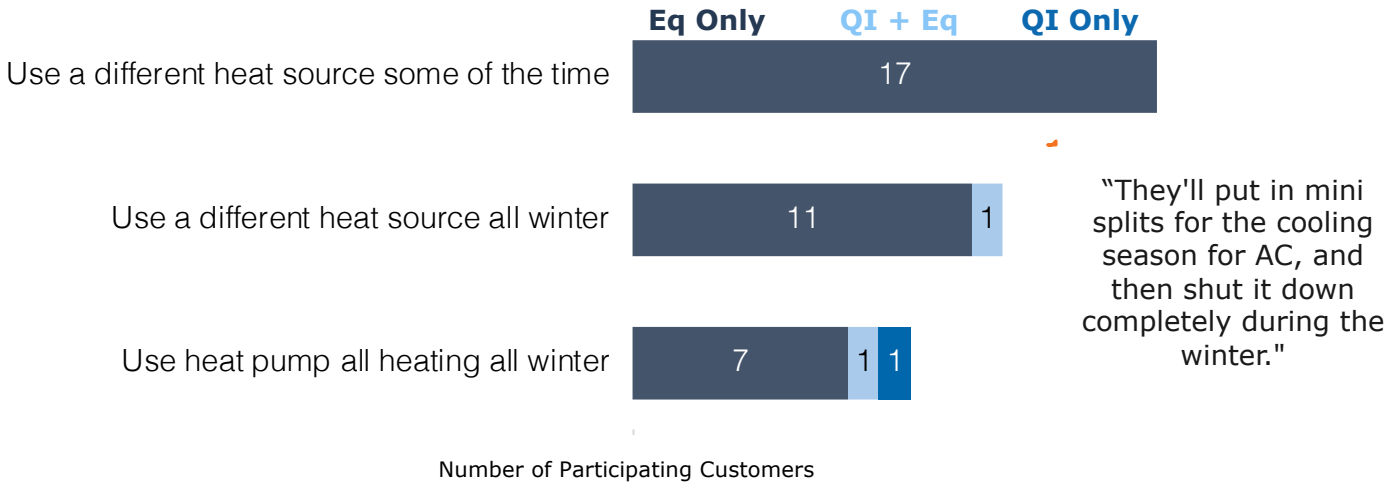
Figure 3-14. Primary Heating Source & Portion of Home Heated Among the Surveyed General Population Group of Non-Participating Customers



To get a better picture of the heat pump use, the evaluation team asked participating customers about their use during the winter, when it could be more

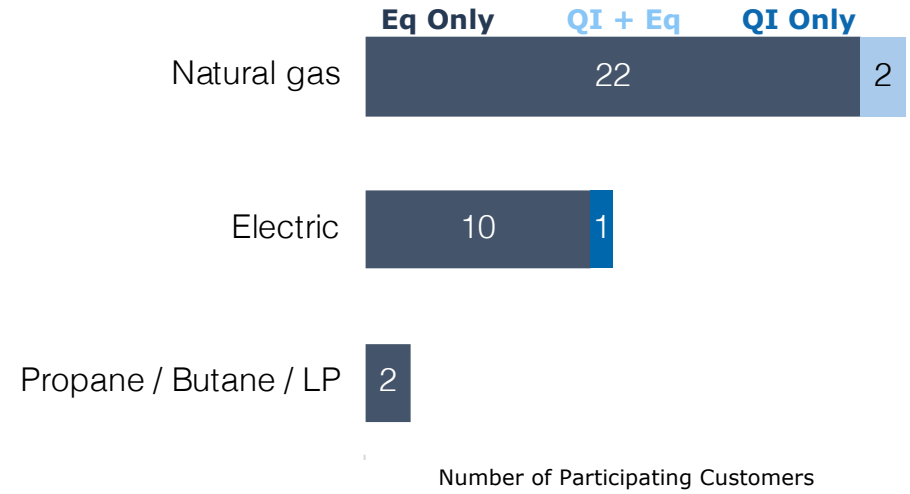
effective to use a different heat source. As shown in Figure 3-15, most respondents with heat pumps planned to use something else besides their heat pump for at least part of the winter, a sentiment repeated during the trade partner interviews.

