MichaelsEnergy

Final Report for:

Efficiency Maine C&I Custom Impact Evaluation

11/8/2024

Efficiency Maine

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Executive Summary

The Efficiency Maine Trust (Efficiency Maine) contracted Michaels Energy to complete an impact evaluation and cost-benefit analysis of the Commercial and Industrial (C&I) Custom Program. This evaluation covers projects incentivized between July 1, 2019, and June 30, 2022. This report summarizes the findings of the evaluation and offers recommendations for future program use.

Program Overview

The C&I Custom Program incentivizes tailored energy efficiency projects that require site-specific engineering analyses and/or projects with energy conservation measures that are not otherwise covered by prescriptive incentives. The C&I Custom Program is primarily designed to overcome the barriers confronting Maine's larger businesses and institutions when investing in complex energy efficiency and distributed generation projects. These projects represent important facility improvements that reduce the inefficient use of energy and keep operating costs down for Maine's largest energy users.

Evaluation Goals and Objectives

The approach to the evaluation was designed to achieve the two primary study objectives: **quantify and verify energy and demand savings** and **analyze program cost-effectiveness**.

The following activities were completed to meet the study objectives.

- **Evaluation Planning** – Critical to ensuring the project results met Efficiency Maine's reporting and program delivery needs. Our collaborative approach included reviewing program tracking data and input from Efficiency Maine staff at the outset.
- **Data Collection** - A comprehensive data collection approach was used to evaluate a census of measures implemented during the program period covered, July 1, 2019, to June 30, 2022. Measures were assigned to either a High or Basic level of rigor to cost-consciously complete a full review of measures. Both levels included a participant phone survey and an engineering desk review of project documentation and calculations. The High Rigor approach also included onsite verification, data collection, and a more rigorous analysis of energy use and measure savings for larger and more complex measures/projects. For some High Rigor sites, onsite verification was unnecessary, as comprehensive and useful trend data could be obtained directly from the customer via secure file transfer. The decision to go onsite and collect data or verify the site through trend data received from the customer was made on a case-by-case basis in collaboration with Efficiency Maine.
- **Impact Evaluation and Cost-Benefit Analysis** – Our impact evaluation approach determined the evaluation adjustment factors and verified gross impacts for each measure. Our net impact evaluation approach determined free ridership, participant spillover factors, and a net-to-gross ratio for each measure. Measure-level results were aggregated to the sub-program level. Finally, we assessed program cost-effectiveness with the Efficiency Maine Primary Benefit-Cost Test (PBCT) and the Program Administrator Cost tests (PAC) using Efficiency Maine's methods programmed in the Excel Measure

Screening tool. Our analysis includes trends and sensitivity analyses, adding meaningful context and identifying important drivers to the impact evaluation and cost-benefit results.

- **Management & Reporting** – Finally, the evaluation results were shared with Efficiency Maine through a comprehensive final report (this document).

Impact Evaluation Results

Using desk reviews, phone surveys, and on-site data collection, the evaluation team verified and adjusted the energy savings of the individual measures in the C&I Custom Program. A census of all measures incentivized through the program between July 1, 2019, and June 30, 2022, were evaluated. The overall results of the evaluation are in Table 1 below. These results do not include five enrollments (1059275, 1052950, 1092382,1164847, and 1208977) which were determined to be unrepresentative of the C&I Custom Program. All program-level results displayed throughout this report omit these enrollments.

Table 1. C&I Custom Program Impact Results

	Electric Energy Savings (kWh)	Electric Demand Savings (W kW)	Electric Demand Savings (S kW)	Natural Gas Savings (therms)	Ex Ante Unregulated Fuels (MMBtu)
Ex Ante Gross Savings	20,989,457	2,384.50	2,644.92	610,263	96,540
Realization Rate	98%	99%	101%	93%	101%
Verified Gross Savings	20,608,308	2,364.13	2,680.14	565,444	97,321
NTGR	94.42%	94.42%	94.42%	94.42%	94.42%
Verified Net Savings	**19,458,365**	**2,232.21**	**2,530.59**	**533,892**	**91,891**

Cost-Benefit Analysis Results

Michaels Energy analyzed the C&I Custom Program's cost-effectiveness using Efficiency Maine's Primary Benefit Cost Test (PBCT) and the Program Administrator Cost test (PAC). The PBCT test measures the net benefits of a program based on the total costs and benefits of the program from the perspective of the program administrator and all utility customers, including both participants and non-participants. The PAC test measures the net costs of the program based on the costs and benefits to the program administrator, including incentives. The PAC test does not include any net costs to the participant. In both cases, a benefit/cost ratio greater than one is considered cost-effective.

Michaels calculated the C&I Custom Program's cost-effectiveness using two avoided cost scenarios built into the Cost Benefit Analysis Tool (CBAT) in effRT. The first used avoided cost values from the 2018 Avoided Energy Supply Costs (AESC) study including Maine-specific transmission and distribution (T&D) values, expressed in 2021 dollars. The second used values from the 2021 AESC study, which also included Maine-specific T&D values expressed in 2021 dollars and includes additional values for a cost of carbon (COC).

Table 2 below shows the cost-benefit results for each test type and avoided cost scenario. Overall, the program was cost-effective using both test types and both avoided cost scenarios.

Table 2. Cost-Benefit Analysis Results

Avoided Cost Scenario	PBCT	PAC
AESC 2018 + ME T&D in $2021	4.01	5.00
AESC 2021 COC	8.19	9.76

1 Methodology

Efficiency Maine contracted Michaels Energy to complete an impact evaluation and cost-benefit analysis of the C&I Custom Program. This evaluation covers projects incentivized between July 1, 2019, and June 30, 2022. This section summarizes the evaluation methodology used to conduct the impact evaluation and cost-benefit analysis activities.

1.1 Participation Summary

A total of 114 individual measures were incentivized through the program for 101 unique enrollments from July 1, 2019, to June 30, 2022. This evaluation reviewed a census of all measures/projects completed during this timeframe. Projects were split into two categories of rigor, basic or high, for determining the data collection strategy and approach for the engineering analysis and review. Table 3 provides a breakdown of the sub-program category, measure name, and data collection strategy used to evaluate the measures. At a high level, a basic rigor project received an engineering desk review of project documentation and tracked savings calculations, as well as a phone verification of installed measure parameters and baseline conditions and assumptions. High rigor sites included everything that a basic rigor site received, as well as onsite verification with metering or collection of trend data from a building automation system when available.

