

# Energy Efficiency Programs Evaluation

## Final Report

December 21, 2017



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## Executive Summary

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The Platte River Power Authority (Platte River), working with Fort Collins Utilities (Utilities), tasked Research Into Action and its partners, Apex Analytics and Mesa Point Energy, with evaluating their residential and commercial energy efficiency programs. The evaluation focused on the programs Platte River and Utilities identified as high-priority for 2017 research in initial discussions. These programs include:

- › The components of the Efficiency Works Homes program (audit, direct install, rebates)
- › Midstream lighting
- › The components of the Efficiency Works Business program (audits, rebates, and Building Tune-Up).

Platte River administers the evaluated programs in all four of its owner municipalities: Estes Park, Fort Collins, Longmont, and Loveland. This study aggregates data from the four cities to present findings for Platte River as a whole. Because the study was conducted in partnership with Fort Collins Utilities, the body of the report presents findings for the City of Fort Collins alone, as well as aggregate findings for the four Platte River cities, including Fort Collins.

The evaluation focused on program years 2014, 2015 and 2016. Over the three-year period, the evaluated programs, combined, accounted for 100% of Platte River's reported gross electric savings and 98% of program spending (including both incentives and administrative costs).

Below, we present key findings from the impact and process evaluations, along with conclusions and recommendations, organized by program.

### Programs Evaluated

A brief description of each evaluated program is below, the body of the report presents detailed evaluation findings for each program, and each program-focused chapter begins with a more detailed description.

- › **Efficiency Works Business** seeks to increase energy efficiency in commercial buildings. The program incorporates three elements: ASHRAE Level 1 audits to help customers identify energy efficiency opportunities, incentives to reduce the cost of efficient equipment or improvements, and retro-commissioning through the Building Tune-Up offering.
- › **Efficiency Works Homes** focuses on household energy savings while also supporting improved indoor air quality. The program provides home efficiency audits to identify and prioritize energy efficiency improvements, in which the auditor may also install lighting products and small domestic hot water devices (showerheads and aerators).<sup>1</sup> The program offers rebates for 23

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<sup>1</sup> Prior to 2017, all participants in Efficiency Works for Homes were required to have a home efficiency audit. In 2017, the program dropped this requirement for participants interested in replacing HVAC equipment only.

individual home improvements involving the building envelope and mechanical systems. In 2015, the program began experimenting with a streamline delivery path, designed to simplify the decision-making and upgrade process for participants using standardized pricing and grouping measures into packages.

- › **Midstream Retail Lighting** works with lighting retailers and manufacturers to increase consumer adoption of efficient lighting by offering general advertising, in-store signage, sales associate training, and instant customer incentives through price markdowns on qualified lighting products.

## Evaluation Objectives

Platte River Power Authority, in partnership with Fort Collins Utilities, conducted this evaluation to independently verify program outcomes and identify opportunities for program improvement. To this end, the process and impact evaluations addressed certain common research questions for all programs. Table ES-1 lists these questions.

**Table ES-1: Research Objectives to Be Addressed Across Programs**

Evaluation Type	Common Research Questions
Impact	<ul style="list-style-type: none"> <li>• How much savings (kWh, kW, therms, water, etc.) has the program generated (gross savings)? How much of those savings are attributable to the program (net savings)?</li> <li>• How do the program's costs compare to its savings? Provide the information to report cost effectiveness from various perspectives and the relative impact of each program on the portfolio cost effectiveness.</li> <li>• What assumptions and methods does the program use to estimate energy savings, and how could they be improved to increase the accuracy of those estimates?</li> </ul>
Process	<ul style="list-style-type: none"> <li>• What value, including non-energy benefits, do customers find in the program? How satisfied are customers with the program? Does participation influence customer satisfaction with Fort Collins Utilities or other Platte River Power Authority utility clients?</li> <li>• What motivates customers and/or trade allies to participate in the program?</li> <li>• What barriers prevent additional customers and/or trade allies from participating in the program?</li> <li>• What opportunities exist to streamline program processes (both internal and customer-facing)?</li> </ul>

In addition to these common research questions, through conversations with Platte River and Utilities staff, the evaluation team identified a variety of specific research questions that expanded on these topics and tailored them to the needs of the individual programs. These detailed research objectives are listed in Section 1.2 and in the chapters presenting detailed, program-level findings in the body of the report.



## Research Approach

Six key evaluation activities inform the findings presented in this report:

- › **Surveys:** The evaluation team surveyed:
  - 272 residents of the Platte River owner municipalities that participated in Efficiency Works Homes (a 20% response rate)
  - 90 businesses and organizations in the Platte River owner municipalities that participated in the Efficiency Works Business program (a 14% response rate)
  - 953 residents of the Platte River owner municipalities that had not recently participated in Efficiency Works Homes (a 9% response rate)
- › **In-depth interviews:** The evaluation team conducted in-depth interviews with 28 market actors involved in delivery of the evaluated programs, including auditors, installation contractors, lighting retailers, and lighting manufacturers.
- › **Database review:** For each evaluated program, the evaluation team reviewed program tracking data to ensure the program was tracking the fields necessary to evaluate energy savings and to identify inconsistent or missing data.
- › **Project file review:** For a representative sample of projects, the evaluation team reviewed supplemental information to the program tracking data to assess the savings calculations.
- › **Engineering review:** The evaluation team reviewed the engineering calculations and assumptions used to estimate energy savings for each of the evaluated programs and identify opportunities to bring assumptions in-line with industry best practice.
- › **Site visits:** The evaluation team visited 20 of the sampled project sites to confirm that measures had been installed as described in the program tracking database and project documentation.

Both in selecting projects for detailed evaluation review and in conducting surveys with program participants and non-participants, the evaluation team drew sufficient samples to provide estimates at 90% confidence with 10% precision across the four Platte River owner municipalities.

## Definitions

This report uses the following terms:

- › **Ex ante gross savings:** Savings values reported by the program implementer, calculated using engineering or deemed methods (on a measure, project, or program level). Values reflect all installations through the program, without consideration of program influence.
- › **Ex post gross savings:** The gross savings values calculated by the evaluator based on evaluation findings, also called verified savings.
- › **Ex ante net savings:** Savings values reported by the program implementer, adjusted to consider the influence of the program on the installation (program attribution).

- › Ex post net savings: Verified gross savings adjusted to account for program attribution.
- › Realization rate: The ratio of ex post savings to ex ante savings ( $RR = \text{Ex Post} / \text{Ex Ante}$ ). Typically calculated on gross savings values, but can also be calculated from net savings. A realization rate greater than one indicates verified savings were greater than reported savings, while a value lower than one indicates verified savings were less than reported.
- › Net-to-gross: The net to gross ratio is the adjustment made to gross savings to account for program attribution. Two components, free ridership and spillover, determine the net to gross ratio, which is calculated as  $NTG = 1 - \text{Free Ridership} + \text{Spillover}$ .<sup>2</sup>
  - Free ridership represents projects that would have occurred without change in the absence of the program.
  - Spillover represents energy saving actions or measure installations influenced by the program that do not receive direct program incentives.

## Results

This section summarizes findings from the impact and process evaluations. It begins with findings on program impacts at the portfolio and program levels, followed by key findings and conclusions and recommendations specific to each program, drawing on both impact and process evaluation activities.

## Impact Evaluation

The verified annual electric kWh savings for the combined 2014-2016 program years were higher than the reported results for the portfolio. The verified residential portfolio returned 118% and commercial returned 103% of the gross reported annual electric savings. The three-year total annual electric kWh savings for the portfolio was over 65 million kWh, with the evaluated residential program impacts representing 17 percent and commercial 83 percent of the verified gross kWh savings. The sector and overall portfolio ex ante claimed and ex post verified gross savings are shown in Table ES-2 below.

**Table ES-2: Platte River 2014-2016 Gross Impacts**

	Ex Ante Gross kWh savings	Ex Post Gross kWh savings	Gross kWh realization rate
Residential Portfolio	9,274,522	10,939,151	118%
Commercial Portfolio	53,189,153	54,537,080	103%
<b>Overall Portfolio</b>	<b>62,463,675</b>	<b>65,476,231</b>	<b>105%</b>

<sup>2</sup> A third component, market effects, is included in some net to gross calculations to account for changes in the marketplace for energy efficient devices resulting from the programs. Estimating market effects can be complex and resource-intensive, and this evaluation uses only free ridership and spillover in determining net savings values.

The net impact evaluation also returned verified realization rates that were higher than reported ex ante net annual electric energy savings. The verified annual electric kWh net savings across 2014-2016 program years were higher than reported results for the portfolio, with realization rates of 120% for the residential and 110% for the commercial portfolio. The three-year total annual electric kWh net savings for the portfolio was over 55 million kWh, with the evaluated residential program impacts representing 15% and commercial 85% of the verified net kWh savings. The sector and overall portfolio ex ante claimed and ex post verified net savings are shown in Table ES-3 below.

**Table ES-3: Platte River 2014-2016 Net Impacts**

	Ex Ante Net kWh savings	Ex Post Net kWh savings	Net kWh realization rate
Residential Portfolio	6,839,302	8,175,324	120%
Commercial Portfolio	42,694,860	47,116,568	110%
<b>Overall Portfolio Programs</b>	<b>49,534,162</b>	<b>55,291,892</b>	<b>112%</b>

The evaluation team estimated the cost-effectiveness of the 2014-2016 programs using the leading cost effectiveness modeling tool, Integral Analytics “DSMore.” The focus of the cost-effectiveness testing was based on following three different cost-effectiveness perspectives, or tests (as defined by the California Standard Practice Manual):

- › Utility Cost Test (UCT)
- › Modified Total Resource Cost (TRC) test
- › Participant Cost Test (PCT)

A more detailed discussion of these tests and the cost-effectiveness analysis is included in Appendix A. The 2014-2016 residential programs portfolio was only cost effective (with benefits exceeding costs, or test ratio greater than or equal to 1.0) based on the participant cost test (PCT). The residential evaluated findings resulted in Utility Cost Test (UCT), Total Resource Cost (TRC), and Participant Cost Test (PCT) cost-effective ratios of 0.60, 0.47, and 2.08, respectively (Table ES-4). The 2014-2016 commercial programs portfolio were cost effective across all three perspectives. The evaluated commercial findings resulted in UCT, TRC, and PCT cost-effective ratios of 1.21, 1.49, and 5.36, respectively. Though it is complicated to compare cost effectiveness results across program administrators (due to different avoided cost assumptions, and accounting for and inclusion of both non-energy costs and benefits), the cost-effectiveness of the Platte River programs are lower than other jurisdictions the evaluation team has reviewed, primarily driven by the low avoided costs of \$32/MWH.

**Table ES-4: Platte River 2014-2016 Portfolio Cost-Effectiveness Results**

	UCT	TRC	PCT
Residential Portfolio	0.60	0.47	2.08
Commercial Portfolio	1.21	1.49	5.36
<b>Overall Portfolio Programs</b>	<b>1.06</b>	<b>1.12</b>	<b>4.16</b>

A review of the more granular program-level results shows that while the portfolio realization rates were close to the originally claimed (ex ante) values, individual program performance varied. The gross annual electric verified realization rates ranged from 93% for the Efficiency Works Homes Program to 121% for the Midstream Lighting Program. The Commercial Rebates component of the Efficiency Works Business program showed consistent verified savings, which was the primary driver of the 103% commercial gross realization rates, since it accounted for 97% of the Efficiency Works Business Program savings.

**Table ES-5: Platte River Program-Level 2014-2016 Gross kWh Impacts**

	Ex Ante Gross kWh savings	Ex Post Gross kWh savings	Gross kWh realization rate
Midstream Lighting	8,157,437	9,901,503	121%
Efficiency Works Homes	1,117,085	1,037,648	93%
Efficiency Works Business Rebates	50,810,668	52,316,731	103%
Efficiency Works Business BTU	2,378,485	2,220,349	93%
<b>Overall Portfolio Gross Savings</b>	<b>62,463,675</b>	<b>65,476,231</b>	<b>105%</b>

**Table ES-6: Platte River Program-Level 2014-2016 Net kWh Impacts**

	Ex Ante kWh savings	Ex Post kWh savings	kWh realization rate
Midstream Lighting	5,465,483	6,634,007	121%
Efficiency Works Homes	1,373,819	1,541,317	112%
Efficiency Works Business Rebates	40,839,641	45,149,339	111%
Efficiency Works Business BTU	1,855,218	1,967,229	106%
<b>Overall Portfolio Gross Savings</b>	<b>49,534,162</b>	<b>55,291,892</b>	<b>112%</b>

A review of the cost effectiveness at the program-level shows a greater divergence between programs than was the case for savings impacts. This is attributable to the inclusion of delivery and incentive costs and how cost-effectiveness is calculated. The Midstream Lighting program, which represented the majority (81%) of residential net electric kWh savings, did not have sufficient impact on the cost effectiveness of the residential portfolio to make the portfolio cost effective from the UCT and TRC

perspective. The Efficiency Works Homes program, which represented 19% of net verified annual electric savings, received the lowest cost effectiveness score among residential programs. The 2014-2016 Rebate component of the Efficiency Works Business Program was highly cost-effective, while the BTU component of the Efficiency Works Business was the lowest performing program of the portfolio. This likely reflects the higher cost of delivering these complex and customized projects. In total, the commercial portfolio generated just over \$2.5 million dollars in net UCT lifetime benefits less costs. Portfolio-wide, the 2014-2016 programs generated slightly under \$2 million in TRC benefits.

**Table ES-7: Summary of 2014-2016 Program Level Cost-Effectiveness**

	UCT	TRC	PCT
Midstream Lighting	2.43	1.01	3.52
Efficiency Works Homes	0.20	0.25	1.12
Commercial Rebates	1.26	1.58	5.75
Commercial BTU	0.22	0.18	0.89
<b>Overall Portfolio Programs</b>	<b>1.06</b>	<b>1.12</b>	<b>4.16</b>

## Program Highlights and Recommendations

This section presents specific findings from the impact and process evaluations of each program.

### Efficiency Works Business

The Efficiency Works Business program seeks to increase energy efficiency in existing commercial buildings. Customer engagement in the Efficiency Works Business program is heavily driven by a trade ally network, where many local trade allies build their business models around the incentive program offered through Efficiency Works.

### Key Findings

- › **Overall, program savings as reported by the implementer are reliable and accurate, resulting in realization rates generally at or above one.** Interactions throughout the evaluation process indicate that program staff are dedicated and work hard to help ensure the program meets best practices.
- › **The program largely calculates reported savings values accurately in accordance with industry norms. For some projects, documentation of savings could be stronger.** In some cases, documentation and verification activities, especially for larger projects, more complex projects, custom projects, or measures with less certain savings, did not provide sufficient certainty that installation and operation occurred as anticipated. Program staff reported they have recently taken, and plan additional, steps to increase the consistency of documentation in the future.

- › **Program savings algorithms and deemed savings values are generally within industry norms, but could be better organized and archived in one location to ensure proper savings calculations are being used.**
- › **Evaluation findings validate the program's assumed net-to-gross ratio.** The evaluation estimated a NTG ratio for Efficiency Works Business rebates of 0.863, an estimate very close to the value of 0.856 the program had used previously. This net-to-gross ratio reflects a free ridership rate of 26% based on participant survey data and an assumed spillover value of 12.7%, based on an in-depth analysis of commercial rebate program spillover the evaluation team conducted in another jurisdiction.
- › **Efficiency Works Business is largely trade ally driven.** The most common way participants found their contractor for the Efficiency Works project is through an existing relationship. At the same time, contractors reported most of their jobs come to them through prior customers or customer referrals. Those contractors who perform marketing (5 of 8) use energy efficiency as a primary message.
- › **A minority of participating businesses received an audit through the program.** Program documentation indicates 24% of participating businesses received an audit and contractors reported that even fewer of their rebated projects have had audits. Those participants that do receive audits are motivated to learn how they can save on their energy bills, reduce energy waste, corroborate what a contractor promised, or help the environment.
- › **The program has been influential in accelerating energy conservation among participating businesses.** Sixty-four percent of surveyed businesses reported purchasing and installing additional energy efficient equipment because of their experience with Efficiency Works. Almost two-thirds of those businesses (62%) rated their experience with Efficiency Works as very or extremely important on their decision to buy and install the additional energy efficiency items. Of the businesses that installed additional upgrades, roughly half applied for rebates.

### *Conclusions and Recommendations*

**Conclusion 1:** Platte River is currently working to improve project file management, an effort that evaluation findings suggest will be beneficial in ensuring that the program's project files and data tracking systems are complete and uniform. In particular, the program administrators are currently working to provide complete project file management, including centrally tracking data on assessments and more consistently documenting QA inspections of completed projects.

**Recommendation 1:** Continue efforts to increase the detail and consistency of information tracked in the program database and collected in project files, including assessment and QA inspection data. Enhanced documentation and verification activities are particularly important for custom projects or other projects for which reliable savings values are not easily estimated.

**Recommendation 2:** Improve tracking and documentation of deemed savings values and sources of savings assumptions, regularly update this documentation as deemed values change and new technologies and offerings enter the program.

**Conclusion 2:** The program has not been capturing interactive energy savings for projects that impact the temperature in conditioned space, reducing the need for air conditioning or increasing the need for heating, and thus may not be claiming all of the energy savings resulting from Efficiency Works projects.

**Recommendation 3:** Include interactive savings resulting from reduced need for air conditioning or increased need for heating in estimates of energy savings for projects that reduce the use of energy in air conditioned spaces.

**Conclusion 3:** Larger building rehabilitation and remodeling projects may present an opportunity for energy efficiency improvements that Efficiency Works for Business is not currently taking advantage of.

**Recommendation 3:** Identify and engage with contractors and other actors involved in planning and conducting remodeling projects in commercial buildings. Based on discussion with these market actors, Efficiency Works staff should consider how, if at all, they might modify the program to more effectively leverage existing remodeling projects.

### Building Tune-Up

The Building Tune-Up (BTU) component of the Efficiency Works Business program provides retro-commissioning services through program-qualified Retro-commissioning Service Providers (RSPs). Retro-commissioning seeks to assist with equipment and system functionality and optimize integrated operation to reduce energy waste and improve building performance and occupant comfort. This program provides customers with expert building analysis and prescriptive services at a discount to help lower customers' energy and water costs. The BTU program utilizes the facility assessment component of Efficiency Works as a marketing and outreach channel for capturing customers; essentially a screening process to find invested and dedicated businesses. Additionally, the RSPs frequently bring projects into the program.

The BTU evaluation focused on verifying program savings and assumptions, as well as identifying opportunities to streamline program processes and overcome barriers to greater participation.

### Key Findings

- › **Building operators at the visited sites had a very positive view of the program and the assistance they received.** Interviewed participants expressed similarly high levels of satisfaction with all elements of the program, including finding a contractor, the presentation of findings, retro-commissioning outcomes, and cost-sharing requirements.
- › **The evaluation noted incomplete documentation, uncertainties in project details, or inconsistencies between analysis results and reported savings.**
- › **Some of the sites did not implement or maintain all of the measures, and this was the primary driver of a realization rate lower than one.**
- › **The BTU program is complex, and this complexity may contribute to the BTU program's greater costs per unit of saved energy than the rebate component of Efficiency Works Business.**

- › **A lack of understanding of the value of retro-commissioning among business owners may prevent greater uptake of BTU.** This was according to participants, auditors, and retro-commissioning service providers.
- › **The level of documentation trade allies are required to provide to become an RSP and the low volume of retro-commissioning referrals through Building Tune-Up has frustrated some trade allies.**

### *Conclusions and Recommendations*

**Conclusion 1:** The files for some BTU projects were not complete and providers used calculation tools and methodologies inconsistently.

**Recommendation 1:** Program staff should strive to provide consistent and clearly documented retro-commissioning measures and savings estimates.

**Conclusion 2:** A lack of awareness of the availability and benefits of retro-commissioning services are a barrier to greater uptake of BTU, but raising awareness will require a targeted approach.

**Recommendation 2:** Efficiency Works should investigate targeted approaches to raising awareness of retro-commissioning among those businesses with the greatest potential to benefit.

**Conclusion 3:** The BTU program includes some unnecessary complexity. Approaches and documentation have limited consistency across projects due to third-party control, and some analysis activities may not directly contribute to savings realization.

**Recommendation 3:** To reduce cost and increase cost effectiveness, program implementers should develop and implement program design changes to streamline the program administration, investigation, and implementation phases of the program.

**Conclusion 4:** There is a disconnect between RSP expectations upon entering the program and the actual volume of BTU projects available for RSPs.

**Recommendation 4:** Efficiency Works staff should review the role they expect RSPs to play in recruiting BTU projects, ensure that role is clearly communicated to RSPs and contractors considering becoming RSPs, and provide RSPs with resources to support their role.

**Recommendation 5:** Efficiency Works staff should consider whether there is sufficient potential in the retro-commissioning market to support the number of RSPs currently registered with the program.

### *Efficiency Works for Homes*

The Efficiency Works for Homes program, which Fort Collins Utilities has offered since 2010, seeks to increase the energy efficiency and increase the indoor air quality, comfort, and safety of existing homes.



### Key Findings

- › **The evaluation found a moderate level of free-ridership: 24% (64 of 268) of participants indicated they would have performed the home's retrofits in absence of the program.** Calculating the individual free-ridership and weighting across all participants by savings, leads to a 79% NTG ratio absent any spillover. This result was the same between audit-only direct install participants and that of prescriptive retrofit installations.
- › **Efficiency Works Homes participants indicated a strong degree of spillover:** 37% (98 of 268) participants indicated making additional efficient improvements to their homes outside of the program, and, of these 98 participants, 44% believed the program had an extremely or very strong influence on their decision, while another 31% believed the program had a somewhat important influence on their decision.
- › **The streamline path simplifies the decision-making process for participants, leading to greater uptake of measures, but contractors are dissatisfied with its current design.** Streamline path participants were more likely than standard path participants to be aware of available financing options and to report a clear understanding of next steps following the audit. At the same time, they were less likely to report that making the upgrades would require a great deal of effort. Contractors, however, expressed dissatisfaction with the administrative work required, the standardized pricing, and executing a scope of work they had not developed. None of the interviewed contractors wanted the number of streamline path projects they complete to increase.
- › **Difficulty accessing data increased the resources required to complete this evaluation and limited its ability to verify savings assumptions.** The process of extracting assessment files from the program's Salesforce database was resource intensive for the implementer, and extracting data from those files, in turn, was labor intensive for the evaluation team. The assessment files did not consistently and uniformly provide data on baseline conditions.

### Conclusions and Recommendations

**Conclusion 1:** The streamline path eases the upgrade process for participants, increasing the likelihood they will install rebated measures, but, to be sustainable, it must more effectively work with contractors.

**Recommendation 1:** Investigate ways to increase contractor involvement in developing streamline path scopes of work and provide greater flexibility in standardized pricing while maintaining the streamline path's participant benefits. Efficiency Works staff should investigate other program administrators' approaches and gather contractor feedback on any proposed changes to the program.

**Conclusion 2:** Improved data tracking and an updated billing analysis provide opportunities to more effectively capture the full range of energy savings benefits the program achieves.

**Recommendation 2:** Develop systems to capture assessment data in a more systematic way and store the data in a more readily accessible electronic format. Capturing data in a uniform, consistent way and storing them in a more easily-accessible, electronic database format would

allow future evaluation efforts to conduct a more detailed, granular review of savings and assumptions.

**Recommendation 3:** Conduct an updated billing analysis, including a review of spillover savings from audit-only participants.

### Midstream Retail Lighting

The Midstream Retail Lighting program provides point-of-purchase rebates for sales of energy efficient lighting products, including LED specialty and general service lamps and lighting controls, at national and local retailers. Advertising, in-store signage, sales-associate training, and instant customer incentives, ranging from \$1-\$3 for general service lamps, \$1-\$5 for specialty lamps, \$10 for occupancy sensors, and \$5 for dimmers, drive participation. To provide incentives, the Platte River Power Authority, in partnership with Fort Collins Utilities, also works with manufacturers to reduce the cost of the items by partially paying for them outright. Fort Collins Utilities launched the midstream retail lighting program in 2005, and in 2007 Platte River took over administration of the program and expanded it to all four owner municipalities.

### Key Findings

- › **As one might expect in a successful mid- and upstream program, market actors higher in the supply chain saw greater value from program incentives than those closer to the end user.** Manufacturers recommended reinstating the incentive for A-line bulbs or increasing the incentive for specialty LED bulbs, as well as transitioning outreach to harder-to-reach populations, such as those in rural areas. Retailers, in contrast, perceived that the program had a relatively minor effect on sales of efficient bulbs, although local managers partially attributed their efficient bulb sales to corporate-level support for the technology.
- › **Participant survey findings suggest the market continues to shift toward LED bulbs, as more respondents purchased LEDs than other bulb types and those who purchased LEDs bought more of them.** Respondents who purchased lighting products more frequently reported purchasing standard LED bulbs (52%) compared to other standard bulbs (31-36%), as well as specialty LED bulbs (32%) compared to other specialty bulbs (12-18%). Respondents also reported purchasing a greater number of LED bulbs than CFLs or incandescent/halogen bulbs.
- › **The evaluation found higher gross savings than assumed for the Midstream Lighting program.** This was largely due to the higher baseline wattages for EISA exempt bulbs, as well as slightly higher annual hours of use. Overall, the program applied conservative values for the per-unit efficient light bulb savings estimates, and relied on established secondary sources for their claimed savings.
- › **Given the lack of certainty with estimates for net-to-gross of midstream lighting programs, the evaluation team finds Platte River's ex ante net-to-gross ratio is appropriate, but recommends a decreasing ratio for 2017 and beyond to reflect rapid market adoption of LEDs.** A review of secondary sources and a national lighting database found that estimates from multiple studies coalesced around the program's currently assumed net-to-gross ratio of 66-69%. Although market actor interviews and customer surveys varied in their assessment of the influence of program incentives, they do not provide reason to question this estimate.

- › **Uncertainty remains in key areas of controls' savings assumptions that should be researched if savings for this measure become large in the future.** First, there is an opportunity to update the underlying participant assumptions of controls placement, bulbs being controlled, number of bulbs per house, and bulbs per room type. This would require Platte River to conduct a residential saturation study. Second, the percent savings referenced in the evaluation literature do not appear to be adequately researched with field studies to determine actual savings. Although we do not recommend that Platte River undertake this research, Platte River should recognize the inherent uncertainty in these estimates.

### *Conclusions and Recommendations*

**Conclusion 1:** Reflecting the volatility of the residential lighting market, market actors were divided on the continued need for program incentives to drive LED uptake, with manufacturers seeing them as necessary, retailers less so, and survey findings indicating a continuing shift toward LEDs. There are drawbacks to withdrawing incentives from the market too early as well as remaining in the market once it has transformed. In this type of volatile market, it can be beneficial for a program to target its interventions toward the market segments likely to be slowest to transform on their own.

**Recommendation 1:** Focus incentives and market intervention on retail channels that are most likely to serve hard-to-reach customers and closely monitor the market to consider reintroducing incentives for A-line LEDs.

**Conclusion 2:** Gathering additional product details from participating retailers would allow for more accurate savings estimates.

**Recommendation 2:** Require retailers to provide the data necessary to closely track lamps based on their baseline (e.g. EISA compliant or exempt).

### *Structure of This Report*

The report begins with an introduction, describing the evaluation's scope and research objectives. Chapter Two describes the evaluation methodology. Each subsequent chapter focuses on one of the evaluated programs. Each program-specific chapter includes: a description of the program; research questions and approach; findings; and conclusions and recommendations. Each chapter further separates the approach and findings by process and impact. In addition, we include chapters on the best practices review and overarching conclusions and recommendations, both of which look at the portfolio as a whole. Survey instruments, interview guides, and raw frequencies are included in the appendices.

# 1. Introduction

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This report presents findings from impact and process evaluations of select energy efficiency programs that Fort Collins Utilities (Utilities) implements. Utilities implements three of these programs, the Efficiency Works Business, Efficiency Works Homes, and Midstream Lighting, programs in partnership with the Platte River Power Authority (Platte River), which offers the programs in all four of its owner-municipalities (Estes Park, Longmont, and Loveland, as well as Fort Collins). Platte River partnered with Utilities in this evaluation effort, expanding the scope of the evaluation for these three programs to include the four cities collectively. As a result, for these programs, this report presents findings for both Utilities specifically and Platte River's owner municipalities as a group.

Utilities and Platte River undertook this evaluation to ensure their programs continue to meet best practices and provide the greatest benefit to their customers. This evaluation was not designed to fulfill regulatory requirements, but rather to support Utilities' and Platte River's continuous improvement efforts.

## 1.1. Programs Evaluated

Utilities and Platte River prioritized six programs for evaluation in 2017. In the residential sector, these programs include the components of the Efficiency Works Home program (audit, direct install, rebates), appliance rebates, appliance recycling, midstream lighting, and Home Energy Reports (HER). In the commercial sector, these programs include the three elements of the Efficiency Works Business program (audits, rebates, and Building Tune Up).

A brief description of each program is below, each of the chapters presenting evaluation findings begins with a more detailed program description.

- › **Efficiency Works Business** seeks to increase energy efficiency in existing commercial buildings. The program incorporates three elements: ASHRAE Level 1 audits to help customers identify energy efficiency opportunities, incentives to reduce the cost of efficient equipment or improvements, and retro-commissioning through the Building Tune-Up offering. Platte River administers the Efficiency Works Business program in Fort Collins, Longmont, Loveland, and Estes Park.
- › **Efficiency Works Homes** focuses on household energy savings while also supporting improved indoor air quality. The program provides home efficiency audits to identify and prioritize energy efficiency improvements, in which the auditor may also install lighting products and small domestic hot water devices (showerheads and aerators).<sup>3</sup> The program offers rebates for 23 individual home improvements involving the building envelope and mechanical systems. In 2015, the program began experimenting with a streamline delivery path, designed to simplify the decision-making and upgrade process for participants using standardized pricing and

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<sup>3</sup> Prior to 2017, all participants in Efficiency Works for Homes were required to have a home efficiency audit. In 2017, the program dropped this requirement for participants interested in replacing HVAC equipment only.

grouping measures into packages. Platte River administers the Efficiency Works Homes program in Fort Collins, Longmont, Loveland, and Estes Park.

- › **Midstream Retail Lighting** works with lighting retailers and manufacturers to increase consumer adoption of efficient lighting by offering general advertising, in-store signage, sales associate training, and instant customer incentives through price markdowns on qualified lighting products.

## 1.2. Evaluation Objectives

As noted above, Fort Collins Utilities and the Platte River Power Authority conducted this evaluation to independently verify program outcomes and identify opportunities for program improvement. To this end, the process and impact evaluations addressed certain common research questions for all programs. Table 1-1 lists these questions.

**Table 1-1: Evaluation Research Programs to be Addressed Across Programs**

Evaluation Type	Common Research Questions
Impact	<ul style="list-style-type: none"> <li>• How much savings (kWh, kW, therms, water, etc.) has the program generated (gross savings)? How much of those savings are attributable to the program (net savings)?</li> <li>• How do the program's costs compare to its savings? Provide the information to report cost effectiveness from various perspectives and the relative impact of each program on the portfolio cost effectiveness.</li> <li>• What assumptions and methods does the program use to estimate energy savings, and how could they be improved to increase the accuracy of those estimates?</li> </ul>
Process	<ul style="list-style-type: none"> <li>• What value, including non-energy benefits, do customers find in the programs? How satisfied are customers with the programs? Does participation influence customer satisfaction with Fort Collins Utilities or other Platte River Power Authority utility clients?</li> <li>• What motivates customers and/or trade allies to participate in the program?</li> <li>• What barriers prevent additional customers and/or trade allies from participating in the program?</li> <li>• What opportunities exist to streamline program processes (both internal and customer-facing)?</li> </ul>

In addition to these common research questions, through conversations with Utilities and Platte River staff, the evaluation team identified a variety of specific research questions that address the information needs of each of the evaluated programs. The following sections provide brief program descriptions and list the targeted research questions the evaluation addressed for each program.

**Table 1-2: Program-Specific Research Objectives**

Program	Specific Research Objectives
Efficiency Works for Business	<ul style="list-style-type: none"> <li>• How could processes be streamlined?</li> <li>• Are there best practices or lessons learned from the different assessment approaches the Platte River cities use?</li> <li>• How can Fort Collins' assessment process be more closely coordinated with the application process?</li> <li>• How can the customer application process be improved to drive additional participation?</li> <li>• How can the program serve a larger number of projects with existing staff resources?</li> <li>• How can the program increase its conversion rate from assessment to retrofit?</li> <li>• What value does the city representative's participation in the audit bring to the customer?</li> <li>• What barriers prevent more small/medium businesses from participating?</li> <li>• Is the program reaching a point of market saturation for lighting retrofits, and, if so, what other measures offer promising opportunities?</li> <li>• For continued program success, will the marketing and outreach balance between Contractors and customers need to be adjusted?</li> </ul>
Efficiency Works for Homes	<ul style="list-style-type: none"> <li>• What effect has the "streamlined path" customer messaging had on program enrollment and customer uptake of recommended measures?</li> <li>• What role did the availability of financing in general, and on-bill financing in particular, play in uptake of recommended measures?</li> <li>• What impact has streamlining the QA process had on the contractor experience and operations? How has it affected the quality of work performed?</li> <li>• What barriers prevent participants from moving forward with recommended measures, and how do various program offerings (e.g. streamlined path, financing, advisors, auditors) address those barriers?</li> <li>• What value does having an energy advisor, distinct from the auditor, add to the program? And conversely, is the customer experience negatively impacted from the model?</li> <li>• What are optimal rebate amounts for measures incentivized through EW – Home? Are there measures not incented which would provide additional value to customer or contractor base?</li> </ul>

### 1.3. Evaluation Approach

The evaluation activities were tailored to the unique program design aspects and evaluation needs of each program. Broadly, the evaluation team conducted four activities to assess program impacts and three activities to evaluate program processes (Table 1-3). Additional detail on each of these activities is available in the next chapter.

**Table 1-3: Evaluation Activities by Program**

Program	Database Review	Engineering Review	Project File Review	Site Visit	Participant Survey	Non-Participant Survey	Market-Actor Interviews
Efficiency Works for Business	Impact	Impact	Impact	Impact	Process/ Impact		Process
Efficiency Works for Homes	Process/ Impact	Impact	Impact		Process/ Impact	Process/ Impact	Process
Midstream Retail Lighting	Impact	Impact			Process/ Impact	Process/ Impact	Process/ Impact

## 1.4. Structure of This Report

The next chapter describes the evaluation methodology. Each subsequent chapter focuses on one of the evaluated programs. Each program-specific chapter includes: a description of the program; research questions and approach; findings; and conclusions and recommendations. Each chapter further separates the approach and findings by process and impact. In addition, we include chapters on the best practices review and overarching conclusions and recommendations, both of which look at the portfolio as a whole. Survey instruments, interview guides, and raw frequencies are included in the appendices.

## 2. Methodology

This chapter describes the approaches used to answer the research questions laid out in Section 1.2. We separate our description of the research methodology by approaches primarily contributing to the impact evaluation and approaches primarily contributing to the process evaluation.

### 2.1. Impact

Two primary and complementary goals of the impact evaluation were to (1) verify and adjust savings values, and (2) to identify program improvements for improved performance and so that savings realization rates are driven as close as possible to unity.

#### 2.1.1. Residential Programs

The impact evaluation team conducted a variety of activities to reach the impact research objectives for the residential programs including: database review, in-depth review of projects, engineering assumptions review, and per unit savings review. These activities are described in further detail below.

##### 2.1.1.1. Database Review

The impact evaluation team reviewed databases associated with each of the residential programs. The activities associated with each program are described in Table 2-1.

**Table 2-1: Database Review Activities**

Program	Activity
Efficiency Works for Homes	Determined whether household and baseline details are being captured during the audit.
Midstream Lighting	Determined what lighting product details were being captured (bulb type, style, wattage, lumens) in the tracking data.
All	Determined missing details and make recommendations for data capture going forward.

##### 2.1.1.2. Eligibility Review

For the Appliance Rebate, Appliance Recycling, and Efficiency Works – Home Programs, the impact evaluation team conducted a detailed review of a sample of 2016 projects. For this review, the team validated that the make and models were program-qualified and collected additional measure details if available in the applications.



### 2.1.1.3. Savings and Assumptions Review

For each of the residential programs the impact evaluation team reviewed current assumptions and calculated program savings.

**Table 2-2: Savings and Assumptions Review Activities**

Program	Activity
Efficiency Works – Home	<ul style="list-style-type: none"> <li>• Calibrated savings to tracking database based on sample</li> <li>• As appropriate, recommended alternative savings for equipment (deemed savings) measures</li> <li>• Verified installation and baseline conditions (early replacement versus replace on burnout) via participant survey</li> <li>• Evaluated the audit-only homes to understand the sources of any audit-only savings</li> </ul>
Midstream Lighting	<ul style="list-style-type: none"> <li>• Reviewed and validated engineering assumptions (in-service rates, delta watts, hours of use, interactive effects)</li> <li>• Developed alternative savings, where appropriate, and provided a systematic approach to applying reliable savings estimates to each bulb type</li> <li>• Determined appropriate estimated useful life (EUL) and lifecycle costs for cost effectiveness</li> </ul>

### 2.1.2. Non-Residential Programs

The evaluation team took the steps shown in Table 2-3 to evaluate the energy impacts of the rebate and building tune-up programs. The following sections provide additional detail on each activity.

**Table 2-3: Tasks Performed for Each Evaluated Program Component**

Program	Tracking System and File Review	Engineering Desk Review	Deemed Savings Review	On-Site Verification
EW-B Rebates	X	X	X	X
EW-B BTU	X	X		
Assessments	X	X	X	

#### 2.1.2.1. Tracking System/Database Review

Although some of the Platte River owner municipalities use internal tracking systems, Platte River provides a master tracking system that captures data for all four utilities. There are separate trackers for the rebate and BTU program components, and assessment tracking is generally left to, and reported by, the assessment service providers, Nexant and Brendle Group.

### 2.1.2.2. Sampling

To have significant confidence in the findings, the evaluation team drew a sample of projects from the full list of projects completed in both the rebate and building tune-up programs over the 2014 to 2016 program years. Drawing a sample limits the number of projects to be investigated through desk reviews and site verifications so that ample time can be spent on that limited set. Using standard statistical methods, the team calculated the sufficient sample sizes required to obtain 90 percent confidence of the savings estimate with a +/-10% level of precision. Table 2-4 shows the population sizes and sample sizes for Platte River, which includes all four-member cities, and for Fort Collins Utilities alone.

**Table 2-4: Efficiency Works for Business Sample Sizes**

Program	Platte River population size	Platte River sample size	Fort Collins Utilities population size	Fort Collins Utilities sample size
Rebate Program	2,415	99	1,258	65
BTU Program	16	13	7	7

Since projects from Fort Collins are also included in the population of Platte River projects, only a pro rata share of additional Platte River projects were selected for the overall sample beyond the Fort Collins sample. An initial sample of sixty-five Fort Collins projects were selected, then an additional thirty-four non-Fort Collins projects were selected to round out a complete rebate program sample of ninety-nine projects.

For the BTU program, a similar technique was employed. A census of all seven Fort Collins projects were selected for review and an additional six projects from the remainder were selected to form a complete BTU program sample of thirteen projects.

### 2.1.2.3. Sample Stratification

An additional level of resolution was developed to ensure the rebate program sample captured projects with the wide range of characteristics found in the program. Analysis of project characteristics showed that the vast majority of projects (over 90%) accounted for only 37% of program savings. The remaining 8.4% of projects accounted for 63% of program savings, with the 11 largest projects accounting for nearly one-quarter of program savings. Table 2-5 shows the breakdown of strata developed to ensure projects from these categories were captured in the sample.

**Table 2-5: Rebate program sample stratification**

Stratum	Population Size	Percent of Project Count	Percent of Ex Ante Gross Savings (kWh)	Sample of Fort Collins Projects	Sample of Project from Other Cities
Projects less than or equal to 50,000 kWh	2,134	91.6%	37%	29	16
Projects between 50,000 kWh and 400,000 kWh	185	7.9%	39%	29	16
Projects greater than 400,000 kWh	11	0.5%	24%	8	2
<b>Total sample</b>	<b>2,330</b>	<b>100%</b>	<b>100%</b>	<b>65</b>	<b>34</b>

#### 2.1.2.4. Desk Review

Desk reviews were conducted on each of the sampled projects. Findings from the desk reviews are detailed in the following sections for each category of project type, including: lighting (retrofit and new construction), refrigeration, variable speed drives, cooling, other (envelope, air compressor, custom), and water. Each project from the BTU program sample was also part of the desk review process.

The desk review was conducted both to assess the savings calculations used by measure as well as individual projects. The desk review consisted of a review of project information from the tracking database and supplementary documents including:

- › Measure savings algorithms
- › Project applications
- › Project communications
- › Actual calculation of savings using algorithms
- › Project and equipment specifications
- › Project scope
- › Project invoices

In some cases the ex ante deemed savings values or algorithms were replaced. The most common source of updated values and calculations was the Xcel Energy 2017 DSM Plan.<sup>4</sup> This is a Colorado-specific resource valuable to Platte River for developing its own program savings calculations, and which Platte River staff reported using extensively.

<sup>4</sup> "2017/2018 Demand-Side Management Plan - Electric and Natural Gas," Public Service Company of Colorado, Proceeding No. 16A-0512EG, July 1, 2016, Revised July 21, 2016

### 2.1.2.5. Site Verification

The evaluators visited 20 of the sampled project sites.<sup>5</sup> Site visits confirmed that measures had been installed as described in the program tracking database and project documentation. The 20 project sites visited consisted of 15 Fort Collins projects, four Loveland projects, and one Longmont project.

Metrics captured during site visits included: installation site/location, equipment type, make/model, operational characteristics, efficiencies, and other applicable project details. Detailed results of the site visits are presented in Appendix E.

In each case it was found that projects were implemented in accordance with project documentation.

### 2.1.2.6. Calculation of Ex Post Savings

For ex post calculations, the evaluator replicated the ex ante calculations and savings when they were found to be appropriate and properly applied. In cases where the ex ante savings were either improperly calculated or where algorithms did not reflect industry best practice, the evaluator updated the algorithms and recalculated savings to determine ex post savings.

Updates and refinements to the ex ante savings are described in the individual measure sections below.

### 2.1.2.7. Efficiency Works – Building Tune Up

To reach a 90% confidence level with 10% precision, the evaluation team evaluated all seven projects completed in the Fort Collins Utilities' service territory during the evaluation period. We also reviewed six additional projects from other Platte River municipalities.

The evaluation team assessed the measures in the Building Tune-Up (BTU) program to be sure that they are appropriate for the application, persistent, and result in real savings. Like the assessment and rebate elements, savings, calculations, and reporting were checked for persistence and reliability.

## 2.2. Process

### 2.2.1. Program Document Review

To develop a deep understanding of program logic, design and processes, the evaluation team reviewed documents relevant to program design and processes. Relevant documents included:

- › Rebate applications
- › Rebate application processing procedures
- › Project trackers
- › Program summaries

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<sup>5</sup> A final round of site visits may be conducted to address particular project concerns and uncertainties

### 2.2.2. In-Depth Interviews

The evaluation team conducted in-depth interviews with key program staff and market actors (Table 2-6). We used purposive sampling approaches to select market actors to interview from each population. Table 2-6 lists the market actor groups with whom we conducted interviews, the number of interviews completed, and how we prioritized respondents for sampling.

**Table 2-6: Market Actor In-Depth Interviews**

Program	Group	Number of Interviews Completed	Notes on Sampling
All	Staff	13	Evaluation manager and program staff at Fort Collins Utilities and Platte River
Efficiency Works Homes	Auditors	4	Focused on auditors with most experience with the program
	Participating Contractors	5	Focused on highest volume contractors, ensured sample represents contractors serving all four cities
Efficiency Works Business	Participating Contractors and Auditors	13*	<ul style="list-style-type: none"> <li>• 8 contractors that have done lighting projects in 2017</li> <li>• 3 contractors that have done non-lighting project in 2017</li> <li>• 2 contractors providing assessments</li> </ul>
	BTU Participants	4	Contacted all 10 that had participated in evaluation period
Midstream Lighting	Store Managers of Participating and Formerly Participating Retailers	3	<ul style="list-style-type: none"> <li>• 2 participating retailers</li> <li>• 1 formerly participating retailer</li> </ul>
	Lighting Manufacturer Staff	3	Staff of lighting manufacturers whose products are rebated under Platte River's midstream lighting program

\* Note that contractor roles are not mutually exclusive. One EW-B contractor and one assessor had also acted as contractors for BTU projects. Additionally, two lighting contractors also conducted non-lighting projects.

Interviewers took detailed notes during each interview and, with respondents' permission, recorded the conversation. We used the recording to fill in any gaps in notetaking. We identified overarching themes that emerge from in-depth interviews with each population and used qualitative analysis software to classify interview data by theme for analysis.

### 2.2.3. Surveys

We conducted web-based surveys with three populations: residential program (Efficiency Works Home, Appliance Rebate, Appliance Recycling) participants, residential non-participants (general population),

and Efficiency Works Business program participants. The surveys investigated the process-related topics of importance to Utilities and Platte River and collected information requested by the impact teams to support the estimation of gross savings.

### 2.2.3.1. Residential Programs Participant Survey

The evaluation team sent emails to customers that program data indicated had participated<sup>6</sup> in the Efficiency Works for Homes, Appliance Rebates, or Appliance Recycling programs in 2016, inviting them to complete an online survey about their experience. To reduce the potential for non-response bias in our survey findings, we contacted the nonresponding participants in our sample multiple times. To further boost response rates and meet sampling targets among appliance recycling participants, we offered these respondents a \$5 Amazon gift card as an incentive to complete the survey. We sought contacts that were at least partially responsible for making decisions about energy related issues in their household. Our sampling targets were consistent with the sample sizes the impact evaluation team identified as necessary to achieve 90% confidence with 10% precision both within the City of Fort Collins and within Platte River's service area as a whole (Table 2-7).

**Table 2-7: Residential Programs Participant Survey Responses\***

Group		Sample	Completed Surveys	Response Rate
Efficiency Works for Homes	Fort Collins	916	196	21%
	Platte River (All Cities)	1,386	272	20%
Total	Fort Collins	1,772	375	21%
	Platte River (all cities)	2,242	451	20%

\* 179 participants in Fort Collins Utilities' Appliance Rebates and Recycling programs were also surveyed as part of this participant survey effort.

### 2.2.3.2. Residential Non-Participant Survey

The residential non-participant survey sample frame included residential utility customers in Fort Collins, Longmont, and Loveland that did not participate in the Efficiency Works for Homes, or Fort Collins Utilities' Appliance Rebate or Appliance Recycling programs in 2016, and for whom valid email addresses were available. To minimize the burden on customers, we randomly selected a sample of participants within each city to receive survey invitations. We also eliminated any participants recently invited to participate in a Longmont Power and Communications survey from our sample. We drew these samples of sufficient size to meet the targeted number of responses, based on the response rate of a small-scale, pre-test of the survey.

<sup>6</sup> Participation was defined as any household that started a project that was included in the utility provided project trackers.

**Table 2-8: Residential Programs Non-Participant Survey Responses**

Group	Sample	Completed Surveys	Response Rate
Fort Collins	4,698	383	8%
Platte River (Including Fort Collins)	10,694	953	9%

The non-participant survey addressed respondents' awareness of the evaluated programs and relevant actions they had undertaken outside of those programs (e.g. making changes to their home to improve energy efficiency, purchasing and/or disposing of an appliance). Both the participant and non-participant surveys also gathered data on respondents' lighting purchase behaviors to inform the evaluation of the Midstream Retail Lighting program and on Fort Collins residents' recall of and reactions to Home Energy Reports.

### 2.2.3.3. Efficiency Works Business Participant Survey

Our Efficiency Works Business sample frame included all customers that had a record of applying for an Efficiency Works Business rebate and/or receiving an audit in 2016. In order to increase response rates, after sending an email invitation and a series of email reminders, we called participant organizations that had not yet responded. We also offered business respondents a \$20 Amazon gift card as an incentive to complete the survey. Table 2-9 summarizes survey response by the size bin of the respondent's largest Efficiency Works for Business project. To reduce the potential for non-response bias in our survey findings, we contacted the nonresponding participants in our sample multiple times.

**Table 2-9: Efficiency Works Business Participant Survey Responses**

Location	Size Bin of Participant's Largest Project	Sample*	Completed Surveys	Response Rate
Fort Collins	0 to 49,999 kWh	297	50	17%
Platte River	0 to 49,999 kWh	502	64	13%
Fort Collins	50,000 to 399,999 kWh	27	8	30%
Platte River	50,000 to 399,999 kWh	63	16	25%
Fort Collins	400,000 kWh or more	3	0	0%
Platte River	400,000 kWh or more	5	0	0%
Fort Collins	Total**	402	66	16%
Platte River	Total**	659	90	14%

\* With addition of phone only participants

\*\* Includes audit-only

## 2.2.4. Best Practices Review

We worked with Utilities and Platte River to identify a group of program administrators that operate in a context similar to Utilities and Platte River and offer similar programs. We compared program costs and reported outcomes between these comparison organizations and Utilities and Platte River, followed by a more detailed review of specific program offerings. We largely based this review on secondary data, including annual reports and program plans and evaluation reports, when available.

## 2.3. Assessment of Net-to-Gross Values

Net-to-gross (NTG) ratios take into account the effects of free-ridership (FR) and spillover (SO) on gross savings (Figure 2-1). Free-ridership refers to the portion of energy savings that participants would have achieved in the absence of the program through their own initiatives and expenditures (U.S. DOE, 2014).<sup>7</sup> Spillover refers to the program-induced adoption of additional energy-saving measures by participants who did not receive financial incentives or technical assistance for the additional measures installed (U.S. DOE, 2014). The evaluation team used the following formula to calculate the NTG ratio:

$$NTG = 1 - FR + SO$$

**Figure 2-1: NTG Elements**



We designed our battery of survey questions to be very brief. We adapted some of the questions to adhere to each program's delivery methods and measures. We explain each of the NTG components in more detail below.

<sup>7</sup> The U.S. Department of Energy (DOE) (2014). *The Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures. Chapter 23: Estimating Net Savings: Common Practices*. Retrieved August 29, 2016 from [http://energy.gov/sites/prod/files/2015/02/f19/UMPCChapter23-estimating-net-savings\\_0.pdf](http://energy.gov/sites/prod/files/2015/02/f19/UMPCChapter23-estimating-net-savings_0.pdf).



### 2.3.1. Free-Ridership

The evaluation team's methodology for calculating free-ridership consists of two components, free-ridership change which captures how the project would have changed without program assistance and free-ridership influence which captures the program's influence on the project.

To measure free-ridership change, respondents were asked to identify how their project would have changed if they had not participated in the program. Respondents were given the following options:<sup>8</sup>

- › I would not have done a project at all
- › I would have delayed the project more than six months
- › I would have done a smaller, less expensive project, or one that saved less energy
- › I would have done the same project

To measure free-rider influence, respondents rated how much influence program-related factors had on their respective decisions to install the measures. Influence was rated on a five-point scale, from "1" (not at all influential) to "5" (extremely influential). Program factors included:

- › The rebate or bill credit
- › Any technical assistance received from Efficiency Works and your Utility
- › Your contractor's recommendation
- › Sales associate or store staff member
- › In-store, point of purchase materials

Appliance recycling participants were also asked about the convenience of the free appliance pick-up service.

Responses indicating that lack of program assistance would have resulted in significant changes to what was done and high program influence on the project were taken to indicate lack of free-ridership. Responses that indicated that lack of program assistance would not have changed what was done and that there was little program influence on the project were taken to indicate free-ridership.

### 2.3.2. Spillover

Spillover estimates energy savings from additional energy improvements made by participants who are influenced by the program to do so, and is used to adjust gross savings. It is important to include estimates of spillover when free-ridership adjustments are made to ensure a balanced NTG ratio; doing so accounts for both positive (spillover) and negative (free-ridership) influences.

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<sup>8</sup> Response options varied slightly between the residential and commercial participant surveys. The options listed in the text are from the residential survey. Beyond slight wording changes, the primary difference was that the commercial participant survey broke the "smaller, less expensive project" option into two options: "Installed some measures, but not others," and "Installed less efficient measures."

The evaluation team's spillover approach varied between residential and commercial programs, although both drew on participant survey data. The surveys asked respondents to indicate what energy-saving measures they had installed since participating in the program and whether they had received incentives for those measures. The evaluation team then asked participants to rate the importance of their experience with the program in their decision to buy and install the efficient items. Importance was rated on a five-point scale, from "1" (not at all important) to "5" (extremely important).

Energy-saving upgrades we asked of residential participants included:

1. Appliance(s)
2. Heating or cooling equipment
3. Water heater
4. Windows
5. Insulation
6. Sealing air leaks attics, crawl spaces, and basements
7. Sealing or insulating ducts

Energy-saving upgrades asked of commercial participants included:

1. Lighting
2. Cooling equipment
3. Insulation or windows
4. Food service equipment
5. Grocery display cases or refrigerated warehouses
6. Office equipment and/or appliances
7. Variable frequency drives (VFDs)
8. Water-saving measures
9. Business Tune-up (BTU) Retro-commissioning

## 3. Efficiency Works for Business

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### 3.1. Program Description

The Efficiency Works Business program seeks to increase energy efficiency in existing commercial buildings. Customer engagement in the Efficiency Works Business program is heavily driven by a trade ally network, where many local trade allies build their business model around the incentive program offered through Efficiency Works.

The program incorporates three components:

- › **Facility Assessments:** ASHRAE Level 1 audits are available to help customers identify energy efficiency opportunities
- › **Rebates for Upgrades:** prescriptive or custom incentives are available to reduce the cost of efficient equipment or improvements
- › **Building Tune-Up (BTU):** provides retro-commissioning services. Due to the distinct nature of this component, we report findings on BTU separately, in Chapter 4.

#### 3.1.1. Facility Assessments

Facility assessments, or audits, are a free service provided to participating businesses. These audits are intended to offer a general overview of efficiency opportunities within a facility that a business can adopt. Two consulting firms provide these audits.

The facility assessment analyzes existing building systems and equipment to identify opportunities to save energy, thereby reducing operating costs and environmental impacts. To complete the facility assessment process, the participant must first complete and submit an assessment application. Once accepted, the application is forwarded to the auditor for scheduling. The auditor then performs the on-site audit with the participant. There are four different facility assessments available to participating businesses.

- › **The Simple Facility Assessment (One-Page Audit)** provides a summary report of a facility's energy and water efficiency opportunities and rebates available for installing the recommended measures.
- › **The Expanded Facility Assessment** provides a more detailed report on specific opportunities to save energy, which is beneficial for managers planning efficiency goals.
- › **The Fort Collins ClimateWise Expanded Assessment**, offered to eligible ClimateWise partners,<sup>9</sup> is an expanded version of the audit that also includes solid waste, recycling, composting, and transportation in the analysis.

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<sup>9</sup> ClimateWise is a program offered to Fort Collins businesses that provides free, simple solutions for reducing environmental impacts, waste, and energy and water use.

- › **The Fort Collins Building Code Required Assessment** is a required assessment for businesses that plan to have building alterations that exceed a \$50,000 valuation.

The audit is followed with a report sent to the participating business. If a participant wishes to move forward with a rebated project, the assessor is available to provide additional assistance in completing the project by reviewing bids and financing.

### 3.1.2. Rebates for Upgrades

The process for participating in the rebate program often starts with ensuring the project is eligible for incentives. Participants or their contractors submit an application to Efficiency Works program staff, who review it for eligibility and then notify the participant. Preapprovals are required for projects with rebates greater than \$1,000, for VFD projects, and for all custom projects. Participants or their contractors must submit preapproval applications before equipment is installed but after a bid has been selected. During this process, the program determines whether on-site verification is necessary. After preapproval, the business completes the project and installs all measures per program and code requirements. The rebate is paid to businesses, or the contractor completing the upgrade, within six weeks of receipt of a finalized rebate application, documentation, and any project invoices.

The Efficiency Works Business program offers two types of project rebates: prescriptive rebates and custom rebates. For some measures, prescriptive rebates are calculated based on formulas that account for building or usage characteristics, while incentives for other measures offer a fixed amount for installing a specific energy efficient technology. Prescriptive incentives are available to commercial customers for installing measures related to the building envelope, mechanical system, and lighting. Incentives are also available for business-specific measures in the food service, grocery store, and data center industries.

There are times when a project requires unique measures that may not meet the general equipment requirements in the prescriptive program. In these situations, a business can participate in the custom incentive program. To qualify for custom incentives, a business must submit site-specific efficiency plans to Efficiency Works, which will then be reviewed for rebate eligibility.

## 3.2. Research Questions and Evaluation Approach

Table 3-1 lists the research questions driving this evaluation. A brief description of the research activities that inform the evaluation of the Efficiency Works Business program follows the table.

**Table 3-1: Efficiency Works Business Research Questions**

Evaluation Type	Research Questions
Impact	<ul style="list-style-type: none"> <li>• How much savings (kWh, kW, Therms, water, etc.) has the program generated (gross savings)? How much of those savings are attributable to the program (Net savings)</li> <li>• What assumptions and methods does the program use to estimate energy savings, and are there opportunities to increase the accuracy of those estimates?</li> </ul>

Evaluation Type	Research Questions
Process	<ul style="list-style-type: none"> <li>• How could processes be streamlined? <ul style="list-style-type: none"> <li>– Are there best practices or lessons learned from the different assessment approaches the Platte River cities use?</li> <li>– How can Fort Collins’ assessment process be more closely coordinated with the application process?</li> <li>– How can the customer application process be improved to drive additional participation?</li> <li>– How can the program serve a larger number of projects with existing staff resources?</li> </ul> </li> <li>• How can the program increase its conversion rate from assessment to retrofit?</li> <li>• What value does the city representative’s participation in the audit bring to the customer?</li> <li>• What barriers prevent more small/medium businesses from participating?</li> <li>• Is the program reaching a point of market saturation for lighting retrofits, and, if so, what other measures offer promising opportunities?</li> <li>• For continued program success, will the marketing and outreach balance between Contractors and customers need to be adjusted?</li> </ul>

### 3.2.1. Impact Evaluation Methods

The evaluation team took the steps shown in Table 3-2 to evaluate the energy impacts of the rebate and building tune-up programs. The following sections provide additional detail on each activity.

**Table 3-2: Tasks Performed for Each Evaluated Program Component**

Program	Tracking System and File Review	Engineering Desk Review	Deemed Savings Review	On-Site Verification
EW-B Rebates	X	X	X	X
EW-B BTU	X	X		X
Assessments	X	X	X	

#### 3.2.1.1. Tracking System/Database Review

Although some of the Platte River owner municipalities use internal tracking systems, Platte River provides a master tracking system that captures data for all four utilities. There are separate trackers for the rebate and BTU program components, and assessment tracking is generally left to, and reported by, the assessment service providers, Nexant and Brendle Group. Once the onsite visit is complete, Platte River maintains records of assessments for Estes Park, Loveland and Longmont internally, while Fort Collins Utilities archives assessments that take place in Fort Collins.

### 3.2.1.2. Engineering Desk Reviews

The evaluation team drew a sample of 99 projects (65 in Fort Collins and 34 in other Platte River municipalities) completed over the 2014 to 2016 program years to provide statistical estimates at 90% confidence with 10% precision. To ensure this sample accurately represented the savings the Efficiency Works for Business program received, we stratified the sampled products between three size bins.<sup>10</sup> Desk reviews were conducted on each of the sampled projects. The desk review was conducted both to assess the savings calculations used by measure as well as individual projects. The desk review consisted of a review of project information from the tracking database and supplementary documents.

### 3.2.1.3. On-Site Verification

The evaluators visited 17 of the sampled project sites (12 in Fort Collins, four in Loveland, and one in Longmont). Site visits confirmed that measures had been installed as described in the program tracking database and project documentation. Metrics captured during site visits included: installation site/location, equipment type, make/model, operational characteristics, efficiencies, and other applicable project details. Detailed results of the site visits are presented in Appendix E.

### 3.2.1.4. Calculation of Ex-Post Savings

For ex post calculations, the evaluator replicated the ex ante calculations and savings when they were found to be appropriate and properly applied. In cases where the ex ante savings were either improperly calculated or where algorithms did not reflect industry best practice, the evaluator updated the algorithms and recalculated savings to determine ex post savings. The most significant modifications to the ex ante assumptions was the inclusion of interactive factors for lighting and a reduction in per-unit savings for refrigeration door gaskets.

## 3.2.2. Process Evaluation Methods

The process findings on the Efficiency Works Business program includes information gathered from the following data collection activities:

- › **Staff Interviews:** The evaluation team conducted in-depth interviews with program staff. The output of these discussions helped shape survey questions and interviews related to the Efficiency Works Business program.
- › **Participating Contractor Interviews:** The evaluation team conducted in-depth interviews with thirteen participating contractors and auditors. Interviews focused on the market actors' experience with various program elements, market conditions, and customer barriers to participation.
- › **Efficiency Works Business Participant Survey:** The evaluation team conducted web-based surveys of businesses that participated in the Efficiency Works Business program. This survey

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<sup>10</sup> Small: projects with estimated savings less than or equal to 50,000 kWh; medium: projects between 50,000 kWh and 400,000 kWh; and large: projects greater than 400,000 kWh.

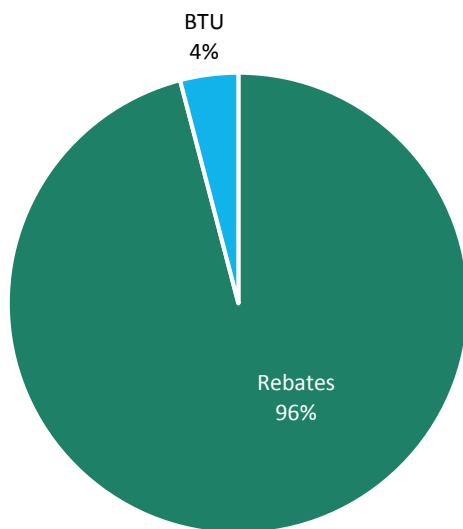
included questions regarding participants' experience and satisfaction with various program elements.

### 3.3. Impact Evaluation Findings

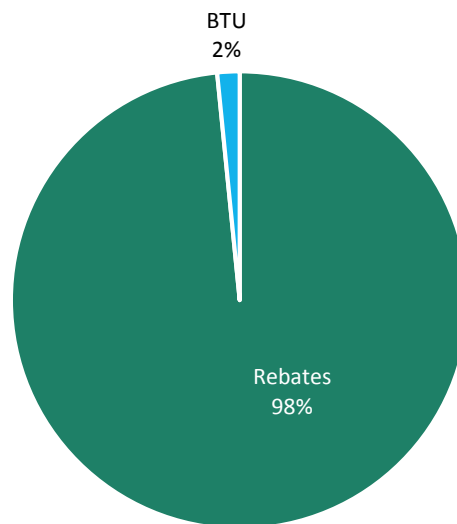
Each of the EW-B program elements work together to provide a coordinated and comprehensive suite. The EW-B impact evaluation separates each of these elements into different sections.

There are no direct energy savings associated with the assessment program. The breakdown of net energy savings among the other evaluated programs, rebates and BTU, is shown for all Platte River's cities in Figure 3-1 and for Fort Collins only in Figure 3-2.

**Figure 3-1: Rebate and BTU Program Ex Post Net Savings Breakdown for all Platte River Cities**

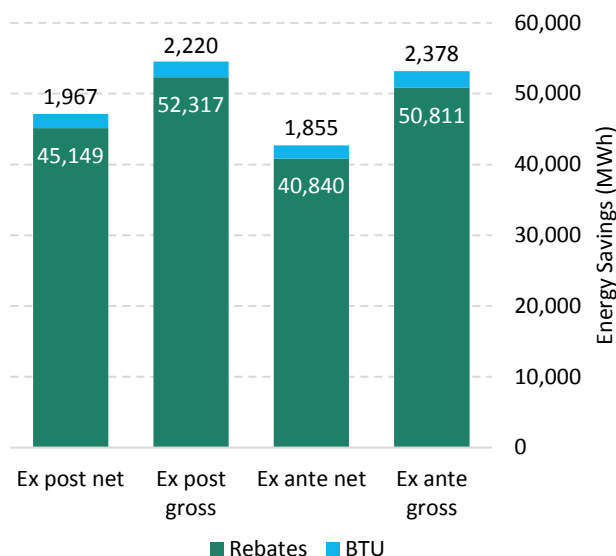


**Figure 3-2: Rebate and BTU Program Ex Post Net Savings Breakdown for Fort Collins**



The primary purposes of an impact analysis are to assess gross and net energy savings of the program projects. An impact evaluation verifies measure installations, identifies key energy assumptions, and provides the research necessary to calculate defensible and accurate savings attributable to the program. Figure 3-3 below provides the summary results of the program evaluation. The population ex post kWh savings was calculated by first calculating the ex post savings for the sample and then extrapolating to the entire population.

**Figure 3-3: Ex Ante and Ex Post Energy Savings from Rebate and BTU Programs for all Platte River Cities, MWh**



**Figure 3-4: Ex Ante and Ex Post Energy Savings from Rebate and BTU Programs for Fort Collins, MWh**

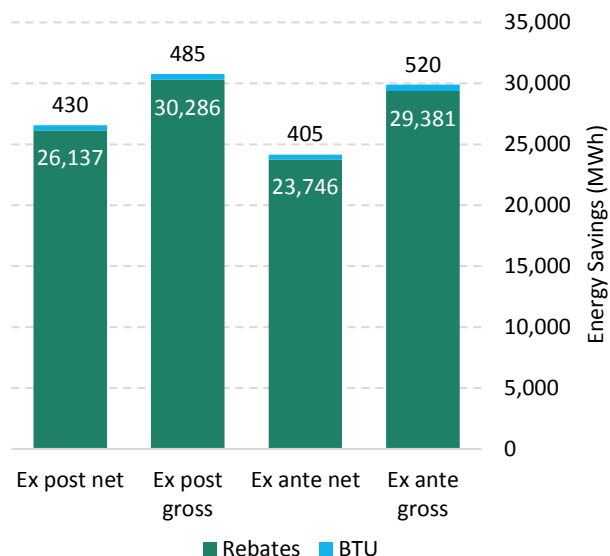


Table 3-3 shows this data in tabular format, including key indicators for realization rate and net-to-gross factors.

**Table 3-3: Program Evaluation Findings - All Platte River Cities**

	Energy Savings (MWh)				Key Indicators	
	Ex ante gross	Ex ante net	Ex post gross	Ex post net	RR	NTG
Rebates	50,811	40,840	52,317	45,149	1.030	0.863
BTU	2,378	1,855	2,220	1,967	0.934	0.886
<b>Total</b>	<b>53,189</b>	<b>42,695</b>	<b>54,537</b>	<b>47,117</b>	<b>1.025</b>	<b>0.864</b>

Table 3-4 breaks out those same data points for Fort Collins Utilities only.

**Table 3-4: Program Evaluation Findings - Fort Collins Only**

	Energy Savings (MWh)				Key Indicators	
	Ex ante gross	Ex ante net	Ex post gross	Ex post net	RR	NTG
Rebates	29,381	23,746	30,286	26,137	1.031	0.863
BTU	520	405	485	430	0.934	0.886
<b>Total</b>	<b>29,901</b>	<b>24,151</b>	<b>30,771</b>	<b>26,567</b>	<b>1.029</b>	<b>0.863</b>



The ex-ante NTG ratios for the EW-B programs varied between 0.78 and 0.90, with a weighted average of 0.804, which is similar to, but less than the Ex Post NGT ratios shown above.

In addition to energy savings, the programs impacted demand, gas use, and water consumption. Table 3-5 shows ex post net savings for these other resources. Because impacts for these resources are not specifically tracked, there are no ex ante values.

**Table 3-5: Program Evaluation Impact Findings, Including Non-Electric Energy Savings, All Platte River Cities**

Program	Ex Post Net Energy Savings (MWh)	Ex Post Net Demand Reduction (kW)	Ex Post Net Gas Savings (therms)	Ex Post Net Water Savings (gallons)
Rebates	45,149	5,412	-3,889	5,968,935
BTU	1,967	83	160,453	0
<b>Total</b>	<b>47,117</b>	<b>5,495</b>	<b>156,564</b>	<b>5,968,935</b>

In completing this impact evaluation, the evaluation team identified a range of opportunities for Fort Collins Utilities and the Platte River Power Authority to more effectively track projects and assess program outcomes and value. These opportunities are summarized in Appendix D.

### 3.3.1. Efficiency Works Facility Assessments

Approximately 25 to 30 of the 99 projects in the rebate program sample group underwent a facility assessment at some stage. Review of associated assessments revealed two primary levels of report detail. Reports labeled as “Assessment Summary” are one-to-two-page documents that provide a basic list of a small number of recommended measures, providing information primarily focused on financial metrics like cost, incentives, and estimated simple payback. The second document type, labeled as “Assessment Reports,” are roughly 15-to-20-page documents. These reports provide a detailed review of existing energy consumption, including an end-use analysis, and descriptions of relevant energy saving retrofit measures and operational improvements. These recommendations provide details on energy and cost savings.

A primary purpose for funding and administering assessments is to draw customers to apply for incentives through the rebate program. However, there is no direct tracking of assessments in the rebate program tracking databases, nor are assessment reports linked to associated projects. There are no unique identifiers that correlate between the rebate program tracking databases and the third-party assessment tracking databases. Due to this lack of correlation, it is difficult to judge the direct impact of the assessments both from an impact evaluation perspective or from the perspective of program influence. Further, in some program years, the program offered incentives, like the Business Efficiency Grant, that required participants to have an assessment. Participation in these offerings has the potential to further bias estimates of the assessments’ impact on project uptake.

To gain a rough estimate of correlation between the programs, premise addresses were used to identify sites where both an assessment occurred and a rebated project was completed. Even this level of

correlation is inaccurate due to inexact addresses being captured in different databases. For example, an address could be captured as “S 9th Street” on one list and “South Ninth St.” on another.

Regardless, a rough correlation was obtained using this method.<sup>11</sup> The evaluation team found that rebate projects occurred at approximately 34% of the locations that had assessments. Alternatively, approximately 24% of rebate projects occurred at addresses where assessments had occurred.

### 3.3.2. Efficiency Works Rebates

The Efficiency Works Business program provides incentives to customers of any of the four utilities. The measures that are eligible for the program are listed in Appendix I, and include the following measure categories:

- › Lighting - Existing Buildings
- › Lighting - New Construction
- › Cooling Efficiency
- › Building Envelope
- › Food Service Equipment
- › Grocery Efficiency
- › I.T. Office Equipment and Controls
- › Variable Frequency Drives (VFD)
- › Water Efficiency
- › Custom efficiency

From a measure category standpoint, ex ante and ex post savings can be compared. Table 3-6 shows the ex ante and ex post savings values.

**Table 3-6: Electric Energy Savings (kWh) by Measure Category, All Platte River Cities**

Measure Category	Ex Ante Gross	Ex Ante NTG*	Ex Ante Net	Realization Rate	Ex Post Gross	Ex Post NTG	Ex Post Net
Water	2,210	0.900	1,989	1.000	2,210	0.863	1,907
Building envelope	205,624	0.870	178,893	1.000	205,624	0.863	177,454
Air compressor	358,264	0.870	311,690	1.000	358,264	0.863	309,182
Cooling	1,434,794	0.870	1,248,271	0.958	1,374,396	0.863	1,186,104

<sup>11</sup> To increase the accuracy of our matching between lists, the evaluation team matched addresses only on building number, street name, and city. All modifiers to the street name (e.g. N, S, E, W, St., Ave., etc.) were removed.

## Energy Efficiency Programs Evaluation

Measure Category	Ex Ante Gross	Ex Ante NTG*	Ex Ante Net	Realization Rate	Ex Post Gross	Ex Post NTG	Ex Post Net
Lighting - NC	1,713,088	0.780	1,336,209	1.017	1,741,378	0.863	1,502,809
Other	1,770,800	0.870	1,540,596	1.005	1,779,156	0.863	1,535,412
Motors - VSD	2,072,305	0.870	1,802,905	1.005	2,081,778	0.863	1,796,574
BTU Projects	2,378,485	0.780	1,855,218	0.934	2,220,349	0.886	1,967,229
Refrigeration	8,197,886	0.870	7,132,161	0.833	6,829,819	0.863	5,894,134
Lighting	35,055,697	0.780	27,343,444	1.050	36,810,499	0.863	31,767,460
<b>Totals</b>	<b>53,250,253</b>	<b>0.804</b>	<b>42,799,033</b>	<b>1.004</b>	<b>53,460,509</b>	<b>0.864</b>	<b>46,188,799</b>

\* Ex ante net-to-gross values taken from *Define Measures* tab in *!Configure* Excel Workbook

Figure 3-5 shows the breakdown of rebate program savings attributed to Fort Collins' projects and to other cities from three perspectives. Ex ante gross is the savings claimed for the programs before the evaluation activities, without regard for free-ridership or spillover (net-to-gross). Ex post gross savings is equal to the ex ante gross multiplied by the realization rate. Ex post net savings takes into account free-ridership and spillover by applying a net-to-gross ratio to the ex post gross savings.

**Figure 3-5: Rebate Program Savings: Ex Ante Gross, Ex Ante Net, Ex Post Gross, and Ex Post Net**

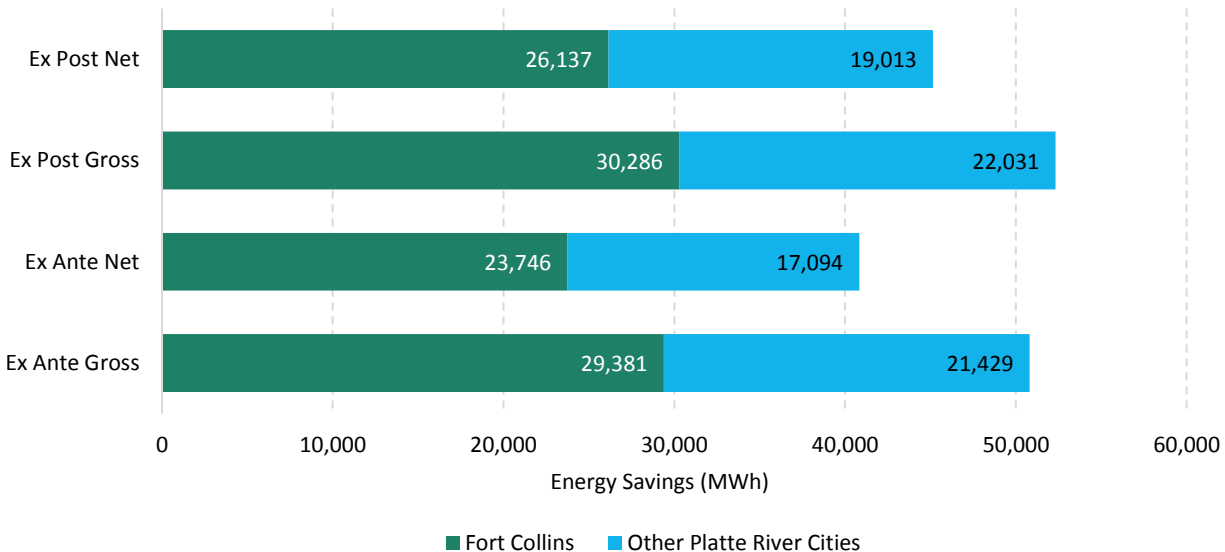
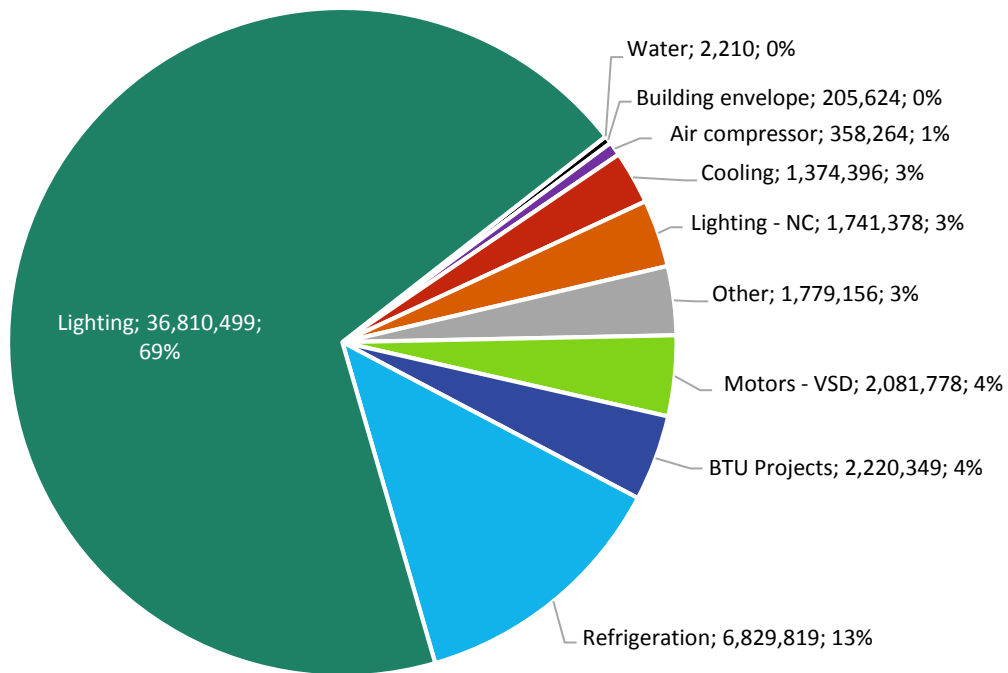
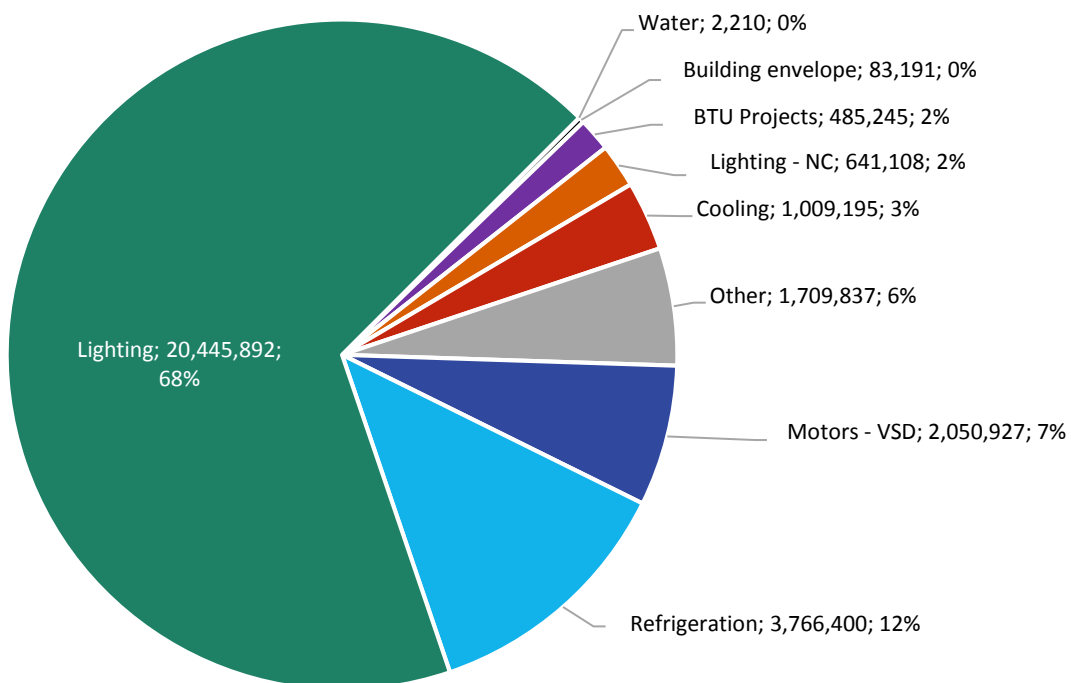


Figure 3-6 shows the breakdown of ex post energy savings by measure category for the population of rebate program projects during the 2014 - 2016 program years.

**Figure 3-6: Breakdown of Ex Post Net Savings by Measure, All Platte River Cities**



**Figure 3-7: Breakdown of Ex Post Net Savings by Measure, Fort Collins**



Lighting produced the majority of the savings in the C&I sector, accounting for over 70% of the program savings (69% from retrofit projects and + 3% from new construction projects for all Platte River cities). Refrigeration measures accounted for 12% of savings while the remaining savings was derived from cooling, motors, and other measures.

These reported values are for electric energy savings, which has been the focus of the program. However, natural gas therm savings, water, and energy demand (kW) are also important resources. Table 3-7 shows the saving for all utility types (electric energy, electric demand, gas, and water).

**Table 3-7: Savings of Non-Electric Energy Resources**

Ex Post Net Energy Savings (MWh)	Ex Post Net Demand Reduction (kW)	Ex Post Net Gas Savings (therms)*	Ex Post Net Water Savings (gallons)
45,149	5,412	-3,889	5,968,935

\* Since gas savings was not tracked in the project tracking sheets, this therm penalty only accounts for negative interactive effects applied from the sample to the population, as well as some positive gas savings from water measures.