Figure 3-15. Use of Heat Pump During the Winter for Participating Customers



Of the 29 participating customers who used something besides their heat pump to heat their home in the winter, most planned on using natural gas, as seen in Figure 3-16.

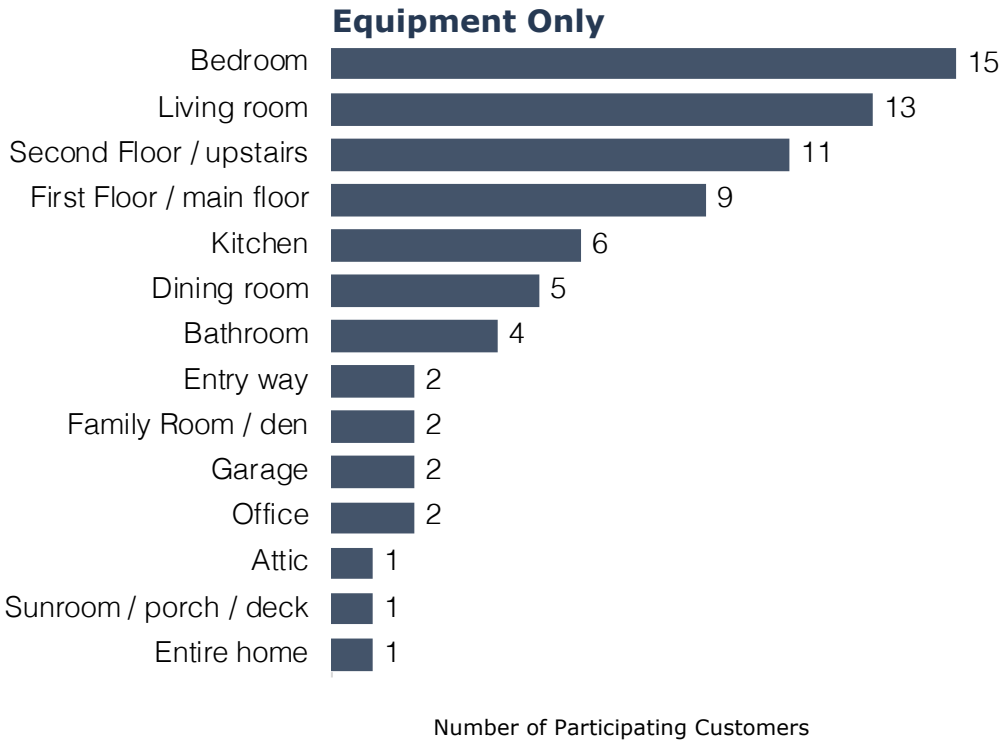
Figure 3-16. Additional Energy Sources During the Winter Among Participating Customers with Heat Pumps



For participating customers, mini-split heat pumps are most commonly used in bedrooms, living rooms, or whole floors of the home, as seen below in Figure 3-17. Among non-participating customers, secondary heat sources were most commonly

used to heat basements, followed by sunrooms, bedrooms, and living rooms, suggesting these room types are good opportunities for mini-split technology.

Figure 3-17. Mini-Split Heat Pump Use by Room for Participating Customers



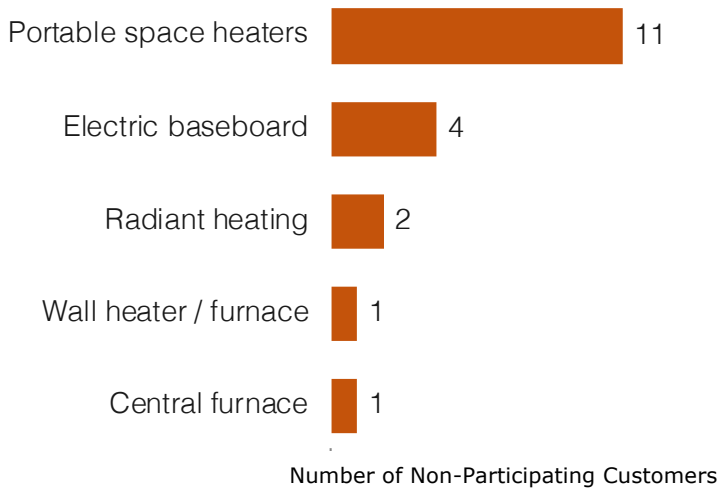
Note: This question was only asked of mini-split heat pump customers.