Table 3. Measure Breakdown by Data Collection Strategy

Program Data		Approach		Total
Sub-Program Category	Measure Name	Basic	High	
Electric				
Large	Custom Generic-Useful Life 13 years	3	1	4
	Custom Generic-Useful Life 15 years	-	2	2
Small	Custom Continuous Process-Useful Life 10 years	2	-	2
	Custom Continuous Process-Useful Life 13 years	1	-	1
	Custom Continuous Process-Useful Life 15 years	1	-	1
	Custom Continuous Process-Useful Life 20 years	1	1	2
	Custom Continuous Process-Useful Life 25 years	1	-	1
	Custom Generic-Useful Life 10 years	33	5	38
	Custom Generic-Useful Life 12 years	1	-	1
	Custom Generic-Useful Life 13 years	7	-	7
	Custom Generic-Useful Life 15 years	13	3	16
	Custom Generic-Useful Life 20 years	5	1	6
	Custom Generic-Useful Life 7 years	2	-	2
	Custom Generic-Useful Life 9 years	1	-	1
	Custom Single Shift-Useful Life 10 years	1	-	1
Natural Gas				
Large	Custom Continuous Process-Useful Life 15 years	-	1	1
	Custom Generic-Useful Life 15 years	-	1	1
	Custom Generic-Useful Life 20 years	-	1	1
Small	Custom Generic-Useful Life 10 years	4	-	4

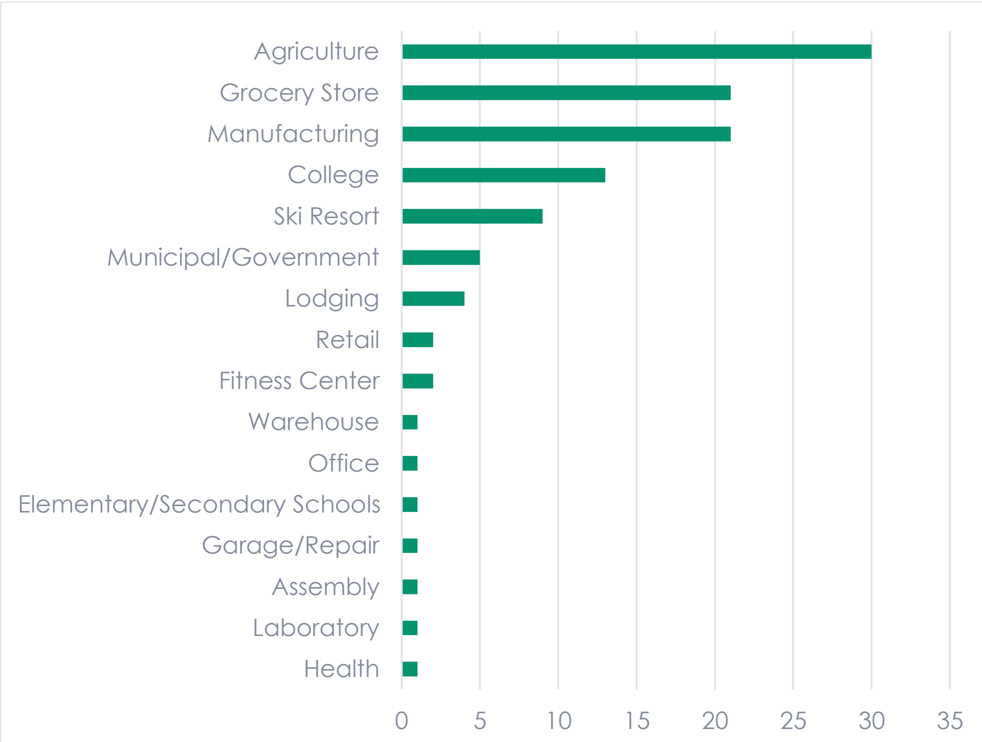
Program Data		Approach		Total
Sub-Program Category	Measure Name	Basic	High	
	Custom Generic-Useful Life 12 years	1	-	1
	Custom Generic-Useful Life 15 years	4	2	6
	Custom Generic-Useful Life 20 years	2	-	2
Thermal[1]				
Small	Custom Continuous Process-Useful Life 20 years	1	-	1
	Custom Generic-Useful Life 15 years	1	-	1
	Custom Generic-Useful Life 20 years	1	-	1
Unregulated Fuels[2]				
Large	Custom Generic-Useful Life 20 years	-	1	1
Small	Custom Generic-Useful Life 10 years	3	-	3
	Custom Generic-Useful Life 15 years	4	-	4
	Custom Generic-Useful Life 20 years	2	-	2
Total Project Measures		**95**	**19**	**114**
Unique Enrollments		**91**	**10**	**101**

[1] The Custom Efficiency Program stopped using thermal enrollments in November 2019 and started using either natural gas or unregulated fuel enrollments depending on the fuel source to better facilitate year end reporting.

[2] Unregulated fuels include all combustion fuels other than natural gas such as propane, heating oil and biomass (wood).

Error! Reference source not found. shows a breakdown of all project measures by facility type. Prominent facility types in the program include Agriculture, Grocery Stores and Manufacturing.

Figure 1. Breakdown of Measures by Facility Type



A summary of participation by program is provided in Table 4. The Small Custom Program – Electric accounts for the largest amount of electric savings and measures for the entire custom portfolio for the evaluated period. Note that the ex ante savings listed in Table 4 and Table 5 are all-encompassing, and include the ex ante savings for the enrollments that were determined to be nonrepresentative of the program for purposes of reporting the program-level savings.

Table 4. Participation Summary by Sub-Program

Sub-Program	# of Measures	Ex Ante kWh	Ex Ante W kW	Ex Ante S kW	Ex Ante NG (therms)	Ex Ante Unregulated (MMBtu)
Small Custom Program - Electric	79	14,170,329	2,090.88	1,778.10	(13,731)	86
Small Custom Program - Natural Gas	13	(71,540)	(12.22)	(3.22)	124,686	-
Small Custom Program - Unregulated Fuels	9	(23,528)	(8.00)	(1.00)	-	7,384
Large Custom Program - Electric	6	10,348,280	850.80	981.10	(1,294)	-
Large Custom Program - Natural Gas	3	(754,099)	(87.00)	(87.00)	500,602	-
Small Custom Program - Thermal	3	(59,849)	(7.16)	(3.56)	-	29,473

Sub-Program	# of Measures	Ex Ante kWh	Ex Ante W kW	Ex Ante S kW	Ex Ante NG (therms)	Ex Ante Unregulated (MMBtu)
Large Custom Program - Unregulated Fuels	1	-	-	-	-	59,597
Total	**114**	**23,609,593**	**2,827.30**	**2,664.42**	**610,263**	**96,540**

Table 5 shows a breakdown of all project measures by end-use. The most common end-uses in the program for the evaluated period include indoor agriculture lighting (mostly cannabis), advanced heating, ventilation, and cooling (HVAC) controls, and efficient snowmaking equipment.