In estimating population savings of therms and water, the evaluators assume that the percentage of sample relative to population savings for electric energy can be applied to calculate overall water savings. This value was obtained using this formula:

$$\text{Population water saved} = \text{Sample water saved} * (\text{Population kWh saved} / \text{Sample kWh saved})$$

### 3.3.2.1. Description and Assessment of Application and Tracking System

The rebate tracking system is populated by the application sheets and the application sheets contain additional information and capabilities; savings and rebates are calculated directly in the application forms.

The application spreadsheets are submitted by the participant and reviewed by the program administrator, Platte River. The spreadsheet consists of a set of tabs that are either input by the applicant, or are automatically calculated by the application spreadsheet. The tabs variously focus at the program level and project level.

The common tabs viewable by the user include:

- › Navigation
- › Page 1 - General Info
- › Page 11 - Determine Incentive
- › Page 12 - Sign Payment Request
- › Page 13 - BE Grant

Project specific tabs include specialized sheets for lighting retrofit, lighting new construction, cooling, envelope, food service, grocery, IT and office, motor variable speed drives (VSDs), water efficiency, and a catch-all tab for custom projects that are not captured in the other tabs. There are also hidden tabs

used by the administrators that include a revision key, project inputs, electric rates and miscellaneous data.

The spreadsheet rolls up savings, incentives, and other key metrics from the project specific tabs into the common tabs. application for import into the project tracking system. The spreadsheet is “protected” so that program participants can only view and edit certain tabs and cells of the application.

Deemed savings values and calculations are embedded in the application, providing a high level of consistency and clarity from project to project. The systems is clear and useful, and much of the concepts and capabilities should be included in any future program tracking system.

### 3.3.2.2. Measure-Specific Findings

The following sections present detailed impact findings by measure category.

#### Lighting

Lighting projects, both retrofit and new construction, make up the large majority of rebate program projects in both quantity and energy savings. Combined, the measure category accounts for over two-thirds of energy savings for the rebate program in both Fort Collins and Platte River overall.

Table 3-8 and Table 3-9 show the ex ante gross energy savings and ex post gross energy savings for both Platte River (all cities combined) and broken out for Fort Collins only for retrofit measures and new construction measures, respectively. The corresponding realization rates are shown, as well.

**Table 3-8: Retrofit Lighting Sample Gross Savings and Realization Rate**

Jurisdiction	Ex ante energy savings (kWh)	Ex post energy savings (kWh)	Realization Rate
Platte River (all cities)	8,723,544	9,160,223	1.050
Fort Collins only	6,607,291	6,967,786	1.055

**Table 3-9: New Construction Lighting Sample Gross Savings and Realization Rate**

Jurisdiction	Ex ante energy savings (kWh)	Ex post energy savings (kWh)	Realization Rate
Platte River (all cities)	969,395	985,403	1.017
Fort Collins only	368,987	378,518	1.026

The realization rates were calculated to be just over one. Various factors affected this realization rate, but the two most impactful were:

- › In the large majority of lighting projects, applicants manually adjusted lighting wattages, rather than using standard lighting table values.

- › Ex Ante estimates and the application/algorithm does not include interactive effects, but interactive effects were added during the evaluation.

Nearly all lighting projects use project-specific, implementer-reported fixture wattages instead of adhering to the embedded wattage table. The lighting measure application is designed to use a detailed lighting wattage table, embedded within the application spreadsheet, which is intended to ascribe deemed wattages to the various baseline and retrofit fixtures involved in each project. Either to create a (perceived) increase in accuracy or to increase the ease of working with non-matching fixture types, users are allowed to overwrite the wattages that populate from this wattage table. The lighting wattage table in the 2014 - 2016 application workbooks is somewhat out of date and has insufficient breadth to capture many of the fixture types/permutations currently being installed. As program staff noted, given the range of lighting upgrades available, creating a comprehensive table may not be practical, and any table would require an option for other, custom projects.

In a majority of the sampled projects, users ended up inputting wattages that may be more accurate than the lookup value. In other cases, the nominal wattage specified with a product's packaging or a spec sheet may be appreciably different from the actual fixture wattage. Lamps have varied characteristics at different temperatures and in different fixtures/installations. Lighting tables may be advantageous because they capture variations in the real-world power draw of a large number of fixtures. This helps establish consistent, accepted wattages for the various fixture types.

It should be noted that Efficiency Works Business staff take the added step of validating entered fixture wattages by referring to DesignLights Consortium's (DLC) qualified product list database which lists tested input wattages for a large number of available solid state lighting products. This type of verification is necessary for energy savings estimates that use project specific, participant reported values for power and hours of usage. While this approach is valid and may result in accurate savings estimates, it essentially treats each project as a custom project, increasing administrative costs as staff must verify savings estimates on a per-project basis.

Most ex post savings values for lighting projects in the sample were calculated by making the reported wattages consistent with those in the wattage table, in addition to validating fixture counts and types. Ex post savings was greater than ex ante for several projects and was lower for others.

Table 3-10 shows the resulting realization rate before and after interactive effects were considered.

**Table 3-10: Comparison of Ex Post Gross Savings With and Without Interactive Effects – Lighting Retrofits**

Ex ante gross (kWh)	Non-interactive Ex post gross (kWh)	Interactive ex post gross (kWh)	Non-interactive RR	Interactive RR
8,723,544	8,669,155	9,160,223	0.994	1.050

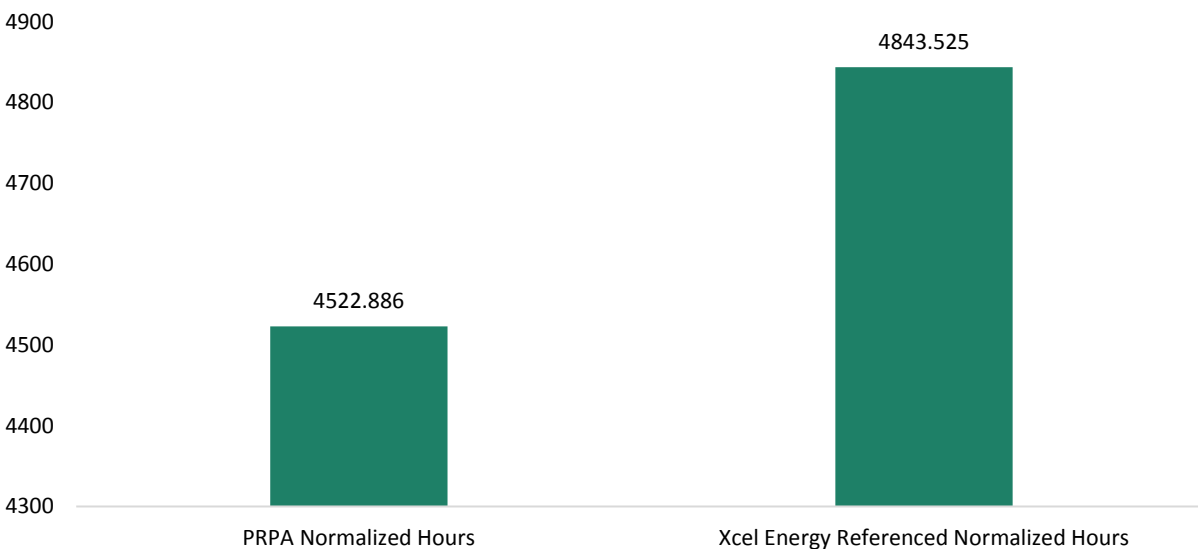
More efficient lighting, especially LED-based fixtures, output far less heat than older technologies. Ex post savings values were calculated by applying factors to increase electric energy savings for interior projects where it could be assumed there was space cooling, and thus the efficient lighting would reduce the need for cooling. Conversely, a heating penalty was calculated to account for the reduced heat contribution from the upgraded lighting. The evaluation team recommends including these

interactive factors in future energy savings calculations for lighting retrofit projects, although doing so would require adherence to capturing characteristics of space heating and space cooling equipment and operation for each project facility.

Finally, the lighting retrofit sheet in the application allows for manual entry of hours of operation. While it appears that customer reported hours of operation are reasonable, Platte River and its owner municipalities may want to perform a lighting operating hours survey, consider using deemed hours, or check hours against standard hours during the application phase. Since energy savings is calculated using fixture wattage reduction multiplied by hours of operation, the accuracy of this value strongly impacts the accuracy of savings estimates for this high impact measure.

While ex post energy savings was calculated, for the most part, using customer reported hours of operation, the evaluation team performed a comparison of customer reported hours to deemed hours of operation based on building type for each sampled project. Figure 3-8 shows a comparison of normalized reported hours of operation for the sampled projects to normalized deemed hours of operation for those same projects using Xcel Energy's deemed hours of operation from their 2017/2018 DSM plan. Using Xcel's assumptions results in an increase in hours, and thus energy savings of approximately 7 percent. If a deemed hours approach is preferred, Platte River could choose to use Xcel Energy's regionally-specific deemed hours table, or implement their own deemed hours table if they feel Xcel's values are not relevant to the Platte River owner municipalities.

**Figure 3-8: Comparison of Customer-Reported to Deemed Lighting Hours of Use**



Similar to the practice of requiring use of a lighting wattage table to determine baseline and retrofit fixture wattages, use of deemed hours by building type is a useful method to reduce administration time and errors in customer-input of operating hours. While user-entered values may often be more accurate than averages by building type, users may also mischaracterize their own building's operating hours significantly. To reduce administration time and potential uncertainties, Platte River and Fort Collins Utilities should consider the merits of implementing required use of a lighting wattage table and deemed hours of operation by building type.



## Refrigeration

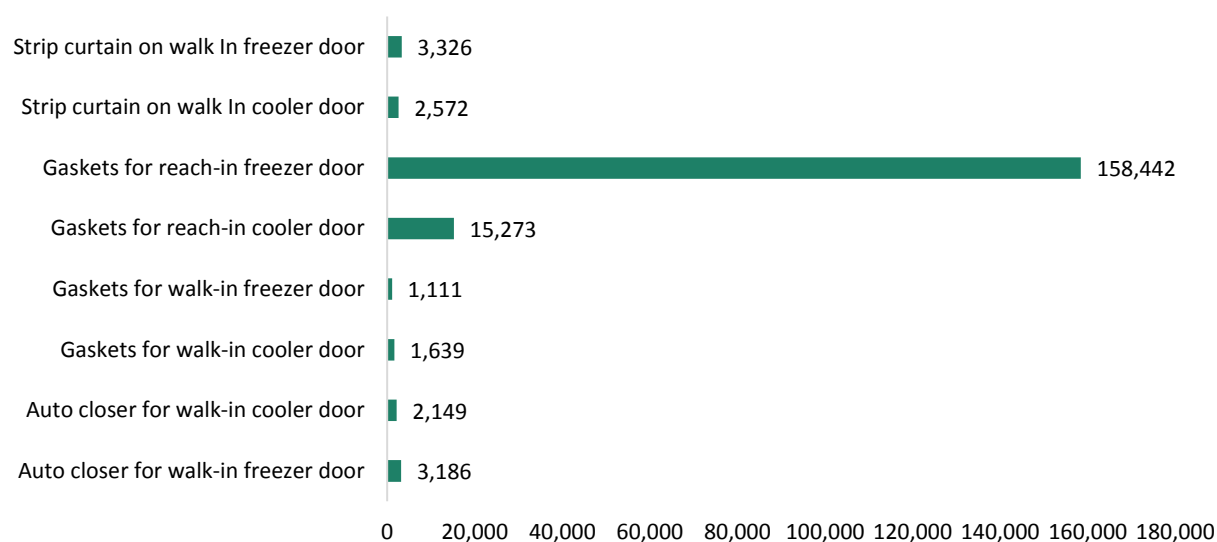
Refrigeration measures including grocery and food service measures, provide roughly 13% of savings in the population. There are many measures in the refrigeration category, but only a subset of the measures appears to have been utilized during the evaluated period.

The measures that were utilized as part of the sample include:

- › Auto closers for walk-in cooler and freezer doors
- › Gaskets for reach-in and walk-in cooler and freezer doors
- › Strip curtains for walk in cooler and freezer doors

Figure 3-9 shows that the vast majority of savings from the refrigeration category comes from the installation of gaskets on reach-in freezer doors.

**Figure 3-9: Breakdown of Ex Post Gross kWh Savings by Refrigeration Measure Type, Sampled Projects**



Ex post savings was calculated for sampled refrigeration projects resulting in realization rates shown in Table 3-11.

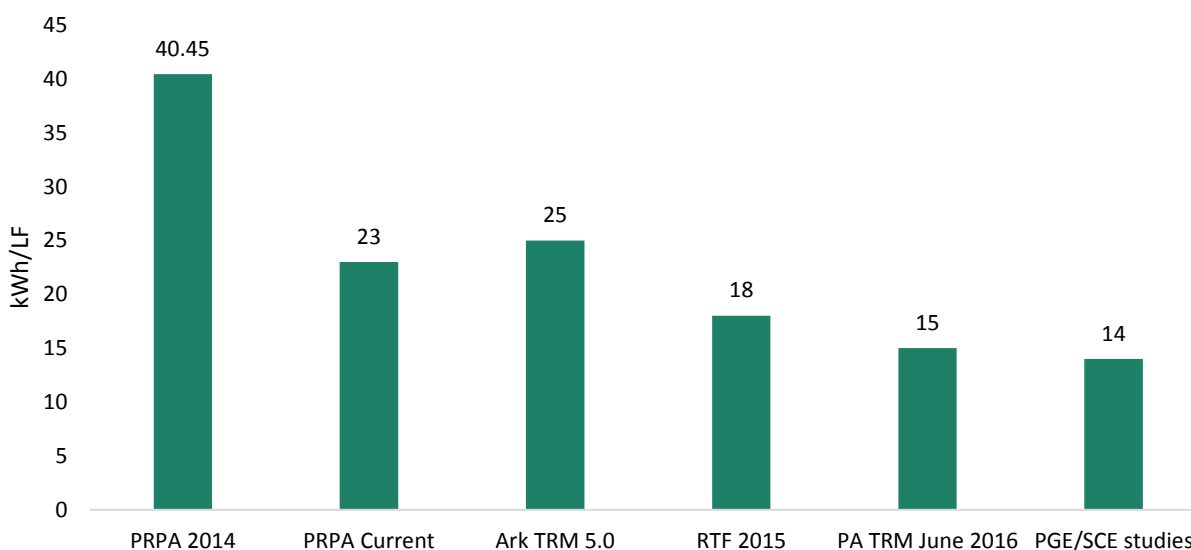
**Table 3-11: Refrigeration Sample Savings and Realization Rates**

Jurisdiction	Ex ante energy savings (kWh)	Ex post energy savings (kWh)	Realization Rate
Platte River (all cities)	226,987	189,107	0.833
Fort Collins only	215,327	180,751	0.839

The ex ante values presented in Table 3-11, and used by Platte River, are taken from the deemed values used by the Regional Technical Forum (RTF)<sup>12</sup> which maintains a database of deemed savings measures. Use of secondary research for selecting deemed savings values is an appropriate approach for the refrigeration measures in the program. Research to date has been somewhat limited, and assumptions such as the baseline effectiveness of the replaced gasket is difficult to quantify without further analysis.

Deemed savings values used to calculate ex post savings were taken from the 2016 Pennsylvania TRM. This document provides values based on updated secondary research which shows a general decrease in savings per linear foot of gasket. As an example, Figure 3-10 compares the deemed savings per linear foot for replacing gaskets on walk-in coolers from various sources. It should be noted that the 40.45 kWh/LF shown in the figure were calculated by the evaluator, but savings were calculated using a per-door savings figure rather than a per linear foot figure.

**Figure 3-10: Comparison of Deemed Savings (kWh/LF) For Replacing Gaskets on Walk-in Coolers**



Platte River and its owner municipalities should continue to monitor and update deemed savings values based on progressing research regarding refrigeration measure savings.

Ex post savings for refrigeration measures are calculated based on reported or observed (during evaluation site visits) characteristics including number of measures and size of doors, and the application of select deemed savings values.

Two projects dominated the sample. Both were gasket projects for large grocery stores. The gaskets on reach-in freezer doors from these two projects made up over 80% of the refrigeration savings from the sample. This highlights the need to ensure accuracy of the deemed savings values attributed to these high impact measures.

<sup>12</sup> "The RTF is a technical advisory committee to the Northwest Power and Conservation Council established in 1999 to develop standards to verify and evaluate energy efficiency savings." (<https://rtf.nwccouncil.org/>).

A revision in treatment of gasket measures also impacted the measure realization rate. In earlier program years, savings and incentive were calculated per door, rather than per square foot or linear foot addressed. Applying revised savings on a square foot or linear foot basis reduced savings for earlier projects.

The evaluation team calculated ex post savings using an average value of 16 kWh/LF and 0.73 W/LF of gaskets for all walk-in and reach-in coolers reflecting the average savings for restaurants, supermarkets, and smaller stores. In like manner, average gasket savings for walk-in and reach-in freezers has been placed at 72.67 kWh/LF and 1.7 W/LF.

Other refrigeration measures, such as strip curtains and auto closers were found to have reasonable ex ante deemed savings values, which we do not recommend updating. Several additional measures such as night covers, EC motors, anti-sweat heater controls, and zero energy doors were not installed during the evaluation period. Since these measures are not used, and thus are low to no impact, no changes to the deemed values are required at this time.

### *Motor Variable Speed Drives (VSDs)*

The Efficiency Works for Business rebate program offers incentives for installing VSDs on motors ranging from 1 to 75 horsepower for fan, pump, and compressor systems. Savings for larger motor VSDs can also be included as a custom measure.

Savings for the measure is calculated by applying a VSD savings factor of 33% to a calculation of estimated motor consumption based on reported operating hours, motor horsepower, quantity, deemed motor efficiency, load factor, and a factor for redundancy. This formula is identical to that found in the Xcel Energy DSM plan. The evaluation team judged this approach to be accurate and calculated ex post gross energy savings using the same algorithm. Ex ante and ex post savings are shown for each jurisdiction in Table 3-12.

**Table 3-12: VSD Sample Savings and Realization Rate**

Jurisdiction	Ex ante energy savings (kWh)	Ex post energy savings (kWh)	Realization Rate
Platte River (all cities)	1,890,727	1,899,369	1.005
Fort Collins only	1,890,727	1,899,369	1.005

While the input assumptions and savings algorithm are reasonable, greater confidence in savings calculations could be gained by obtaining more detail on each VSD-controlled motor, and going forward, the implementer should increase M&V analysis for larger VSD jobs.

The deemed efficiencies included in the savings calculation are drawn from an industry-standard table of NEMA motor efficiencies, but for simplicity the application draws from one permutation of motor type: NEMA Premium, 1,800 RPM, totally-enclosed fan-cooled. While this is a common motor configuration, greater accuracy in savings calculations could be achieved by capturing more detail on each controlled motor and by using the full NEMA table of motor efficiencies. Capturing motor speed (RPM) and enclosure type (open drip-proof [ODP] vs. totally-enclosed fan-cooled [TEFC]) in the

application and using these characteristics to identify deemed motor efficiency could increase the accuracy of savings calculations.

Additionally, deemed savings values assume a 65% load factor for fan motors and 75% for pump motors, as well as a deemed 33% VSD savings. These values might not be representative of actual load and savings and while the general approach for this measure is deemed appropriate, these factors could be further investigated to ensure accuracy.

Providing incentives for motors that exceed minimum efficiencies required by code would offer an additional opportunity for the program. The energy use of the existing equipment could provide baseline energy consumption for these installations because motors tend to have long lives, and can be economically re-refurbished in many cases. This measure could be considered for the future of the program.

### Cooling

The rebate program provides incentives for (1) simple incremental increases in efficiency when replacing standard rooftop units and other cooling equipment, and (2) several additional rebates for various technology upgrades on new and existing cooling equipment. Four cooling projects were included in the sample and 84 occurred in the population. The sampled projects included rebates for efficiency improvements as well as for advanced evaporative pre-cooling and premium ventilation packages.

Ex ante and ex post savings, along with the associated realization rates, are shown for each jurisdiction in Table 3-13.

**Table 3-13: Cooling Sample Savings and Realization Rate**

Jurisdiction	Ex ante energy savings (kWh)	Ex post energy savings (kWh)	Realization Rate
Platte River (all cities)	313,763	300,555	0.958
Fort Collins only	310,925	298,116	0.959

The savings algorithm used to calculate energy savings and demand reduction from high efficiency cooling equipment was deemed accurate, although a single deemed operating hours value was used in the calculation. Instead using a deemed equivalent full load hours (EFLH) based on building type provides an opportunity to increase the accuracy of savings estimates. For instance, two of the reviewed projects involved rooftop unit replacements at hotels. Using an Xcel Energy table for EFLH by building type, lodging would use 677 hours instead of the assumed 1,100 used to calculate ex ante savings for those measures.<sup>13</sup> In other cases, for hospitals for example, the EFLH would be much higher, resulting in higher energy savings. While using an overall, average value, may provide accurate savings estimates in aggregate, it would nonetheless remain important to monitor building type in order to track whether shifting trends in program participation bring disproportionate numbers of buildings with higher- or lower-than average use into the program, potentially affecting overall savings.

<sup>13</sup> Ex post savings was calculated using 677 hours for these two projects.

Data on the type of building in which equipment is ultimately installed may be more difficult to obtain as the program moves to a midstream delivery approach for these measures. Nonetheless, if midstream market actors are required to provide an installation address to ensure the unit is installed in a Platte River owner municipality, they may also be able to report building type.

Savings for premium ventilation packages on new cooling equipment is set at a deemed 360 kWh/ton of cooling.<sup>14</sup> Platte River cited several PEI studies as relevant to this measure, but the evaluation team found no direct citation or correlation for this deemed 360 kWh/ton value.<sup>15</sup> The value is conservative compared to several of the results in the cited studies. The evaluation team recommends reassessing the validity of this deemed value or developing a separate savings algorithm for this add-on measure. No changes were made to ex post savings for this measure.

Ex post savings from the advanced evaporative pre-cooling add-on measure was calculated using a formula from Xcel Energy's 2017/2018 DSM plan. Ex ante savings for these measures was calculated using a nearly identical formula, but several inputs were stipulated. The formula includes factors including capacity, baseline efficiency, and equivalent full load hours, although these factors could have used actual inputs related to the proposed equipment's size and features with little additional effort.

Finally, the evaluation found that not all demand reduction totals from cooling projects were populating in the project tracking database, although program staff report that the project tracking method the program adopted in 2017 addresses this issue. In one of the four projects reviewed, an error in the spreadsheet that rolls up savings for import into the tracking database resulted in the sheet not capturing kW reduction for three of ten line items. This error was corrected in calculating the ex post demand savings.

Platte River and its owner municipalities may benefit from increasing the priority of the cooling efficiency measures in coming program years, as the program has done by introducing a mid-stream HVAC program starting in 2017. The rebate program currently relies on lighting upgrades for the vast majority of savings, and with improvements in baseline efficiencies due to EISA legislation and market factors, savings margins may start to reduce for that measure. With a likelihood of reduced program impacts from lighting projects, cooling measures are a positive choice for increasing their relative impact on the program.

### *Water Measures*

Three water measure projects were reviewed during the evaluation. Evaluated measures implemented under the program include low flow showerheads, low flow toilets, and very low flow toilets. While the deemed savings values for the toilet savings are reasonable and in line with industry standard practice, the savings per showerhead may be overstated by a factor as high as 10. Consequently, the realization rate for the water measures is relatively low at 68%, as shown in Table 3-14.

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<sup>14</sup> Premium ventilation packages typically include premium economizers, CO<sub>2</sub> sensor-enabled demand controlled ventilation (DCV), and variable speed fan control.

<sup>15</sup> "Premium Ventilation Proof of Concept Field Test," Reid Hart, NPCC Regional Technical Forum, October 13, 2009 and "Premium Ventilation Package Testing - Short-Term Monitoring Report - Task 7," Reid Hart, prepared for Bonneville Power Administration, October 12, 2009

**Table 3-14: Water Sample Savings and Realization Rate**

Jurisdiction	Ex ante water savings (gallons)	Ex post water savings (gallons)	Realization Rate
Platte River (all cities)	505,690	344,710	0.682
Fort Collins only	505,690	344,710	0.682

Platte River and its owner municipalities would benefit from revisiting and revising their deemed savings values per fixture for programs going forward. Additionally, there is a need to more completely identify the baseline conditions, such as toilet gallons per flush, and baseline showerhead flow. For example, toilet savings calculations may underestimate water savings because a residential calculation is used for high use building types like schools, clubs, and sorority or fraternity houses.

Gas savings were not captured for at least one showerhead measure, only water savings. There is an opportunity for Platte River to capture gas savings for any water savings measure that reduces domestic hot water use. The Evaluation calculated the gas savings and included this result in the ex post therms reported herein.

### *Other Measures/Projects*

The evaluation review included several other measures, including one building envelope project, one air compressor project, and several projects classified as “other.” Some of these projects had large savings associated with them, but since there were a small number of these types of projects their overall contribution to energy savings was small. Two of the sampled project are specialized and custom.

### Building Envelope

A single building envelope measure was included in the sample and only 18 were completed in the program over the three years evaluated. Overall savings for envelope measures was 205,624 kWh, or less than 0.5% of program savings.

Energy 10 modelling was indicated as the source of the deemed savings values for Efficiency Works’ envelope measure savings calculations. Neither the citation nor the actual model were provided with project files. Some areas of uncertainty for the sampled project include that details of the baseline windows are not known, and HVAC type was unknown, but assumed to be gas heating with electric cooling. Reliability could be increased through more thorough reporting and modelling, or ensuring that documentation is included in the project file. The deemed savings values for windows were compared to values in two other TRMs: Wisconsin and Arkansas. The deemed values were similar to those of these other two TRMs.

No gas savings were reported, and in calculating ex post savings, natural gas savings was added. Gas savings is significant for many envelope measures. Inclusion of gas savings values has two potential benefits for the program. First, if the gas savings are not being claimed by another program administrator that is also supporting the project, they can be included as a benefit in cost effectiveness testing and may be instrumental in showing cost effectiveness. Second, reporting of natural gas savings could help municipalities achieve their goals related to carbon dioxide emissions. For the sampled

project, a realization rate of one was assigned. The resulting values were accepted as the most reliable estimate of savings given the uncertainties mentioned.

### Air Compressor

The sample included one project consisting of the retrofit and reconfiguration of several very large, high pressure blowers at an industrial facility. Although the project addressed a custom, high-pressure blower configuration, and thus was custom in nature, the program categorized it as an air compressor project. While the estimated savings are reasonable and calculations are in keeping with reasonable engineering practice, the calculations are of a somewhat preliminary nature. The project system could be more clearly and comprehensively documented.

Some specific information on this project that would help complete the file include:

1. Schematic diagrams and equipment information, and mechanical drawings, of the pre- and post-retrofit systems. The baseline and post-case system configurations are not described.
2. Description of the retrofit including baseline and post-case systems and their operation. There appeared to be elements of the project that could affect savings, such as motor replacement (including slip factors, efficiency changes, and changes in load) that were not detailed in the file.
3. Description of calculation method, including assumptions and measured data. The approach used to calculate savings is understandable, but some of the data, calculations, and assumptions are not clear.

Projects like this one may not fit well into a prescriptive rebate category. However, clear and detailed files and verifications are important, especially since these measures are complex, less common, and tend to have large savings attributed. Large savings may indicate that a higher level of diligence is required. Clearer project documentation, including construction documents and clear detailed presentation of field conditions, calculations and findings would be warranted.

### Refrigeration

The sample included one large refrigeration project involving two major refrigeration system changes. The reported savings were reasonable, but the methods and assumptions used to estimate them are not well documented in the project file. Additionally, a site visit revealed that the actual scope and location of the project was not adequately described and varied significantly from what the evaluator was first given to understand.

There would be value in working to ensure that the scope and savings are well vetted and reliable, that the assumed baseline is clear and justifiable, and that implementation is as reflected in the project files. Some specific information on this project that would help complete the file include detailed savings calculations for the project. Savings looks reasonable, but this value should be rendered more reliable by including detailed calculations.

### Other

One of the sampled projects fits somewhere between a custom rebate project and a retro-commissioning project that may have fit in the BTU program component. The project is labeled as "Other" in the rebate project tracking database. The project consisted of retro-commissioning and

capital improvements involving reconfiguration of some of the zones served, enhanced control system strategies for large air handling units (supply air temperature resets, unoccupied setbacks), addition of electric dampers, and terminal controls.

A report was included with the project files that details the measures and savings calculations, but leaves several questions unanswered. The report shows a disaggregation of the facility's energy savings, but does not include a description of how that disaggregation was completed. There are individual sections for each recommended measure with detail on overall savings for the measure, as well as system descriptions and characteristics, but the report lacks detail on actual savings calculations for each component of the project.

Some of the savings estimates were speculative (for example, actual allowable reset schedule reduction in duct pressure are not known) and it would be beneficial to determine via post-installation M&V if the final scope reflects or differs from the retro-commissioning study. The project scope is described in a retro-commissioning report, but is not fully defined. It would also be useful to include mechanical drawings to better understand the affected systems. Specific information on this project that would help complete the file include savings calculation spreadsheets and related information, and a detailed post installation verification report documenting the actual scope that was implemented.

The project claimed 160,280 kWh in energy savings. This project has a level of uncertainty in the measures implemented and therefore the savings. Despite uncertainty in the savings calculations and implementation status, ex post savings was set equal to ex ante.

### 3.3.2.3. Overall Rebate Program Gross Savings Analysis

Realization rates at the measure level are provided in the previous sections, but program level realization is the most important element of a portfolio evaluation. To calculate a final program-level realization rate, ex post energy savings for each sampled project was added together to obtain a total ex post energy savings for the sample group. That number was divided by the ex ante energy savings for the same sample group to obtain a program-level realization rate, as shown in Table 3-15.

**Table 3-15: Sample Overall Energy Savings and Realization Rate**

Jurisdiction	Ex Ante Energy Savings (MWh)	Ex Post Energy Savings (MWh)	Realization Rate
Platte River (all cities)	14,097	14,515	1.030
Fort Collins only	11,008	11,347	1.031

Once a program-level realization rate was established using ex ante and ex post savings from the sample group, that realization rate was applied to the overall program savings to determine a final ex post gross energy savings for the population. This was done for Platte River as a whole and for Fort Collins separately, as shown in Table 3-16.



**Table 3-16: Efficiency Works for Business Rebate Program Total Gross Savings**

Jurisdiction	Ex Ante Gross Energy Savings (MWh)	Ex Post Gross Energy Savings (MWh)	Realization Rate
Platte River (all cities)	50,811	52,317	1.030
Fort Collins only	29,381	30,286	1.031

Overall, the evaluation team found that approximately 3% greater energy savings should be attributed to the rebate program for the 2014 - 2016 program years.

#### 3.3.2.4. Net Savings Analysis

Net energy savings is calculated by applying a net-to-gross ratio to the ex post gross energy savings for the program (Table 3-17). Using the net-to-gross ratio estimation methodology described in Section 2.3, the team estimated program free-ridership at 26%. About one-third of participants (35%) reported conducting non-incentivized efficiency upgrades; scaling these reported upgrades to account for program attribution, program-induced spillover occurred among 25.8% of participants. It is challenging to assign savings estimates to nonresidential spillover due to the relatively few actions with deemed savings, as compared to the residential sector. Accordingly, the team turned to nonresidential sector spillover research conducted for a Midwest regulated utility.<sup>16</sup> That spillover research used a comprehensive methodology outside the scope of the current study that included both participant and nonparticipant spillover estimated from detailed surveys with customers, distributors, and contractors. The study generated an estimate of nonresidential lighting spillover of 12.7%. We adopted this figure as a conservative estimate of Efficiency Works Business spillover across all measure types. Taken together, the free-ridership and spillover estimates yield a net-to-gross ratio of 86.4%.

**Table 3-17: Rebate Program Net Savings**

Jurisdiction	Ex Post Gross Energy Savings (MWh)	Net-to-gross Ratio	Ex Post Net Energy Savings (MWh)
Platte River (all cities)	52,317	0.863	45,149
Fort Collins	30,286	0.863	26,137

## 3.4. Process Evaluation Findings

### 3.4.1. Participant Profile

The majority of surveyed businesses were small to medium in size, both in terms of number of employees and number of locations (Table 3-18). During in-depth interviews, contractors also reported that they primarily worked with small and medium-sized businesses on Efficiency Works projects.

<sup>16</sup> This research was presented in a peer-reviewed paper for an evaluation conference and is included in Appendix F.

**Table 3-18: Size of Participating Businesses: Number of Employees**

Size of Firm	Participant Type		
	Audit Only (n=10)	Audit & Rebate (n=46)	Rebate Only (n=33)
<b>Number of Employees</b>			
1 to 9	40%	54%	18%
10 to 19	10%	15%	24%
20 to 99	50%	13%	27%
100 or more	0%	15%	12%
DK or Prefer not to answer	0%	2%	18%
<b>Number of Locations</b>			
1	90%	41%	36%
2 to 9	10%	26%	27%
10 to 19	0%	7%	3%
20 to 99	0%	7%	6%
100 or more	0%	7%	18%
DK or Prefer not to answer	0%	13%	9%

The surveyed participants were relatively evenly distributed across industries, with no more than 16% reporting they represented any single industry. Retail (16%) was the most common industry reported, followed by religious (11%), food service (10%), and health care (10%).<sup>17</sup> During in-depth interviews, most contractors said Efficiency Works Business participants represented an even mix of commercial spaces including retail stores, office buildings, medical facilities, and car dealerships.

### 3.4.2. Contractor Profile

The interviewed contractors were relatively experienced with the program, as most of them (7 of 9) had been submitting EW-B rebates for more than six years (Table 3-19). About half of the contractors (5 of 9) reported their business had grown as a result of their work with the EW-B program. These contractors appeared to be more active with the program, as all five of them reported 25% or more of their jobs earn rebates through the program. Most contractors (6 of 9) worked in all four communities where the program is available. Two worked in three of the four communities and the last contractor worked only in Loveland and Fort Collins.

<sup>17</sup> See Appendix H.1 for complete description of participating businesses.

**Table 3-19: Experience as an Efficiency Works Business Contractor (n = 9)**

Length of Time	Number of Contractors
Seven to nine years	4
Five to six years	3
Three to four years	2

Most contractors (7 of 9) reported that roughly a third of their work or less goes through the EW-B program (Table 3-20).

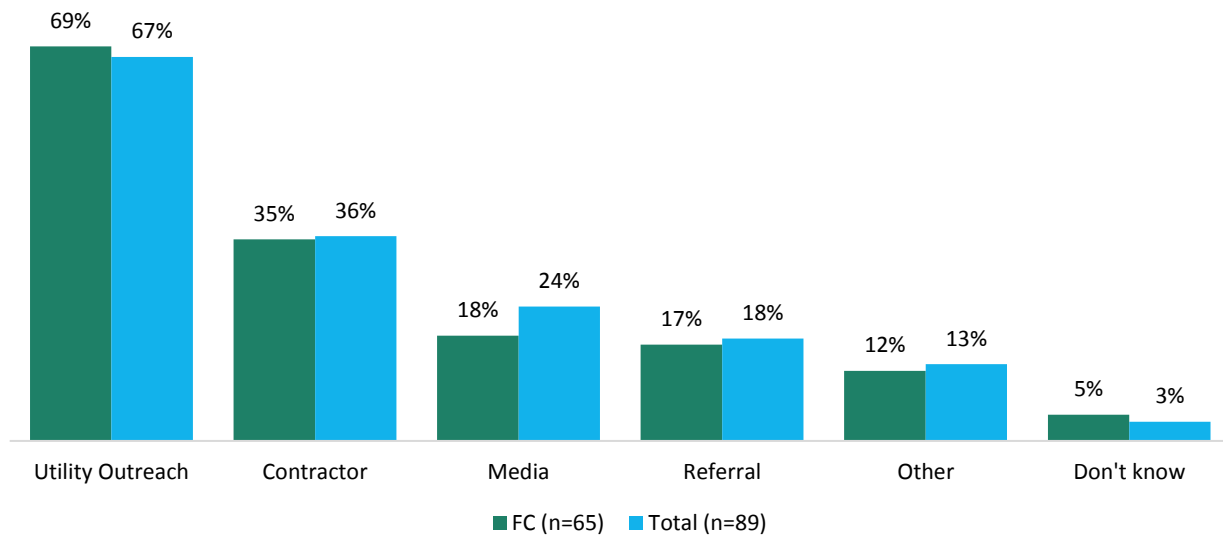
**Table 3-20: Proportion of Efficiency Works Business Projects(n = 9)**

Percent of Projects with EW-B Rebates	Number of Contractors
75 to 100%	2
25 to 35%	4
5 to 8%	3

### 3.4.3. Overall Program Awareness

While participants value the program's current outreach channels, there may be opportunities to more closely align outreach with business owners' preferred information sources. Fort Collins Utilities participants most often became aware of Efficiency Works Business through utility communications, like an email, newsletter, or bill insert (Figure 3-11). Participants from Platte River's other owner municipalities more often reported learning about the program from a contractor. Overall, the top awareness sources among participants are relatively consistent with how they want to learn about Efficiency Works. Most participants (71%) said the best way to inform businesses like theirs about Efficiency Works opportunities is through utility sources, particularly through a utility email, newsletter, or bill insert.

There may be an opportunity for the program to more effectively draw on social media; no respondents reported learning about the program through social media, but 19% cited it as the best channel to inform businesses like theirs about Efficiency Works. Findings also suggest that, while Efficiency Works Business is a contractor-driven program, non-contractor-led outreach efforts remain important. Participants more often reported learning about the program from a contractor than they reported contractors being the best way to learn about the program.

**Figure 3-11: Sources of Program Awareness\***

\* Utility outreach sources include: utility email, newsletter, or bill insert, utility website, and utility representative.  
 Referral sources include: other businesses, friend or family member, and coworker.  
 Media sources include: social media, advertisement on a website, and online search.

Four contractors agreed that a lack of awareness was a primary reason why more businesses do not participate in the Efficiency Works Business program. One elaborated, saying that small electrical contractors do not have the resources to market the program to their customers, and, as a result, businesses that work with these contractors may not learn about the program. To overcome these barriers, these contractors suggested increased marketing, particularly targeted marketing to small- and medium-sized businesses. Program staff noted that one way the program seeks to build awareness is by providing marketing materials for program contractors to use.

### 3.4.4. Efficiency Works Facility Assessments

#### 3.4.4.1. Assessment Motivations

Businesses are motivated to conduct facility assessments primarily for cost savings, though some non-energy benefits motivated many participants as well. Most businesses that received an assessment were motivated by the monetary benefits of the energy efficiency audit (Table 3-21), primarily stating they were interested in reducing their energy bills (89%) or energy waste (75%). Some non-energy benefits, like helping the environment (61%) or their community (48%) were less commonly cited than financial motivations, but still important to a notable number of participants.

**Table 3-21: Motivations for Having an Energy Assessment Performed\***

Motivation	Total (n=56)
Reduce energy bills	89%
Reduce energy waste	75%
Do your part to help the environment	61%
Do your part to help your community	48%
Learn about my business' energy usage	36%
Improve the appearance of my space	25%
Increase comfort of my space	23%
Other	4%
Don't know	0%

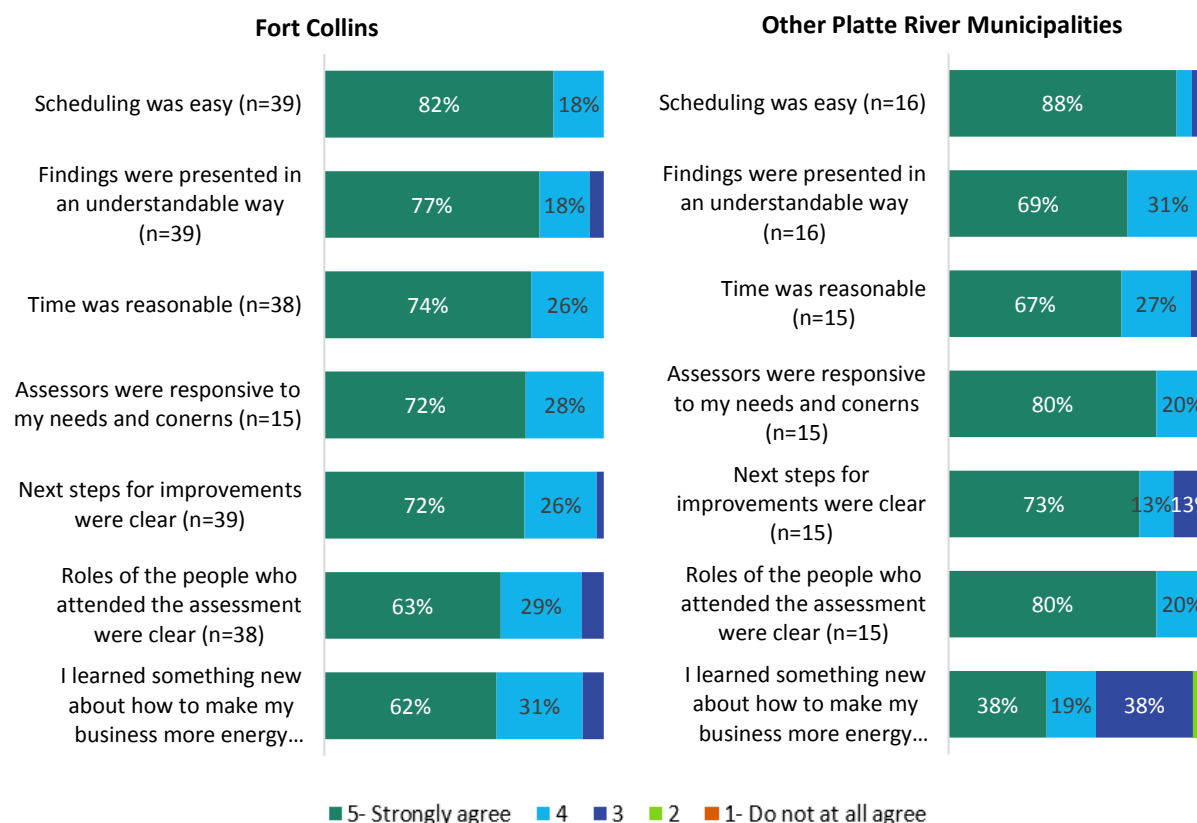
\* Multiple responses allowed.

During in-depth interviews, auditors gave a variety of reasons as to why customers are interested in having an energy assessment performed, which were largely consistent with participants' responses. These include:

- › Learning about upgrade opportunities that are low-to-no-cost or have short paybacks,
- › Corroborating what a contractor promised an upgrade could achieve, and
- › Learning how to reduce utility bills, which auditors noted was particularly important for small and medium businesses.

#### 3.4.4.2. Assessment Process

**The facility assessment process generally works well for participants.** Most participants who received a facility assessment reported a positive experience with all elements of the audit process. The ease of scheduling the facility assessment received the highest ratings among participants from all of Platte River's owner municipalities (Figure 3-12). Participants who received an Efficiency Works facility assessment were satisfied with the experience and would recommend the service to other businesses. The interviewed auditors reported that businesses had a few concerns about the audit process, including how long the walk-through would take and how long it would be before they received rebates for installing efficient equipment. Participants gave the lowest ratings to the statement that the audit taught them something new about how to make their businesses more energy efficient.

**Figure 3-12: Perceptions of the Audit Process\***


\* Excludes respondents that refused to answer or replied, "Don't know"

The majority of participants reported they were very satisfied with the audit process. Most did not recommend any improvements, with roughly a third of those (21% of all respondents) explicitly noting that the process had worked well. Participant survey findings indicate that the factors preventing participants from moving forward with upgrades are largely external to the audit process. Relatively few participants reported that changes to the audit process could have encouraged them to move forward with more recommended measures (Table 3-22). Those that did offer recommendations most often suggested that offering more or larger rebates would have increased the affordability of the measures and allowed them to move forward with more recommendations.

**Table 3-22: Open-Ended Participant Suggestions for Improving Audit Process**

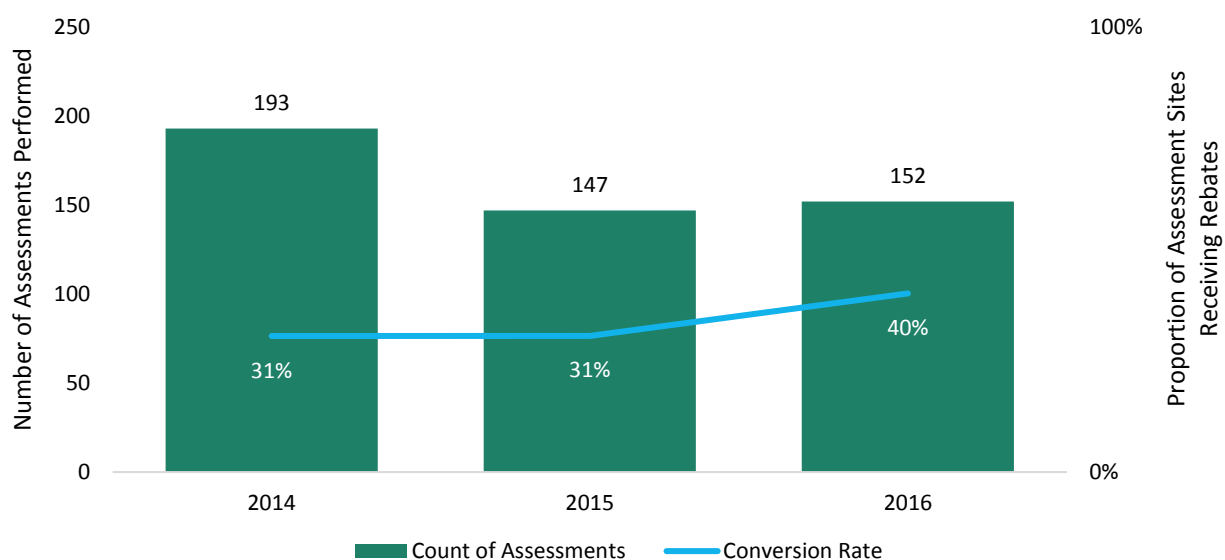
Audit Improvements	Percent (n= 33)
No suggestions offered	60%
Offer more or larger rebates to improve affordability of projects	15%
Present more advanced recommendations or detail	9%
Other	15%

**The facility assessment process differs across utilities, and auditors were mixed on which way works best.** The process of scheduling audits and following-up with audit recipients is different between Fort Collins and Platte River's other owner municipalities. In Fort Collins, Utilities staff schedule the audits for the auditors. As a result, the auditor's first direct contact with the participant occurs during the audit. While auditors working in Fort Collins reported this process works smoothly, it prevents auditors from having a conversation with participants prior to the audit. One interviewed auditor noted that these pre-audit conversations, which address the participant's motivations and concerns, can be beneficial as they give the auditor "a flavor what to expect." Outside of Fort Collins, the auditors work more directly with the participant to schedule the audit, send the audit results to the participant directly, and follow up with the participant.

During a facility assessment in Fort Collins, a Fort Collins account representative and water efficiency expert will walk through the facility with the business owner and auditor. In the other cities, auditors reported they are typically alone with the business owner unless the business is one of the utility's key accounts, in which case the utility may send an account representative. The auditors did not report any negative feedback from customers in Fort Collins about having several people attend the walk-through. The interviewed auditors noted that having Fort Collins Utilities representatives attend the audit occasionally slowed the process because more people naturally bring up more questions. At the same time, the auditors noted it was an advantage to have the Fort Collins Utilities representatives at the walk-through because they could help with any customer relations issues or questions. By addressing these questions, the auditors noted that Utilities staff could help to maintain or strengthen relationships between account representatives and their customers. Participant survey findings also did not indicate challenges arising from having additional utility representatives attend the audit. A large majority of participants agreed that the roles of everyone attending the assessment were clear (see Figure 3-12, above).

### 3.4.4.3. Uptake of Assessment Recommendations

**Program data suggests that approximately a third (34%) of the facilities that received assessments between 2014 and 2016 received Efficiency Works rebates for installing efficient equipment** (Figure 3-13). The surveyed participants reported greater uptake of audit recommendations, with almost all (91%) facility assessment participants reporting installing at least some of the measures their audits recommended, and 43% reporting completing all of the recommended measures. One potential cause of the higher conversion among survey respondents is that program records indicate that 8 of the 56 survey respondents who reported receiving facility assessments received Business Efficiency Grants. Assessments were required for participants to receive the grants.

**Figure 3-13: Assessments Completed and Proportion of Assessment Sites Receiving Rebates by Year, from Program Data**

**Lack of funds and low anticipated return on investment prevent some Efficiency Works participants from completing all the measures recommended in their audits.** Reasons for not installing all of the recommended lighting and non-lighting measures were primarily related to financial barriers, where at least three-quarters of respondents reported the improvements were either too expensive or did not offer enough return on investment (Table 3-23). A smaller proportion of businesses reported they had recently upgraded their equipment or they didn't have enough time to install the recommended equipment.

**Table 3-23: Barriers Hindering the Installation of Recommended Equipment\***

Reason	Lighting Measures (n=14)	Non-Lighting Measures (n=25)
Too expensive	43%	60%
Not enough return on investment	36%	28%
Recently upgraded	14%	16%
Not enough time	7%	8%
Other	14%	12%
Don't know	0%	4%

\* Multiple responses allowed.

Consistent with participants' survey responses, more than half of the interviewed contractors (5 of 8) cited financial barriers as a main reason why more businesses do not make upgrades. Contractors noted that competing priorities can also be a barrier. Contractors stated that, in some cases, other necessary projects take precedence over energy efficiency upgrades, and, in others, the tenant would rather spend



a smaller amount of money to keep old equipment running than spent a larger sum of money to replace the equipment. Another contractor suggested that some businesses may not participate because the lighting incentives do not cover as much of the project cost as they used to.

The interviewed Efficiency Works auditors had little involvement with participants' ultimate decision to move forward with the recommended upgrades. Nonetheless, both interviewed auditors speculated that after financial barriers, limited time and staff resources was a significant barrier. To alleviate this barrier, both auditors said they offer to help businesses identify contractors and get bids, although they are unable to provide this assistance for every project. These auditors noted that Fort Collins Utilities staff provide this type of support for customers in Fort Collins, taking the role, to some extent, of an energy concierge to hand-hold the businesses through the process and ensure their project comes to fruition. The auditors reported this type of hand-holding is valuable.

**Contractors rarely use audit results when completing projects that qualify for Efficiency Works – Business Rebates.** Program data suggest approximately one fourth (24%) of the properties at which Efficiency Works Business rebate projects occurred in 2015 and 2016 received facility assessments through the program. This number exceeds interviewed contractors' estimates. All of the interviewed contractors who provided estimates (5 of 5) reported that five to ten percent of their projects received an audit through the program prior to installing rebated measures.<sup>18</sup> Potentially explaining their underestimation of the prevalence of audits, none of the interviewed contractors (0 of 8) reported regularly using Efficiency Works Business audit results in their work. The interviewed lighting contractors stated that they perform their own lighting audit as part of the sales process. Two lighting contractors noted that they do not use audit results because the program does not send the results to them.

Contractors that had reviewed audit result reported they did not find them useful. The two contractors who reported receiving results from audits done through the program were critical of the auditors' recommendations. One reported encountering audit recommendations that would not work mechanically in the building. This contractor noted that when he has to give the participant decisionmaker information that conflicts with the auditor, "it erodes the decisionmaker's confidence in the program." For this reason, he said the "soft approach" of offering ideas and later talking with a contractor, used by most auditors, is a better than a hard sell.

A lighting contractor reported encountering situations in which auditors' knowledge of lighting technologies appeared out of date. This contractor reported that addressing inaccuracies in audit reports had made it difficult to meet customer expectations while correctly installing the most appropriate technologies. This contractor also reported a perception that facility assessments steered people away from lighting upgrades, which he viewed as a mistake because lighting projects contribute a large percentage of program savings. As a result of these challenges, he reported his firm has chosen to do fewer EW-B projects.

Finally, two lighting contractors noted that customers frequently have facility assessments after committing to lighting upgrades. These contractors reported that often, after they sell the customer on a lighting project and submit the pre-approval form to Platte River, program staff ask the contractor if they can approach the customer to do an audit and discuss non-lighting measures.

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<sup>18</sup> The other three contractors said they did not know what percentage of sites had an audit through the program first.

#### 3.4.4.4. Awareness of Assessments Among Businesses Not Receiving Them

**Most “rebate-only” participants were aware of Efficiency Works’ facility assessments.** Among participants who received rebates but did not receive an energy audit, almost three-fourths (71%) were aware the program offered energy assessments.

**Among businesses that were aware of the energy assessment, the most prominent reason for not scheduling one was failure to find the value proposition of the audit compelling.** Over one-fourth of businesses that only received rebates reported they were unaware that their utility and Efficiency Works Business offer facility assessments (Table 3-24). Other common reasons for why businesses did not conduct energy assessments were because they were already aware of the actions they could take to save energy in their workplace (19%) or they did not have the resources required (time and effort) to schedule an audit (16%). Several respondents elaborated in open-ended “other” responses that they could not remember if they had received an audit.

**Table 3-24: Barriers Hindering the Scheduling of EW-B Energy Assessments\***

Reason	Percent (n=31)
Unaware they were available	29%
My business is already aware of the actions we could take to save energy	19%
My business is unable to devote the time and effort required	16%
Efficiency is not a priority for my business	3%
My business is not convinced the information gained will be worth the time and effort required	3%
Could not recall if audit was conducted or had one years ago	13%
Other	6%
Don't know	13%

\* Multiple responses allowed.

Participants who received an energy assessment reported they believe other businesses don’t take advantage of Efficiency Works energy audits because they are not aware of them (84%), they are not convinced the information they gain will be worth the time and effort required (46%), or they are unable to devote the time and effort required to complete an assessment (38%). These reasons are consistent with the reasons reported by participants who did not receive an energy assessment, where lack of awareness was the largest factor deterring businesses from scheduling an audit.

#### 3.4.4.5. Remaining Opportunity in Commercial Lighting

**Contractors and auditors reported a lot of opportunity left to convert commercial buildings to efficient lighting, though conversions may be getting harder.** Both contractors (5) and auditors (2) reported considerable remaining opportunity in the commercial lighting market to replace interior and exterior lights with LEDs. One contractor and one auditor each estimated that 95% of the buildings they work on include LED lighting measures. Another contractor estimated there are three-to-four years of

opportunity left to replace other lighting technologies with LEDs. Two respondents noted that they still see T-12 fluorescent lamps at businesses and one elaborated to say that T-12s are still in stock at some supply houses.

One auditor noted that it will be more challenging to convert facilities with CFLs to LEDs due to the small energy savings that can be captured, and a contractor said that many businesses that have not yet switched to LEDs likely face barriers to doing so that will make them hard to convert. This contractor gave the highest reported saturation of LEDs among the contractors interviewed, at 70 to 80% of businesses.

Lighting was the most common measure type recommended to businesses, though many participants installed only some of the lighting measures recommended (Table 3-25). Both interviewed auditors mentioned that some businesses were wary of new lighting technologies because of poor experiences with newly-installed lighting in the past, making them hesitant to move forward with lighting projects. Notably, lighting was also the most common measure participants reported installing without receiving a rebate from Efficiency Works; almost three-fourths of assessment and rebate participants reported they bought additional energy efficient lighting equipment and did not apply for a rebate.

**Table 3-25: Measure Types Recommended but Not Installed by Energy Assessment Participants**

Measure Type	Fort Collins Utilities (n=40)	Total (n=56)
Lighting	25%	25%
Cooling equipment	25%	20%
Insulation or windows	18%	16%
Food service equipment	15%	13%
Grocery display cases or refrigerated warehouses	5%	7%
Office equipment and appliances	8%	7%
Variable frequency drives (VFDs)	10%	7%
Water-saving measures	13%	11%
Business Tune-up (BTU) Retro-commissioning	8%	5%
Other	5%	5%

### 3.4.5. Efficiency Works Incentives

#### 3.4.5.1. Program Outreach

**Efficiency Works Business projects are largely driven by contractors.** Almost half (46%) of participants who completed an energy efficiency project used a contractor that they had previously worked with, while a small proportion (less than 10%) found their contractor through an Efficiency Works resource (Table 3-26). Further, some participants (9%) reported the contractor had initiated the contact by visiting their work location. Of the seven participants who had used Efficiency Works resources to find

their contractor, five agreed that the process of finding a contractor was easy and two reported they were unsure.

**Table 3-26: How Participants Found Their Contractors**

Source	Percent (n=79)
Had worked with the contractor previously	46%
Referral	16%
Contractor initiated contact through a site visit	9%
Efficiency Works assessment	8%
Installed improvements themselves	4%
Efficiency Works website	1%
Other	9%
Don't know	8%

Contractors interviews are consistent with participant survey findings, in that contractors reported their jobs are most often generated through existing relationships with customers (3 of 8), referrals from existing customers (5 of 8), and marketing (5 of 8). Two contractors reported that the program has referred customers to them, though both said that this was rare. Program staff also reported that EW-B participation was largely contractor-driven.

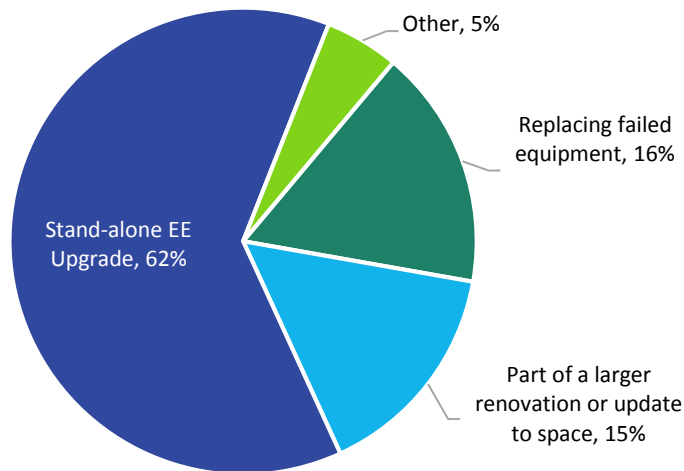
In an open-ended response, one of the interviewed contractors reported that the program's practice of occasionally offering a 50% incentive bonus on lighting measures can bring contractors from outside of the region, who this contractor believes complete lower-quality work, to Platte River's owner municipalities. This contractor stated that competition from these outside contractors made it more difficult for his firm to take advantage of the bonus incentives. He reported that, when he re-contacted customers who had chosen not to move forward with projects for financial reasons when standard incentives were available, many reported other contractors had already contacted them and were not receptive to his outreach.

This contractor suggested the program could benefit by giving existing contractors priority when offering bonus incentives. He said, "We've been in the program for a long time and we're rooted in the communities. We want to see people like us get a chance at this bonus money before it's released to others because it draws others from out of the area who don't offer a warranty or aren't in the area after installation, and that is damaging the reputation of Efficiency Works."

**Contractors use marketing that emphasizes energy efficiency as a primary message.** All five contractors who market their services say that energy efficiency is a primary part of the message. Contractors reported that secondary messages include how much money the customer can save via energy savings and via the rebate (2 respondents). Another includes messages about maintenance savings and "investment potential."

**Most Efficiency Works Business projects are standalone energy efficiency upgrades.** Almost two-thirds (62%) of businesses that received Efficiency Works rebates installed measures as part of a standalone energy efficiency upgrade (Figure 3-14). The remainder were divided between those who needed to replace failing equipment and those who were conducting a larger renovation, of which the upgrades were a part. During in-depth interviews, all eight interviewed contractors reported that most (at least 80%) of their Efficiency Works projects are standalone projects, not part of a larger remodel or new construction project. One contractor suggested that standalone projects are easier for the business's accounting purposes and to measure the return on investment.

**Figure 3-14: Reasons for Conducting Upgrade Project (n= 79)**



### 3.4.5.2. Participant Motivations

**Most businesses complete upgrades to achieve cost savings.** Businesses reported choosing to have energy efficient equipment installed for their projects because of the financial benefits of the improvements, either due to the availability of utility rebates (75%) or the payback on investment (58%) (Table 3-27). While relatively few respondents reported installing new measures to replace failed equipment, a larger number indicated that the age or condition of the existing equipment was a motivator in their selection of an efficient alternative.

**Table 3-27: Motivations for Installing Energy Efficient Equipment\***

Motivation	Total (n=79)
Availability of utility rebates	75%
Payback on investment	58%
Age/condition of existing equipment	47%
Recommendation from a vendor/supplier	38%
Previous experience with a similar efficient measure	25%
Previous experience with the utility program	20%

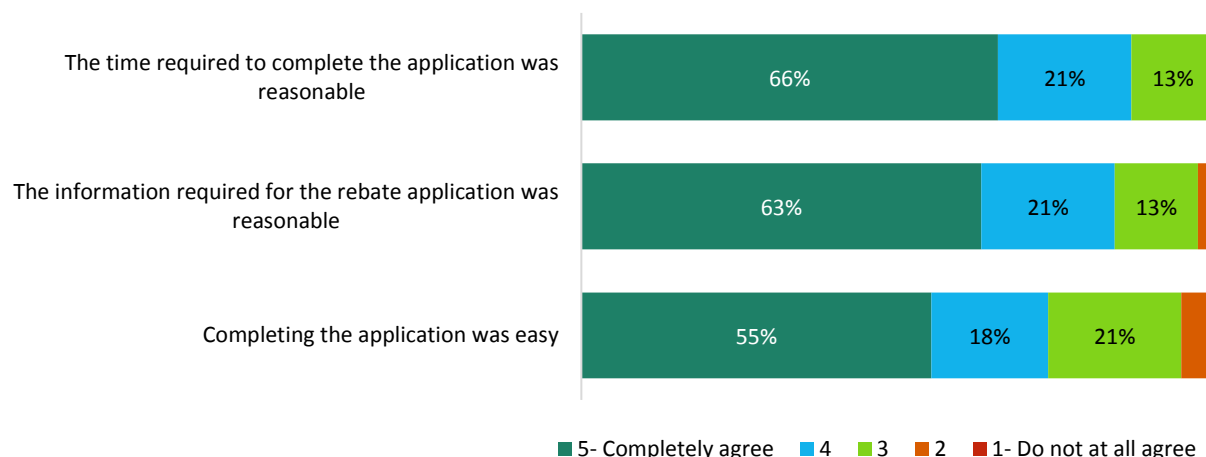
Motivation	Total (n=79)
My business's policies/standards require energy efficient equipment	10%
Other	6%
Don't know	1%

\* Multiple responses allowed.

### 3.4.5.3. Participation Process

Overall participant satisfaction was high with the rebate application and pre-approval processes. Participants were highly satisfied with the application process (Figure 3-15). Of the rebate recipients who completed the application themselves (49%), most perceived the length (87%) and the information (84%) required to complete the application to be reasonable. The ease of completing the application received slightly lower ratings among participants, where one-fourth gave a “2” or “3” rating on the 5-point agreement scale. Most of the participants who provided a lower rating for the ease of the application also gave slightly lower ratings on both the information required for the application as well as the time required to complete it, indicating the ease was lowered by these elements.

**Figure 3-15: Participant Perceptions of the Rebate Application Process (n=38)**



\* Excluded respondents that refused to answer or replied, “Don’t know”

Efficiency Works requires custom projects and projects with rebates exceeding \$1000 to undergo a pre-approval process before the energy efficiency improvements can be installed. Over half (58%) of the surveyed businesses who received rebates were aware that their project had required pre-approval.<sup>19</sup> Of those that experienced the pre-approval process, over half (59%) said the process did not cause any delays in their project. Most of the rest (26%) reported the process caused project delays of a few weeks or less, while few (4%) reported a delay of a few months and 9% did not know the extent of their project

<sup>19</sup> 18% of businesses were aware that their project had not required pre-approval, while 24% were unsure.

delays. Program records indicate that only one of the participants that reported project delays was a Business Efficiency Grant recipient, suggesting the assessments associated with these grants were not a major cause of delays. The interviewed contractors confirmed that the pre-approval process did not cause problems or significant delays. The majority of contractors (6 of 9)<sup>20</sup> reported that delays occurred only occasionally and were typically one to two days.

**Contractors who participated frequently found the application process accessible and easy to complete, while those with less experience found it challenging.** About half (5 of 9) of interviewed contractors said the application was very easy to use with its drop-down menus and links between sections that pre-fill in duplicate information, such as the project address. Those who liked the application said they use it frequently. Four contractors who reported using the application infrequently reported challenges to filling out the application. One of them said it took him “a long time to understand the whole process.” The challenges these contractors reported related to staying up-to-date with the application, entering detailed information, and the incentive amounts. We elaborate on each below.

- › **Staying up to date:** Two contractors reported the perception that the application is “constantly changing,” with one describing efforts to use the latest rebate application form only to find out there was a newer version available.
- › **Detailed information:** One contractor stated that the Efficiency Works Business application requires more detailed information than other utilities typically require. Contractors indicated that the Efficiency Works application uses equipment- and site-specific details to calculate savings values specific to each project to a greater extent than other programs they had used, which draw on assumptions and deemed values to a greater extent in their savings estimates.
- › **Incentive improvement:** Contractors reported that Efficiency Works’ approach to determining lighting incentives by calculating the wattage reduction encourages the greatest reduction in energy usage possible. However, lighting contractors said this approach provides the greatest incentive to businesses that have long used inefficient technologies, while providing less of an incentive for businesses to upgrade from older efficient technologies to the latest ones. The interviewed contractors also suggested that higher incentives would increase uptake of LED tubes and lighting controls in particular.

Despite these difficulties, nearly all contractors (8 of 9) mentioned, unprompted, that when they encounter challenges, Efficiency Works staff are quick to answer the phone and willing to help resolve the issue. The contractors spoke very positively of the EW-B staff saying that they are responsive, knowledgeable, helpful, “fantastic to work with,” and “care about their jobs.”

**Rebate participants were highly satisfied with their experience in installing energy efficiency improvements and receiving a rebate.** In all cities, large majorities of participants were satisfied with all elements of the project experience (Figure 3-16). Consistent with their satisfaction ratings, 99% of participants reported they would recommend efficiency rebates from Efficiency Works to other businesses. Despite mostly high satisfaction ratings, participants in Fort Collins reported somewhat

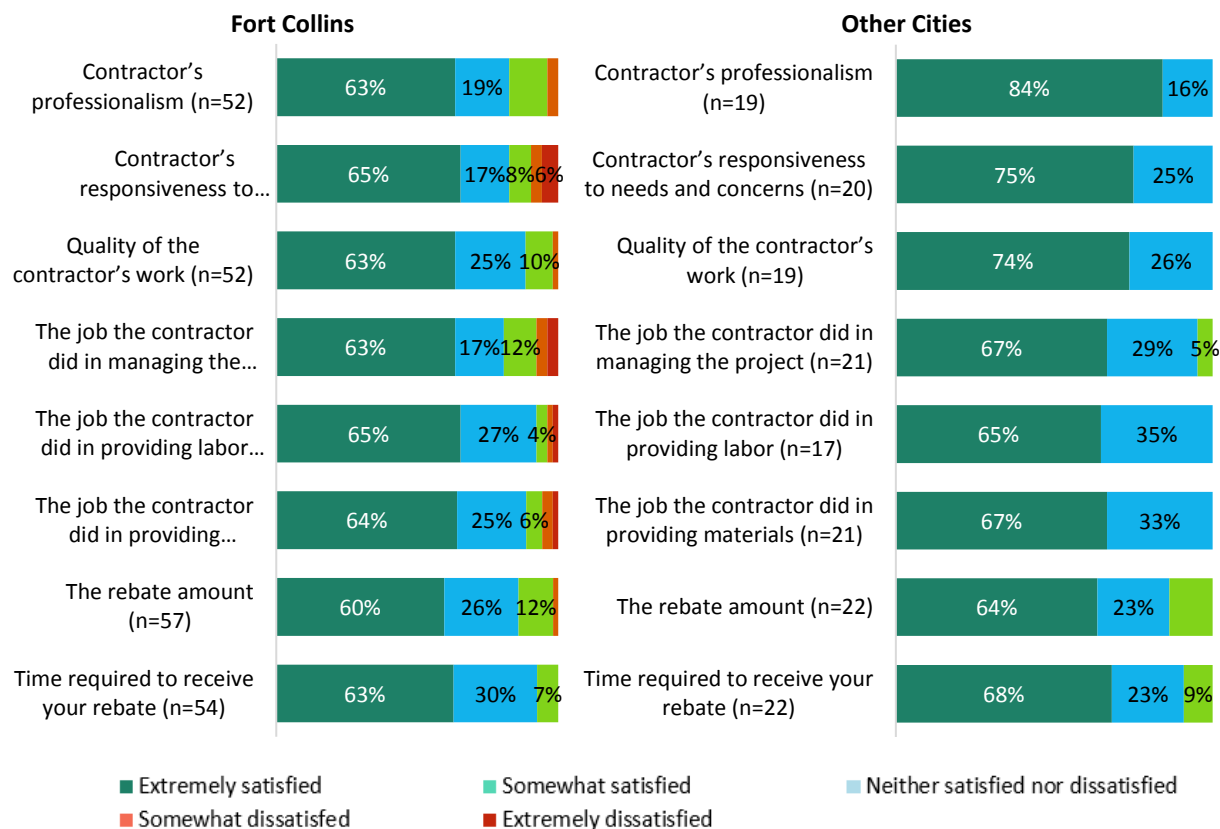
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<sup>20</sup> A seventh contractor said that pre-approval delays were “such a job by job individual answer that I can’t give you a blanket answer.” The eighth contractor said he did not know if pre-approval delayed projects because in his experience that is “something the customer drives.” Finally, the ninth contractor said that it was his understanding that he does not have to get pre-approval anymore as of this year.

lower satisfaction with the measure installation process. Several Fort Collins respondents reported low satisfaction with almost all elements of the project experience, especially with their contractor. Specifically, almost 10% of Fort Collins participants were dissatisfied with the contractor's responsiveness to their needs and concerns and the job their contractor did in managing their project.

Further investigation revealed that the same contractor had installed measures for many of these dissatisfied Fort Collins respondents. Of nine businesses that used this contractor, six reported low-to-medium satisfaction with their experiences working with the contractor. In each element related to the contractor experience, these respondents make up a notable portion of the respondents who expressed low-to-moderate satisfaction. On average, roughly 15% of Fort Collins participants did not report high satisfaction across all of the contractor items. Of these dissatisfied respondents, roughly half had used the same contractor (for each item, the proportion of who had used this same contractor ranged from 44% to 67% of the dissatisfied respondents).

**Figure 3-16: Rebate Recipient Satisfaction with EE Project Experience**



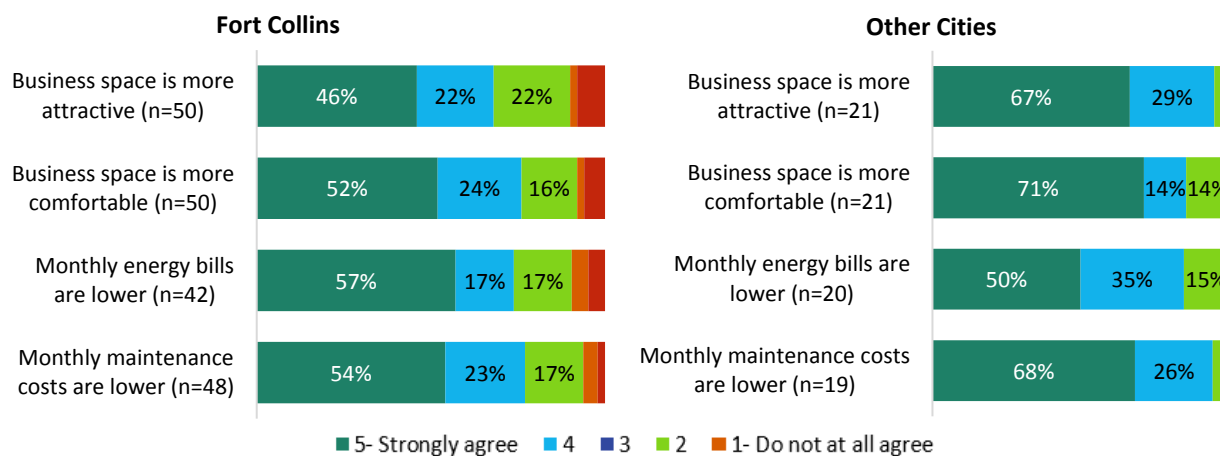
\* Excluded respondents that refused to answer or replied, "Don't know"

**Overall, most participants were satisfied with their experience after the energy upgrades were installed.** At least three-fourths of both Fort Collins participants and those in the other Platte River municipalities agreed that their business space is now more comfortable following the upgrades (Figure 1 5). Similar proportions of respondents agreed that their monthly maintenance costs are lower, their business space is more attractive, and their monthly energy bills are lower. However, around 10% of



Fort Collins Utilities customers did not agree that their business space is more attractive or comfortable, nor are their energy bills lower following their energy efficiency project. These responses were not related to participants' responses regarding their experience with their contractors.

**Figure 3-17: Participant Experience Following Upgrade**



**Few challenges emerged with Efficiency Works Business's quality assurance processes.** Almost all of the interviewed contractors who had experience with the program's quality assurance process (5 of 6) reported their experience had been positive. They reported that the quality assurance findings were reasonable and presented in a constructive way. According to one contractor, "They don't make you feel like they're grading you when you walk around. You just show them what you did and make sure it all jives with the application. It's very easy."

The one contractor who reported a minor challenge said that sometimes program staff can be slower to follow-up with the participant than this contractor would prefer. This contractor reported they may not learn about participant concerns for three or four months. The contractor recommended that the follow-up with the participant occur sooner after the project is complete so that the contractor can resolve the problem quickly.

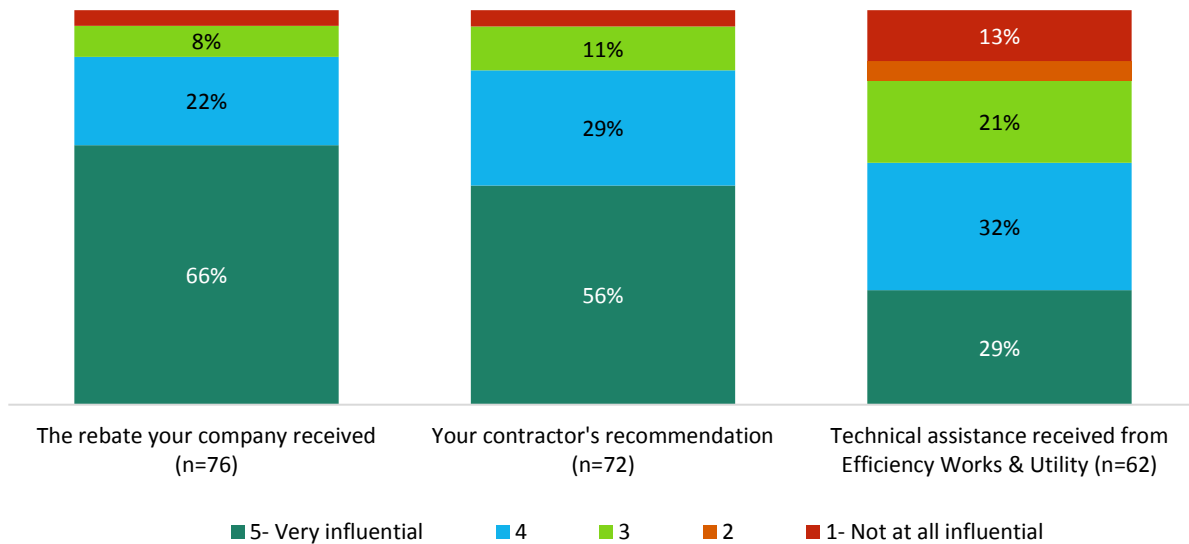
#### 3.4.5.4. Influence of Incentives on Measure Uptake

**Rebates motivated and enabled participants to complete their energy efficiency projects.** The majority (78%) of participants reported they would not have been able to conduct the same efficiency upgrades without the rebate. Further, of the roughly one-fifth (22%) of participants who reported they would have installed the same measures had the rebate not been available, fewer than half (47%) were certain they would have had the funds to cover the full cost of the project without the rebate. Thus, only 10% of participants would have installed the same measures and covered the full cost on their own.

Consistent with their reports of the importance of rebates in enabling them to complete their projects, participants most often reported the rebate as very influential in their decisions to install energy efficient equipment (Figure 3-18). This is also consistent with participants' reports that rebates were a motivator in their decision to install energy efficiency measures (see Table 3-27 in Section 3.4.5.2 above). The recommendation received from the contractor was slightly less influential than the rebate,

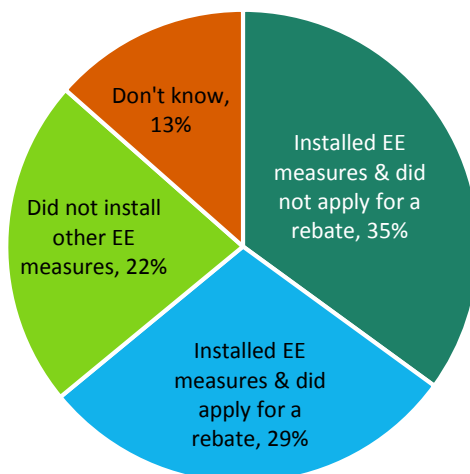
but still highly influential on participants' decision to install energy efficient measures. Potentially reflecting the contractor-driven nature of the Efficiency Works – Business program, technical assistance provided to the business directly by Efficiency Works and their utility was significantly less influential in businesses' decision to install energy efficient equipment, where 39% of respondents gave a rating of "3" or below on the influence scale.

**Figure 3-18: Influential Factors in Decision to Install Efficiency Equipment**



**The program has been influential in accelerating energy conservation among participating businesses.**

Many organizations reported purchasing and installing additional energy efficient equipment because of their experience with Efficiency Works. Almost two-thirds (64%) of all surveyed businesses reported installing undertaking additional projects to install energy efficiency measures since participating in the Efficiency Works Business program (Figure 3-19). Of these businesses, roughly half installed measures and did not apply for rebates, while the other half did apply for rebates.

**Figure 3-19: Program Influence on Installing Other EE Measures (n=89)**

**Participants' experience with Efficiency Works and their utility was an important factor in their decision to buy and install the additional energy efficiency items.** Almost two-thirds (62%) rated their experience with Efficiency Works as very or extremely important on their decision to pursue energy efficiency upgrades, while one-quarter rated it as "somewhat important", and the remainder did not consider their interaction with Efficiency Works as important in their decision to pursue other energy efficient items (Figure 3-20).

**Figure 3-20: Importance of Experience with EW-B in Decision to Pursue Efficient Upgrades (n=31)**

Most often, participants who installed efficient equipment without receiving a rebate reported doing so because rebates were not available for the types of improvements they made (26%), or they were unsure if rebates were available (32%). A notable minority, however, cited aspects of the program as reasons they did not pursue a rebate. Some of these participants reported they did not want to go through the application process (19%). For example, in open-ended responses, some participants reported sporadically installing small measures, for which a rebate would be too small to justify the effort. Others (16%) reported that participating in the program was not feasible given their project timelines. For example, one participant reported the funds their utility had allocated for EW-B rebates had already been dispersed when the participant decided to conduct additional improvements.

### 3.5. Conclusions and Recommendations

**Conclusion 1:** Platte River is currently working to improve project file management, an effort that evaluation findings suggest will be beneficial in ensuring that the program's project files and data tracking systems are complete and uniform.

In particular, the program administrators are currently working to provide complete project file management, including centrally tracking data on assessments and more consistently documenting QA inspections of completed projects. Improved tracking will allow the program and its evaluators to more readily identify which facilities receiving incentives have had an assessment, one indicator of assessment effectiveness. A common approach for tracking QA assessments would also be beneficial. The reviewed program documentation captured pre- and post-retrofit inspections as a collection of site photos or an email confirming a site visit was performed.

**Recommendation 1:** Continue efforts to increase the detail and consistency of information tracked in the program database and collected in project files, including assessment and QA inspection data. Specifically, Platte River should ensure that adopted data tracking practices:

- Ensure that applications capture full name and comprehensive contact information, as well as metrics such as facility description, operational characteristics, and a complete description of the project, including existing and proposed equipment.
- Flag projects at premises where the program performed an assessment and track the assessment date and auditor. Ideally, the database would also track assessment findings such as total estimated energy savings opportunity. The evaluation team recognizes that Fort Collins approaches facility assessments differently from the other Platte River cities, which may complicate tracking, but a basic level of audit tracking connected to the rebate database would be beneficial.
- Consistently document incentive project QA inspection findings in a structured report that captures the date and time of the visit, project details, on-site findings, and images.

**Recommendation 2:** Improve tracking and documentation of deemed savings values and sources of savings assumptions, and regularly update fixture types and review key assumptions contributing to savings estimates. Platte River should develop a centralized resource that tracks deemed savings values and sources of savings assumptions in a consistent way.

**Conclusion 2:** The program has not been capturing interactive energy savings for projects that impact the temperature in conditioned space, reducing the need for air conditioning or increasing the need for heating, and thus may not be claiming all of the energy savings resulting from Efficiency Works projects.

**Recommendation 3:** Include interactive savings resulting from reduced need for air conditioning or increased need for heating in estimates of energy savings for projects that reduce the use of energy in air conditioned spaces.

**Conclusion 3:** Larger building rehabilitation and remodeling projects may present an opportunity for energy efficiency improvements that Efficiency Works – Business is not currently taking advantage of.