The trade allies also saw that it was uncommon to have a mini-split heat pump serve the entire home:

> *"You got your story and a half houses all over those areas and they're looking for a more efficient way to heat and cool their half story because a lot of them have a master bedroom up there… They don't want to tear apart their main floor to run a bunch of trunk lines up to get heat and cooling up there. They'd rather just go with a ductless."*

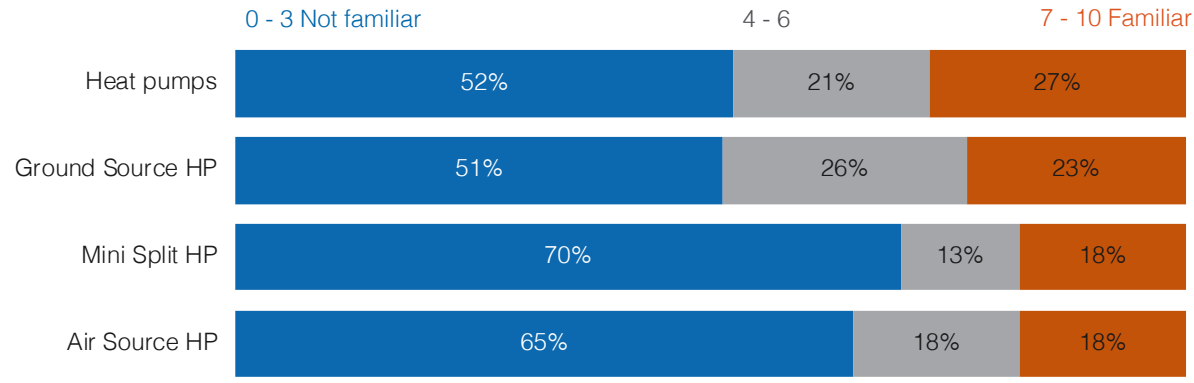
As shown in Figure 3-18, portable space heaters were the most common secondary heat source among the general population of non-participant respondents. The remaining respondents had some type of hard-wired electric heating source. Both portable space heaters and hard-wired heating sources could both be good candidates for mini-split heat pump technology.

Figure 3-18. Electric Heating Equipment Used in the General Population Group of Non-Participating Customers



The majority of the non-participating customer respondents were unfamiliar with heat pumps, as seen in Figure 3-19. There appears to be ample opportunity to increase awareness of heat pump technology among residential customers.

Figure 3-19. Non-Participating Customer Awareness of Heat Pump (HP) Technologies



Similar to Minnesota, most states in which the selected peer utilities operate have laws against incentivizing fuel switching. This is determined on a state-by-state basis, so some peer utilities can incentivize it. The ones unable to incentivize fuel switching found this to be frustrating. Utility J, an electric utility, remedies this by working directly with the local gas utility to offer incentives for a dual-fuel program.

Utility G has developed a novel technique to claim heating and cooling savings for customers switching from propane or oil heaters to electric heat pumps. They worked with a heat pump manufacturer to create a custom system that will switch on a propane or oil fuel system when it is economical (below a certain temperature), but use the mini-split heat pump when it is not. Because of this system, they are able to incentivize electric heating and cooling equipment to

residences with a propane or oil system. Utility J is also implementing a version of this where they can incentivize packaged upgrades to both oil/propane and electric equipment at the same time with the addition of controls, although they did not create custom technology.

Most utilities use the federal standard as baseline for their heat pump rebates.

- Utility D uses SEER 15 for CACs and SEER 13 for heat pumps.
- Utility F uses 13 or 14 SEER for heat pumps depending on the state.
- Utility J refers to the federal minimum for heat pumps, but has different savings calculations for multi- and single-head heat pumps. They also have different calculations specific to a ductless heat pump in a bonus room.
- Utility B mentioned that they have different calculations based on replacing a working system and for early retirement.
- Utility G calculates heating and cooling savings if going from propane/oil to electric, but only cooling savings if going from natural gas to electric.