Table 5. Participation Summary by End Use

End Use	# of Measures	Ex Ante kWh	Ex Ante W kW	Ex Ante S kW	Ex Ante NG (therms)	Ex Ante Unregulated (MMBtu)
Indoor Agriculture Lighting	28	4,584,781	797.68	864.86	(13,731)	(230)
Advanced HVAC Controls	12	450,554	35.94	82.94	22,693	1,810
Efficient Snowmaking Equipment	10	2,792,236	505.60	19.50	-	1,252
Commercial Refrigeration	9	1,337,605	156.40	88.69	-	-
Refrigerated Cases	8	340,296	39.49	35.93	22,227	567
Manufacturing Heat Recovery	6	(813,948)	(94.16)	(90.56)	421,617	88,158
Indoor Lighting	5	3,800,282	321.00	392.10	(1,294)	-
Advanced Ventilation	5	417,418	26.40	48.00	101,442	-
Efficient HVAC Units	4	(18,157)	(11.40)	4.90	15,056	2,195
Air compressor	3	3,873,876	466.10	466.40	-	-
Efficient Process Equipment	3	2,799,175	191.50	236.30	-	2,123
Weatherization	3	2,787	-	0.80	11,093	247
Efficient HVAC Chiller	2	1,471,019	118.60	260.70	-	-
Efficient Process Chiller	2	289,156	34.21	34.22	-	-
Wastewater Treatment	2	205,697	1.98	1.76	-	-
Lighting Controls	2	226,520	23.60	23.60	-	-
Smart Thermostats	2	(25,440)	(3.00)	(2.90)	25,551	-
Other Heat Recovery	2	473,277	56.08	40.90	-	-
Indoor Ag HVAC	1	337,699	40.10	40.10	-	-
High Efficiency Process Motors	1	-	-	-	-	418
Industrial Fiber Laser	1	241,363	27.60	27.60	-	-
Efficient Transformers	1	(2,803)	(0.32)	(0.32)	5,609	-
Steam Boiler Improvements	1	268,248	59.90	59.90	-	-

End Use	# of Measures	Ex Ante kWh	Ex Ante W kW	Ex Ante S kW	Ex Ante NG (therms)	Ex Ante Unregulated (MMBtu)
Destratification Fans	1	557,952	34.00	29.00	-	-
Total	**114**	**23,609,593**	**2,827.30**	**2,664.42**	**610,263**	**96,540**

1.2 Impact Evaluation Methodology

1.2.1 Sampling and Data Collection Approach

Michaels evaluated a census of measures incentivized and installed during the program period covered. A two-tiered rigor approach was utilized to optimize the data collection budget across the population of measures. After analyzing the program tracking data, measures were assigned to either a Basic or High level of rigor. Assignments were made commensurate to project complexity/size, the uncertainty of tracked savings, and relative data collection cost.

Basic Rigor: Engineering Desk Review and Phone Verification. The Basic Rigor approach included the following:

- An engineering desk review of project documentation and tracked savings calculations to determine if the project application and tracked savings were accurate and reflected accepted engineering principles.
- Reviewed the tracked savings relative to the system and buildings' energy use for reasonableness.
- Phone verification of each measure's installed quantity and functionality and that the installed equipment met the application specifications and program eligibility requirements (i.e., equipment is not listed in the Technical Reference Manual (TRM)).
- Phone verification of baseline conditions and assumptions.

High Rigor: Onsite Measurement and Verification (M&V). A high rigor verification involved everything that a basic rigor site included, with the addition of an onsite verification following either International Performance Measurement and Verification Protocol[3] (IPMVP) option A or D, or in some cases, a comprehensive review/analysis of trend data and facility data received from the customer. IPMVP Option A is a retrofit isolation that measures only certain key parameters. Option D involved a whole facility-calibrated simulation. This approach included:

- A rigorous engineering desk review of the project documentation, including program-provided energy analysis and methodology, assumptions, and stipulations.
- Onsite verification of installed equipment, quantities (if applicable), nameplate data, and other design/operations features.
- Data collection to document inputs, key operating and performance factors, control sequences, load profiles, and operating schedules.
- Documentation of adjacent energy-impacted systems that may have interactive effects.
- Trend data collected and analyzed from building automation systems whenever possible.
- Submetering to confirm operating schedules, develop typical operation profiles, and update calculation inputs. (Largest and most complex projects.)

[3] https://evo-world.org/en/products-services-mainmenu-en/protocols/ipmvp

- In some cases, a physical onsite visit was not completed either because the customer was unwilling to do a site visit, or Michaels was able to collect the necessary information to evaluate the project through robust trend data and relevant information provided by the customer. In cases where a site visit was not completed, the steps to evaluate the project and the information used to verify the results were reviewed and approved in collaboration with Efficiency Maine evaluation staff.

1.2.2 Data Collection Activities

Data collection to support the evaluation of implemented measures involved the following activities: program tracking data review, in-depth interviews with program management and delivery team staff, project documentation review and developing site-specific evaluation plans, completing engineering desk reviews, completing participant phone surveys, and conducting onsite verification and in-depth interviews with site-contacts. Michael's approach to each is described below.

1.2.2.1 Review Program Tracking Data

The first step to evaluating any program is thoroughly reviewing the tracking data. The review enabled us to 1) confirm the categorization of measures into High or Basic data collection approaches, 2) determine if project documents and data were available for engineering desk reviews, and 3) if contact information and sufficient site details were available for conducting phone surveys and scheduling on-site visits.

The evaluation team triaged the measures into meaningful groups to be as economical as possible with data collection sequencing for consistency and better quality assurance and quality control. Michaels identified enrollments installed at the same site and assigned those projects to one engineer for consistency and to lessen the burden on the project contact. This led to less time spent reviewing project documentation and streamlined customer outreach.

Program tracking data was the source of ex ante tracked measure impact values "of record" against which the verified impacts were compared. Thus, engineering desk reviews included an audit of program tracking data for each measure to ensure values were entered accurately. All of Michaels' assigned project staff received access to Efficiency Maine's project tracking database, EffRT, to view project documentation and reported savings.

1.2.2.2 Conduct In-depth Interviews with Program Management and Delivery Team Staff

Throughout the evaluation, Michaels utilized the program management team as a resource for answering questions that came up during the project review and evaluation. This proved to be a valuable tool for project engineers and a good use of project funds. Indoor agriculture lighting projects were a specific focus of this evaluation. A formal interview was held with Efficiency Maine and the delivery team to gain more insight into how the delivery team implemented the indoor agriculture lighting projects.

1.2.2.3 Review Project Documentation and Develop Site-specific Evaluation Plans

Michaels' assigned engineering staff reviewed all project documentation (application, program verification, calculation files/workbooks, photos, invoices, etc.) to develop a site-specific evaluation plan for each measure/project. Notably, the site-specific evaluation plans served as roadmaps used by all staff involved in the evaluation.

Each site-specific evaluation plan included the following:

1. Description of the building/facility, including building type and description, space types, occupancy patterns, and square footage.
2. Inventory of measure(s) installed at the site, including description and quantity.
3. Summary of analysis methods, calculations, inputs, assumptions, and parameters used to develop each measure's tracked savings. (For one lighting controls and several indoor lighting measures, the evaluation team referenced the TRM to determine if calculation methods followed standardized methods for prescriptive measures.)
4. An M&V data collection plan which specified the parameters and calculation inputs that were intended to be collected or monitored. For projects requiring data logging and metering, high rigor sites, the M&V plan identified the data to be collected, including the specific equipment/systems to be sub-metered, the types of meters to be installed, and the metering intervals and durations. Specific questions to ask the site contact were also included in the M&V plan.