More than 60% of Efficiency Works – Business participants reported the measures they installed were part of a stand-alone energy efficiency upgrade, while contractors reported that at least 80% of their

Efficiency Works projects were stand-alone upgrades. This performance, and participants' reports of the importance of program incentives in enabling them to make upgrades, suggest that the program is effective in motivating energy efficiency improvements. Nonetheless, there may be additional opportunity to incorporate energy efficiency into rehabilitation, remodeling, or tenant build-out projects already occurring in commercial buildings. Integrating energy efficiency improvements into these types of projects may provide an opportunity to install a wider range of measures more cost effectively than would be possible in a stand-alone project.

**Recommendation 4:** Identify and engage with contractors and other actors involved in planning and conducting remodeling projects in commercial buildings. Based on discussion with these market actors, Efficiency Works staff should consider how, if at all, they might modify the program to more effectively leverage existing remodeling projects.

## 4. Building Tune-Up

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### 4.1. Program Description

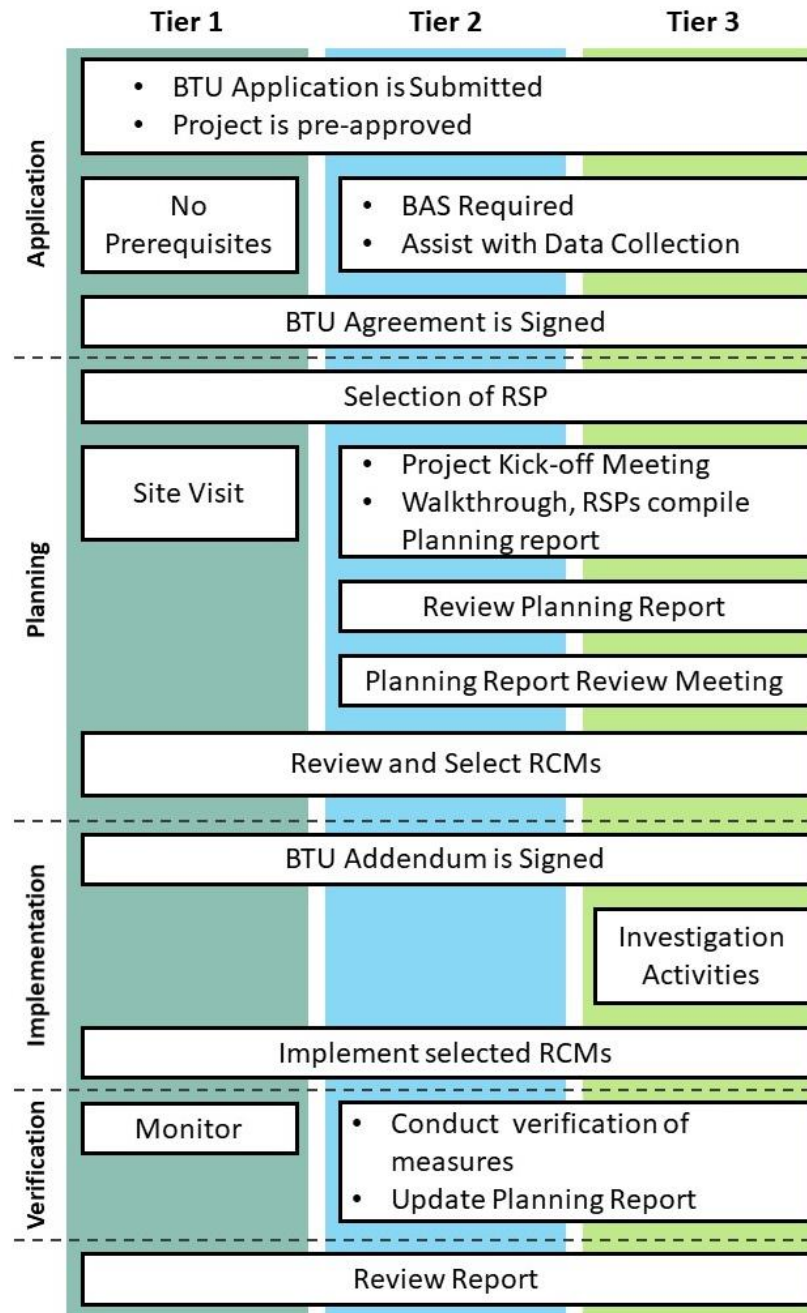
The final element of the Efficiency Works Business program is the BTU component, where businesses can retro-commission their facility by utilizing qualified Retro-commissioning Service Providers (RSPs). Retro-commissioning (RCx) seeks to assist with equipment and system functionality, and optimize integrated operation to reduce energy waste and improve building performance and occupant comfort. The purpose of this program is to provide customers with expert building analysis and prescriptive services at a discount to help lower customers' energy and water costs. The BTU program utilizes the facility assessment component of Efficiency Works as a marketing and outreach channel for capturing customers; essentially a screening process to find invested and dedicated businesses.

This program offers three tiers to participants due to varying building types and systems. Platte River determines which tier is most applicable to the building.

- › **Tier 1- Direct Implementation:** uses a direct implementation, prescriptive approach to enhance the performance of the building energy and water systems, allowing them to operate at their highest efficiency, typically for small and medium sized buildings.
- › **Tier 2- RCx Study and Implementation Support:** a hybrid of the Tier 1 and Tier 3 options, where a flexible, no-cost tune-up analysis of simple or complex systems likely found in medium-sized buildings is conducted.
- › **Tier 3- RCx Study, Implementation Support, and Verification:** offers application, planning, investigation, implementation, and verification services to customers who typically have large and complex buildings and systems.

Participation in the BTU program involves four phases, the steps in each phase differ based on the participant's tier. These phases are described in greater detail in Figure 4-1.

Figure 4-1: BTU Process Flow Chart



#### 4.1.1. Application Phase

Businesses must submit a BTU application to apply for building retro-commissioning funding. For Tier 1 buildings, the program will pay \$0.15 per square foot of building area to implement measures that can save energy, water, improve comfort, operation, and efficiency of the building. The customer commits to spending \$0.05 per square foot of building area (up to \$12,000). For Tier 2 and 3 projects, the

program will cover 100% of the cost to identify measures that can save energy, water, improve comfort, operation, and efficiency of the building. The application process ensures the facility meets specific requirements, has the building owner authorize the work to be performed, collects information, and commits to providing facility access and personnel time to meet with the RSP. Activities under the application phase are mostly the same for each tier level, with the exception that for Tier 2 and 3, businesses are required to have a building automation system (BAS) and to provide more information (Figure 4-1). Tier 3 buildings should have either a central heating and/or cooling plant, or relatively complex industrial or manufacturing processes.

### 4.1.2. Planning Phase

As part of the planning phase, RSPs first collect basic facility information from the businesses' application. With this information in hand, RSPs conduct a walk-through with the potential BTU participant. The complexity and level of technical services provided by the RSP during the walkthrough and review are heightened for Tier 2 and Tier 3 projects (Figure 4-1), where the building systems are further gauged to identify potential tune-up opportunities. RSPs walk the building with the customer and collect information on how the building is operated, its characteristics, and its systems. After the walk-through, Tier 1 participants are presented a list of options from which they select measures, rather than a formal report, while the RSPs prepare a written report of potential measure options with deemed savings estimates and present that to Tier 2 and 3 participants.

For all tier levels, the RSPs discuss the potential options with the participant and confirms they understand the cost-sharing requirements. The customer must commit to spending at least \$0.05 per square foot up to \$12,000 for the implementation of retro-commissioning measures, which is the same requirement for all tier levels. The customer has the option to withdraw from the participation process at this point. If they decide to continue they move on to the investigation and implementation phase.

### 4.1.3. Investigation and Implementation Phase

During the investigation and implementation phase, the RSPs present an addendum with updated measures and talk with the customer about budgets and priorities (Figure 4-1). Tier 1 participants experience immediate implementation of selected measures. Tier 2 participants obtain vendor quotes or staff work load estimates and progress to implementation. Tier 3 participants also obtain vendor quotes or staff work load estimates, and additionally receive further tune-up testing to estimate potential energy savings, and develop diagnostic and calculation plans before progressing to implementation.

### 4.1.4. Verification Phase

Different tier levels go through different verification processes after the building has been retro-commissioned (Figure 4-1). For Tier 1 projects, pre- and post- monitoring is conducted to verify the deemed savings for the measures implemented. A final BTU report is then completed and submitted to Tier 1 customers during this phase.

Tier 2 and 3 projects require more elaborate verification activities than Tier 1 businesses. Processes include data trending (for Tier 3 only), spot measurements, visual checks, and interviews to verify the



measures were installed correctly and properly functioning. Data trending procedures, which are required for Tier 3 only, involve a computer that monitors the building's systems over a two-week period. Afterward, the RSP reviews the trend analysis from the computer, which allows them to know precisely what the energy savings will be from recommended measures and updates the addendum if necessary.

The data collected during the site visits are used to create either an Updated Retro-Commissioning Planning Report (Tier 2) or a Verification Report (Tier 3), which summarize final savings calculations, implementation discrepancies, and documentation of verification activities.

## 4.2. Research Questions and Evaluation Approach

Table 4-1 lists the research questions driving this evaluation. A brief description of the research activities that inform the evaluation of the Appliance Rebate program follows the table.

**Table 4-1: Appliance Rebate Research Questions**

Evaluation Type	Research Questions
Impact	<ul style="list-style-type: none"> <li>• How much savings (kWh, kW, therms, water, etc.) has the program generated (gross savings)? How much of those savings are attributable to the program (net savings)?</li> <li>• What assumptions and methods does the program use to estimate energy savings, and are there opportunities to increase the accuracy of those estimates?</li> </ul>
Process	<ul style="list-style-type: none"> <li>• How could processes be streamlined?</li> <li>• What barriers prevent more businesses from participating?</li> <li>• For continued program success, will the marketing and outreach balance between Contractors and customers need to be adjusted?</li> </ul>

### 4.2.1. Impact Evaluation Methods

The impact evaluation of the BTU component of the Efficiency Works for Business program drew on reviews of the program tracking system and files, a detailed desk review of a sample of projects and site visits of three project sites. The evaluation team sampled 13 of the 18 BTU projects reported in the population for evaluation. These 13 projects account for 1,221 MWh of savings (ex post gross), and the entire population of 18 BTU projects total 2,220 MWh of savings. Additional detail on the impact evaluation sampling approach for Efficiency Works for Business, including the BTU component, is included in Section 2.1.2 and Section 3.2.1.

### 4.2.2. Process Evaluation Methods

The process findings on the BTU program includes information gathered from two data collection activities:

- › **Participant Interviews:** The evaluation team conducted in-depth interviews with four BTU participants. Interviews focused on participant experiences and benefits to participating.

- › **RSP Interviews:** The evaluation team conducted in-depth interviews with four RSPs.<sup>21</sup> Interviews focused on how processes could be streamlined or improved and participant motivations and barriers to participation.

In addition to these interviews, the evaluation team drew on findings from the web-based Efficiency Works Business rebate and assessment participant survey, in which the 90 respondents answered questions about awareness of the BTU program.

### 4.3. Impact Evaluation Findings

On an ex post basis, the BTU program contributes approximately 4% of the savings to the Efficiency Works for Business program for all utilities, but only provides 2% of the Fort Collins savings. Although the program has a relatively small impact on overall commercial and industrial (C&I) sector portfolio savings, it serves a need for facilities in the service territory and addresses operational and system configuration measures not addressed by the rebate program.

Compared to the rebate program, it appears that the program provides these benefits, at a relatively high cost and level of effort. For the rebate program sample, savings were acquired at an average of \$0.11 per kWh of first year savings, while the cost per kWh for the BTU program is \$0.296 per kWh on average for the sample.

Generally, the high level of detail in engineering analysis leading up to the retro-commissioning implementation resulted in detailed savings calculations and supporting documentation. In some cases, however, results did not correlate with reported savings, information was missing, or uncertainties in details led to a calculation of ex post savings not in agreement with the ex ante estimate. It appears that the program relies on the service providers calculations to estimate savings and that internal engineering vetting is limited.

While the service provider's calculations are in keeping with industry practice, there is some inconsistency in approach and identification of best building operations approach. The program has created an extensive engineering application and calculation tool (Building Tune-up Program Application [v2.1]). This tool, which is similar to the Rebate program application form, includes a large number of individual worksheets. However, the spreadsheet is used only for Tier 1 BTU projects and service providers rely on their own internal tools or Xcel Energy retro-commissioning program tools for Tier 2 and 3 BTU projects. The Platte River tool is an interesting resource, and with some program refinement, could be key to optimizing and expanding the program.

Table 4-2 shows the energy savings associated with each sampled project.

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<sup>21</sup> We spoke with four RSPs, but due to cross-over in their responsibilities (one was also an EW-B auditor, and another was also a EW-B lighting contractor), not all RSPs answered all interview questions.

**Table 4-2: Ex ante and ex post savings for sampled BTU projects**

Project	Ex Ante MWh	Ex Ante kW	Ex Post MWh	Ex Post kW	Energy RR
A	316.82	2.30	316.82	2.30	1.00
B	241.16	27.20	241.16	15.98	1.00
C	184.53	10.90	184.53	10.90	1.00
D	177.60	0.00	177.60	0.00	1.00
E	123.50	0.00	45.30	5.37	0.37
F	61.10	0.00	52.33	0.00	0.86
G	49.25	1.90	49.25	0.00	1.00
H	47.67	0.00	47.67	0.00	1.00
I	44.03	29.00	44.03	17.80	1.00
J	35.59	0.00	35.60	0.00	1.00
K	16.00	0.00	16.00	0.00	1.00
L	10.79	0.00	10.79	0.00	1.00
M	0.00	0.00	0.00	0.00	-

Note: Projects have been anonymized here to protect participant privacy. The evaluation team will share identifiable participant data with Platte River and its owner municipalities to enable them to address the identified issues.

The factors contributing to reduced realization rates for the two sampled projects that the evaluation found to be less than one include:

- › **Project E:** The discrepancy in ex post vs. ex ante savings comes from exclusion of one measure, involving terminal unit setbacks, for which implementation was almost immediately reversed due to occupant comfort issues.
- › **Project F:** Due to a clerical error, the savings recorded in the tracking system did not match the savings reported in the verification report. Correction of this issue resulted in a realization rate of 0.86.

#### 4.3.1. Description and Assessment of Application and Tracking System

Like Efficiency Works for Business rebates, the BTU component includes an application spreadsheet with multiple tabs. While the application has a multitude of tabs, it is not clear whether these tabs are being fully leveraged and used by the tune-up service providers. As an alternative, the providers appear to use their own, custom calculations, or the Xcel Energy retro-commissioning calculation tool. The BTU application's questionnaire tabs are extensive, and may be useful. However, they may be too detailed and thus often not used during the tune-up.

While the BTU program guide calls for specific documents such as "BTU Work Order," "Diagnostic and Calculation Plan," "Final BTU Report," "Updated RCx Plan," and "Verification Report," several of the projects were missing many, if not all, of these specific documents.

Platte River has indicated that there are plans to migrate the tracking system to an online program tracking service provided by a third party. While work on changing the system is ongoing, the evaluator is not aware of a projected date for implementation of the new system.

#### 4.3.2. Overall Gross Savings Analysis

A realization rate for the BTU program's gross energy savings was calculated by summing the total ex post savings for the sample and dividing by the total ex ante savings for those same sampled projects. This is shown in Table 4-3.

**Table 4-3: Sample Overall Energy Savings and Realization Rate**

Ex Ante Energy Savings (MWh)	Ex Post Energy Savings (MWh)	Realization Rate
1,308	1,221	0.934

Once a program-level realization rate was established using ex ante and ex post savings from the sample group, that realization rate was applied to the overall program savings to determine a final ex post gross energy savings for the population. This is shown in Table 4-4.

**Table 4-4: BTU Program Total Gross Savings**

Jurisdiction	Ex Ante Gross Energy Savings (MWh)	Ex Post Gross Energy Savings (MWh)	Realization Rate
Platte River (all cities)	2,378	2,220	0.934
Fort Collins	520	485	0.934

Overall, reported energy savings exceed the evaluation team's estimate by approximately 25% for the 2014 - 2016 program years.

#### 4.3.3. Net Savings Analysis

Given the small sample of BTU participants interviewed, the evaluation team was unable to generate estimates of free-ridership and spillover that we could reasonably extrapolate to the population of BTU projects as a whole. As a result, we do not recommend changes to the program's existing NTG assumptions. Program data indicate that between 2010 and 2014, net-to-gross estimates were steady at approximately 88%. Thus, we maintain this value (Table 4-5).

**Table 4-5: BTU program net savings**

Jurisdiction	Ex post gross energy savings (MWh)	Net-to-gross Ratio	Ex post net energy savings (MWh)
Platte River (all cities)	2,220	0.886	1,967
Fort Collins	485	0.886	430

## 4.4. Process Evaluation Findings

This section presents findings from the process evaluation of the Building Tune-Up component of the Efficiency Works for Business program. We begin with a review of feedback on program processes, followed by program satisfaction, motivations for and barriers to participation.

### 4.4.1. Overall Program Satisfaction

**BTU participants were highly satisfied with the BTU project experience, outcomes, and cost.** All the interviewed participants were satisfied with their experience and reported they would highly recommend the BTU program to other businesses. Participants elaborated that if businesses have the interest, dedication, and capacity to go through with the project, the costs and benefits are worth the effort. As one participant said, “anywhere you can save is a win-win situation for everybody.”

BTU participants reported notable changes in their energy use, lower electricity bills, and positive feedback from the building occupants as a result of their participation. Most participants reported few negative consequences from the BTU project, though two participants expressed some concerns. One participant was concerned about the recommendation to set back the HVAC system during periods when the building was not occupied during the winter, for fear of frozen pipes. Another participant speculated that other employees at their company may have considered aspects of the retro-commissioning as negative such as uncomfortable HVAC “set points” and inability to run equipment late in the evenings.

Participants were also satisfied with the cost of the BTU project. Two businesses reported they did not have to contribute any money to the project, while the other two said the money required was very reasonable. One participant even noted they felt that the cost was too low, elaborating they were willing to spend more on the project.

### 4.4.2. Motivations

**Cost savings motivate businesses to participate in the retro-commissioning program and influence which recommended measures they implement.** BTU participants most often mentioned financial reasons, primarily reducing operating costs, as their primary motivation for participating in the BTU program. Other reasons for moving forward with the retro-commissioning included: lowering carbon emissions, enhancing the performance and comfort of the building, and creating a healthier workspace for the building occupants. During in-depth interviews, RSPs concurred that financial reasons were an important motivation for participants, who typically sought to identify energy-saving opportunities and capture incentives.

The interviewed BTU participants reported they moved forward with most, if not all the recommended measures. Participants reported choosing the retro-commissioning services they implemented based on the affordability of the options. Three of the four businesses reported they decided to move forward with the retro-commissioning by analyzing the costs and benefits of the measures. They reported selecting services that were low-cost, offered high return on investment, and had the greatest potential for energy savings. Participants also reported they preferred lower cost options due to the ease of their installation. Reasons for not moving forward with all the recommendations primarily had to do with the

affordability of the options; two of the businesses mentioned they will likely implement the rest of the recommendations at a later time when funding is available.

BTU participants differed in how they came into the BTU program. Two participants entered the EW-B assessment process with a pre-existing desire to have retro-commissioning conducted on their building. The other two participants scheduled the EW-B assessment because they wanted to find out about general opportunities for saving energy and money at their facility. These two participants received a recommendation for the retro-commissioning service during the EW-B assessment and decided to move forward with the BTU program. Thus, two of the four BTU participants reported they intentionally scheduled an assessment for the purpose of moving forward with the BTU program, while the other two reported that the RCx was not a motivation for the audit.

Half of the BTU participants had previously considered the actions recommended by the RCx service, while the other half had never thought of them. The participants who had previously considered these improvements reported the BTU program catalyzed the process by lowering the project costs. The participants who learned of these improvements from the RCx noted the program had opened their eyes to opportunities and possibilities never previously considered.

### 4.4.3. Barriers to Participation

**Retro-commissioning is a somewhat niche offering, and, as such, EW-B auditors may not widely publicize the BTU offering.** The interviewed Efficiency Works Business auditors said they recommend the Business Tune-Up (BTU) program in fewer than half of the buildings they audit.<sup>22</sup> Auditors reported that the size and complexity of the building's systems determines whether they judge the building to be a good candidate for the BTU program. Auditors described buildings with multiple large roof-top units with economizers or buildings with outdated controls and hot water systems that can be turned down as good candidates. Buildings that EW-B auditors do not view as good candidates for the BTU program include smaller businesses with systems similar to those in residential buildings or buildings with equipment so old it should be replaced instead of recommissioned. One Efficiency Works auditor added that many businesses are tenants and even though they may pay utility bills, they do not want to invest in the equipment that someone else owns. The flip side is also a barrier in that the building owner who owns the equipment is not paying the utility bills, which prevents them from investing in retro-commissioning work.

Less than one-third (30%) of the surveyed EW-B participants recalled their assessor mentioning the BTU program during their facility assessments. Most of the remaining EW-B audit participants (52% of EW-B participants who received an audit) reported they did not recall whether the assessor mentioned the BTU program during their facility assessment, while 18% recalled that the auditor did not mention BTU.

**A lack of understanding of the value of retro-commissioning among business owners may prevent greater uptake of BTU.** The interviewed BTU participants speculated that a common barrier preventing many organizations from participating is a general lack of awareness or understanding of retro-commissioning. Two of the interviewed BTU participants reported that other businesses may not fully understand what the BTU service provides, how the process works, or the benefits the retro-

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<sup>22</sup> One auditor estimated 40 to 50% of the time and the other said he recommends it to about one-third of buildings.

commissioning will bring. As one participant explained, “I think [other businesses] don’t quite understand the benefits of it... smaller organizations probably don’t have a resource that could help a team really decide what’s the best thing to do and trust it.”

Similarly, an Efficiency Works Business auditor reported that the biggest barrier to participation in the BTU program is a lack of business owner understanding of what retro-commissioning provides. The auditor elaborated that it is challenging for auditors to convince audit participants that their equipment may not be functioning optimally. He said, “with other programs, you get new lights or a new hot water heater, or you get a new refrigeration unit, so you’re like, that’s where my dollars went. With the tune-up, you’re fixing stuff you already have that you think may be running okay. It doesn’t have the same tangible outcomes the other offerings have.”

**Resource constraints, or uncertainty over the resources required, are another barrier that may limit participation in BTU.** Two BTU participants speculated that financial barriers deter other businesses from participating in the program. These participants elaborated that some businesses may not be able to pay the per square foot copay required, or simply they lack the resources to oversee a BTU project. They noted these barriers may be particularly relevant for smaller businesses because such businesses typically lack the resources, capacity, or staff to manage an intricate process that the BTU requires.

One RSP suggested that businesses may decline to participate in BTU because they are unsure of the effort involved. This RSP noted that, for the retro-commissioning projects their company generated, it has taken significant effort to develop relationships with the participant decisionmaker. This RSP reported meeting with participant decisionmakers several times to build their understanding of what the program can provide. Another RSP speculated that businesses may give retro-commissioning lower priority than other repairs, or that businesses who are performing well financially may not be inclined to shift resources from their core business to lower utility bills.

#### 4.4.4. Overcoming Participation Barriers

**BTU participants and RSPs suggested that more broadly marketing the BTU offering could help to overcome barriers related to a lack of awareness of retro-commissioning.** Two BTU participants noted that, to reach more businesses, Efficiency Works could develop retro-commissioning-specific marketing materials such as bill inserts, mailings, and emails. Specifically, two participants suggested that case studies could provide examples of what could be accomplished through retro-commissioning that would be attractive to other businesses. According to one participant, “Case studies that could be provided to show the benefits from folks who have gone through the process and seen the results [would help] someone be more comfortable in implementing” retro-commissioning measures.

An Efficiency Works Business auditor also suggested that case studies could provide businesses with examples of how much energy savings similar buildings have achieved, which would help encourage participation. This auditor and another noted that incorporating interval-level energy usage data or building energy benchmarking data could support this type of outreach by identifying high energy users with potential retro-commissioning opportunities.<sup>23</sup>

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<sup>23</sup> Fort Collins is currently in the process of developing a mandatory commercial building benchmark policy.



An RSP suggested that focusing BTU outreach on the period from September through December would be advantageous because HVAC contractors typically see a lower volume of business at that time of year and potential participant businesses tend to be more willing to spend funds in the second half of their fiscal year.

### 4.4.5. Program Processes

#### 4.4.5.1. Project Generation

**The level of documentation trade allies are required to provide to become an RSP and the low volume of retro-commissioning referrals they receive through Efficiency Works Business has frustrated some trade allies.** Two RSPs provided feedback about the RSP approval process and both said it required them to provide a considerable amount of documentation.<sup>24</sup> One reported that it took them about 35 hours to obtain the necessary qualifications to become an RSP. They also reported that the required documentation was very technical and, “was frustrating because we put a lot of work into it and nothing has come of it.” This contractor went on to add that other contractors they spoke with who went through the RSP approval process described it as a “big waste of time.”

The program website showed that 25 contractors are approved RSPs, yet most of those RSPs have completed very few BTU projects in the past several years. Even the two most active RSPs reported that the Efficiency Works Business program rarely refers customers interested in retro-commissioning projects to them. One reported they have only received one project referral in the last year and the other added that “there’s lots of retro-commissioning projects done not for Platte River.” In interviews, certified RSPs indicated they expected that, by becoming an Efficiency Works Business RSP, the program would assign BTU projects to them, yet this has not been their experience. For example, one contractor reported frustration that in their four years of being an RSP, the program has not referred one project to them. The other RSP reported that most of their BTU projects are generated through their organization’s existing relationships with a property management company.

**Participant pathways into the Efficiency Works Business BTU program vary.** Some BTU participants enter the program after receiving an audit through the Efficiency Works Business program, and one RSP reported that they understood there to be a requirement that all buildings have an Efficiency Works – Business audit prior to receiving retro-commissioning. Other RSPs reported that participants vary in whether they have had an audit, with one saying, “sometimes they have and sometimes they haven’t [had an audit].” Another RSP reported that “usually” BTU projects start with Efficiency Works Business doing the initial audit, but that none of their BTU projects have done that because they perform the initial audit as part of their retro-commissioning service.<sup>25</sup>

**Participants reported satisfaction with the process of finding a contractor for their BTU projects.**

Despite the low volume of retro-commissioning projects assigned through the program, of those businesses that conducted a BTU project, most found their RSP through Efficiency Works channels.

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<sup>24</sup> A third contractor who reported being an RSP since the pilot did not comment on the approval process and the fourth could not comment due to time limitations in the interview.

<sup>25</sup> This contractor was not on the Efficiency Works approved RSP list, but was listed as an Efficiency Works Business contractor. When contacted for an interview, he reported that he also completes retro-commissioning projects through the BTU portion of the Efficiency Works Business program.



Among the BTU participants interviewed most (3 of 4) found their contractor by way of recommendations or assignments from the program (Table 4-6). All BTU participants reported finding a contractor was an easy process.

**Table 4-6: How BTU Participants Found Contractor**

Source of Contractor	Count (n=4)
Business chose from program recommended contractors	2
Program provided a contractor	1
Had worked with contractor previously	1

#### 4.4.5.2. Program Application

**In general, RSPs reported moderately high satisfaction with the program application process, and noted improvements.** RSPs reported that the BTU program application is easy to fill out, though one contractor added the caveat that he has only done an application for a Tier 1 project. Another RSP anticipated that the application would be easier if he did them more often. However, this same RSP added that the application has gotten easier over time because there is now less data entry required.

#### 4.4.5.3. Walk-Through and Presentation of Findings

**Participants and RSPs find the walk-through and presentation of findings a valuable and straightforward process for their BTU projects.** All BTU participants were satisfied with the retro-commissioning walkthrough. Respondents reported that the process was easy and described the experience as “informative,” “thorough,” and “excellent.” One participant elaborated that the RSP was knowledgeable, responsive to their needs and concerns, and skilled at pointing out opportunities. While generally satisfied, one participant noted that the process was lengthy.

All the interviewed RSPs reported that BTU participants were “very interested” in the information the RSPs provided to them at the end of the walk-through. The interviewed RSPs noted that participants are engaged and committed by the time the walk through takes place. RSPs find the walk-through process valuable as well. One RSP noted that speaking with the participant at the end of the walk-through provides a good chance to “cross-examine our thoughts with their thoughts” prior to doing the report write-up.

Participants reported that they had a chance to review the findings from the walk-through in a written report and provide feedback and questions to the RSP before the recommendations were finalized. This review process involved an in-person, round-table conversation between the participating businesses and the RSPs, in which they discussed the suggestions together, or the recommendations were contemplated independently on the businesses’ end. Participants reported high satisfaction with this process. All the interviewed participants who discussed these meetings reported that the findings presented from their walkthrough were clear and understandable. Further, these participants also noted that the RSP was able to answer their questions.

In general, RSPs agreed that the presentation of findings is valuable for the customer and not too difficult for themselves. Two RSPs said the final reports are good for the customer because they provide an overview that summarizes and condenses the information from the walk-through.

### 4.4.5.4. Invoicing and Payments

RSPs reported minimal challenges related to invoicing and payments, however some RSPs raised unprompted concerns about the program pricing structure.

**The flat-rate pricing and unbillable work required has resulted in low margins for some RSPs' BTU work.** The BTU program has flat-rate pricing for BTU measures in Tier 1 projects. One RSP reported that Efficiency Works has not increased these rates since the BTU pilot, and they do not reflect current prices for measures or labor. While RSPs can request to increase measure prices, they must do so for each project individually. This RSP suggested that updating these pricing levels would decrease the amount of effort for RSPs and ensure fair pricing.

The amount of up-front, unbillable work required for BTU projects was another concern for this same RSP. RSPs are allowed to apply for two to three hours as part of the initial site assessment and survey. However, this RSP reported that it takes an average of eight hours of work to communicate with each customer, answer questions, and conduct research on new technologies. They noted, "there's a ton of time given away and that demotivates you as a contractor."

## 4.5. Conclusions and Recommendations

**Conclusion 1:** The files for some BTU projects were not complete and providers used calculation tools and methodologies inconsistently.

The BTU program guide lists a variety of specific documents that RSPs are required to provide, but several of the reviewed projects were missing some or all of these documents. In some cases, the documentation did not clearly articulate the savings calculation approach, and in others, while the approach was clear, there was no documentation of key assumptions underlying savings estimates.

**Recommendation 1:** Program staff should strive to provide consistent and clearly documented retro-commissioning measures and savings estimates.

**Conclusion 2:** A lack of awareness of the availability and benefits of retro-commissioning services are a barrier to greater uptake of BTU, but raising awareness will require a targeted approach.

The interviewed RSPs and BTU participants agreed that a lack of understanding of what the BTU offering provides and what participation involves prevents greater BTU uptake. However, as Efficiency Works Business auditors reported, not all buildings and not all businesses have the potential to benefit from retro-commissioning. As a result, a mass-outreach campaign is likely to be an inefficient approach to increasing BTU awareness among those businesses that are best positioned to take advantage of the service.

**Recommendation 2:** Efficiency Works should investigate targeted approaches to raising awareness of retro-commissioning among those businesses with the greatest potential to benefit. Platte River staff should consider whether it would be worthwhile to conduct a

potential study to inform this effort. A potential study could provide insights on the remaining potential for retro-commissioning in the market and identify the business or building types that present the greatest opportunity.

**Conclusion 3:** The BTU program includes some unnecessary complexity. Approaches and documentation have limited consistency across projects due to third-party control, and some analysis activities may not directly contribute to savings realization.

**Recommendation 3:** To reduce cost and increase cost effectiveness, program implementers should develop and implement program design changes to streamline the program administration, investigation, and implementation phases of the program.

**Conclusion 4:** There is a disconnect between RSP expectations upon entering the program and the actual volume of BTU projects available for RSPs.

RSPs reported that the process of becoming qualified to conduct BTU projects was rigorous, and stated that they expected their participation would result in a higher volume of work than has occurred. This may reflect a mismatch in expectations, with these RSPs expecting to receive BTU projects as referrals from the program, while program staff expect them to primarily recruit projects independently. A large majority of the RSPs on the program's qualified list have conducted very few BTU projects.

**Recommendation 4:** Efficiency Works staff should review the role they expect RSPs to play in recruiting BTU projects, ensure that role is clearly communicated to RSPs and contractors considering becoming RSPs, and provide RSPs with resources to support their role. For example, the program could provide marketing materials and/or sales training to help RSPs more effectively recruit BTU projects.

**Recommendation 5:** Efficiency Works staff should consider whether there is sufficient potential in the retro-commissioning market to support the number of RSPs currently registered with the program. If not, the program may consider issuing an RFP to select a limited number of RSPs with the understanding that each would complete a higher volume of projects, rather than maintaining an open network in which both providers and program staff must invest time and effort in certifying providers who may ultimately complete few projects.

## 5. Efficiency Works for Homes

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### 5.1. Program Description

The Efficiency Works for Homes (EW-H) program seeks to increase the energy efficiency and increase the indoor air quality of existing homes. The program comprises four key components:

- › **Efficiency Advisers:** Upon entering the program, participants are assigned a staff member of CLEAResult, the program implementation contractor, to serve as their Efficiency Adviser. The Efficiency Adviser is the participant's primary point of contact for the program, and maintains a relationship with the participant throughout their participation process. The Efficiency Adviser has an initial intake conversation with the participant to identify participant's priorities and potential barriers. The adviser also works with the participant to schedule the Home Efficiency Audit. Following the audit, the adviser contacts the participant and offers to discuss the audit findings and, if the participant would like, schedule contractors to provide bids for the recommended improvements. The adviser is also available to review bids the participant receives. The efficiency adviser communicates with the customer during and after the installation to ensure the customer is satisfied with the work and to catch any problems that might occur.
- › **Home Efficiency Audits:** Home Efficiency Audits are available to participants at a cost of \$60. Implementation contractor staff typically conduct the audits, although the program occasionally contracts with outside auditors to meet demand. Audits include blower door testing to measure air leakage and an infrared camera scan to identify places where heat is escaping from the home. During the audit, the auditor also offers to install LED light bulbs and low-flow showerheads and faucet aerators. Following the audit, the auditor provides the participant with a report recommending and prioritizing opportunities to increase the home's energy efficiency. The program removed the requirement that projects installing only HVAC measures receive an audit in 2017; previously audits had been required for all projects.
- › **Rebates:** The program offers rebates for 23 individual home improvements involving the building envelope and mechanical systems. Rebates are offered on a per-unit basis for equipment, a per-square-foot basis (with caps) for insulation and windows, and based on measured improvement for air sealing. Participants must use a program-qualified contractor to be eligible for rebates. The installation contractor typically submits the rebate application and necessary documentation, and participants typically receive the rebate within two weeks of completing the project.
- › **Quality Assurance (QA):** In the initial program design, a key goal of Efficiency Works for Homes was to change contractor practices to increase energy efficiency. QA site visits are performed on 10% of EW-H projects and involve a photo documentation procedure where contractors take digital photos of the installation process. This allows for QA reviews without having to visit the site, saving money, and allowing for QA reviews on more jobs.

In the fall of 2015, the Efficiency Works for Homes program began experimenting with an alternate delivery approach called the streamline path, which is designed to simplify the decision-making and participation processes for participants. Under the streamline path, the auditor presents the audit findings at the end of the audit visit, rather than mailing the participant a report days later. In presenting the findings, the auditor groups efficiency opportunities into progressively more comprehensive “good,” “better,” and “best” measure packages.

Contractors participating in the streamline path agree to provide insulation and air sealing at standardized prices. This allows the auditor to present project costs associated with each of the measure packages, along with financing options and savings estimates so participants can compare options based on their expected net monthly cost. The program assigns a participating contractor to complete the installation for participants who choose to move forward with one of the measure packages at the agreed-upon price.

During their initial conversations, Efficiency Advisers determine whether a participant will enter the streamline path or the program’s standard path, which provides audit findings as a menu of efficiency opportunities and leaves the participant responsible for finding a contractor and obtaining cost estimates, although Efficiency Advisers are available to help. Fort Collins Utilities piloted the streamline path from the fall of 2015 until the fall of 2016, and expanded the offering to all Platte River municipalities in 2017.

Table 5-1 provides an overview of the Efficiency Works for Homes program.

**Table 5-1: Efficiency for Works Homes Overview**

Offered Since	Measures Offered	Incentives	Other Details
Year 2010	Comprehensive retrofits and direct installation of LED lighting and small domestic hot water measures	Variable	Three participation offerings: <ol style="list-style-type: none"> <li>1. Home efficiency assessment</li> <li>2. Direct install measures</li> <li>3. Rebates for prescriptive measures</li> </ol>

## 5.2. Research Questions and Evaluation Approach

The evaluation team addressed a wide range of research questions related to the Efficiency Works - Home program (Table 5-2).

**Table 5-2: Efficiency Works for Homes Research Objectives**

Evaluation Type	Research Questions
Impact	<ul style="list-style-type: none"> <li>• How much savings (kWh, kW, Therms, water, etc.) has the program generated (gross savings)? How much of those savings are attributable to the program (net savings)?</li> <li>• How do the program’s costs compare to its savings?</li> <li>• What assumptions and methods does the program use to estimate energy savings and are there opportunities to increase the accuracy of those estimates?</li> </ul>

Evaluation Type	Research Questions
Process	<ul style="list-style-type: none"> <li>• What effect has the streamlined path had on program enrollment and customer uptake of recommended measures?</li> <li>• What role did the availability of financing in general, and on-bill financing in particular, play in uptake of recommended measures?</li> <li>• What impact has streamlining the QA process had on the contractor experience and operations? How has it affected the quality of work performed?</li> <li>• What barriers prevent participants from moving forward with recommended measures, and how do various program offerings (e.g. streamline path, financing, advisors, auditors) address those barriers?</li> <li>• What value does having an energy advisor, distinct from the auditor, add to the program? Conversely, is the customer experience negatively impacted from the model?</li> <li>• What are optimal rebate amounts for measures incentivized through Efficiency Works for Homes? Are there measures not incented that would provide additional value to the customer or contractor base?</li> </ul>

### 5.2.1. Impact Evaluation Approach

The evaluation combined the three related program elements under the Efficiency Works umbrella (audits, direct installation of measures during the audit, and rebates) together for one comprehensive program impact evaluation. The evaluation team reviewed the database of program participants, conducted surveys with participants,<sup>26</sup> reviewed and extracted the key measure and household characteristics from the participant assessment files, reviewed the assumed energy savings used by Fort Collins Utilities and Platte River Power Authority, and then estimated energy savings for the Efficiency Works program.

Because participant household and baseline measure characteristic data were stored only in PDF files, the evaluation team limited the number of files reviewed from the sample of survey participants. The evaluation team identified the highest impact measures installed through the program, from the extensive list of available measures, for through engineering reviews. To determine the high impact measures, the evaluation team relied on the summary energy impacts spreadsheet provided early in the evaluation,<sup>27</sup> and selected measures that contributed over 5% of fuel-specific savings. A summary of the high impact electric measures is shown in Table 5-3.

<sup>26</sup> Survey samples reflected proportional participation based on standard versus streamlined participation, audit-only versus those that installed measures, and those that received on-bill financing.

<sup>27</sup> Efficiency Works\_2016\_SavingsFINAL.xlsx

**Table 5-3: Summary of Efficiency Works High Impact Measures (Percent of Claimed Program Savings)**

High Impact Measure	Electric kWh	Natural Gas Therms
Central AC	18%	NA
Air Sealing	15%	26%
Gas Furnace	18%	30%
Insulation: Attic	23%	29%
LED Lighting	17%	NA
<b>Total</b>	<b>92%</b>	<b>85%</b>

The evaluation team used engineering algorithms from the Illinois TRM that were consistent with Xcel TRM savings algorithms for the following measures: air sealing, attic insulation, and central air conditioning. Gas furnace savings were derived exclusively from Xcel's 2017/2018 DSM plan. LED lighting savings were developed in a manner consistent with the midstream lighting savings.<sup>28</sup> Wherever possible, we used participant data for inputs and used secondary data to fill in gaps.

The key tasks for the Efficiency Works evaluation included the following:

- › Database review
  - Are household and baseline details being captured during the audit? Determine missing details and make recommendations for data capture going forward.
- › Review and validate engineering assumptions
  - Calibrate savings to tracking database based on a sample of projects
  - As appropriate, recommend alternative savings for equipment (deemed savings) measures
- › Verify installation and baseline conditions (early replacement versus replace on burnout) via participant survey
- › Evaluate the audit-only homes to understand the sources of any audit-only savings.

For the net savings analysis, the evaluation team applied the fast-feedback battery described in Section 2.3.1, adjusting the program influence questions for the unique program delivery approach. Program influence factors included the audit itself and interactions with the assessor, phone interactions with the energy advisor, the rebate, and for those receiving on-bill financing, the on-bill loan received through the program. For spillover analysis, the evaluation team used the spillover battery from the participant survey coupled with previous billing analysis findings.<sup>29</sup> The previous billing analysis findings showed

<sup>28</sup> Xcel had consistent algorithms as the IL TRM for air sealing, attic insulation, and central AC, but gas furnace savings algorithms were different and IL TRM relied on deemed electric ECM estimates whereas Xcel used algorithms, which are preferred as they will allow Fort Collins Utilities to calibrate savings on an ongoing basis.

<sup>29</sup> Fort Collins Utilities program staff provided the team with findings from a billing analysis conducted by their implementation contractor. The billing analysis documentation was not available to the team, so no citation is available.

evidence of strong spillover savings, since savings represented by the audit-only participants were a significant portion of the overall program savings (for Fort Collins).

### 5.2.2. Process Evaluation Approach

The process findings on the Efficiency Works Homes program includes information gathered from the following data collection activities:

- › **Staff Interviews:** The evaluation team conducted in-depth interviews with program staff. The output of these discussions helped shape survey questions related to the Efficiency Works - Home program.
- › **Contractor and Auditor Interviews:** The evaluation team conducted in-depth interviews with contractors and auditors that had done work through the Efficiency Works Home program. Interviews focused on program processes and interactions with participants.
- › **Residential Surveys:** The evaluation team conducted web-based surveys of Platte River customers and households that participated in the Efficiency Works Home, Appliance Rebate, and Appliance Recycling programs.

## 5.3. Impact Evaluation Findings

This section presents findings from each of the key impact evaluation activities.

### 5.3.1. Tracking Database Review

The original tracking database developed by Fort Collins Utilities, which was used from program inception (2009) through mid-2014, included most of the details required for engineering analysis. In mid-2014, the program shifted to the implementation contractor's (CLEAResult's) Salesforce database system, which housed basic information about projects, including basic measure and rebate information, installation date and some basic home characteristics. This database also included PDF files of individual project assessment data, containing more details on home and baseline characteristics. The PDFs were not easily extracted by implementation contractor staff, and did not lend themselves to automated extraction of information because their content and location of baseline data were not standardized (i.e., the files and information for each project varied). Therefore, the evaluation team requested the PDF files for only the respondents to the survey described in the Methods section above.

The team reviewed each set of project files and extracted key data for the engineering algorithm, including central air conditioner cooling capacity, pre-installation attic insulation baseline R-values, and pre/post CFM50 air volume measurements for air sealing.<sup>30</sup> With the exception of Cubic Feet per Minute (CFM) data, the data were found in inconsistent locations in the PDFs and files lacked some necessary data. The details provided in Table 5-4 below are a high-level snapshot of the critical parameters the team used in the savings analysis and whether these data were available in the tracking database and/or

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<sup>30</sup> CFM signifies cubic feet per minute of airflow. CFM50 signifies the airflow needed to create a change in building pressure of 50 Pascals.



assessment files. A comprehensive listing of the parameters used for engineering estimates are included in Appendix B.1.

**Table 5-4: Efficiency Works Homes Program – Tracking Database Findings**

Factor	In Tracking Database	In Audit/ Assessment Files	Example	Notes
Measure information	Yes	Yes	Installed Equipment, Date	
Measure savings information	No	No	Electric and natural gas savings assumed for each measure	The team had to use lookups for Platte River savings, and an alternative lookup and logic for Fort Collins
Baseline condition	No	Yes	Existing R-Value, CFM existing, SEER Existing	
Efficient condition	No	Yes	Post R-Value, Attic Area, CFM post, SEER post	
HVAC fuel and system type	Some	Fuel type only	Gas/Electric heat, System type, CAC	Database contains heat type (gas/electric). Neither includes electric heating type (HP/baseboard) or if home has CAC

### 5.3.2. Per-Unit Savings

The engineering analysis of individual measures involved identifying appropriate savings algorithms that were (1) commonly used by Technical Reference Manuals (TRMs) and consistent with Xcel-based algorithms, and (2) would allow Fort Collins Utilities to continue using them and calibrate their participant savings on an ongoing basis. Rather than relying on fully-deemed input values, using savings algorithms allows administrators to calibrate the anticipated participant savings based on actual household and baseline characteristics, which have a significant impact on realized savings.

One unique aspect of the engineering review is that it required using two different sets of ex ante savings estimates: Fort Collins Utilities relied solely on findings from a previous billing analysis for all participants and applied the findings to only a limited set of measures, whereas Platte River relied on a combination of savings from the same billing analysis, supplemented with savings primarily from Xcel Energy. One additional difference between the Efficiency Works for Homes assumptions is that Fort Collins applied electric and gas savings to all participants irrespective of heating fuel type (electric versus gas) whereas Platte River applied fuel-specific savings based on space and water heating type. Table 5-5 provides a comparison of the high-impact measure savings assumptions for the two utilities, categorized by home heating fuel type.

**Table 5-5: Efficiency Works Homes Program – Ex Ante High Impact Measure Assumptions**

Measure	Utility	Ex Ante Per Unit kWh	Ex Ante Per Unit Therms	Source
Air Sealing	Fort Collins	NA	NA	NA
	Platte River	4,908	214.7	Xcel deemed savings
Attic Insulation	Fort Collins	450	122.2	Billing analysis
	Platte River	2,089	144.4	Xcel deemed savings
Gas Furnace*	Fort Collins	450	122.2	Billing analysis
	Platte River	0 (92%) 450 (95%)	111.9 (92%) 115.4 (95%)	Xcel deemed savings
Central AC	Fort Collins	450	0	Billing analysis
	Platte River	450	0	Billing analysis and Xcel
LED lighting	Fort Collins	NA	NA	
	Platte River	40	0	From lighting program
Other**	Fort Collins	225	23.5	Billing analysis
	Platte River	NA	NA	NA

\* Gas furnace includes both 92% and 95% efficiency measures, but only 95% requires ECM fan. Platte River assigns gas furnace ECM electric kWh savings only to 95% measures, whereas Fort Collins assigns 450 kWh savings to both 92% and 95% measures.

\*\* Note that “Other” is only used by Fort Collins, and applies to additional non-attic insulation prescriptive installed measures for those properties that did NOT receive attic insulation.

As noted above, the evaluation team used engineering algorithms from the Illinois TRM for air sealing, attic insulation, and central air conditioning, while gas furnace electric (ECM [Electrically Commutated Motor] fan) and gas savings were developed based on Xcel 2017/2018 Demand Side Management (DSM) plan algorithms. Direct install LED lighting savings were developed in a manner consistent with the midstream lighting savings. The key drivers of the savings analysis are described here and displayed in tables in the following section:

- › **Air Sealing:** The evaluation found average per-unit savings of 261 kWh for Fort Collins and 248 kWh for Platte River. The analysis used program participant data for average home air loss (CFM50), primary heating fuel type, and efficiency of HVAC equipment. Platte River assumed 530 kWh per home, resulting in a realization rate of 47%. Fort Collins Utilities does not claim air sealing savings, and thus the team produced no Fort Collins realization rate for air sealing. The Efficiency Works for Homes program requires air sealing in conjunction with attic insulation and the additive ex post savings for attic insulation plus air sealing comes very close to the Fort Collins attic insulation value, discussed below.
- › **Attic insulation:** The evaluation estimated savings for attic insulation to be 934 kWh for electrically heated homes and 86 kWh for gas heated homes, resulting in average per-unit savings of 200 kWh for Fort Collins and 160 kWh for Platte River. Participant data included in the analysis were R-values, attic area, and primary heating fuel type. The baseline R-value was 21.9,

which is relatively high compared with other evaluations on which the team has worked. Fort Collins Utilities assumed an average of 446 kWh, resulting in a 45% realization rate for air sealing alone, but the realization rate increases to 103% if the air sealing (261 kWh) and attic insulation savings are included together. As noted above, both Fort Collins Utilities and Platte River require air sealing to be performed for all attic insulation installations; they do not claim air sealing savings as a standalone measure. Platte River assumed 584 kWh, for a realization rate of 27%.

- › **Central AC:** The evaluation estimated per-unit savings for central air conditioning (CAC) of 399 kWh for Fort Collins and 424 kWh for Platte River. The CAC analysis used participant data for seasonal energy efficiency Ratio (SEER) levels and comprehensive 2014 tracking data for capacity. The survey resulted in 26% of customers installing CAC as an early replacement, which has a significant impact on the baseline and annual savings. The realization rate for CAC was 74% for Fort Collins and 84% for Platte River.
- › **Gas furnace:** The evaluation team estimated ECM savings of 591 kWh for 95% Annual Fuel Use Efficiency (AFUE) furnaces, based on Xcel Colorado 2017/2018 DSM plan. The 92% AFUE furnaces, however, had zero kWh savings since the program does not require ECM fans on these units. On average, this resulted in 124% realization rate for Fort Collins and 131% realization rate for Platte River.
- › **LED lighting:** The evaluation team estimated average savings of 40 kWh per bulb, which was very similar to the ex ante estimates by both Fort Collins Utilities and Platte River. Individual measures showed differences in realization rates, A-lamps showed lower savings due to non-EISA (Energy Independence and Security Act) exemptions while LED retrofit kits showed higher realization rates due to being EISA-exempt and having higher baseline wattages.
- › **Pass-through measures:** Pass-through measures, including whole house fan, evaporative cooler, gas boiler and water heater, window replacement, and other non-attic insulation measures, represent a minority of electric kWh savings (7%), and did not receive engineering analysis savings. For these measures the evaluation team adopted the ex ante savings.
- › **Audit savings:** Fort Collins Utilities claims 225 kWh and 23.5 therm savings for each completed audit, regardless of measures installed. The evaluation did not conduct a billing analysis and was therefore unable to verify the savings. Therefore, audit savings are separated in the tables below and only included in the overall net savings totals (they are excluded from the total evaluated gross savings estimates).

### 5.3.3. Gross Impact

Overall, evaluated gross 2014-2016 annual electric savings in Fort Collins are 725,990 kWh, representing a realization rate of 98%. Realization rates vary by measure, as shown in Table 5-6. The highest realization rate was for gas furnaces, and the lowest were for central air conditioners and attic insulation. Yet, as noted above, the combination of air sealing and attic insulation (which is consistent with Fort Collins Utilities historic billing analysis), produces a realization rate near parity.

**Table 5-6: Efficiency Works Homes 2014-2016 Gross Impacts – Energy (kWh): Fort Collins**

Measure	Quantity Claimed	Quantity Verified	Ex Ante Per Unit kWh Savings	Ex Post Per Unit kWh Savings	Ex Ante Total kWh Savings	Ex Post Total kWh Savings	Gross Realization Rates
Air Sealing	293	293	0	268	0	76,455	NA
Central AC	329	329	540	399	177,660	131,346	74%
Gas Furnace	392	392	450	567	176,400	222,216	126%
Insulation: Attic	359	359	450	202	161,550	72,504	45%
LED	4,171	4,171	40	40	166,840	167,407	100%
Pass Through	2,274	2,274	18	18	56,288	56,063*	100%
<b>Evaluated Total</b>	<b>3,650</b>	<b>3,650</b>			<b>738,738</b>	<b>725,990</b>	<b>98%</b>
Audit	2,347	NA	225	NA	528,075	NA	NA
Audit % of Total					42%		

\* Note the difference between ex ante and ex post savings are a result of not assigning electric kWh savings for strictly gas savings measures. Since the Fort Collins Utilities savings logic assigns electric savings if non-attic measures are installed, some gas-only measures receive electric savings.

Overall, other Platte River owner municipalities evaluated gross annual electric savings are 311,658 kwh from 2014-2016, representing a realization rate of 82%. This realization rate is lower than Fort Collins, driven primarily by the attic insulation and air sealing results.

**Table 5-7: Efficiency Works Homes 2014-2016 Gross Impacts – Energy (kWh): Other Platte River Owner Municipalities**

Measure	Quantity Claimed	Quantity Verified	Ex Ante Per Unit kWh Savings	Ex Post Per Unit kWh Savings	Ex Ante Total kWh Savings	Ex Post Total kWh Savings	Gross Realization Rates
Air Sealing	81	81	530	248	42,922	20,075	47%
Central AC	189	189	507	424	95,730	80,088	84%
Gas Furnace	169	169	447	588	75,600	99,288	131%
Insulation: Attic	128	128	584	160	74,729	20,508	27%
LED	1,678	1,678	40	41	67,120	69,453	103%
Pass Through	740	740	30	30	22,246	22,246	100%
<b>Grand Total</b>	<b>2,985</b>	<b>2,985</b>			<b>378,347</b>	<b>311,658</b>	<b>82%</b>

The following tables outline the demand savings for Fort Collins and the other Platte River owner municipalities. Note Fort Collins did not claim any demand savings, so realization rates could not be calculated.

**Table 5-8: Efficiency Works Homes 2014-2016 Gross Impacts – Demand (kW): Fort Collins**

Measure	Quantity Claimed	Quantity Verified	Ex Ante Per Unit kW Savings	Ex Post Per Unit kW Savings	Ex Ante Total kW Savings	Ex Post Total kW Savings	Gross Realization Rates
Air Sealing	293	293	N/A	0.0636	N/A	18.14	N/A
Central AC	329	329	N/A	0.3035	N/A	99.85	N/A
Gas Furnace	392	392	N/A	0.2314	N/A	90.71	N/A
Insulation: Attic	359	359	N/A	0.0252	N/A	9.06	N/A
LED	4,171	4,171	N/A	0.0387	N/A	161.38	N/A
Pass Through	2,274	2,274	N/A	0.0045	N/A	10.25	N/A
<b>Evaluated Total</b>	<b>3,650</b>	<b>3,650</b>	<b>N/A</b>		<b>N/A</b>	<b>389.40</b>	<b>N/A</b>
Audit			N/A	0.0257	N/A	60.28	N/A

**Table 5-9: Efficiency Works Homes 2014-2016 Gross Impacts – Demand (kW): Platte River**

Measure	Quantity Claimed	Quantity Verified	Ex Ante Per Unit kW Savings	Ex Post Per Unit kW Savings	Ex Ante Total kW Savings	Ex Post Total kW Savings	Gross Realization Rates
Air Sealing	81	81	0.2549	0.1198	20.65	9.70	47%
Central AC	189	189	0.1492	0.1253	28.20	23.69	84%
Gas Furnace	169	169	0.1988	0.2604	33.60	44.01	131%
Insulation: Attic	128	128	0.1819	0.0491	23.28	6.29	27%
LED	1,678	1,678	0.0040	0.0041	6.71	6.91	103%
Pass Through	740	740	0.0008	0.0008	0.59	0.59	100%
<b>Grand Total</b>	<b>2,985</b>	<b>2,985</b>			<b>113.03</b>	<b>91.19</b>	<b>82%</b>

The evaluation team also estimated therm savings for air sealing, gas furnaces, and attic insulation. Overall, evaluated gross annual natural gas therm savings in Fort Collins are 95,538 therms from 2014-2016, for a realization rate of 95%. Realization rates were similar to that of electric with lower rates for attic insulation; as above, however, the combination of air sealing and insulation lead to a higher realization rate.

**Table 5-10: Efficiency Works Homes 2014-2016 Gross Impacts – Natural Gas (Therms): Fort Collins**

Measure	Quantity Claimed	Quantity Verified	Ex Ante Per Unit Therm Savings	Ex Post Per Unit Therm Savings	Ex Ante Total Therm Savings	Ex Post Total Therm Savings	Gross Realization Rates
Air Sealing	285	285		56.9		16,508	N/A
Gas Furnace	392	392	122.2	133.1	47,902	52,194	109%
Insulation: Attic	359	359	122.2	51.1	43,870	18,488	42%
Pass Through	2,274	2,274	3.9	3.7	8,818	8,348	95%
<b>Grand Total</b>	<b>3,321</b>	<b>3,321</b>			<b>100,591</b>	<b>95,538</b>	<b>95%</b>
Audit	2,347	2,135	23.5	23.5	55,155	50,173*	91%
Audit % of Total					35%		

\* Note the difference between ex ante and ex post savings are a result of not assigning natural gas therm savings for strictly electric participants.

Overall, other Platte River owner municipalities evaluated gross annual natural gas savings are 43,648 therms from 2014-2016, for a realization rate of 76%. Realization rates were similar to that of electric, with higher gas furnace and lower insulation rates.

**Table 5-11: Efficiency Works Homes 2014-2016 Gross Impacts – Natural Gas (Therms): Platte River**

Measure	Quantity Claimed	Quantity Verified	Ex Ante Per Unit Therm Savings	Ex Post Per Unit Therm Savings	Ex Ante Total Therm Savings	Ex Post Total Therm Savings	Gross Realization Rates
Air Sealing	81	81	145.7	60.6	11,801	4,911	42%
Gas Furnace	169	169	115.4	142.7	19,499	22,647	116%
Insulation: Attic	128	128	129.7	53.4	16,606	6,837	41%
Pass Through	740	740	10.5	10.5	7,791	7,791	100%
<b>Grand Total</b>	<b>1,118</b>	<b>1,118</b>			<b>55,697</b>	<b>43,648</b>	<b>76%</b>

The evaluation team estimated water savings for faucet aerators, showerheads, and toilet bags. Overall, evaluated gross annual water savings in Fort Collins are over 1.1 million gallons from 2014-2016, though realization rates were not possible given the lack of ex ante toilet bag savings.

**Table 5-12: Efficiency Works Homes 2014-2016 Gross Impacts – Water (thousand gallons): Fort Collins**

Measure	Quantity Claimed	Quantity Verified	Ex Ante Per Unit Water Savings	Ex Post Per Unit Water Savings	Ex Ante Total Water Savings	Ex Post Total Water Savings	Gross Realization Rate
Faucet Aerator	316	316	2.482	0.747	784	236	30%
Showerhead	218	218	2.365	2.803	516	611	119%
Toilet Bag	88	88	n/a	3.711	n/a	327	n/a
<b>Total</b>	<b>622</b>	<b>622</b>				<b>1,174</b>	<b>n/a</b>

**Table 5-13: Efficiency Works Homes 2014-2016 Gross Impacts – Water (thousand gallons): Platte River**

Measure	Quantity Claimed	Quantity Verified	Ex Ante Per Unit Water Savings	Ex Post Per Unit Water Savings	Ex Ante Total Water Savings	Ex Post Total Water Savings	Gross Realization Rate
Faucet Aerator	194	194	2.482	0.747	482	145	30%
Showerhead	157	157	2.365	2.803	371	440	119%
Toilet Bag	68	68	n/a	3.711	n/a	252	n/a
<b>Total</b>	<b>1,041</b>	<b>1,041</b>				<b>837</b>	<b>n/a</b>

### 5.3.4. Net Impact

The evaluation found a moderate level of free-ridership: 24% (64 of 268) of participants indicated they would have performed their home retrofits in absence of the program, while only two percent of participants (n=5) indicated a low level (1 or 2 of 5 on rating scale) of program influence in their decision to upgrade.<sup>31</sup> Calculating the individual free-ridership and weighting across all participants by savings, leads to a 21% overall Efficiency Works Homes free-ridership score (i.e., 79% net to gross (NTG) absent any spillover). This result was the same between audit-only direct install participants and that of retrofit installations.

Efficiency Works Homes participants indicated a strong degree of spillover: 37% (98 of 268) participants indicated making additional efficient improvements to their homes outside of the program, and, of these 98 participants, 44% believed the program had an extremely or very strong influence on their decision, while another 31% believed the program had a somewhat important influence on their decision. Spillover measures included installation of LED lighting (n=21), efficient appliances (n=41), windows (n=33), and other HVAC equipment (n=24).

<sup>31</sup> One-third of participants were unsure about program influence and received a mid-point free-ridership score of 50% for influence.

The Fort Collins Utilities team, had previously used a billing analysis to estimate what was effectively spillover savings. Those participants that chose to not install measures through the program nonetheless saved an average of 225 kWh electric and 23.5 therms per participant relative to the control group. This represents 42% of ex ante claimed electric savings and 35% of claimed ex ante natural gas savings (see Table 5-6 and Table 5-10).

The net savings results are shown in the following group of tables. The measure categories are reported differently in the net savings tables to account for the unique NTG values assumed for audit-only savings (80%), direct install (DI) savings (which differed between small domestic hot water [DHW – 90%] and LED lighting [78%]), and prescriptive measures (87%). It should be noted that the iconfigure file, provided by Fort Collins Utilities, which documented the assumed ex ante NTG values, applied an 80% NTG to the audit “spillover” savings, while the evaluation team did not apply any NTG to the audit spillover savings. Further, Platte River did not assume any spillover audit savings, so the evaluation team applied the same per-audit spillover savings to the Platte River net results reported below.

**Table 5-14: Efficiency Works Homes 2014-2016 Net Impacts – Energy (kWh): Fort Collins**

Measure	Ex Ante NTG	Ex Post NTG	Ex Ante Net kWh Savings	Ex Post Net kWh Savings	Net Realization Rates
Audit	80%	79%	422,460	528,075	125%
DI-DHW	90%	79%	12,411	10,894	88%
DI-LED	78%	79%	130,135	132,251	102%
Prescriptive	87%	79%	485,346	429,228	88%
<b>Grand Total</b>			<b>1,050,560</b>	<b>1,101,607</b>	<b>105%</b>

**Table 5-15: Efficiency Works Homes 2014-2016 Net Impacts – Energy (kWh): Platte River**

Measure	Ex Ante NTG	Ex Post NTG	Ex Ante Net kWh Savings	Ex Post Net kWh Savings	Net Realization Rates
Audit	NA	79%	NA	193,500	NA
DI-DHW	90%	79%	4,139	3,633	88%
DI-LED	78%	79%	52,354	54,868	105%
Prescriptive	87%	79%	266,766	187,709	70%
<b>Grand Total</b>			<b>323,259</b>	<b>439,710</b>	<b>136%</b>



**Table 5-16: Efficiency Works Homes 2014-2016 Net Impacts – Demand (kW): Fort Collins**

Measure	Ex Ante NTG	Ex Post NTG	Ex Ante Net kW Savings	Ex Post Net kW Savings	Net Realization Rates
Audit	80%	79%	N/A	60	N/A
DI-DHW	90%	79%	N/A	2	N/A
DI-LED	78%	79%	N/A	127	N/A
Prescriptive	87%	79%	N/A	178	N/A
<b>Grand Total</b>			<b>N/A</b>	<b>368</b>	<b>N/A</b>

**Table 5-17: Efficiency Works Homes 2014-2016 Net Impacts – Demand (kW): Platte River**

Measure	Ex Ante NTG	Ex Post NTG	Ex Ante Net kW Savings	Ex Post Net kW Savings	Net Realization Rates
Audit	80%	79%	NA	22	NA
DI-DHW	90%	79%		1	NA
DI-LED	78%	79%	5	53	1010%
Prescriptive	87%	79%	92	89	96%
<b>Grand Total</b>			<b>98</b>	<b>164</b>	<b>168%</b>

**Table 5-18: Efficiency Works Homes 2014-2016 Net Impacts – Natural Gas (Therms): Fort Collins**

Measure	Ex Ante NTG	Ex Post NTG	Ex Ante Net Therm Savings	Ex Post Net Therm Savings	Net Realization Rates
Audit	80%	79%	44,124	50,173	114%
DI-DHW	90%	79%	3,982	3,495	88%
DI-LED	78%	79%			
Prescriptive	87%	79%	83,665	71,980	86%
<b>Grand Total</b>			<b>131,770</b>	<b>125,648</b>	<b>95%</b>

**Table 5-19: Efficiency Works Homes 2014-2016 Net Impacts – Natural Gas (Therms): Platte River**

Measure	Ex Ante NTG	Ex Post NTG	Ex Ante Net Therm Savings	Ex Post Net Therm Savings	Net Realization Rates
Audit	80%	79%		20,210	
DI-DHW	90%	79%	3,030	2,660	88%
DI-H2O	90%	79%			
DI-LED	78%	79%			
Prescriptive	87%	79%	45,527	30,667	67%
<b>Grand Total</b>			<b>48,557</b>	<b>53,537</b>	<b>110%</b>

**Table 5-20: Efficiency Works Homes 2014-2016 Net Impacts – Water (thousand gallons): Fort Collins**

Measure	Ex Ante NTG	Ex Post NTG	Ex Ante Total Net Water Savings	Ex Post Total Net Water Savings	Net Realization Rate
Faucet Aerator	90%	79%	706	186	26%
Showerhead			464	483	104%
Toilet Bag			n/a	258	n/a
<b>Total</b>			<b>n/a</b>	<b>927</b>	<b>n/a</b>

**Table 5-21: Efficiency Works Homes 2014-2016 Net Impacts – Water (thousand gallons): Platte River**

Measure	Ex Ante NTG	Ex Post NTG	Ex Ante Total Net Water Savings	Ex Post Total Net Water Savings	Net Realization Rate
Faucet Aerator	90%	79%	433	114	26%
Showerhead			334	348	104%
Toilet Bag			n/a	199	n/a
<b>Total</b>			<b>n/a</b>	<b>661</b>	<b>n/a</b>

## 5.4. Process Evaluation Findings

This section presents process evaluation findings for the Efficiency Works for Homes Program. It begins with a review of participants sources of awareness, motivations for participation, and barriers to participation. It then examines participant and contractor experiences with program processes, and finally assesses participant and contractor experiences with key program design elements, including Efficiency Advisers, the streamline path, and program financing.

### 5.4.1. Awareness, Motivations, and Barriers

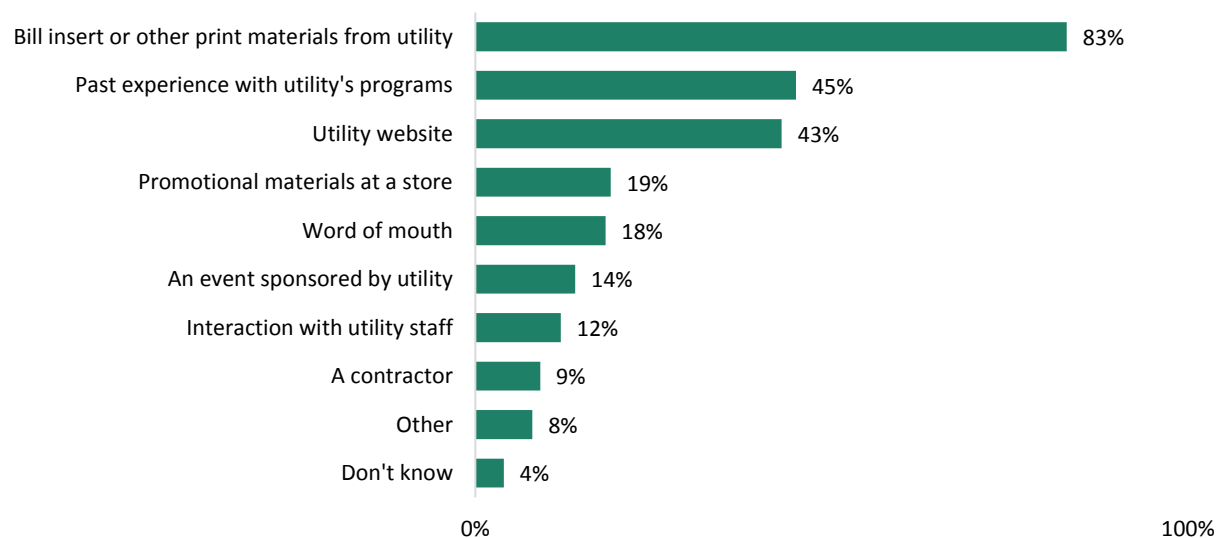
#### 5.4.1.1. Awareness

**Contractors largely drive participation in Efficiency Works-Home by promoting the rebates, benefits of high efficiency equipment, and the quality assurance benefits of the program.** Program staff reported that the EW-H participation is largely contractor-driven, but the five interviewed contractors varied in the reported sources of their projects. Two interviewed contractors corroborated program staff, reporting that their companies initiate the majority of their EW-H projects. Two other contractors reported an even split between projects they initiated and referrals from the program, and the final contractor said that almost all of their EW-H projects come to them from the EW-H program.

All four of the contractors that reported independently recruiting EW-H projects, said they promote the program on service calls. Two contractors also reported using paid advertising through direct mail or on the Internet. Contractors reported that, when they discuss the program with potential participants, they typically mention the availability of rebates (3 contractors) and the benefits of high-efficiency equipment (1 contractor). Another contractor reported informing customers that participating in the program provides the advantage of having an approved contractor complete the work to meet high standards, verified through a quality assurance process that would not happen outside of the program.

Residents who had not participated in EW-H were most often aware that their utility offered home energy audits (32%), followed by Home Energy Reports (30%), rebates for installation of efficient heating and cooling equipment (25%) and rebates for recycling old refrigerators and freezers (23%). Survey respondents who did not participate in EW-H but were nonetheless aware of the audits and building shell and heating system rebates the program offers most often reported learning about the program from utility-driven outreach efforts, like bill inserts (Figure 5-1). Contractors were a less common source of awareness among non-participants, although many of these respondents may not have considered home energy upgrades seriously enough to reach out to contractors.

**Figure 5-1: Non-Participant Sources of Awareness of EW-H Audits and Rebates (n=322)**



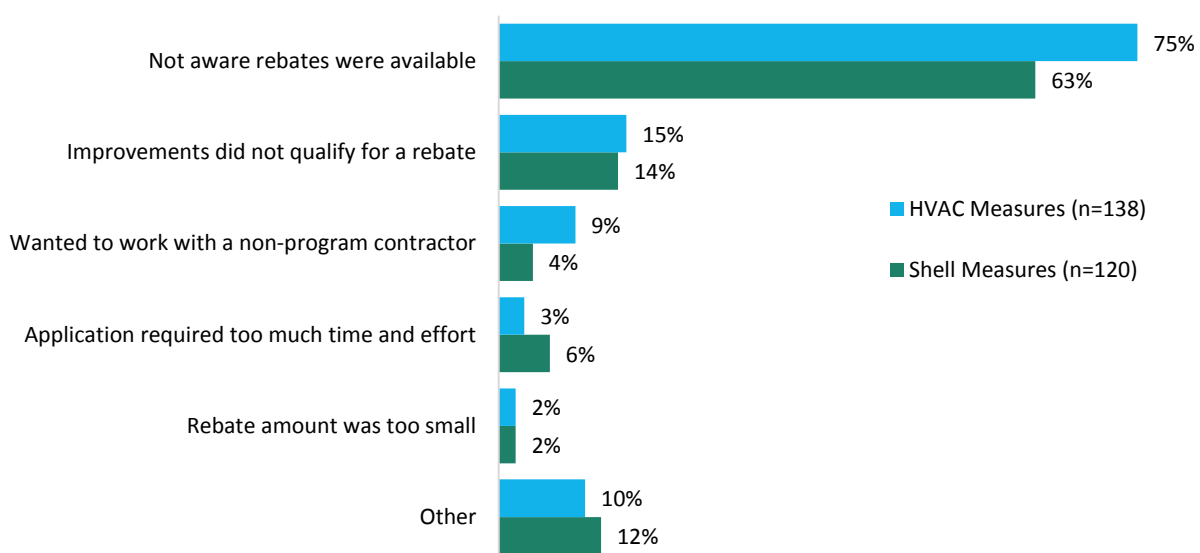
Slightly more than 12% of homeowners that did not participate in EW-H reported making insulation or air sealing improvements to their homes without receiving an efficiency rebate and 18% reported replacing a heating or cooling system without receiving an efficiency rebate (Table 5-22). Those that made insulation and air sealing improvements without a rebate most often reported making improvements that are typically easier and lower cost, like installing weather stripping around doors and windows and air sealing in outdoor walls. Those who installed HVAC equipment without receiving a rebate most often reported installing a natural gas furnace and a central air conditioner.

**Table 5-22: Measures Non-Participants Reported Installing Without Program Rebates (n=953, Multiple responses allowed)**

Measure Installed Outside of Program	Proportion of Non-Participants
<b>Any building shell improvement</b>	<b>12.6%</b>
<i>Weather stripping around doors and windows</i>	6.1%
<i>Air sealing in outdoor walls</i>	6.0
<i>Attic insulation</i>	5.9%
<i>New windows</i>	5.0%
<i>Wall insulation</i>	3.7%
<i>Floor insulation</i>	2.3%
<i>Duct sealing</i>	1.6%
<i>Other</i>	1.7%
<b>Any HVAC installation</b>	<b>18.0%</b>
<i>Natural gas furnace</i>	7.6%
<i>Central air conditioner</i>	7.5%
<i>Whole house fan</i>	1.0%
<i>Natural gas boiler</i>	0.9%
<i>Heat pump</i>	0.6%
<i>Other</i>	2.3%

Non-participants who reported installing HVAC equipment and those who reported upgrading building shell measures both most often reported they did not participate in the program because they were not aware rebates were available for the improvements they made (Figure 5-2). Non-participants who installed HVAC measures were more likely to report they did not use the program because they wanted to work with a contractor that was outside the program's contractor network than those non-participants who installed building shell improvements.

**Figure 5-2: Reasons Homeowners Who Made Improvements Outside Program Did Not Apply for Rebates (Multiple responses allowed)**



#### 5.4.1.2. Motivations

Multiple data sources confirm that customers' strongest motivations to participate in EW-H were **making their homes more comfortable and saving money on energy bills**. Increasing home comfort was the most common motivator that contractors and auditors cited for the customers they worked with (Table 5-23), although those respondents were divided on whether it was the most important motivator. Four of the six respondents (4 auditors, 2 contractors) citing comfort as a motivation said it was the most important reason while the other two said it was the second most important reason behind saving money. Contractors and auditors noted that participants' comfort issues were mostly related to temperature, with some areas of the home being drafty, too hot, or too cold.

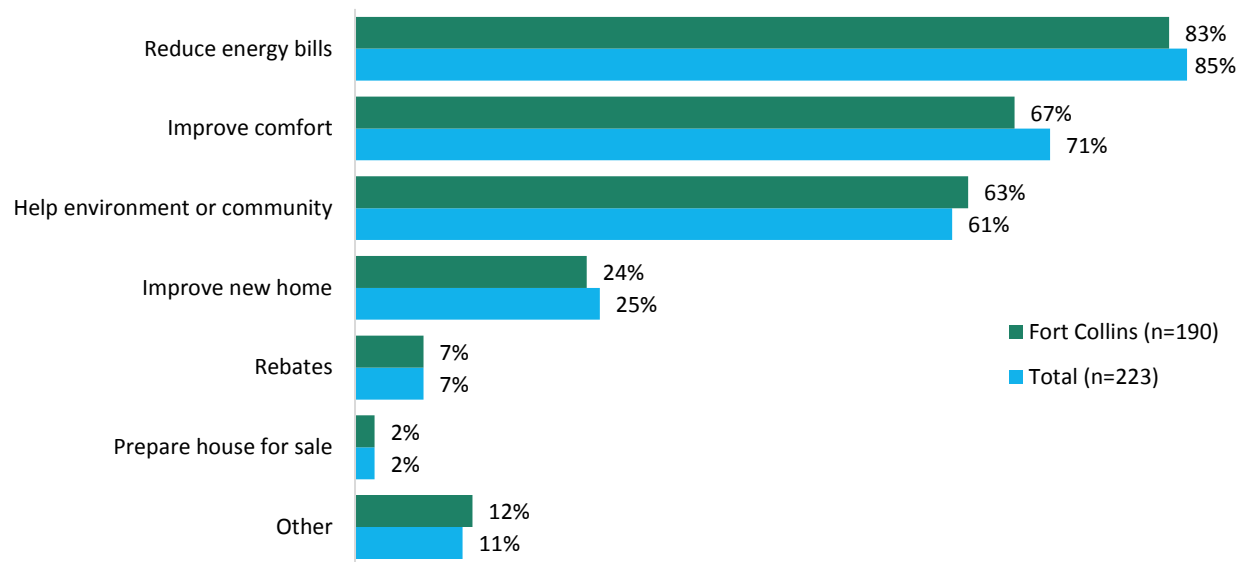
**Table 5-23: Motivations for Homeowners to Complete Projects (n=9)\***

Motivation	Number of Respondents
Make home more comfortable	6
Save money on energy bills	5
Reduce environmental impact	3
Rebates	3
Audits	2
Improve indoor air quality	1

\* Multiple responses allowed. Respondents gave between one and four reasons each.

Consistent with contractors' and auditors' assessment, the surveyed EW-H participants most often reported they were interested in the efficiency audit because they wanted to reduce their energy bills (85%), or make their home more comfortable (71%) (Figure 5-3). A quarter (25%) wanted to improve a newly-purchased home. 11% of respondents had another reason and selected "other". While "rebates" was not a category on this open-ended measure, about 7% of respondents originally selected "other" and specifically indicated that they had an efficiency audit performed to get rebates. These responses were separated into the ad hoc category "rebates".

**Figure 5-3: Participant Survey Respondent Motivations for Receiving EW-H Audit**



In their initial conversations, the program's Efficiency Advisors also record participants' priorities and barriers, which are captured in the program database. Advisors' assessments of participant priorities are largely consistent with contractor and auditor reports and participant survey findings. Advisors most often rated increasing home comfort as a participant priority (Table 5-24). Reducing energy bills was the third most commonly-cited customer priority, after rebates.

**Table 5-24: EW-H Participant Priorities, as Recorded by Energy Advisors**

Priorities	Audit-Only (n=1,379)	Rebate (n=1,003)	Total (n=2,382)
More Comfortable Home	57%	47%	53%
Rebates	31%	55%	41%
Reduce Energy Bills	35%	24%	30%
Expert Advice	29%	20%	25%
Save Energy	19%	12%	16%
Reduce Impact on Environment	2%	2%	2%
Finding a Contractor	2%	2%	2%

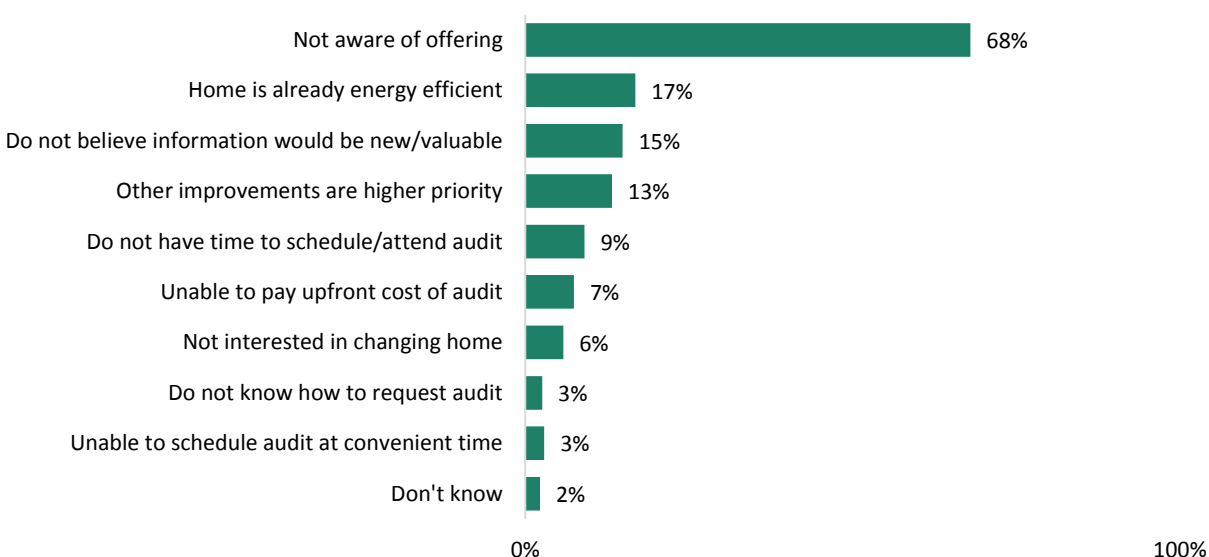
Priorities	Audit-Only (n=1,379)	Rebate (n=1,003)	Total (n=2,382)
Financing	2%	2%	2%
None Listed	3%	3%	3%

Rebates were second most commonly-cited participant priority in the energy advisors' ratings. We hypothesize that participants who prioritize rebates likely enter the program with a specific home energy upgrade project in mind. In contrast, other participants may enter the program seek information about how to increase their home's comfort or efficiency. Without a specific upgrade in mind, this later group is likely not yet ready to consider rebates. Consistent with this hypothesis, participants for whom advisors cited rebates as a priority were nearly three times as likely to install HVAC measures (47% of those who prioritized rebates, relative to 17% of others) than participants who did not prioritize rebates.

#### 5.4.1.3. Barriers

**The most common barrier to uptake of Efficiency Works audits is a lack of awareness that the audits are available** (Figure 5-4). Fewer than half of the surveyed homeowners who had not had an audit were aware that home energy audits were a service their utility offered. One interviewed auditor offered suggestions to increase awareness of EW-H in Larimer County by leveraging realtor networks and the Larimer Country Conservation Corps. This assessor suggested these groups could provide free or low-cost advertising for the program by distributing pamphlets to the homeowners or home-buyers with whom they interact.