4. CONCLUSIONS & RECOMMENDATIONS

This chapter presents the research team's key findings and associated recommendations regarding the Xcel Energy Residential Cooling Product in Minnesota. All recommendations are based on key findings from our evaluation research and are designed to reflect the context of future product years, acknowledging expected changes in the market and planned product changes.

Overall, the evaluation team found that participating customers and trade partners in the Residential Cooling Product were generally satisfied with the program. There is corresponding evidence from this evaluation that the product has had a positive net impact on energy efficiency within the Xcel Energy Minnesota service area, and that changes to product processes may further increase this impact. There are opportunities to raise levels of awareness among customers and for heat pumps to provide electric heating savings. Specific findings and recommendations follow.

- **Key Finding 1: The product shows influence in the market, with a retrospective NTGR of 0.62.** Separated by product component, the NTGR for equipment is 0.71, while the NTGR for Quality Installation is 0.54. The product shows influence in the market, particularly the influence of trade partners' recommendations of energy efficient equipment to customers. However, customers lack awareness of Quality Installation, resulting in a retroactive NTGR of 0.62.
    - **Recommendation 1: If the product design remains the same, the evaluation team recommends using a prospective NTGR of 0.62. If Xcel Energy implements a number of actions, this could presumably result in a prospective NTGR of 0.80 or higher.** To significantly improve the influence of the program, the evaluation team recommends diluting free-riders by increasing awareness and understanding of QI. This may be achieved by clarifying program incentives, terminology, and requirements through improved product materials and verification, requiring training for trade partners, and adding a trade partner incentive for QI. Furthermore, marketing the program to customers will increase demand and program attribution.
- **Key Finding 2: Contractors report that they are conducting QI as part of their standard practice, while most customers do not know what QI is.** Awareness of QI is low for both participating customers (18%) and non-participating customers (15%), and many Trade Partners do not recognize the term "Quality Installation." Furthermore, the evaluation team was unable to document any influence of the program on QI practices.
    - **Recommendation 2a. Incorporate Quality Installation into the name of the measure and include a description of QI requirements within the table showing incentives on the application.** This would make QI part of the conversation trade partners have with customers.

- **Recommendation 2b. Provide further training to contractors regarding the term "Quality Installation."** Provide further information on the application and other materials about what Quality Installation entails. Determine what types of training manufacturers and distributors are offering (and what terms they are using), and distinguish Xcel Energy's offering accordingly. Use the same term consistently with contractors, customers, and on the application.
- **Recommendation 2c. Provide a separate incentive to contractors completing QI.** At least one other peer utility provides a separate contractor incentive, partially to cover costs of making a separate customer visit to test the equipment when temperatures are less than 55 degrees during installation.
- **Recommendation 2d. Require a small percentage of QIs to be verified.** Consider focusing on verifying the refrigerant charge and airflow, as another recent study in Minnesota found that these are responsible for most of the savings and contractors may not be routinely measuring total system airflow at the air handler.[13] Use verification as a training tool by reviewing results with contractors who are not passing the verification. Use existing protocols for M&V regarding a statistically valid sample with modifications as applicable to residential cooling applications. Rather than solely testing a random sample, some options to consider for adaptations to the QI verification include:
  - Contractor-specific protocols regarding thresholds for mandatory testing, such as:
    - new contractors,
    - contractors above a certain number of installations, and
    - contractors that had a previous inspection with unsatisfactory results.
  - If a project is chosen for verification, withhold the contractor incentive until the tests are passed.
- **Recommendation 2e. Require training for all participating trade partners reminding them of the QI process, its name, specific incentives, and how to market it to customers.** In those trainings, teach them how to talk to customers about the benefits of QI and the QI-specific incentives. Also emphasize the benefits of completing QI for contractors (e.g., potential increases in customer satisfaction).
- **Recommendation 2f. Educate consumers about QI to increase awareness and help drive demand.** If customers understand the link between QI and Xcel Energy rebates, assessing program

[13] *Improving Installation and Maintenance Practices for Minnesota Residential Furnaces, Air Conditioners and Heat Pumps* (September 20, 2016). Conservation Applied Research & Development (CARD) FINAL REPORT. Prepared for: Minnesota Department of Commerce, Division of Energy Resources. Prepared by: Seventhwave. Filing: COMM-201305222-72623.

attribution will be more straightforward. Consider marketing to consumers via the following channels:

- Bill inserts.
- Make customer-facing marketing materials available for contractors to have on-hand during their sales and installation visits with customers.
- Targeted marketing as mentioned in Recommendation 3.