Importantly, the site-specific evaluation plans complied with the ISO-NE Manual for Measurement and Verification of Demand Reduction Value from Demand Resources requirements for on-peak and seasonal peak resources participating in the ISO-NE Forward Capacity Market, as applicable.

1.2.2.4 Complete Engineering Desk Reviews

The engineering desk review examined the methods for developing ex ante measure-level impacts and the reasonableness of ex ante impact estimates for all measures. The ex ante calculations, project documentation, and input parameters were assessed to ensure they were appropriate, the results were accurate, and they followed sound engineering principles and industry best practices. The desk review also included verifying tracked measure cost documentation, such as invoices and project bids, and any available documentation to support the development of baseline costs.

Engineering desk reviews preceded onsite data collection for the projects selected for the High Rigor approach. For these projects, the desk reviews yielded valuable insights and informed the development of the site-level M&V plans.

1.2.2.5 Complete Participant Phone Surveys

Michaels attempted to conduct a phone survey with each participant, regardless of the evaluation rigor of the project. Questions were prepared before the call, and answers were recorded in an Excel spreadsheet. The participant phone survey served several purposes for this study:

- Confirmed equipment installation and functionality, obtained operational characteristics of the facility and installed equipment, and learned about other factors that affected the project energy use, including any atypical conditions at the time of the baseline determination.
- Verified baseline conditions and inputs to the savings calculations, as specified in the site-specific evaluation plan.
- Identified any non-routine events that may have impacted energy use or operational levels that would be reflected in past data or energy use.
- Solicited information on the customer decision-making process and decision drivers to implement the measure(s) to estimate free ridership.
- Determined if the participant implemented additional energy savings measures outside of the program and, if so, obtained baseline and operating characteristics to estimate its impact on the evaluated measure and any participant spillover.
- Confirmed measure cost documentation and reasonableness of costs.

Note that some customers were unresponsive, despite multiple outreach attempts by Michaels Energy, Efficiency Maine, and the delivery team. In such cases, the projects had to be verified using the information in the project documentation. Additionally, in some cases, the customer responded to the project-specific questions but declined to complete the net-to-gross survey.

1.2.2.6 Conduct Onsite Verification and M&V

Onsite data collection and M&V followed the site-specific evaluation plan developed for each measure and project selected for the High Rigor approach. The focus of the onsite data collection was to verify and/or update the assumptions and inputs for the energy analyses, including (but not limited to): verification of installation quantity, operating schedule, system loading conditions, validation of baseline selection, and verification that the site or end-use system(s) are functioning and operating as planned (and if not, how the observed operation differs from the intended operation, taking into account daily, weekly, and seasonal variations).

Depending on the measure's complexity, some onsite evaluations required onsite measurement and/or obtaining customer-stored data to support M&V calculations, such as spot measurements, data logging, and interval metering. For this evaluation, metering was completed at three agriculture facilities and one grocery store. The measures metered included indoor agriculture lighting, indoor HVAC, and commercial refrigeration. If available, customer-supplied trend data, utility billing, or interval data for up to 15 minutes was used. This data was used in lieu of an in-person site visit for some of the High Rigor sites, where either the customer was unwilling to do a site visit or when going on-site would not have produced more accurate results.

1.2.2.7 Conduct In-depth Interviews with Site Contacts

During the onsite visit, the assigned evaluation engineer asked the site contact follow-up questions to fill in any information gaps, identified non-routine events, and confirmed the operating characteristics of the replaced equipment and any baseline conditions used to calculate ex ante impacts. In some cases, the net-to-gross survey was completed with the customer while onsite as well.

1.2.3 Gross Impact Methodology

Verified gross impacts are the energy savings and demand reduction resulting from measure implementation. Utilizing data collection and analysis through Basic and High Rigor approaches described above, Michaels computed verified energy consumption and demand and the resultant energy and demand reduction for each fuel type applicable for each evaluation measure.

This impact evaluation reflects our expert assessment of the baseline conditions and measure calculations for the appropriateness of the engineering approach and technical soundness of the application. When equipment data, measured or logged operating data, control sequences, or seasonal effects differed from the ex ante calculations, our engineer revised the energy analysis to reflect our verified site findings.

Realization Rate. Michaels computed a realization rate (RR) adjustment factor for each measure evaluated and for each applicable fuel type.

RR = Verified Impacts/ Ex Ante Impacts

Lastly, Michaels categorized the evaluation adjustments to the tracked savings to identify systematic issues/errors and provide more meaningful insights and actionable recommendations. Categories used for this evaluation include:

- **Inaccurate Assumptions:** Assumptions include any assumed values or conditions used to calculate baseline and/or measure savings. Inaccurate assumptions could be an assumption of idealized conditions that are not representative of actual conditions. Examples of assumptions that may be inaccurate include hours of use, facility size or type, scheduling or controls sequencing, incorrect building or energy code, use of an inaccurate Technical Reference Manual (TRM) algorithm for the use case, or inaccurate operating conditions, load profiles, performance curves, efficiency, or equipment sizing.
- **Calculation or Engineering Error:** Errors in the savings calculations that are not attributable to the abovementioned categorizations. This covers anything from spreadsheet cell reference errors, using TRM algorithms inappropriate for the evaluated measure, missing or double-counting adjustment factors, or misplaced decimal points.
- **Operated or Installed Differently:** Different operating hours than what is specified in the ex ante savings calculations and was not apparent at the time of project completion; includes equipment not installed or shut down (backup equipment). This also included adjustments due to COVID-19 shutdowns and atypical operations.
- **Inaccurate Baseline:** Examples include building types misclassified for baseline determination, using efficiencies of existing equipment when code-minimum efficiencies should be used (or vice-versa), or using a baseline that does not align with code or industry standard practice. This category was used when the evaluation team found that the baseline used to calculate project savings was inaccurate.
- **Inaccurate Energy Model:** Errors or inaccuracies identified in energy models that use computer simulations to develop project savings rather than equations or algorithms.

The reasons for adjustment for each enrollment can be found in Appendix B.

1.2.4 Net-to-Gross Methodology

Net impacts are computed by applying the calculated net-to-gross ratio (NTGR) to the verified gross impacts.

NTGR = 1 – free ridership + spillover

The two components of the NTGR that were estimated for this evaluation were free ridership (FR) and participant spillover (SO). Free ridership occurs when a customer receives benefits through a program but would have taken exactly the same action in the absence of the program. Participant spillover results from a program participant's actions that result in additional energy and demand impacts not funded by the program. Both free ridership and participant spillover are computed as numerical factors; the final NTGR is interpreted as a percentage of the verified gross impacts attributable to the program.