**Figure 5-4: Barriers to Uptake of Efficiency Works – Homes Audits Among Homeowners Who Had Not Received an Audit (n=207)**



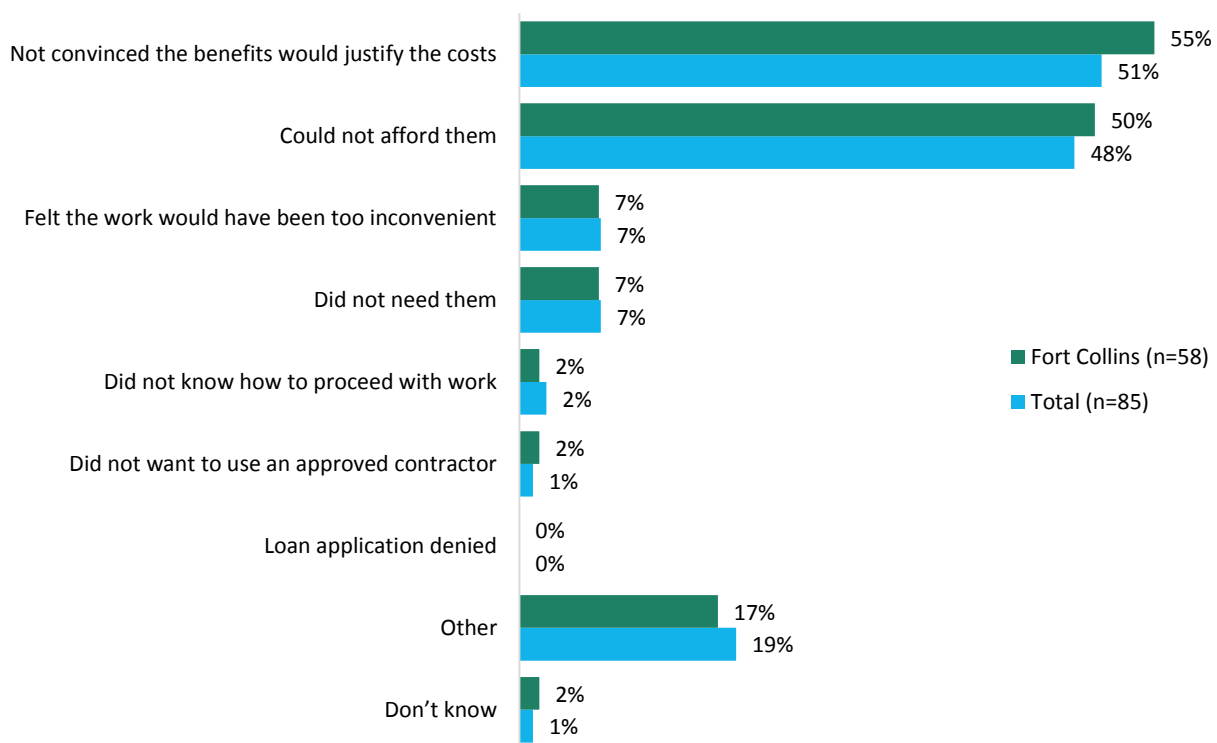
Surveyed findings suggest that homeowners who were aware of the audit offering but declined to participate primarily did so because they saw limited value in participation. These homeowners most

often reported their homes were already energy efficient or they did not believe the audit would provide new or valuable information.

Consistent with the reasons that aware non-participants did not pursue audits, the most common reasons audit participants did not move forward with the recommended improvements reflect a lack of perceived value in those improvements. EW-H auditors reported that the most common reasons participants do not move forward with projects are a lack of comfort issues in the home (mentioned by two auditors), and financial barriers (mentioned by one auditor).

Reasons the surveyed participants cited for choosing not to move forward with some or all of the improvements recommended in their audits are consistent with the auditors' assessment. Participants most often reported that they were not convinced the benefits of the recommended improvements would justify the costs, followed by simply being unable to afford the improvements (Figure 5-5). Some participants noted that they considered the cost/benefit trade off in deciding on future improvements.

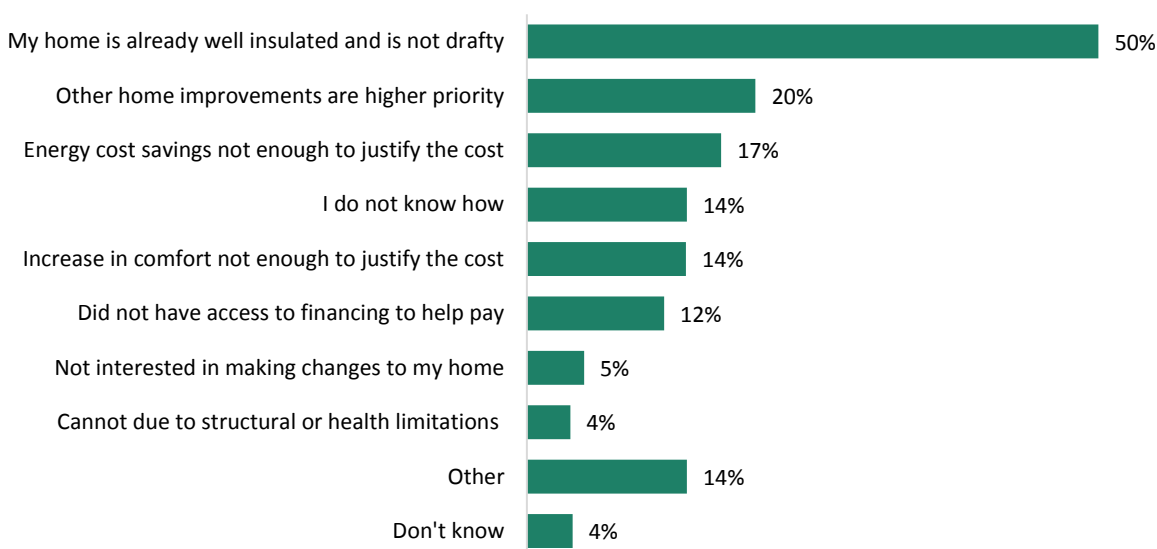
**Figure 5-5: Barriers to Completing Some or All Measures Recommended in EW-H Audits Among EW-H Participants**



Consistent with auditors' assertions and the reasons participants did not install measures recommended in their audits, non-participants who were aware incentives were available for insulation and air sealing improvements most often indicated they had not made improvements because they did not see sufficient value in doing so. Nonparticipants most often noted that their homes were already well insulated, followed by giving greater priority to other home improvements (Figure 5-6). Other barriers, like a lack of awareness of the process, lack of access to financing, and structural limitations were cited less frequently.



**Figure 5-6: Barriers to Uptake of Insulation and Air Sealing Improvements Among Non-Participants (n=213)**



## 5.4.2. Participation Process and Participant Experience

### 5.4.2.1. Audit process

**Both auditors and participants reported that the audit process typically occurs smoothly.** Auditors reported that some homeowners are more interested and engaged than others, though all auditors mentioned that homeowners were particularly interested in the infrared imaging displaying air leaks.

Auditors reported the following challenges to conducting the audits, though they did not report them to be formidable obstacles:

- › Time constraints to get measurements and perform direct install of instant savings measures, which is harder with a more engaged customer (3 auditors).
- › Gaining access to the attic or crawlspace if furniture or other items are in the way (1 auditor).
- › The homeowner is not home at the scheduled audit time (1 auditor).

Three auditors noted that the audit's focus on the building envelope and heating and cooling systems prevents them from effectively addressing plug-load energy efficiency opportunities. Finally, one auditor described duplicative work in having to fill out both a written report and a spreadsheet that contain much of the same information. According to this auditor, filling in this information twice was time consuming had the potential to introduce errors between the spreadsheet and report.

Respondents gave high ratings to the audit experience, with large majorities agreeing that the auditor was responsive to their needs and concerns and the audit took a reasonable amount of time to complete (Figure 5-7). Respondents were least likely to agree that they understood the next steps

necessary to make the recommended improvements, although 88% nonetheless rated the statement a “4” or “5” on a five-point scale of agreement.

**Figure 5-7: Participant Experience with Energy Audit\***



\* The above percentages refer to the proportion of respondents rating “4” or “5” on a 5-point scale of agreement. All five interviewed contractors said that they look at audit results prior to entering the home because they include valuable information of the size and age of the home. Two contractors reported that the audits were a motivating factor for participants to complete projects and both thought it was a mistake to remove the audit requirement for HVAC projects.

#### 5.4.2.2. Measure Installation and Rebates

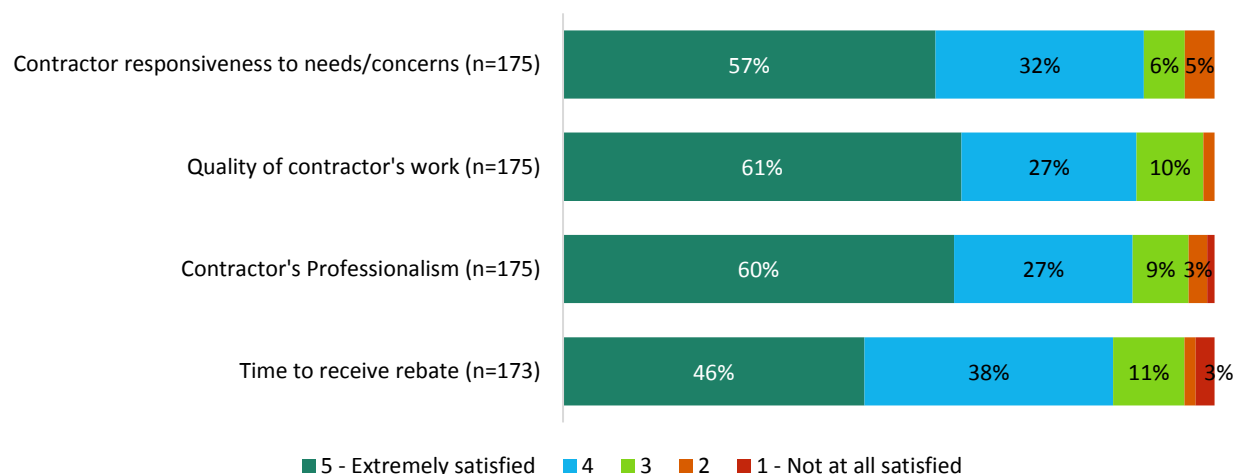
Contractors appear to bear most of the burden of the application process; they described the application as challenging and complex while participants were largely satisfied with the application process. Contractors (4 of 5) found the rebate application challenging because they reported it required a lot of detailed information to be filled out correctly, with two describing it as “cumbersome.” Two contractors mentioned that the documentation required on Xcel’s rebate forms was much simpler.

To meet the requirements of the application process, contractors reported they need to have an administrative system that, in one contractor’s words, “keeps paperwork flowing through the pipeline at a reasonable rate.” Two contractors described a multi-step checklist they must follow when a customer goes through the rebate program, with one noting that paperwork is involved “from beginning to end.” One of these contractors added that the rebate submissions forms requires a “high-level” person who understands technical details of the rebated equipment. Two contractors stated that they had lost points in the contractor scoring system when changes in office personnel resulted in longer response times to program inquiries and caused clerical errors with rebate submissions.

In contrast to the difficulties that contractors described with the application process, participants generally rated the installation experience highly. Large majorities of participants were satisfied that their contractors did high-quality work, were responsive to their needs and concerns, and acted

professionally (Figure 5-8). A large majority of participants were also satisfied with amount of time needed to receive their rebate.

**Figure 5-8: Participant Satisfaction with Measure Installation and Rebate Process**



**The rebate amounts are sufficient to motivate trade allies to use rebates as a marketing tactic and to motivate participants to complete upgrades.** A majority of contractors (3 of 4) who market their services use the rebate as part of their marketing message. In addition, the rebates facilitated participants' home upgrades. Nearly three-fourths of participants (73%) said the rebate was important in their decision to complete the upgrade.<sup>32</sup> If the rebate had not been available, 10% of participants would not have done their upgrade project at all and another 41% would have done a smaller or less expensive project; likely a less energy efficient project. At the same time, the cost of upgrades remains a barrier as half of the participants reported that they did not complete some or all of the recommended upgrades because of they could not afford them (50% in Fort Collins and 48% in Platte River territory).

While survey and interview data are consistent in showing that participants and contractors value the rebates the program offers, they offer limited insight regarding optimal rebate amounts. Program data suggest that, on average, Efficiency Works Homes participants received incentives of approximately \$740, with 62% of participants receiving incentives between \$500 and \$1,099. The data the evaluation team reviewed did not allow a calculation of the proportion of overall project costs these incentives represent. A high-level review of measure-level incentives across three comparison program administrators (Efficiency Vermont, Energy Trust of Oregon, and Xcel Energy's Colorado programs) found Efficiency Works Homes incentives generally in-line with those of other administrators. Efficiency Works incentives for insulation, which range from \$0.30 to \$1.00 per square foot, depending on the location and type of insulation, were somewhat higher than those offered by Energy Trust or Efficiency Vermont, which ranged from \$0.25 to \$0.40 per square foot. However, the available information from these programs did not make clear whether they apply a cap to insulation incentives, as Efficiency Works does.

<sup>32</sup> Seventy-three percent of participants rated the importance of the rebate as a "4" or "5" on a 1 to 5 scale where 5 equals extremely important and 1 equals not at all important.

Our findings did not uncover additional measures that would be worthwhile to rebate in the program. The most commonly-reported completed energy efficiency upgrade ineligible for rebates was installing weather-stripping, for which we do not recommend creating a rebate. One contractor mentioned that they would like to see a different brand of whole house fan eligible for rebates as their customers reportedly do not like the fan that qualifies for rebates.

### 5.4.2.3. Quality Assurance Process

**While contractors described the Efficiency Works Quality Assurance (QA) process as comprehensive, all expressed positive views of the process.** The interviewed contractors reported that the program has high standards and, as a consequence, verifies a large number of elements for each project. This includes verifying that projects pass code inspections, that contractors have made the proper readings and measurements at the site, that the contractors have completed the commissioning forms correctly, and, as one contractor said, “scrutinizing the report paperwork.” Despite the need to undertake this comprehensive review, all five interviewed contractors spoke positively of the QA procedure.

Three of the interviewed contractors described the QA process as educational, saying it has “raised the standards” of their firms and other participating contractors. Two of these contractors reported learning techniques from the QA reviews they have since adopted at their companies, in order to continue to meet the program’s standards. One of these contractors added that the QA process has “has brought a lot of really positive outcomes to our team and our customer service ratings have gone up since it’s been implemented.”

One contractor noted that the program’s requirement of photo documentation had facilitated her company’s internal quality assurance process. This contractor reported that she can review the photos in real-time and inform the installers if there is something they are overlooking, thus catching errors before the program’s QA reviewer inspects the project and reducing the number of times installers must return to the site.

Two contractors reported positive changes to the QA process. One commented that the process has improved in general, saying, “They’ve gone through a constant evolving to make things easier or to get more accurate information. They’ve made various changes to make sure we’re doing the best we can.” Another reported that the QA process has become more sensitive to the needs of the contractor. Specifically, this contractor appreciated that the program’s QA inspectors now inform the contractor and give them the opportunity to fix any issues identified before informing the customer. This contractor noted that, when the program’s QA inspector would inform the customer directly that the contractor had missed some element of the process, it “really made people mad at us.”

### 5.4.3. Key Program Design Elements

This section reviews three key program design elements of the Efficiency Works for Homes program: the use of Efficiency Advisers, the streamline path offering, and the financing offerings the program has made available to help participants pay for their efficiency improvements.

### 5.4.3.1. Efficiency advisers

**While auditors see the efficiency adviser's role as a trusted resource to answer questions and encourage projects as valuable, contractors reported the role confuses participants and convolutes their relationship with their customers.** All four auditors spoke positively of the efficiency advisers and said they were an important resource for participants because they helped to answer questions and connect participants with a contractor. Two auditors mentioned that “most people aren't willing to commit to something right after the audit” and that communication with the adviser following audit helps to close the project. More senior CLEAResult staff added that, while the adviser is an added cost, they help to improve participation and satisfaction rates.

Contractors and auditors reported minimal communication with efficiency advisers, mostly via email, but noted this communication is effective. Auditors appreciated the adviser's role in scheduling the audits and providing relevant utility data prior to the audit. One contractor said the efficiency advisers were helpful in making sure her firm turns in the necessary paperwork following the project.

While one interviewed contractor expressed a positive view of the adviser's role, saying their initial interaction with the participant can increase the participant's trust in the contractor and justify the contractor's presence in their home, the other four interviewed contractors expressed concerns about the adviser role. One contractor said they perceived that customers found the advisers “pushy” in encouraging them to do upgrades beyond what they wanted to do. The other three said the efficiency adviser complicates the contractors' relationship with the customer.

One contractor described “our relationship to the efficiency advisers and our customer's relationships to the advisers” as the thing she most want to change about the program. This contractor noted that participants interact with multiple program representatives, including the efficiency adviser, auditor, and contractor, and may be confused about the division of responsibilities between them. This contractor also noted that the participant may reach out to the efficiency adviser when there are issues with the installation, rather than the contractor directly, which can delay contractor response times and “convolutes communication with the customer and diminishes the relationship we have to our customer base.”

Another contractor expressed misgivings about the efficiency adviser's role as an intermediary in his relationship with the customer. He said he has proven himself to be an expert at his specialization and has met the program's high standards. Thus, it was “tough” for him to allow the adviser to speak on his behalf and trust that the adviser will answer the homeowner's questions about the project scope accurately.

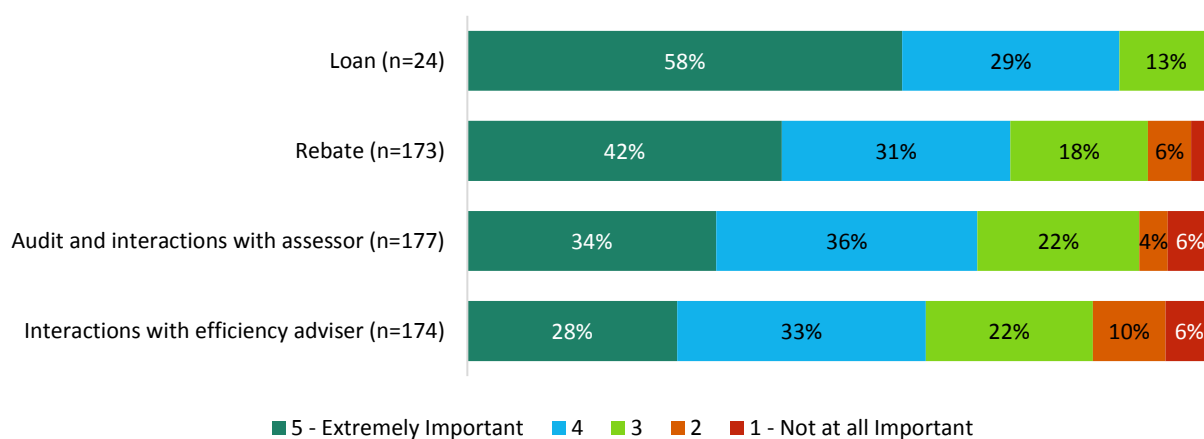
Three of five contractors said they had capacity to perform the role of the energy adviser and were well positioned to do so because the contractors have been to the participant's home and can therefore answer specific, technical questions. A fourth contractor said that her firm could provide the same service, but said she would prefer to “keep it the way it is now” with separate roles. The fifth contractor saw value in keeping the roles separate. He said that since he benefits from the sale of equipment and the adviser does not, the adviser builds trust between the customer and contractor.

**Survey data indicate that participants find value in the role of the efficiency advisor, but their interactions may not be as influential as other program elements.** A large majority of surveyed participants recalled communicating with an efficiency advisor (78%) and more than three-fourths of those (77%) engaged with the adviser, asking questions or seeking advice. A vast majority (95%) of

participants who engaged with the adviser reported that they found the efficiency adviser's assistance and advice to be very or extremely helpful. Approximately three-fourths of all audit participants (76%) also rated the independence of the assessor and efficiency adviser, who lack a financial stake in any upgrade project, as either extremely or very important in their decision to make upgrades.

Nonetheless, participants rated their interactions with the efficiency adviser as less influential on their decision to complete efficiency improvements than the program's on-bill financing option (for those who used it), the available rebates, or their audit and interactions with the assessor (Figure 5-9).

**Figure 5-9: EW-H Participant Ratings of Importance of Program Elements in Upgrade Decision**



#### 5.4.3.2. Streamline Path

Findings indicate that the streamline path provides notable benefits to participants, while raising challenges for contractors and auditors.

##### *Participant Benefits*

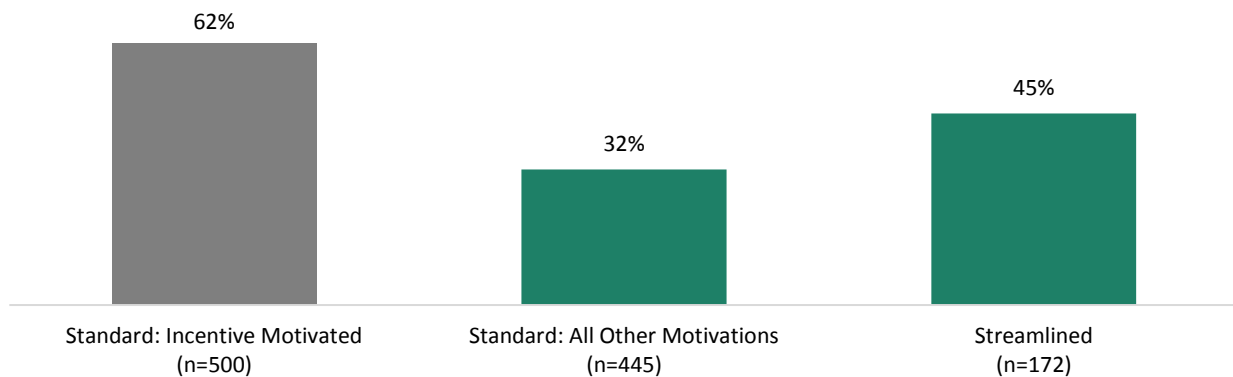
**For participants, the streamline path facilitates the decision and measure installation process and increases uptake.** Two auditors who had completed streamline path audits reported that the measure packages encouraged upgrades by simplifying the decision-making process for participants. A third auditor who had not completed streamline path audits also speculated that the approach would be beneficial. This contractor anticipated that the discussions following a streamline audit would more effectively inform customers about the special pricing, financial assistance available, and that approved contractors can start working on their project quickly. Program data and survey findings support these auditors' assertions that the streamline path facilitates participant decision making.

Overall, for audits conducted in 2016, there was not a notable difference in audit-to-retrofit conversion rates between the streamline path (45%) and the standard path (48%). However, as noted in Section 5.4.1.2, above, a notable portion of participants were motivated to participate in the program by the availability of rebates, suggesting they already had a project in mind for which they wanted a rebate. The vast majority (99%) of these participants were assigned to the program's standard path. The

streamline path is designed to make the energy upgrade decision easier for those interested in increasing their home's efficiency but unsure of the best way to do so, and thus would not be appropriate for participants who know what they want to install. Participants entering the program with a project in mind may be expected to convert from audits to retrofits at a higher rate than those entering the program with more general interests. These participants are more likely to have a sense for the scale of the project they plan to undertake and be prepared to undertake a project of that scale than participants without a specific project in mind.

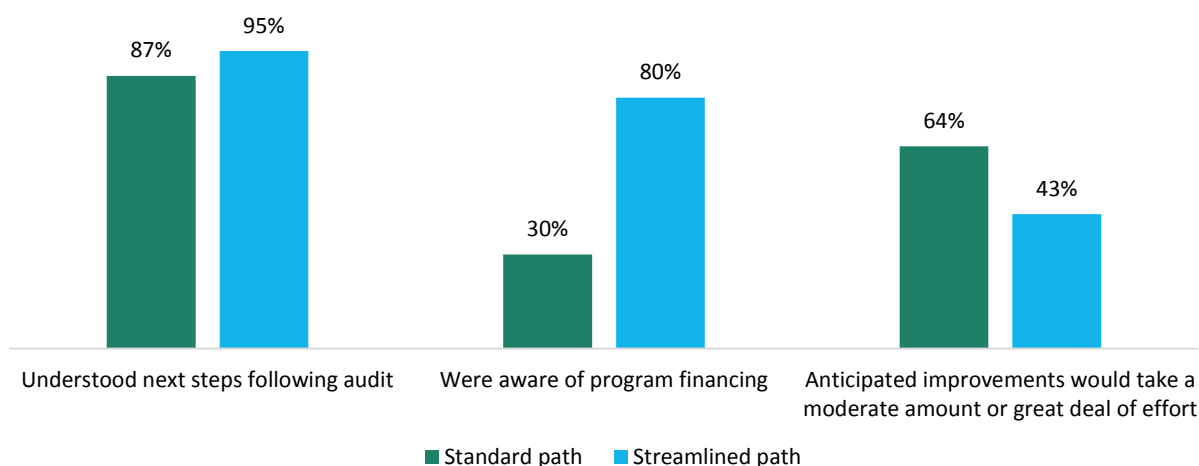
An analysis of the audit-to-retrofit conversion rates of participants motivated by rebates distinct from other standard path participants supports the hypothesis that those entering the program with a project in mind are likely to convert at a higher rate (Figure 5-10). It further suggests that, among participants who may not have a specific project in mind, the streamline path results in a higher conversion rate than the standard path.

**Figure 5-10: Audit-to-Retrofit Conversion Rate by Path and Participant Motivation (Audits Conducted in 2016)**



Consistent with the higher conversion rate indicated in program data, EW-H participant survey findings suggest that participants in the streamline path had greater awareness of how to proceed following their audit and of the financing support available (Figure 5-11). Although, with a limited sample, the differences were not statistically significant, streamline path participants were somewhat more likely than standard path participants to agree that they understood the next steps following their audit. Streamline path participants were significantly more likely than standard path participants to be aware of the program's financing option.<sup>33</sup> Streamline path participants were less likely than standard path participants to anticipate that making the recommended improvements would take either a moderate amount or a great deal of effort. Instead, streamline path participants most often anticipated improvements would require some, not much, or very little effort. This difference, however, was not statistically significant.

<sup>33</sup>  $p = .001$

**Figure 5-11: Comparison of Streamline and Standard Path Respondents on Key Program Metrics**

**Assessors, efficiency advisors, or contractors may group measures into informal “packages,” even for standard path participants, to communicate more effectively with participants about their upgrade options.** Approximately one fourth (27%) of surveyed participants reported that the assessor grouped their upgrade options into “good”, “better” and “best” packages, rather than presenting a menu of individual options, considerably more than the 8% of respondents who program data indicated used the streamline path. Notably, among respondents the program data indicated were on the standard path, 33% self-reported that the assessor grouped the options into “good”, “better” and “best” packages. This suggests that, in discussing upgrade options with participants, assessors, efficiency advisors, or contractors may be grouping measures together, even if the participants are not part of the streamline path.

### *Auditor and Contractor Challenges*

**Despite the benefits for participants, auditors and contractors expressed serious concerns about the viability of the streamline path.** Two of the four interviewed auditors and three of the five interviewed contractors had experience with projects in the streamline path. The challenges with the streamline path that these auditors and contractors reported fall into three categories:

- › Additional effort required to complete streamline path projects
- › The standardized pricing that goes into the measure packages
- › Increased complexity in the relationship between the contractor and the customer

Given these concerns, two of the three contractors with streamline path experience reported that they wanted fewer streamline path projects going forward, and none reported they wanted more. The following sections provide additional detail about each area of concern.



### Effort Required

**Both auditors and contractors reported that streamline path projects require more time and effort on their part than standard path projects; for contractors, this added effort offsets the cost savings from shifting the responsibility for making the sale to the auditor.** Auditors reported that the streamline path extends the time required to complete the audit by between 60 and 90 minutes, citing two reasons. First, auditors must make precise measurements of the home, rather than relying on square footage estimates, because precise measurements are necessary to accurately price the measure packages. Second, auditors reported that presenting the measure packages at the end of the audit typically takes between 30 and 60 minutes.

All the interviewed contractors with streamline path experience reported the streamline path involves an increased administrative burden. One described it as “a lot of extra work for the contractors” and another said it increased the overhead. One of these contractors noted that this added administrative effort offset any savings from not having to recruit customers and sell jobs, saying “For all the effort you save on the sales front, you add that back into the administrative part. It’s kind of a wash.”

The third contractor reported raising their rates to offset the cost of the additional administrative and commissioning requirements. As an example, he said that to qualify for a \$500 rebate, their prices may reflect \$300 in paperwork and commissioning costs they would not otherwise complete. This contractor suggested that other companies may decline to participate in the program because they do not want to take on the additional administrative and commissioning costs, and instead focus on offering lower prices. Program staff note, however, that the program’s requirements ensure equipment is properly sized and commissioned, steps that contractors seeking to offer the lowest prices may omit. .

### Standardized Pricing

**Contractors reported that the streamline path’s standardized pricing did not provide sufficient flexibility for variation in conditions between homes or changes in the market.** The streamlined path includes standardized pricing for insulation and air-sealing services. Program staff have negotiated menu-pricing with contractors for these measures to facilitate the development of the measure packages. One interviewed contractor said his company was dissatisfied with the process of updating or revising the standardized pricing. This contractor reported that, as market shifts had increased his cost for both materials and labor, the program allowed his company to increase their menu-pricing only to reflect the increased cost of materials, for which they were required to supply documentation. He added that the once-a-year opportunity to discuss the standardized pricing with Efficiency Works was not sustainable for his company.

The streamline path does not include standardized pricing for HVAC measures. An HVAC contractor who participated in the Neighborhood Pilot preceding the establishment of the streamline path said the program requested standardized pricing from them, but his company refused to provide it, stating that each of their projects is too customized to facilitate flat-rate or menu-style pricing.

### Complexity of Relationships

**Contractors reported challenges in completing a scope of work they had no involvement in developing.** Two interviewed contractors mentioned challenges related to implementing a scope of work they had not generated. One reported that, in some cases, it was not possible to implement the scope as they received it due to logistical limitations, and in other cases this contractor thought there was a better solution than what was recommended. The other contractor said that in some cases, once he arrived to complete a project he would find that equipment or supplies not included in the scope of work the auditor defined needed to be installed. As these items had not been included that in the package pricing, his company had to absorb the cost to properly complete the job. This contractor reported these items were often relatively minor, with costs in the hundreds, rather than thousands, of dollars.

Finally, one HVAC contractor reported the pay structure of the streamline path was inconvenient for their firm because, when participants had comprehensive projects, he would have to wait until other contractors finished their portion of the work before EW-H would pay him for his portion.

#### 5.4.3.3. Financing

**Contractors and auditors typically discuss financing options with customers, including the Elevations Loan, but see the Elevations Loan as less attractive than Fort Collins' prior on-bill financing offering.**

The two auditors with streamline path experience reported that they mention the program financing option on every project. These auditors reported they provide more in-depth information about financing if they think the customer might need it or want more information about it. They noted that the efficiency adviser's questions about the customer's interest in financing during their initial discussions give the auditors a good sense of how much time they should spend talking about it. The two independent auditors interviewed both reported they do not view it as their role to discuss financing with customers.<sup>34</sup>

Contractors reported they typically present financing options to customers. Two contractors said they discuss financing options on every sales call and three said they take cues from the customer to decide whether they present financing options. Most contractors (4 of 5) said they discuss the Elevations Credit Union HELP loan with customers and one of them said they also discuss an in-house financing option. The fifth contractor said the only financing service they discuss with customers is a loan they offer through Wells Fargo that offers a term of 12 to 16 months with no interest.

Contractors reported most customers do not pursue financing for three reasons: 1) The customer does not want to take on debt; 2) the customer has already budgeted for the project and is prepared to pay up front; or 3) the customer prefers to pay with a credit card to earn points or airline miles. One contractor added that, when a customer needs financing, the Elevations loan is a great option for them because the process is streamlined and works well. He said he "had heard nothing but positive feedback about the Elevations loan from [his] customers."

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<sup>34</sup> While staff members of CLEAResult, the program's implementation contractor, conduct the majority of the program's audits, two of the interviewed auditors operate independently and contact to the program to conduct audits when project volume justifies doing so.

Four contractors and two auditors said that the availability of financing allowed projects to happen that would not otherwise, although both auditors and one of the contractors reported the on-bill financing (OBF) option previously offered by Fort Collins Utilities was more effective in moving projects forward than the Elevations loan. Customers reportedly responded very well to the OBF package and found the low interest rate and the ease of paying it on their utility bill attractive. As one assessor pointed out, “people across the board seemed to love that option” and surmised that the Elevations loan was not as attractive because it involved “an extra step.” A contractor added that while financing helps to make projects happen, the current financing does not drive projects “nearly as much as when OBF was available.” She said that when the OBF option was removed, it dramatically reduced the number of EW-H projects her firm completed.

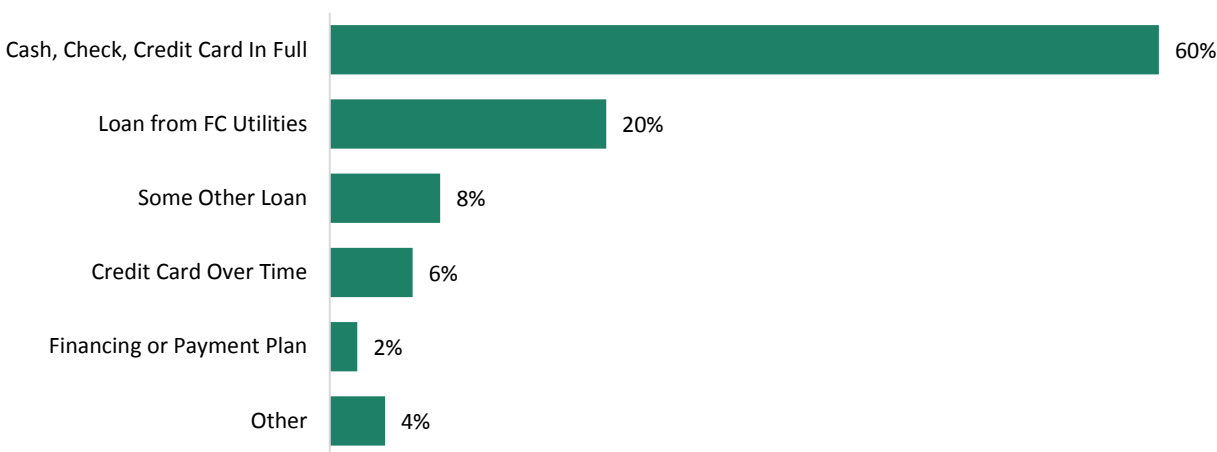
**While most participants did not use an energy loan, the availability of financing allowed those who used it to complete more comprehensive projects.** Despite auditors’ reports that they typically present the program’s financing offering to customers, fewer than half of the surveyed participants reported awareness that the loan was available (Table 5-25). Consistent with contractors’ reports that many participants have already budgeted for their projects, the most common reason those aware of the loan cited for not using it was that they did not need financing.

**Table 5-25: Participant Response to Program Financing Option (n=121)\***

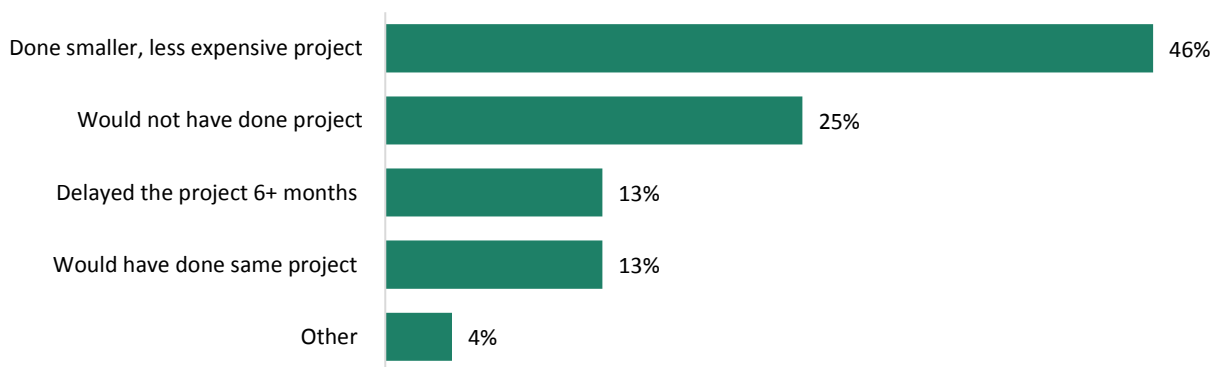
Response to Loan Offering	Percent
Used program financing offering	20%
Not aware of program financing offering	52%
Aware of program financing offering but did not use	28%
<i>Did not need financing</i>	20%
<i>Did not want to take on debt or commit to payments</i>	7%
<i>Wanted loan with different terms</i>	2%
<i>Did not want to go through application process</i>	1%
<i>Did not think I would qualify</i>	0%
<i>Applied but did not qualify</i>	0%
<i>Other</i>	2%
<i>Don't know</i>	1%

\* Includes only Fort Collins participants who installed measures following their audits.

Further supporting the finding that participants often declined to use financing because they did not need it, the majority of surveyed participants reported paying for their projects with cash, check, or a credit card that they intended to repay in full at the end of the month. Those that used a financing source other than the program’s energy loan most often reported using an independent, personal loan rather than a credit card or a contractor’s repayment plan (Figure 5-12).

**Figure 5-12: Surveyed Participants Payment Method for Energy Upgrades (n=121)**

Survey findings suggest that the financing offering was valuable for participants that used it. As Figure 5-9, above, suggests, the surveyed participants who received loans rated them as important in their decision to make efficiency improvements more frequently than any other program element. Further, more than 80% of respondents indicated that, had the loan not been available they would have either delayed their project, altered it in ways that likely would have reduced their energy savings, or canceled it altogether (Figure 5-13).

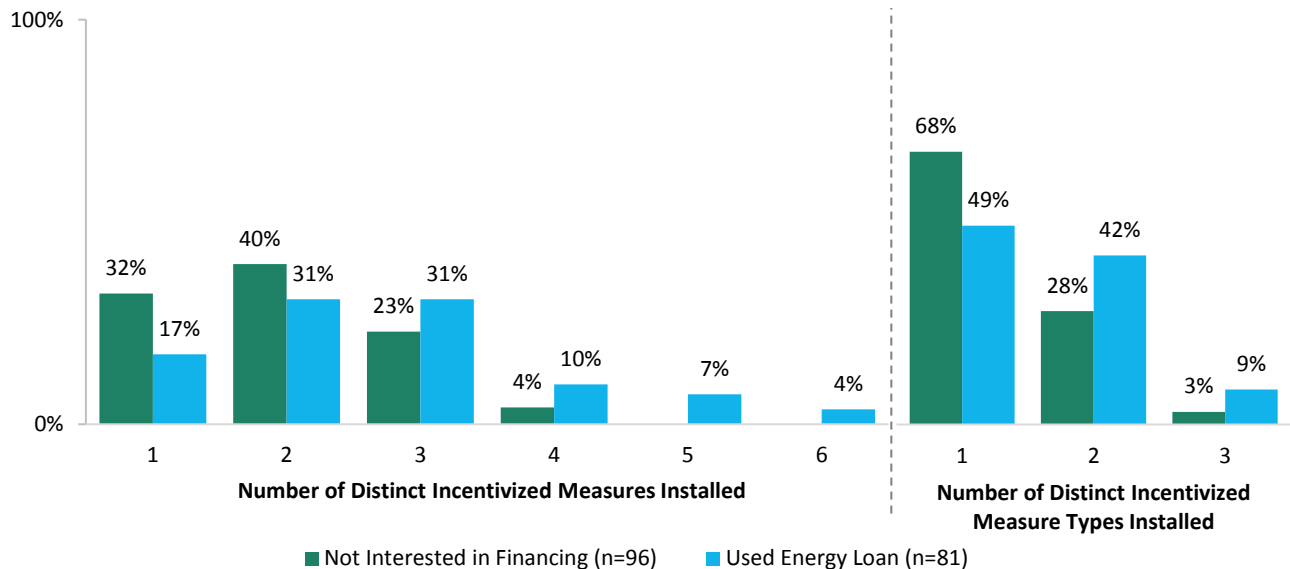
**Figure 5-13: Participants' Likely Actions if Loan Were Not Available (n=24)**

Program data support participants' survey responses that the loan allowed them to complete larger and more comprehensive projects. Participants who the program data indicate used an energy loan installed an average of 2.7 incentivized measures, while participants that program data indicates were not interested in financing installed an average of 2.0 incentivized measures.<sup>35</sup> Data also indicate that participants who used energy loans completed more comprehensive projects, with 51% installing

<sup>35</sup> Program data listed a financing status for 206 of the 1,051 projects in Fort Collins that installed incentivized measures. Ninety-six (46.6%) of those projects were listed as "not interested," while 81 (39.3%) were listed as "Financing Complete – Energy Loan Utilized." The remaining 29 projects (14%) had a variety of intermediate financing statuses and are not included in this comparison.

measures of more than one type (for example, both HVAC and shell measures) relative to 31% of those not interested in financing. Figure 5-14 illustrates the distribution of the number of measures installed and measure types included in projects using energy loans and those not interested in financing.

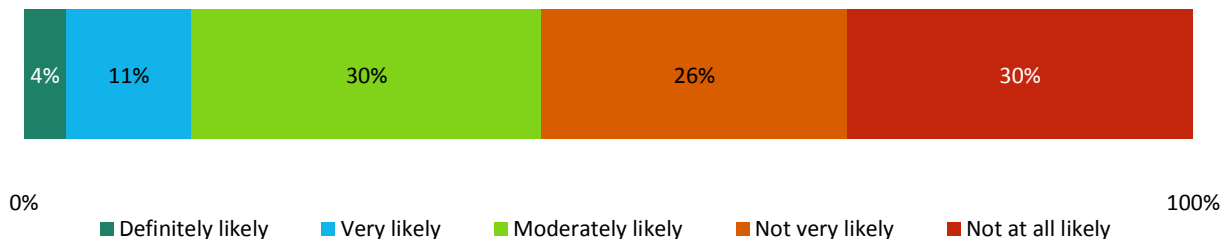
**Figure 5-14: Comprehensiveness of Projects Using Energy Loans and Those Not Interested in Financing\***



\* Distinct measure types include shell measures (insulation and air sealing), HVAC, and water heaters.

While most non-participants reported that the availability of a low-interest loan to pay for energy efficiency improvements would not increase their likelihood of making energy efficiency improvements, a small group of non-participants reported that a low-interest loan would make them more likely to make improvements (Figure 5-15).

**Figure 5-15: Non-Participant Likelihood of Participation if a Low Interest Loan Were Available (n=602)**



## 5.5. Conclusions and Recommendations

**Conclusion 1:** The streamline path eases the upgrade process for participants, increasing the likelihood they will install rebated measures, but, to be sustainable, it must more effectively work with contractors.

Streamline path participants were more likely to be aware of the program’s financing offering, generally anticipated making the recommended improvements would require less effort, and were generally more likely to report they understood the next steps following their audits than standard path participants. Consistent with these findings, program data suggest that streamline path participants were more likely to install measures recommended in their audits than standard path participants, with the exception of those standard path participants who entered the program with a project in mind.

However, the interviewed contractors reported that the streamline path approach does not work for their businesses. Contractors were dissatisfied with the standardized pricing and their lack of involvement in developing the scope of work. Due to this dissatisfaction, none of the interviewed contractors wanted more streamline path projects, and most wanted less. Given the key role of contractors in delivering the Efficiency Works – Homes program, to succeed over the long-term, the streamline path will need to gain contractor support.

The need to simplify decision-making and participation processes for participants while ensuring that energy upgrades remain an attractive business opportunity for contractors is a common challenge for home energy retrofit programs, and approaches vary. For example, National Grid’s EnergyWise program in Rhode Island assigns contractors to install weatherization measures scoped by an independent auditor, but keeps a program representative on-call to address any changes to the scope of work that the installation contractor determines are necessary. Auditors also provide installation contractors with photos to accompany the scope of work so the installation contractors can better prepare for the job. Evaluation interviews found that installation contractors were largely satisfied with this approach.<sup>36</sup> Enhabit (formerly Clean Energy Works Oregon) takes a different approach, assigning participants a contractor who conducts the energy assessments.<sup>37</sup> The assessment contractor then develops the scope of work and offers installation services directly, while Enhabit provides energy adviser services and offers an online portal to help participants move through the process and contractors track the progress of their customers.

**Recommendation 1:** Investigate ways to increase contractor involvement in developing streamline path scopes of work and provide greater flexibility in standardized pricing while maintaining the streamline path’s participant benefits. Efficiency Works staff should investigate other program administrators’ approaches, like those cited above, and gather contractor feedback on any proposed changes to the program.

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<sup>36</sup> Research Into Action, Inc., “National Grid Rhode Island EnergyWise Single Family Process Evaluation” (Waltham, MA: National Grid, September 1, 2016).

<sup>37</sup> Participants can also request to work with a specific participating contractor when they enter the program.

**Conclusion 2:** Improved data tracking and an updated billing analysis provide opportunities to more effectively capture the full range of energy savings benefits the program achieves.

Difficulty accessing data increased the resources required to complete this evaluation and limited its ability to verify savings assumptions. The process of extracting assessment files from the program's Salesforce database was resource intensive for CLEAResult, and extracting data from those files, in turn, was labor intensive for the evaluation team. The assessment files further did not consistently and uniformly provide data on baseline conditions. Capturing these data in a uniform, consistent way and storing them in a more easily-accessible, electronic format would allow future evaluation efforts to review savings and assumptions in a more detailed, granular way.

This evaluation focused on a granular, engineering-based assessment to allow Efficiency Works to update its savings assumptions to better represent actual program participants and installed measures. However, the evaluation found moderate free ridership and significant spillover, suggesting that the program could benefit from conducting a billing analysis. An updated billing analysis could ensure that the results of the engineering calculations are reliable and adequately accounting for interactive effects, it would also capture spillover savings.

**Recommendation 2:** Develop systems to capture assessment data in a more systematic way and store the data in a more readily accessible electronic format. Capturing data in a uniform, consistent way and storing them in a more easily-accessible, electronic database format would allow future evaluation efforts to conduct a more detailed, granular review of savings and assumptions.

**Recommendation 3:** Conduct an updated billing analysis, including a review of spillover savings from audit-only participants.

## 6. Midstream Retail Lighting

### 6.1. Program Description

The Midstream Retail Lighting program provides point-of-purchase rebates for sales of energy efficient lighting products at national and local retailers. Throughout Platte River's owner municipalities there are seven unique retailers and 18 participating storefronts: eight in Fort Collins and an additional 10 stores in Longmont and Loveland. Advertising, in-store signage, sales-associate training, and instant customer incentives through price markdowns drive participation. To provide incentives, Fort Collins Utilities also works with manufacturers to reduce the cost of the items by partially paying for them outright.

Platte River owner municipalities began offering home lighting incentives in 2005 as a partnership with retailers to discount CFL light bulbs. They expanded the offering in 2009 to include LED bulbs, and again in 2012 to include occupancy (occ) sensors and dimmers. In 2014, the program phased out CFLs. Special promotions have been used occasionally to drive further participation. For example, in 2005 there was a "turn in a torchiere" campaign where customers exchanged a halogen-based torchiere for CFL-based fixtures. For the 2014-2016 program years, Fort Collins partner retailers continued to offer specialty CFLs while Platte River has transitioned to LEDs-only. Fort Collins Utilities dropped CFLs entirely in 2015 and both utilities offered only LEDs.

**Table 6-1: Consumer Products Appliance Recycling Overview**

Offered Since	Measures Offered	Incentives	Other Details
Year 2005	LED specialty and general service lamps, lighting controls (occ sensors and dimmers)	\$1-\$3/general service lamp, \$1-\$5/specialty, \$5/occ sensor, \$10/dimmer	CFLs offered through 2014, phased out in 2014 (specialty only at that point), general service LED phased out at end of 2016

### 6.2. Research Questions and Evaluation Approach

The evaluation addressed three research questions related to the Midstream Retail Lighting program:

- › For which products has the market transformed such that few sales are attributable to program incentives? For which products is intervention still justified?
- › What barriers prevent additional customers from participating in the program (i.e. purchasing efficient lighting)?
- › Why have some retailers stopped participating in the program, and what would motivate them to participate again?



### 6.2.1. Impact Evaluation Approach

The evaluation team reviewed a census of Platte River’s lighting tracking database records to validate annual electric energy savings and demand. The availability of light bulb characteristics in the tracking database, including make, model, wattage, and type of the bulbs were critical inputs to the impact evaluation. The ex post evaluated savings algorithm was applied based on existing tracking database details that were reformatted and reclassified (such as using bulb description and model number to create actual wattage, bulb type, and bulb style fields) to allow ex post estimates to be developed. Considerable effort was made to transform the tracking database to make the ex post savings analysis possible, which involved applying the results of primary data collection for some parameters (deltas watts and in-service rates) and secondary data for the hours of use. A more detailed explanation regarding the ex post analysis are detailed in Appendix B.2.

The primary research conducted for the Midstream lighting program included:

- › Database review
  - What lighting product details were being captured (bulb type, style, wattage, lumens) in the tracking data? Determine missing details and make recommendations for data capture going forward.
- › Residential general population survey (Section 0)
- › Per unit savings review
  - Reviewed and validated engineering assumptions (in-service rates, delta watts, hours of use, interactive effects).
  - Developed alternative savings, where appropriate, and provided a systematic approach to applying reliable savings estimates to each bulb type.
  - Determined appropriate estimated useful life (EUL) and lifecycle costs for cost effectiveness.

For net savings, the evaluation team used three unique approaches:

1. **Sales data approach.** Because Apex Analytics is involved in numerous other lighting evaluations and research, our team drew on high-level market sales data, descriptive statistics, reports, and a national lighting sales database and model our team developed to determine program attribution. In fact, the CREED LightTracker team (also members of Apex) have completed the 2016 program year modeling effort and shared details of the impacts of midstream lighting program spending on household efficient lighting market share, among other key lighting market insights.
2. **Secondary data.** The evaluation team has played pivotal roles in other recent lighting evaluations across the country, and leveraged a comprehensive literature review to help benchmark the existing NTG assumptions.
3. **Qualitative data based on interviews.** The evaluation team also interviewed three retailers and three manufacturers to understand their perspective about working with the program and how the incentives and program marketing collateral impacts the sales of efficient LED lighting.

## 6.2.2. Process Evaluation Approach

The process findings on the Midstream Retail Lighting program includes information gathered from four data collection activities:

- › **Staff Interviews:** The evaluation team conducted in-depth interviews with program staff. The output of these discussions helped shape priorities for interviews with market actors familiar with the Midstream Retail Lighting program.
- › **Retailer Interviews:** The evaluation team conducted three in-depth interviews with store managers of participating (2) and formerly participating retailers in the Mid-Stream Retail Lighting program. The interviews with the currently participating retailers focused on market saturation and transformation of LEDs and attribution to the program, while the interview with the previously participating retailer also discussed reasons for no longer participating.
- › **Lighting Manufacturer Interviews:** The evaluation team conducted three in-depth interviews with staff of manufacturers whose products are rebated under the Midstream Retail Lighting Program. These interviews focused on changes in the market, program influence, and market transformation.
- › **Residential Surveys:** The evaluation team conducted web-based surveys of Platte River customers and households that participated in the Efficiency Works Home, Appliance Rebate, and Appliance Recycling programs. These surveys included questions regarding lighting purchasing behaviors and awareness of the Midstream Lighting marketing materials.

## 6.3. Impact Evaluation Findings

### 6.3.1. Database and Project File Review

The evaluation team reviewed the historical tracking database and relied on the “actuals” worksheets to inform the savings analysis.<sup>38</sup> The tracking data review showed that the program captures some, but not all, of the key parameters necessary for savings development. A summary of the parameters is included in Table 6-2. For example, the program captures bulb description and quantity, but lacks categorization of bulb type, bulb style, and wattage – all key components of savings estimation. These inputs are particularly important since bulbs must be assigned as to whether they must comply or are exempt from the 2007 EISA. The bulb description included many of the required parameters, but they had to be parsed out of the text description to populate these data including bulb type (LED vs CFL), actual wattage, and bulb style (A-lamp vs reflector vs specialty etc.).

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<sup>38</sup> 2014 data was compiled from the “2014 LWAT Actual Worksheet.xlsx” file, 2015 data from the “2015 LWAT Actual Worksheet.xlsx” file, and 2016 data from the “2016 Tracking Spreadsheet updated 010617.xlsx” file.

**Table 6-2: Lighting Program – Tracking Database Findings**

Factor	Included as Distinct Field	Example	Notes
Bulb Description	Yes	PLC 4.5W(40W) A19 LED CAN WRMGL	
Total Bulb Quantity	Yes	1	Included both units rebated and bulbs per pack
Bulb type	No	LED; CFL	Had to be extracted from bulb description field
Bulb style	No	A-lamp; BR30; G25 Globe; PAR20	Had to be extracted from bulb description field
Actual wattage	No	9 watts	Had to be extracted from bulb description field
Baseline or equivalent wattage	No	43 watts	Had to assign based on actual wattage, type, and style
Lumens	No	800 lumens	Used to help assign baseline wattage

### 6.3.2. Per-Unit Savings

Fort Collins and the other Platte River owner municipalities applied conservative values for the per unit efficient light bulb savings estimates, and relied on established secondary sources for their claimed savings. The claimed savings for the program light bulbs were developed using annual operating hours from a previous Xcel Energy study, assumed 100% in-service rate, no interactive effects, and applied a constant 3.5 multiplier for baseline wattage regardless of bulb type or style using the actual wattages of the bulbs for establishing baseline wattages. A summary of the ex ante savings parameter assumptions relative to the ex post parameter recommendations is shown in Table 6-3. A more comprehensive summary, including ex post savings sources and discussion, is include in Appendix B.2.

**Table 6-3: Midstream Lighting Program Ex Ante vs Ex Post Parameter Assumptions**

Parameter	Ex Ante Value	Ex Post Value	Description of Ex Post Value
In service rate	1.0	0.98	Based on telephone survey and projected future installations
Hours of use - Annual	912.5	1058.5	Based on large-scale Northeast metering study
Hours of use - Daily	2.5	2.9	Based on large-scale Northeast metering study
Interactive Effects	1.0	1.0	Not updated
Delta Watts	3.5	5.0	Based on actual baseline assignments for all program bulbs

Controls savings were calculated using the analysis framework used by Fort Collins Utilities, developed by Brent Protzman in 2011, which includes an analysis of savings by room type.<sup>39</sup> Savings were updated

<sup>39</sup> Protzman, B. "CL Dimmers" and "In Wall Sensor Switch no bulb replacement". Prepared for Utilities, October 11, 2011.

with more recent secondary research on percent savings for dimmers and sensors as well as baseline consumption of controlled bulbs, see Appendix B.3 for additional details. The analysis assumes that controls are equally likely on program-discounted LEDs and a household mix of efficient and inefficient bulbs, as the program conducts co-marketing of controls with program-discounted LEDs, but is unlikely to only be used with program-discounted LEDs.

Measure-specific findings include:

- › **LED Reflector** – The evaluation found an average of 50 kWh per reflector resulting in a gross realization rate of 144% and 149% for Fort Collins and Platte River, respectively. This was largely driven by higher delta watts, and to a lesser extent, higher hours of use.
- › **LED A-lamp** – For A-lamps the evaluation team found very similar savings (34.4 kWh) as the estimated ex ante value (33.5 kWh).
- › **LED Specialty** – (Globes and candelabras) – The ex post savings of 39 kWh resulted in a gross realization rate of 180% and 177% for Fort Collins and Platte River, respectively. Similar to reflectors, this was driven by higher delta watts and higher hours of use.
- › **LED Other** – These bulbs, including fixtures, recessed cans, and unidentifiable bulbs, averaged 42.4 kWh per bulb for a realization rate of 131% and 128% for Fort Collins and Platt River, respectively.
- › **CFL** – Although no longer offered, the evaluation updated the savings estimate and found 53.3 kWh for a realization rate of 113% for Fort Collins (Platte River did not offer CFLs during the years examined in this study).
- › **Controls: Occupancy Sensors and Dimmers** – For controls, the evaluation team found 7 kWh per dimmer and 52 kWh per sensor (175% and 62% realization rates, respectively). The key drivers of the changes were the estimated baseline consumption of the controlled lighting. For dimmers, the ex ante analysis assumed that program LEDs were the baseline; the evaluation team increased the baseline to account for some share of dimmers used on less-efficient bulbs. For sensors, the ex ante analysis used research from approximately 15 years ago to estimate bulbs per room and wattage per bulb. Therefore, evaluated baseline consumption for sensors was lower than the ex ante analysis.

The evaluation team considered making adjustments to savings for two additional parameters: cross-service area sales (i.e., for incented bulbs sold to customers that do not live in the Utilities service territories, also referred to as leakage) and cross-sector sales (i.e., for incented lamps that may go to business customers). The evaluation team selected to follow the guidelines of the Uniform Methods Project (UMP) and assume that the increased savings of sales to nonresidential customers is offset by leakage, thus excluding both of these parameters from the analysis.<sup>40</sup> Note that while the UMP does allow for exceptions to this assumption (e.g., service territories that are largely surrounded by other program administrators offering similar midstream incentives can claim cross-sector sales but not

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<sup>40</sup> Department of Energy, “Residential Lighting Evaluation Protocol The Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures.” (forthcoming), pg. 28.

leakage), the evaluation team elected to use a conservative approach and exclude both parameters since the extent of the leakage – particularly to Wyoming to the north – is unknown.<sup>41</sup>

### 6.3.3. Gross Impact

Overall, the evaluation estimated the Midstream Lighting Program savings to be 5,735,753 kWh for Fort Collins and 9,901,503 kWh for the other Platte River owner municipalities, representing realization rates of 120% and 121% respectively. The gross impact savings realization rates varied by lighting measure, with occupancy sensors showing the lowest realization rate, at 62%, and LED specialty lighting the highest realization rate, at 180%.<sup>42</sup>

**Table 6-4: Midstream Lighting 2014-2016 Gross Impacts – Energy (kWh): Fort Collins**

Measure	Qty Claimed	Qty Verified	Ex Ante Unit kWh Savings	Ex Post Unit kWh Savings	Ex Ante Total kWh Savings	Ex Post Total kWh Savings	Gross RR
LED Reflector	39,241	39,241	34.8	50.1	1,364,670	1,967,476	144%
LED A-lamp	56,578	56,578	33.5	34.4	1,894,106	1,947,323	103%
LED Specialty	9,396	9,396	21.8	39.2	205,114	368,280	180%
LED Other	2,748	2,748	32.3	42.4	88,836	116,405	131%
Occ Sens	1,573	1,573	84.0	52.0	132,132	81,796	62%
CFL	22,462	22,462	47.2	53.3	1,061,168	1,196,072	113%
Dimmer	8,343	8,343	4.0	7.0	33,372	58,401	175%
<b>Total</b>	<b>140,341</b>	<b>140,341</b>			<b>4,779,398</b>	<b>5,735,753</b>	<b>120%</b>

<sup>41</sup> Note also that estimates of leakage, even in well-funded studies, are considered challenging and often produce results with limited confidence and precision.

<sup>42</sup> Bulb category realization rates varied for Platte River and Fort Collins due to variable quantities of sales of individual bulbs that comprised each category.

**Table 6-5: Midstream Lighting 2014-2016 Gross Impacts – Energy (kWh): Platte River**

Measure	Qty Claimed	Qty Verified	Ex Ante Unit kWh Savings	Ex Post Unit kWh Savings	Ex Ante Total kWh Savings	Ex Post Total kWh Savings	Gross RR
LED Reflector	68,650	68,650	34.2	51.0	2,345,068	3,501,115	149%
LED A-lamp	110,209	110,209	33.5	34.3	3,695,665	3,783,401	102%
LED Specialty	22,104	22,104	22.0	38.9	485,327	859,643	177%
LED Other	6,386	6,386	32.9	42.2	209,949	269,682	128%
Occ Sens	3,567	3,567	84.0	52.0	299,628	185,484	62%
CFL	22,462	22,462	47.2	53.3	1,061,168	1,196,072	113%
Dimmer	15,158	15,158	4.0	7.0	60,632	106,106	175%
<b>Total</b>	<b>248,536</b>	<b>248,536</b>			<b>8,157,437</b>	<b>9,901,503</b>	<b>121%</b>

Evaluated demand savings were 348 kW for Fort Collins and 626 kW for the other Platte River owner municipalities, representing realization rates of 140% and 141% respectively. Differences in the realization rates for the energy and demand savings were driven solely by the delta watts for each bulb category.

**Table 6-6: Midstream Lighting 2014-2016 Gross Impacts – Demand (kW): Fort Collins**

Measure	Qty Claimed	Qty Verified	Ex Ante Unit kW Savings	Ex Post Unit kW Savings	Ex Ante Total kW Savings	Ex Post Total kW Savings	Gross RR
LED Reflector	39,241	39,241	0.0018	0.0029	70.6	113.8	161%
LED A-lamp	56,578	56,578	0.0011	0.0014	62.2	79.2	127%
LED Specialty	9,396	9,396	0.0014	0.0037	13.2	34.8	264%
LED Other	2,748	2,748	0.0026	0.0045	7.1	12.4	173%
Occ Sens	1,573	1,573	0.0096	0.0059	15.1	9.3	61%
CFL	22,462	22,462	0.0034	0.0041	76.4	92.1	121%
Dimmer	8,343	8,343	0.0005	0.0008	4.2	6.7	160%
<b>Total</b>	<b>140,341</b>	<b>140,341</b>			<b>248.8</b>	<b>348.2</b>	<b>140%</b>

**Table 6-7: Midstream Lighting 2014-2016 Gross Impacts – Demand (kW): Platte River**

Measure	Qty Claimed	Qty Verified	Ex Ante Unit kW Savings	Ex Post Unit kW Savings	Ex Ante Total kW Savings	Ex Post Total kW Savings	Gross RR
LED Reflector	68,650	68,650	0.0019	0.0030	130.4	206.0	158%
LED A-lamp	110,209	110,209	0.0013	0.0016	143.3	176.3	123%
LED Specialty	22,104	22,104	0.0016	0.0042	35.4	92.8	263%
LED Other	6,386	6,386	0.0024	0.0040	15.3	25.5	167%
Occ Sens	3,567	3,567	0.0096	0.0059	34.2	21.0	61%
CFL	22,462	22,462	0.0034	0.0041	76.4	92.1	121%
Dimmer	15,158	15,158	0.0005	0.0008	7.6	12.1	160%
<b>Total</b>	<b>248,536</b>	<b>248,536</b>			<b>442.6</b>	<b>625.9</b>	<b>141%</b>

#### 6.3.4. Net Impacts

As noted in the methods section, the evaluation team reviewed numerous secondary sources and leveraged a national lighting sales database and model to inform the lighting program net impacts. While some of the sources showed some degree of variability across the different methods used to estimate net savings, a surprising number of studies coalesced their estimates very close to the currently assumed 66%-69% NTG for the program.<sup>43</sup> Given the lack of certainty with estimates for NTG of midstream lighting programs, the evaluation team is recommending Platte Rivers' use of the ex ante NTG was appropriate and adopted this same estimate for ex post net savings. Going forward, the evaluation team recommends a decreasing NTG for 2017 and beyond to reflect the rapid market adoption of LEDs. A more detailed discussion of the net impacts findings is reviewed in Appendix C.1.

<sup>43</sup> The program used 66% for 2014-2015 bulbs and controls and 69% for 2016 bulbs and controls. The team used a weighted average to report a single 67% value in the following impact tables.

**Table 6-8: Midstream Lighting 2014-2016 Net Impacts – Energy (kWh): Fort Collins**

Measure	Ex Ante NTG	Ex Post NTG	Ex Ante Net kWh Savings	Ex Post Net kWh Savings	Net Realization Rates
LED Reflector	67%	67%	914,329	1,318,209	144%
LED A-lamp	67%	67%	1,269,051	1,304,706	103%
LED Specialty	67%	67%	137,426	246,748	180%
LED Other	67%	67%	59,520	77,991	131%
Occ Sens	67%	67%	88,528	54,803	62%
CFL	67%	67%	710,983	801,368	113%
Dimmer	67%	67%	22,359	39,129	175%
<b>Total</b>			<b>3,202,197</b>	<b>3,842,955</b>	<b>120%</b>

**Table 6-9: Midstream Lighting 2014-2016 Net Impacts – Energy (kWh): Platte River**

Measure	Ex Ante NTG	Ex Post NTG	Ex Ante Net kWh Savings	Ex Post Net kWh Savings	Net Realization Rates
LED Reflector	67%	67%	1,571,196	2,345,747	149%
LED A-lamp	67%	67%	2,476,096	2,534,879	102%
LED Specialty	67%	67%	325,169	575,961	177%
LED Other	67%	67%	140,666	180,687	128%
Occ Sens	67%	67%	200,751	124,274	62%
CFL	67%	67%	710,983	801,368	113%
Dimmer	67%	67%	40,623	71,091	175%
<b>Total</b>			<b>5,465,483</b>	<b>6,634,007</b>	<b>121%</b>



**Table 6-10: Midstream Lighting 2014-2016 Net Impacts – Demand (kW): Fort Collins**

Measure	Ex Ante NTG	Ex Post NTG	Ex Ante Net kW Savings	Ex Post Net kW Savings	Net Realization Rates
LED Reflector	67%	67%	47.3	76.2	161%
LED A-lamp	67%	67%	41.7	53.1	127%
LED Specialty	67%	67%	8.8	23.3	264%
LED Other	67%	67%	4.8	8.3	173%
Occ Sens	67%	67%	10.1	6.2	61%
CFL	67%	67%	51.2	61.7	121%
Dimmer	67%	67%	2.8	4.5	160%
<b>Total</b>			<b>166.7</b>	<b>233.3</b>	<b>140%</b>

**Table 6-11: Midstream Lighting 2014-2016 Net Impacts – Demand (kW): Platte River**

Measure	Ex Ante NTG	Ex Post NTG	Ex Ante Net kW Savings	Ex Post Net kW Savings	Net Realization Rates
LED Reflector	67%	67%	87.4	138.0	158%
LED A-lamp	67%	67%	96.0	118.1	123%
LED Specialty	67%	67%	23.7	62.2	263%
LED Other	67%	67%	10.3	17.1	167%
Occ Sens	67%	67%	22.9	14.1	61%
CFL	67%	67%	51.2	61.7	121%
Dimmer	67%	67%	5.1	8.1	160%
<b>Total</b>			<b>296.5</b>	<b>419.4</b>	<b>141%</b>

### 6.3.5. Measure Lifetime

Expected useful lifetimes (EULs) are a critical input for cost effectiveness testing, and, for efficient lighting measures, include a great deal of uncertainty due to the extended operating life of LEDs coupled with legislation and shifting market dynamics. As the market transitions away from CFL and incandescent production in favor of halogen and LEDs, this uncertainty is only increasing. The evaluation team has developed protocols for estimating efficient lighting EUL for several TRMs as well as the UMP, and recommends Platte River adopt the same EUL approach that allows savings to be claimed beyond

the EISA 2020 backstop, but short of the technical life of the LED. This concept of a “sunset” year for savings is cited in the UMP:<sup>44</sup>

*...the Uniform Methods Project protocols recommend applying a “sunset” year where savings can be claimed, to be determined by the period in which consumers are unlikely to find an alternative other than LED lamps. This sunset year could exceed 2020 for a few reasons, including: Sell-through, enforcement, political uncertainty, and halogen burn-out period.*

Based on the reasons cited in the UMP, the evaluation team recommends a sunset year of 2023, and that Platte River adopt the following EUL table for LED and CFL measures installed during 2014-2016 program years. We recommend, however, that the market is closely monitored to determine if this EUL should be shortened (due to even more rapidly occurring natural adoption of LEDs) or extended further (due to delays and/or modifications of the EISA backstop that could potential slow down adoption of LEDs).<sup>45</sup>

**Table 6-12. Midstream Lighting Recommended EULs\***

Measure	Unadjusted Average LED EUL (years)	EISA Backstop Sunset Year	Recommended Adjusted LED EUL (years)
2014	9.3	2023	9.0
2015	9.3	2023	8.0
2016	9.3	2023	7.0

\* Note these capped EULs are also applicable to 2014 CFLs installed through the Fort Collins lighting program.

## 6.4. Process Evaluation Findings

### 6.4.1. Efficient Lighting Market

**Manufacturers said Platte River’s program is necessary to move the market in specialty LED bulbs because numerous cheaper alternatives exist in the specialty category and suggested either increasing the incentive amount or shifting to target rural areas.** All three manufacturers agreed that Platte River’s program is very important in driving the purchase of residential specialty LEDs and that moving the specialty market to LED will be difficult without the support of utility programs. They reported specialty LEDs have low market penetration with one manufacturer estimating fewer than 25% of specialty lamps sold are LEDs. They also noted that specialty incandescent bulbs are relatively cheap, and one manufacturer suggested that a \$1.50 discount per lamp would spur more dramatic conversion than the current \$1 discount. One manufacturer thought it would be at least another two-to-three years before programs like Platte River’s promoting specialty LED bulbs are unnecessary.

<sup>44</sup> Department of Energy, “Residential Lighting Evaluation Protocol The Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures.” (forthcoming), pg. 13.

<sup>45</sup> For example, at the time of this evaluation the National Electrical Manufacturers Association (NEMA) reached a settlement with the Department of Energy to revisit the EISA backstop, and a decision is not expected before 2018. With a three-year requirement from a final ruling to enactment, the backstop would now not take effect until 2021 at the soonest, and may no longer include the expansion of the general service lamp definition that was announced in January 2017.

Manufacturers could not provide numbers specific to Platte River's owner municipalities on the extent to which the instant discount boosted sales of specialty LED bulbs, but gave general estimates. One manufacturer noted that, for one warehouse club retailer, locations with utility incentive programs sell 40% more LED bulbs than those without utility programs, and another said that LED sales increase 20 to 25% due to utility programs. The latter manufacturer noted that utility funding can increase LED sales 40 to 50% at certain times of the year, such as Earth Day or when it starts to get dark earlier in the Fall.

Key market changes over the past few years that manufacturers cited include:

- › Increased pack size (going from one bulb to a multi-pack),
- › Improved color rendering index (CRI),
- › Better power factor (draws less power), and
- › Improved aesthetic to make LEDs look more like incandescent bulbs.

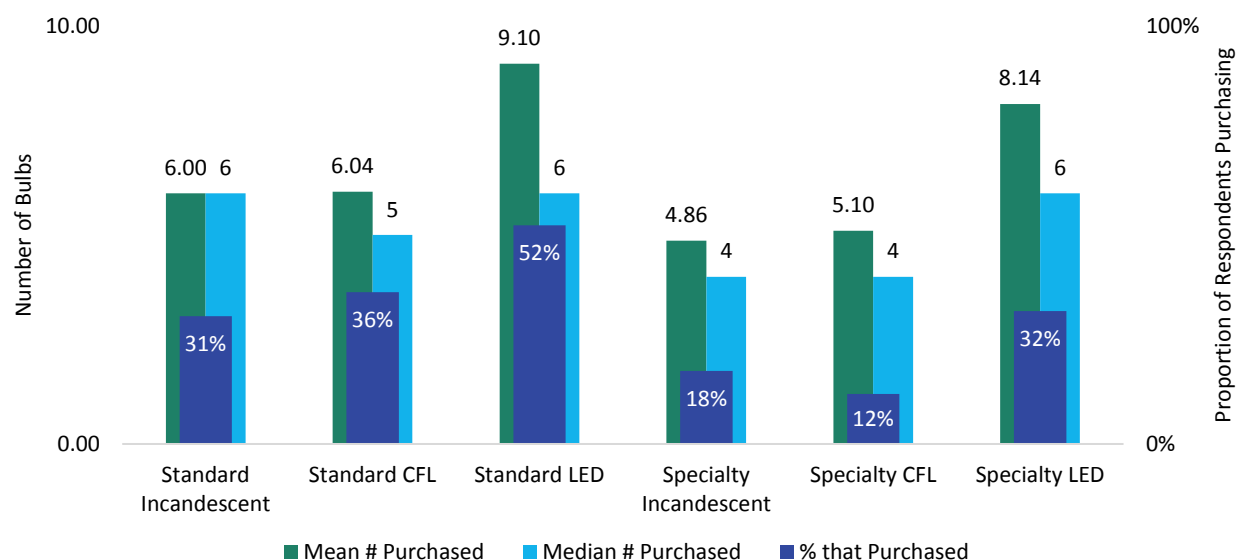
Market changes in the next couple of years will depend upon:

- › International Organization for Standardization (ISO) standards
- › Upcoming EISA backstop legislation decision on minimum efficiency to take effect in 2020
- › Policy decisions related to the Environmental Protection Agency (EPA) and ENERGY STAR.

Other than connected, smart lights, manufacturers did not identify new technologies with potential to increase energy efficiency entering the market. They noted that the smart lights are still relatively expensive and penetration is low. One manufacturer thought it would be 10 to 15 years before those types of lights are commonplace.

All three manufacturers said they would like to see standard A-line LED bulbs added back into the program because these are the most common type of bulb in homes. One said that there is "still a long way to go on [converting] general purpose lighting" to LED. Another manufacturer suggested increasing the incentive for the screw based retrofit kits that are included in the program and another suggested incentivizing fixtures. Finally, one manufacturer suggested that Platte River shift its focus to less densely populated rural areas where LED penetration is still low. She noted that residents in those areas are less "environmentally aware" than residents in cities and program efforts should focus on reaching those residents.

Participant survey findings suggest the market continues to shift toward LED bulbs, as more respondents purchased LEDs than other bulb types and those who purchased LEDs bought more of them. Respondents most frequently reported purchasing standard LED bulbs (52% of respondents who made any lighting purchase; 34% of all 1404 customers surveyed) compared to other standard bulbs (31-36%; 20-24% of all 1404 customers surveyed), as well as specialty LED bulbs (32%; 21% of all 1404 customers surveyed) compared to other specialty bulbs (12-18%; 8-11% of all 1404 customers surveyed). Respondents also reported purchasing a greater number of LED bulbs than CFLs or incandescent/halogen (Figure 6-1).

**Figure 6-1: Survey Respondent Reports of Lighting Product Purchases (n=919)**

**Growing consumer awareness and demand for LEDs led retailers to expect growing demand for standard and specialty LED bulbs in the next 12 months.** The participating retailers indicated that a majority of the standard A-lamp bulbs they sold in the last 12 months were LED and expected that proportion to reach 100% within the next year (Table 7 1). When the program stopped discounting standard A-lamp bulbs, one retailer said their sales of efficient standard bulbs decreased slightly because it was the most commonly bought bulb through the program.<sup>46</sup>

**Table 6-13: Proportion of LED Lamps Sold and Expected to Sell\***

Store	Proportion LED A-Lamps Sold in Last 12 Months	Proportion LED A-Lamps in next 12 Months	Proportion LED Specialty Lamps Sold in Last 12 Months	Proportion LED specialty in next 12 Months
Chain 1	80%	Should go to 100%	20%	20%
Chain 2	75%	Should go to 100%	30 to 50%	Should go to 100%

\* The manager at the formerly participating store said he did not know proportion of LED sales without “running lots of reports.”

The store managers reported that fewer than half of the specialty bulbs they sold in the last 12 months were LED. Both store representatives said that proportion would have been about the same without program support, though for different reasons. One representative reasoned that his supplier is committed to stocking LED bulbs and consumers demand LED bulbs. The other representative said it probably would have been the same because the incentive does not reduce the price of the specialty bulbs “very much.”

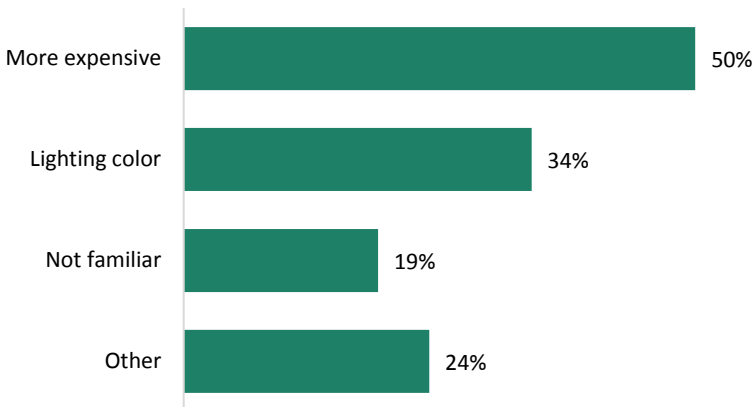
<sup>46</sup> The other two store representatives did not know how their sales of standard A-lamp bulbs changed when the program stopped discounting them.

In contrast to standard bulbs, the interviewed retailers were split in their expectations for specialty LED bulbs. One retailer expected a dramatic rise in the sales of LED specialty bulbs over the next 12 months, while the other did not expect a change. Both store representatives said that if the program stopped, their sales would not change much because of the growing consumer demand for LEDs, though one said LED specialty sales might decrease slightly.

### 6.4.2. Barriers to Uptake of Efficient Lighting

**Cost and knowledge are Barriers to LED Uptake.** When asked why they did not purchase LED light bulbs, the largest proportion of respondents indicated that it was because LEDs are more expensive than other bulbs, followed by concerns over lighting color. Respondents who selected “other” had varying reasons, but three indicated that they believed LED light bulbs did not fit and/or work in a particular fixture and two indicated comfort with what they had already been using.

**Figure 6-2: Reasons to Not Purchase LED Light Bulbs (n=148)**



Lighting retailers’ assessments of the main reasons customers do not purchase LEDs were consistent with survey findings. Other than cost, retailers most often cited concerns about the color of the light, particularly whether the light will be too white or too blue (2 of 3 respondents). Retailers also said that customers can be confused about lighting options. The third retailer said that in their experience, people tend to purchase LED unless the market has not provided an LED solution for the type of bulb they are seeking to buy. Examples he gave included specialty lights for microwaves or other appliances.

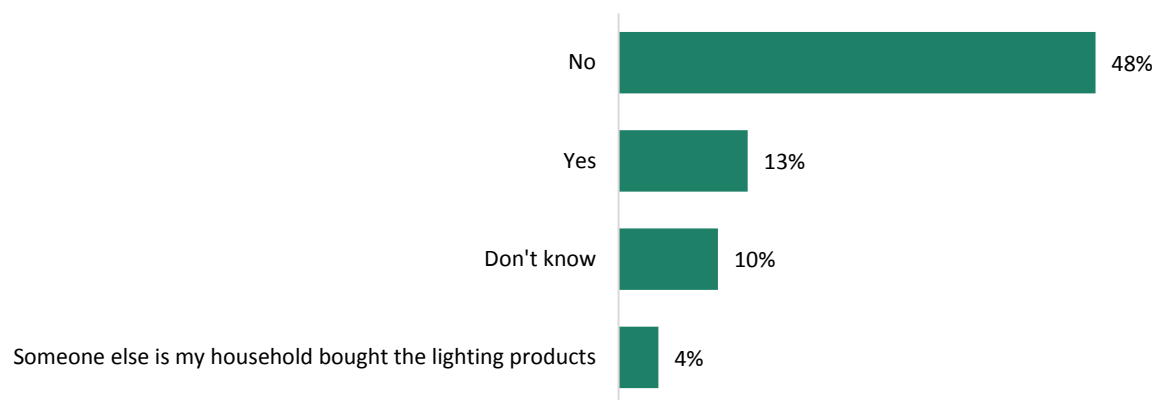
### 6.4.3. Program Delivery

**Retailers were satisfied with and benefitted from their participation.** Representatives from two participating retailers were satisfied with their participation in the program. They reported no challenges to participating and had no recommended changes. The retailers said they benefit from participating because it helps them make a sales pitch to customers who want to reduce energy costs, and it helps them stay competitive and provide energy efficiency to the market. The lighting department manager at one retail chain said the program’s design means that store-level managers do not have to worry about SKU selection, budgets, or quantity limits, which he preferred over the paper rebates the program reportedly used when it first started.

The store manager at the formerly participating store said his store participated in the midstream lighting program between 2012 and 2016. He stopped participating because it did not seem “worth it” to him when Platte River reduced the number of products it discounted. His sales of efficient lighting had not noticeably decreased since he stopped participating in the program because his supplier is committed to efficient lighting and put in “almost 40 feet of [display space for] new light selection which offset any losses we might have had from not participating,” he said. He added that the employee who had been the contact person for the program had left, and stated that he might be interested in participating again if he knew more about the program.

**Despite retailers displaying lighting POP, a minority of survey respondents recall seeing lighting POP materials.** During in-depth interviews, both participating retailers reported that they display the promotional Point of Purchase (POP) materials in their stores. One chain store representative confirmed that his store’s corporate office has an agreement with Platte River to display aisle signage, stickers on beams, and provide pamphlets to hand out to customers. Nonetheless, a minority of survey respondents recalled seeing POP materials when buying lighting products (Figure 6-3).

**Figure 6-3: Survey Respondent Recall of POP Materials (n=1061)**



## 6.5. Conclusions and Recommendations

**Conclusion 1:** Reflecting the volatility of the residential lighting market, market actors were divided on the continued need for program incentives to drive LED uptake, with manufacturers seeing them as necessary, retailers less so, and survey findings indicating continuing shift toward LEDs. There are drawbacks to withdrawing incentives from the market too early as well as remaining in the market once it has transformed. In this type of volatile market, it can be beneficial for a program to target its interventions toward the market segments likely to be slowest to transform on their own.