- **Key Finding 3: Cost and lack of awareness present the greatest challenges to participation.** For non-participating customers, cost and lack of knowledge regarding equipment and rebates were the largest barriers to participation. Only 16% of the general population group of non-participating customers were aware of the Residential Cooling Product rebates. Awareness of heat pumps among non-participating customers was also low, at less than 30%. At the same time, 54% of non-participating customers who use cooling equipment installed that equipment more than 10 years ago, suggesting there is substantial opportunity to upgrade to more energy-efficient equipment.
  - **Recommendation 3. Target customers during critical decision-making moments.** Marketing at critical moments when upgrades are likely to take place will help ensure that Xcel Energy rebates are "top-of-mind" so that when the purchase decision happens, the information is readily accessible. For example, Xcel Energy could target customers with new accounts who have purchased an existing home that may need upgrades. Xcel Energy could highlight the combined heating and cooling advantages of heat pumps along with the rebates. Targeted marketing could include:
    - Rebate information in USPS mailers that are sent out when customers submit a change of address. This is one way to identify customers who have recently moved.
    - Targeted online marketing for customers who search for equipment or trade partners.
    - Targeted marketing to customers who recently moved into older homes specifically.
    - When known, target customers who have installed a heating system and are served by Xcel Energy for electricity.
- **Key Finding 4: There appear to be opportunities for marketing the Residential Cooling Product rebates alongside related programs.** Of surveyed participating customers, 61% reported they had installed a thermostat along with their cooling equipment; of these, 26% reported that they installed smart thermostats. Almost half (47%) of surveyed participating customers also participate in Saver's Switch, Xcel Energy's DR program for air conditioning. There may also be opportunities for combining the heating and cooling programs; of non-participating customers who had made a recent heating upgrade, 61% had yet to replace their cooling equipment because they perceived no need, even though they had an older

CAC or ASHP. Many peer utilities offer cooling and heating rebates under one program.

  - **Recommendation 4a. Market smart thermostats and DR along with the Residential Cooling Product rebates.** This could help increase uptake of these related products.
  - **Recommendation 4b. Combine the Residential Cooling and Heating products so these programs are one seamless experience for customers and contractors.** This would allow Xcel Energy to help customers understand the value of replacing heating and cooling systems together. It would also help capitalize on the combined heating and cooling capabilities of heat pumps (see Key Finding 5).

- **Key Finding 5: There are opportunities to claim heating savings for heat pumps displacing other electric heat sources.** Although only 7% of the non-participating customers surveyed use electricity as their primary heat source, an additional 31% use electricity as a secondary heat source in a variety of room types (most commonly basements, sunrooms, bedrooms, and living rooms). Among participants who installed mini-split heat pumps, about 1/4 replaced electric heating, and 2/3 of mini-splits are used for at least a portion of the winter.
  - **Recommendation 5a. Promote mini-split heat pumps to customers who are currently using electricity as a secondary heat source.** Savings could be claimed not just for the cooling season but also for a portion of the heating season.
  - **Recommendation 5b. Work with third-party research organizations to conduct more detailed research to determine heating hours of use for heat pumps to better understand potential energy savings.** Additional research will help determine what portion of the heating season customers are using heat pumps versus other electric heat sources.
- **Key Finding 6: While the program passes cost-effectiveness tests, staff would like to see it pass by a wider margin.** The highest efficiency equipment in particular has high incremental costs that pose challenges for cost-effectiveness. The program will experience increased challenges to meet cost-effectiveness in the next plan cycle due to a reduction in avoided revenue requirements.
  - **Recommendation 6. Explore the value of non-energy benefits (NEBs) to reduce incremental costs.** Once the value of NEBs is estimated, then that portion of the incremental costs associated with higher efficiency equipment can be either excluded from both the costs and benefits or included in both the costs and benefits when calculating cost-effectiveness. The National Standard Practice Manual and recent Minnesota-specific research regarding cost-effectiveness tests should be referenced when determining how these benefits should be treated in any benefit-cost testing.