1.2.4.1 Free Ridership

The free ridership analysis is based on participants' self-reported intentions and influences collected through a standard series of questions of the participant phone survey. Michaels estimated free ridership using an approach employed to evaluate other Efficiency Maine programs. This approach is based on two components: a self-reported intent score and a program influence score. The intent score included a question about the respondent's likelihood of installing the measure if they had not participated in the program. The questions, responses, and scoring used for the self-reported intent score can be found in Table 6. A score of 1.0 indicates that the customer intended to install the equipment, even if the program did not exist (full free rider). A score of 0.5 indicates that the customer had some intent on installing the equipment, even if the program did not exist, but the number of units or timing would have likely differed without the program (partial free rider). A score of 0 indicates that the customer did not intend to install the equipment in the absence of the program.

Table 6. Intention Scale Scoring

Question	Answer	Score
If an Efficiency Maine incentive had not been awarded, do you think your company would have still moved forward with the project, installed a cheaper alternative, done nothing or something else?	Exactly the same thing	1.0
	Installed equipment of the same level of efficiency but fewer units or at a later time	0.5
	Installed something less efficient (including standard efficiency equipment or whatever is required by code)	0
	Done nothing (i.e., kept existing equipment)	0
	Something else	0
	Don't know	0

The influence score was based on a question using a scale of 0-10 asking about the program's influence on their decision to install the energy-efficient equipment. A customer who answered 0 to the influence question means that the program had no influence at all on their decision and was given a score of 1. A customer who answered 10 to the influence question means that the program entirely influenced their decision and was given a score of 0. The influence score is scaled based on the respondent's answer, and the full scoring values can be found in Table 7.

Table 7. Influence Scale Scoring

Influence Scale	Influence Score
0	1
1	0.9
2	0.8

Influence Scale	Influence Score
3	0.7
4	0.6
5	0.5
6	0.4
7	0.3
8	0.2
9	0.1
10	0

These two score components, intent and influence, were averaged together to create a combined free ridership score between 0 and 1 for each participant. These individual scores were weighted based on the savings from each project to come up with an overall average free ridership score for the program. A low free ridership score indicates that the program greatly influenced the participants to install the energy-efficient measures.

1.2.4.2 Spillover

Participant spillover was determined through self-reports to a standard series of questions in participant interviews. Maine TRM methodologies were used with the information available from the participants' self-reporting about the spillover projects to calculate savings. In scenarios where spillover projects did not align with TRM methodologies, savings analyses for similar projects completed at similar facilities were used and adjusted as deemed necessary to align with the information specified by the customer during the NTG interview. Spillover was calculated for nine projects. Five of the projects were lighting upgrades, three were HVAC upgrades, and one was a process heat recovery project. The net-to-gross survey questions can be found in Appendix C.

1.3 Cost-Benefit Analysis Methodology

Michaels Energy analyzed the C&I Custom Program's cost-effectiveness using Efficiency Maine's Primary Benefit Cost Test (PBCT)) and the Program Administrator Cost test (PAC). Efficiency Maine's Cost Benefit Analysis Tool (CBAT) in the effRT database was used to conduct the cost-benefit analysis. Within the tool, inputs were verified, and the evaluation team ensured that the calculations and outputs used were correct.

The evaluation team performed sensitivity analyses to compute results for scenarios with variations of important inputs and identified key drivers of differences between the tracked estimated benefit/cost ratio and those calculated with the verified impacts of this evaluation. Michaels worked with Efficiency Maine to identify two different scenarios to analyze, including 1) a retrospective scenario using AESC 2018 in 2021 dollars to represent the avoided cost assumptions when the projects in this evaluation were implemented; and 2) a prospective scenario using AESC 2021 also in 2021 dollars which includes values for a cost of carbon and represents the avoided cost assumptions currently being utilized by Efficiency Maine.

2 Results

2.1 Impact Evaluation

Table 8 presents the all-encompassing verified annual savings achieved through the C&I Custom Program. The remainder of the results tables exclude five enrollments from the savings calculations, which were removed for various reasons and are explained in more detail in section 2.1.1 below.

Table 8. All-encompassing Verified Gross Annual Savings

	Electric Savings (kWh)	Winter Demand Savings (W kW)	Summer Demand Savings (S kW)	Natural Gas Savings (therms)	Unregulated Savings (MMBtu)
Total Program Ex Ante Gross Savings	23,609,593	2,827.30	2,664.42	610,263	96,540
Program Realization Rate	102%	136%	101%	93%	101%
Total Program Verified Gross Savings	**24,111,758**	**3,837.52**	**2,691.10**	**565,444**	**97,321**

2.1.1 Gross Impact Results

The following sections break down the annual savings by impact category but exclude five enrollments determined to be unrepresentative projects for evaluating prospective measures based on major operational changes to the project or overall inapplicability to the program. The five enrollments removed from the impact savings analysis were 1059275, 1059520, 1092382, 1164847, and 1208977. Enrollments 1059275, 1059520, 1164847, and 1208977 were removed due to their inapplicability to evaluate a prospective program. All enrollments were Efficient Snowmaking Equipment projects which initially did not have winter demand savings. The evaluation determined that these projects should indeed have winter demand savings which were produced for each project and reflected in the verified results. However, this addition of demand savings inappropriately inflated the realization rate. Therefore, it was determined that these projects would be removed from the final results to not skew the overall demand realization rate for the program used to evaluate future projects. Enrollment 1092382, an Efficient Snowmaking Equipment project at a manufacturing facility, was removed due to major operational changes that would be unlikely to occur at other facilities installing this type of measure. The equipment is being operated substantially differently than expected making it not representative of the program. **Error! Not a valid bookmark self-reference.** Table 9 shows the overall gross impact results for the C&I Custom Program after removing the five unrepresentative enrollments. [4]

[4] The remaining report tables and calculations exclude the five unrepresentative enrollments from the analysis (1059275, 1059520, 1092382,1164847 and 1208977).

Table 9. Verified Gross Annual Savings (exclusions removed)

	Electric Savings (kWh)	Winter Demand Savings (W kW)	Summer Demand Savings (S kW)	Natural Gas Savings (therms)	Unregulated Savings (MMBtu)
Total Program Ex Ante Gross Savings	20,989,457	2,384.50	2,644.92	610,263	96,540
Program Realization Rate	98%	99%	101%	93%	101%
Total Program Verified Gross Savings	**20,608,308**	**2,364.13**	**2,680.14**	**565,444**	**97,321**

2.1.2 Net-to-Gross Results

Net impacts were computed by applying the calculated net-to-gross ratio (NTGR) to the verified gross impacts.

NTGR = 1 – free ridership + spillover

The two components of the NTGR that were estimated for this evaluation were free ridership (FR) and participant spillover (SO). Free ridership occurs when a customer receives benefits through a program but would have taken exactly the same action in the absence of the program. Participant spillover results from a program participant's actions that result in additional energy and demand impacts not funded by the program. Both free ridership and participant spillover are computed as numerical factors; the final NTGR is interpreted as a percentage of the verified gross impacts attributable to the program.