Data collected for this evaluation show clear signs that the market is moving toward LED technologies, with LEDs being the most common bulb type residents reported purchasing and those who bought LEDs buying greater quantities than those who bought other lighting technologies. However, manufacturers reported that incentives are still necessary, while retailers expected minimal changes in sales of efficient lighting products if incentives were withdrawn. The conundrum that these divergent views raises is common to program administrators across the country, who are closely monitoring the market and determining how – if at all – to continue market intervention.

As states like New York have experienced, eliminating programs too soon runs the risk of backsliding and slowing the adoption of LEDs. Platte River and its member municipalities have focused their incentives on specialty LEDs in an effort to drive that portion of the market. Prior research has not conclusively demonstrated that a focus on specialty energy efficient lamps results in a higher net to gross ratio, but there are indications that targeting hard-to-reach markets through a focus on retail channels like dollar stores and drug stores may lead to a higher net to gross ratio.

**Recommendation 1:** Focus incentives and market intervention on retail channels that are most likely to serve hard-to-reach customers and closely monitor the market to consider reintroducing incentives for A-line LEDs.

**Conclusion 2:** Gathering additional product details from participating retailers would allow for more accurate savings estimates.

It is important to capture the type, style, and wattage of an incandescent bulb, as these parameters determine whether a bulb is subject to the 2007 Energy Independence and Security Act (EISA), and therefore what an appropriate baseline savings value should be. The program's tracking system recorded many of these data in an open-ended text description, rather than recording them in distinct fields, which would have facilitated analysis.

**Recommendation 2:** Require retailers to provide the data necessary to closely track lamps based on their baseline (e.g. EISA compliant or exempt). Platte River should require retailers to provide bulb type, style, wattage, and, ideally, lumen ratings, in their data submissions. This would allow the savings analysis to incorporate more closely calibrated delta watts.

## 7. Best Practices Review

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To identify opportunities for Fort Collins Utilities and the Platte River Power Authority to more efficiently and effectively deliver energy savings to their customers, the evaluation team conducted a review of the energy efficiency outcomes and program offerings of a group of comparison program administrators around the United States. In consultation with Utilities and Platte River staff, we selected organizations to include as comparisons due to their structure as public utilities and their reputations as innovators in their energy efficiency offerings. All of the comparison program administrators provide a range of program offerings and models, both in the commercial and residential sectors. The program administrators included in the review were:

- › Austin Energy (Texas)
- › Eugene Water and Electric Board (EWEB, Oregon)
- › Snohomish County Public Utility District (SnoPUD, Washington)
- › Sacramento Municipal Utility District (SMUD, California)

This section first provides a brief background about the utilities included in this comparison. We then compare a rough metric of the cost of saved energy (CSE, spending per kWh saved) across the programs. This comparison allowed us to identify differences in outcomes between administrators, which we then investigated further to determine whether they stemmed from differences in program offerings or delivery approaches and whether those offerings or approaches might represent opportunities for Utilities or Platte River. Our review drew on findings from evaluations, annual reports, and energy information provided by the United States Energy Information Administration (EIA).

### 7.1. Background and History of Utilities

Like Fort Collins Utilities, Austin Energy and EWEB are municipal utilities; SnoPUD and SMUD are both public utility districts, which EIA classifies as a “political subdivision.” All of the utilities included in this comparison are larger than Fort Collins Utilities, with SMUD as the largest, covering most of the City of Sacramento and Sacramento County. EWEB is most comparable in size to Fort Collins Utilities, with just over 80,000 residential customers and located in mid-sized college town.



**Table 7-1: Characteristics of Comparison Utilities**

Utility	Ownership Type	Area	# of Residential Customers	# of Commercial Customers	# of Industrial Customers
Austin Energy	Municipal	Part of City of Austin, surrounding suburbs of Austin	403,754	49,023	121
EWEB	Municipal	City of Eugene, rural areas west and north of Eugene	81,420	9,469	1,765
SnoPUD	Political Subdivision	All of Snohomish County & Camano Island (mix of rural, suburban, small community)	305,966	31,023	74
SMUD	Political Subdivision	Most of City of Sacramento and Sacramento County, urban and suburban	546,155	66,832	2,585
<b>Fort Collins Utilities</b>	<b>Municipal</b>	<b>City of Fort Collins; urban and suburban</b>	<b>61,738</b>	<b>8,843</b>	<b>13</b>

Source: EIA (U.S. Energy Information Administration). 2016. *Electric power sales, revenue, and energy efficiency Form EIA-861 detailed data files*. Accessed November 2017. Washington, DC: U.S. Department of Energy. <https://www.eia.gov/electricity/data/eia861/>

### 7.1.1. Austin Energy

Austin Energy has been serving the Greater Austin area since 1895 and is considered the nation's 8th largest publicly owned electric utility. Austin Energy is funded through its energy sales and services and its operations are contained under the Electric Reliability Council of Texas (ERCOT). Austin Energy has been a leader in dedication to environmental stewardship, particularly through their heavy prioritization of generating renewable energy and promotion of energy efficiency. They've been recognized for their leadership in protecting the environment and superior energy efficiency approaches by being awarded the ENERGY STAR Partner of the Year Award through the U.S. EPA ten different times.

Austin Energy provides a suite of residential and commercial energy efficiency programs to its customers. For residential customers, these offerings include a variety of incentives for the purchase of energy efficient appliances, including window air conditioners, smart thermostats, heat pump water heaters, heat pumps, and central air conditioners. Austin Energy also offers a Home Performance with ENERGY STAR program that provides a more comprehensive approach. This program is contractor-driven and implemented. Residents who are interested in whole-house improvements may find a participating contractor, who then conducts a home energy analysis and recommends improvements, such as installing a new heat pump, adding insulation, or sealing ducts. Austin Energy additionally delivers the Power Partner Thermostat program, which is a voluntary air conditioner cycling program.

For commercial customers, Austin Energy offers expansive custom and prescriptive rebates for energy efficient appliances, equipment, heating and cooling systems, and other property improvements. On top of these standard rebates, Austin Energy also provides bonus rebates for small and medium businesses (SMBs) and other programs explicitly targeted for this section of the market.

### 7.1.2. Eugene Water and Electric Board

EWEB was founded in 1911 and is Oregon's largest customer-owned utility. EWEB is chartered by the City of Eugene and provides water and electricity to customers located in Eugene and some surrounding areas. EWEB is dedicated to renewable resources and energy conservation; over three-fourths of the power supply comes from hydroelectric resources and less than 5% is generated from fossil fuels.

Although its energy efficiency offerings are not as comprehensive as Austin Energy's, EWEB offers rebates for energy efficient appliances, equipment, and weatherization measures to its residential electric customers. Additionally, because EWEB is a water utility as well as an energy provider, they provide rebates for water-saving measures like high efficiency toilets, hand valves, and sprinkler timers. EWEB also offers a Home Energy Score program, which focuses on rental housing; tenants and landlords receive free home energy assessments and an energy score for their rental house.

EWEB offers prescriptive and custom rebates for businesses interested in updating their business space with energy efficient improvements. Additionally, they provide incentives for water conservation measures for businesses, such as WaterSense toilets.

### 7.1.3. PUD 1 of Snohomish County

Located in northwestern Washington, SnoPUD is the second largest publicly owned utility in the state, and is categorized as a municipal corporation. It was created in 1936 as a water and electric utility service and evolved to primarily be an electrical distribution system by 1949 (though water is still supplied to a segment of the service territory). Similar to EWEB, the majority of SnoPUD's electricity supply is generated through hydroelectric resources provided through the Bonneville Power Administration. Other fuels in the electricity mix include nuclear (11%) and very small proportion of fossil fuels (2%).

Residential energy efficiency programs provided by SnoPUD include incentives for energy efficient appliances, Smart Savings kits (LED lightbulb kits), weatherization rebates, special pricing on LEDs, and discounted water-saving measures. On the commercial side, prescriptive and custom incentives are available for businesses upgrading to energy efficient equipment and systems.

### 7.1.4. Sacramento Municipal Utility District

SMUD, established in 1946, is the largest utility in this review, and the sixth-largest community-owned electric service provider in the nation. Though their largest single power source is a gas-generated power plant, SMUD was the first large utility in California to reach more than 20% renewable energy in its electricity mix.

SMUD's size allows it to provide a wide array of energy efficiency programs to its residential and commercial customers. Rebates, incentives, and financing are available for home heating and cooling system upgrades, pool and spa efficiency, energy efficient appliances, special LED lighting pricing, and the Home Performance Program (HPP). The HPP uses a "whole-house" approach to upgrading to energy efficiency, where residents may earn up to \$8000 in rebates (for electric heating) for various home improvements. Similar to Austin Energy's Home Performance with ENERGY STAR program, HPP utilizes a

contractor-driven implementation model to conduct the energy efficiency home assessment and upgrade projects.

SMUD offers extensive commercial energy efficiency programs as well, with an explicit focus on small and medium businesses. SMUD provides custom incentives for energy efficient business upgrades as well as prescriptive, flat incentives for qualifying equipment through their Express Energy Solutions program, which seeks to provide a more streamlined path. The Complete Energy Solutions program targets small and medium businesses, offering no cost energy assessments. SMUD also offers the Small Commercial Deep Energy Retrofit program to local small businesses.

## 7.2. Comparison of Efficiency Program Delivery Costs and Savings

Given differences in the scale on which the various comparison organizations offer energy efficiency programs, it was necessary to develop a common metric to allow for a rough comparison of performance across programs. The metric we used was cost of saved energy (CSE): an organization's reported energy savings divided by its spending on energy efficiency programs. Using this metric, we compared programs based on the data they reported on Energy Information Administration Form EIA-861 for 2015.<sup>47</sup> We calculated two versions of this metric: a CSE that considers all program costs associated with energy efficiency spending and a CSE that only accounts for the customer incentives paid. As Table 7-2 suggests, all of the comparison organizations had lower CSE values, for both versions of the measurement, than Fort Collins Utilities and Platte River Power Authority for their residential programs, with EWEB reporting the lowest CSE.

**Table 7-2: Comparison of Residential Program Costs and Savings Estimates**

Utility	Sales (MWh)	EE Program Life Cycle Costs (1000s)	EE Program Life Cycle Incentives (1000s)	EE Program Life Cycle Savings (MWh)	CSE (All Costs) (\$/kWh)	CSE (Incentives Only) (\$/kWh)
Austin Energy	4,350,651	\$11,289	\$8,475	821,280	\$0.014	\$0.01
EWEB	893,001	\$2,164	\$1,152	183,317	\$0.012	\$0.006
SnoPUD	3,491,905	\$12,049	\$6,885	705,505	\$0.017	\$0.01
SMUD	4,658,310	\$19,977	\$11,913	721,107	\$0.028	\$0.017
<b>Platte River*</b>	<b>1,098,510</b>	<b>\$2,650</b>	<b>\$1,857</b>	<b>60,823</b>	<b>\$0.044</b>	<b>\$0.031</b>
<b>Fort Collins Utilities</b>	<b>485,337</b>	<b>\$2,171</b>	<b>\$1,562</b>	<b>51,090</b>	<b>\$0.042</b>	<b>\$0.031</b>

\* Includes the Cities of Fort Collins, Loveland, Longmont, and the Town of Estes Park.

<sup>47</sup> We recognize that this is an imperfect comparison. The way costs are reported may vary between organizations, as may the assumptions and elements that go into savings estimates. Further, differences in markets (e.g. contractor labor costs) may impact the cost of program delivery. Although imperfect, this comparison provides a jumping-off place for further analyses.

For commercial programs, Fort Collins' CSE was comparable to that of SnoPUD and slightly lower than SMUD's (Table 7-3). Austin Energy and EWEB had the lowest CSE values across the five utilities. Platte River Power Authority's CSE for incentive costs was the highest among all utilities.

**Table 7-3: Comparison of Commercial Program Costs and Savings Estimates**

Utility	Sales (MWh)	EE Program Life Cycle Costs (1000s)	EE Program Life Cycle Incentives (1000s)	EE Program Life Cycle Savings (MWh)	CSE (All Costs) (\$/kWh)	CSE (Incentives Only) (\$/kWh)
Austin Energy	5,653,762	\$7,945	\$5,589	936,791	\$0.008	\$0.006
EWEB	869,438	\$673	\$426	51,553	\$0.013	\$0.008
SnoPUD	2,393,002	\$4,600	\$2,628	278,163	\$0.017	\$0.009
SMUD	3,784,785	\$20,068	\$10,981	593,027	\$0.034	\$0.019
<b>Platte River*</b>	<b>1,041,993</b>	<b>\$3,726</b>	<b>\$3,336</b>	<b>158,515</b>	<b>\$0.024</b>	<b>\$0.021</b>
Fort Collins Utilities	519,801	\$1,844	\$1,647	94,363	\$0.020	\$0.017

\* Includes the cumulation of Cities of Fort Collins, Loveland, Longmont, and the Town of Estes Park EIA data.

In reviewing these comparisons, it is important to recognize that both costs and savings may be recorded differently across jurisdictions. For example, some program administrators may report only gross savings, while others, like Utilities and Platte River, may apply a net-to-gross adjustment. In addition, the costs administrators include in their reporting may vary, with some including elements like evaluation and marketing as program costs, while others account for these costs separately. Due to these types of considerations, the figures presented above, based on EIA data, may differ from figures Utilities and Platte River use in their own reporting.

The following sections investigate the comparison utilities' program offerings in more detail in an effort to identify any characteristics that may lead to the variation in cost of saved energy shown in the tables above.

## 7.3. Comparison of Program Offerings & Models

### 7.3.1. Residential Offerings

Many similarities in residential program offerings exist across the comparison utilities. All utilities provide financial incentives for weatherizing residential homes and for energy efficient heating and cooling equipment, while most engage in mid-stream lighting programs, home energy audits, and appliance rebates. Appliance recycling and providing home energy reports are less common among the utilities, with Fort Collins Utilities doing both, but only one other administrator providing each service.

**Table 7-4: Comparison of Residential Program Offerings**

	Residential Programs						
	Appliance Rebates	Appliance Recycling	Energy Audits	Home Energy Reports	Home Weatherization	HVAC Rebates	Mid-Stream Lighting
Austin Energy	✓		✓		✓	✓	✓
EWEB			✓	✓	✓	✓	
SnoPUD	✓				✓	✓	✓
SMUD	✓	✓	✓		✓	✓	✓
Platte River			✓		✓	✓	✓
Fort Collins	✓	✓	✓	✓	✓	✓	✓

To focus our investigation of differences in program delivery approaches between program offerings that the comparison utilities have in common, we reviewed program-level spending and energy savings data for Fort Collins Utilities. One area that stood out in this analysis were appliance rebates. Appliance rebate program costs, accounting for roughly 7% of spending on all energy efficiency programs and sectors since program inception, were notably higher than program savings, with appliance energy savings accounting for 1.7% of energy savings across programs and sectors.

A review of the comparison programs found differences in the products for which comparison organizations offer incentives relative to Fort Collins Utilities. None of the other utilities in this comparison still offer incentives for efficient dishwashers, as Fort Collins Utilities does. Instead, the comparison utilities offer incentives for products including smart thermostats, window air conditioners, and heat pump water heaters, that are not included in Fort Collins Utilities' appliance rebate program (Table 7-5).

**Table 7-5: Products Included in Comparison Utility Incentive Programs**

Utility	Heat Pump Water Heater Offering	Smart Thermostats	Window AC
Austin Energy	\$800 rebate	\$25 rebate, \$85 for enrolling in Power Partner program (energy cycling)	\$50 rebate for ENERGY STAR rated unit
SnoPUD	\$500 rebate	\$75 rebate	None
EWEB	\$300 to \$400 rebate	None	None
SMUD	\$1000 to \$1500 rebate	\$75 rebate	\$25 rebate for ENERGY STAR rated unit

Three of the comparison utilities provide incentives for smart thermostats. Austin Energy's Power Partner program provides an example. This program offers residents a rebate for purchasing an approved Wi-Fi-enabled thermostat as well as incentives for enrolling in air conditioner cycling, allowing Austin Energy to directly adjust the customer's thermostat during times of peak demand on the hottest

days. Smart thermostats have been shown to reduce energy use for home heating and cooling by an average of about 8–15%.<sup>48</sup>

All the other utilities in this review also offered incentives for heat pump water heaters. Rebates for heat pump water heaters ranged from \$300 (EWEB) to \$1500 (SMUD), depending on the model. Finally, two comparison utilities offered incentives for ENERGY STAR rated window air conditioners (both of which were \$25).

Looking beyond appliance rebates, Efficiency Works – Homes is another element of Fort Collins Utilities' residential portfolio that accounts for a notable portion of all efficiency program spending (roughly 4%). While audit and weatherization programs were common across the comparison organizations, there were notable differences in delivery structure between Efficiency Works – Homes and some of the comparison organizations' programs. SnoPUD, Austin Energy, and SMUD all use a more contractor-driven approach to deliver their existing home upgrade programs. In these programs, the contractor conducts the home energy analyses and installs the recommended improvements. The program does not provide an independent energy auditor or advisor. An evaluation of Austin Energy's Home Performance program found that the program had eliminated application process hurdles and achieved high participation rates through this approach.

Finally, in addition to comparing the delivery structures of common program offerings, we sought to identify any innovative programs the comparison organizations offered. EWEB is most comparable size and market to Fort Collins Utilities, given the prominence of the University of Oregon in Eugene. EWEB offers an innovative Home Energy Score Program, which it developed in partnership with the University. Under this program, tenants (renters) are eligible to receive a free energy audit and energy score for their rental house. EWEB offered internships to University of Oregon students to be trained as energy assessors, conducting the energy audits of rental homes throughout Eugene. A recent evaluation of this program found that tenants and rental owners were satisfied with the program, and it influenced some customers to move forward with energy upgrades.

### 7.3.2. Commercial Offerings

Program data indicate that commercial energy efficiency offerings contribute the bulk of Fort Collins Utilities' energy saving, primarily through rebates offered through the Efficiency Works – Business (EW-B) program. Across the comparison utilities, common program offerings for commercial customers included custom and prescriptive rebate structures, programs dedicated to multi-family housing, and free energy assessments (Table 7-6).

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<sup>48</sup> York, D., S. Nadel, E. Rogers, R. Cluett, S. Kwatra, H. Sachs, J. Amann, and M. Kelly. 2015. "New Horizons for Energy Efficiency: Major Opportunities to Reach Higher Electricity Savings by 2030." *In Proceedings of the ACEEE 2015 Summer Study on Energy Efficiency in Industry*. Washington, DC: ACEEE.

**Table 7-6: Comparison of Commercial Program Offerings**

	Commercial Programs					
	Free Audits	Prescriptive Rebates	Custom Rebates	Multi-Family	Building Retro-Commissioning	SMB-Focused Programs
Austin Energy	✓	✓	✓	✓	✓	✓
EWEB		✓	✓			
SnoPUD	✓		✓	✓		
SMUD	✓	✓	✓	✓	✓	✓
Platte River	✓	✓	✓	✓	✓	
Fort Collins Utilities	✓	✓	✓	✓	✓	

One program offering some comparison organizations provide that Fort Collins Utilities does not is a dedicated offering targeting SMBs. Programs that prioritize small businesses make up a notable proportion of Austin Energy's portfolio, accounting for a 10% of energy savings in 2015 across all energy efficiency and demand response programs. Austin Energy's Small Business Outreach Program provides free onsite assessments to small businesses or nonprofits. Austin Energy also offers bonus rebates on top of standard commercial rebates for small businesses. SMUD also offers a suite of opportunities for small businesses, such as their Complete Energy Solutions program, which provides free energy assessments for small and medium businesses.

## Appendix A. Cost Effectiveness

To analyze the individual program and overall portfolio cost-effectiveness, the team compiled evaluation findings and program inputs provided from Ft Collins and Platte River. The team used DSM<sup>49</sup>, the leading cost-effectiveness tool that has become the Demand Side Management program evaluation and planning industry standard. The team assessed cost-effectiveness using the following three tests, defined by the California Standard Practice Manual.<sup>50</sup>

- › Total Resource Cost (TRC) test - The Total Resource Cost Test measures the net costs of a demand-side management program as a resource option based on the total costs of the program, including both the participants' and the utility's costs.
- › Utility Cost Test (UCT) - Measures the net costs of a demand-side management program as a resource option based on the costs incurred by the program administrator (including incentive costs) and excluding any net costs incurred by the participant. The benefits are similar to the TRC benefits. Costs are defined more narrowly.
- › Participant Cost Test (PCT) - Measures the quantifiable benefits and costs to the customer due to participation in a program. Since many customers do not base their decision to participate in a program entirely on quantifiable variables, this test cannot be a complete measure of the benefits and costs of a program to a customer.

Table A-1 summarizes benefit and cost inputs for each cost-effectiveness test. The savings and costs are reported on a net basis, meaning that the NTG ratio was applied to account for the impacts of free ridership and spillover.

**Table A-1: Summary of Benefits and Costs Included in Each Cost-Effectiveness Test**

Components	TRC	UCT	PCT
<b>Benefits</b>			
Avoided Power Supply Costs	✓	✓	
Avoided Capacity Costs	✓	✓	
Bill Reductions			✓
Non-Energy Benefits	Participant*		
Incentives			✓

<sup>49</sup> Additional details are provided online at <http://www.integralanalytics.com/products-and-services/dsm-planning-and-evaluation/dsmore.aspx>

<sup>50</sup> *California Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects*. October 2001.



Components	TRC	UCT	PCT
<b>Costs</b>			
Direct Utility DSM Costs	✓	✓	
Direct Customer DSM Costs	✓		✓
Utility Program Administration	✓	✓	
Lost Revenues			

Fort Collins and Platte River were interested in providing two avoided cost scenarios for the cost-effectiveness testing: a low case, which represents the avoided costs of generation, at \$32.2 per MWH, and a higher case, which represents the avoided wholesale rates paid by Fort Collins, at \$53.73 /MWH. A summary of the cost tests and which benefits and costs are included for the electric utility type are reviewed in Table A-2 below.

**Table A-2: Cost Effectiveness Testing Benefits and Costs by Electric Utility Type**

Test	Benefits / Costs	Integrated Utility	Generation Co.	Distribution Co.
TRC	Benefits	Avoided costs	Avoided costs	Wholesale rates
	Costs	Total measure costs	Total measure costs	Total measure costs
UCT	Benefits	Avoided costs	Avoided costs	Wholesale rates
	Costs	Rebate	Rebate	Rebate
PCT	Benefits	Retail rates	N/A	Retail rates
	Costs	Net measure costs		Net measure costs

Table A-3 presents the key cost-effectiveness analysis assumptions as provided by Ft Collins and Platte River staff. These input assumptions inform the benefits portion of the cost-effectiveness.

**Table A-3: Assumptions and Source for Cost-Effectiveness Analysis**

Assumption	Source
Discount Rate = 4.0%	
Line Losses = 4.0% (2.6% distribution, 1.4% transmission)	
Avoided Electric Energy Costs = \$0.0322/kWh (Platte River) \$0.0537/kWh (Fort Collins)	Fort Collins and Platte River provided
Avoided Capacity Costs = \$45.60/kW-yr*	

\* Capacity costs were embedded within the energy costs provided to the evaluation team

The other component to benefits are the evaluated net lifetime savings associated with the programs. The team used the findings from the evaluation study to populate net lifetime savings for each measure (gross savings, NTG, and expected useful life). Other benefits that were factored into the tests other resource benefits, including water and waste water costs and avoided carbon benefits (in \$/kWh per tons of avoided carbon) and non-resource benefits, in the form of a modified TRC which. The modified TRC test included a ten-percent benefits adder to account for additional non-energy benefits. Xcel currently assumes a ten-percent benefits adder for their electric programs<sup>51</sup>.

Program spending data is another critical input for the cost-effectiveness testing, though represents the costs of delivering the programs. The team compiled actual spending, distributed between incentives and implementation/overhead costs. Table A-4 summarizes 2014-2016 electric spending by program and for other portfolio-related activities.

**Table A-4: Platte River 2014-2016 Spending Totals**

	Overhead and Delivery Costs	Incentive Costs	Total Costs
EW Homes	\$1,355,345	\$1,789,887	\$3,145,232
Midstream Lighting	\$90,000	\$598,698	\$688,698
<b>Total Residential Programs</b>	<b>\$1,445,345</b>	<b>\$2,388,585</b>	<b>\$3,833,930</b>
EW Business Rebates	\$960,107	\$10,579,566	\$11,539,64
EW Business Btu	\$48,893	\$538,757	\$587,650
<b>Total Commercial</b>	<b>\$1,009,000</b>	<b>\$11,118,323</b>	<b>\$12,127,323</b>
<b>Portfolio Total</b>	<b>\$2,454,345</b>	<b>\$13,506,908</b>	<b>\$15,961,253</b>

The following sections provide the cost-effectiveness test results reported by overall portfolio, sector-level portfolio, and program level.

<sup>51</sup> Many other jurisdictions include non-energy benefits adders for cost-effectiveness testing, please see American Council for an Energy-Efficient Economy. "A National Survey of State Policies and Practices for the Evaluation of Ratepayer Funded Energy Efficiency Programs." February 2012. for additional details. Available online at <http://aceee.org/research-report/u122>.

## A.1. Overall Portfolio

Table A-5 through Table A-7 show total benefits and costs for the overall portfolio, along with the benefit/cost ratio for each cost-effectiveness test. As shown, the overall portfolio passed the UCT, TRC, and Participant tests and generated almost \$1 million in UCT net lifetime benefits.

**Table A-5: Utility Cost Test Results**

	Benefits	Costs
Avoided Costs	\$16,943,429	
Incentives		\$13,506,908
Program Overhead Costs		\$2,454,345
<b>Total</b>	<b>\$16,943,429</b>	<b>\$15,961,253</b>
<b>UCT Benefit/Cost Ratio</b>		<b>1.06</b>

**Table A-6: Total Resource Cost Test Results**

	Benefits	Costs
Avoided Costs	\$18,637,772	
Participant Costs (net)		\$12,937,678
Program Overhead Costs		\$4,398,936
Other Benefits	\$779,591	
<b>Total</b>	<b>\$19,417,362</b>	<b>\$17,336,615</b>
<b>TRC Benefit/Cost Ratio</b>		<b>1.12</b>

**Table A-7: Participant Cost Test Results**

	Benefits	Costs
Participant Bill Savings (gross)	\$51,439,867	
Incentives	\$13,506,908	
Participant Costs (gross)		\$15,605,529
<b>Total</b>	<b>\$64,946,774</b>	<b>\$15,605,529</b>
<b>PTC Benefit/Cost Ratio</b>		<b>4.16</b>

## A.2. Residential Portfolio

Table A-8 through Table A-10 show total benefits and costs for the residential portfolio, along with the benefit/cost ratio for each cost-effectiveness test. As shown, the residential portfolio assessed the UCT, TRC, and Participant tests and did not generate positive UCT net lifetime benefits.

**Table A-8: Utility Cost Test Results**

	Benefits	Costs
Avoided Costs	\$2,296,883	
Incentives		\$2,388,585
Program Overhead Costs		\$1,445,345
<b>Total</b>	<b>\$5,444,423</b>	<b>\$3,833,930</b>
<b>UCT Benefit/Cost Ratio</b>		<b>0.6</b>

**Table A-9: Total Resource Cost Test Results**

	Benefits	Costs
Avoided Costs	\$2,526,572	
Participant Costs (net)		\$4,391,617
Program Overhead Costs		\$1,855,138
Other Benefits	\$403,601	
<b>Total</b>	<b>2,930,173</b>	<b>\$6,246,755</b>
<b>TRC Benefit/Cost Ratio</b>		<b>0.47</b>

**Table A-10: Participant Cost Test Results**

	Benefits	Costs
Participant Bill Savings (gross)	\$9,493,086	
Incentives	\$2,388,585	
Participant Costs (gross)		\$5,699,747
<b>Total</b>	<b>\$11,881,670</b>	<b>\$5,699,747</b>
<b>PTC Benefit/Cost Ratio</b>		<b>2.08</b>

### A.3. Efficiency Works Homes

Table A-11 through Table A-13 show total benefits and costs for the Efficiency Works Homes Program, along with the benefit/cost ratio for each cost-effectiveness test.

**Table A-11: Utility Cost Test Results**

	Benefits	Costs
Avoided Costs	\$624,448	
Incentives		\$1,789,887
Program Overhead Costs		\$1,355,345
<b>Total</b>	<b>\$624,448</b>	<b>\$3,145,232</b>
<b>UCT Benefit/Cost Ratio</b>		<b>0.20</b>

**Table A-12: Total Resource Cost Test Results**

	Benefits	Costs
Avoided Costs	\$686,892	
Participant Costs (net)		\$2,857,111
Program Overhead Costs		\$1,567,568
Other benefits	\$403,601	
<b>Total</b>	<b>\$1,090,493</b>	<b>\$4,424,679</b>
<b>TRC Benefit/Cost Ratio</b>		<b>0.25</b>

**Table A-13: Participant Cost Test Results**

	Benefits	Costs
Participant Bill Savings (gross)	\$2,019,919	
Incentives	\$1,789,887	
Participant Costs (gross)		\$3,409,440
<b>Total</b>	<b>\$3,809,806</b>	<b>\$3,409,440</b>
<b>PTC Benefit/Cost Ratio</b>		<b>1.12</b>

## A.4. Midstream Lighting

Table A-14 through Table A-16 show total benefits and costs for the Midstream Lighting Program, along with the benefit/cost ratio for each cost-effectiveness test.

**Table A-14: Utility Cost Test Results**

	Benefits	Costs
Avoided Costs	\$1,672,436	
Incentives		\$598,698
Program Overhead Costs		\$90,000
<b>Total</b>	<b>\$1,672,436</b>	<b>\$688,698</b>
<b>UCT Benefit/Cost Ratio</b>		<b>2.43</b>

**Table A-15: Total Resource Cost Test Results**

	Benefits	Costs
Avoided Costs	\$1,839,679	
Participant Costs (net)		\$1,534,506
Program Overhead Costs		\$287,570
<b>Total</b>	<b>\$1,839,679</b>	<b>\$1,822,076</b>
<b>TRC Benefit/Cost Ratio</b>		<b>1.01</b>

**Table A-16: Participant Cost Test Results**

	Benefits	Costs
Participant Bill Savings (gross)	\$7,473,166	
Incentives	\$598,698	
Participant Costs (gross)		\$2,290,307
<b>Total</b>	<b>\$8,071,864</b>	<b>\$2,290,307</b>
<b>PTC Benefit/Cost Ratio</b>		<b>3.52</b>

## A.5. Commercial Portfolio

The following tables represent the commercial portfolio results. Table A-17 through Table A-19 show total benefits and costs for the commercial portfolio, along with the benefit/cost ratio for each cost-effectiveness test. As shown, the commercial portfolio passed the UCT, TRC, and Participant tests and generated more than \$2.5 million in UCT net lifetime benefits.

**Table A-17: Utility Cost Test Results**

	Benefits	Costs
Avoided Costs	\$14,646,545	
Incentives		\$11,118,323
Program Overhead Costs		\$1,009,000
<b>Total</b>	<b>\$14,646,545</b>	<b>\$12,127,323</b>
<b>UCT Benefit/Cost Ratio</b>		<b>1.21</b>

**Table A-18: Total Resource Cost Test Results**

	Benefits	Costs
Avoided Costs	\$16,111,200	
Participant Costs (net)		\$8,546,062
Program Overhead Costs		\$2,543,798
Other Benefits	\$375,990	
<b>Total</b>	<b>\$16,487,190</b>	<b>\$11,089,860</b>
<b>TRC Benefit/Cost Ratio</b>		<b>1.49</b>

**Table A-19: Participant Cost Test Results**

	Benefits	Costs
Participant Bill Savings (gross)	\$41,946,781	
Incentives	\$11,118,323	
Participant Costs (gross)		\$9,905,782
<b>Total</b>	<b>\$53,065,104</b>	<b>\$9,905,782</b>
<b>PTC Benefit/Cost Ratio</b>		<b>5.36</b>

## A.6. EW Business Rebates

Table A-20 through Table A-22 shows total benefits and costs for the Rebate component of the EW Business Program, along with the benefit/cost ratio for each cost-effectiveness test.

**Table A-20: Utility Cost Test Results**

	Benefits	Costs
Avoided Costs	\$14,519,916	
Incentives		\$10,579,566
Program Overhead Costs		\$960,107
<b>Total</b>	<b>\$14,519,916</b>	<b>\$11,539,674</b>
<b>UCT Benefit/Cost Ratio</b>		<b>1.26</b>

**Table A-21: Total Resource Cost Test Results**

	Benefits	Costs
Avoided Costs	\$15,971,908	
Participant Costs (net)		\$7,837,789
Program Overhead Costs		\$2,479,147
Other Benefits	\$374,525	
<b>Total</b>	<b>\$16,346,432</b>	<b>\$10,316,936</b>
<b>TRC Benefit/Cost Ratio</b>		<b>1.58</b>

**Table A-22: Participant Cost Test Results**

	Benefits	Costs
Participant Bill Savings (gross)	\$41,766,486	
Incentives	\$10,579,566	
Participant Costs (gross)		\$9,100,927
<b>Total</b>	<b>\$52,346,052</b>	<b>\$9,100,927</b>
<b>PTC Benefit/Cost Ratio</b>		<b>5.75</b>



## A.7. Efficiency Works - Business BTU

Table A-23 through Table A-25 shows total benefits and costs for the Btu component of the EW Business Program, along with the benefit/cost ratio for each cost-effectiveness test.

**Table A-23: Utility Cost Test Results**

	Benefits	Costs
Avoided Costs	\$126,629	
Incentives		\$538,757
Program Overhead Costs		\$48,893
<b>Total</b>	<b>\$126,629</b>	<b>\$587,650</b>
<b>UCT Benefit/Cost Ratio</b>		<b>0.22</b>

**Table A-24: Total Resource Cost Test Results**

	Benefits	Costs
Avoided Costs	\$139,292	
Participant Costs (net)		\$708,273
Program Overhead Costs		\$64,651
Other Benefits	\$1,465	
<b>Total</b>	<b>\$140,757</b>	<b>\$772,924</b>
<b>TRC Benefit/Cost Ratio</b>		<b>0.18</b>

**Table A-25: Participant Cost Test Results**

	Benefits	Costs
Participant Bill Savings (gross)	\$180,295	
Incentives	\$538,757	
Participant Costs (gross)		\$804,856
<b>Total</b>	<b>\$719,052</b>	<b>\$804,856</b>
<b>PTC Benefit/Cost Ratio</b>		<b>0.89</b>

## Appendix B. Algorithms

### B.1. Efficiency Works – Home Savings Algorithms

#### B.1.1. Central Air Conditioning

The following equation represents the annual electric and demand savings calculations for central air conditioning, calculated for early replacement and time of sale. The savings were developed from the Illinois TRM.

$$Savings_{GrosskWh} = FLH_{cool} * BTU * (\frac{1}{SEER_{base}} - \frac{1}{SEER_{ee}}) / 1000$$

The following table represents the definitions, values, and sources of inputs for central AC.

**Table B-1: Central AC Detailed Inputs**

Factor	Definition	Value	Source
FLH <sub>cool</sub>	Full Load Hours of air conditioning	613	Xcel Energy Assumption, page 486 in the “2015/2016 Demand-Side Management Plan Electric and Natural Gas.” October 30, 2014.
BTU	Cooling capacity of efficient unit, in BTU/hr	34,800	Actual program participants’ audit data of installed unit.
SEER <sub>base</sub>	Seasonal Energy Efficiency Ratio of existing cooling system (kBtu/kWh)	12.2	For 26% of units (based on 2017 evaluation survey of participants), customers replaced a unit with existing life. The existing SEER of customers with audit data was 10. Federal standard is 13 SEER.
SEER <sub>ee</sub>	Seasonal Energy Efficiency Ratio of newcooling system (kBtu/kWh)	14.5, 15 or 16	Based on actual installed unit

#### B.1.2. Attic Insulation

The following equation represents the annual electric, demand, and natural gas savings calculations for attic insulation. Evaluation analysis of attic insulation is based on IL TRM, based on heating and cooling savings for natural gas and electric heat homes.

$$\Delta kWh = (\Delta kWh_{cooling} + \Delta kWh_{heating})$$

Where

$$\begin{aligned} \Delta kWh_{cooling} &= (1/R_{old} - 1/R_{attic}) * A_{attic} * (1 - Framing\_factor\_attic) * 24 \\ &* CDD * DUA / (1000 * \eta_{Cool}) * ADJWallAtticCool * PctCAC \end{aligned}$$

$$\Delta kWh_{heating} = ((1/R_{old} - 1/R_{attic}) * A_{attic} * (1 - Framing\_factor\_attic)) * 24 * HDD / (\eta_{Heat} * 3412)) * ADJWallAtticHeat$$

$$\Delta Therms = ((1/R_{old} - 1/R_{attic}) * A_{attic} * (1 - Framing\_factor\_attic))) * 24 * HDD / (\eta_{Heat} * 100,067 Btu/therm) * ADJWallAtticHeat$$

The following table represents the definitions, values, and sources of inputs for Attic Insulation.

**Table B-2: Attic Insulation Detailed Inputs**

Factor	Definition	Value	Source
R_attic	R-value of new attic assembly	50.1	average based on actuals collected in sample audit files
R_old	R-value value of existing assemble and any existing insulation.	21	average based on actuals collected in sample audit files
Framing_factor_attic	Adjustment to account for area of framing	7%	IL TRM Assumption; ASHRAE, 2001, "Characterization of Framing Factors for New Low-Rise Residential Building Envelopes (904-RP)," Table 7.
A_attic	Total area of insulated ceiling/attic (ft <sup>2</sup> )	1264	average based on actuals collected in sample audit files
CDD	Cooling Degree Days, weighted by population in Estes Park vs Fort Collins	977	CDD 65, weighted by population in Estes Park vs Fort Collins, <a href="http://www.degreedays.net/#generate">http://www.degreedays.net/#generate</a>
HDD	Heating Degree Days, weighted by population in Estes Park vs Fort Collins	5,193	HDD 60, weighted by population in Estes Park vs Fort Collins, <a href="http://www.degreedays.net/#generate">http://www.degreedays.net/#generate</a>
DUA	Discretionary Use Adjustment, Reflects the fact that people do not always operate their AC when conditions may call for it	0.75	IL TRM; Energy Center of Wisconsin, May 2008 metering study; "Central Air Conditioning in Wisconsin, A Compilation of Recent Field Research", p31.
$\eta_{Cool}$	Seasonal Energy Efficiency Ratio of cooling system (kBtu/kWh)	13.3	Actual data for portion of participants receiving high efficiency AC, IL TRM for average 2006-2014 customer for remainder
PctCAC	% population with CAC (RECS is reporting 55% in North Mountain region)	Electric: 60% Gas: 79%	2017 Evaluation Survey Responses

Factor	Definition	Value	Source
$\eta_{\text{Heat}}$	Efficiency of heating system	1.32 Electric 0.69 Gas	Electric = IL TRM Calculation, Uses Actual data for portion of participants receiving high efficiency heat pump, IL TRM for average 2006-2014 customer for remainder of HPs, COP of 1 for baseboard heat. Uses RECs for share of HPs vs baseboard heating.  Gas = actual participant data
ADJWallAtticCool ADJWallAtticHeat	Billing Analysis Adjustment to account for prescriptive engineering algorithms overclaiming saving	1	IL Assumes 75% for cooling and 60% for heating, we are assuming 100% due to lack of billing analysis
Distribution Efficiency		0.85	IL TRM assumption of 15% distribution losses

### B.1.3. Air Sealing

The following equation represents the annual electric, demand, and natural gas savings calculations for air sealing. Evaluation analysis of air sealing is based on IL TRM, based on heating and cooling savings for natural gas and electric heat homes.

$$\Delta kWh = (\Delta kWh_{cooling} + \Delta kWh_{heating})$$

Where:

$$\Delta kWh_{cooling} = [(((CFM50_{existing} - CFM50_{new})/N_{cool}) * 60 * 24 * CDD * DUA * 0.018) / (1000 * \eta_{Cool})] * LM * PctCAC$$

$$\begin{aligned} \Delta kWh_{heating} &= (((CFM50_{existing} - CFM50_{new})/N_{heat}) * 60 * 24 * HDD * 0.018) / (\eta_{Heat} * 3,412) \end{aligned}$$

$$\Delta Therms = (((CFM50_{existing} - CFM50_{new})/N_{heat}) * 60 * 24 * HDD * 0.018) / (\eta_{Heat} * 100,000)$$

The following table represents the definitions, values and sources of inputs for air sealing.

**Table B-3: Air Sealing Detailed Inputs**

Factor	Definition	Value	Source
CFM50_existing	CFM Existing Infiltration at 50 Pascals as measured by blower door before air sealing	2262	Average participant based on a of sample audit/assessment files, averaged across all customers (natural gas and electric).
CFM50_new	CFM New Infiltration at 50 Pascals as measured by blower door after air sealing.	25% Reduction= 1696 33% = 1,515 50% = 1,131	Based on Measure specifications of 25%, 33% and 50% reduction
N_cool N_heat	Cooling and Heating Leakage Conversion factor from leakage at 50 Pascal to leakage at natural conditions	19.4	Average N-factors (BPI) from the tracking database across all participants.
CDD	Cooling Degree Days	977	CDD 65, weighted by population in Estes Park vs Fort Collins, <a href="http://www.degreedays.net/#generate">http://www.degreedays.net/#generate</a>
HDD	Heating Degree Days, weighted by population in Estes Park vs Fort Collins	5,193	HDD 60, weighted by population in Estes Park vs Fort Collins, <a href="http://www.degreedays.net/#generate">http://www.degreedays.net/#generate</a>
DUA	Discretionary Use Adjustment, Reflects the fact that people do not always operate their AC when conditions may call for it	0.75	IL TRM; Energy Center of Wisconsin, May 2008 metering study; "Central Air Conditioning in Wisconsin, A Compilation of Recent Field Research", p31.
$\eta$ Cool	Seasonal Energy Efficiency Ratio of cooling system (kBtu/kWh)	13.3	Actual data for portion of participants receiving high efficiency AC, IL TRM for average 2006-2014 customer for remainder
PctCAC	% population with CAC (RECS is reporting 55% in North Mountain region)	Electric: 60% Gas: 79%	2017 Evaluation Survey Responses
$\eta$ Heat	Efficiency of heating system	Electric = 1.32 0.69 Gas	Electric = IL TRM Calculation, Uses Actual data for portion of participants receiving high efficiency heat pump, IL TRM for average 2006-2014 customer for remainder of HPs, COP of 1 for baseboard heat. Uses RECs for share of HPs vs baseboard heating. Gas = actual participant data
LM	Latent Multiplier Latent multiplier to account for latent cooling demand	2.1	Adjusts Chicago LM to account for humidity difference, assuming linear relationship.

### B.1.4. Gas Furnace

The following equation represents the annual electric, demand, and natural gas savings calculations for gas furnaces. Evaluation of electric and natural gas savings of gas furnace are based on the most recent Xcel filing for their 2017/2018 DSM plan.

$$\Delta kWh = (RatedkW_{Non\_ECM} - RatedkW_{ECM}) * Annual\ operating\ hours$$

**Table B-4: Gas Furnace ECM Fan Detailed Inputs**

Factor	Definition	Value	Source
RatedkW_ Non_ECM	kW capacity of standard furnace fan		Xcel 2017/2018 plan
RatedkW_ECM	kW capacity of standard furnace fan		Xcel 2017/2018 plan
Annual operating hours	Furnace fan annual operating hours		Xcel 2017/2018 plan

$$\Delta therms = (Gas_{FurnaceCapacity} * (AFUE_{ee} \div AFUE_{base}) - Gas_{FurnaceCapacity}Gas_{FurnaceCapacity}) \times GasHeatingLoad \div 100,000$$

**Table B-5: Gas Furnace Detailed Inputs**

Factor	Definition	Value	Source
Gas_Furnace_ Heating_Load	Furnace heat load		Participant data
AFUE_Base	AFUE of standard gas furnace	0.78-0.80	Code baseline
AFUE_Eff	AFUE of efficient gas furnace		Participant data

## B.2. Consumer Products Lighting Algorithms

### B.2.1. All Light Bulbs

The following equation represents the annual electric and demand savings calculations for all midstream non-control light bulb products. The savings were developed from the UMP and supplemented with primary and secondary sources.

*Annual Electric kWh*

$$= [(Equivalent\ baseline\ wattage - Actual\ ee\ wattage) * In - service\ rate \\ * Annual\ operating\ hours\ of\ use * Interactive\ effects] / 1000$$

**Table B-6: Lighting – Annual Electric kWh Saving Algorithm**

Factor	Definition	Average Value	Source
Equivalent baseline wattage	Actual baseline bulb wattage	Varies	EISA legislation, tables included below for reference (but are based on lumens)
Actual EE wattage	Actual efficient bulb wattage	Varies	Tracking database
In-service rate	% of bulbs installed	98%	Participant and general population survey results (adjusted for multiyear installations over time per UMP) – see table below for calculation
Hours of Use	Average daily or annual operating hours	2.9 (Daily); 1058.5 (Annual)	Northeast Energy Efficiency Partnerships (NEEP) Study*
Interactive effects	Factor to adjust savings to account for heat loss	1.0	NA – residential IE less of an issue than commercial

\* <http://www.neep.org/sites/default/files/resources/ResLightingDeeperDiveFINAL1.pdf>

**B.2.2. Equivalent Baseline Wattage Estimates (for Delta Watts Calculation)**

The difference between the efficient wattage of a program bulb and the equivalent wattage of the inefficient alternative is the delta watts, which is a key driver of savings for the midstream lighting program. Traditionally, evaluations would use the bulb type (LED vs CFL), the bulb style (A-lamp, BR30, G25 globes as example), the actual rated wattage and lumen output of the new purchased bulb. With these critical parameters, the baseline or equivalent wattage of the inefficient alternative can be defined. As an example, the standard approach for assigning LED A-lamp general service lamp baseline equivalent wattages is using the following table (Table B-7). The lumen value of the bulb of interest is used to identify the lumen range, and then the WattsBase (Post-EISA 2007) is used to assign the equivalent wattage.

**Table B-7: EISA Baseline Wattage by Lumen Output for General Service Lamps (GSL)**

Lumen Range	Incandescent Equivalent Watts <sub>Base</sub> (Pre-EISA 2007)	Watts <sub>Base</sub> (Post-EISA 2007)	Watts <sub>Base</sub> Post 2020
2000-2600	150	72	23
1600-1999	100	72	23
1100-1599	75	53	18
800-1099	60	43	15

450-799	40	29	9
310-449	25	25	25

Since the midstream lighting tracking database excluded lumen values, the team had to rely on alternative existing databases that had assigned lumen-based equivalencies to actual wattage bulbs based on the bulb type and style. The team matched up the type, style, and actual wattage with the same categories in the established alternative lighting databases to categorize and assign the baseline wattages. Because different bulbs have unique lumens per watt (some LEDs are more efficient and have greater lumens/watt than others), the matrix of bulb type/style/actual wattage relative to baseline wattage was not uniform: there were often overlapping baseline wattages assigned to the same actual wattage bulbs. In these instances, the team assigned a single baseline wattage according to a simple rule – the wattage with the greatest number of bulb models in that category was used.

To help demonstrate the evaluation approach to assigning baseline equivalent wattages, we have included candelabra specialty bulbs as an example. A summary of the actual wattage and evaluated assigned baseline wattages are shown in Table B-8. As previously noted, the team was able to leverage existing lighting databases that had already received evaluated baselines to assign baselines according to the bulb type, style, and actual wattage. The team also verified the baseline assignments by spot checking the largest volume bulb sales by model number for each bulb type and style. The largest volume wattage category below is 4.5-watt candelabras, representing 3,408 total bulbs rebated through the program.

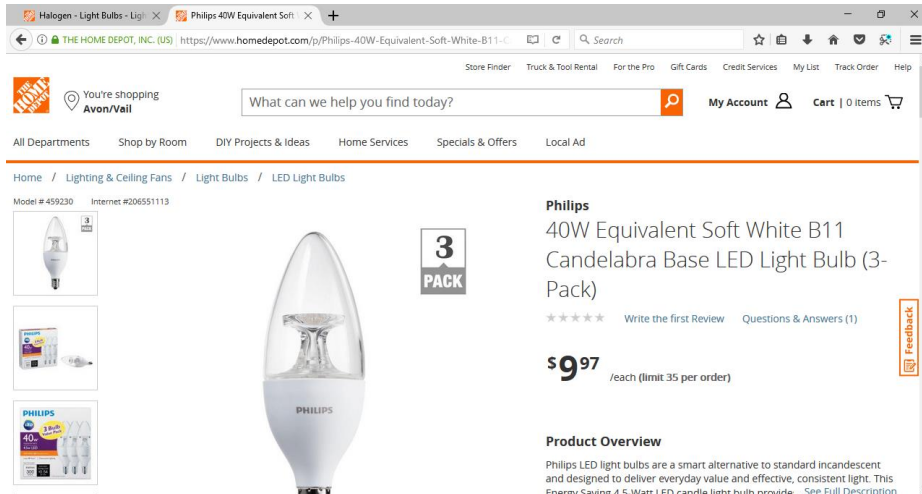
**Table B-8: Program Candelabra Actual versus Baseline Wattages**

		Baseline equivalent wattage (watts)					
		17	25	35	40	50	60
Actual Efficient Wattage (watts)	2	56					
	3		1,913				
	3.5		112				
	4			1,935			
	4.5				3,408		
	5				2,630		
	6.5					502	
	7					802	
	12						97
	13						7

The single largest bulb model associated with this category was a Philips bulb, model 459230, with a bulb description of “PLC 4.5W(40W) B11 CN BSE SW 3PK.” As noted in the product description, the rated equivalent wattage is 40 watts, and the actual wattage is 4.5 watts. We have included a screen shot of



the actual bulb on Home Depots website below. The light output rating on this bulb is 300 lumens. Using the lumens equivalency tables from the Illinois TRM, we find that the equivalent baseline wattage for this bulb is 40 watts. The lumens equivalency table for specialty light bulbs is shown in Figure B-1.



**Figure B-1: Average 2016 Midstream LED Incentives by State**

IL-TRM\_Effective\_060116\_v5.0\_Vol\_3\_Re

ilsagfiles.org/SAG\_files/Technical\_Reference\_Manual/Version\_5/Final/IL-TRM\_Effective\_060116\_v5.0\_Vol\_3\_Re

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Automatic Zoom

Illinois Statewide Technical Reference Manual- 5.5.6 LED Specialty Lamps

Bulb Type	Lower Lumen Range	Upper Lumen Range	WattsBase
	350	499	40
	500	1049	60
<b>Decorative</b> (Shapes B, BA, C, CA, DC, F, G, candelabra bases less than 1050 lumens)	70	89	10
	90	149	15
	150	299	25
	300	499	40
	500	1049	60

**Directional Lamps -**  
For Directional R, BR, and ER lamp types<sup>751</sup>:

Bulb Type	Lower Lumen Range	Upper Lumen Range	WattsBase
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The team would also like to note why CFL to LED replacements were excluded from the baseline wattages. The decision was largely based upon Fort Collins Utilities and Platte River's continued support and promotion for CFLs (during the 2014 period), so it's not a conservative estimate but assumes a code/standard baseline, as is done for all other measures in the portfolio.

### B.2.3. In-service Rates

Relying on the participant and general population surveys to inform the percentage of bulbs that were purchased and placed into service (relative to the percentage placed into storage), the team estimated the first-year in-service rate (ISR). There were 209 participants that had purchased LED bulbs, and 84.8% of these bulbs were installed. There were 164 general population survey respondents that had purchased LED bulbs, and 90.6% of these bulbs were installed. The first-year in-service rate from both surveys was 87.3%. Since additional bulbs are installed over the course of the next several years, the UMP provides guidance on accounting for the eventual installation of these bulbs originally placed in storage. A summary of the annual installations likely to occur is shown in Table B-9.

**Table B-9: 2014 Installation Rate Example**

Year	% Installed	% In Storage	New % Installed
2014	87%	13%	NA
2015	90%	10%	3%
2016	93%	7%	3%
2017	94%	6%	2%
2018	96%	4%	1%
2019	97%	3%	1%
2020	98%	2%	1%
2021	98%	2%	<1%
2022	99%	1%	<1%

$$\text{Demand } kW = \frac{[\text{Equivalent baseline wattage} - \text{Actual ee wattage}]}{1000}$$

### B.3. Lighting Controls

The following equation represents the annual electric and demand savings calculations calculation for dimmers and sensors, calculated by room and for various bulb types. The evaluation used the same analysis structure used by Fort Collins in the past.<sup>52</sup>

$$\text{Savings}_{\text{Gross } kWh} = \left( \frac{\text{Watts}}{1,000} \right) * HOU * \text{PctSave} * \text{NBulbs} * \text{ControlProb}$$

The following table represents the definitions, values, and sources of inputs for dimmers.

<sup>52</sup> Protzman, Brent, 2011. In-Wall Sensor Switch.

**Table B-10: Dimmer Detailed Inputs**

Factor	Definition	Average Value	Source
Watts	Wattage by bulb and room type	Incandescent: 51 Average LED: 15 Program LED: 11	Wattage by room and bulb type (Average LED and incandescent): 2010 U.S. Lighting Market Characterization and Navigant analysis, adjusted to account for EISA compliance and adjusted to align with room types. Assumes dimmers not used on CFLs. Program LED from email with Fort Collins staff.  Saturation of Bulbs by Room type: Xcel Energy saturation study, Table 10.*
HOU	Annual Hours of Use	2.7	NEEP lighting study, link provided above in lighting table. Adjusted to align with room types. Weighted by ControlProb
PctSave	Percent savings of dimmer	25%	Department of Energy, Lighting Market Characterization,** Table F-4 Energy Savings for each Control Type by Application  <a href="https://energy.gov/sites/prod/files/2016/09/f33/energysavingsforecast16_2.pdf">https://energy.gov/sites/prod/files/2016/09/f33/energysavingsforecast16_2.pdf</a>
NBulbs	Number of bulbs per Dimmer	1	Consistent with Protzman, 2011 analysis
ControlProb	Probability of Dimmer by Room type	Varies	Dimmer frequency, by room type: KEMA. 2010. Final evaluation report: upstream lighting program. Prepared by KEMA, Inc. Prepared for: California Public Utilities Commission, Energy Division. Adjusted to remove outdoor lighting.

\* <https://www.xcelenergy.com/staticfiles/xcel/PDF/Regulatory/CO-DSM/CO-Regulatory-DSM-Lighting-Market-Study.pdf>

\*\* [https://energy.gov/sites/prod/files/2016/09/f33/energysavingsforecast16\\_2.pdf](https://energy.gov/sites/prod/files/2016/09/f33/energysavingsforecast16_2.pdf)

**Table B-11: Sensor Detailed Inputs**

Factor	Definition	Average Value	Source
Watts	Wattage by bulb and room type	Incandescent: 51 CFL: 51 Average LED: 15 Program LED: 11	Wattage by room and bulb type (Average LED, incandescent and CFL): 2010 U.S. Lighting Market Characterization and Navigant analysis, adjusted to account for EISA compliance and adjusted to align with room types. Program LED from email with Fort Collins staff.  Saturation of Bulbs by Room type: Xcel Energy saturation study, Table 10.*
HOU	Annual Hours of Use	2.3	NEEP lighting study, link provided above in lighting table. Adjusted to align with room types. Weighted by ControlProb.

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Factor	Definition	Average Value	Source
PctSave	Percent savings of sensor	50%	Department of Energy, Lighting Market Characterization,** Table F-4 Energy Savings for each Control Type by Application <a href="https://energy.gov/sites/prod/files/2016/09/f33/energysavingsforecast16_2.pdf">https://energy.gov/sites/prod/files/2016/09/f33/energysavingsforecast16_2.pdf</a>
NBulbs	Number of bulbs per Sensor	5.1	Consistent with Protzman, 2011 analysis, assumes all bulbs in room are controlled by sensor. Number of bulbs (47.6) installed in average CO home based on Xcel study*** of installed sockets, excluding empty sockets. Percent of bulbs installed per room: Same Xcel study for bulbs installed by room for high use rooms. Rooms not represented in study (hall, garage, utility room, office/den) are assumed to have equal shares of remaining bulbs.
Control Prob	Probability of Sensor by Room type	Varies	Sensor frequency, by room type: KEMA. 2010. Final evaluation report: upstream lighting program. Prepared by KEMA, Inc. Prepared for: California Public Utilities Commission, Energy Division. Adjusted to remove outdoor lighting.

\* <https://www.xcelenergy.com/staticfiles/xcel/PDF/Regulatory/CO-DSM/CO-Regulatory-DSM-Lighting-Market-Study.pdf>

\*\* [https://energy.gov/sites/prod/files/2016/09/f33/energysavingsforecast16\\_2.pdf](https://energy.gov/sites/prod/files/2016/09/f33/energysavingsforecast16_2.pdf)

\*\*\* <https://www.xcelenergy.com/staticfiles/xcel/PDF/Regulatory/CO-DSM/CO-Regulatory-DSM-Lighting-Market-Study.pdf>

$$\text{Demand } kW = \text{Annual electric energy } kWh \div 8760$$

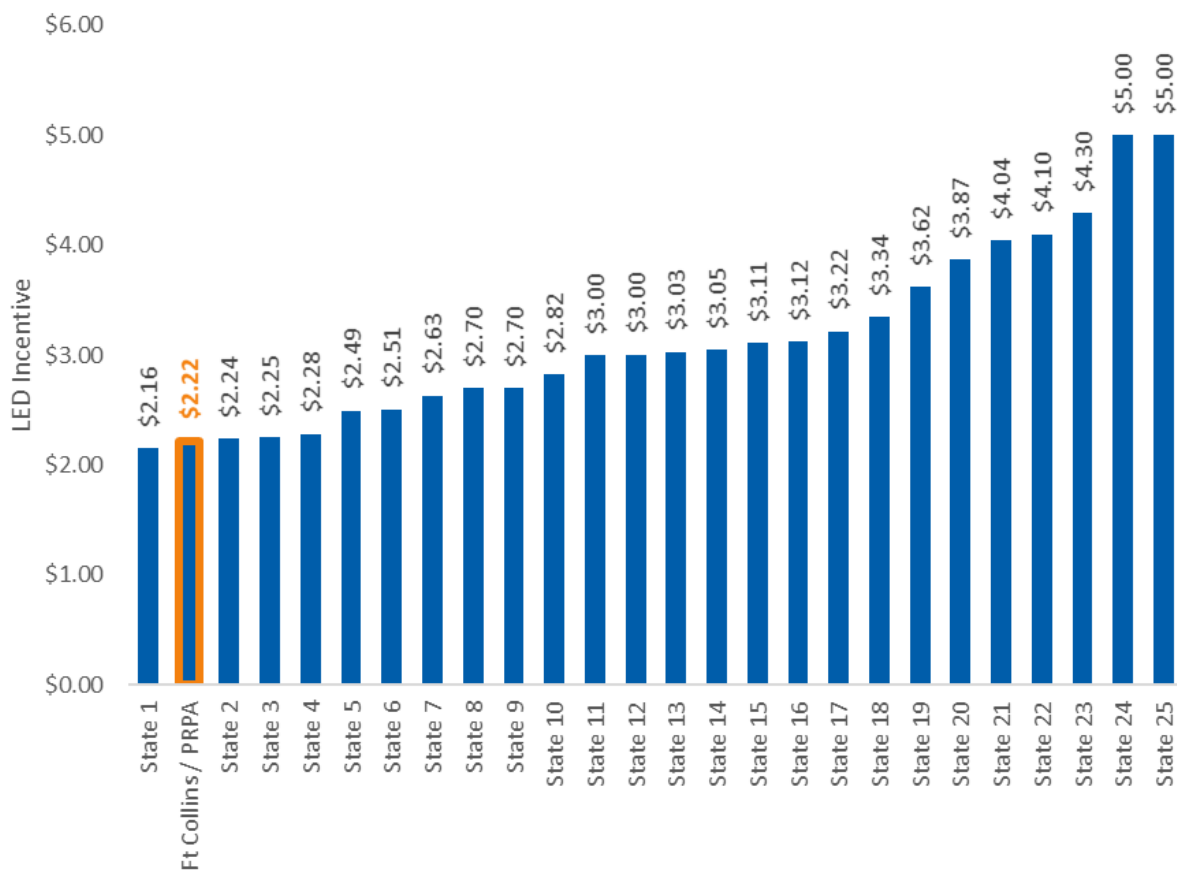
## Appendix C. Net to Gross Details

### C.1. Consumer Products Lighting

#### C.1.1. Approach 1: CREED Sales Database and Model

Comparing the incentive levels by program is a helpful tool to understanding incentive impacts. The evaluation team leverage our partnership with the Consortium for Retail Energy Efficient Data (CREED) to develop a state-level summary that shows what each upstream program is paying to buy down the costs of the LED lighting equipment. A summary of the state-level and Fort Collins/Platte River is shown in Figure C-1. As can be seen in this chart, the Utilities incentives the second lowest in the range of LED lighting products programs. The national sales model that CREED had developed showed a strong and positive correlation between average incentive levels and program attribution – the higher the incentives, the higher the NTG.

**Figure C-1: Average 2016 Midstream LED Incentives by State**



The evaluation team also attempted to use the National Lighting Sales Model, which estimates state-level lighting program impacts based on longevity of programs, average incentive levels, program overhead, and key demographic characteristics. Unfortunately, since the model is a state-level model, only those utilities that represent the majority of incandescent bulbs in a state can be used for NTG impacts. Since Xcel represents over 98% of the utility incentivized midstream lighting products in Colorado, the team does not believe the results of the Colorado model can be applied for Fort Collins Utilities and Platte River lighting programs. The modelling work did find NTG values ranging from 70-80% in the other jurisdictions where clients partnered with the CREED team.

### C.1.2. Approach 2: Secondary Data

The team also conducted secondary research on upstream lighting NTG ratios from other 2014-2016 programs. The results of our secondary research are summarized by year in the tables below. For 2015 and 2016, we limited the research to LED specific NTG ratios since that matches with Fort Collins and Platte Rivers offerings (having dropped CFLs), but for 2014 studies we included CFLs since Fort Collins was still including these bulbs. We should note that the following table are based on the year the NTG estimate was applied, not based on the year the studies were conducted.

**Table C-1: LED NTG Estimates for 2016**

Region	Standard LED	Specialty LED
CT	0.57	
MA	0.90*	
MD	0.71	
WI	0.72	

**Table C-2: LED NTG Estimates for 2015**

Region	Standard LED	Specialty LED
PG&E	0.30	0.39 (reflector)
SCE	0.33	0.38 (reflector)
SDG&E	0.33	0.52 (reflector)
CT	0.63	
Ameren IL	0.69	
ComEd	0.58	
PPL	0.61	
PECO	0.66	0.62

Table C-3: CFL and LED NTG Estimates for 2014

Region	Retail Channel	CFL	LED
CA (standard CFLs)	Discount	0.84	0.69
	Drug	0.63	
	Grocery—chain	0.12	1.00
	Grocery—independent	1.00	1.00
	Hardware	0.54	0.56
	Home Improvement	0.53	0.44
	Mass Merchandise	0.59	
	Membership Club	0.41	0.65
Xcel CO	All	0.79	0.91
Ameren MO	All	1.01 Std. 0.84 Spec.	0.96
ComEd	All	0.64 Std. 0.43 Spec.	0.73
Ameren IL	All	0.63 Std. 0.72 Spec.	
WI	All	0.53	
MA	All	0.62	.95

### C.1.3. Approach 3: Qualitative Assessment

Interviews with manufacturers (n=3) and retailers (n=3) during the in-depth interviews conducted as part of the process evaluation found somewhat conflicting accounts regarding program attribution. The retailer's representatives interviewed believed:

- › program influence was minor relative to market dynamics in general,
- › there has been high demand for LED lighting,
- › pricing has dropped over the past five years,
- › strong corporate interest in promoting LED lighting,
- › and relatively low program incentives for the buydowns.

All three major lighting manufacturers strongly believed that program support is very important for the efficient lighting markets, with all three indicating support for specialty lighting and higher wattage bulbs is critically important. One manufacturer compared their sales in other areas that continue to support A-lamps, and said “the majority of sockets that I sell are A-line, general purpose. [Platte River] is not getting credit for sales on those bulbs. The [stores] that sell A-19 are far exceeding sales of [Platte

River]”. Another manufacturer stated “If you factor in no rebates, the drop-off [due to stopping rebates] would be significant. The flip side, is if the rebate was a little higher, you’d see increased participation, and more savings.”

Note that the retailer responses are not consistent with other interviews the team has conducted in other jurisdictions. For example, based on in-person interviews conducted at the 2017 ENERGY STAR Partner meeting there is tremendous uncertainty in the lighting market, particularly around the EISA backstop, and concern that the market could backslide to halogens. For example, a study between Massachusetts and New York found that when New York cut all upstream incentives for CFLs and LEDs saturation began lagging behind Massachusetts.<sup>53</sup>

### C.1.4. Recommended NTG

Estimating NTG is extremely challenging, and – while there are notable limitations (discussed above) in comparing secondary NTG values from upstream lighting programs - the ex ante Fort Collins and Platte River values tend to be in the middle of the range of values seen elsewhere. Note, however, the incentives were on the lower end of other programs, which could lead to higher FR (i.e., low incentives are not enough to “move” the market and motivate customers to purchase the more efficient EE option).

Given the challenge of estimating upstream NTG, the wide range of values, and the lack of more detailed sales data specific to the Fort Collins and Platte Rivers service territories, the evaluation team recommends not changing the existing values of 0.66 for 2014-2015, and 0.69 for 2016.

Going forward, however, we recommend dropping the NTG value by 5% a year (e.g., 0.64% in 2017), even if the program is limited to specialty LEDs. Note, however, that there remains tremendous uncertainty in the lighting market, particularly around the EISA backstop,<sup>54</sup> as well as evidence of energy efficiency backsliding in jurisdictions that have ended support for energy efficiency lamps (see study cited above), so the evaluation team does believe there is still opportunity to support both standard and specialty LED lamps. One strategy to potentially improve NTG is to focus on specific distribution channels, including grocery, drug, dollar, discount stores, and mass merchandisers, which have lagged in terms of LED market share, as well as to raise incentive levels. The sales are shown below in Figure C-2.

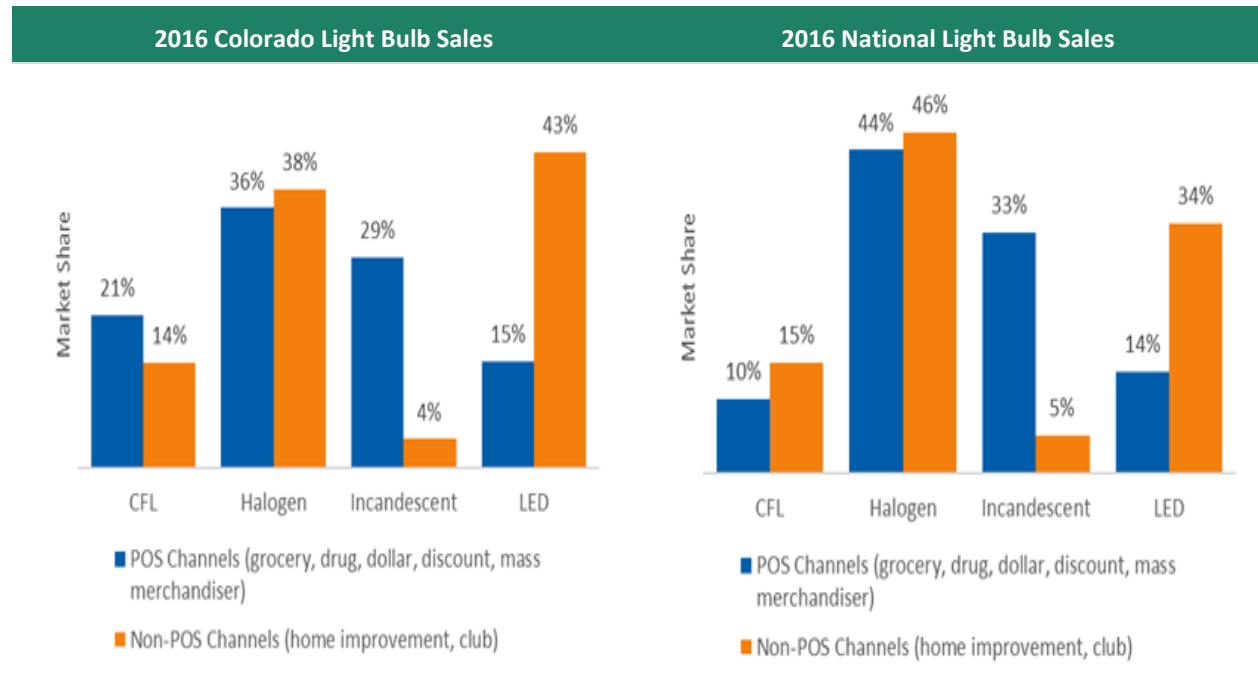
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<sup>53</sup> Cadmus and NMR Group, “Lighting Market Assessment and Saturation Stagnation Overall Report” August, 2015. Available online at: <http://ma-eeac.org/wordpress/wp-content/uploads/Lighting-Market-Assessment-and-Saturation-Stagnation-Overall-Report.pdf>

<sup>54</sup> Based on in-person interviews conducted at the 2017 ENERGY STAR Partner meeting. The evaluation team is preparing a separate summary of our key findings from the Partner meeting.



**Figure C-2: Lighting Type 2016 Market Shares for Colorado and USA, Across Retail Channels**



## Appendix D. Detailed Efficiency Works for Business Recommendations

This appendix presents a list of qualitative findings and actionable items identified during the Efficiency Works for Business impact evaluation. Additional measure or program specific findings are included elsewhere in this report.

It should be noted that despite these findings and suggestions, the current programs are cost effective and of great value to the utilities. Programs are generally well designed and are conscientiously operated by a dedicated and effective staff.

To maximize the value of the evaluation and to improve programs as much as possible, it is recommended that Platte River track and address each of the issues identified in the evaluation.

This appendix is used to help with continuous improvement of programs. The program administrator was provided with this table in draft format. The last column represents the *Program Administrator Response* to these recommendations.

**Table D-1: Key Qualitative Findings and Recommendations**

No	Finding	Discussion	Recommendation	Program Administrator Response
1	Program files are not uniform and in some cases not complete	Optimal program operation requires careful project tracking and file management.	Each project file, whether for the BTU or the Rebate program should be rigidly set and populated. Administrators should require that every project have uniform sub directories, applications, savings documentation. Program flow and documentation models should be designed, published and strictly enforced.	The program administrators are currently working to provide complete project file management.

## Energy Efficiency Programs Evaluation

No	Finding	Discussion	Recommendation	Program Administrator Response
2	Tracking system is lacking some key parameters	The tracking sheets do not always capture an optimal level of detail on project sites and related energy assessments and project inspections performed at the site.	Capture project site characteristics such as building type, operating hours, etc., as well as details on pre- and post-inspections and/or assessments in the project tracking databases. A detailed project description would also be valuable.	The program considers assessments separate from the rebate program, but administrators are considering how these two programs can be linked efficiently. The program application and process strive to balance the participant experience and barriers to collecting or requiring this data when applying for rebates.
3	Insufficient citations of savings calculation methods	Savings methodologies are currently a disparate selection of supporting documentation, as well as some embedded formulas and deemed values in the application spreadsheets.	Undertake an effort to collect deemed savings values and calculations currently implemented. This information should be stored in a single master document. Ideally, this would entail the development of a technical reference manual. The Xcel Energy DSM filings may be leveraged because their information is fairly up to date, regionally specific, and vetted.	The program team agrees this would be helpful to collect the deemed savings in one place.
4	Deemed savings values outdated	Several deemed savings values for measures have not been updated or validated for years. Savings from high impact measures being implemented hinge on these deemed values.	Identify measures that have significantly uncertain deemed savings values and/or have the highest contribution to savings. Investigate and adopt the most current, industry-accepted approach to these measures.	Much of the deemed savings contribute to the lighting and refrigeration savings, which have been updated over the years. The remaining savings have not been updated due to no change in baseline or no significant participation in the measure.

## Energy Efficiency Programs Evaluation

No	Finding	Discussion	Recommendation	Program Administrator Response
5	Need for cost effectiveness inputs at the measure level	Cost effectiveness can be accurately calculated during implementation at the measure level with adequate planning and integration of specific parameters on a project level.	Integrate estimates of incremental cost at the measure level in the application spreadsheet. Also capture measure life. Consideration should also be given to attributing the cost of an associated assessment to a particular project.	The program currently tracks these attributes in 2017.
6	Lighting wattage table not well documented and not adequately comprehensive	The lighting wattage table currently in use does not provide enough resolution and/or specific fixture types to allow consistent use of the drop down menus in the lighting retrofit tab.	Update or replace the existing table with a more comprehensive, up-to-date version. As newer LED fixture types emerge, older wattage tables are unlikely to capture the most common retrofits occurring in the market.	The lighting wattage table primarily provides standardized wattages for existing or old lighting equipment. New LED fixture wattages vary widely, so program requires participant to enter wattage of new LED fixtures.
7	Incentives capped for most measures at 100% of project cost	Currently, rebates for most measures are capped at 100% of project cost. Ordinarily, rebates should never be capped above 100% of the <i>incremental cost</i> . In some cases the incremental cost and the project cost are the same.	Revisit this practice and evaluate whether this generous incentive amount is required to obtain the level of participation desired for the programs.	Although rebates cannot exceed 100% of project cost, the average rebate as a percentage of the average project cost is about 35%. The program designs the rebates to be on average less than 75% of the project cost versus setting a percent project cost cap.
8	Opportunity for inclusion of additional measures	There may be additional measures that could be included in the programs. For example, currently the programs only include a motor-related measure specific to VSD controls. A premium efficiency motors measure is often included in other territories and incentivization of the motors themselves may be cost effective	Investigate the inclusion of other measures such as a 'premium' (or higher) efficiency motor measure into the rebate program.	The program considers new program measures and rebates regularly and performs a detailed potential study to identify potential new measures to offer.

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No	Finding	Discussion	Recommendation	Program Administrator Response
9	Cooling efficiency may be underutilized	Cooling measures only make up approximately 3% of rebate program savings, while this measure may have significant opportunity in the market.	Increase promotion of, and marketing strategy for, cooling efficiency measures. As the future market potential for savings from lighting retrofits dwindles due to EISA legislation, cooling measures are a logical option for diversification of savings.	Cooling rebates were moved from the regular downstream program to a midstream program in 2016 and is currently be offered through this channel. The program has seen a significant increase in participation with the midstream model.
10	BTU program complexity may be increasing costs without improving savings outcomes	The BTU program includes some unnecessary complexity. Approaches and documentation have limited consistency across projects due to third-party control. Additionally, some analysis activities may not be directly contributing to savings realization.	Revise the process for BTU projects. Savings calculations could be streamlined and reduced/modified to provide a level of rigor consistent with the level of savings. Consider prescribed calculations for common retro-commissioning measures and templated calculation sheets for other measures.	This is a good recommendation and program is considering how to improve the BTU process and savings.
11	Lighting and other appropriate measures should include interactive effects where appropriate.	Most DSM programs around the country recognize that interactive effects are significant and real. Interactive effects have been included in the evaluated savings resulting in lighting realization rate greater than one.	Integrate calculation of interactive effects.	We have considered this in the past, but decided to not include interactive savings. We have discussed this recently and are considering if we should include them in the future.

## Energy Efficiency Programs Evaluation

No	Finding	Discussion	Recommendation	Program Administrator Response
12	Natural gas, water savings, and non-energy benefits should be tracked	The programs have a significant effect on not only electric use, but on use of other fuels. Additionally, non-energy benefits (NEB) are very important and have a significant impact on program value and cost effectiveness. NEB may include a wide range of categories such as: water savings, avoided future and O&M costs, occupancy comfort, property values, environmental improvements, and so on.	Tracking of other fuels and NEBs will help further demonstrate the significant value of the programs. Consideration of NEBs and qualitative and/or quantitative value should be included during program design and implementation.	We only track natural gas savings in BTU program as it is considered for the payback calculation. We have standalone water measures rebated through EW business rebates and are tracked in this program. We are interested in how other utilities track the other mentioned non-energy benefits.
13	For custom projects, the baseline, energy savings calculations, and post-retrofit verification are not adequately documented, reviewed, or verified.	For larger projects, and custom projects, appropriate measurement and verification is warranted. The FEMP M&V Guidelines recommend spending 10-20% of project savings value on M&V.	Develop and follow a custom program protocol that ensures adequate measurement and verification.	We already have this.
14	In situ baselines appear to be used for most measures, and this may not be appropriate in some cases.	Sometimes when equipment is going to be replaced anyway, or is at the end of its expected useful life, it may be more appropriate to use minimum code baselines.	Develop a protocol delineating how in situ or code baselines should be used in different scenarios.	This is currently used in program when appropriate.

## Appendix E. C&I Site Visits

The evaluation team performed site visits of a subset of Efficiency Works Business projects from the sample set. The team visited a total of 20 facilities including 17 rebate project sites and 3 BTU project sites. Sites ranged in size from small retail shops to large corporate campuses and were located in Fort Collins, Loveland, and Longmont. Table E-1 shows key findings from these site visits.

**Table E-1: Key Site Visit Findings**

No	Building Type	Measure Type	Project Description	Findings	RR
A	Retail store in strip mall	Lighting	Replace 321 incandescent and halogen retail display track lighting bulbs with LED	On-site count of LED bulbs on track lights was less than rebated quantity, but track systems appeared to be reconfigured often for varied displays. De-lamping may have occurred.	1.12
B	Warehouses	Exterior Lighting	Replace 50 CFL and metal halide exterior wall pack fixtures with LED wall packs	Count and fixture type matched project details	1.00
C	College Campus Building	Refrigeration	Large, antiquated campus refrigeration system replaced with new high efficiency system.	Met with university energy managers and discussed project details. While unclear from project documentation, it appears the old refrigeration system was in a different building from the new one. Limited info on baseline condition of previous refrigeration system other than “wet cork insulation” and age of facility. Unclear whether baseline refrigeration system should have been used as baseline or if a code baseline should have been used for the new facility.	1.05
D	Strip Mall	Exterior Lighting	Replace 9 exterior metal halide fixtures with LED	Count and fixture type match project details, but a pair of 14-watt LEDs likely captured as single 38-watt LED on application	1.02
E	Senior Care Facility	Lighting	Replace 1,075 60-watt incandescent A19 bulbs with 10-watt LED bulbs	Spot checked vacant resident apartments and common areas; quantity rebated is reasonable with spot check. Viewed store room stock: all LEDs	1.10

## Energy Efficiency Programs Evaluation

No	Building Type	Measure Type	Project Description	Findings	RR
F	Corporate Campus	Exterior Lighting	Replace parking lot pole lights, bollards, and wall packs with LEDs	Performed site tour with facility representative and confirmed fixture types and comprehensiveness of project referring to lighting plan	0.99
G	Distribution Center	Exterior Lighting	Replace 125 1,080-watt metal halide parking lot pole lights with 160-watt LED	Obtained as-built lighting plan from facility manager and validated against project documentation. One fixture was damaged during installation (and subsequently replaced) and was available for inspection, confirming rebated fixture matches.	1.00
H	Strip Mall	Exterior Lighting	Replace 9 1,005-watt metal halide parking lot pole fixtures with LED retrofit kit rated at 405-watts	Located 9 specific parking lot pole lights out of many in parking lot and visually verified LED retrofit kit and photosensors	0.95
I	Retail	Exterior and Signage Lighting	Replace four 1,080-watt metal halide parking lot pole fixtures with induction lamps. Replace 2-part neon sign with 240-watt LED sign. Photocells on each fixture.	Three pole fixtures noted on-site, each with two lamps, but site contact noted one of 3 have been decommissioned. LED sign noted on-site. Contact stated that a single photocell controls all but there is also a timer to shut lights off late each night.	1.10
J	Industrial Facility	Air compressor	Installation of VFDs on several blower fans used for industrial glass tempering process.	Site visit occurred during time where process was running at highest energy intensity, so lower speeds could not be validated and site staff was not aware if VFDs ran at lower speeds for the other processes. Fifty percent duty cycle as stipulated in energy savings calculation difficult to validate but discussions with site staff suggest process runs nearly constantly during staffed hours. Project is a good example of the need for enhanced M&V.	1.00
K	Big Box Retail	Lighting	Replace 445 351-watt 4-foot 4-lamp T8 fixtures with T5s rated at 225-watts per fixture	Comprehensive count totaled 441 fixtures, not 445, but since rebate is several years old it is conceivable that lighting was slightly reconfigured during that time. Manager noted operating hours are set by central office, but currently approximate hours in application	1.10



## Energy Efficiency Programs Evaluation

No	Building Type	Measure Type	Project Description	Findings	RR
L	College Campus Building	Other	Large university facility including classrooms and laboratories. Measures included RCx and capital improvements including duct static pressure reset, supply air temperature reset, electric dampers, and the creation of cool rooms for low temperature refrigerators, among others	Met with university energy managers. Visited two of three cool rooms and verified low temperature refrigeration systems are now exhausting heat into these rooms with dedicated cooling instead of distributed throughout building in hallways, etc. Attempted to validate supply air temperature reset, but supply air temperature was not set as depicted in project description; appears measure was not completed or did not persist.	1.00
M	Grocery Store	Refrigeration	Reach-in cooler and freezer gaskets (>1,500 LF), auto closers, strip curtains, small LF of walk-in gasket	Count of gasket LF did not exactly match rebated amount, but store recently changed from one major grocery chain to another and there was evidence of reconfiguration. Total count of gasket LF within reasonable range and gaskets were clearly recently replaced.	0.91
N	Restaurant	Refrigeration	Auto closers on 2 doors, strip curtains on 4 doors, gaskets on walk-in and reach-in coolers and reach-in freezers	Count of gaskets on site exceeded rebated amount, although exact locations of gaskets in question was not able to be verified. Auto closers and strip curtain quantity also exceeded rebated amount. Some strip curtains damaged or could have been actively removed due to inconvenience.	0.54
O	Bar	Refrigeration	Installation of 1/20th HP electrically commutated motor on walk-in cooler/freezer	Verified installation of motor on 10" walk-in cooler evaporator fan. Cooler was 39 degrees F with dimensions 88" x 74" x 7' tall.	0.97
P	Liquor Store	Refrigeration	Auto closers, strip curtains, and new gaskets on 9 reach-in cooler doors	More than 9 reach-in cooler doors (22 on beer cooler and 3 on wine cooler) and many or all doors appear to have new gaskets. Auto closer and strip curtains on beer cooler. Auto closer on wine cooler did not function to fully close door.	0.62

## Energy Efficiency Programs Evaluation

No	Building Type	Measure Type	Project Description	Findings	RR
Q	Restaurant	Refrigeration	Gaskets on 15 reach-in cooler doors; strip curtains on 2 walk-in cooler doors	Count of reach-in cooler doors exceeded rebate amount (20 doors counted), so rebated amount valid; strip curtains found on 2 walk-in cooler doors, but one strip curtain had one strip fully removed and another falling off.	0.30
R	Hospital	BTU Program - RCx	Large medical facility/hospital with several RCx measures including zonal temperature and airflow setback, operating room airflow occupancy control, unoccupied corridor light shedding, and exterior lighting controls.	Met with facility manager and facility supervisor and reviewed measure implementation and current BAS configuration. RCx measures remain implemented. Operating room occupancy pilot measure proved successful and staff intends to implement on additional future operating rooms.	1.00
S	Municipal Facility	BTU Program - RCx	Municipal public safety offices/facility with several RCx measures including heating plant lockout, terminal unit scheduling, dust static pressure reset, hot water valve leaky, synchronous belts on RTUs, and lobby electric baseboards	Met with municipal facilities managers and energy manager. Verified several controls measures, visually inspected synchronous belt on one RTU. Discussion with facility staff revealed terminal unit scheduling was a failed measure due to occupant comfort issues.	0.37
T	Museum	BTU Program - RCx	Museum facility with several RCx measures including heating and cooling plant lockouts, chiller ice-making operation, chilled water VFD control, AHU/ERV scheduling, AHU unoccupied mixed air temperature control, ERV direct evaporative cooler control and supply air temperature reset	Met with energy manager and facility staff. Review BAS control sequences for most measures, visually noted chiller ice-making system. Most measure implemented as described in RCx study, although chilled water VFD control continues to prove a difficult challenge at this facility due to chiller shutdown at low flow rates.	0.86

## Appendix F. Nonresidential Spillover

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### **Not all Spillover is the Same – So Don't Treat it That Way!**<sup>55</sup>

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#### **ABSTRACT**

Many survey-based spillover approaches ask respondents to provide a single, global measure of program influence on un-incented sales of efficient equipment – asking vendors and contractors to assess the program's influence on their sales or asking end-users to assess the program's influence on their purchases. Such approaches do not fully take into account that program influence may operate differently in different situations and often may operate in a manner that is invisible to any single observer. We developed an approach that assesses program influence operating in five efficient-equipment sales scenarios reflecting how the market for efficient equipment works, and identifying up to three separate pathways of program influence within each of the five scenarios. These include pathways of *indirect* program influence that can be assessed only by combining information from multiple actors.