2.1.2.1 Free ridership & Spillover

A total of 67 responses were collected from the net-to-gross survey. Table 10 presents the final weighted average free ridership, spillover, and net-to-gross ratio for the C&I program. A net-to-gross ratio of 94.42% was applied to all project impacts.

Table 10. Free Ridership & Spillover Results

# of Participants	Free ridership	Spillover	NTG Ratio
67	0.0923	0.0365	94.42%

Table 11 shows the total program-verified net annual savings for each impact after applying the net-to-gross ratio for the C&I Custom Program.

Table 11. Verified Net Annual Savings

	Electric Savings (kWh)	Winter Demand Savings (W kW)	Summer Demand Savings (S kW)	Natural Gas Savings (therms)	Unregulated Fuels (MMBtu)
Total Program Verified Gross Savings	20,608,308	2,364.13	2,680.14	565,444	97,321
NTG Ratio	94.42%	94.42%	94.42%	94.42%	94.42%
Total Program Verified Net Savings	**19,458,365**	**2,232.21**	**2,530.59**	**533,892**	**91,891**

2.1.3 End Use Level Impacts

Individual impact results tables by end use can be found in Appendix A.

2.1.4 Indoor Agriculture Lighting

In late 2020, Efficiency Maine received board approval to start funding measures for indoor agriculture lighting through the Custom program. In late 2021, some indoor agriculture lighting measures were shifted to the prescriptive program. One objective of this evaluation was to improve Efficiency Maine's confidence in its savings calculations and increase the savings precision for indoor agriculture lighting measures. Table 12 shows the verified and net annual savings by impact type for the 28 indoor agriculture lighting projects that were evaluated. Metering was conducted at three of the indoor agriculture lighting facilities.

Table 12. Indoor Agriculture Lighting Annual Savings

	Annual Energy Savings (kWh)	Annual Winter Demand Savings (W kW)	Annual Summer Demand Savings (S kW)	Annual Energy Savings NG (therms)	Annual Energy Savings Unregulated Fuels (MMBtu)
Total Program Ex Ante Gross Savings	4,584,781	797.68	864.86	(13,731)	(230)
Program Realization Rate	103%	95%	98%	130%	101%
Total Program Verified Gross Savings	4,701,692	754.60	844.22	(17,836)	(233)
NTG Ratio	94.42%	94.42%	94.42%	94.42%	94.42%
Total Verified Net Savings	**4,439,337**	**712.50**	**797.11**	**(16,841)**	**(220)**

2.2 Cost-Benefit Analysis

Michaels Energy analyzed the C&I Custom Program's cost-effectiveness using the Primary Benefit Cost Ratio (PBCR) and the Program Administrator Cost test (PAC). The PBCR test measures the net benefits of a program based on the total costs and benefits of the program from the perspective of the program administrator and all utility customers, including both participants and non-participants. The PAC test measures the net costs of a program based on the costs and benefits to the program administrator, including incentives. The PAC test does not include any net costs to the participant. In both cases, a benefit/cost ratio greater than one is considered cost-effective.

2.2.1 Cost-Effectiveness Inputs

Michaels used the following inputs to calculate cost-effectiveness. Many of the values are built into the effRT Cost Benefit Analysis Tool (CBAT).

Table 13. Cost-Effectiveness Inputs

Input	Source	Retrospective Values	Current Values
Avoided Costs	effRT	AESC 2018 + ME T&D in 2021$	AESC 2021 COC in 2021$
Generation Mark-up	effRT	8%	8%
Discount Rate	effRT	2.8%	1%
Incentive Costs	Efficiency Maine	Incentive paid per project	Incentive paid per project
Net Participant Costs	Efficiency Maine	Max of incentive and recorded measure cost for each project	Max of incentive and recorded measure cost for each project
Program Costs	Efficiency Maine	Program delivery and marketing as reported in Annual Report	Program delivery and marketing as reported in Annual Report
Measure Savings	Impact Evaluation	-	-
Measure Lives	effRT	As defined by measure type	As defined by measure type

2.2.2 Cost-Benefit Results

Michaels calculated the C&I Custom Program's cost-effectiveness using two avoided costs scenarios. The first used avoided cost values from the 2018 AESC study including Maine-specific transmission and distribution values, expressed in 2021 dollars. The second used values from the 2021 AESC study, also expressed in 2021 dollars and included values for the cost of carbon.

Table 14 shows the cost-benefit results for each test type and avoided cost scenario. Overall, the program was cost-effective using both test types and both avoided cost scenarios.

Table 14. Cost-Benefit Analysis Results

Avoided Cost Scenario	PBCT	PAC
AESC 2018 + ME T&D in $2021	4.01	5.00
AESC 2021 COC	8.19	9.76

3 Findings and Recommendations

Overall, the evaluation team found that a majority of the project enrollments had sufficient documentation and robust calculations to support the project savings. This is reflected in the near 100% or over 100% overall realization rates for each impact produced through the evaluation.

Based on the findings of the evaluation, Michaels Energy produced the following adjustment factors for the C&I Custom Program. To produce a singular adjustment factor for demand, the evaluation team used the same methodology used in previous Efficiency Maine evaluations[5].

Table 15. C&I Custom Program Adjustment Factors

Program	Energy RR	Demand RR	Free ridership	Spillover
C&I Custom Program Adjustment Factors	98.18%	99.87%	9.23%	3.65%

3.1 Indoor Agriculture Lighting

To evaluate the indoor agriculture lighting projects, Michaels created a calculation template that accounted for key factors for verifying the project savings. One major finding was that many of the projects needed to be adjusted for hours of use. Three of the indoor agriculture lighting sites were metered for a period of almost three months, and the hours of use, lights on and off, were metered and used to adjust the projects accordingly. Metering at the sites was also conducted on the HVAC equipment to determine when equipment was running to better calculate the HVAC interactive effects of the lighting. Additionally, the PPF values of lighting fixtures were updated to comply with the wattages listed in the Design Lights Consortium documentation. We recommend that the delivery team use this same methodology when determining fixture wattages for future projects.

3.2 Efficient Snowmaking Equipment

For five out of the nine snowmaking measures, the Program decided not to claim peak winter demand savings. The customer for the five projects stated that because of the compressed air reductions achieved as part of these projects (along with several others that had also been processed through Efficiency Maine programs), the facilities were now running, on average, fewer compressors than before. The delivery team assumed that the more efficient snowmaking equipment would allow for snow to be produced at a higher rate during peak hours using the same amount of compressed air, and therefore the electrical demand of the compressors during peak hours would not change. Findings from the virtual onsite visit with the customer contradicted the ex ante assumption, finding that these facilities are actually limited by water pumping capacity and not compressed air usage, so during peak times the compressors end up operating at lower loads compared to the baseline, leading to winter peak demand savings. The water pumping capacity limits the total number of snow guns able to be run at the facilities to roughly 15% of the fleet at any given time.

[5] To calculate RRd, Efficiency Maine uses Summer kW * 4/12 + Winter kW * 8/12 = 99.87%

As a result, the evaluation team determined that winter peak demand savings should indeed be calculated for these projects. These findings are reflected in the verified savings, therefore bringing the realization rates for these projects to well over 100%. For future projects such as this, it is recommended that the main drivers behind the snow production and runtimes be verified. Additionally, for snowmaking projects, it is recommended that trend data be collected during project implementation when possible. This would provide better insight into the equipment's run time and hours of use, eliminating future adjustments in forthcoming evaluations.

3.3 End Use Level Impacts

Table 16. Electric Impacts by End Use End

	# of Measures	Ex Ante Electric Savings (kWh)	Electric RR	Gross Electric Savings (kWh)	NTG Ratio	Net Electric Savings (kWh)
Indoor Agriculture Lighting	28	4,584,781	102.55%	4,701,692	94.42%	4,439,337
Advanced HVAC Controls	12	450,554	132.51%	597,022	94.42%	563,708
Commercial Refrigeration	9	1,337,605	93.59%	1,251,880	94.42%	1,182,025
Refrigerated Cases	8	340,296	149.74%	509,545	94.42%	481,112
Manufacturing Heat Recovery	6	(813,948)	76.07%	(619,176)	94.42%	(584,626)
Advanced Ventilation	5	417,418	95.07%	396,841	94.42%	374,698
Indoor Lighting	5	3,800,282	92.66%	3,521,376	94.42%	3,324,883
Efficient HVAC Units	4	(18,157)	115.09%	(20,897)	94.42%	(19,731)
Efficient Snowmaking Equipment	4	172,100	79.58%	136,950	94.42%	129,308
Efficient Process Equipment	3	2,799,175	85.75%	2,400,306	94.42%	2,266,369
Air compressor	3	3,873,876	105.04%	4,069,221	94.42%	3,842,158
Weatherization	3	2,787	100.00%	2,787	94.42%	2,631
Other Heat Recovery	2	(25,440)	100.10%	(25,466)	94.42%	(24,045)
Smart Thermostats	2	205,697	73.60%	151,392	94.42%	142,945
Wastewater Treatment	2	289,156	173.63%	502,053	94.42%	474,038
Efficient HVAC Chiller	2	1,471,019	69.99%	1,029,576	94.42%	972,126
Efficient Process Chiller	2	473,277	100.49%	475,577	94.42%	449,039
Lighting Controls	2	226,520	96.98%	219,674	94.42%	207,416
Efficient Transformers	1	241,363	100.00%	241,363	94.42%	227,895
Industrial Fiber Laser	1	268,248	93.81%	251,649	94.42%	237,607
Destratification Fans	1	(2,803)	100.01%	(2,803)	94.42%	(2,647)
Indoor Agriculture HVAC	1	557,952	100.00%	557,952	94.42%	526,818
High Efficiency Process Motors	1	337,699	76.93%	259,795	94.42%	245,299
Total	**107**	**20,989,457**	**98.18%**	**20,608,308**	**94.42%**	**19,458,365**

Table 17. Electric Major Findings

End Use	Major Findings
Advanced HVAC Controls	Finding 1: For three projects, the delivery team made an incorrect assumption of the hours of use for the equipment. Finding 2: For two projects, the equipment was operated or installed differently than what was originally planned.

End Use	Major Findings
	Finding 3: An inappropriate load profile assumption was made for one project impacting energy savings. Finding 4: An inaccurate energy model was used for one project.
Refrigerated Cases	Finding 1: Two projects had inappropriate efficiency assumptions for the refrigeration load due to a motor replacement. Finding 2: Two projects did not account for the decrease in cooling loads associated with new door heaters.
Manufacturing Heat Recovery	Finding 1: One project incorrectly assumed the annual hours of use for the proposed equipment, causing a decrease in energy savings.
Wastewater Treatment	Finding 1: One project was found to have inappropriate hours of use assumptions for the baseline equipment. For this project, the equipment was required to run 24/7 to maintain the product integrity.
Smart Thermostats	Finding 1: One project was found to have less units installed than originally planned. Finding 2: One project used an inappropriate assumption for the % reduction produced by smart thermostats.
High Efficiency Progress Motors	Finding 1: One project had an inappropriate assumption for the process downtime hours.

Table 18. Winter Demand Impact by End Use

End Use	# of Measures	Ex Ante Winter Demand Savings (W kW)	W kW RR	Gross Winter Demand Savings (W kW)	NTG Ratio	Net Winter Demand Savings (W kW)
Indoor Agriculture Lighting	28	797.68	94.60%	754.60	94.42%	712.50
Advanced HVAC Controls	12	35.94	61.45%	22.09	94.42%	20.85
Commercial Refrigeration	9	156.40	95.31%	149.07	94.42%	140.75
Refrigerated Cases	8	39.49	182.79%	72.18	94.42%	68.16
Manufacturing Heat Recovery	6	(94.16)	75.89%	(71.46)	94.42%	(67.47)
Advanced Ventilation	5	26.40	96.86%	25.57	94.42%	24.14
Indoor Lighting	5	321.00	122.10%	391.93	94.42%	370.06
Efficient HVAC Units	4	(11.40)	73.95%	(8.43)	94.42%	(7.96)
Efficient Snowmaking Equipment	4	62.80	44.48%	27.94	94.42%	26.38
Efficient Process Equipment	3	191.50	109.17%	209.06	94.42%	197.39
Air compressor	3	466.10	109.00%	508.07	94.42%	479.72
Other Heat Recovery	2	(3.00)	100.00%	(3.00)	94.42%	(2.83)
Smart Thermostats	2	1.98	73.72%	1.46	94.42%	1.38
Wastewater Treatment	2	34.21	170.44%	58.31	94.42%	55.05
Efficient HVAC Chiller	2	118.60	0.00%	-	94.42%	-
Efficient Process Chiller	2	56.08	101.27%	56.79	94.42%	53.62
Lighting Controls	2	23.60	123.02%	29.03	94.42%	27.41
Efficient Transformers	1	27.60	100.00%	27.60	94.42%	26.06
Industrial Fiber Laser	1	59.90	83.47%	50.00	94.42%	47.21
Destratification Fans	1	(0.32)	100.00%	(0.32)	94.42%	(0.30)
Indoor Agriculture HVAC	1	34.00	100.00%	34.00	94.42%	32.10
High Efficiency Process Motors	1	40.10	73.96%	29.66	94.42%	28.00
Total	**104**	**2,384.50**	**99.15%**	**2,364.13**	**94.42%**	**2,232.21**

Table 19. Winter Demand Major Findings

End Use	Major Findings
Refrigerated Cases	Finding 1: Two projects had inappropriate efficiency assumptions for the refrigeration load due to a motor replacement. Finding 2: Two projects did not account for the decrease in cooling loads associated with the new door heaters.
Manufacturing Heat Recovery	Finding 1: For one project, the facility implemented water reduction strategies as part of a separate project, which resulted in lower water usage/flow rates than assumed in the ex ante calculations. Finding 2: For one project when calculating the energy penalty for the new condenser pumps, the delivery team failed to convert horsepower to kW and did not consider any motor loading factor or motor efficiency.