From surveys of 33 distributors and 29 contractors that represented 50% of program savings for a large C&I program, we quantified the un-incented sales of efficient lighting equipment that occurred in each of the five scenarios. Each respondent reported the quantity of multiple lighting types sold in various scenarios, the percentage of sales that received incentives, the degree of program influence on their recommendations, and the percentage of their equipment recommendations that were accepted. For each influence pathway, we calculated program indirect influence as the product of the influence of each actor on the next one. We assessed program *direct* influence with participant and nonparticipant surveys.

In total, program influence accounted for 11.5M kWh in savings, or two-thirds of the survey respondents' total savings from un-incented lighting sales. Results showed that the program generally had greater *indirect* than *direct* influence on end-users and that vendors transmitted greater program influence than did contractors. One possible limitation of this approach is that it does not account for vendor stocking practices as a source of influence.

Potential threats to the validity of these results include the possible lack of reliability in the reported frequency with which recommendations are made and the reported influence of those recommendations; the assignment of an attribution proportion based on an influence rating scale; and restriction considering equipment recommendations as the only pathway of influence. We discuss these issues in the conclusion.

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<sup>55</sup> Presented at the 2017 International Energy Program Evaluation Conference

### Introduction

We developed an innovative approach to estimating lighting-related spillover savings – that is, savings from un-incented sales of high-efficiency lighting equipment that resulted from direct or indirect program influence – for a utility’s large C&I program. The approach built upon existing methods of assessing spillover savings in which surveyed trade allies estimate program-influenced sales of un-incented energy efficient measures. The remainder of this section describes existing approaches to assessing spillover and the limitations of those approaches and then describes the theory behind the current approach.

### Definition and Assessment of Spillover

Spillover refers to reductions in energy or demand savings resulting from program influences but not arising directly from program participation (e.g., Violette and Rathbun, 2014). Spillover assessments typically distinguish between participant and nonparticipant spillover. Participant spillover generally occurs when a program participant’s experience with the program leads them to install additional measures. Nonparticipant spillover occurs when program nonparticipants install measures either because of direct program influence (e.g., marketing, discussions with program staff) or because a program-influenced trade ally convinced them to carry out the upgrade.

A variety of approaches exist to assessing spillover (Violette and Rathbun, 2014; Haeri and Khawaja, 2012). Survey, or self-report, approaches are common because of the low cost. The limitations of self-report approaches are well known, and it is not the purpose of this paper to review or refute them. Because of their low cost and ease of administration, self-report approaches will continue to be used, so the objective of researchers should be to identify limitations that can be overcome with improved design and implementation.

Survey approaches to assessing participant spillover are somewhat more homogeneous than those for nonparticipant spillover. The core of the common approach is to ask program participants to report efficient equipment that they installed without program incentives or rebates but because of program influence. Most of the variation exists in how program influence is assessed and quantified and whether the approach differentiates “like” and “unlike” or “inside” and “outside” spillover (e.g., Dyson & Goldberg, 2007; Saxonis, 2007; Tetra Tech, 2011).

Greater heterogeneity exists in nonparticipant spillover approaches. One approach is to survey program nonparticipants about program-influenced but not incented upgrades (Saxonis, 2007). This approach is similar to what I have called the common participant spillover approach, except that the assessment of program influence generally focuses on awareness of the program and influence of program marketing.

The other general approach to assessing nonparticipant spillover, which seems to be growing in popularity in recent years, is to survey trade allies about their sales of program-influenced, un-incented equipment to program nonparticipants (e.g., Tetra Tech, 2011). The “core” approach here is to obtain estimates of: 1) the volume of un-incented equipment sold; 2) the amount of that equipment that was sold to program non-participants; and 2) the program’s influence on those sales. Even within this core approach, methods vary in terms of how each of those estimates are obtained.

## Limitations to Assessment of Spillover

It is not the purpose of this paper to review all existing methods in detail, but it is valuable to identify some limitations in some of the common existing approaches, described above, that our approach seeks to avoid.

Surveying participants or nonparticipants about program influence can reveal only *direct* program influence, but not the program's *indirect* influence acting through the actions of vendors and contractors. While they can report on the influence that the vendors or contractors had on them, their reports cannot reveal how much that influence can be attributed to the program because they do not know how much the program influenced the vendors and contractors. This limitation seems particularly troublesome for assessing nonparticipant spillover, as it is conceivable that indirect program influence on their actions is greater than direct program influence. Beyond the inability to reveal indirect influences, assessing spillover through surveys of end-users is problematic because of the low incidence of reported spillover activities, which can result in significant variability in spillover savings estimates from one sample to another (Haeri and Khawaja, 2012).

Assessing spillover through trade ally surveys can avoid the above limitations, but can have its own limitations. First, while trade allies may be able to provide reliable estimates of the percentage of sales that receive incentives, that does not necessarily translate into the percentage of sales that go to nonparticipants, as their un-incented sales may be to participants (participant spillover) as well as to nonparticipants – and there is no reason to expect that a trade ally would reliably estimate the proportion of un-incented sales that went to each group.

Further, trade ally survey methods often ask respondents to assess the program's influence on their sales of un-incented equipment. While trade allies certainly can report on the program's influence on their recommendations to their customers (e.g., Tetra Tech, 2011), that by itself does not equate to the program's total influence on the customer unless the trade ally's recommendations are completely determined by program influence. The program's influence on a trade ally's sales to customers is a function of the program's influence on the trade ally and the trade ally's influence on the customer.

The issue of assessing program indirect influence via the trade ally is complicated by the fact that it often is the case that there are at least two agents in the sales channel – an equipment vendor, such as a distributor or manufacturer representative, and an installation contractor. In such cases, the indirect program influence through that sales channel is the function of the program's influence on the vendor, the vendor's influence on the contractor, and the contractor's influence on the end-user.

A final issue is the assumption that the vendor or contractor always has some influence – or, at least, some *measurable* influence – in a sale. A vendor's stocking practices may be a more-or-less constant source of influence across sales. However, whether or not a vendor or contractor makes a specific equipment recommendation in a sale may be a variable source of influence. In cases in which the end-user specifies the equipment desired, there is no vendor or contractor influence from equipment recommendations.<sup>56</sup>

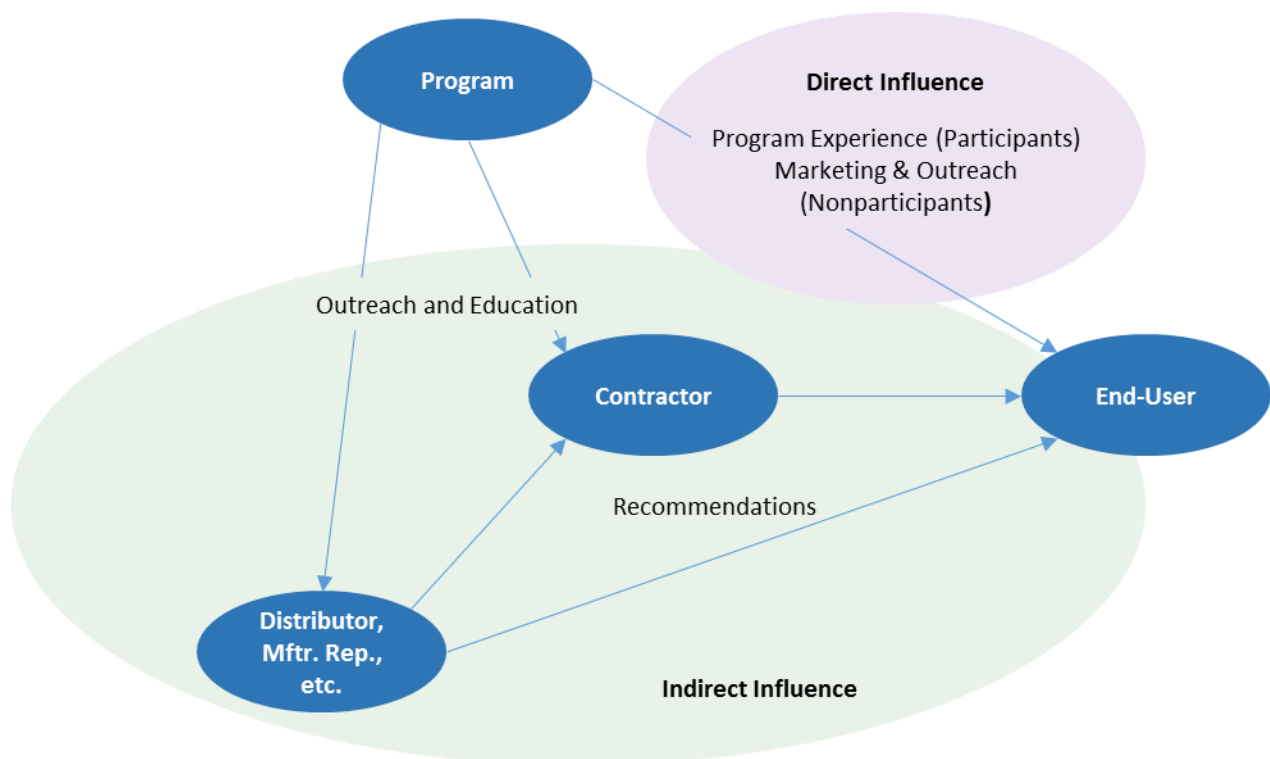
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<sup>56</sup> Of course, over time the vendor or contractor's stocking practices may influence the equipment request. This certainly must be considered in assessing long-term market effects.

The failure to take account of the various roles of distributors and installation contractors introduces another concern for trade ally surveys. Any such surveys that include both equipment vendors (who sell to end-users as well as to contractors) and from contractors (who buy from vendors to sell to end-users) creates the risk of double-counting equipment that installation contractors buy from vendors and sell to end-users.

## Multiple Spillover Scenarios

As the foregoing discussion shows, end-users may acquire equipment in a variety of ways. Equipment vendors sell to installation contractors but they may also sell directly to end-users, and each transaction may occur with or without an equipment recommendation. The various permutations of who sells to whom and whether or not a seller made an equipment recommendation represent differing possible pathways of program influence, as seen in Figure 1. Each arrow represents a *possible* but not *necessary* influence pathway. For example, a vendor may sell to a contractor who sells to an end-user, but without any equipment recommendations.



**Figure 1.** Pathways of program influence on end-users. Direct influence, via program experience and marketing and outreach. Indirect influence, via outreach and education to trade allies, and trade allies' recommendations to those below them in the sales channel and to end-users.

Through the above analysis, we can identify five scenarios through which equipment is sold to end-users: 1) a vendor sells directly to an end-user *without* an equipment recommendation; 2) a vendor sells directly to an end-user *with* an equipment recommendation; 3) a vendor sells to a contractor *without* a recommendation, but the contractor sells to an end-user *with* an equipment recommendation; 4) a vendor sells to a contractor *with* a recommendation, and the contractor sells to an end-user also *with* an equipment recommendation; and 5) a vendor sells to a contractor either *with* or *without* a recommendation but the contractor sells to an end-user *without* a recommendation. In

scenario 5, the presence or absence of a vendor recommendation is irrelevant to the influence on the end-user since the contractor makes no recommendation.

The significance of identifying the multiple scenarios in which sales may occur is that, while there is always the possibility for direct program influence, the various scenarios represent different possible pathways for program indirect influence. In scenarios 1 and 5, there is no indirect program influence.<sup>57</sup> In scenarios 2 and 4, the only indirect program influence is via the vendor or the contractor, respectively. However, in scenario 3, program influence may be transmitted via the contractor to the end-user or via the vendor to the contractor and on to the end-user (Table 1).

**Table 1.** Five Sales Scenarios and Four Influence Pathways

Sales Scenarios*	Influence Pathways			
	1: Direct Program Influence	Indirect Program Influence		
		2: via Vendor Only	3: via Contractor Only	4: via Vendor and Contractor
1. Vendor ⇒ end-user without recommendation	✓			
2. Vendor ⇒ end-user with recommendation	✓	✓		
3. Vendor ⇒ contractor without recommendation, contractor ⇒ end-user with recommendation	✓		✓	
4. Vendor ⇒ contractor with recommendation, contractor ⇒ end-user with recommendation	✓		✓	✓
5. Vendor ⇒ contractor with or without recommendation, contractor ⇒ end-user without recommendation	✓			

\* "⇒" = "sells to"

Since the program's indirect influence via any pathway is a function of the influence of each actor in that scenario upon the next actor, then the indirect influence may vary from pathway to pathway. As detailed below, we used data from surveys of vendors and contractors as well as program tracking data to estimate the total sales of un-incented high-efficiency equipment in each of the above scenarios. We used the survey data to estimate the program indirect influence via distributors and contractors and calculated the program indirect influence in each pathway. We used data from previous participant and nonparticipant surveys to estimate program direct influence on end-users.

<sup>57</sup> Other than via program influence on stocking practices. We have not considered that in the current analysis, but may attempt to incorporate it in the future.

### Description of Survey

We designed separate online survey instruments for vendors and installation contractors. Both surveys asked respondents to report the number of units they sold within the utility service territory of 39 types of program-eligible high-efficiency lighting, in the following 12 categories:

- LED linear tube
- LED exterior wall pack
- LED high bay
- LED screw-in
- LED screw-in reflectors
- LED refrigerated case
- LED exit signs
- T5 high bay 150-400 watt
- T5 or T8 tube
- Ceramic metal halide
- Induction exterior fixture
- CFL screw-in

The surveys then asked questions designed to allocate the total reported sales to the five scenarios identified above. The vendor survey asked what percentage of total sales of each measure type were to contractors and what percentage were to end-users. As explained below, to avoid double-counting of spillover from sales involving both vendors and contractors, we assessed spillover savings *only* from the portion of vendor-reported sales that were to end-users.

Both surveys asked about the percentages of sales in which the respondent made equipment recommendations – the vendor survey asked this separately about contractor and end-user sales, while the contractor survey asked this only about end-user sales.

Both surveys asked respondents to report the percentage of end-user sales for which the customers reported they would apply for the program incentives, which provides an estimate of the percentage of un-incented sales.

Finally, both surveys asked respondents to rate the program's influence on their recommendations, and the contractor survey asked respondents to rate the influence of vendor recommendations on their recommendations to end-user customers; all such ratings used a scale from 1 ("no influence") to 5 ("great influence"). Both surveys assessed the respondents' influence on their end-user customers by asking what percentage of their recommendations the customers accepted.

### Data Collection Methodology

The online survey approach amounted to an attempted census of lighting trade allies in the utility service territory who had done any the program projects during the 2013-2015 program cycle. We identified approximately 350 such firms in program tracking data. The tracking data included a "business type" field, allowing us to classify all members of the utility's trade ally network into vendors (those who primarily sold, but did not install, equipment) and installation contractors. We classified non-network firms based on information on the firms' websites, as confirmed in the survey. About one-third of the lighting firms were vendors and two-thirds were contractors.



We conducted the spillover surveys at the same general time as, but separately from, a process evaluation survey of trade allies conducted by telephone. We initially allocated trade allies with projects from the most recent program year to the survey frame for the process evaluation. The interviewer for the process survey asked each contact to agree to complete the online spillover survey. We sent an email invitation with a survey link to those who agreed to take the spillover survey. We also sent email invitations to complete the online survey to all lighting vendors and contractors not included in the process sample and those in the sample but not reached by the time the process survey was completed.

The email invitation to complete the online survey explained the purpose of the survey. The invitation provided contact information for key evaluation team and the utility staff. We sent up to three weekly follow-up emails to all recipients of the email survey invitation (including those process survey respondents who agreed to complete the online survey).

After three weeks in the field, we also placed calls to 40 large vendors and contractors who had not completed the survey to encourage survey completion.

The above efforts resulted in the completion of the online surveys by 33 vendors and 29 contractors. Together, those sixty-two respondents represented 50% of the lighting savings for the most recent program year.

### **Assigning Savings to Sold Measures**

We first developed a kWh savings value for each of the 39 lighting measure categories. The kWh savings algorithm is summarized below:

$$\text{kWh Savings} = \text{Watts}_{(\text{base})} - \text{Watts}_{(\text{efficient})} / 1000 \times \text{Annual Hours of Use}$$

The baseline wattage for each set was based on commercially available nominally efficient wattages. We used the Energy Independence and Security Act (EISA) of 2007 and 2009 Department of Energy regulations to determine nominally efficient baselines. We based the efficient wattage for each lighting category on either the wattage of the actual offered measure or the midpoint wattage when a range was provided. We based annual hours of use for all interior lighting was based on the program's TRM-weighted building hours, and based exterior hours on the region's annual non-daylight hours.

### **Estimation of Total and Un-Incented Savings**

For each survey respondent, we multiplied the number of units sold of each lighting type by the estimated per-unit savings to estimate the total energy savings from that respondent's sales of high-efficiency lighting. If a respondent reported selling a particular type of high-efficiency lighting but did not report the number of units sold, we assigned zero savings to that lighting type for that respondent.

We subtracted each respondent's incented savings from total savings to generate an estimate of un-incented savings. We had two sources for each respondent's estimate of incented savings. The first source was the estimated total savings, calculated as just described, multiplied by the estimated percentage of sales for which the customer applied for the program incentives. The second source was the program tracking data, specifically the program-incented lighting savings for projects the respondent's firm had done. To provide the most conservative spillover estimate we used the source that produced the *lower* estimate of un-incented savings for each respondent.

From the resulting estimate of un-incented savings for each survey respondent, we further subtracted any tracked spillover savings that were associated with program-incented projects (“inside spillover”) that respondent’s firm had done. This produced the final net un-incented sales value for each survey respondent.

### Allocation of Un-Incented Savings to the Five Scenarios

For each survey respondent, we allocated the savings from the net un-incented sales to the five scenarios. We allocated vendor sales to end-users to scenarios 1 and 2 and contractor sales to scenarios 3, 4, and 5 (Table 2). The distribution of the vendor sales between scenarios 1 and 2 and of the contractor sales among scenarios 3 to 5 depended on the percentage of sales that involved recommendations.

**Table 2.** Allocation of Savings from Un-Incented Sales to the Five Scenarios

Scenario		Calculation of Un-Incented Sales by Scenario			
Vendor sales to end-users	1	Total un-incented sales	X	Percentage of sales in which vendor recommended equipment	
	2	Total un-incented sales	X	Percentage of sales in which vendor did not recommend equipment	
Contractor sales	3	Total un-incented sales	X	Percentage in which vendor <i>did not</i> recommend equipment	X Percentage in which contractor recommended equipment
	4	Total un-incented sales	X	Percentage in which vendor recommended equipment	X Percentage in which contractor recommended equipment
	5	Total un-incented sales	X	Percentage of sales in which contractor <i>did not</i> recommend equipment**	

\*All contractor sales are to end-users.

\*\*In this scenario, it does not matter whether or not the vendor recommended equipment, since the contractor did not recommend equipment, and therefore any vendor recommendations did not get passed on to the end-user.

Again, none of the scenarios includes the vendors’ reported sales to contractors. That is because all vendor sales to contractors also represent contractor sales to end-users. Since this approach already counts the contractors’ reported sales to end-users, adding vendor sales to contractors would double-count those sales.

### Calculation of Program Indirect Influence on End-Users

We used the survey data to calculate mean program *indirect* influence through each of the three indirect influence pathways identified in Table 1, above. As Table 2 shows, program indirect influence in each pathway is a function of the influence of each actor in the pathway on the next actor in the pathway.

**Table 3.** Calculation of Program Indirect Influence for each Influence Pathway

Pathway	Program Indirect Influence Is a Function of...		
Vendor only	Program influence on vendor	&	Vendor influence on end-user
Contractor only	Program influence on contractor	&	Contractor influence on end-user
Vendor and contractor	Program influence on vendor	&	Vendor influence on contractor & Contractor influence on end-user

We determined that the appropriate function for combining the component influence factors is a multiplicative product of percentages, where in each case 0% is “no influence” and 100% is “complete influence.” This makes sense because the product of any combination of influences cannot be greater than any of the component influences, and any component influence factor that is less than 100% will attenuate the effect of any greater other factor.

One set of influence measures already was assessed as a percentage: we assessed vendors’ and contractors’ influence on end-users as the percentage of their equipment recommendations that end-users accepted. As described above, contractors rated vendor influence, and both contractors and vendors rated program influence, on a scale from 1 (“no influence”) to 5 (“great influence”). We converted those ratings into percentages as shown in Table 4.

**Table 4.** Conversion of Influence Rating to Percentages

Rating	Percentage
1	0%
2	25%
3	50%
4	75%
5	100%

### Calculation of Program Direct Influence on End-Users

The current approach does not try to distinguish between un-incented sales to program participants versus nonparticipants. The approach instead uses a weighted average of the assessed program influence on energy efficiency upgrades undertaken by participants and nonparticipants from previous participant and nonparticipant surveys.

Of 488 program participants who completed the participant survey during the most recent program year, 34 reported un-incented efficiency upgrades. Those 34 respondents reported the program’s influence on those upgrades on a scale from 1 (“unimportant”) to 5 (“very important”). As with the vendor and contractors’ influence ratings, we converted those scores to 0% to 100%.

In the most recent nonparticipant survey for the program (in the year prior to the most recent program year), 27 respondents reported on the influence of the utility’s energy efficiency marketing on the decision to undertake efficiency upgrades. Again, respondents rated influence on a 1-5 scale, which the evaluators converted to scores from 0% to 100%.

Not surprisingly, the participant survey yielded a higher mean program influence score (73.4%) than did the nonparticipant survey (14.8%). To provide the weights for the two scores, we estimated the participant and nonparticipant shares of the total sales of un-incented high-efficiency equipment, using data from the vendor and contractor survey and an independent estimate of the *participant* spillover

rate. The estimates used the following formulas, where  $x$  = total sales,  $y$  = participant sales,  $z$  = nonparticipant sales,  $q$  = un-incented sales,  $r$  = incented sales, and  $s$  = participant spillover rate.

$$(1): x = y + z$$

$$(2): x = q + r$$

$$(3): r = y - (y * s) = y * (1 - s)$$

Formulas (1) and (2) simply show that total sales are the sum of participant and nonparticipant sales, which are the sum of un-incented and incented sales. Formula (3) shows that the incented proportion of sales is equal to the total of participant sales minus the spillover (or un-incented) portion of participant sales.

We calculated the savings-weighted mean percentages of incented ( $r$ ) and un-incented sales ( $q$ ) from the vendor and contractor surveys, yielding values of  $r = .694$  and  $q = .306$ .

We separately estimated a participant spillover savings rate of .015 based on the savings from un-incented equipment installed as part of incented projects (i.e., the “inside” spillover), which the program implementer tracked in the program database. Although this value likely underestimates total participant spillover, it is consistent with spillover levels found in other evaluations of nonresidential programs.<sup>58</sup> To the extent that it underestimates participant spillover, it produces a more conservative combined end-user influence value.

Substituting the values of  $r$  and  $s$  into Formula (3), above, and solving for  $y$ :

$$.694 = y * (1 - .015) = y * .895$$

$$y = .694 / .895 = .705$$

Thus, participant sales represent 70.5%, and nonparticipant sales represent 29.5% of un-incented high-efficiency sales. We used those values with the participant and nonparticipant influence values to produce a weighted mean value for program direct influence on end-users:

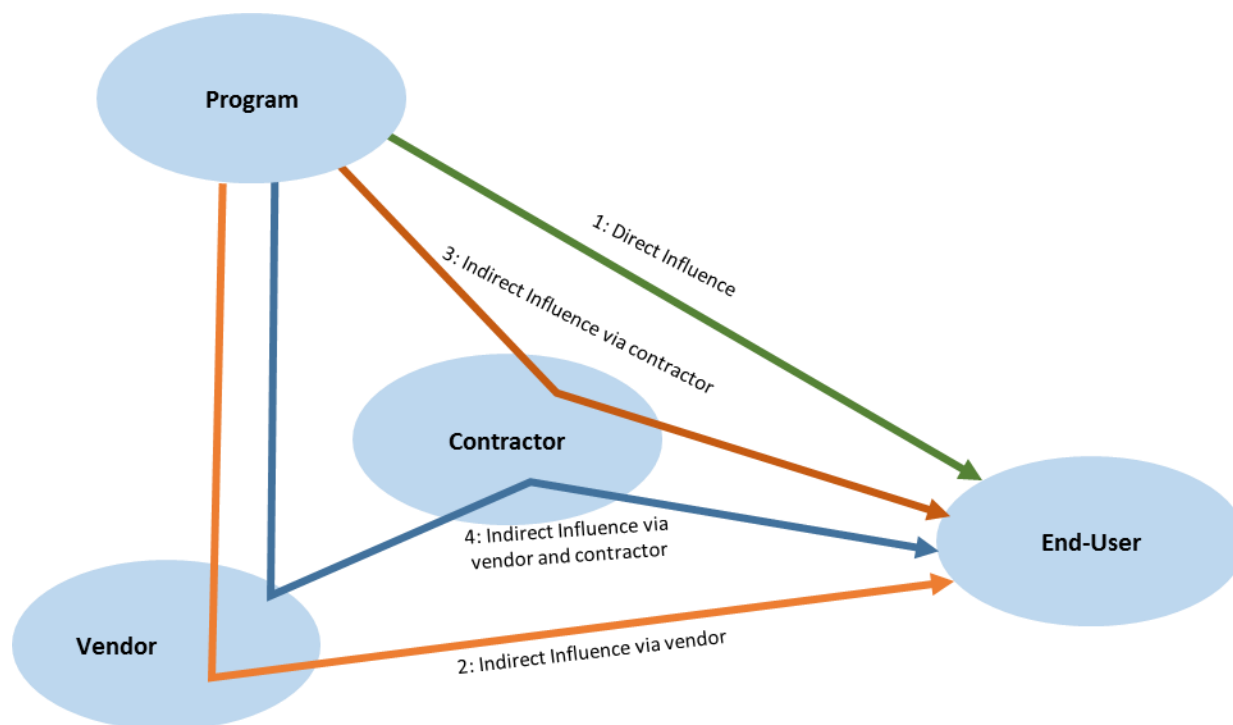
$$(.734 * .705) + (.148 * .295) = .561, \text{ or } 56\%$$

### Calculation of Maximum Program Influence in Each Scenario

The final stage in calculating the total spillover is to multiply the total savings from un-incented measures in each scenario by the influence value for that scenario. As Table 1 showed, however, scenarios 2, 3, and 4 each have multiple possible pathways of influence. Thus, when a vendor or contractor sells directly to an end-user with equipment recommendations (scenarios 2 and 3, respectively), there can be both program direct influence (which exists in each scenario) but also program indirect influence via the vendor’s or contractor’s recommendations. When a vendor sells to a contractor with recommendations and the contractor sells to an end-user with recommendations, the program may influence the end-user directly, indirectly through its influence on the contractor, or indirectly through its influence on the vendor and the vendor’s influence on the contractor. Figure 3 shows the four pathways identified in Table 1.

<sup>58</sup> For example, Tetra Tech (2011), *op. cit.*

To represent the program influence for each scenario with multiple influence pathways, we used whichever influence pathways had the greatest influence. For example, in the scenario where a vendor sells to a contractor with recommendations and the contractor sells to an end-user with recommendations (scenario 4), if pathway 3 has greater influence than pathway 1 or pathway 4, then pathway 3 defines the program influence in that scenario.<sup>59</sup>



**Figure 2.** Pathways of program influence on end-users (revisited).

## Results

Summing the spillover savings for the five scenarios produced a total spillover savings value for the surveyed vendors and contractors of 12,061,250 kWh. This represented more than 12% of the gross ex ante lighting savings for that program year. The vendor- and contractor- reported sales data were highly skewed, which, combined with relatively small samples, produced large relative errors around the mean savings values. Thus, any population estimates would have low precision. Even if we do not extrapolate to the population, the sample results themselves have some imprecision in that they relied on estimated mean influence levels. To account for this, we calculated the relative errors for the influence ratings and used them to calculate a 90% confidence interval around the spillover estimate.

Table 5 shows the results of applying our method. For each of the five scenarios, the table shows the total un-incented savings, the mean influence level for each relevant influence pathway and the maximum influence across those pathways (representing the influence within the scenario). It also

<sup>59</sup> The mean influence value across pathways would not be appropriate, as the various influence values in a scenario represent influence operating in separate pathways, and they do not combine in any way to determine the total or overall influence exerted in that scenario. As each is independent of the other, the one with the greatest impact is the one that represents the program influence.

shows the initial spillover estimate that results from multiplying the un-incented savings by the program influence as well as the “low” estimate that represents the lower bound of the 90% confidence interval.

Thus, we have 90% confidence that the sampled vendors and contractors represent at least 11,777,137 kWh of lighting-related spillover savings, assuming that they provided unbiased estimates of total sales and influence.

**Table 5.** Estimated Program Lighting Spillover – Reports by 33 Vendors and 29 Contractors

Scenario	Total Un-Incented Savings (kWh)	Mean Influence by Pathway*				Maximum Influence	Spillover	
		1	2	3	4		Initial Estimate	“Low” Estimate
1: Vendor recommends and sells to end-user	6,837,910	56%	85%			85%	5,790,329	5,409,412
2: Vendor sells to end-user without recommendation	772,213	56%				56%	434,012	410,906
3: Only contractor makes recommendations	1,815,142	56%		62%		62%	1,133,610	1,031,735
4: Vendor and contractor both make recommendation	6,775,447	56%		62%	60%	62%	4,230,275	3,851,196
5: Contractor does not make recommendation	841,848	56%				56%	473,024	447,960
Total	17,042,561						12,061,250	11,510,886

\*Pathways are those shown in Figure 2:

1. Direct program influence on end-user.
2. Indirect influence via vendor (program influence on vendor X vendor influence on end-user).
3. Indirect influence via contractor (program influence on vendor X vendor influence on end-user).
4. Indirect influence via both vendor and contractor (program influence on vendor X vendor influence on contractor X contractor influence on end-user).

## Conclusions

The approach described in this paper is not the only effort made to integrate information from multiple actors in the sales channel to estimate program-attributable savings. Prah et al. (2008) laid out guidelines for integrating data from market actors and end-users in estimating net-to-gross, and Meyer (2017) recently applied such an approach to estimating free-ridership in upstream HVAC programs. Moreover, market effects research frequently attempts to integrate information from varying types of actors to assess how programs affect the market.

What is perhaps new in the approach we have described is the effort to assess the differing amounts of program influence on equipment sales in various scenarios that represent the way the

market for efficient equipment works. We believe this could produce a more accurate estimate of program-influenced savings than one that relies on single average rating of program influence on sales of efficient equipment.

This research confirms that equipment vendors are important actors in the market for efficient equipment. Finally, the results demonstrate that efficiency programs may in some cases have greater *indirect* than *direct* influence on end-users, which underscores the value of maintaining strong trade ally networks to support that indirect influence.

As always, this research faces some threats to validity. First, it assumes reliability both of vendors' and contractors' reports of how often they make recommendations and of their reports of how often their recommendations are followed. In fact, we not only asked vendors how often they made recommendations to contractors, but we also asked contractors how often their vendors made recommendations to them. While the vendors, on average, reported they made equipment recommendations 68% of the time, the surveyed contractors reported, on average, that their vendors recommended equipment only 47% of the time. Similarly, we had competing sources of estimating vendor influence on contractors. One was vendors' reports of the percentage of the time that contractors accepted their recommendations – a mean of 72%. The other source, as described in the methods section above, was contractors' ratings of vendor influence – a mean of 3.5 on a 1-5 scale, which we translated as 62.5% influence. For this research, we used the contractors', not vendors', responses for estimating both frequency and level of vendor influence, both of which reduced the estimated amount of vendor-influence savings. But the greater point remains, of the need for a reliable measure.

A second potential threat is the calculation of an influence percentage from a 1-to-5 influence rating scale, such as in vendors' ratings of program influence on their equipment recommendations. For example, we translated an influence rating of 5, or "great influence," as meaning the program had 100% influence on the vendor's recommendations. The argument against this is that it implies that, without the program influence, the vendor definitely would have made different recommendations. This is a reasonable objection, which we will consider in future application of this method.

One final limitation of the approach described here is that it recognizes equipment recommendations as the only channel by which vendors and contractors deliver program influence. In particular, it does not account for vendor stocking practices or pricing as a source of influence. We will attempt to incorporate these variables into future iterations of this method.

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## Appendix G. Data Collection Instruments

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### G.1. Non-Residential Participant Survey

#### G.1.1. Introduction

Thank you for agreeing to participate! Your feedback is very valuable in helping [Utility Name] understand what its energy efficiency programs have accomplished and how it can better work with customers like you to save energy.

#### G.1.2. Screening [ASK ALL]

[IF REBATE >0]

S1\_A. Our records show your business received equipment rebates through Efficiency Works and [Utility Name] for the [Project Name] project completed on [Completion Date]. Is that correct?

[SINGLE RESPONSE]

1. Yes – My business received rebates for that project
2. No – My business did not receive rebates for that project
98. Don't know [SKIP TO END]

[IF S1\_A = 1 or 2]

S1\_B. Did your business receive a site assessment through Efficiency Works and [Utility Name] for the [Project Name] project completed on [Completion Date]?

1. Yes – my business received an energy assessment at that location
2. No – my business received an energy assessment at another location(s)
3. No – my business did not receive an energy assessment at any location
98. Don't know

[IF S1\_B = 2]

S1\_C. Please provide both the location where your business most recently had a site assessment through Efficiency Works and [Utility Name] and the date of the assessment.

[FORM RESPONSE]

1. Address: [OPEN ENDED RESPONSE]
2. Date: [OPEN ENDED RESPONSE]

[IF AUDIT >0 AND REBATE = 0]

S1\_D. Our records show your business received a site assessment through Efficiency Works and [Utility Name] at [Site Address] on [Completion Date]. Is that correct?

1. Yes – my business received an energy assessment

- 2. No – My business did not receive an energy assessment [SKIP TO END]
- 98. Don't know [SKIP TO END]

S2. We would like to hear from an employee who was involved in the [IF S1\_B = 1 or S1\_B = 2 (and or S1\_D = 1 “energy assessment”; if S1\_A = 1 “rebate application”; if S1\_A = 1 AND S1\_B = 1 or 2 “energy assessment or rebate application”) experience. Were you involved in the [IF S1\_B = 1 or S1\_B = 2 “energy assessment”; if S1\_A = 1 “rebate application”; if S1\_A = 1 AND S1\_B = 1 or 2 “energy assessment or rebate application”]?

[SINGLE RESPONSE]

- 1. Yes – I was involved in the [IF S1\_B = 1 or S1\_B = 2 “energy assessment”; if S1\_A = 1 “rebate application”; if S1\_A = 1 AND S1\_B = 1 or 2 “energy assessment or rebate application”]
- 2. No – I was not involved in the [IF S1\_B = 1 or S1\_B = 2 “energy assessment”; if S1\_A = 1 “rebate application”; if S1\_A = 1 AND S1\_B = 1 or 2 “energy assessment or rebate application”]
- 98. Don't know

[IF S2 = 2 or 98]

S3. Please provide the contact information for an employee who was involved in the [IF S1\_B = 1 or S1\_B = 2 “energy assessment”; if S1\_A = 1 “rebate application”; if S1\_A = 1 AND S1\_B = 1 or 2 “energy assessment or rebate application”]

[FORM RESPONSE]

- 1. Name: [OPEN-ENDED RESPONSE]
- 2. Role: [OPEN-ENDED RESPONSE]
- 3. Email: [OPEN-ENDED RESPONSE]

[IF S2 = 2 or 98 SKIP TO END]

S4. Which of the following best describes your role at your company?

[SINGLE RESPONSE]

- 1. Owner
- 2. Executive (VP, CFO, COO)
- 3. Engineer
- 4. Architect
- 5. Contractor
- 6. Technician
- 7. Building operator
- 8. Sales manager/business development
- 96. Other, please specify: [OPEN-ENDED RESPONSE]

### G.1.3. Efficiency Works-Business [ASK IF S1\_A = 1 OR S1\_B = 1 or 2 OR S1\_D = 1]

Q1. From what sources have you heard about business energy assessments or efficient equipment rebates offered through Efficiency Works and [Utility Name]? Select all that apply.

[MULTIPLE RESPONSE,]

1. [Utility Name] email, newsletter, or bill insert
2. [Utility Name] representative
3. [Utility Name] website
4. Social media (for example, Facebook, Twitter, LinkedIn)
5. Advertisement on a website
6. Contractor
7. Other businesses
8. A friend or family member
9. Online search
10. A coworker
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

Q2. What are the best ways to inform businesses like yours about business energy assessments or efficiency equipment rebates offered through Efficiency Works and [Utility Name]? Select all that apply.

[MULTIPLE RESPONSE,]

1. [Utility Name] email, newsletter, or bill insert
2. [Utility Name] representative
3. [Utility Name] website
4. Social media
5. Advertisement on a website
6. Contractor
7. Other businesses
8. A friend or family member
9. Online search
10. A coworker
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

### G.1.4. Efficiency Works-Business Assessment Barriers [S1\_B = 3 or 98 OR S1\_D = 2 or 98]

Q3. Were you aware that Efficiency Works and [Utility Name] offer energy assessments to help businesses identify opportunities to save energy?

[SINGLE RESPONSE]

1. Yes
2. No

98. Don't know

[IF Q3=1]

Q4. Why did your business decide not to conduct a business energy assessment from Efficiency Works or [**Utility Name**]? Select all that apply.

[MULTIPLE RESPONSE]

[RANDOMIZE 1 - 5]

1. My business is unable to devote the time and effort required
2. Efficiency is not a priority for my business
3. My business is not convinced the information gained will be worth the time and effort required
4. My business is already as energy efficient as it can be
5. My business is already aware of the actions we could take to save energy
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

#### G.1.5. Efficiency Works-Business Assessment [S1\_B = 1 or 2 OR S1\_D = 1]

Now we have some questions about the Business Assessment that was conducted at [Site Address] (or [Provided Address]) on [Audit Date] (or [Provided Date])

Q5. Why was your business interested in having a business energy assessment performed? Select all that apply.

[MULTIPLE RESPONSE, RANDOMIZE 1 – 7]

1. Reduce energy bills
2. Reduce energy waste
3. Learn about my business' energy usage
4. Do your part to help the environment
5. Do your part to help your community
6. Increase comfort of my space
7. Improve the appearance of my space
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

Q6. To what extent do you agree with each of the following statements about your energy assessment experience:

[MATRIX QUESTION: SCALE]

[RANDOMIZE] Item	1 – Do not at all agree	2	3	4	5 – Completely agree	98 DK
Scheduling the assessment was easy						
The time required to complete the assessment was reasonable						
The people who conducted the assessment were responsive to my needs and concerns						
The roles of all the people who attended the assessment were clear						
The findings from the assessment were presented in an understandable way						
I learned something new about how to make my business more energy efficient						
The next steps to make the recommended improvements to my business were clear						

### G.1.6. Efficiency Works-Business Assessment Barriers [S1\_B = 1 or 2 OR S1\_D = 1]

[S1\_B = 1 OR 2 OR S1\_D = 1]

Q7. Did you move forward with all, some, or none of the recommended measures from your energy assessment?

[SINGLE RESPONSE]

- 1. All
- 2. Some
- 3. None
- 98. Don't know

[IF Q7 = 2 OR 3]

Q8. What types of recommended measures did you **not** move forward with? Select all that apply.

[MULTIPLE RESPONSE]

- 1. Lighting
- 2. Cooling equipment
- 3. Insulation or windows
- 4. Food service equipment
- 5. Grocery display cases or refrigerated warehouses

- 6. Office equipment and appliances
- 7. Variable frequency drives (VFDs)
- 8. Water-saving measures
- 9. Business Tune-up (BTU) Retro-commissioning
- 96. Other, please specify: [OPEN-ENDED RESPONSE]
- 98. Don't know

[IF Q8 =1]

Q9. Why did you not move forward with all of the recommended **lighting** measures from your audit? (Select all that apply).

[MULTIPLE RESPONSE]

- 1. Recently upgraded lighting
- 2. Too expensive
- 3. Not enough time
- 4. Not enough return on investment
- 96. Other, please specify: [OPEN-ENDED RESPONSE]
- 98. Don't know

[IF Q8 =2 - 96]

Q10. Why did you not move forward with all of the recommended **non-lighting** measures from your audit? (Select all that apply)

[MULTIPLE RESPONSE]

- 1. Recently upgraded recommended measures
- 2. Too expensive
- 3. Not enough time
- 4. Not enough return on investment
- 96. Other, please specify: [OPEN-ENDED RESPONSE]
- 98. Don't know

[IF Q7>1]

Q11. What could Efficiency Works, [Utility Name], your assessor or your contractor have done differently that would have helped you move forward with more of the recommended measures from your audit?

[OPEN ENDED RESPONSE]

[IF S1\_B = 1 OR 2 OR S1\_D]

Q12. In your opinion, why don't more businesses like yours take advantage of business energy assessments from Efficiency Works or [Utility Name]? Select all that apply.

[MULTIPLE RESPONSE]

[RANDOMIZE 1 - 5]

1. They are unable to devote the time and effort required
2. They are not aware of them
3. Efficiency is not a priority for their business
4. They are not convinced the information they gain will be worth the time and effort required
5. They believe their businesses are already as energy efficient as they can be
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

[IF S1\_B = 1 OR 2 OR S1\_D]

Q13. Would you recommend using business energy assessments from Efficiency Works and [Utility Name] to other businesses like yours?

[SINGLE RESPONSE]

1. Yes
2. Maybe
3. No
98. Don't know

[IF Q13>1]

Q14. Why would you not recommend using Efficiency Works business energy assessments to other businesses like yours?

[OPEN ENDED RESPONSE]

[IF S1\_B = 1 OR 2 OR S1\_D]

Q15. Did the assessor mention Efficiency Works Business Tune-Up retro-commissioning program during your assessment?

[SINGLE RESPONSE]

1. Yes
2. No
98. Don't know

### G.1.7. Efficiency Works-Business Rebates [ASK IF S1\_A = 1]

Next, we have some questions about the rebate application and installation processes for the [Project Name] project that was completed on [Completion Date].

Q16. Which of the following circumstances was the primary reason that prompted you to conduct your project?

[SINGLE RESPONSE]

1. Replacing failed equipment
2. Part of a larger renovation or update to space
3. Wanted to save energy and reduce bills
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

Q17. Why was your business interested in having an energy efficiency equipment installed? Select all that apply.

[MULTIPLE RESPONSE]

[RANDOMIZE 1 – 7]

1. Payback on investment
2. Availability of utility rebates
3. Age/condition of existing equipment
4. My business's policies/standards require energy efficient equipment
5. Previous experience with the utility program
6. Previous experience with a similar efficient measure
7. Recommendation from a vendor/supplier
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

Q18. Did you complete the rebate application or did your contractor complete it?

[SINGLE RESPONSE]

1. I completed the rebate application on my own
2. My contractor completed the rebate application
3. My contractor and I completed the rebate application together
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know



[IF Q18 = 1 or 3]

Q19. To what extent do you agree with each of the following statements about your rebate application experience:

[MATRIX QUESTION: SCALE]

[RANDOMIZE] Item	1 – Do not at all agree	2	3	4	5 – Completely agree	98 DK
Completing the application was easy						
The time required to complete the application was reasonable						
The information required for the rebate application was reasonable						

Q20. How did you find the contractor that installed the energy efficiency improvements?

[SINGLE RESPONSE]

1. Efficiency Works website
2. Efficiency Works assessment
3. Had worked with the contractor previously
4. Referral
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

[IF Q20 = 1, or 2]

Q21. To what extent do you agree that the process of finding a contractor was easy?

1. 1 – Do not at all agree
2. 2
3. 3
4. 4
5. 5 – Strongly agree

[IF Q21 <4]

Q22. What about the process of finding a contractor was difficult

[OPEN ENDED RESPONSE]

Q23. Certain types of projects, and all projects over a certain size, require pre-approval from Efficiency Works and [Utility Name], meaning they have to have an application form approved before installing their energy efficiency improvements. Did your project require pre-approval?

1. Yes
2. No
98. Don't know

[IF Q23= 1]

Q24. To what extent, if any, did the pre-approval process result in any delays in your project?

1. No delays
2. A week or less
3. A few weeks
4. A few months
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

Q25. How satisfied are you with each of the following aspects of your experience installing energy efficiency improvements and receiving a rebate?

[MATRIX QUESTION: SCALE]

[RANDOMIZE] Item	1 – Not at all satisfied	2	3	4	5 – Extremely Satisfied	98 DK
The contractor's responsiveness to your needs and concerns						
The contractor's professionalism						
The quality of the contractor's work						
The time required to receive your rebate						
The rebate amount						
The job the contractor did in managing the project						
The job the contractor did in providing labor for the project						
The job the contractor did in providing materials for the project						

Q26. We would also like to know about your experience after the energy upgrades were installed. To what extent do you agree that, after installing the upgrades:

[MATRIX QUESTION: SCALE]

[RANDOMIZE] Item	1 – Do not at all agree	2	3	4	5 – Strongly agree	98 DK
Your business space is more comfortable						
Your monthly energy bills are lower						
Your monthly maintenance costs are lower						
Your business space is more attractive						

Q27. In your opinion, why don't more businesses like yours take advantage of Efficiency Works energy efficiency rebates? Select all that apply.

[MULTIPLE RESPONSE]

[RANDOMIZE 1 - 5]

1. They cannot afford to make energy efficiency improvements
2. They do not have the time or staff capacity to manage an energy efficiency improvement project
3. They are not aware of them
4. Efficiency is not a priority for their business
5. They believe their businesses are already as energy efficient as they need to be
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

Q28. Would you recommend efficiency rebates from Efficiency Works and [Utility Name] for upgrading equipment to other businesses like yours?

1. Yes
2. Maybe
3. No
98. Don't know

[IF Q28= 3 OR 98]

Q29. Why would you not recommend using efficiency rebates from Efficiency Works and [Utility Name] for upgrading equipment to other businesses like yours?

[OPEN ENDED RESPONSE]

Q30. What additional efficiency measures that are not offered through Efficiency Works would be helpful for your business to increase energy efficiency?

[OPEN ENDED RESPONSE]

### G.1.8. Efficiency Works-Business Rebates Free-ridership/spillover [S1\_A = 1]

[S1\_A = 1]

Q31. If you had not received a rebate(s) from Efficiency Works and [Utility Name] for the measures you installed for the [Project Name] project, which of the following would you most likely have done?

1. Not installed any measures
2. Installed some measures, but not others
3. Delayed installing measures
4. Installed less efficient measures
5. Installed the same measures, but paid the full cost yourself
96. Other, please specify: [OPEN-ENDED RESPONSE]

[IF Q31 = 5]

Q32. If your business had not received the incentive from your utility, would you say it definitely would have, might have, or definitely would not have had the funds, internal or other, to cover the entire cost of the [Project Name] project?

1. Definitely would have
2. Maybe
3. Definitely would NOT have
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

[IF S1\_A = 1]

Q33. How influential were each of the following elements of the Efficiency Works and [Utility Name] program in your decision to install the energy efficient equipment you installed for the [Project Name] project?

[MATRIX QUESTION: SCALE]

[LOGIC] Item	1 – Not at all influential	2	3	4	5 – Very influential	Not applicable	Don't Know
The rebate you received							
Any other technical assistance you received from Efficiency Works and [Utility Name]							
Your contractor's recommendation							

[ASK ALL]

Q34. Because of your experience with the Efficiency Works and [Utility Name] program, have you bought and installed energy efficient equipment at your business without applying for a rebate or bill credit from [Utility Name]?

[SINGLE RESPONSE]

1. Yes, installed energy efficient equipment because of my experience and did not apply for a rebate
2. No, installed energy efficient equipment, and applied for a rebate from Efficiency Works and [Utility Name]. [SKIP TO END OF SECTION]
3. No, did not purchase energy efficient equipment [SKIP TO END OF SECTION]
98. Don't know [SKIP TO END OF SECTION]

[IF Q34= 1]

Q35. What type of energy efficient equipment have you installed in your business without receiving a rebate from Efficiency Works and [Utility Name]?

[MULTIPLE RESPONSE]

1. Lighting
2. Cooling equipment
3. Insulation or windows
4. Food service equipment
5. Grocery display cases or refrigerated warehouses
6. Office equipment and/or appliances
7. Variable frequency drives (VFDs)
8. Water-saving measures
9. Business Tune-up (BTU) Retro-commissioning
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

[IF Q35 = 1]

Q36. What type of efficient lighting and how many did you install in your business without receiving a rebate from the Efficiency Works and [Utility Name] program? Select all that apply.

[MULTIPLE RESPONSE]

Measure	Count
1. Automatic controls	
2. LED new hardwired fixtures	
3. LED retrofit kits	
4. Fixtures retrofitted to LED	
5. LED replacement lamps	
6. T8 or T5 Upgrades	
96. Other, please specify: [Open-ended response]	
98. Don't know	

[IF Q35 = 2]

Q37. What type of efficient cooling equipment and how many did you install in your business without receiving a rebate from the Efficiency Works and [Utility Name] program? Select all that apply.

[MULTIPLE RESPONSE]

Measure	Count
1. Split/Unitary cooling units (includes mini-split heat pumps or air conditioners)	
2. Packaged Terminal Air Conditioning (PTAC) units	
3. Evaporative condensing units	
4. Advanced evaporative cooling units	
5. Air economizers	
6. PTAC/PTHP Controls	
7. Advanced RTU Controllers	
8. Premium ventilation package units (New units that select the integrated economizer (i.e. differential control) and demand control ventilation options for new equipment.)	
96. Other, please specify: [Open-ended response]	
98. Don't know	

[IF Q35 = 3]

Q38. What type of efficient insulation or windows and how many did you install in your business without receiving a rebate from the Efficiency Works and [Utility Name] program? Select all that apply.

[MULTIPLE RESPONSE]

Measure	Count
1. Efficient windows (Tier 1) U-value $\leq 0.30$ for all building orientations & SHGC $\leq 0.25^*$ for south, east, & west glazing (performance rating for entire window and frame**)	
2. Efficient windows (Tier 2) U-value $\leq 0.18$ for all building orientations & SHGC $\leq 0.22^*$ for south, east, & west glazing (performance rating for entire window and frame**)	
3. Window films	
4. Roof insulation	
5. Wall insulation	
6. Cool roof	
96. Other, please specify: [Open-ended response]	
98. Don't know	

[IF Q35 = 4]

Q39. What type of efficient food service equipment and how many did you install in your business without receiving a rebate from the Efficiency Works and [Utility Name] program? Select all that apply.

[MULTIPLE RESPONSE]

Measure	Count
1. High efficiency ice machine - (CEE Tier 2)	
2. High efficiency ice machine - (ENERGY STAR)	
3. Insulated Hot Food Holding Cabinets (min 7 cu ft)	
4. Reach-in refrigerators and Freezers (<19 cu ft)	
5. Reach-in refrigerators and Freezers (19 -30 cu ft)	
6. Reach-in refrigerators and Freezers (31 -60 cu ft)	
7. Reach-in refrigerators and Freezers (61 -90 cu ft)	
8. Electric steamers	
9. Electric fryers	
10. Electric griddles	
11. Combination ovens – electric	
12. Convection ovens – electric	
13. Vent hood controls w/ VFC fans and sensors	
96. Other, please specify: [Open-ended response]	
98. Don't know	

[IF Q35 = 5]

Q40. What type of efficient grocery display cases or refrigerated warehouses and how many did you tune-up or upgrade in your business without receiving a rebate from the Efficiency Works and [Utility Name] program? Select all that apply.

[MULTIPLE RESPONSE]

Measure	Count
1. Auto closer for walk-in freezer door	
2. Auto closer for walk-in cooler door	
3. Auto closer for reach-in freezer door	
4. Auto closer for reach-in cooler door	
5. Gaskets for walk-in freezer door	
6. Gaskets for walk-in cooler door	

## Energy Efficiency Programs Evaluation

Measure	Count
7. Gaskets for reach-in freezer door	
8. Gaskets for reach-in cooler door	
9. Strip curtain on walk-in cooler door	
10. Strip curtain on walk-in freezer door	
11. Zero energy glass doors w/ no ASH	
12. LED case lighting replacing T8/elec	
13. LED case lighting replacing T-10/12/mag	
14. Occupancy sensor controlling LED or T8 lamp case lighting	
15. EC motors in reach-in and display cases	
16. EC motor in walk-in cooler/freezer	
17. EC motor compressor head cooling fans	
18. Night covers	
19. Smart defrost control walk-in freezer	
20. Evap fan controls walk-ins	
21. Outside air economizers for walk-ins	
96. Other, please specify: [Open-ended response]	
98. Don't know	

[IF Q35 = 6]

Q41. What type of efficient office equipment and/or appliances and how many did you install in your business without receiving a rebate from the Efficiency Works and [Utility Name] program?  
Select all that apply.

[MULTIPLE RESPONSE]

Measure	Count
1. Desktop/side computer	
2. Thin client	
3. Server virtualization (replacing existing server)	
4. ENERGY STAR LED desk lamp (replacing incandescent)	
5. ENERGY STAR LED undercabinet fixture (replacing fluorescent)	
6. ENERGY STAR torchiere (replacing incandescent/halogen floor lamp)	
7. Smart strip energy efficient surge protector	
8. Plug strip w/ motion sensor or occupancy schedule	
9. Vending machine with occupancy or schedule controls	



## Energy Efficiency Programs Evaluation

Measure	Count
96. Other, please specify: [Open-ended response]	
98. Don't know	

[IF Q35 = 7]

Q42. What was the horse power of the Motor VFD(s) you installed and how many did you install in your business without receiving a rebate from the Efficiency Works and [Utility Name] program? Select all that apply.

[MULTIPLE RESPONSE]

Horsepower	Count
1. 1 – 5	
2. 7.5 - 10	
3. 15 - 20	
4. 25 - 30	
5. 40 - 50	
6. 60 - 75	
96. Other, please specify: [Open-ended response]	
98. Don't know	

[IF Q35 = 8]

Q43. What type of water-saving measures and how many did you install in your business without receiving a rebate from the Efficiency Works and [Utility Name] program? Select all that apply.

[MULTIPLE RESPONSE]

Measure	Count
1. Ice machine	
2. Electric steamers	
3. Residential clothes washer	
4. Commercial clothes washer vended	
5. Commercial clothes washer non-vended	
6. Residential dishwasher	
7. Commercial dishwasher	
8. Tank toilets (less than 1.28 GPF)	
9. Premium tank toilets (1.0 GPF or less)	
10. Flush valve toilets (less than 1.28 GPF)	

Measure	Count
11. Urinals (less than .5 GPF)	
12. Ultra-low flow aerators (.5 GPM or less)	
13. Low flow aerators (1.0 GPM or less)	
14. Low flow pre-rinse spray valves	
15. Low flow shower heads	
16. Irrigation rain sensor	
17. Soil moisture sensor	
18. Irrigation controller or add-on weather station	
19. High efficiency nozzles	
20. Pressure reducing heads	
21. Pressure regulators (PRV or zone valve)	
22. Commercial sprinkle audit	
96. Other, please specify: [Open-ended response]	
98. Don't know	

[IF Q35 = 9]

Q44. What type of retro-commissioning measures did you conduct in your business without receiving a rebate from the Efficiency Works and [Utility Name] program?

[OPEN-ENDED RESPONSE]

[IF Q35 = 96]

Q45. What type of energy efficient [PIPE RESPONSE FROM Q35\_96] did you install in your business without receiving a rebate from the Efficiency Works and [Utility Name] program and how many?

[OPEN-ENDED RESPONSE]

[IF Q34 = 1]

Q46. How important was your experience with Efficiency Works and [Utility Name] on your decision to buy and install the additional energy efficiency items?

[SINGLE RESPONSE]

1. Not at all important
2. Not very important
3. Somewhat important
4. Very important
5. Extremely important
98. Don't know

[IF Q34 = 1]

Q47. Why didn't you receive a rebate for installing these energy efficient measures?

[MULTIPLE RESPONSE]

1. Rebates are not available for the type of improvement or equipment installed
2. Rebates are available for that type of improvement or equipment, but the specific variety you installed did not qualify
3. You do not know whether rebates were available for the improvement or equipment you installed
4. You did not want to go through the process of applying for the rebate
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

### G.1.9. Firmographics [ASK ALL]

Finally, we have some general questions about your business.

Q48. Including yourself, how many employees work at the [Site Address] location?

[SINGLE RESPONSE]

1. 1
2. 2-4
3. 5-9
4. 10-19
5. 20-99
6. 100-499
7. 500 or more
98. Don't know
99. Prefer not to answer

Q49. How many locations does your organization have?

[SINGLE RESPONSE]

1. 1
2. 2-4
3. 5-9
4. 10-19
5. 20-99
6. 100-499
7. 500 or more
98. Don't know
99. Prefer not to answer

Q50. What is the principal industry of your organization?

[SINGLE RESPONSE]

1. Agriculture, Forestry, Fishing and Hunting
2. Mining, Quarrying, and Oil and Gas Extraction
3. Utilities
4. Construction
5. Manufacturing
6. Wholesale Trade
7. Retail Trade
8. Transportation and Warehousing
9. Information
10. Finance and Insurance
11. Real Estate and Rental and Leasing
12. Professional, Scientific, and Technical Services
13. Management of Companies and Enterprises
14. Administrative and Support and Waste Management and Remediation Services
15. Educational Services
16. Health Care and Social Assistance
17. Arts, Entertainment, and Recreation
18. Accommodation and Food Services
19. Other Services (except Public Administration)
20. Public Administration
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know
99. Prefer not to answer

## G.2. Residential Participant Survey

### G.2.1. Introduction

Thank you for agreeing to take our survey. It should take you about 10 minutes. Please click the double arrow button below to start the survey.

### G.2.2. Screening

S1. Who in your household is most often responsible for the following types of actions? Please select one answer for each action.

[MATRIX QUESTION]

[SHOW ALL]	1. I am solely responsible	2. I share responsibility	3. Someone else is responsible
1. Paying utility bills			
2. Purchasing energy-using products like appliances or light bulbs			
3. Making decisions about home upgrades or renovations			

[IF S1\_1 = 3 and UTILITY NAME = FC; OR S1\_2 = 3 and (RECYCLING OR APP.REBATE =1); OR S1\_3 = 3 AND EW-H = 1]

S2. Please provide the contact information for the person in your household who is responsible for the following action(s).

[MATRIX QUESTION]

[ONLY DISPLAY ITEMS WHERE 3 WAS SELECTED IN S1]	1. Name	2. Email	3. Phone
1. [IF UTILITY NAME = FORT COLLINS UTILITIES] Paying utility bills			
2. [IF RECYCLING or APP REBATE = 1] Purchasing energy-using products like appliances or light bulbs			
3. [IF EW-H =1] Making decisions about home upgrades or renovations			

[IF S1\_1 AND S1\_2 AND S1\_3 = 3 SKIP TO END]

### G.2.3. Efficiency Works Home [ASK IF RECORDS INDICATE RESPONDENT PARTICIPATED IN EW-H]

[IF EW-H = 1 AND S1\_1 = 1 OR 2]

Q1. Our records show your household received a home efficiency audit through Efficiency Works and [Utility Name]. Is that correct?

[SINGLE RESPONSE]

- 1. Yes – My household received an efficiency audit
- 2. No – My household did not receive an efficiency audit
- 98. Don't know

[IF Q1=2 OR Q1=98]

Q2. In the past year, has someone visited your home to identify opportunities to make it more energy efficient? If so, we'll refer to that as your "home efficiency audit."

[SINGLE RESPONSE]

- 1. Yes – My household received an efficiency audit
- 2. No – My household did not receive an efficiency audit [SKIP TO END OF SECTION]
- 98. Don't know [SKIP TO END OF SECTION]

[IF Q1=1 OR Q2=1]

Q3. We would like to hear from a household member who was directly involved in the efficiency audit. Were you involved in the audit?

[SINGLE RESPONSE]

- 1. Yes – I was involved in the efficiency audit
- 2. No – I was not involved in the efficiency audit [SKIP TO END OF SECTION]
- 98. Don't know [SKIP TO END OF SECTION]

[IF Q3=1]

Q4. We'd like to know why were you interested in having an efficiency audit performed on your home. Were you interested in learning about ways to...

Select all that apply.

[MULTIPLE RESPONSE – RANDOMIZE OPTIONS 1-5]

- 1. Reduce my energy bills
- 2. Help the environment or my community
- 3. Make my home more comfortable
- 4. Prepare my home for sale
- 5. Improve my newly-purchased home
- 96. Other, please specify: [OPEN-ENDED RESPONSE]
- 98. Don't know

[IF Q3=1]

Q5. To what extent do you agree with each of the following statements?

[MATRIX QUESTION: SCALE]

[RANDOMIZE Items]	1 – Do not at all agree	2	3	4	5 – Completely agree	98 DK
1. Scheduling the audit was easy						
2. The time required to complete the audit was reasonable						
3. The person who conducted the audit was responsive to my needs and concerns						
4. The findings from the audit were easy to understand						
5. I learned something new about how to make my home more efficient						
6. I understood the next steps needed to make the recommended improvements						

[IF Q3=1 AND ONLY ITEMS PROGRAM DATA INDICATES RESPONDENT RECEIVED]

Q6. For each of the following, please indicate whether the person who conducted your home efficiency audit installed the item and whether it is still in place:

[MATRIX QUESTION]

[DISPLAY ONLY ITEMS PROGRAM DATA INDICATES RESPONDENT RECEIVED] Item	1. The assessor installed the item and it is still in place	2. The assessor installed the item, but it has been removed	3. The assessor did not install the item	98 DK
1. New aerators on your faucets				
2. Standard LED lightbulbs				
3. LED lightbulbs for recessed fixtures				
4. New showerhead(s)				
5. A water displacement bag in your toilet tank				

[IF ANY ITEM IN Q6=2]

Q7. Why did your household remove the item(s) your assessor installed?

[MATRIX QUESTION]

[DISPLAY ONLY ITEMS FOR WHICH Q6=2] Item	[OPEN-ENDED RESPONSE]
New aerators on your faucets	
Standard LED lightbulbs	
LED lightbulbs for recessed fixtures	
New showerhead(s)	
A water displacement bag in your toilet tank	

[IF Q3=1]

Q8. How did the assessor describe the energy efficiency opportunities they identified in your home?

[SINGLE RESPONSE]

1. They grouped them into “good,” “better,” and “best” packages
2. They presented a menu of individual options
96. Other (please specify): [OPEN-ENDED RESPONSE]
98. Don't know

[IF Q3=1]

Q9. Which of the following statements best describes how you felt about the options the assessor presented?

[SINGLE RESPONSE]

1. There were too many options. It was difficult to identify the best path to take.
2. There were too few options. I couldn't find one to meet my needs.
3. The number of options was about right. I found one that met my needs.
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

[IF Q3=1]

Q10. When you received your audit recommendations, how much effort did you anticipate the recommended improvements would require of you? (Effort in terms of choosing exactly what to do, selecting a contractor, scheduling the work, etc.)

[SINGLE RESPONSE]

1. A great deal of effort
2. A moderate amount of effort
3. Some effort
4. Not much effort



- 5. Very little effort
- 98. Don't know

[IF Q3=1]

Q11. Do you recall communicating with an efficiency adviser? The adviser may have helped you schedule your audit, reviewed your audit with you, helped you find a contractor, or provided other advice by phone or email.

- 1. Yes
- 2. No
- 98. Don't know

[IF Q11=1]

Q12. Did you ask any questions of, or seek any advice from, the efficiency adviser?

- 1. Yes
- 2. No
- 98. Don't know

[IF Q12=1]

Q13. How helpful did you find the efficiency adviser's assistance and advice?

[SINGLE RESPONSE]

- 1. Not at all helpful
- 2. Not very helpful
- 3. Somewhat helpful
- 4. Very helpful
- 5. Extremely helpful
- 98. Don't know

[SINGLE RESPONSE]

[IF Q11=1]

Q14. Neither the assessor nor the efficiency adviser receive any direct financial benefit if you decide to install energy efficiency upgrades. How important was it that you could turn to someone other than a contractor for advice when making decisions about energy upgrades?

[SINGLE RESPONSE]

- 1. Not at all important
- 2. Not very important
- 3. Somewhat important
- 4. Very important
- 5. Extremely important
- 98. Don't know

[IF RECORDS INDICATE ANY INCENTIVIZED MEASURE WAS INSTALLED]

Q15. Our records indicate that your household received a rebate from **[Utility Name]** for making the energy efficiency improvements listed below. Is that correct?

[MATRIX QUESTION]

[DISPLAY ONLY ITEMS PROGRAM DATA INDICATES RESPONDENT INSTALLED] Item	1. Yes, made improvement and received rebate	2. Made improvement, but did not receive rebate	3. No, did not make improvement	98 DK
1. Sealing my home against air leakage				
2. Adding insulation				
3. Sealing and insulating your ducts				
4. Replacing my windows				
5. Replacing the blower motor on my air handler				
6. Installing mechanical ventilation				
7. Installing a heat pump				
8. Installing a gas furnace				
9. Installing a gas boiler				
10. Installing a water heater				
11. Installing central air conditioning				
12. Installing a whole-house fan				
13. Installing an evaporative cooler				

[IF Q15\_11=1 OR Q15\_11=2]

Q16. Did the central air conditioning system you installed replace an existing system, or was this the first air conditioning system installed in your home?

[SINGLE RESPONSE]

- 1. The new system replaced an existing one
- 2. This was the first central air conditioning system installed in our home
- 98. Don't know

[IF Q16=1]

Q17. Which of the following best describes the condition of your old central air conditioning system?

[SINGLE RESPONSE]

- 1. It was fully operational
- 2. It was operational, but required minor repairs

- 3. It was operational, but required major repairs
- 4. It was not operational
- 98. Don't know

[IF Q17=3]

Q18. About how much would those repairs have cost?

[SINGLE RESPONSE]

- 1. \_\_\_\_\_ [FORCE NUMERIC RESPONSE]
- 98. Don't know

[IF Q17=1]

Q19. About how old was the central air conditioning system you replaced?

[SINGLE RESPONSE]

- 1. \_\_\_\_\_ years [FORCE NUMERIC RESPONSE]

[Do not read:]

- 98. Don't know

[IF ANY ITEM IN Q15=1 OR 2 OR 98]

Q20. Did your home efficiency audit recommend any energy efficiency improvements that you have not made?

[SINGLE RESPONSE]

- 1. Yes, and we plan to make additional improvements in the next six months
- 2. Yes, and we do not plan to make additional improvements in the next six months
- 3. No, we made all the recommended improvements
- 98. Don't know

[IF RECORDS DO NOT INDICATE AN INCENTIVIZED MEASURE WAS INSTALLED, ALL ITEMS DISPLAYED IN Q15=3, OR Q20=2]

Q21. Please tell us why you decided not to make some or all of the recommended energy efficiency improvements. Please select all that apply:

[MULTIPLE RESPONSE – RANDOMIZE OPTIONS 1-7]

- 1. I did not need them
- 2. I could not afford them
- 3. My loan application was denied
- 4. I did not want to use a program-approved contractor
- 5. I was not convinced the benefits would justify the costs
- 6. I felt the work would have been too inconvenient
- 7. I did not know how to proceed with work
- 96. Other, please specify: [OPEN-ENDED RESPONSE]
- 98. Don't know

[IF ANY ITEM IN Q15=1 OR ANY ITEM IN Q15=2]

Q22. How satisfied are you with each of the following aspects of your experience working with the contractor who installed your energy efficiency improvements and receiving a rebate?

[MATRIX QUESTION: SCALE]

[LOGIC] Item	1 – Not at all satisfied	2	3	4	5 – Extremely Satisfied	98 DK
1. The contractor's responsiveness to your needs and concerns						
2. The contractor's professionalism						
3. The quality of the contractor's work						
4. The time it took to receive your rebate						

[IF ANY ITEM IN Q15=1 OR ANY ITEM IN Q15=2]

Q23. We would also like to know about your experience after making the upgrades. To what extent do you agree with the following statements?

Since making my upgrades...

[MATRIX QUESTION: SCALE]

[RANDOMIZE] Item	1 – Do not at all agree	2	3	4	5 – Strongly agree	98 DK
1. My home is more comfortable.						
2. My monthly energy bills are lower						
3. My home is more valuable						
4. My home is safer						
5. There is less dust and pollen in my home						

[IF ANY ITEM IN Q15=1 OR ANY ITEM IN Q15=2]

Q24. If rebates for your home improvement had not been available, which of the following best describes what you would have done after your home efficiency audit?

[SINGLE RESPONSE]

1. I would not have done a project at all
2. I would have delayed the project more than six months
3. I would have done a smaller, less expensive project, or one that saved less energy
4. I would have done the same project
98. Don't know

[IF ANY ITEM IN Q15=1 OR ANY ITEM IN Q15=2, AND UTILITY=FORT COLLINS, AND LOANS AVAILABLE ON PROJECT DATE]

Q25. The Efficiency Works program and Fort Collins Utilities want to know how they can make energy efficiency improvements available to a wider range of people, and they recognize that paying the upfront cost of the improvements is challenging for some people. How did you pay for the energy efficiency upgrades that your home efficiency audit identified?

[SINGLE RESPONSE]

1. Cash, check, or credit card with intention to pay the cost in full at the end of the month
2. Credit card with intention to repay over time
3. Financing or payment plan from the contractor
4. Loan provided through Fort Collins Utilities that you could repay on your utility bill
5. Some other type of loan (including home equity line of credit, personal loan from a bank, or a loan from family, friends, or peers)
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

[IF Q25 WAS DISPLAYED AND Q25≠4]

Q26. When you made your improvements, were you aware that Fort Collins Utilities was offering a financing option with a 2.5% interest rate that people could repay as a line-item on their utility bills?

[SINGLE RESPONSE]

1. Yes
2. No
98. Can't recall

[IF Q26=1]

Q27. Why did you not use the on-bill financing option from Fort Collins Utilities to pay for your energy efficiency upgrades? Please select all that apply:

[MULTIPLE RESPONSE]

1. I did not need financing.
2. I did not want to take on debt or commit to monthly payments.
3. I did not think I would qualify.
4. I applied, but did not qualify.
5. I did not want to go through the application process.
6. I wanted a loan that offered different terms (for example, repaying over a different period).
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

[IF Q25=4]

Q28. Which of the following best describes what you would have done if you had not received the on-bill loan through Fort Collins Utilities for the improvements your home efficiency audit recommended?

[SINGLE RESPONSE]

1. I would not have done a project at all.
2. I would have delayed the project more than six months.
3. I would have done a smaller, less expensive project, or one that saved less energy.
4. I would have done the same project.
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

[IF ANY ITEM IN Q15=1 OR ANY ITEM IN Q15=2]

Q29. How important were each of the following elements in your decision to complete the energy efficiency improvements you made to your home?

[MATRIX QUESTION: SCALE]

Item	1- Not at all important	2	3	4	5- Extremely important
Your home efficiency audit and interactions with the assessor who came to your home					
Your phone or email interactions with the efficiency adviser					
Your rebate					
[IF Q25=4] The on-bill loan you received through Fort Collins Utilities					

## G.2.4. Appliance Rebates [ASK IF RECORDS INDICATE RESPONDENT RECEIVED AN APPLIANCE REBATE AND Q1 OR Q2 <> 1]

[IF APP. REBATE =1 AND S1\_2 = 1 OR 2]

Q30. Our records show that you received a bill credit from Fort Collins Utilities for purchasing an energy efficient **[Appliance Type]**. Is that correct?

[SINGLE RESPONSE]

1. Yes – I purchased a **[Appliance Type]** and received a bill credit from Fort Collins Utilities
2. I purchased a **[Appliance Type]**, but did not receive a bill credit
3. No – I did not purchase a **[Appliance Type]** [SKIP TO END OF SECTION]
98. Don't know [SKIP TO END OF SECTION]

[IF Q30=1 OR Q30=2]

Q31. Is the **[Appliance Type]** that you purchased still plugged in and functioning?

[SINGLE RESPONSE]

1. Yes, it is plugged in and functioning
2. No, it is plugged in, but not functioning
3. No, it is not plugged in
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

[IF Q30=1 OR Q30=2]

Q32. Were you involved in, and do you recall, the decision to select the specific model of **[Appliance Type]** you purchased?

[SINGLE RESPONSE]

1. Yes
2. No [SKIP TO END OF SECTION]
98. Don't know [SKIP TO END OF SECTION]

[IF Q32=1]

Q33. How important were each of the following features in your decision to purchase the model of **[Appliance Type]** you chose?

[MATRIX QUESTION]

[RANDOMIZE] Item	1- Not at all important	2	3	4	5-Extremely important	98 DK
Capacity						
Dimensions or other concerns about appropriateness for your space						
Appearance						
[IF APPLIANCE TYPE=CLOTHES WASHER] Orientation (top load vs. front load)						
Product features, like <b>[Features by Appliance]</b>						
Price						
Energy cost to operate						
ENERGY STAR® certification						
Availability of a bill credit from Fort Collins Utilities						
User reviews						
Independent product reviews from sources like Consumer Reports or CNET						

[IF Q32=1]

Q34. Did you interact with a store staff member as you were deciding which model of [Appliance Type] to purchase?

[SINGLE RESPONSE]

1. Yes
2. No
98. Don't know

[IF Q34=1]

Q35. Which of the following features, if any, did you discuss with a store staff member? For each, please indicate whether you or the sales associate brought it up first.

[MATRIX QUESTION]

[RANDOMIZE] Item	Discussed – you brought it up	Discussed – store staff member brought it up	Discussed – do not recall who brought it up	Did not discuss	98 Do not recall if you discussed
Capacity					
Dimensions or other concerns about appropriateness for your space					
Appearance					
[IF APPLIANCE TYPE=CLOTHES WASHER] Orientation (top load vs. front load)					
Product features, like <b>[Features by Appliance]</b>					
Price					
Energy cost to operate					
ENERGY STAR® certification					
Availability of a bill credit from Fort Collins Utilities					
User reviews					
Independent product reviews from sources like Consumer Reports or CNET					



[IF Q32=1]

Q36. Do you recall seeing any signs like this in the store when you were shopping for your **[Appliance Type]**: [DISPLAY IMAGE OF POINT OF PURCHASE MATERIALS]

[SINGLE RESPONSE]

- 1. Yes
- 2. No
- 98. Don't know

[IF Q30=1 AND Q32=1]

Q37. Did you complete the application to receive the bill credit for the efficient **[Appliance Type]** you purchased, or did someone else complete it?

[SINGLE RESPONSE]

- 1. I completed it
- 2. Someone else in my household completed it
- 3. The salesperson or another retailer staff member
- 96. Other, please specify: [OPEN-ENDED RESPONSE]
- 98. Don't know

[IF Q30=1 AND Q32=1]

Q38. To what extent do you agree with each of the following statements:

[MATRIX QUESTION: SCALE]

Item	1 – Do not at all agree	2	3	4	5 – Completely Agree	98 DK
It was easy to find a <b>[Appliance Type]</b> with the features I wanted that qualified for a bill credit						
[IF Q37=1] The application form was easy to complete						
I received my bill credit in a reasonable amount of time						

[IF Q30=1 AND Q32=1]

Q39. How influential were each of the following in your decision to purchase an energy efficient **[Appliance Type]**?

[MATRIX QUESTION: SCALE]

Item	1 – Not at all influential	2	3	4	5 – Extremely influential	98 DK
[IF Q34=1] The sales associate or other store staff member						
[IF Q36=1] The Efficiency Works signs (like the ones shown previously) [DISPLAY IMAGE ON SAME PAGE]						
The availability of a bill credit from Fort Collins Utilities						

[IF Q30=1 AND Q32=1]

Q40. Which of the following best describes what you would have done if the bill credit from Fort Collins Utilities had not been available?

[SINGLE RESPONSE]

1. I would have purchased the same model of [Appliance Type] or another ENERGY STAR model
2. I would have purchased a [Appliance Type] that did not qualify for ENERGY STAR
3. I would not have purchased a [Appliance Type] or would have waited more than six months
98. Don't know

### G.2.5. Appliance Recycling [ASK IF RECORDS INDICATE RESPONDENT RECYCLED AN APPLIANCE AND Q1 OR Q2 <> 1 AND UTILITY NAME = FC]

[IF RECYCLING=1 AND S1\_2 = 1 OR 2]

Q41. Our records indicate you used Fort Collins Utilities' appliance pick-up and recycling service to recycle your **[Recycled Appliance]** and received a credit on your utility bill for doing so. Is that correct?

[SINGLE RESPONSE]

1. Yes
2. No
98. Don't know

[IF Q41=1]

Q42. How did you learn about the opportunity to recycle your **[Recycled Appliance]** through Fort Collins Utilities and earn a bill credit? Please select all that apply.

[MULTIPLE RESPONSE]

1. From a store staff member when you were buying a new **[Recycled Appliance]**
2. From a sign or other information in the store when you were buying a new **[Recycled Appliance]**
3. From the Fort Collins Utilities website
4. From an Efficiency Works home efficiency audit
5. From family, friends, or acquaintances
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

[IF Q41=1]

Q43. Were you using the recycled unit as your primary **[Recycled Appliance]**, or was it a secondary or spare?

[SINGLE RESPONSE]

1. It was our primary **[Recycled Appliance]**
2. It was a secondary or spare **[Recycled Appliance]**

[IF Q43=2]

Q44. For how much of the year was the recycled **[Recycled Appliance]** plugged in and in use?

[SINGLE RESPONSE]

1. Year round (operated 12 months of the year)
2. Most of the year (operated 8-11 months of the year)
3. About half the year (operated 5-7 months of the year)
4. Seasonal (operated 2-4 months of the year)
5. Rarely or never (Operated 1 month of the year or less)
98. Don't know

[IF Q41=1]

Q45. If the appliance pickup program from Fort Collins Utilities had not been available, would you still have recycled the **[Recycled Appliance]** or would you have kept it?

[SINGLE RESPONSE]

1. Would have disposed of it
2. Would have kept it
98. Don't know

[IF Q45=2 OR 98]

Q46. Did you replace the **[Recycled Appliance]** you recycled with a different one?

[SINGLE RESPONSE]

1. Yes, replaced the unit
2. No, did not replace the unit

[IF Q46=1]

Q47. Is the **[Recycled Appliance]** you got to replace the one you recycled an ENERGY STAR® or high-efficiency model?

[SINGLE RESPONSE]

1. Yes
2. No
98. Don't know

[IF Q46=1]

Q48. Was the **[Recycled Appliance]** you got to replace the one you recycled brand new or used?

[SINGLE RESPONSE]

1. Brand new
2. Used

[IF Q46=1]

Q49. Would you have replaced the **[Recycled Appliance]** if the recycling program through Fort Collins Utilities had not been available?

[SINGLE RESPONSE]

1. Yes
2. No
98. Don't know

[IF Q45=1]

Q50. If the appliance recycling program through Fort Collins Utilities had not been available, which of the following best describes how you would have disposed of your **[Recycled Appliance]**?  
Would you have:

[SINGLE RESPONSE]

1. Sold it
2. Given it away for free
3. [IF Q46=1] Had it removed by the retailer that sold me my replacement **[Recycled Appliance]**
4. Taken it to a dump

5. Taken it to a recycling center
6. Hired someone else to haul it away

IF Q50=1]

Q51. Who would you most likely have sold your **[Recycled Appliance]** to?

[SINGLE RESPONSE]

1. A friend or relative
2. Someone who responded to an ad placement
3. An appliance dealer

[IF Q51=3]

Q52. How old was the **[Recycled Appliance]** you recycled?

[SINGLE RESPONSE]

1. Less than 10 years
2. More than 10 years
98. Don't know

[IF Q50=2]

Q53. Who would you most likely have given your **[Recycled Appliance]** to?

[SINGLE RESPONSE]

1. A friend or relative
2. Someone who responded to an ad placement
3. A charitable organization
96. Other, please specify: [OPEN-ENDED RESPONSE]

[IF Q41=1]

Q54. Why did your household decide to recycle your **[Recycled Appliance]** through Fort Collins Utilities? Please select all that apply:

[MULTIPLE RESPONSE - RANDOMIZE]

1. It was convenient
2. Wanted bill credit
3. Wanted to ensure the **[Recycled Appliance]** would be responsibly recycled
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

[IF Q41=1]

Q55. To what extent do you agree with each of the following statements about your appliance pickup experience?

[MATRIX QUESTION: SCALE]

[LOGIC] Item	1 – Do not at all agree	2	3	4	5 – Completely agree	98 DK
I was able to schedule an appliance pickup at a convenient day and time.						
The time between my application and my appliance pickup was reasonable.						
I understood what I would need to do during the appliance pickup.						
The people who picked up my <b>[Recycled Appliance]</b> behaved professionally.						
I received my bill credit in a reasonable amount of time.						

## G.2.6. Home Energy Reports [ASK IF UTILITY=FORT COLLINS AND S1\_1 = 1 OR 2]

[IF UTILITY NAME = FORT COLLINS UTILITIES]

Q56. Do you recall receiving a Home Energy Report in the mail, like the one pictured here, that provides detailed information on your home's energy usage and compares your home energy use to your neighbors? Please note we are not referring to the home water report your home may also receive.

[SINGLE RESPONSE, INCLUDE IMAGE OF HOME ENERGY REPORT]

1. Yes, I receive Home Energy Reports
2. No, I do not recall receiving Home Energy Reports
3. I no longer receive Home Energy Reports because I contacted Fort Collins Utilities and opted out of them
98. Don't know

[IF Q56=1]

Q57. How often do you read the Home Energy Report?

[SINGLE RESPONSE]

1. I read it every time I receive it
2. I read it most of the time
3. I read it sometimes
4. I rarely read it
5. I have never read it

6. I no longer receive Home Energy Reports because I contacted Fort Collins Utilities and opted out of them
98. Don't know

[IF Q57 = 1 OR 2 OR 3]

Q58. How useful have the Home Energy Reports been in helping you understand your home's energy use?

[SINGLE RESPONSE]

1. Not at all useful
2. Not very useful
3. Somewhat useful
4. Very useful
5. Extremely useful
98. Don't know

[IF Q57= 1, 2, OR 3]

Q59. How valuable do you find each of the following elements in the Home Energy Reports?

[MATRIX QUESTION: SCALE]

Item	1 – Not at all valuable	2	3	4	5 – Extremely valuable	98 DK
Comparison to neighbors						
Information about when during the day you use the most electricity						
Tracking your progress (compares you to yourself from last year)						
Energy-saving tips						

[ASK FOR EACH ITEM IN Q59= 1 OR 2]

Q60. Why don't you find [PIPE IN EACH Q59 ITEM RATED 1 OR 2] valuable?

1. [OPEN-ENDED RESPONSE]

### G.2.7. Midstream Lighting [ASK ALL]

[DISPLAY TO ALL] [Utility Name] works with retailers and manufacturers to increase purchases of efficient light bulbs. The next set of questions is about your experience buying light bulbs or lighting controls for your home.

[ASK ALL]

Q61. In the last 12 months, which of the following did you or someone in your household purchase? Please select all that apply.

[MULTIPLE RESPONSE]

1. Standard light bulbs for indoor use
2. Specialty light bulbs such as flood lights, candelabras, or globe lights
3. Light fixtures (these units include both the light and the wiring needed to attach the unit directly to electrical supply)
4. Dimmer switches or occupancy sensors
97. None of the above
98. Don't know

[IF Q61= 3 OR 4≠97 OR 98]

Q62. How many lighting products of each type did you purchase?

[NUMERIC RESPONSE] Item	Number
1. [IF Q61.3 IS SELECTED] Light fixtures	
2. [IF Q61.4 IS SELECTED] Dimmer switches or occupancy sensors	

Q62b. How many lighting products of each type did you purchase?

[MATRIX QUESTION]

[IF Q61 = 1 OR 2]

[NUMERIC RESPONSE] Item	1. Incandescent / halogen [INCLUDE IMAGE]	2. Compact fluorescent [INCLUDE IMAGE]	3. LED [INCLUDE IMAGE]
1. [IF Q61.1 IS SELECTED] Standard light bulbs for indoor use			
2. [IF Q61.2 IS SELECTED] Specialty light bulbs			



[DISPLAY IF Q62b\_1.3>0 OR Q62b\_2.3>0]

Q63. Of the [PIPE IN SUM OF Q62B\_3\_1 AND Q62B\_3\_2] LED bulbs that you bought in the last year, how many did you install, how many did you store for later, and how many did you install but since remove?

Please answer for all the bulbs you purchased. The total should equal [PIPE IN SUM OF Q62B\_3\_1 AND Q62B\_3\_2].

[VALIDATE THAT RESPONSE SUMS TO NUMBER ENTERED IN Q62\_3.A AND Q62\_3.B]

1. Number installed: [NUMERIC RESPONSE]
2. Number in storage: [NUMERIC RESPONSE]
3. Number previously installed, but have since been removed: [NUMERIC RESPONSE]

[IF (Q61 = 1 or 2) AND Q63 is NOT DISPLAYED]: Bought standard or specialty lights but not LED)

Q64. Why did you not purchase LED light bulbs? Select all that apply.

[MULTIPLE RESPONSE – DO NOT READ LIST]

1. They are more expensive than other bulbs
2. I am not familiar with them
3. I like the lighting color of incandescent and halogen bulbs
4. Other, please specify: [OPEN-END RESPONSE]

[IF Q61 1 - 4 IS SELECTED]

Q65. Do you recall seeing any signs or stickers, like the one pictured here, in the store when you were buying lighting products?

[SINGLE RESPONSE, INCLUDE IMAGE OF LIGHTING POP MATERIALS]

1. Yes
2. No
3. Someone else in my household bought the lighting products
98. Don't know

### G.2.8. Spillover [ASK IF RESPONDENT CONFIRMED PARTICIPATION IN ANY PROGRAM (IF Q1=1 OR Q2=1 OR Q30=1 OR Q41=1) USE HIERARCHY = EW-H, REBATE, THEN RECYCLING ]

[IF Q1=1 OR Q2=1 OR Q30=1 OR Q41=1]

Q66. We just have a few more questions about how the **[Program Name]** may have influenced your other decisions about your home's energy use. Because of your experience with the program,

have you bought and installed items to improve your home's energy-efficiency without applying for a rebate or bill credit from **[Utility Name]**?

[SINGLE RESPONSE]

1. Yes, I installed energy-efficient items because of my experience, and I did not apply for a rebate
2. No, I installed energy-efficient items, and applied for a rebate from **[Utility Name]**. [SKIP TO END OF SECTION]
3. No, I did not purchase energy-efficient items [SKIP TO END OF SECTION]
98. Don't know [SKIP TO END OF SECTION]

[IF Q66=1]

Q67. What energy-efficient items have you installed in your home without receiving a rebate or bill credit from **[Utility Name]**?

[MULTIPLE RESPONSE]

1. Appliance(s)
2. Heating or cooling equipment
3. Water heater
4. Windows
5. Insulation
6. Sealing air leaks in windows, walls, and doors
7. Sealing or insulating ducts
96. Other, please specify: [OPEN-ENDED RESPONSE]
97. None of the above
98. Don't know [SKIP TO END OF SECTION]

[IF Q67=1]

Q68. What kind of energy-efficient appliance(s) did you buy?

[MULTIPLE RESPONSE]

1. Refrigerator
2. Stand-alone freezer
3. Dishwasher
4. Clothes washer
5. Clothes dryer
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

[IF Q67=2, OR Q15 7, 8, 9, 11, 12 , OR 13=2]

Q69. What type of heating or cooling equipment did you buy?

[MULTIPLE RESPONSE]

1. Central air conditioner
2. Window/room air conditioner unit
3. Air source heat pump
4. Boiler
5. Furnace
6. Wi Fi-enabled thermostat
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

[IF Q67=3, OR Q15\_10=2]

Q70. What type of water heater did you buy? If you are unsure of the fuel type or storage type, please type what you know in the "other" box.

[SINGLE RESPONSE]

1. Gas: Standard tank
2. Gas: Whole house tankless system
3. Electric: Standard tank
4. Electric: Heat pump
5. Electric: Whole house tankless system
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

[IF Q67=5 OR Q15\_2=2]

Q71. Where in your home did you add insulation?

[MULTIPLE RESPONSE]

1. Attic
2. Walls
3. Below the floor
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

[IF Q66 = 1 AND Q67 <> NONE OF THE ABOVE]

Q72. How important was your experience with **[Program Name]** in your decision to buy and install the additional energy efficient items?

[SINGLE RESPONSE]

1. Not at all important
2. Not very important
3. Somewhat important
4. Very important

- 5. Extremely important
- 98. Don't know

[IF Q66 = 1]

Q73. Why didn't you receive a rebate or bill credit for installing these items?

[SINGLE RESPONSE]

- 1. Rebates are not available for the type of improvement or equipment installed
- 2. Rebates are available for that type of improvement or equipment, but the specific variety I installed did not qualify
- 3. I do not know whether rebates were available for the improvement or equipment I installed
- 4. I did not want to go through the process of applying for the rebate
- 96. Other, please specify: [OPEN-ENDED RESPONSE]
- 98. Don't know

### G.2.9. Demographics/Firmographics [ASK ALL]

[ASK ALL]

Q74. Overall, how satisfied are you with your experience with **[Utility Name]**?

[SINGLE RESPONSE]

- 1. Not at all satisfied
- 2. Not very satisfied
- 3. Somewhat satisfied
- 4. Very satisfied
- 5. Extremely satisfied

[ASK ALL]

You're almost done! We just have a few questions left about your home.

Q75. What is the primary fuel you use to heat your home?

[SINGLE RESPONSE]

- 1. Electricity (including a heat pump, electric baseboards, electric furnace)
- 2. Natural gas (including a gas boiler or gas furnace)
- 3. Heating oil
- 4. Propane
- 96. Other, please specify: [OPEN-ENDED RESPONSE]
- 98. Don't know

[ASK ALL]

Q76. What is the primary fuel you use for water heating?

[SINGLE RESPONSE]

- 1. Electricity
- 2. Natural gas
- 3. Propane
- 96. Other, please specify: [OPEN-ENDED RESPONSE]
- 98. Don't know

[IF APPLIANCE TYPE=CLOTHES WASHER]

Q77. What type of clothes dryer do you use in your home?

[SINGLE RESPONSE]

- 1. An electric dryer
- 2. A gas dryer
- 3. Do not own a clothes dryer
- 96. Other, please specify: [OPEN-ENDED RESPONSE]
- 98. Don't know

[IF Q15\_11≠1 AND Q15\_11≠2]

Q78. Does your home have a central air conditioner?

[SINGLE RESPONSE]

- 1. Yes
- 2. No
- 98. Don't know

[IF Q15\_1=1 OR Q15\_1=2]

Q79. How many stories are there in your home?

[SINGLE RESPONSE]

- 1. 1
- 2. 2
- 3. 3
- 4. 4 or more

## G.2.10. Closing [SHOW TO ALL]

Thank you for completing the survey. Hit the double arrow button below to submit your answers.

## G.3. Residential Non-Participant Survey

### G.3.1. Introduction

Thank you for agreeing to take our survey. It should take you about 10 minutes. Please click the double arrow button below to start the survey.

### G.3.2. Screening

[ASK ALL]

S1. Do you currently rent or own the residence you live in?

- 1. Own/buying
- 2. Rent/lease
- 98. Don't know

[ASK ALL]

S2. Who in your household is most often responsible for the following types of actions? Please select one answer for each action.

[MATRIX QUESTION]

[SHOW ALL]	I am solely responsible	I share responsibility	Someone else is responsible
Paying utility bills			
Purchasing energy-using products like appliances or light bulbs			
Making decisions about home upgrades or renovations			

[IF ALL ANSWERS TO S2 = Someone else is responsible, USE THIS TERMINATION SCRIPT]

For this research, Fort Collins Utilities is surveying individuals who are responsible for making energy-related spending decisions. That is all the questions we have at this time. Thank you.

### G.3.3. Awareness

[ASK ALL]

Q1. Are you familiar with any rebates or programs that Fort Collins Utilities offers to help people save energy?

[SINGLE RESPONSE]

- 1. Yes
- 2. No
- 98. Don't know

[IF Q1 = 1, ELSE SKIP]

Q2. To the best of your knowledge, what energy-related rebates or programs does Fort Collins Utilities offer?

[MULTIPLE RESPONSE]

1. Recycling of old refrigerators or freezers
2. Rebates for purchasing ENERGY STAR dishwashers or clothes washers
3. ] Rebates for purchasing water-efficient toilets or sprinkler equipment
4. Home Energy Reports that compare your home's energy usage to your neighbors
5. Home efficiency audits in which an expert comes to your home to identify energy-saving opportunities
6. Rebates for installing insulation and sealing your home against air leakage
7. Rebates for installing energy efficient heating and cooling equipment
8. CFL and LED light bulb discounts at the store
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

[IF Q1 = 1, ELSE SKIP]

Q3. How have you heard about the rebates or energy efficiency programs?

[MULTIPLE RESPONSE]

1. A contractor
2. Word of mouth such as colleague or family member
3. Promotional materials at a store
4. The Fort Collins Utilities website
5. Past experience with Fort Collins Utilities programs
6. Bill insert or other print materials from Fort Collins Utilities
7. An event sponsored by Fort Collins Utilities
8. Interaction with Fort Collins Utilities staff or representatives at a community event
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

### G.3.4. Barriers to Participation [IF S1=1]

[IF S1=1]

Q4. Which of the following have you or other members of your household done in the past three years?

[MULTIPLE RESPONSE, RANDOMIZE]

1. Had a home efficiency audit, in which an expert comes to your home to identify ways you could save energy
2. Added insulation or sealed your home against air leakage

3. Purchased new heating or cooling equipment, such as a furnace, heat pump, central air conditioner, boiler, or whole house fan
4. Gotten rid of a refrigerator or freezer that still worked
5. Purchased a new clothes washer
6. Purchased a new dishwasher
97. None of the above

#### G.3.4.1. Efficiency Works – Homes

[IF S1 = 1 AND Q2\_5 IS SELECTED AND Q4\_1 IS NOT SELECTED ]

Q5. There could be several reasons why someone has not had an efficiency audit performed at their residence. We'd like to know what some reasons might be why you have not had a home efficiency audit. Please select any options below that apply to your situation.

[MULTIPLE RESPONSE]

1. Unable to pay the \$60 upfront cost of the audit
2. Not interested in making changes to my home
3. My home is already energy efficient
4. Do not believe it would provide new or valuable information
5. Do not have time to schedule and attend the audit
6. Unable to schedule an audit at a convenient time
7. Other home improvements are a higher priority than increasing energy efficiency
8. Don't know how to request one
9. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

[IF Q4\_2 IS SELECTED]

Q6. What type of insulation and air sealing improvements have you made? Please select all that apply

[MULTIPLE RESPONSE]

1. Added insulation to my attic
2. Added insulation to my walls
3. Added insulation below my floors
4. Added weather stripping around doors and windows
5. Installed new windows
6. Had my ductwork sealed
7. Sealed gaps in outdoor walls that allowed air leakage
8. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know



[IF ANY OPTION IN Q6 IS SELECTED OTHER THAN Q6\_4 OR Q6\_98]

Q7. Did you receive a rebate from Fort Collins Utilities, Efficiency Works, or your natural gas utility for the insulation and/or air sealing improvements you made?

[SINGLE RESPONSE]

- 1. Yes
- 2. No
- 98. Don't know

[IF Q7=2]

Q8. Why didn't you receive a rebate for your insulation and air sealing improvements?

[MULTIPLE RESPONSE]

- 1. Was not aware rebates were available
- 2. Improvements did not qualify for a rebate
- 3. Application process required too much time and effort
- 4. Rebate amount was too small
- 5. Wanted to work with a contractor that was not part of the rebate program
- 96. Other, please specify: [OPEN-ENDED RESPONSE]
- 98. Don't know

[IF Q4\_2 IS NOT SELECTED AND Q4 IS DISPLAYED]

Q9. There could be several reasons why someone has not done insulation or air-sealing improvements to their home. Please select from the options below any reasons why have you not improved your home's insulation or taken steps to seal against air leakage.

[MULTIPLE RESPONSE]

- 1. Not interested in making changes to my home
- 2. My home is already well insulated and is not drafty
- 3. Other home improvements are higher priority than improving insulation or air sealing
- 4. Not convinced the energy cost savings would justify the cost and effort of making improvements
- 5. Not convinced the improvements would increase comfort in my home enough to justify the cost and effort
- 6. Did not have access to financing to help pay for improvements
- 7. I do not know how to go about improving my home's insulation and seal against air leakage. I cannot add insulation or air sealing due to my home's structural or health and safety limitations (for example, vaulted ceilings, knob and tube wiring, etc.).
- 96. Other, please specify: [OPEN-ENDED RESPONSE]
- 98. Don't know

[IF Q4\_2 IS NOT SELECTED AND Q4 IS DISPLAYED]

Q10. If a low-interest loan were available that could cover up to 100% of the project cost, how likely would you be to pursue improving your home's insulation or seal against air leakage?

[SINGLE RESPONSE]

- 1. Not at all likely
- 2. Not very likely
- 3. Moderately likely
- 4. Very likely
- 5. Definitely likely
- 98. Don't know

[IF Q4\_3 IS SELECTED]

Q11. What type of heating or cooling equipment did you buy? Select all that apply.

[MULTIPLE RESPONSE]

- 1. Central air conditioner
- 2. Window/room air conditioner unit
- 3. Heat pump
- 4. Natural gas boiler
- 5. Natural gas furnace
- 6. Evaporative cooler
- 7. Whole house fan
- 96. Other, please specify: [OPEN-ENDED RESPONSE]
- 98. Don't know

[IF ANY ITEM IN Q11 IS SELECTED OTHER THAN Q11\_98]

Q12. Did you apply for a rebate for the heating and cooling equipment you bought?

[MATRIX QUESTION]

[LOGIC] Item	1. Yes	2. No	98. DK
[IF Q11_1 IS SELECTED] a) Central air conditioner			
[IF Q11_3 IS SELECTED] c) Heat pump			
[IF Q11_4 IS SELECTED] d) Natural gas boiler			
[IF Q11_5 IS SELECTED] e) Natural gas furnace			
[IF Q11_6 IS SELECTED] f) Evaporative cooler			
[IF Q11_7 IS SELECTED] g) Whole house fan			
[IF Q11_96 IS SELECTED] h) <b>[Open-ended response from Q11_96]</b>			

[IF ANY ITEM IN Q12=2]

Q13. Why did you not apply for a rebate for your heating or cooling equipment? Please select all that apply:

[MATRIX QUESTION]

[MULTIPLE RESPONSE] Item	1. Not aware rebates were available	2. Equipment I bought did not qualify for a rebate	3. Application process required too much time and effort	4. Rebate amount was too small	5. Wanted to work with a contractor that was not part of the rebate program	96. Other, specify [OPEN ENDED RESPONSE]	98 Don't know
[IF Q12_a = 2] a) Central air conditioner							
[IF Q12_c = 2] c) Heat pump							
[IF Q12_d = 2] d) Natural gas boiler							
[IF Q12_e = 2] e) Natural gas furnace							
[IF Q12_f = 2] f) Evaporative cooler							
[IF Q12_g = 2] g) Whole house fan							
[IF Q12_h = 2] [Open-ended response from Q11_96]							

### G.3.4.2. Appliance Recycling

[IF Q4\_4 IS SELECTED]

Q14. What did you do with the refrigerator or freezer you got rid of?

[SINGLE RESPONSE, RANDOMIZE OPTIONS 1-7]

1. Sold it
2. Gave it away for free
3. Had it removed by a retailer or dealer that sold you a replacement appliance
4. Took it to a dump
5. Took it to a recycling center
6. Hired someone else to haul it away
7. Used Fort Collins Utilities' service to pick up and recycle refrigerators and freezers
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

[IF Q2\_1 IS SELECTED AND Q4\_4 IS SELECTED AND Q14\_7 IS NOT SELECTED]

Q15. Compared to the way you got rid of your refrigerator or freezer, how convenient is Fort Collins Utilities' appliance pickup and recycling service?

[SINGLE RESPONSE]

1. Much less convenient
2. Somewhat less convenient
3. About as convenient
4. Somewhat more convenient
5. Much more convenient
98. Don't know

[IF Q15 = 1, 2 OR 3]

Q16. How important was convenience in your decision to get rid of your refrigerator or freezer the way you did?

[SINGLE RESPONSE]

1. Not at all important
2. Not very important
3. Somewhat important
4. Very important
5. Extremely important

[IF Q15 = 1 OR 2]

Q17. What is inconvenient about Fort Collins Utilities appliance pickup and recycling service?

1. [OPEN-ENDED RESPONSE]

## G.3.4.3. Appliance Rebates

*Clothes Washers*

[IF Q4\_5 IS SELECTED]

Q18. Did you interact with a sales associate or other store staff member as you were deciding which model of clothes washer to purchase?

[SINGLE RESPONSE]

- 1. Yes
- 2. No
- 98. Don't know

[IF Q18=1]

Q19. Which of the following features did you discuss with a sales associate? For each, please indicate whether you were first to bring it up, or the sales associate was.

[MATRIX QUESTION]

[RANDOMIZE] Item	Discussed – You brought it up	Discussed – Sales associate brought it up	Discussed – Do not recall who brought it up	Did not discuss	98 Do not recall if you discussed
Capacity					
Dimensions or other concerns about appropriateness for your space					
Appearance					
Orientation (top load vs. front load)					
Product features, like steam function, countdown timer, extra rinse cycle, etc.					
Price					
Energy cost to operate					
ENERGY STAR certification					
Availability of a bill credit from Fort Collins Utilities					
User reviews					
Independent product reviews from sources like Consumer Reports or CNET					

[IF Q4\_5 IS SELECTED]

Q20. Do you recall seeing any signs or stickers like this in the store when you were shopping for your clothes washer: [DISPLAY IMAGE OF POINT OF PURCHASE MATERIALS]

[SINGLE RESPONSE]

- 1. Yes
- 2. No
- 98. Don't know

[IF Q4\_5 IS SELECTED]

Q21. Was the clothes washer you purchased ENERGY STAR-certified?

[SINGLE RESPONSE]

- 1. Yes
- 2. No
- 98. Don't know

[IF Q21=1]

Q22. Did you apply for a rebate from Fort Collins Utilities for purchasing an ENERGY STAR clothes washer?

[SINGLE RESPONSE]

- 1. Yes
- 2. No
- 98. Don't know

[IF Q22 = 2]

Q23. Why did you not apply for a rebate for the clothes washer? Select all that apply.

[MULTIPLE RESPONSE]

- 1. I did not know about the availability of rebates for ENERGY STAR clothes washers
- 2. I did not want to go through the process of applying
- 3. I did not think the one I bought would qualify for a rebate
- 4. The rebate amount did not seem worth it
- 5. Other, please specify: [OPEN-ENDED RESPONSE]
- 98. Don't know

[IF Q4\_5 IS SELECTED]

Q24. To what extent did you consider energy efficiency when you were deciding which model of clothes washer to buy?

[SINGLE RESPONSE]

- 1. I did not consider energy efficiency at all

2. I considered energy efficiency, but other features were more important
3. Energy efficiency was equally important to other features I considered
4. Energy efficiency was one of the most important features I considered
5. I would not have purchased a model that was not energy efficient
98. Don't know

[IF Q21 = 2 AND Q24\_3, Q24\_4, OR Q24\_5 IS SELECTED]

Q25. Why did you not choose an ENERGY STAR model?

[MULTIPLE RESPONSE]

1. ENERGY STAR models were more expensive than I wanted to pay for
2. I could not find an ENERGY STAR model with the features I wanted
3. All the ENERGY STAR models had premium features that I didn't want to pay for
4. I did not know how to find, or what to look for in, ENERGY STAR models
5. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

### Dishwashers

[IF Q4\_6 IS SELECTED]

Q26. Did you interact with a sales associate or other store staff member as you were deciding which model of dishwasher to purchase?

[SINGLE RESPONSE]

1. Yes
2. No
98. Don't know

[IF Q4\_6 IS SELECTED AND Q26 = 1]

Q27. Which of the following features did you discuss with a sales associate? For each, please indicate whether you were first to bring it up, or the sales associate was.

[MATRIX QUESTION]

[RANDOMIZE] Item	Discussed – You brought it up	Discussed – Sales associate brought it up	Discussed – Do not recall who brought it up	Did not discuss	98 Do not recall if you discussed
Capacity					
Dimensions or other concerns about appropriateness for your space					
Appearance					

[RANDOMIZE] Item	Discussed – You brought it up	Discussed – Sales associate brought it up	Discussed – Do not recall who brought it up	Did not discuss	98 Do not recall if you discussed
Product features, like a third rack, sanitization cycle, etc.					
Price					
Energy cost to operate					
ENERGY STAR certification					
Availability of a bill credit from Fort Collins Utilities					
User reviews					
Independent product reviews from sources like Consumer Reports or CNET					

[IF Q4\_6 IS SELECTED]

Q28. Do you recall seeing any signs or stickers like this in the store when you were shopping for your dishwasher: [DISPLAY IMAGE OF POINT OF PURCHASE MATERIALS]

[SINGLE RESPONSE]

- 1. Yes
- 2. No
- 98. Don't know

[IF Q4\_6 IS SELECTED]

Q29. Was the dishwasher you purchased ENERGY STAR-certified?

[SINGLE RESPONSE]

- 1. Yes
- 2. No
- 98. Don't know

[IF Q29=1]

Q30. Did you apply for a rebate from Fort Collins Utilities for purchasing an ENERGY STAR dishwasher?

[SINGLE RESPONSE]

- 1. Yes
- 2. No
- 98. Don't know



[IF Q30= 2]

Q31. Why did you not receive a rebate for the dishwasher? Select all that apply.

[MULTIPLE RESPONSE]

1. I did not know rebates were available for ENERGY STAR dishwashers
2. I did not want to go through the process of applying
3. I did not think the one I bought would qualify for a rebate
4. The rebate amount did not seem worth it
5. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

[IF Q4\_6 IS SELECTED]

Q32. To what extent did you consider energy efficiency when you were deciding which model of dishwasher to buy?

[SINGLE RESPONSE]

1. I did not consider energy efficiency at all
2. I considered energy efficiency, but other features were more important
3. Energy efficiency was equally important to other features I considered
4. Energy efficiency was one of the most important features I considered
5. I would not have purchased a model that was not energy efficient
98. Don't know

[IF Q29 = 2 AND Q32\_3, Q32\_4, OR Q32\_5 IS SELECTED]

Q33. Why did you not choose an ENERGY STAR model?

[MULTIPLE RESPONSE]

1. ENERGY STAR models were more expensive than I wanted to pay for
2. I could not find an ENERGY STAR model with the features I wanted
3. All the ENERGY STAR models had premium features I did not want to pay for
4. I did not know how to find, or what to look for in, ENERGY STAR models
5. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

### G.3.5. Midstream Lighting

[DISPLAY TO ALL] Fort Collins Utilities works with retailers and manufacturers to increase purchases of efficient light bulbs. The next set of questions is about your experience buying light bulbs or lighting controls for your home.

[ASK ALL]

Q34. In the last 12-months, which of the following did you or someone in your household purchase?  
Please select all that apply.

[MULTIPLE RESPONSE]

1. Standard light bulbs for indoor use
2. Specialty light bulbs such as flood lights, candelabras, or globe lights
3. Light fixtures. These are entire units including light and wiring to attach the unit directly to electrical supply
4. Dimmer switches or occupancy sensors
97. None of the above
98. Don't know

[IF Q34 = 3 OR 4]

Q35. Q35a. How many lighting products of each type did you purchase?

[NUMERIC RESPONSE] Item	Number
[IF Q34.3 IS SELECTED] Light fixtures	
[IF Q34.4 IS SELECTED] Dimmer switches or occupancy sensors	

[IF Q34 = 1 OR 2]

Q35b. How many lighting products of each type did you purchase? If none, please enter zero.

[MATRIX QUESTION]

[NUMERIC RESPONSE] Item	1. Incandescent / halogen [INCLUDE IMAGE]	2. Compact fluorescent [INCLUDE IMAGE]	3. LED [INCLUDE IMAGE]
1. [IF Q34.1 IS SELECTED] Standard light bulbs for indoor use			
2. [IF Q34.2 IS SELECTED] Specialty light bulbs			

[DISPLAY IF Q35b\_1.3 &gt;0 OR Q35b\_2.3&gt;0]

Q36. Of the LED bulbs that you bought in the last year, how many did you install, how many did you store to install later, and how many did you install but since remove?

Please answer for all the bulbs you purchased. The total should equal [PIPE IN SUM OF Q35B\_3\_1 AND Q35B\_3\_2].

[VALIDATE THAT RESPONSE SUMS TO NUMBER ENTERED IN Q35\_3.A AND Q35\_3.B]

1. Number installed: [NUMERIC RESPONSE]
2. Number in storage, not yet installed: [NUMERIC RESPONSE]

3. Number previously installed, but have since been removed: [NUMERIC RESPONSE]

[If Q35b\_1 > 0 AND Q35b\_2 = 0 or blank AND Q35b\_3 = 0 or blank]

Q37. Why did you not purchase LED light bulbs? Select all that apply.

[MULTIPLE RESPONSE – DO NOT READ LIST]

1. They are more expensive than other bulbs
2. I am not familiar with them
3. I like the lighting color of incandescent and halogen bulbs
4. Other, please specify: [OPEN-END RESPONSE]

[ASK ALL]

Q38. How likely are you to purchase any LED lightbulbs in the next year?

[SINGLE RESPONSE]

1. Not at all likely
2. Not very likely
3. Somewhat likely
4. Fairly likely
5. Very likely
98. Don't know

[IF Q34\_1, Q34\_2, Q34\_3, OR Q34\_4 IS SELECTED]

Q39. Do you recall seeing any signs or stickers like the one pictured here in the store when you were buying lighting products?

[SINGLE RESPONSE, INCLUDE IMAGE OF LIGHTING POP MATERIALS]

1. Yes
2. No
3. Someone else in my household bought the lighting products
98. Don't know

### G.3.6. Home Energy Reports

Q40. Do you recall receiving a Home Energy Report, like the one pictured here, that provides detailed information on your home's energy usage and compares your home energy use to your neighbors? Please note we are not referring to the home water report your home may also receive.

[SINGLE RESPONSE, INCLUDE IMAGE OF HOME ENERGY REPORT]

1. Yes, I receive Home Energy Reports
2. No, I do not recall receiving Home Energy Reports

- 3. I no longer receive Home Energy Reports because I contacted Fort Collins Utilities and opted out of them
- 98. Don't know

[If Q40 = 3]

Q41. Why did you choose to opt out of receiving the Home Energy Reports? Select all that apply.

[MULTIPLE RESPONSE]

- 1. They came too frequently
- 2. I didn't find the information accurate
- 3. I didn't find the information informative
- 4. I wanted to reduce the amount of mail I get
- 5. Other, please specify: [OPEN-END RESPONSE]

[IF Q40=1]

Q42. How often do you read the Home Energy Report?

[SINGLE RESPONSE]

- 1. I read it every time I receive it
- 2. I read it most of the time
- 3. I read it sometimes
- 4. I rarely read it
- 5. I have never read it

[IF Q42 = 1, 2, OR 3]

Q43. How useful have the Home Energy Reports been to help you understand your home's energy use?

[SINGLE RESPONSE]

- 1. Not at all useful
- 2. Not very useful
- 3. Somewhat useful
- 4. Very useful
- 5. Extremely useful
- 98. Don't know

[IF Q42 = 1, 2, OR 3]

Q44. What actions to save energy, if any, have you taken in response to the Home Energy Reports? Select all that apply.

[MULTIPLE RESPONSE]

- 1. Purchased energy saving products for my home and received a rebate from Fort Collins Utilities or my natural gas utility

2. Purchased energy saving products for my home but did not receive a rebate from Fort Collins Utilities or my natural gas utility
3. Made energy saving modifications to my home. For example: installed insulation or windows
4. Changed my thermostat setting
5. Turned off lights when not in use
6. Ran energy-using appliances at night
7. Unplugged or used a power strip to turn off appliances when not in use
8. Looked for additional information on how to save energy
9. Nothing in particular
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

[IF Q42 = 1, 2, OR 3]

Q45. We'd like to know how valuable each of the following elements in the Home Energy Reports is to you. Please rate each element using a 1 to 5 scale where 1 is "not at all valuable" and 5 is "extremely valuable." Please select one answer for each item.

[MATRIX QUESTION: SCALE]

Item	1 – Not at all valuable	2	3	4	5 – Extremely valuable	98 DK
Comparison to neighbors						
Information about when during the day you use the most electricity						
Tracking your progress (compares you to yourself from last year)						
Energy-saving tips						

[ASK FOR EACH ITEM IN Q45 = 1 OR 2]

Q46. Why don't you find [PIPE IN EACH 0 ITEM RATED 1 OR 2] valuable?

1. [OPEN-ENDED RESPONSE]
98. Don't know

[IF Q42= 1, 2, OR 3]

Q48. Have you ever looked at the My Energy tool, which provides information about your home's energy usage, on the Fort Collins Utilities website, like the information pictured here?

[INCLUDE IMAGE OF ENERGY USAGE INFORMATION FROM WEBSITE]

1. Yes, I've logged in and looked at my utility information
2. No, I haven't accessed this information online
98. Don't know

[If Q48 = 1 AND Q42=1, 2, OR 3]

Q49. Compared to the information presented in the Home Energy Reports, how useful is the information on the Fort Collins Utilities website for understanding your home's energy usage?

1. The website information is much more useful than the Home Energy Reports
2. The website information is more useful than the Home Energy Reports
3. The website is about as useful as the Home Energy Reports
4. The website is less useful than the Home Energy Reports
5. The website is much less useful than the Home Energy Reports
98. Don't know

[IF Q49 =1 OR 2]

Q50. Why don't you find the website information useful?

1. [OPEN-ENDED RESPONSE]

### G.3.7. Demographics

[ASK ALL]

Q51. Overall, how satisfied are you with your experience with Fort Collins Utilities?

[SINGLE RESPONSE]

1. Not at all satisfied
2. Not very satisfied
3. Somewhat satisfied
4. Very satisfied
5. Extremely satisfied

[ASK ALL]

You're almost done with the survey. We just have a few questions about your home.

Q52. What is the primary fuel you use to heat your home?

[SINGLE RESPONSE]

1. Electricity (including a heat pump, electric baseboards, electric furnace)
2. Natural gas (including a gas boiler or gas furnace)
3. Heating oil
4. Propane
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

[ASK ALL]

Q53. What is the primary fuel you use for water heating?

[SINGLE RESPONSE]

- 1. Electricity
- 2. Natural gas
- 3. Propane
- 96. Other, please specify: [OPEN-ENDED RESPONSE]
- 98. Don't know

[IF Q4\_5 IS SELECTED]

Q54. What type of clothes dryer do you use in your home?

[SINGLE RESPONSE]

- 1. An electric dryer
- 2. A gas dryer
- 3. Do not own a clothes dryer
- 96. Other, please specify: [OPEN-ENDED RESPONSE]
- 98. Don't know

[IF Q11\_1 IS NOT SELECTED]

Q55. Does your home have a central air conditioner?

[SINGLE RESPONSE]

- 1. Yes
- 2. No
- 98. Don't know

[ASK ALL]

Q56. How many stories are there in your home? Please include finished attics or basements in your count.

[SINGLE RESPONSE]

- 1. 1
- 2. 2
- 3. 3
- 4. 4 or more

Q58. Including yourself, how many people currently live in your home year-round?

- 1. I live by myself
- 2. Two people
- 3. Three people
- 4. Four people

- 5. Five people
- 6. Six people
- 7. Seven people
- 8. Eight or more people
- 98. Don't know
- 99. Prefer not to say

Q59. What is the highest level of education you have completed so far?

- 1. Less than high school
- 2. Some high school
- 3. High school graduate or equivalent (such as GED)
- 4. Trade or technical school
- 5. Some college (including Associate degree)
- 6. College degree (Bachelor's degree)
- 7. Some graduate school
- 8. Graduate degree, professional degree
- 9. Doctorate
- 98. Don't know
- 99. Prefer not to say

Q60. What was your total annual household income for 2016, before taxes?

- 1. Under \$20,000
- 2. 20 to under \$30,000
- 3. 30 to under \$40,000
- 4. 40 to under \$50,000
- 5. 50 to under \$60,000
- 6. 60 to under \$75,000
- 7. 75 to under \$100,000
- 8. 100 to under \$150,000
- 9. 150 to under \$200,000
- 10. \$200,000 or more
- 98. Don't know
- 99. Prefer not to say

Q61. What is your race? [Multiple response]

- 1. White, European-American
- 2. Black, African-American
- 3. American Indian or Alaska Native
- 4. Asian
- 5. Native Hawaiian or other Pacific Islander
- 96. Other, please specify: [OPEN-ENDED RESPONSE]
- 98. Don't know
- 99. Prefer not to say



Q62. Are you of Hispanic, Latino, or Spanish Origin?

- 1. Yes, I am of Hispanic, Latino, or Spanish origin
- 2. No, I am not of Hispanic, Latino, or Spanish origin
- 98. Don't know
- 99. Prefer not to say

Q63. How old are you?

- 1. Less than 18 yrs old
- 2. 18 to 24 yrs
- 3. 25 to 34 yrs
- 4. 35 to 44 yrs
- 5. 45 to 54 yrs
- 6. 55 to 64 yrs
- 7. 65 yrs or older
- 99. Prefer not to say

### G.3.8. Closing

[SHOW TO ALL] Thank you for completing the survey. Please click the double arrow button below to submit your answers.

## Appendix H. Survey Frequencies

The Tables below summarize the responses from the following survey efforts: non-residential participant survey, residential participant survey and residential non-participant survey.

### H.1. Non-Residential Participant Survey

S1\_A. Our records show your business received equipment rebates through Efficiency Works and [Utility Name] for the [Project Name] project completed on [Completion Date]. Is that correct?

Response Option	Fort Collins (n = 65)	Total (n=89)
Yes - my business received rebates for that project	87%	89%
No - my business did not receive rebates for that project	0%	0%
Don't know	0%	0%
Not Asked	12%	11%

S1\_B. [IF S1\_A = YES OR NO] Did your business receive a site assessment through Efficiency Works and [Utility Name] for the [Project Name] project completed on [Completion Date]?

Response Option	Fort Collins (n=56)	Total (n=78)
Yes- my business received an energy assessment at that location	59%	58%
No- my business received an energy assessment at another location	0%	1%
No- my business did not receive an energy assessment at any location	14%	18%
Don't know	29%	23%

S1\_C. [IF S1\_B= NO, RECEIVED AN ENERGY ASSESSMENT AT ANOTHER LOCATION] Please provide both the location where your business most recently had a site assessment through Efficiency Works and [Utility Name] and the date of the assessment.

*Open ended Response Options used for survey programming. No data to report.*

S1\_D. [IF AUDIT > 0 AND REBATE = 0] Our records show your business received a site assessment through Efficiency Works and [Utility Name] at [Site Address] on [Completion Date]. Is that correct?

Response Option	Fort Collins (n = 8)	Total (n = 10)
Yes- my business received an energy assessment	100%	100%
No- my business did not receive an energy assessment	0	0
Don't know	0	0

S2. We would like to hear from an employee who was involved in the [energy assessment, rebate application, or energy assessment or rebate application] experience. Were you involved in the [energy assessment, rebate application, or energy assessment or rebate application]?

Response Option	Fort Collins (n = 65)	Total (n = 89)
Yes- I was involved	100%	100%
No- I was not involved [ASKED S3 THEN SCREENED OUT]	0	0
Don't know [ASKED S3 THEN SCREENED OUT]	0	0

S3. Please provide the contact information for an employee who was involved in the  
*Open ended Response Options used for finding the appropriate contact. No data to report.*

S4. Which of the following best describes your role at your company?

Response Option	Fort Collins (n = 65)	Total (n = 89)
Owner	31%	33%
Executive	12%	33%
Engineer	5%	33%
Architect	0%	33%
Contractor	3%	33%
Technician	0%	33%
Building Operator	8%	33%
Sales Manager / Business Development	3%	33%
Other	38%	33%

### H.1.1.1. Efficiency Works Business

Q1. From what sources have you heard about business energy assessments or efficient equipment rebates offered through Efficiency Works and [Utility Name]? Select all that apply.

Response Option	Fort Collins (n=65)	Total (n=89)
Utility email, newsletter, or bill insert	42%	38%
Utility representative	25%	25%
Utility website	34%	31%
Social media (for example, Facebook, Twitter, LinkedIn)	0%	0%
Advertisement on a website	5%	3%
Contractor	35%	36%
Other businesses	11%	11%
A friend or family member	2%	1%

Response Option	Fort Collins (n=65)	Total (n=89)
Online search	3%	6%
A coworker	2%	3%
Other	14%	15%
Don't know	5%	3%

Q2. What are the best ways to inform businesses like yours about business energy assessments or efficiency equipment rebates offered through Efficiency Works and [Utility Name]? Select all that apply. *Multiple Responses Allowed*

Response Option	Fort Collins (n=65)	Total (n=89)
Utility email, newsletter, or bill insert	71%	71%
Utility representative	31%	28%
Utility website	42%	37%
Social media (for example, Facebook, Twitter, LinkedIn)	17%	19%
Advertisement on a website	5%	7%
Contractor	26%	23%
Other businesses	23%	19%
A friend or family member	11%	10%
Online search	11%	12%
A coworker	5%	3%
Other	6%	6%
Don't know	5%	1%

### H.1.2. Energy Assessment Barriers

Q3. [IF S1 INDICATES DID NOT RECEIVE ENERGY ASSESSMENT] Were you aware that Efficiency Works and [Utility Name] offer energy assessments to help businesses identify opportunities to save energy?

Response Option	Fort Collins (n=23)	Total (n=31)*
Yes	65%	71%
No	35%	29%
Don't know	0%	0%

\* 2 respondents who were rebate-only participants were not asked this question.

Q4. [IF Q3 = YES] Why did your business decide not to conduct a business energy assessment from Efficiency Works or [Utility Name]? Select all that apply. *Multiple Responses Allowed*

Response Option	Fort Collins (n=15)	Total (n=22)
My business is unable to devote the time and effort required	20%	23%
Efficiency is not a priority for my business	0%	5%
My business is not convinced the information gained will be worth the time and effort required	0%	5%
My business is already as energy efficient as it can be	0%	0%
My business is already aware of the actions we could take to save energy	27%	27%
Other	40%	27%
Don't know	13%	18%

### H.1.3. Energy Assessment Participants

Q5. [IF S1 INDICATES HAD EFFICIENCY ASSESSMENT] Why was your business interested in having a business energy assessment performed? Select all that apply. *Multiple Responses Allowed*

Response Option	Fort Collins (n=40)	Total (n=56)
Reduce energy bills	90%	89%
Reduce energy waste	73%	75%
Learn about my business' energy usage	43%	36%
Do your part to help the environment	68%	61%
Do your part to help your community	55%	48%
Increase comfort of my space	28%	23%
Improve the appearance of my space	25%	25%
Other	0%	4%
Don't know	0%	0%

Q6. [IF S1 INDICATES HAD EFFICIENCY ASSESSMENT] To what extent do you agree with each of the following statements about your energy assessment experience:

*Scheduling the assessment was easy*

Response Option	Fort Collins (n=40)	Total (n=56)
1- Do not at all agree	0%	0%
2	0%	0%
3	0%	2%
4	18%	14%

## Energy Efficiency Programs Evaluation

Response Option	Fort Collins (n=40)	Total (n=56)
5- Completely agree	80%	82%
Don't know	2%	2%

*The time required to complete the assessment was reasonable*

Response Option	Fort Collins (n=40)	Total (n=56)
1- Do not at all agree	0%	0%
2	0%	0%
3	0%	2%
4	25%	25%
5- Completely agree	70%	68%
Don't know	5%	5%

*The people who conducted the assessment were responsive to my needs and concerns*

Response Option	Fort Collins (n=40)	Total (n=56)
1- Do not at all agree	0%	0%
2	0%	0%
3	0%	0%
4	28%	25%
5- Completely agree	70%	71%
Don't know	2%	4%

*The roles of all the people who attended the assessment were clear*

Response Option	Fort Collins (n=40)	Total (n=56)
1- Do not at all agree	0%	0%
2	0%	0%
3	8%	5%
4	27%	25%
5- Completely agree	60%	64%
Don't know	5%	5%

*The findings from the assessment were presented in an understandable way*

Response Option	Fort Collins (n=40)	Total (n=56)
1- Do not at all agree	0%	0%
2	0%	0%
3	5%	4%

## Energy Efficiency Programs Evaluation

Response Option	Fort Collins (n=40)	Total (n=56)
4	18%	21%
5- Completely agree	75%	73%
Don't know	2%	2%

*I learned something new about how to make my business more energy efficient*

Response Option	Fort Collins (n=40)	Total (n=56)
1- Do not at all agree	0%	0%
2	0%	2%
3	8%	16%
4	30%	27%
5- Completely agree	60%	54%
Don't know	2%	2%

*The next steps to make the recommended improvements to my business were clear*

Response Option	Fort Collins (n=40)	Total (n=56)
1- Do not at all agree	0%	0%
2	0%	0%
3	3%	5%
4	25%	21%
5- Completely agree	70%	70%
Don't know	2%	4%

Q7. [IF S1 INDICATES HAD EFFICIENCY ASSESSMENT] Did you move forward with all, some, or none of the recommended measures from your energy assessment?

Response Option	Fort Collins (n=40)	Total (n=56)
All	40%	43%
Some	50%	48%
None	5%	5%
Don't know	5%	4%

Q8. [IF Q7 = SOME OR NONE] What types of recommended measures did you **not** move forward with? Select all that apply. *Multiple Responses Allowed*

Response Option	Fort Collins (n=22)	Total (n=31)
Lighting	45%	45%
Cooling equipment	45%	35%

## Energy Efficiency Programs Evaluation

Response Option	Fort Collins (n=22)	Total (n=31)
Insulation or windows	32%	29%
Food service equipment	27%	23%
Grocery display cases or refrigerated warehouses	9%	13%
Office equipment and appliances	14%	13%
Variable frequency drives (VFDs)	18%	13%
Water-saving measures	23%	19%
Business Tune-up (BTU) Retro-commissioning	14%	10%
Other	9%	13%
Don't know	0%	0%

Q9. [IF Q8 LIGHTING IS SELECTED] Why did you *not* move forward with all of the recommended **lighting** measures from your audit? (Select all that apply). *Multiple Responses Allowed*

Response Option	Fort Collins (n=10)	Total (n=14)
Recently upgraded lighting	0%	14%
Too expensive	50%	43%
Not enough time	10%	7%
Not enough return on investment	30%	36%
Other	20%	14%
Don't know	0%	0%

Q10. [IF Q8 NONLIGHTING MEASURE IS SELECTED] Why did you *not* move forward with all of the recommended **non-lighting** measures from your audit? (Select all that apply) *Multiple Responses Allowed*

Response Option	Fort Collins (n=18)	Total (n=25)
Recently upgraded lighting	11%	16%
Too expensive	56%	54%
Not enough time	11%	8%
Not enough return on investment	28%	28%
Other	22%	24%
Don't know	6%	4%

Q11. [IF Q7 = SOME, NONE, OR DON'T KNOW] What could Efficiency Works, [Utility Name], your assessor or your contractor have done differently that would have helped you move forward



with more of the recommended measures from your audit? *Open Ended Coded Responses, Multiple Responses Allowed*

Coded Responses	Fort Collins (n=24)	Total (n = 33)
Nothing	33%	39%
Very satisfied; no improvements needed	21%	21%
Improve affordability of projects; offer more or larger rebates	21%	15%
Strengthen assessors' knowledge	9%	9%
Other	8%	15%

Q12. [IF S1 INDICATES HAD EFFICIENCY ASSESSMENT] In your opinion, why don't more businesses like yours take advantage of business energy assessments from Efficiency Works or [Utility Name]? Select all that apply. *Multiple Responses Allowed*

Response Option	Fort Collins (n=40)	Total (n=56)
They are unable to devote the time and effort required	40%	38%
They are not aware of them	83%	84%
Efficiency is not a priority for their business	23%	25%
They are not convinced the information they gain will be worth the time and effort required	45%	46%
They believe their businesses are already as energy efficient as they can be	13%	14%
Other	3%	4%
Don't know	5%	4%

Q13. [IF S1 INDICATES HAD EFFICIENCY ASSESSMENT] Would you recommend using business energy assessments from Efficiency Works and [Utility Name] to other businesses like yours?

Response Option	Fort Collins (n=40)	Total (n=56)
Yes	100%	100%
Maybe	0%	0%
No	0%	0%
Don't know	0%	0%

Q14. [IF Q13 = MAYBE, NO, OR DON'T KNOW] Why would you not recommend using Efficiency Works business energy assessments to other businesses like yours?

*No respondents met display criteria*

Q15. [IF S1 INDICATES HAD EFFICIENCY ASSESSMENT] Did the assessor mention Efficiency Works Business Tune-Up retro-commissioning program during your assessment?

Response Option	Fort Collins (n=40)	Total (n=56)
Yes	28%	30%
No	18%	18%
Don't know	55%	52%

Q16. [IF S1 INDICATES CONDUCTED REBATED PROJECT] Which of the following circumstances was the primary reason that prompted you to conduct your project?

Response Option	Fort Collins (n=57)	Total (n=79)
Replacing failed equipment	21%	16%
Part of a larger renovation or update to space	14%	15%
Wanted to save energy and reduce bills	60%	62%
Other	5%	5%
Don't know	0%	1%

Q17. [IF S1 INDICATES CONDUCTED REBATED PROJECT] Why was your business interested in having an energy efficiency equipment installed? Select all that apply. *Multiple Responses Allowed*

Response Option	Fort Collins (n=57)	Total (n=79)
Payback on investment	60%	58%
Availability of utility rebates	77%	75%
Age/condition of existing equipment	49%	47%
My business's policies/standards require energy efficient equipment	7%	10%
Previous experience with the utility program	26%	20%
Previous experience with a similar efficient measure	30%	25%
Recommendation from a vendor/supplier	42%	38%
Other	5%	6%
Don't know	0%	1%

Q18. [IF S1 INDICATES CONDUCTED REBATED PROJECT] Did you complete the rebate application or did your contractor complete it?

Response Option	Fort Collins (n=57)	Total (n=79)
I completed the rebate application on my own	23%	25%
My contractor completed the rebate application	46%	43%
My contractor and I completed the rebate application together	21%	23%

Response Option	Fort Collins (n=57)	Total (n=79)
Other	7%	5%
Don't know	4%	4%

Q19. [IF Q18 = COMPLETED APPLICATION ON MY OWN OR WITH CONTRACTOR] To what extent do you agree with each of the following statements about your rebate application experience:

*Completing the application was easy*

Response Option	Fort Collins (n=25)	Total (n=38)
1- Do not at all agree	0%	0%
2	8%	5%
3	16%	21%
4	20%	18%
5- Completely agree	56%	55%
Don't know	0%	0%

*The time required to complete the application was reasonable*

Response Option	Fort Collins (n=25)	Total (n=38)
1- Do not at all agree	0%	0%
2	0%	0%
3	16%	13%
4	16%	21%
5- Completely agree	68%	66%
Don't know	0%	0%

*The information required for the rebate application was reasonable*

Response Option	Fort Collins (n=25)	Total (n=38)
1- Do not at all agree	0%	0%
2	4%	3%
3	16%	13%
4	16%	21%
5- Completely agree	64%	63%
Don't know	0%	0%

Q20. [IF S1 INDICATES CONDUCTED REBATED PROJECT] How did you find the contractor that installed the energy efficiency improvements?

Response Option	Fort Collins (n=57)	Total (n=79)
Efficiency Works website	2%	1%
Efficiency Works assessment	9%	8%
Had worked with the contractor previously	44%	46%
Referral	16%	16%
Other	19%	18%
Don't know	6%	7%

Q21. [IF Q20 = EFFICIENCY WORKS WEBSITE OR ASSESSMENT] To what extent do you agree that the process of finding a contractor was easy?

Response Option	Fort Collins (n=6)	Total (n=7)
1- Do not at all agree	0%	0%
2	0%	0%
3	0%	0%
4	17%	29%
5- Completely agree	50%	43%
Don't know	33%	29%

Q22. [IF Q21 <4] What about the process of finding a contractor was difficult?

*No respondents met display criteria*

Q23. [IF S1 INDICATES CONDUCTED REBATED PROJECT] Certain types of projects, and all projects over a certain size, require pre-approval from Efficiency Works and [Utility Name], meaning they have to have an application form approved before installing their energy efficiency improvements. Did your project require pre-approval?

Response Option	Fort Collins (n=57)	Total (n=79)
Yes	58%	58%
No	16%	18%
Don't know	26%	24%

Q24. [IF Q23 = YES] To what extent, if any, did the pre-approval process result in any delays in your project?

Response Option	Fort Collins (n=33)	Total (n=46)
No delays	58%	59%
A week or less	9%	11%

## Energy Efficiency Programs Evaluation

Response Option	Fort Collins (n=33)	Total (n=46)
A few weeks	18%	15%
A few months	6%	4%
Other	6%	2%
Don't know	3%	9%

Q25. [IF S1 INDICATES CONDUCTED REBATED PROJECT] How satisfied are you with each of the following aspects of your experience installing energy efficiency improvements and receiving a rebate?

### *The contractor's responsiveness to your needs and concerns*

Response Option	Fort Collins (n=57)	Total (n=79)
1- Extremely dissatisfied	5%	4%
2- Somewhat dissatisfied	4%	3%
3- Neither satisfied nor dissatisfied	7%	5%
4- Somewhat satisfied	16%	18%
5- Extremely satisfied	60%	62%
Don't know	9%	9%

### *The contractor's professionalism*

Response Option	Fort Collins (n=57)	Total (n=79)
1- Extremely dissatisfied	0%	0%
2- Somewhat dissatisfied	4%	3%
3- Neither satisfied nor dissatisfied	12%	9%
4- Somewhat satisfied	18%	16%
5- Extremely satisfied	58%	62%
Don't know	9%	10%

### *The quality of the contractor's work*

Response Option	Fort Collins (n=57)	Total (n=79)
1- Extremely dissatisfied	0%	0%
2- Somewhat dissatisfied	2%	1%
3- Neither satisfied nor dissatisfied	9%	6%
4- Somewhat satisfied	23%	23%
5- Extremely satisfied	58%	59%
Don't know	9%	10%

*The time required to receive your rebate*

Response Option	Fort Collins (n=57)	Total (n=79)
1- Extremely dissatisfied	0%	0%
2- Somewhat dissatisfied	0%	0%
3- Neither satisfied nor dissatisfied	7%	8%
4- Somewhat satisfied	28%	27%
5- Extremely satisfied	60%	62%
Don't know	5%	4%

*The rebate amount*

Response Option	Fort Collins (n=57)	Total (n=79)
1- Extremely dissatisfied	0%	0%
2- Somewhat dissatisfied	2%	1%
3- Neither satisfied nor dissatisfied	12%	13%
4- Somewhat satisfied	26%	25%
5- Extremely satisfied	60%	61%
Don't know	0%	0%

*The job the contractor did in managing the project*

Response Option	Fort Collins (n=57)	Total (n=79)
1- Extremely dissatisfied	4%	3%
2- Somewhat dissatisfied	4%	3%
3- Neither satisfied nor dissatisfied	11%	9%
4- Somewhat satisfied	16%	19%
5- Extremely satisfied	58%	59%
Don't know	9%	8%

*The job the contractor did in providing labor for the project*

Response Option	Fort Collins (n=57)	Total (n=79)
1- Extremely dissatisfied	2%	1%
2- Somewhat dissatisfied	2%	1%
3- Neither satisfied nor dissatisfied	4%	3%
4- Somewhat satisfied	25%	25%
5- Extremely satisfied	60%	57%
Don't know	9%	13%

*The job the contractor did in providing materials for the project*

Response Option	Fort Collins (n=57)	Total (n=79)
1- Extremely dissatisfied	2%	1%
2- Somewhat dissatisfied	4%	3%
3- Neither satisfied nor dissatisfied	5%	4%
4- Somewhat satisfied	23%	25%
5- Extremely satisfied	60%	61%
Don't know	7%	6%

Q26. [IF S1 INDICATES CONDUCTED REBATED PROJECT] We would also like to know about your experience after the energy upgrades were installed. To what extent do you agree that, after installing the upgrades:

*Your business space is more comfortable*

Response Option	Fort Collins (n=57)	Total (n=79)
1- Do not at all agree	5%	4%
2	2%	1%
3	14%	14%
4	21%	19%
5- Completely agree	46%	52%
Don't know	12%	10%

*Your monthly energy bills are lower*

Response Option	Fort Collins (n=57)	Total (n=79)
1- Do not at all agree	4%	3%
2	4%	3%
3	12%	13%
4	12%	18%
5- Completely agree	42%	43%
Don't know	26%	22%

*Your monthly maintenance costs are lower*

Response Option	Fort Collins (n=57)	Total (n=79)
1- Do not at all agree	2%	1%
2	4%	3%
3	14%	11%
4	19%	20%

## Energy Efficiency Programs Evaluation

Response Option	Fort Collins (n=57)	Total (n=79)
5- Completely agree	46%	49%
Don't know	16%	15%

*Your business space is more attractive*

Response Option	Fort Collins (n=57)	Total (n=79)
1- Do not at all agree	7%	5%
2	2%	1%
3	19%	15%
4	19%	22%
5- Completely agree	40%	47%
Don't know	12%	10%

Q27. [IF S1 INDICATES CONDUCTED REBATED PROJECT] In your opinion, why don't more businesses like yours take advantage of Efficiency Works energy efficiency rebates? Select all that apply.  
*Multiple Responses Allowed*

Response Option	Fort Collins (n=57)	Total (n=79)
They cannot afford to make energy efficiency improvements	28%	28%
They do not have the time or staff capacity to manage an energy efficiency improvement project	46%	44%
They are not aware of them	72%	76%
Efficiency is not a priority for their business	33%	29%
They believe their businesses are already as energy efficient as they need to be	18%	16%
Other	5%	5%
Don't know	11%	8%

Q28. [IF S1 INDICATES CONDUCTED REBATED PROJECT] Would you recommend efficiency rebates from Efficiency Works and [Utility Name] for upgrading equipment to other businesses like yours?

Response Option	Fort Collins (n=57)	Total (n=79)
Yes	98%	99%
Maybe	2%	1%
No	0%	0%
Don't know	0%	0%



Q29. [IF Q28 = NO OR DON'T KNOW] Why would you not recommend using efficiency rebates from Efficiency Works and [Utility Name] for upgrading equipment to other businesses like yours?

*No respondents met display criteria*

Q30. What additional efficiency measures that are not offered through Efficiency Works would be helpful for your business to increase energy efficiency? *Open Ended Coded Response, Multiple Responses Allowed*

Coded Response	Fort Collins (n=57)	Total (n=79)
None / can't think of any	23%	20%
New HVAC	4%	4%
Solar or Electric storage	2%	3%
On-demand water heater	2%	1%
Other	11%	9%
Not answered	60%	63%

Q31. [IF S1 INDICATES CONDUCTED REBATED PROJECT] If you had not received a rebate(s) from Efficiency Works and [Utility Name] for the measures you installed for the [Project Name] project, which of the following would you most likely have done?

Response Option	Fort Collins (n=57)	Total (n=79)
Not installed any measures	28%	27%
Installed some measures, but not others	21%	18%
Delayed installing measures	14%	20%
Installed less efficient measures	11%	10%
Installed the same measures, but paid the full cost yourself	23%	22%
Other	4%	4%

Q32. [IF Q31 = INSTALLED THE SAME MEASURE BUT PAID THE FULL COST YOURSELF] If your business had not received the incentive from your utility, would you say it definitely would have, might have, or definitely would not have had the funds, internal or other, to cover the entire cost of the [project name] project?

Response Option	Fort Collins (n=13)	Total (n=17)
Definitely would have	62%	47%
Maybe	31%	41%
Definitely would NOT have	0%	0%
Other	0%	0%
Don't know	8%	12%

Q33. [IF S1 INDICATES CONDUCTED REBATED PROJECT] How influential were each of the following elements of the efficiency works and [UTILITY NAME] program in your decision to install the energy efficient equipment you installed for the [project name] project?

*THE REBATE YOUR RECEIVED*

Response Option	Fort Collins (n=57)	Total (n=79)
1- Not at all influential	5%	4%
2	0%	0%
3	7%	8%
4	19%	22%
5- Very influential	65%	63%
Not applicable	2%	1%
Don't know	2%	3%

*ANY OTHER TECHNICAL ASSISTANCE YOU RECEIVED FROM EFFICIENCY WORKS AND [UTILITY NAME]*

Response Option	Fort Collins (n=57)	Total (n=79)
1- Not at all influential	12%	10%
2	4%	4%
3	9%	16%
4	28%	25%
5- Very influential	23%	23%
Not applicable	18%	14%
Don't know	7%	8%

*YOUR CONTRACTOR'S RECOMMENDATION*

Response Option	Fort Collins (n=57)	Total (n=79)
1- Not at all influential	5%	4%
2	0%	0%
3	12%	10%
4	25%	27%
5- Very influential	51%	51%
Not applicable	7%	6%
Don't know	0%	3%

Q34. Because of your experience with the Efficiency Works and [Utility Name] program, have you bought and installed energy efficient equipment at your business without applying for a rebate or bill credit from [Utility Name]?

Response Option	Fort Collins (n=65)	Total (n=89)
Yes, installed energy efficient equipment because of my experience and did not apply for a rebate	34%	35%
No, installed energy efficient equipment, and applied for a rebate	25%	29%
No, did not purchase energy efficient equipment	29%	22%
Don't know	12%	13%

Q35. [IF Q34 = YES] What type of energy efficient equipment have you installed in your business without receiving a rebate from Efficiency Works and [Utility Name]? **Multiple Responses Allowed**

Response Option	Fort Collins (n=22)	Total (n=31)
Lighting	73%	74%
Cooling equipment	36%	32%
Insulation or windows	18%	13%
Food service equipment	9%	13%
Grocery display cases or refrigerated warehouses	0%	0%
Office equipment and/or appliances	18%	19%
Variable frequency drives (VFDs)	14%	13%
Water-saving measures	36%	35%
Business Tune-up (BTU) Retro-commissioning	5%	3%
Other	5%	6%
Don't know	0%	0%

Q36. [IF Q35 LIGHTING IS SELECTED] What type of efficient lighting and how many did you install in your business without receiving a rebate from the Efficiency Works and [Utility Name] program? Select all that apply. **Multiple Responses Allowed**

Response Option	Fort Collins (n=16)	Total (n=23)
Automatic controls	44%	30%
LED new hardwired fixtures	38%	26%
LED retrofit kits	25%	17%
Fixtures retrofitted to LED	13%	9%
LED replacement lamps	44%	30%
T8 or T5 Upgrades	19%	13%

## Energy Efficiency Programs Evaluation

Response Option	Fort Collins (n=16)	Total (n=23)
Other	6%	4%
Don't know	19%	13%

Q37. What type of efficient cooling equipment and how many did you install in your business without receiving a rebate from the Efficiency Works and [Utility Name] program? Select all that apply.  
*Multiple Responses Allowed*

Response Option	Fort Collins (n=8)	Total (n=10)
Split/Unitary cooling units	38%	30%
Packaged Terminal Air Conditioning (PTAC) units	25%	20%
Evaporative condensing units	0%	10%
Advanced evaporative cooling units	0%	0%
Air economizers	25%	20%
PTAC/PTHP Controls	13%	10%
Advanced RTU Controllers	13%	10%
Premium ventilation package units	13%	10%
Other	0%	0%
Don't know	25%	20%

Q38. What type of efficient insulation or windows and how many did you install in your business without receiving a rebate from the Efficiency Works and [Utility Name] program? Select all that apply. *Multiple Responses Allowed*

Response Option	Fort Collins (n=4)	Total (n=4)
Efficient windows (Tier 1)	25%	25%
Efficient windows (Tier 2)	50%	50%
Window films	50%	50%
Roof insulation	0%	0%
Wall insulation	25%	25%
Cool roof	25%	25%
Other	25%	25%
Don't know	0%	0%

## Energy Efficiency Programs Evaluation

Q39. What type of efficient food service equipment and how many did you install in your business without receiving a rebate from the Efficiency Works and [Utility Name] program? Select all that apply. *Multiple Responses Allowed*

Response Option	Fort Collins (n=1)	Total (n=3)
High efficiency ice machine - (CEE Tier 2)	0%	0%
High efficiency ice machine - (ENERGY STAR)	0%	0%
Insulated Hot Food Holding Cabinets (min 7 cu ft)	0%	33%
Reach-in refrigerators and Freezers (<19 cu ft)	0%	0%
Reach-in refrigerators and Freezers (19 -30 cu ft)	0%	0%
Reach-in refrigerators and Freezers (31 -60 cu ft)	0%	33%
Reach-in refrigerators and Freezers (61 -90 cu ft)	0%	0%
Electric steamers	0%	0%
Electric fryers	0%	0%
Electric griddles	0%	0%
Combination ovens – electric	0%	0%
Convection ovens – electric	0%	0%
Vent hood controls w/ VFC fans and sensors	0%	0%
Other	0%	0%
Don't know	100%	33%

Q40. What type of efficient grocery display cases or refrigerated warehouses and how many did you tune-up or upgrade in your business without receiving a rebate from the Efficiency Works and [Utility Name] program? Select all that apply.

*No respondents met display criteria*

Q41. What type of efficient office equipment and/or appliances and how many did you install in your business without receiving a rebate from the Efficiency Works and [Utility Name] program? Select all that apply. *Multiple Response Allowed*

Response Option	Fort Collins (n=3)	Total (n=6)
Desktop/side computer	33%	33%
Thin client	0%	0%
Server virtualization (replacing existing server)	33%	33%
ENERGY STAR LED desk lamp (replacing incandescent)	67%	33%
ENERGY STAR LED undercabinet fixture (replacing fluorescent)	33%	17%
ENERGY STAR torchiere (replacing incandescent/halogen floor lamp)	0%	0%

## Energy Efficiency Programs Evaluation

Response Option	Fort Collins (n=3)	Total (n=6)
Smart strip energy efficient surge protector	33%	17%
Plug strip w/ motion sensor or occupancy schedule	33%	17%
Vending machine with occupancy or schedule controls	0%	0%
Other	0%	17%
Don't know	33%	17%

Q42. What was the horse power of the Motor VFD(s)you installed and how many did you install in your business without receiving a rebate from the Efficiency Works and [Utility Name] program? Select all that apply. *Multiple Responses Allowed*

Response Option	Fort Collins (n=3)	Total (n=4)
1 – 5	33%	50%
7.5 - 10	0%	0%
15 - 20	0%	0%
25 - 30	0%	0%
40 - 50	0%	0%
60 -75	0%	0%
Other	0%	0%
Don't know	67%	50%

Q43. What type of water-saving measures and how many did you install in your business without receiving a rebate from the Efficiency Works and [Utility Name] program? Select all that apply.

Response Option	Fort Collins (n=8)	Total (n=11)
Ice machine	25%	18%
Electric steamers	13%	9%
Residential clothes washer	13%	9%
Commercial clothes washer vended	13%	9%
Commercial clothes washer non-vended	0%	0%
Residential dishwasher	0%	0%
Commercial dishwasher	13%	18%
Tank toilets (less than 1.28 GPF)	25%	18%
Premium tank toilets (1.0 GPF or less)	13%	9%
Flush valve toilets (less than 1.28 GPF)	0%	0%
Urinals (less than .5 GPF)	0%	0%
Ultra-low flow aerators (.5 GPM or less)	38%	36%

## Energy Efficiency Programs Evaluation

Response Option	Fort Collins (n=8)	Total (n=11)
Low flow aerators (1.0 GPM or less)	13%	9%
Low flow pre-rinse spray valves	0%	0%
Low flow shower heads	0%	0%
Irrigation rain sensor	25%	18%
Soil moisture sensor	0%	0%
Irrigation controller or add-on weather station	25%	18%
High efficiency nozzles	13%	9%
Pressure reducing heads	0%	0%
Pressure regulators (PRV or zone valve)	0%	0%
Commercial sprinkle audit	13%	9%
Other	13%	9%
Don't know	13%	18%

Q44. What type of retro-commissioning measures did you conduct in your business without receiving a rebate from the Efficiency Works and [Utility Name] program?

Verbatim responses	Total (n=1)
I checked this box because we are continuously doing things but many are likely too small to qualify for a rebate or, they happen outside of a timeline where the rebate process would be possible...???	100%

Q45. What type of energy efficient [PIPE RESPONSE FROM Q35\_96] did you install in your business without receiving a rebate from the Efficiency Works and [Utility Name] program and how many?

Verbatim responses	Total (n=2)
Just a regular refrigerator. Just one	50%
2 lighted emergency exit signs.	50%

Q46. [IF Q34 = YES] How important was your experience with Efficiency Works and [Utility Name] on your decision to buy and install the additional energy efficiency items?

Response Option	Fort Collins (n=22)	Total (n=31)
Not at all important	0%	3%
Not very important	9%	10%
Somewhat important	18%	26%
Very important	64%	52%
Extremely important	9%	10%

## Energy Efficiency Programs Evaluation

Response Option	Fort Collins (n=22)	Total (n=31)
Don't know	0%	0%

Q47. [IF Q34 = YES] Why didn't you receive a rebate for installing these energy efficient measures?

Response Option	Fort Collins (n=22)	Total (n=31)
Rebates are not available for the type of improvement or equipment installed	27%	26%
Rebates are available for that type of improvement or equipment, but the specific variety you installed did not qualify	9%	6%
You do not know whether rebates were available for the improvement or equipment you installed	36%	32%
You did not want to go through the process of applying for the rebate	18%	19%
Other	18%	26%
Don't know	9%	10%

Q48. Including yourself, how many employees work at the [Site Address] location?

Response Option	Fort Collins (n=65)	Total (n=89)
1	2%	1%
2-4	17%	21%
5-9	18%	17%
10-19	18%	18%
20-99	20%	22%
100-499	11%	8%
500 or more	5%	4%
Don't know	6%	6%
Prefer not to answer	3%	2%

Q49. How many locations does your organization have?

Response Option	Fort Collins (n=65)	Total (n=89)
1	48%	45%
2-4	17%	17%
5-9	6%	8%
10-19	3%	4%
20-99	6%	6%
100-499	3%	3%



## Energy Efficiency Programs Evaluation

Response Option	Fort Collins (n=65)	Total (n=89)
500 or more	8%	7%
Don't know	5%	6%
Prefer not to answer	5%	4%

Q50. What is the principal industry of your organization?

Response Option	Fort Collins (n=65)	Total (n=89)
Education	5%	4%
Entertainment	0%	0%
Financial	3%	4%
Food Sales	2%	2%
Food Service	12%	10%
Health Care	12%	10%
Lodging	0%	1%
Manufacturing	0%	1%
Mixed Use	3%	4%
Office	2%	1%
Parking	0%	0%
Public Service	2%	1%
Religious	14%	11%
Residential	0%	0%
Retail	15%	16%
Service	6%	6%
Storage	0%	2%
Tech/Science	5%	4%
Utility	0%	0%
Other	20%	20%
Don't know	0%	0%
Prefer not to answer	0%	0%

## H.2. Residential Participant Survey

S1. Who in your household is most often responsible for the following types of actions? Please select one answer for each action.

### *Paying Utility Bills*

Response Option	Fort Collins (n = 375)	Total (n = 451)
I am solely responsible	67%	67%
I share responsibility	29%	29%
Someone else is responsible	3%	3%

### *Purchasing Energy-Using Appliances or Light Bulbs*

Response Option	Fort Collins (n = 375)	Total (n = 451)
I am solely responsible	42%	43%
I share responsibility	58%	57%
Someone else is responsible	1%	0%

### *Making Decisions about Home Upgrades or Renovations*

Response Option	Fort Collins (n = 375)	Total (n = 451)
I am solely responsible	30%	32%
I share responsibility	68%	67%
Someone else is responsible	1%	1%

S2. [IF NOT CORRECT CONTACT] Please provide the contact information for the person in your household who is responsible for the following action(s).

*Open ended Response Options used for finding the appropriate contact. No data to report.*

### H.2.1. Efficiency Works Homes

Q1. [IF RECORDS SHOW PARTICIPATED IN EW-H AND S1 PAY UTILITY BILLS OR S1 PURCHASE ENERGY USING APPLIANCE = SOLELY RESPONSIBLE OR SHARE RESPONSIBILITY] Our records show your household received a home efficiency audit through Efficiency Works and [Utility Name]. Is that correct?

Response Option	Fort Collins (n = 195)	Total (n = 271)
Yes - My household received an efficiency audit	98%	99%
No - My household did not receive an efficiency audit	1%	0%
Don't know	1%	1%

Q2. [IF Q1 = NO OR DON'T KNOW] In the past year, has someone visited your home to identify opportunities to make it more energy efficient? If so, we'll refer to that as your "home efficiency audit."

Response Option	Fort Collins (n = 1)	Total (n = 1)
Yes - My household received an efficiency audit	100%	100%
No - My household did not receive an efficiency audit	0%	0%
Don't know	0%	0%

Q3. [IF Q1=YES OR Q2 =YES] We would like to hear from a household member who was directly involved in the home efficiency audit. Were you involved in the audit?

Response Option	Fort Collins (n = 193)	Total (n = 268)
Yes - I was involved in the efficiency audit	98%	99%
No - I was not involved in the efficiency audit	2%	1%
Don't know	0%	0%

Q4. [IF Q3 = YES] We'd like to know why were you interested in having an efficiency audit performed on your home. Were you interested in learning about ways to... *Multiple Responses Allowed*

Response Option	Fort Collins (n = 190)	Total (n = 264)
Reduce my energy bills	83%	100%
Help the environment or community	63%	72%
Make my home more comfortable	67%	84%
Prepare my home for sale	2%	3%
Improve my newly purchased home	24%	29%
Other	19%	22%
Don't know	0%	0%

Q5. [IF Q3 = YES] To what extent do you agree with each of the following statements?

*Scheduling the Audit was Easy*

Response Option	Fort Collins (n = 190)	Total (n = 264)
1- Do not at all agree	0%	0%
2	2%	2%
3	6%	6%
4	19%	19%
5- Completely agree	73%	74%
Don't know	0%	0%

*The time requires to complete the audit was reasonable*

Response Option	Fort Collins (n = 190)	Total (n = 264)
1- Do not at all agree	0%	0%
2	2%	1%
3	5%	4%
4	26%	24%
5- Completely agree	67%	70%
Don't know	1%	1%

*The person who conducted the audit was responsive to my needs and concerns*

Response Option	Fort Collins (n = 190)	Total (n = 264)
1- Do not at all agree	0%	0%
2	1%	1%
3	4%	3%
4	18%	18%
5- Completely agree	76%	76%
Don't know	1%	1%

*The findings from the audit were easy to understand*

Response Option	Fort Collins (n = 190)	Total (n = 264)
1- Do not at all agree	0%	0%
2	1%	2%
3	8%	6%
4	32%	32%
5- Completely agree	60%	60%
Don't know	0%	0%

*I learned something new about how to make my home more efficient*

Response Option	Fort Collins (n = 190)	Total (n = 264)
1- Do not at all agree	1%	1%
2	4%	3%
3	7%	8%
4	20%	19%
5- Completely agree	68%	68%
Don't know	1%	0%

*I understood the next steps needed to make the recommended improvements*

Response Option	Fort Collins (n = 190)	Total (n = 264)
1- Do not at all agree	0%	1%
2	3%	3%
3	9%	8%
4	28%	25%
5- Completely agree	60%	63%
Don't know	1%	1%

Q6. [IF Q3 = YES AND ONLY DISPLAYED IF PROGRAM DATA INDICATES RESPONDENT RECEIVED] For each of the following, please indicate whether the person who conducted your home efficiency audit installed the item and whether it is still in place.

*New Aerators on Your Faucets*

Response Option	Fort Collins (n = 15)	Total (n = 30)
The assessor installed the item and it is still in place	60%	77%
The assessor installed the item, but it has been removed	0%	3%
The assessor did not install the item	40%	20%
Don't know	0%	0%

*Standard LED Lightbulbs*

Response Option	Fort Collins (n = 97)	Total (n = 139)
The assessor installed the item and it is still in place	29%	35%
The assessor installed the item, but it has been removed	2%	1%
The assessor did not install the item	67%	61%
Don't know	2%	2%

*LED Lightbulbs for Recessed Fixtures*

Response Option	Fort Collins (n = 52)	Total (n = 78)
The assessor installed the item and it is still in place	35%	37%
The assessor installed the item, but it has been removed	0%	1%
The assessor did not install the item	65%	60%
Don't know	0%	1%

*New Showerhead(s)*

Response Option	Fort Collins (n = 25)	Total (n = 43)
The assessor installed the item and it is still in place	48%	49%
The assessor installed the item, but it has been removed	0%	5%
The assessor did not install the item	52%	47%
Don't know	0%	0%

*A Water Displacement Bag in your Toilet Tank*

Response Option	Fort Collins (n = 5)	Total (n = 10)
The assessor installed the item and it is still in place	80%	50%
The assessor installed the item, but it has been removed	0%	10%
The assessor did not install the item	20%	40%
Don't know	0%	0%

Q7. [IF ANY ITEM IN Q6 = REMOVED] Why did your household remove the item(s) your assessor installed? [OPEN-ENDED *Open Ended Coded Response, Multiple Responses Allowed*]

*New Aerators*

Coded Response	Fort Collins (n = 0)	Total (n = 1)
New aerators on your faucets	-	100%

*Standard LED lights*

Response Option	Fort Collins (n = 2)	Total (n = 3)
Too small or too bright	100%	67%
Didn't like the look	0%	33%

*New Showerheads*

Response Option	Fort Collins (n = 0)	Total (n = 1)
Not effective	-	100%

*Water displacement bad*

Response Option	Fort Collins (n = 0)	Total (n = 1)
Toilet stopped working with it		100%

Q8. [IF Q3 = YES] How did the assessor describe the energy efficiency opportunities they identified in your home?

Response Option	Fort Collins (n = 190)	Total (n = 264)
The grouped them into “good”, “better”, and “best” packages	27%	27%
They presented a menu of individual options	48%	46%
Other	12%	12%
Don’t know	13%	15%

Q9. [IF Q3 = YES] Which of the following statements best describes how you felt about the options the assessor presented?

Response Option	Fort Collins (n = 190)	Total (n = 264)
There were too many options. It was difficult to identify the best path to take	5%	5%
There were too few options. I couldn’t find one to meet my needs.	3%	2%
The number of options was about right. I found one that met my needs.	71%	73%
Other	16%	14%
Don’t know	5%	6%

Q10. [IF Q3 = YES] When you received your audit recommendations, how much effort did you anticipate the recommended improvements would require of you? (Effort in terms of choosing exactly what to do, selecting a contractor, scheduling the work, etc.)

Response Option	Fort Collins (n = 190)	Total (n = 264)
A great deal of effort	13%	11%
A moderate amount of effort	49%	52%
Some effort	26%	27%
Not much effort	8%	6%
Very little effort	3%	2%
Don’t know	1%	2%

Q11. [IF Q3 = YES] Do you recall communicating with an efficiency adviser? The adviser may have helped you schedule your audit, reviewed your audit with you, helped you find a contractor, or provided other advice by phone or email.

Response Option	Fort Collins (n = 190)	Total (n = 264)
Yes	78%	81%
No	10%	9%
Don't know	12%	10%

Q12. [IF Q11 = YES] Did you ask any questions of, or seek any advice from, the efficiency adviser?

Response Option	Fort Collins (n = 148)	Total (n = 215)
Yes	77%	82%
No	18%	13%
Don't know	5%	5%

Q13. [IF Q12 = YES] How helpful did you find the efficiency advisor's assistance and advice?

Response Option	Fort Collins (n = 113)	Total (n = 176)
Not at all helpful	1%	1%
Not very helpful	3%	3%
Somewhat helpful	20%	18%
Very helpful	45%	48%
Extremely helpful	30%	30%
Don't know	1%	1%

Q14. [IF Q11 = YES] Neither the assessor nor the efficiency adviser receive any direct financial benefit if you decide to install energy efficiency upgrades. How important was it that you could turn to someone other than a contractor for advice when making decisions about energy upgrades.

Response Option	Fort Collins (n = 148)	Total (n = 215)
Not at all important	0%	0%
Not very important	5%	4%
Somewhat important	18%	16%
Very important	39%	39%
Extremely important	37%	39%
Don't know	1%	1%



Q15. [IF RECORDS INDICATE ANY INCENTIVIZED MEASURE WAS INSTALLED] Our records indicate that your household received a rebate from [Utility Name] for making the energy efficiency improvements listed below. Is that correct?

*Sealing My Home Against Air Leakage*

Response Option	Fort Collins (n = 68)	Total (n = 86)
Yes- made improvement and received rebate	91%	90%
Made improvement, but did not receive rebate	1%	3%
No, did not make improvement	0%	0%
Don't know	7%	7%

*Adding Insulation*

Response Option	Fort Collins (n = 84)	Total (n = 113)
Yes- made improvement and received rebate	93%	92%
Made improvement, but did not receive rebate	2%	4%
No, did not make improvement	1%	2%
Don't know	4%	3%

*Sealing and Insulating your Ducts*

No respondents met display criteria

*Replacing My Windows*

Response Option	Fort Collins (n = 10)	Total (n = 13)
Yes- made improvement and received rebate	90%	92%
Made improvement, but did not receive rebate	10%	8%
No, did not make improvement	0%	0%
Don't know	0%	0%

*Replacing the Blower Motor on My Air Handler*

Response Option	Fort Collins (n = 1)	Total (n = 2)
Yes- made improvement and received rebate	100%	100%
Made improvement, but did not receive rebate	0%	0%
No, did not make improvement	0%	0%
Don't know	0%	0%

*Installing a Mechanical Ventilation*

Response Option	Fort Collins (n = 1)	Total (n = 1)
Yes- made improvement and received rebate	100%	100%
Made improvement, but did not receive rebate	0%	0%
No, did not make improvement	0%	0%
Don't know	0%	0%

*Installing a Heat Pump*

No respondents met display criteria

*Installing a Gas Furnace*

Response Option	Fort Collins (n = 46)	Total (n = 68)
Yes- made improvement and received rebate	87%	91%
Made improvement, but did not receive rebate	0%	0%
No, did not make improvement	9%	6%
Don't know	4%	3%

*Installing a Gas Boiler*

No respondents met display criteria

*Installing a Water Heater*

Response Option	Fort Collins (n = 13)	Total (n = 15)
Yes- made improvement and received rebate	77%	73%
Made improvement, but did not receive rebate	0%	0%
No, did not make improvement	8%	7%
Don't know	15%	20%

*Installing Central Air Conditioning*

Response Option	Fort Collins (n = 33)	Total (n = 53)
Yes- made improvement and received rebate	91%	94%
Made improvement, but did not receive rebate	0%	0%
No, did not make improvement	6%	4%
Don't know	3%	2%

*Installing a Whole House Fan*

Response Option	Fort Collins (n = 26)	Total (n = 31)
Yes- made improvement and received rebate	88%	87%
Made improvement, but did not receive rebate	4%	6%
No, did not make improvement	4%	3%
Don't know	4%	3%

*Installing an Evaporative Cooler*

Response Option	Fort Collins (n = 1)	Total (n = 2)
Yes- made improvement and received rebate	100%	50%
Made improvement, but did not receive rebate	0%	50%
No, did not make improvement	0%	0%
Don't know	0%	0%

Q16. [IF Q15 INSTALLING CAC = YES MADE IMPROVEMENT AND RECEIVED REBATE OR MADE IMPROVEMENT BUT DID NOT RECEIVE REBATE] Did the central air conditioning system you installed replace an existing system, or was this the first air conditioning system installed in your home?

Response Option	Fort Collins (n = 30)	Total (n = 50)
The new system replaced an existing one	83%	86%
This was the first central air conditioning system installed in our home	17%	14%
Don't know	0%	0%

Q17. [IF Q16 = THE NEW SYSTEM REPLACED AN EXISTING ONE] Which of the following best describes the condition of your old central air conditioning system?

Response Option	Fort Collins (n = 25)	Total (n = 43)
It was fully operational	48%	35%
It was operational, but required minor repairs	16%	21%
It was operational, but required major repairs	28%	26%
It was not operational	8%	19%
Don't know	0%	0%

Q18. [IF Q17 = IT WAS OPERATIONAL BUT REQUIRED MAJOR REPAIRS] About how much would those repairs have cost? *Open Ended Numerical Response*

Descriptives	Fort Collins (n = 6)	Total (n = 9)
Range	\$1-\$100,000	\$1-\$100,000
Average	\$18584	\$12684

Q19. [IF Q17 = IT WAS FULLY OPERATIONAL] About how old was the central air conditioning system you replaced? *Open Ended Numerical Response*

Descriptives	Fort Collins (n = 12)	Total (n = 15)
Range	3-22 years	3-22 years
Average	19.17 years	18.86 years

Q20. [IF ANY ITEM IN Q15 = YES MADE IMPROVEMENT AND RECEIVED REBATE OR MADE IMPROVEMENT BUT DID NOT RECEIVE REBATE OR DON'T KNOW] Did your home efficiency audit recommend any energy efficiency improvements that you have not made?

Response Option	Fort Collins (n = 127)	Total (n = 183)
Yes, and we plan to make additional improvements in the next six months	18%	17%
Yes, and we do not plan to make additional improvements in the next six months	46%	46%
No, we made all the recommended improvements	30%	28%
Don't know	6%	8%

Q21. [IF RECORDS DO NOT INDICATE AN INCENTIVIZED MEASURE WAS INSTALLED, ALL ITEMS DISPLAYED WHERE Q15 = DID NOT MAKE IMPROVEMENT OR Q20 = YES, AND WE DO NOT PLAN TO MAKE ADDITIONAL IMPROVEMENTS IN THE NEXT SIX MONTHS] Please tell us why you decided not to make some or all of the recommended energy efficiency improvements. *Multiple Responses Allowed*

Response Option	Fort Collins (n = 58)	Total (n = 85)
I did not need them	7%	7%
I could not afford them	50%	48%
My loan application was denied	0%	0%
I did not want to use a program-approved contractor	2%	1%
I was not convinced the benefits would justify the costs	55%	51%
I felt the work would have been too inconvenient	7%	7%
I did not know how to proceed with work	2%	2%
Other	17%	19%

## Energy Efficiency Programs Evaluation

Response Option	Fort Collins (n = 58)	Total (n = 85)
Don't know	2%	1%

Q22. [IF ANY ITEM IN Q15 = YES, MADE IMPROVEMENT AND RECEIVED REBATE OR MADE IMPROVEMENT BUT DID NOT RECEIVE REBATE] How satisfied are you with each of the following aspects of your experience working with the contractor who installed your energy efficiency improvements and receiving a rebate? [Note: The following tables exclude respondents that were shown the question but did not answer]

### *The contractor's responsiveness to your needs and concerns*

Response Option	Fort Collins (n = 120)	Total (n = 176)
1- Not at all satisfied	0%	0%
2	6%	5%
3	5%	6%
4	33%	32%
5- Extremely satisfied	56%	57%
Don't know	0%	0%

### *The contractor's professionalism*

Response Option	Fort Collins (n = 120)	Total (n = 176)
1- Not at all satisfied	1%	1%
2	3%	3%
3	10%	9%
4	28%	27%
5- Extremely satisfied	59%	60%
Don't know	0%	1%

### *The quality of the contractor's work*

Response Option	Fort Collins (n = 121)	Total (n = 177)
1- Not at all satisfied	0%	0%
2	1%	2%
3	9%	10%
4	28%	27%
5- Extremely satisfied	62%	61%
Don't know	1%	1%

### The time it took to receive your rebate

Response Option	Fort Collins (n = 120)	Total (n = 176)
1- Not at all satisfied	2%	3%
2	2%	2%
3	9%	11%
4	35%	38%
5- Extremely satisfied	51%	45%
Don't know	2%	2%

Q23. [IF ANY ITEM IN Q15 = YES, MADE IMPROVEMENT AND RECEIVED REBATE OR MADE IMPROVEMENT BUT DID NOT RECEIVE REBATE] We would also like to know about your experience after making the upgrades. To what extent do you agree with the following statements? *[Note: The following tables exclude respondents that were shown the question but did not answer]*

### My home is more comfortable

Response Option	Fort Collins (n = 119)	Total (n = 175)
1- Do not at all agree	3%	3%
2	4%	5%
3	14%	11%
4	31%	31%
5- Strongly Agree	45%	49%
Don't know	2%	2%

### My monthly energy bills are lower

Response Option	Fort Collins (n = 119)	Total (n = 175)
1- Do not at all agree	6%	5%
2	3%	5%
3	24%	22%
4	29%	29%
5- Strongly Agree	28%	29%
Don't know	11%	10%

### My home is more valuable

Response Option	Fort Collins (n = 117)	Total (n = 173)
1 - Do not at all agree	2%	2%
2	3%	3%

## Energy Efficiency Programs Evaluation

Response Option	Fort Collins (n = 117)	Total (n = 173)
3	25%	21%
4	32%	29%
5 - Strongly Agree	31%	36%
Don't know	7%	9%

### *My home is safer*

Response Option	Fort Collins (n = 116)	Total (n = 172)
1- Do not at all agree	15%	13%
2	9%	8%
3	30%	26%
4	16%	15%
5- Strongly Agree	15%	21%
Don't know	16%	17%

### *There is less dust and pollen in my home*

Response Option	Fort Collins (n = 116)	Total (n = 172)
1- Do not at all agree	11%	9%
2	7%	9%
3	26%	24%
4	19%	17%
5- Strongly Agree	15%	16%
Don't know	22%	24%

Q24. [IF ANY ITEM IN Q15 = YES, MADE IMPROVEMENT AND RECEIVED REBATE OR MADE IMPROVEMENT BUT DID NOT RECEIVE REBATE] If rebates for your home improvement had not been available, which of the following best describes what you would have done after your home efficiency audit? *[Note: The following tables exclude respondents that were shown the question but did not answer]*

Response Option	Fort Collins (n = 121)	Total (n = 177)
I would not have done a project at all	10%	8%
I would have delayed the project more than six months	11%	12%
I would have done a smaller, less expensive project, or one that saved less energy	40%	41%
I would have done exactly the same project	36%	36%
Don't know	2%	2%

Q25. IF ANY ITEM IN Q15 = YES, MADE IMPROVEMENT AND RECEIVED REBATE OR MADE IMPROVEMENT BUT DID NOT RECEIVE REBATE AND UTILITY = FORT COLLINS AND LOANS AVAILABLE ON PROJECT DATE] The Efficiency Works program and Fort Collins Utilities want to know how they can make energy efficiency improvements available to a wider range of people, and they recognize that paying the upfront cost of the improvements is challenging for some people. How did you pay for the energy efficiency upgrades that your home efficiency audit identified?

Response Option	Fort Collins (n = 121)
Cash, check, or credit card with intention to pay the cost in full at the end of the month	60%
Credit card with intention to repay over time	6%
Financing or payment plan from the contractor	2%
Loan provided through Fort Collins Utilities that you could repay on your utility bill	20%
Some other type of loan (including home equity line of credit, personal loan from a bank, or a loan from family, friends, or peers)	8%
Other	4%
Don't know	0%

Q26. [IF Q25 ≠ LOAN PROVIDED THROUGH FORT COLLINS UTILITY] When you made your improvements, were you aware that Fort Collins Utilities was offering a financing option with a 2.5% interest rate that people could repay as a line-item on their utility bills?

Response Option	Fort Collins (n = 92)
Yes	37%
No	47%
Can't recall	16%

Q27. [IF Q26 = YES] Why did you not use the on-bill financing option from Fort Collins Utilities to pay for your energy efficiency upgrades?

Response Option	Fort Collins (n = 34)
I did not need financing	71%
I did not want to take on debt or commit to monthly payments	27%
I did not think I would qualify	0%
I applied but did not qualify	0%
I did not want to go through the application process	3%
I wanted a loan that offered different terms (for example, repaying over a different period)	9%
Other	9%
Don't know	3%



Q28. [IF Q25 = LOAN PROVIDED THROUGH FORT COLLINS UTILITIES] Which of the following best describes what you would have done if you had not received the on-bill loan through Fort Collins Utilities for the improvements your home efficiency audit recommended?

Response Option	Fort Collins (n = 24)
I would not have done a project at all	25%
I would have delayed the project more than six months	13%
I would have done a smaller, less expensive project, or one that saved less energy	46%
I would have done the same project	13%
Other	4%
Don't know	0%

Q29. [IF ANY ITEM IN Q15 = YES, MADE IMPROVEMENT AND RECEIVED REBATE OR MADE IMPROVEMENT BUT DID NOT RECEIVE REBATE] If How important were each of the following elements in your decision to complete the energy efficiency improvements you made in your home? [Note: The following tables exclude respondents that were shown the question but did not answer]

*Your home efficiency audit and interactions with the assessor who came to your home*

Response Option	Fort Collins (n = 121)	Total (n = 177)
1 - Not at all important	7%	6%
2	4%	4%
3	15%	19%
4	37%	36%
5 - Extremely important	37%	34%
Don't know	0%	0%

*Your phone or email interactions with the efficiency adviser*

Response Option	Fort Collins (n = 118)	Total (n = 174)
1 - Not at all important	8%	6%
2	9%	10%
3	22%	22%
4	33%	33%
5 - Extremely important	28%	28%
Don't know	0%	0%

*Your rebate*

Response Option	Fort Collins (n = 118)	Total (n = 173)
1 - Not at all important	3%	3%
2	5%	6%
3	17%	18%
4	27%	31%
5 - Extremely important	48%	42%
Don't know	0%	0%

*The on-bill loan you received through Fort Collins Utilities*

Response Option	Fort Collins (n = 24)
1 - Not at all important	0%
2	0%
3	13%
4	29%
5 - Extremely important	58%
Don't know	0%

## H.2.2. Appliance Rebates

Q30. [IF RECORDS SHOW RECEIVED APPLIANCE REBATE AND S1 PURCHASE ENERGY SAVING EQUIPMENT = SOLE RESPONSIBILITY OR PARTIAL RESPONSIBILITY] Our records show that you received a bill credit from Fort Collins Utilities for purchasing an energy efficient. Is that correct?

Response Option	Fort Collins (n = 105)
Yes – I purchased a [appliance type] and received a bill credit	90%
I purchased a [appliance type] but did not receive a bill credit	6%
No – I did not purchased a [appliance type]	0%
Don't know	4%

Q31. [IF Q30 = YES PURCHASED AND RECEIVED BILL CREDIT OR PURCHASED BUT DID NOT RECEIVE BILL CREDIT] Is the appliance that you purchased still plugged in and functioning?

Response Option	Fort Collins (n = 101)
Yes, it is plugged in and functioning	98%
No, it is plugged in, but not functioning	0%
No, it is not plugged in	0%
Other	2%

## Energy Efficiency Programs Evaluation

Response Option	Fort Collins (n = 101)
Don't know	0%

Q32. [IF Q30 = YES PURCHASED AND RECEIVED BILL CREDIT OR PURCHASED BUT DID NOT RECEIVE BILL CREDIT] Were you involved in, and do you recall, the decision to select the specific model of [Appliance Type] you purchased?

Response Option	Fort Collins (n = 101)
Yes	99%
No	1%
Don't know	0%

Q33. [IF Q32 = YES] How important were each of the following features in your decision to purchase the model of [Appliance Type] you chose? *[Note: The following tables exclude respondents that were shown the question but did not answer]*

### Capacity

Response Option	Fort Collins (n = 100)
1 - Not at all important	0%
2	4%
3	19%
4	39%
5 - Extremely important	37%
Don't know	1%

### Dimensions

Response Option	Fort Collins (n = 100)
1 - Not at all important	5%
2	7%
3	15%
4	20%
5 - Extremely important	52%
Don't know	1%

### Appearance

Response Option	Fort Collins (n = 100)
1 - Not at all important	4%
2	12%
3	33%

## Energy Efficiency Programs Evaluation

Response Option	Fort Collins (n = 100)
4	34%
5 - Extremely important	17%
Don't know	0%

### *Orientation [IF PURCHASED CLOTHES WASHER]*

Response Option	Fort Collins (n = 93)
1 - Not at all important	1%
2	1%
3	11%
4	24%
5 - Extremely important	62%
Don't know	1%

### *Product Features*

Response Option	Fort Collins (n = 100)
1 - Not at all important	8%
2	10%
3	27%
4	33%
5 - Extremely important	21%
Don't know	1%

### *Price*

Response Option	Fort Collins (n = 99)
1 - Not at all important	1%
2	3%
3	10%
4	38%
5 - Extremely important	49%
Don't know	0%

### *Energy Cost to Operate*

Response Option	Fort Collins (n = 100)
1 - Not at all important	0%
2	3%

## Energy Efficiency Programs Evaluation

Response Option	Fort Collins (n = 100)
3	14%
4	31%
5 - Extremely important	51%
Don't know	1%

### *ENERGY STAR Certification*

Response Option	Fort Collins (n = 100)
1 - Not at all important	1%
2	2%
3	7%
4	26%
5 - Extremely important	62%
Don't know	2%

### *Availability of a Bill Credit*

Response Option	Fort Collins (n = 100)
1 - Not at all important	3%
2	7%
3	23%
4	40%
5 - Extremely important	27%
Don't know	0%

### *User Reviews*

Response Option	Fort Collins (n = 99)
1 - Not at all important	2%
2	6%
3	13%
4	39%
5 - Extremely important	37%
Don't know	2%

*Independent product reviews*

Response Option	Fort Collins (n = 100)
1 - Not at all important	6%
2	9%
3	14%
4	31%
5 - Extremely important	35%
Don't know	5%

Q34. [IF Q32 = YES] How important were each of the following features in your decision to purchase the model of [Appliance Type] you chose?

Response Option	Fort Collins (n = 100)
Yes	81%
No	18%
Don't know	1%

Q35. [IF Q34 = YES] How important were each of the following features in your decision to purchase the model of [Appliance Type] you chose? *[Note: The following tables exclude respondents that were shown the question but did not answer]*

*Capacity*

Response Option	Fort Collins (n = 80)
Discussed- you brought it up	26%
Discussed- store staff member brought it up	25%
Discussed- do not recall who brought it up	11%
Did not discuss	26%
Do not recall if you discussed	11%

*Dimensions*

Response Option	Fort Collins (n = 80)
Discussed- you brought it up	53%
Discussed- store staff member brought it up	4%
Discussed- do not recall who brought it up	11%
Did not discuss	24%
Do not recall if you discussed	9%

*Appearance*

Response Option	Fort Collins (n = 81)
Discussed- you brought it up	27%
Discussed- store staff member brought it up	11%
Discussed- do not recall who brought it up	10%
Did not discuss	42%
Do not recall if you discussed	10%

*Orientation [displayed if purchased clothes washer]*

Response Option	Fort Collins (n = 75)
Discussed- you brought it up	52%
Discussed- store staff member brought it up	16%
Discussed- do not recall who brought it up	11%
Did not discuss	19%
Do not recall if you discussed	3%

*Product Features*

Response Option	Fort Collins (n = 81)
Discussed- you brought it up	21%
Discussed- store staff member brought it up	38%
Discussed- do not recall who brought it up	17%
Did not discuss	16%
Do not recall if you discussed	7%

*Price*

Response Option	Fort Collins (n = 80)
Discussed- you brought it up	53%
Discussed- store staff member brought it up	20%
Discussed- do not recall who brought it up	15%
Did not discuss	10%
Do not recall if you discussed	3%

*Energy Cost to Operate*

Response Option	Fort Collins (n = 80)
Discussed- you brought it up	20%
Discussed- store staff member brought it up	23%

## Energy Efficiency Programs Evaluation

Response Option	Fort Collins (n = 80)
Discussed- do not recall who brought it up	16%
Did not discuss	31%
Do not recall if you discussed	10%

### *ENERGY STAR Certification*

Response Option	Fort Collins (n = 80)
Discussed- you brought it up	23%
Discussed- store staff member brought it up	30%
Discussed- do not recall who brought it up	19%
Did not discuss	21%
Do not recall if you discussed	8%

### *Availability of a Bill Credit*

Response Option	Fort Collins (n = 80)
Discussed- you brought it up	23%
Discussed- store staff member brought it up	35%
Discussed- do not recall who brought it up	14%
Did not discuss	23%
Do not recall if you discussed	6%

### *User Reviews*

Response Option	Fort Collins (n = 80)
Discussed- you brought it up	14%
Discussed- store staff member brought it up	11%
Discussed- do not recall who brought it up	11%
Did not discuss	55%
Do not recall if you discussed	9%

### *Independent Product Reviews*

Response Option	Fort Collins (n = 80)
Discussed- you brought it up	16%
Discussed- store staff member brought it up	4%
Discussed- do not recall who brought it up	8%
Did not discuss	60%
Do not recall if you discussed	13%



Q36. [IF Q32 = YES] Do you recall seeing any signs like this in the store when you were shopping for your [Appliance Type]:

Response Option	Fort Collins (n = 100)
Yes	37%
No	38%
Don't know	25%

Q37. [IF Q32 = YES] How important were each of the following features in your decision to purchase the model of [Appliance Type] you chose?

Response Option	Fort Collins (n = 100)
I completed it	84%
Someone else in my household completed it	12%
The salesperson or another retailer staff member	1%
Other, please specify	0%
Don't know	3%

Q38. [IF Q30 = YES Q32 = YES] How important were each of the following features in your decision to purchase the model of [Appliance Type] you chose? *[Note: The following tables exclude respondents that were shown the question but did not answer]*

*It was easy to find a [appliance type] with the features I wanted that qualified for a bill credit*

Response Option	Fort Collins (n = 94)
1 - Do not at all agree	0%
2	4%
3	5%
4	15%
5 - Strongly Agree	68%
Don't know	7%

*The application form was easy to complete*

Response Option	Fort Collins (n = 94)
1 - Do not at all agree	0%
2	3%
3	4%
4	14%
5 - Strongly Agree	79%
Don't know	1%

*I received my bill credit in a reasonable amount time*

Response Option	Fort Collins (n = 94)
1 - Do not at all agree	0%
2	0%
3	7%
4	14%
5 - Strongly Agree	71%
Don't know	7%

Q39. [IF Q30 =YES Q32 = YES] How important were each of the following features in your decision to purchase the model of [Appliance Type] you chose?

*[IF Q34 = YES] The Sales Associate or Other Store Staff Member*

Response Option	Fort Collins (n =77)
1 - Not at all influential	31%
2	14%
3	29%
4	18%
5 - Extremely influential	7%
Don't know	1%

*[IF Q36 = YES] The Efficiency Works Signs*

Response Option	Fort Collins (n =35)
1 - Not at all influential	3%
2	3%
3	26%
4	40%
5 - Extremely influential	29%
Don't know	0%

*The Availability of a Bill Credit*

Response Option	Fort Collins (n =93)
1 - Not at all influential	5%
2	15%
3	23%
4	30%

Response Option	Fort Collins (n = 93)
5 - Extremely influential	26%
Don't know	1%

Q40. [IF Q30 = YES AND Q32 = YES] Which of the following best describes what you would have done if the bill credit from Fort Collins Utilities had not been available?

Response Option	Fort Collins (n = 94)
I would have purchased the same model of [Appliance Type] or another ENERGY STAR model	85%
I would have purchased a [Appliance Type] that did not qualify for ENERGY STAR	2%
I would not have purchased a [Appliance Type] or would have waited more than six months	4%
Don't know	9%

### H.2.3. Appliance Recycling

Q41. [IF RECORDS SHOW RECYCLED APPLIANCE AND S1 PURCHASING ENERGY USING APPLIANCE = SOLELY RESPONSIBLE OR PARTIALLY RESPONSIBLE] Which of the following best describes what you would have done if the bill credit from Fort Collins Utilities had not been available?

Response Option	Fort Collins (n = 73)
Yes	95%
No	0%
Don't know	5%

Q42. [IF Q41 = YES] How did you learn about the opportunity to recycle your [Recycled Appliance] through Fort Collins Utilities and earn a bill credit?

Response Option	Fort Collins (n = 69)
From a store staff member when you were buying a new [recycled appliance]	6%
From a sign or other information in the store when you were buying a new [recycled appliance]	12%
From the Fort Collins Utilities website	62%
From an Efficiency Works home efficiency audit	3%
From family, friends, or acquaintances	9%
Other	25%
Don't know	3%

Q43. [IF Q41 = YES] Were you using the recycled unit as your primary [Recycled Appliance], or was it a secondary or spare?

Response Option	Fort Collins (n = 69)
It was our primary [recycled appliance]	45%
It was a secondary or spare [recycled appliance]	55%

Q44. [IF Q43 = SECONDARY OR SPARE] For how much of the year was the recycled [Recycled Appliance] plugged in and in use?

Response Option	Fort Collins (n = 38)
Your round (operated 12 months of the year)	84%
Most of the year (operated 8-11 months of the year)	11%
About half the year (operated 5-7 months of the year)	0%
Seasonal (operated 2-4 months of the year)	0%
Rarely or never (operated 1 month of the year or less)	3%
Other	0%
Don't know	3%

Q45. [IF Q41 = YES] Were you using the recycled unit as your primary [Recycled Appliance], or was it a secondary or spare?

Response Option	Fort Collins (n = 69)
Would have disposed of it	49%
Would have kept it	16%
Don't know	12%

Q46. [IF Q45 = WOULD HAVE KEPT IT OR DON'T KNOW] Did you replace the [Recycled Appliance] you recycled with a different one?

Response Option	Fort Collins (n = 25)
Yes, replaced the unit	88%
No, did not replace the unit	12%

Q47. [IF Q46 = YES] Is the [Recycled Appliance] you got to replace the one you recycled an ENERGY STAR or high-efficiency model?

Response Option	Fort Collins (n = 22)
Yes	82%
No	5%
Don't know	14%

Q48. [IF Q46 =YES] Was the [Recycled Appliance] you got to replace the one you recycled brand new or used?

Response Option	Fort Collins (n = 22)
Brand new	77%
Used	23%

Q49. [IF Q46 =YES] Would you have replaced the [Recycled Appliance] if the recycling program through Fort Collins Utilities had not been available?

Response Option	Fort Collins (n = 22)
Yes	41%
No	27%
Don't know	32%

Q50. [IF Q45 = WOULD HAVE DISPOSED OF IT] If the appliance recycling program through Fort Collins had not been available, which of the following best describes how you would have disposed of you [Recycled Appliance]?

Response Option	Fort Collins (n = 44)
Sold it	11%
Given it away for free	23%
Had it removed by the retailer that sold me my replacement [recycled appliance]	0%
Taken it to a dump	23%
Taken it to a recycling center	21%
Hired someone else to haul it away	23%

Q51. [IF Q50=SOLD IT] Who would you most likely have sold your [Recycled Appliance] to?

Response Option	Fort Collins (n = 5)
A friend or relative	0%
Someone who responded to an ad placement	100%
An appliance dealer	0%

Q52. [IF Q51=APPLIANCE DEALER] How old was the [Recycled Appliance] you recycled?

*No respondents met display criteria*

Q53. [IF Q50=GIVEN IT AWAY FOR FREE] Who would you most likely have given your [Recycled Appliance] to?

Response Option	Fort Collins (n = 10)
A friend or relative	0%

Response Option	Fort Collins (n = 10)
Someone who responded to an ad placement	60%
A charitable organization	30%
Other	10%

Q54. [IF Q41=YES] Why did your household decide to recycle your [Recycled Appliance] through Fort Collins Utilities?

Response Option	Fort Collins (n = 69)
It was convenient	74%
Wanted bill credit	74%
Wanted to ensure the [appliance] would be responsibly recycled	78%
Other	2%
Don't know	0%

Q55. [IF Q41=YES] To what extent do you agree with each of the following statements about your appliance pickup experience?

*I was able to schedule an appliance pickup at a convenient day and time*

Response Option	Fort Collins (n = 69)
1 - Do not at all agree	0%
2	0%
3	4%
4	20%
5 - Strongly Agree	74%
Don't know	1%

*The time between my application and my appliance pickup was reasonable*

Response Option	Fort Collins (n = 69)
1 - Do not at all agree	0%
2	0%
3	7%
4	28%
5 - Strongly Agree	64%
Don't know	1%

*I understood what I would need to do during the appliance pickup*

Response Option	Fort Collins (n = 69)
1 - Do not at all agree	0%
2	0%
3	1%
4	17%
5 - Strongly Agree	80%
Don't know	1%

*The people who picked up my [appliance] behaved professionally*

Response Option	Fort Collins (n = 69)
1 - Do not at all agree	0%
2	0%
3	4%
4	9%
5 - Strongly Agree	81%
Don't know	4%

*I received my bill credit in a reasonable amount time*

Response Option	Fort Collins (n = 69)
1 - Do not at all agree	0%
2	1%
3	4%
4	13%
5 - Strongly Agree	68%
Don't know	12%

## H.2.4. Home Energy Reports

Q56. Do you recall receiving a Home Energy Report in the mail, like the one pictured here, that provides detailed information on your home's energy usage and compares your home energy use to your neighbors?

Response Option	Fort Collins (n = 362)
Yes, I receive Home Energy Reports	89%
No, I do not recall receiving Home Energy Reports	7%

## Energy Efficiency Programs Evaluation

Response Option	Fort Collins (n = 362)
I no longer receive Home Energy Reports because I contacted Fort Collins Utilities and opted out of them	4%
Don't know	1%

Q57. [IF Q56 = YES] How often do you read the Home Energy Report?

Response Option	Fort Collins (n = 322)
I read it every time I receive it	76%
I read it most of the time	12%
I read it sometimes	6%
I rarely read it	4%
I have never read it	1%
I no longer receive Home Energy Reports because I contacted Fort Collins Utilities and opted out of them	0%
Don't know	0%

Q58. [IF Q57 = READ EVERY TIME, MOST OF THE TIME, OR SOMETIMES] How useful have the Home Energy Reports been in helping you understand your home's energy use?

Response Option	Fort Collins (n = 306)
Not at all useful	5%
Not very useful	11%
Somewhat useful	40%
Very useful	31%
Extremely useful	12%
Don't know	0%

Q59. [IF Q57 = READ EVERY TIME, MOST OF THE TIME, OR SOMETIMES] How valuable do you find each of the following elements in the Home Energy Reports?

*Comparison to neighbors*

Response Option	Fort Collins (n = 306)
1 - Not at all valuable	16%
2	11%
3	22%
4	28%
5 - Extremely valuable	23%
Don't know	0%



*Information about when during the day you use the most electricity*

Response Option	Fort Collins (n = 306)
1 - Not at all valuable	4%
2	6%
3	23%
4	37%
5 - Extremely valuable	28%
Don't know	3%

*Tracking your Progress*

Response Option	Fort Collins (n = 306)
1 - Not at all valuable	3%
2	6%
3	14%
4	34%
5 - Extremely valuable	42%
Don't know	1%

*Energy-Savings Tips*

Response Option	Fort Collins (n = 306)
1 - Not at all valuable	6%
2	13%
3	24%
4	35%
5 - Extremely valuable	21%
Don't know	1%

Q60. [IF Q59 = NOT VALUABLE (1 OR 2 ON SCALE OF 1-5)] Why don't you find [response from Q59] valuable? *Open Ended Response, Multiple Responses Allowed*

*Comparison to Neighbors*

Response	Fort Collins (n = 80)
Not comparable to neighbors	89%
Will not change my usage	8%
Other	4%

*Information about when during the day you use the most electricity*

Response	Fort Collins (n = 26)
Already know that information	46%
Can't change my usage	38%
Other	15%

*Tracking your progress*

Response	Fort Collins (n = 20)
Usage will not change	52%
Not worth it	14%
Don't know	10%
Other	24%

*Energy-saving tips*

Response	Fort Collins (n = 53)
Already know the tips	37%
Not applicable to me	8%
Don't know	2%
Other	6%

## H.2.5. Mid-Stream Lighting

Q61. In the last 12 months, which of the following did you or someone in your household purchase?  
*Multiple Responses Allowed*

Response Option	Fort Collins (n=375)	Total (n=451)
Standard light bulbs for indoor use	59%	55%
Specialty light bulbs such as flood lights, candelabras, or globe lights	41%	40%
Light fixtures (these units include both the light and the wiring needed to attach the unit directly to electrical supply)	32%	33%
Dimmer switches or occupancy sensors	26%	25%
None of the above	18%	21%
Don't know	2%	2%

Q62.A) How many lighting products of each type did you purchase?

*Light Fixtures*

Light Fixtures	Fort Collins (n = 121)	Total (n = 148)
Mean	5.12	5.20

*Dimmer Switches*

Dimmer Switches	Fort Collins (n = 98)	Total (n = 115)
Mean	2.82	2.80

Q62.B) How many lighting products of each type did you purchase?

*Standard Light Bulbs*

Mean	Fort Collins	Total
Incandescent / halogen	5.1 (n = 100)	5.3 (n = 109)
Compact fluorescent	4.6 (n = 113)	4.6 (n = 126)
LED	8.7 (n = 159)	8.7 (n = 182)

*Specialty Light Bulbs*

Mean	Fort Collins	Total
Incandescent / halogen	3.6 (n = 70)	4.1 (n = 79)
Compact fluorescent	2.2 (n = 54)	2.1 (n = 61)
LED	6.5 (n = 112)	6.9 (n = 135)

Q63. [IF Q62\_B STANDARD OR SPECIALTY LED BULBS IS >0] Of the LED bulbs that you bought in the last year, how many did you install, how many did you store for later, and how many did you install but since remove?

Mean	Fort Collins (n = 181)	Total (n = 216)
Installed	8.7	8.8
In storage	2.7	2.6
Removed	.24	.21

Q64. [IF Q61 = PURCHASED STANDARD OR SPECIALTY LIGHT BULBS AND NOT LED] Why did you not purchase LED light bulbs?

Response Option	Fort Collins (n = 375)	Total (n = 451)
They are more expensive than other bulbs	10%	10%
I am not familiar with them	5%	4%
I like the lighting color of incandescent and halogen bulbs	6%	6%
Other, please specify	4%	4%

Q65. [IF Q61 = LIGHTS OR FIXTURES PURCHASED] Do you recall seeing any signs or stickers, like the one pictured here, in the store when you were buying lighting products?

Response Option	Fort Collins (n = 301)	Total (n=351)
Yes	28%	27%
No	54%	55%
Someone else in my household bought the lighting products	6%	5%
Don't know	12%	13%

### H.2.6. Spillover

Q66. [IF Q1, Q2, Q30, OR Q41 = YES] We just have a few more questions about how the **[Program Name]** may have influenced your other decisions about your home's energy use. Because of your experience with the program, have you bought and installed items to improve your home's energy-efficiency without applying for a rebate or bill credit from [Utility Name]?

Response Option	Fort Collins (n = 357)	Total (n = 432)
Yes, I installed energy efficient items because of my experience and did not apply for a rebate	39%	40%
No, I installed energy efficient items, and applied for a rebate from [Utility Name].	32%	32%
No, I did not install energy efficient items	18%	17%
Don't know	11%	11%

Q67. [IF Q66 = YES] What energy-efficient items have you installed in your home without receiving a rebate or bill credit from [Utility Name]?

Response Option	Fort Collins (n = 139)	Total (n = 171)
Appliance(s)	49%	47%
Heating or cooling equipment	26%	26%
Water heater	34%	29%
Windows	33%	32%
Insulation	29%	30%
Sealing air leaks in windows, walls, and doors	40%	42%
Sealing or insulating ducts	15%	18%
Other, please specify	22%	23%
None of the above	4%	3%
Don't know	0%	1%

Q68. [IF Q67 APPLIANCE IS SELECTED] What energy-efficient items have you installed in your home without receiving a rebate or bill credit from [Utility Name]?

Response Option	Fort Collins (n = 68)	Total (n = 81)
Refrigerator	66%	64%
Stand-alone freezer	9%	10%
Dishwasher	53%	54%
Clothes washer	43%	42%
Clothes dryer	43%	41%
Other, please specify	15%	14%
Don't know	0%	1%

Q69. [IF Q67 HEATING OR COOLING EQUIPMENT IS SELECTED] What type of heating or cooling equipment did you buy?

Response Option	Fort Collins (n = 37)	Total (n = 48)
Central air conditioner	54%	50%
Window/room air conditioner unit	5%	4%
Air source heat pump	8%	8%
Boiler	0%	2%
Furnace	46%	42%
Wi-Fi-enabled thermostat	27%	27%
Other, please specify	19%	19%
Don't know	5%	4%

Q70. [IF Q67 WATER HEATER IS SELECTED] What type of water heater did you buy? If you are unsure of the fuel type or storage type, please type what you know in the "other" box

Response Option	Fort Collins (n = 47)	Total (n = 50)
Gas: Standard tank	74%	72%
Gas: Whole house tankless system	11%	12%
Electric: Standard tank	4%	6%
Electric: Heat pump	2%	2%
Electric: Whole house tankless system	4%	4%
Other, please specify	4%	4%
Don't know	0%	0%

Q71. [IF Q67 INSULATION IS SELECTED] Where in your home did you add insulation?

Response Option	Fort Collins (n = 42)	Total (n = 55)
Attic	67%	67%
Walls	31%	31%
Below the floor	29%	31%
Other, please specify	21%	22%
Don't know	0%	0%

Q72. [IF Q66 = YES AND Q67 <> NONE OF THE ABOVE] How important was your experience with the [Utility Name] in your decision to buy and install the additional energy efficient items?

Response Option	Fort Collins (n = 133)	Total (n = 165)
Not at all important	16%	13%
Not very important	13%	13%
Somewhat important	37%	36%
Very important	24%	25%
Extremely important	7%	9%
Don't know	4%	3%

Q73. [IF Q66 = YES] Why didn't you receive a rebate or bill credit for installing these items?

Response Option	Fort Collins (n = 139)	Total (n = 171)
Rebates are not available for the type of improvement or equipment installed	29%	31%
Rebates are available for that type of improvement or equipment, but the specific variety I installed did not qualify	5%	6%
I did not know whether rebates were available for the improvement or equipment I installed	40%	39%
I did not want to go through the process of applying for the rebate	6%	6%
Other, please specify	15%	13%
Don't know	4%	5%

### H.2.7. Closing

Q74. Overall, how satisfied are you with your experience with [Utility Name]? *[Note: The following table excludes respondents that were shown the question but did not answer]*

Response Option	Fort Collins (n = 374)	Total (n = 450)
Not at all satisfied	1%	1%
Not very satisfied	2%	2%
Somewhat satisfied	15%	15%
Very satisfied	56%	55%
Extremely satisfied	26%	27%

Q75. We just have a few questions left about your home. What is the primary fuel you use to heat your home?

Response Option	Fort Collins (n = 375)	Total (n = 451)
Electricity (including a heat pump, electric baseboards, electric furnace)	14%	13%
Natural gas (including a gas boiler or gas furnace)	84%	85%
Heating oil	0%	0%
Propane	0%	0%
Other, please specify	2%	2%
Don't know	0%	0%

Q76. What is the primary fuel you use for water heating?

Response Option	Fort Collins (n = 375)	Total (n = 451)
Electricity	18%	17%
Natural gas	78%	80%
Propane	0%	0%
Other, please specify	1%	1%
Don't know	2%	2%

Q77. [IF APPLIANCE TYPE = CLOTHES WASHER] What type of clothes dryer do you use in your home?

Response Option	Fort Collins (n = 97)
An electric dryer	86%
A gas dryer	11%
Do not own a clothes dryer	1%
Other, please specify	1%

Response Option	Fort Collins (n = 97)
Don't know	1%

Q78. [IF Q15 AIR CONDITIONER IS NOT SELECTED] Does your home have a central air conditioner?

Response Option	Fort Collins (n = 345)	Total (n = 401)
Yes	75%	75%
No	25%	25%
Don't know	0%	0%

Q79. [IF Q15 INSULATION OR AIR SELECT IS SELECTED] How many stories are there in your home?

Response Option	Fort Collins (n = 63)	Total (n = 80)
1	25%	29%
2	51%	50%
3	21%	19%
4 or more	3%	3%



### H.3. Residential Non-Participant Survey

S1. Do you currently rent or own the residence you live in?

Response Option	Fort Collins (n = 383)	Total (n = 953)
Own	70%	82%
Rent	30%	18%
Don't know	0%	0%

S2. Who in your household is most often responsible for the following types of actions? Please select one answer for each action.

#### *Paying Utility Bills*

Response Option	Fort Collins (n = 383)	Total (n = 953)
I am solely responsible	73%	71%
I share responsibility	25%	26%
Someone else is responsible	2%	3%

#### *Purchasing Energy-Using Appliances or Light Bulbs*

Response Option	Fort Collins (n = 383)	Total (n = 953)
I am solely responsible	44%	43%
I share responsibility	52%	54%
Someone else is responsible	4%	3%

#### *Making Decisions about Home Upgrades or Renovations*

Response Option	Fort Collins (n = 383)	Total (n = 953)
I am solely responsible	32%	32%
I share responsibility	49%	58%
Someone else is responsible	19%	10%

Q1. Are you familiar with any rebates or programs that Fort Collins Utilities offers to help people save energy?

Response Option	Fort Collins (n = 383)	Total (n = 953)
Yes	55%	41%
No	37%	50%
Don't know	9%	9%

Q2. [IF Q1 = YES] To the best of your knowledge, what energy-related rebates or programs does Fort Collins Utilities offer? *Multiple Response Options Allowed*

## Energy Efficiency Programs Evaluation

Response Option	Fort Collins (n = 209)	Total (n = 391)
Home Energy Assessments	76%	79%
Home Energy Reports	85%	73%
Rebates for installing energy efficient heating and cooling equipment	64%	62%
Recycling of old refrigerators and freezers	56%	56%
Rebates for ENERGY STAR dishwashers and clothes washers	78%	51%
Rebates for purchasing water-efficient toilets or sprinkler equipment	73%	47%
Rebates for installing insulation and sealing your home against air leakage	41%	43%
CFL and LED light bulb discounts	44%	42%
Other	4%	4%
Don't know	4%	3%

Q3. [IF Q1 = YES] How have you heard about the rebates or energy efficiency programs? *Multiple Response Options Allowed*

Response Option	Fort Collins (n = 209)	Total (n = 391)
Bill insert or other print materials	67%	69%
Past experience with programs	42%	37%
The website	39%	36%
Promotional materials	21%	16%
Word of mouth	18%	15%
A program-sponsored event	5%	12%
Interaction with FC staff at a community event	9%	10%
Contractor	9%	9%
Other	6%	7%
Don't know	3%	3%
None selected	0%	1%

### H.3.1. Barriers to Participation [IF ERROR! REFERENCE SOURCE NOT FOUND.=1]

Q4. [IF S1 = Own] Which of the following have you or other members of your household done in the past three years? *Multiple Response Options Allowed*

Response Option	Fort Collins (n = 268)	Total (n = 777)
Purchased a new clothes washer	36%	29%

## Energy Efficiency Programs Evaluation

Purchased a new dishwasher	26%	27%
Purchased new heating or cooling equipment	25%	25%
Added insulation or sealed your home against air leakage	20%	22%
Gotten rid of a refrigerator or freezer that still worked	16%	20%
Had a home energy assessment	16%	16%
None of the above	28%	29%

### H.3.2. Efficiency Works – Homes

Q5. [IF S1 = OWN AND Q2 HOME ENERGY ASSESSMENT IS SELECTED AND Q4 HOME ENERGY ASSESSMENT IS NOT SELECTED] There could be several reasons why someone has not had an efficiency audit performed at their residence. We'd like to know what some reasons might be why you have not had a home efficiency audit. Please select any options below that apply to your situation. *Multiple Response Options Allowed*

Response Option	Fort Collins (n = 95)	Total (n = 207)
Home is already energy efficient	27%	25%
Do not believe it would provide new or valuable information	23%	22%
Other home improvements are higher priority	18%	20%
No time to schedule and attend the assessment	14%	14%
Unable to pay the \$60 upfront cost of the assessment	9%	11%
Not interested in making changes to my home	5%	9%
Unable to schedule an assessment at a convenient time	4%	4%
Don't know how to request one	7%	4%
Other	27%	30%
Don't know	4%	3%

Q6. [IF Q4 ADDED INSULATION OR SEALED YOUR HOME IS SELECTED] What type of insulation and air sealing improvements have you made? Please select all that apply *Multiple Response Options Allowed*

Response Option	Fort Collins (n = 54)	Total (n = 172)
Weather stripping around doors and windows	61%	53%
Insulation to my attic	59%	49%
Sealed gaps in outdoor walls	54%	46%
New windows	33%	35%
Insulation to my walls	15%	24%
Insulation below my floors	30%	19%

## Energy Efficiency Programs Evaluation

Ductwork sealed	6%	13%
Other	11%	11%
Don't know	0%	0%

Q7. [IF ANY OPTION IN Q IS SELECTED OTHER THAN Q WEATHER STRIPPING OR Q DON'T KNOW] Did you receive a rebate from Fort Collins Utilities, Efficiency Works, or your natural gas utility for the insulation and/or air sealing improvements you made?

Response Option	Fort Collins (n = 49)	Total (n = 155)
Yes	31%	15%
No	65%	77%
Don't know	4%	7%

Q8. [IF Q=NO] Why didn't you receive a rebate for your insulation and air sealing improvements?  
*Multiple Response Options Allowed*

Response Option	Fort Collins (n = 32)	Total (n = 120)
Not aware rebates were available	50%	63%
Improvements did not qualify for a rebate	19%	14%
Application process required too much time and effort	16%	6%
Wanted to work with a contractor that was not part of the rebate program	9%	4%
Rebate amount was too small	3%	2%
Other	19%	12%
Don't know	9%	9%

Q9. [IF Q ADDED INSULATION OR SEALED HOME IS NOT SELECTED AND Q4 IS DISPLAYED] There could be several reasons why someone has not done insulation or air-sealing improvements to their home. Please select from the options below any reasons why have you not improved your home's insulation or taken steps to seal against air leakage. *Multiple Response Options Allowed*

Response Option	Fort Collins (n = 214)	Total (n = 605)
Home is already well insulated	46%	50%
Other home improvements are higher priority	22%	20%
Not convinced the energy cost savings would justify the cost and effort	16%	17%
I do not know how to go about improving my home's insulation and seal against air leakage	16%	14%
Not convinced the improvements would increase comfort in my home enough	11%	14%
No access to financing	10%	12%

## Energy Efficiency Programs Evaluation

Not interested	6%	4%
I cannot add insulation or air sealing due to my home's structure or health and safety limitations	3%	4%
Other	16%	14%
Don't know	5%	4%
None selected	0%	0%

Q10. [IF 0 ADDED INSULATION OR SEALED HOME IS NOT SELECTED AND Q4 IS DISPLAYED] If a low-interest loan were available that could cover up to 100% of the project cost, how likely would you be to pursue improving your home's insulation or seal against air leakage?

Response Option	Fort Collins (n = 214)	Total (n = 605)
Not at all likely	25%	27%
Not very likely	28%	24%
Moderately likely	29%	27%
Very likely	10%	10%
Definitely likely	3%	3%
Don't know	5%	8%
None selected	0%	0%

Q11. [IF Q4 PURCHASED NEW HVAC IS SELECTED] What type of heating or cooling equipment did you buy? Select all that apply. *Multiple Response Options Allowed*

Response Option	Fort Collins (n = 67)	Total (n = 196)
Natural gas furnace	37%	52%
Central air conditioner	55%	46%
Natural gas boiler	12%	8%
Whole house fan	13%	8%
Window/room air conditioner unit	6%	6%
Heat pump	4%	4%
Evaporative cooler	0%	3%
Other	10%	14%
Don't know	4%	2%

Q12. [IF ANY ITEM IN 0 IS SELECTED OTHER THAN 0 DON'T KNOW] Did you apply for a rebate for the heating and cooling equipment you bought?

*Central Air Conditioner*

## Energy Efficiency Programs Evaluation

Response Option	Fort Collins (n = 37)	Total (n = 91)
Yes	11%	18%
No	78%	73%
Don't know	11%	10%

### Heat Pump

Response Option	Fort Collins (n = 3)	Total (n = 7)
Yes	0%	14%
No	100%	86%
Don't know	0%	0%

### Natural Gas Boiler

Response Option	Fort Collins (n = 8)	Total (n = 15)
Yes	38%	27%
No	38%	53%
Don't know	25%	20%

### Natural Gas Furnace

Response Option	Fort Collins (n = 25)	Total (n = 102)
Yes	28%	22%
No	52%	66%
Don't know	20%	13%

### Evaporative Cooler

Response Option	Fort Collins (n = 0)	Total (n = 6)
Yes	0%	0%
No	0%	100%
Don't know	0%	0%

### Whole House Fan

Response Option	Fort Collins (n = 9)	Total (n = 15)
Yes	44%	33%
No	44%	60%
Don't know	11%	7%

### Other

## Energy Efficiency Programs Evaluation

Response Option	Fort Collins (n = 7)	Total (n = 27)
Yes	14%	7%
No	86%	81%
Don't know	0%	11%

Q13. [IF ANY ITEM IN 0=NO] Why did you not apply for a rebate for your heating or cooling equipment? Please select all that apply. *Multiple Response Options Allowed*

### Central Air Conditioner

Response Option	Fort Collins (n = 29)	Total (n = 66)
Not aware rebates were available	66%	67%
Equipment I bought did not qualify for a rebate	7%	20%
Wanted to work with a contractor that was not part of the rebate program	21%	12%
Application process required too much time and effort	7%	5%
Rebate amount was too small	3%	2%
Other	10%	9%
None of the above	7%	3%

### Heat Pump

Response Option	Fort Collins (n = 3)	Total (n = 6)
Not aware rebates were available	33%	67%
Wanted to work with a contractor that was not part of the rebate program	33%	17%
Application process required too much time and effort	33%	17%
Equipment I bought did not qualify for a rebate	0%	0%
Rebate amount was too small	0%	0%
Other	0%	0%
None of the above	0%	0%

### Natural Gas Boiler

Response Option	Fort Collins (n = 3)	Total (n = 8)
Not aware rebates were available	67%	88%
Equipment I bought did not qualify for a rebate	0%	0%
Application process required too much time and effort	0%	0%
Rebate amount was too small	0%	0%

## Energy Efficiency Programs Evaluation

Wanted to work with a contractor that was not part of the rebate program	0%	0%
Other	0%	0%
None of the above	33%	13%

### Natural Gas Furnace

Response Option	Fort Collins (n = 13)	Total (n = 67)
Not aware rebates were available	54%	70%
Equipment I bought did not qualify for a rebate	8%	16%
Application process required too much time and effort	0%	0%
Rebate amount was too small	8%	3%
Wanted to work with a contractor that was not part of the rebate program	15%	9%
Other	15%	9%
None of the above	15%	3%

### Evaporative Cooler

Response Option	Fort Collins (n = 0)	Total (n = 6)
Not aware rebates were available	0%	67%
Equipment I bought did not qualify for a rebate	0%	17%
Application process required too much time and effort	0%	0%
Rebate amount was too small	0%	0%
Wanted to work with a contractor that was not part of the rebate program	0%	17%
Other	0%	0%
None of the above	0%	17%

### Whole House Fan

Response Option	Fort Collins (n = 4)	Total (n = 9)
Not aware rebates were available	50%	67%
Equipment I bought did not qualify for a rebate	0%	11%
Application process required too much time and effort	0%	0%
Rebate amount was too small	25%	11%
Wanted to work with a contractor that was not part of the rebate program	0%	0%
Other	25%	11%



None of the above	0%	0%
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*Other*

Response Option	Fort Collins (n = 6)	Total (n = 22)
Not aware rebates were available	50%	86%
Equipment I bought did not qualify for a rebate	0%	5%
Application process required too much time and effort	0%	0%
Rebate amount was too small	0%	0%
Wanted to work with a contractor that was not part of the rebate program	17%	5%
Other	17%	5%
None of the above	17%	5%

### H.3.3. Appliance Recycling

Q14. [IF Q4 GOT RID OF FRIDGE OR FREEZER] What did you do with the refrigerator or freezer you got rid of?

Response Option	Fort Collins (n = 42)
Used service to pick up and recycle refrigerators and freezers	29%
Sold it	19%
Had it removed by a retailer or dealer that sold you a replacement appliance	19%
Gave it away for free	14%
Dump	7%
Recycling center	5%
Hired someone else to haul it away	0%
Other	7%
Don't know	0%

Q15. [IF 0 AWARE OF RECYCLING OF OLD FRIDGE AND FREEZERS IS SELECTED AND Q4 GOT RID OF FRIDGE OR FREEZER IS SELECTED AND 0 USED FORT COLLINS SERVICE IS NOT SELECTED] Compared to the way you got rid of your refrigerator or freezer, how convenient is Fort Collins Utilities' appliance pickup and recycling service?

Response Option	Fort Collins (n = 12)
Much less convenient	0%
Somewhat less convenient	8%
About as convenient	25%

Response Option	Fort Collins (n = 12)
Somewhat more convenient	0%
Much more convenient	0%
Don't know	67%

Q16. [IF Q15 = MUCH LESS, SOMEWHAT LESS OR ABOUT AS CONVENIENT] How important was convenience in your decision to get rid of your refrigerator or freezer the way you did?

Response Option	Fort Collins (n = 4)
Not at all important	0%
Not very important	0%
Somewhat important	25%
Very important	50%
Extremely important	25%

Q17. [IF Q15 = SOMEWHAT MORE OR MUCH MORE CONVENIENT] What is inconvenient about Fort Collins Utilities appliance pickup and recycling service?

Response Option	Fort Collins (n = 4)
Scheduling at a time that worked with schedule	25%
No open-ended Response Option	75%

### H.3.4. Appliance Rebates

#### H.3.4.1. Clothes Washers

Q18. [IF Q4 PURCHASED CLOTHES WASHER IS SELECTED] Did you interact with a sales associate or other store staff member as you were deciding which model of **clothes washer to purchase**?

Response Option	Fort Collins (n = 97)
Yes	62%
No	38%
Don't know	0%

Q19. [IF Q18 = YES] Which of the following features did you discuss with a sales associate? For EACH, please indicate whether you were first to bring it up, or the sales associate was.

#### Capacity

Response Option	Fort Collins (n = 60)
Discussed- you brought it up	37%
Discussed- sales associate brought it up	15%

## Energy Efficiency Programs Evaluation

Response Option	Fort Collins (n = 60)
Discussed- do not recall who brought it up	17%
Did not discuss	18%
Do not recall	7%
None Selected	7%

### Dimensions

Response Option	Fort Collins (n = 60)
Discussed- you brought it up	48%
Discussed- sales associate brought it up	8%
Discussed- do not recall who brought it up	8%
Did not discuss	20%
Do not recall	5%
None Selected	10%

### Appearance

Response Option	Fort Collins (n = 60)
Discussed- you brought it up	23%
Discussed- sales associate brought it up	7%
Discussed- do not recall who brought it up	10%
Did not discuss	45%
Do not recall	7%
None Selected	8%

### Orientation

Response Option	Fort Collins (n = 60)
Discussed- you brought it up	48%
Discussed- sales associate brought it up	10%
Discussed- do not recall who brought it up	10%
Did not discuss	20%
Do not recall	3%
None Selected	8%

### Product Features

Response Option	Fort Collins (n = 60)
Discussed- you brought it up	32%

## Energy Efficiency Programs Evaluation

Response Option	Fort Collins (n = 60)
Discussed- sales associate brought it up	20%
Discussed- do not recall who brought it up	15%
Did not discuss	10%
Do not recall	13%
None Selected	10%

### Price

Response Option	Fort Collins (n = 60)
Discussed- you brought it up	52%
Discussed- sales associate brought it up	13%
Discussed- do not recall who brought it up	22%
Did not discuss	5%
Do not recall	5%
None Selected	3%

### Energy Cost to Operate

Response Option	Fort Collins (n = 60)
Discussed- you brought it up	23%
Discussed- sales associate brought it up	18%
Discussed- do not recall who brought it up	17%
Did not discuss	22%
Do not recall	10%
None Selected	10%

### ENERGY STAR® Certification

Response Option	Fort Collins (n = 60)
Discussed- you brought it up	30%
Discussed- sales associate brought it up	25%
Discussed- do not recall who brought it up	17%
Did not discuss	17%
Do not recall	7%
None Selected	5%

### Availability of Bill Credit

Response Option	Fort Collins (n = 60)
Discussed- you brought it up	8%
Discussed- sales associate brought it up	17%
Discussed- do not recall who brought it up	8%
Did not discuss	40%
Do not recall	17%
None Selected	10%

*User Reviews*

Response Option	Fort Collins (n = 60)
Discussed- you brought it up	28%
Discussed- sales associate brought it up	7%
Discussed- do not recall who brought it up	7%
Did not discuss	42%
Do not recall	12%
None Selected	5%

*Independent Product Reviews*

Response Option	Fort Collins (n = 60)
Discussed- you brought it up	15%
Discussed- sales associate brought it up	7%
Discussed- do not recall who brought it up	5%
Did not discuss	47%
Do not recall	18%
None Selected	8%

Q20. [IF Q4 PURCHASED CLOTHES WASHER IS SELECTED] Do you recall seeing any signs or stickers like this in the store when you were shopping for your **clothes washer**?

Response Option	Fort Collins (n = 97)
Yes	19%
No	65%
Don't know	16%

Q21. [IF Q4 PURCHASED CLOTHES WASHER IS SELECTED] Was the clothes washer you purchased ENERGY STAR-certified?

Response Option	Fort Collins (n = 97)
Yes	79%
No	2%
Don't know	19%

Q22. [IF Q21 =YES] Did you apply for a rebate from Fort Collins Utilities for purchasing an ENERGY STAR clothes washer?

Response Option	Fort Collins (n = 77)
Yes	27%
No	64%
Don't know	9%

Q23. [IF Q22 = NO] Why did you not apply for a rebate for the clothes washer? Select all that apply.  
*Multiple Response Options Allowed*

Response Option	Fort Collins (n = 49)
I did not know about the availability of rebates for ENERGY STAR clothes washers	59%
I did not want to go through the process of applying	12%
I did not think the one I bought would qualify for a rebate	10%
The rebate amount did not seem worth it	6%
Other	20%
Don't know	6%

Q24. [IF Q4 PURCHASED CLOTHES WASHER IS SELECTED] To what extent did you consider energy efficiency when you were deciding which model of clothes washer to buy?

Response Option	Fort Collins (n = 97)
I did not consider energy efficiency at all	7%
I considered energy efficiency, but other features were more important	19%
Energy efficiency was equally important to other features I considered	35%
Energy efficiency was one of the most important features I considered	19%
I would not have purchased a model that was not energy efficient	18%
Don't know	3%

Q25. [IF 0 = NO AND 0 EE WAS EQUALLY OR MOST IMPORTANT FEATURE OR Q24 WOULD NOT HAVE PURCHASED A MODEL THAT WAS NOT EE IS SELECTED] Why did you not choose an ENERGY STAR model? *Multiple Response Options Allowed*

*No respondents met display logic criteria.*

## H.3.4.2. Dishwashers

Q26. [IF Q4 PURCHASED NEW DISHWASHER IS SELECTED] Did you interact with a sales associate or other store staff member as you were deciding which model of **dishwasher to purchase**?

Response Option	Fort Collins (n = 69)
Yes	49%
No	46%
Don't know	4%

Q27. [IF 0 PURCHASED NEW DISHWASHER IS SELECTED AND Q26 = YES] Which of the following features did you discuss with a sales associate? For each, please indicate whether you were first to bring it up, or the sales associate was.

*Capacity*

Response Option	Fort Collins (n = 34)
Discussed- you brought it up	24%
Discussed- sales associate brought it up	24%
Discussed- do not recall who brought it up	9%
Did not discuss	21%
Do not recall	18%
None Selected	6%

*Dimensions*

Response Option	Fort Collins (n = 34)
Discussed- you brought it up	38%
Discussed- sales associate brought it up	6%
Discussed- do not recall who brought it up	9%
Did not discuss	26%
Do not recall	12%
None Selected	9%

*Appearance*

Response Option	Fort Collins (n = 34)
Discussed- you brought it up	41%
Discussed- sales associate brought it up	18%
Discussed- do not recall who brought it up	6%
Did not discuss	18%
Do not recall	12%

## Energy Efficiency Programs Evaluation

Response Option	Fort Collins (n = 34)
None Selected	6%

### Product Features

Response Option	Fort Collins (n = 34)
Discussed- you brought it up	29%
Discussed- sales associate brought it up	26%
Discussed- do not recall who brought it up	9%
Did not discuss	21%
Do not recall	12%
None Selected	3%

### Price

Response Option	Fort Collins (n = 34)
Discussed- you brought it up	56%
Discussed- sales associate brought it up	21%
Discussed- do not recall who brought it up	21%
Did not discuss	0%
Do not recall	3%
None Selected	0%

### Energy Cost to Operate

Response Option	Fort Collins (n = 34)
Discussed- you brought it up	24%
Discussed- sales associate brought it up	15%
Discussed- do not recall who brought it up	12%
Did not discuss	26%
Do not recall	18%
None Selected	6%

### ENERGY STAR® Certification

Response Option	Fort Collins (n = 34)
Discussed- you brought it up	35%
Discussed- sales associate brought it up	24%
Discussed- do not recall who brought it up	6%
Did not discuss	15%



## Energy Efficiency Programs Evaluation

Response Option	Fort Collins (n = 34)
Do not recall	18%
None Selected	3%

### Availability of a Bill Credit

Response Option	Fort Collins (n = 34)
Discussed- you brought it up	15%
Discussed- sales associate brought it up	15%
Discussed- do not recall who brought it up	3%
Did not discuss	44%
Do not recall	18%
None Selected	6%

### User Reviews

Response Option	Fort Collins (n = 34)
Discussed- you brought it up	50%
Discussed- sales associate brought it up	0%
Discussed- do not recall who brought it up	3%
Did not discuss	35%
Do not recall	9%
None Selected	3%

### Independent Product Reviews

Response Option	Fort Collins (n = 34)
Discussed- you brought it up	32%
Discussed- sales associate brought it up	0%
Discussed- do not recall who brought it up	3%
Did not discuss	47%
Do not recall	12%
None Selected	6%

Q28. [IF Q4 PURCHASED NEW DISHWASHER IS SELECTED] Do you recall seeing any signs or stickers like this in the store when you were shopping for your **dishwasher**?

Response Option	Fort Collins (n = 69)
Yes	20%
No	59%

Response Option	Fort Collins (n = 69)
Don't know	20%

Q29. [IF Q4 PURCHASED NEW DISHWASHER IS SELECTED] Was the dishwasher you purchased ENERGY STAR-certified?

Response Option	Fort Collins (n = 69)
Yes	74%
No	0%
Don't know	26%

Q30. [IF Q29 = YES] Did you apply for a rebate from Fort Collins Utilities for purchasing an ENERGY STAR dishwasher?

Response Option	Fort Collins (n = 51)
Yes	22%
No	73%
Don't know	6%

Q31. [IF Q30 = NO] Why did you not receive a rebate for the dishwasher? Select all that apply.  
*Multiple Response Options Allowed*

Response Option	Fort Collins (n = 37)
I did not know rebates were available for ENERGY STAR dishwashers	54%
I did not want to go through the process of applying	16%
I did not think the one I bought would qualify for a rebate	8%
The rebate amount did not seem worth it	5%
Other	24%
Don't know	3%

Q32. [IF Q4 PURCHASED NEW DISHWASHER IS SELECTED] To what extent did you consider energy efficiency when you were deciding which model of dishwasher to buy?

Response Option	Fort Collins (n = 69)
Energy efficiency was equally important to other features I considered	30%
I considered energy efficiency, but other features were more important	19%
Energy efficiency was one of the most important features I considered	17%
I would not have purchased a model that was not energy efficient	14%
I did not consider energy efficiency at all	10%
Don't know	9%

Q33. [IF Q29 = NO AND Q32 EE WAS EQUALLY OR MOST IMPORTANT OR WOULD NOT HAVE PURCHASED MODEL THAT WAS NOT EE] Why did you not choose an ENERGY STAR model?

*Multiple Response Options Allowed*

*No respondents met display logic criteria.*

### H.3.5. Midstream Lighting

Q34. In the last 12-months, which of the following did you or someone in your household purchase? Please select all that apply. *Multiple Response Options Allowed*

Response Option	Fort Collins (n = 383)	Total (n = 953)
Standard light bulbs for indoor use	58%	57%
Specialty light bulbs such as flood lights, candelabras, or globe lights	31%	35%
Light fixtures. These are entire units including light and wiring to attach the unit directly to electrical supply	27%	27%
Dimmer switches or occupancy sensors	16%	17%
None of the above	24%	24%
Don't know	2%	2%

Q35a. [IF 0 = LIGHT FIXTURES OR DIMMER SWITCHES] How many lighting products of each TYPE did you purchase?

#### *Light Fixtures*

Light Fixtures	Fort Collins (n = 105)	Total (n = 259)
Mean	5.85	4.97

#### *Dimmer Switches*

Dimmer Switches	Fort Collins (n = 60)	Total (n = 161)
Mean	3.42	2.58

Q35B. [IF 0 = STANDARD OR SPECIALTY LIGHT BULBS] How many lighting products of each type did you purchase? If none, please enter zero.

#### *Standard Light Bulbs*

Mean	Fort Collins	Total
Incandescent / halogen	5.89 (n = 83)	6.00 (n = 280)
Compact fluorescent	5.70 (n = 103)	6.04 (n = 334)
LED	9.46 (n = 126)	9.29 (n = 481)

Note: Response Options with values of zero removed from mean and n.

*Specialty Light Bulbs*

Mean	Fort Collins	Total
Incandescent / halogen	4.31 (n = 36)	4.86 (n = 160)
Compact fluorescent	5.71 (n = 34)	5.10 (n = 109)
LED	10.38 (n = 71)	8.77 (n = 291)

Note: Response Options with values of zero removed from mean and n.

Q36. [DISPLAY IF 0b STANDARD OR SPECIALTY LED BULBS IS >0] Of the LED bulbs that you bought in the last year, how many did you install, how many did you store to install later, and how many did you install but since remove?

Please answer for all the bulbs you purchased. The total should equal [PIPE IN SUM].

Mean	Fort Collins (n = 165)	Total (n = 411)
Installed	9.75	8.78
In storage	1.91	2.11
Removed	0.05	0.09

Q37. [If 0 PURCHASED LIGHT BULBS NOT LED] Why did you not purchase LED light bulbs? Select all that apply. *Multiple Response Options Allowed*

Response Option	Fort Collins (n = 27)	Total (n = 64)
More expensive than other bulbs	48%	48%
I like the lighting color of incandescent and halogen bulbs	30%	39%
Not familiar with them	15%	13%
Other	26%	30%

Q38. How likely are you to purchase any LED lightbulbs in the next year?

Response Option	Fort Collins (n = 383)	Total (n = 953)
Not at all likely	3%	3%
Not very likely	10%	9%
Somewhat likely	22%	21%
Fairly likely	17%	16%
Very likely	40%	45%
Don't know	6%	6%
Not answered	0%	0%

Q39. [IF Q34 PURCHASED STANDARD OR SPECIALTY LIGHTBULBS, LIGHT FIXTURES OR DIMMER SWITCHES] Do you recall seeing any signs or stickers like the one pictured here in the store when you were buying lighting products?

Response Option	Fort Collins (n = 282)	Total (n = 710)
Yes	12%	12%
No	67%	69%
Someone else in my household bought the lighting products	6%	6%
Don't know	15%	13%

### H.3.6. Home Energy Reports

Q40. Do you recall receiving a Home Energy Report, like the one pictured here, that provides detailed information on your home's energy usage and compares your home energy use to your neighbors? Please note we are not referring to the home water report your home may also receive.

Response Option	Fort Collins (n = 383)
Yes	90%
No	6%
Opted out	2%
Don't know	2%

Q41. [IF Q40 = OPTED OUT] WHY DID YOU CHOOSE TO OPT OUT OF RECEIVING THE HOME ENERGY REPORTS? SELECT ALL THAT APPLY. *MULTIPLE RESPONSE OPTIONS ALLOWED*

Response Option	Fort Collins (n = 7)
Didn't find the information accurate	57%
Came too frequently	14%
Wanted to reduce the amount of mail I get	14%
Didn't find the information informative	0%
Other	57%

Q42. [IF Q40 = YES] How often do you read the Home Energy Report?

Response Option	Fort Collins (n = 343)
Every time	71%
Most of the time	17%
Sometimes	7%
Rarely	5%

Response Option	Fort Collins (n = 343)
Never	0%

Q43. [IF Q42 = READ EVERY TIME, MOST TIMES OR SOMETIMES] How useful have the Home Energy Reports been to help you understand your home's energy use?

Response Option	Fort Collins (n = 324)
Not at all useful	7%
Not very useful	14%
Somewhat useful	49%
Very useful	21%
Extremely useful	9%
Don't know	0%

Q44. [IF Q42 = READ EVERY TIME, MOST TIMES OR SOMETIMES] What actions to save energy, if any, have you taken in Response Option to the Home Energy Reports? Select all that apply. *Multiple Response Options Allowed*

Response Option	Fort Collins (n = 324)
Turned off lights when not in use	55%
Changed thermostat setting	43%
Unplugged or used a power strip to turn off appliances when not in use	24%
Purchased energy saving products for my home but did not receive a rebate	23%
Looked for additional information on how to save energy	14%
Ran energy-using appliances at night	12%
Made energy saving modifications to my home	12%
Purchased energy saving products for my home and received a rebate	5%
Nothing	27%
Other	10%
Don't know	2%
Not answered	0%

Q45. [IF Q42 = READ EVERY TIME, MOST TIMES OR SOMETIMES] We'd like to know how valuable each of the following elements in the Home Energy Reports is to you. Please rate each element using

## Energy Efficiency Programs Evaluation

a 1 to 5 scale where 1 is “not at all valuable” and 5 is “extremely valuable.” Please select one answer for each item.

### *Comparison to Neighbors*

Response Option	Fort Collins (n = 324)
1 - Not at all valuable	15%
2	10%
3	19%
4	31%
5 - Extremely valuable	23%
Don't know	2%
Not answered	1%

### *Information about When During the Day you Use the Most Electricity*

Response Option	Fort Collins (n = 324)
1 - Not at all valuable	6%
2	8%
3	15%
4	36%
5 - Extremely valuable	33%
Don't know	2%
Not answered	0%

### *Tracking Your Progress*

Response Option	Fort Collins (n = 324)
1 - Not at all valuable	6%
2	5%
3	15%
4	35%
5 - Extremely valuable	39%
Don't know	1%
Not answered	0%

*Energy Saving Tips*

Response Option	Fort Collins (n = 324)
1 - Not at all valuable	6%
2	8%
3	23%
4	35%
5 - Extremely valuable	25%
Don't know	3%
Not answered	0%

Q46. [ASK FOR EACH ITEM IN 0 = NOT VALUABLE (1 OR 2 ON SCALE OF 1-5)] Why don't you find [ITEM] valuable? *Multiple Response Options Allowed*

*Comparison to Neighbors*

Response Option	Fort Collins (n = 81)
Information not accurate or exhaustive/comparison not valid	77%
Not interested in neighbors' behavior	10%
Not enough information	7%
Nothing can be done anyways	6%
Not Answered	6%

*Information about When During the Day you Use the Most Electricity*

Response Option	Fort Collins (n = 45)
I already know this information	49%
Information is inaccurate	12%
Want to see usage for myself	2%
Not Answered	20%

*Tracking Your Progress*

Response Option	Fort Collins (n = 34)
Nothing more I can do about it	53%
Incorrect information	9%
Too dependent on environmental factors	9%
Not interested	3%
Not Answered	21%



### Energy Saving Tips

Response Option	Fort Collins (n = 46)
Already knew them/have done everything I can	54%
Cannot implement them	17%
Inaccurate/not valid for my situation	15%
Still like them	4%
Not Answered	15%

Q48. [IF Q42 = READ EVERY TIME, MOST TIMES OR SOMETIMES] Have you ever looked at the My Energy tool, which provides information about your home's energy usage, on the Fort Collins Utilities website, like the information pictured here?

Response Option	Fort Collins (n = 324)
Yes	25%
No	71%
Don't know	4%

Q49. [IF Q48 = YES AND Q42 = READ EVERY TIME, MOST TIMES OR SOMETIMES] Compared to the information presented in the Home Energy Reports, how useful is the information on the Fort Collins Utilities website for understanding your home's energy usage?

Response Option	Fort Collins (n = 81)
Much more useful	17%
More useful	20%
About as useful	43%
Less useful	0%
Much less useful	2%
Don't know	17%

Q49. [IF Q49 = MUCH MORE OR MORE USEFUL THAN HERS] WHY DON'T YOU FIND THE WEBSITE INFORMATION USEFUL?

Response Option	Fort Collins (n = 2)
Too time consuming	50%
Too much extraneous information	50%

### H.3.7. Demographics

Q50. Overall, how satisfied are you with your experience with **Fort Collins Utilities**?

Response Option	Fort Collins (n = 383)	Total (n = 953)
Not at all satisfied	1%	1%
Not very satisfied	4%	4%
Somewhat satisfied	27%	24%
Somewhat satisfied	56%	57%
Very satisfied	12%	14%
Not answered	0%	0%

Q51. What is the primary fuel you use to heat your home?

Response Option	Fort Collins (n = 383)	Total (n = 953)
Electricity	23%	16%
Natural gas	73%	81%
Propane	0%	0%
Other	1%	1%
Don't know	3%	2%
Not answered	0%	0%

Q52. What is the primary fuel you use for water heating?

Response Option	Fort Collins (n = 383)	Total (n = 953)
Electricity	23%	17%
Natural gas	69%	76%
Propane	0%	1%
Other	0%	1%
Don't know	8%	5%
Not answered	0%	0%

Q53. [IF Q4 CLOTHES DRYER PURCHASED IS SELECTED] What type of clothes dryer do you use in your home?

Response Option	Fort Collins (n = 97)
An electric dryer	91%
A gas dryer	8%
Do not own a clothes dryer	0%

## Energy Efficiency Programs Evaluation

Response Option	Fort Collins (n = 97)
Other	1%
Don't know	0%
Not answered	0%

Q54. [IF Q11 CENTRAL AIR CONDITIONER IS NOT SELECTED] Does your home have a central air conditioner?

Response Option	Fort Collins (n = 346)	Total (n = 862)
Yes	68%	71%
No	32%	29%
Don't know	1%	1%

Q55. How many stories are there in your home? Please include finished attics or basements in your count.

Response Option	Fort Collins (n = 383)	Total (n = 953)
1	30%	27%
2	39%	43%
3	29%	27%
4 or more	2%	3%
Not answered	0%	0%

Q56. Including yourself, how many people currently live in your home year-round?

Response Option	Fort Collins (n = 383)	Total (n = 953)
I live by myself	23%	20%
Two	38%	44%
Three	18%	16%
Four	14%	13%
Five	4%	3%
Six	0%	1%
Seven	0%	0%
Eight or more	1%	0%
Don't know	0%	0%
Not answered	2%	2%

Q57. What is the highest level of education you have completed so far?

Response Option	Fort Collins (n = 383)	Total (n = 953)
Less Than High School	0%	0%
Some High School	0%	0%
High School Graduate Or Equivalent (Such As Ged)	3%	5%
Trade Or Technical School	3%	4%
Some College	13%	16%
Bachelor's Degree	33%	31%
Some Graduate School	8%	8%
Graduate Degree	30%	27%
Doctorate	7%	6%
Don't Know	0%	0%
Not Answered	2%	3%

Q58. What was your total annual household income for 2016, before taxes?

Response Option	Fort Collins (n = 383)	Total (n = 953)
Under \$20,000	3%	3%
20 to under \$30,000	6%	5%
30 to under \$40,000	4%	6%
40 to under \$50,000	8%	7%
50 to under \$60,000	6%	7%
60 to under \$75,000	10%	9%
75 to under \$100,000	15%	14%
100 to under \$150,000	19%	19%
150 to under \$200,000	6%	5%
\$200,000 or more	4%	4%
Don't know	1%	1%
Not answered	18%	20%

Q59. What is your race? *Multiple Response Options Allowed*

Response Option	Fort Collins (n = 383)	Total (n = 953)
White, European-American	81%	82%
Black, African-American	1%	1%
American Indian or Alaska Native	1%	1%

## Energy Efficiency Programs Evaluation

Response Option	Fort Collins (n = 383)	Total (n = 953)
Asian	3%	2%
Native Hawaiian or other Pacific Islander	0%	0%
Other, please specify:	2%	3%
Don't know	0%	0%
Prefer not to say	15%	14%

Q60. Are you of Hispanic, Latino, or Spanish Origin?

Response Option	Fort Collins (n = 383)	Total (n = 953)
Yes	5%	4%
No	80%	82%
Don't know	1%	1%
Not answered	14%	13%

Q61. How old are you?

Response Option	Fort Collins (n = 383)	Total (n = 953)
Less than 18 yrs old	0%	0%
18 to 24 yrs	3%	1%
25 to 34 yrs	24%	16%
35 to 44 yrs	21%	17%
45 to 54 yrs	13%	15%
55 to 64 yrs	18%	21%
65 yrs or older	15%	22%
Not answered	6%	7%

## Appendix I. Efficiency Works for Business Rebate Measures

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Efficiency Works for Business offers incentives for the following measures:

- › Lighting - Existing Buildings
  - Automatic controls
  - LED hardwired fixtures
  - LED retrofit kits
  - LED retrofits
  - LED replacement lamps
  - T8 or T5 fluorescent upgrades
  - All other retrofits and replacements
- › Lighting - New Construction
  - Incentive based on lighting power density reduction below ASHRAE standard by building type
- › Cooling Efficiency
  - Early replacement of rooftop units and split systems
  - Advanced rooftop unit controllers
  - Premium efficiency packages for new rooftop units
  - Evaporative condensing
  - Advanced evaporative cooling
  - Airside economizer for packaged cooling equipment
  - High efficiency packaged cooling equipment
- › Building Envelope
  - Efficient windows tier 1
  - Efficient windows tier 2
  - Existing window: add window film
  - Roof insulation
  - Wall insulation

- Cool roof
- › Food Service Equipment
  - High efficiency ice machines (CEE2 and Energy Star)
  - Insulated hot food holding cabinet
  - Reach-in refrigerators and freezers
  - Electric steamers
  - Electric fryers
  - Electric griddles
  - Combination ovens - electric
  - Convection ovens - electric
    - Vent hood controls for commercial kitchens
- › Grocery Efficiency
  - Auto closers for walk-in and reach-in freezer and cooler doors
  - Gaskets for walk-in and reach-in freezer and cooler doors
  - Strip curtains for walk-in and reach-in freezer and cooler doors
  - Suction line installation
  - Zero energy glass door with anti-sweat heat
  - Low energy glass doors
  - Anti-sweat heater controls
  - Case lighting retrofit T12/mag - T8/elec
  - LED case lighting replacing T8/elec
  - LED case lighting replacing T10/T12/mag
  - Occupancy sensor controlling LED or T8 lamp case lighting
  - EC motors in display cases, walk-in coolers, compressor head fans
  - EC motors in walk-in coolers and freezers evaporator and condenser fans and compressor head fans
  - Night covers - vertical or horizontal
  - Smart defrost control walk-in freezer
  - Evaporator fans controls on walk-ins
  - Outside air economizers for walk-ins

- › I.T. Office Equipment and Controls
  - Energy Star desktop or side computer
  - Energy Star thin client
  - Virtualized servers and server virtualization software
  - Energy Star LED desk lamp
  - Energy Star LED undercabinet fixture
  - Energy Star torchiere - 55-watt max
  - Smart strip energy efficient surge protector
  - Plug strip w/ motion sensor or occupancy schedule
  - Vending machine occupancy or schedule control
- › Variable Frequency Drives (VFD)
  - VSD on 1 - 75 HP motor
- › Water Efficiency
  - Ice machine
  - Electric steamers
  - Commercial vended clothes washers
  - Commercial non-vended clothes washers
  - Energy Star dishwasher
  - Tank toilets
  - Premium tank toilets
  - Flush valve toilets
  - Urinals
  - Ultra low flow aerators
  - Low flow aerators
  - Low flow pre-rinse spray valves
  - Low flow showerheads
  - Irrigation rain sensor
  - Soil moisture sensor
  - Irrigation controller or add-in weather station
  - High efficiency nozzles



- Pressure reducing heads
  - Pressure regulators (PRV or zone valve)
  - Commercial sprinklers audit
- › Custom efficiency