End Use	Major Findings
Indoor Lighting	Finding 1: For three projects, the delivery team made inappropriate hours of use assumptions. Finding 2: Two projects used outdated coincidence factors for the Efficiency Maine TRM. Finding 3: For one project, the number of fixtures actually installed differed from the ex ante calculations.
Efficient HVAC Units	Finding 1: For one project, the delivery team used the estimated energy savings as opposed to the as-built energy savings when calculating peak demand. Finding 2: For one project, the ex ante peak demand savings calculations for this project incorrectly utilized the timestamps when calculating the winter and summer peak demand period.
Efficient Snowmaking Equipment	Finding 1: One project inherently assumed that the load shape during winter peak hours matched the ex ante load shape across the entire snowmaking season, which was not the case after reviewing the trend data.
Wastewater Treatment	Finding 1: One project was found to have inappropriate hours of use assumptions for the baseline equipment. For this project, the equipment was required to run 24/7 to maintain the product integrity.
Smart Thermostats	Finding 1: One project was found to have less units installed than originally planned. Finding 2: One project used an inappropriate assumption for the % reduction produced by smart thermostats.
Lighting Controls	Finding 1: For one project, the delivery team used the estimated energy savings as opposed to the as-built energy savings when calculating peak demand. Finding 2: One project did not account for lighting levels during peak periods, nor did it account for interactive effects.
High Efficiency Process Motors	Finding 1: One project applied incorrect hours of use assumptions to the peak demand calculations.

Table 20. Summer Demand Impacts by End Use

End Use	# of Measures	Ex Ante Summer Demand Savings (S kW)	S kW RR	Gross Summer Demand Savings (S kW)	NTG Ratio	Net Summer Demand Savings (S kW)
Indoor Agriculture Lighting	28	864.86	98%	844.22	94.42%	797.11
Advanced HVAC Controls	12	82.94	63%	52.49	94.42%	49.56
Commercial Refrigeration	9	88.69	80%	71.14	94.42%	67.17
Refrigerated Cases	8	35.93	197%	70.68	94.42%	66.74
Manufacturing Heat Recovery	6	(90.56)	79%	(71.46)	94.42%	(67.47)
Advanced Ventilation	5	48.00	194%	93.05	94.42%	87.86
Indoor Lighting	5	392.10	96%	378.11	94.42%	357.01
Efficient HVAC Units	4	4.90	111%	5.45	94.42%	5.15
Efficient Process Equipment	3	236.30	80%	189.17	94.42%	178.61
Air compressor	3	466.40	108%	505.46	94.42%	477.25
Weatherization	3	0.80	100%	0.80	94.42%	0.76
Other Heat Recovery	2	(2.90)	100%	(2.90)	94.42%	(2.74)
Smart Thermostats	2	1.76	74%	1.30	94.42%	1.23
Wastewater Treatment	2	34.22	171%	58.52	94.42%	55.26
Efficient HVAC Chiller	2	260.70	102%	264.81	94.42%	250.03
Efficient Process Chiller	2	40.90	107%	43.80	94.42%	41.36
Lighting Controls	2	23.60	137%	32.40	94.42%	30.59
Efficient Transformers	1	27.60	100%	27.60	94.42%	26.06
Industrial Fiber Laser	1	59.90	95%	57.18	94.42%	53.99
Destratification Fans	1	(0.32)	100%	(0.32)	94.42%	(0.30)
Indoor Agriculture HVAC	1	29.00	100%	29.00	94.42%	27.38
High Efficiency Process Motors	1	40.10	74%	29.66	94.42%	28.00
Total	**103**	**2,644.92**	**101.33%**	**2,680.14**	**94.42%**	**2,530.59**

Table 21. Summer Demand Major Findings

End Use	Major Findings
Advanced HVAC Controls	Finding 1: An inaccurate energy model was used for one project.
Refrigerated Cases	Finding 1: Two projects had inappropriate efficiency assumptions for the refrigeration load due to a motor replacement. Finding 2: Two projects did not account for the decrease in cooling loads associated with the new door heaters.
Manufacturing Heat Recovery	Finding 1: For one project, the facility implemented water reduction strategies as part of a separate project, which resulted in lower water usage/flow rates than assumed in the ex ante calculations.

End Use	Major Findings
	Finding 2: For one project when calculating the energy penalty for the new condenser pumps, the delivery team failed to convert horsepower to kW and did not consider any motor loading factor or motor efficiency.
Advanced Ventilation	Finding 1: One project erroneously did not calculate demand savings for one of the spaces included in the project.
Wastewater Treatment	Finding 1: One project was found to have inappropriate hours of use assumptions for the baseline equipment. For this project, the equipment was required to run 24/7 to maintain the product integrity.
Smart Thermostats	Finding 1: One project was found to have less units installed than originally planned. Finding 2: One project used an inappropriate assumption for the % reduction produced by smart thermostats.
Lighting Controls	Finding 1: For one project, the delivery team used the estimated energy savings as opposed to the as-built energy savings when calculating peak demand. Finding 2: One project did not account for lighting levels during peak periods, nor did it account for interactive effects.
High Efficiency Process Motors	Finding 1: One project applied incorrect hours of use assumptions to the peak demand calculations.

Table 22. Natural Gas Impacts by End Use

End Use	# of Measures	Ex Ante Natural Gas Savings (therms)	Natural Gas RR	Gross Natural Gas Savings (therms)	NTG Ratio	Net Natural Gas Savings (therms)
Indoor Agriculture Lighting	28	(13,731)	129.90%	(17,836)	94.42%	(16,841)
Advanced HVAC Controls	12	22,693	51.50%	11,688	94.42%	11,035
Refrigerated Cases	8	22,227	95.28%	21,179	94.42%	19,997
Manufacturing Heat Recovery	6	421,617	96.29%	405,962	94.42%	383,309
Advanced Ventilation	5	101,442	103.13%	104,615	94.42%	98,777
Indoor Lighting	5	(1,294)	1209.70%	(15,653)	94.42%	(14,780)
Efficient HVAC Units	4	15,056	100.00%	15,056	94.42%	14,216
Weatherization	3	11,093	100.00%	11,093	94.42%	10,474
Other Heat Recovery	2	25,551	96.39%	24,628	94.42%	23,253
Lighting Controls	2	-	N/A	(1,565)	94.42%	(1,478)
Destratification Fans	1	5,609	111.96%	6,280	94.42%	5,930
Total	**76**	**610,263**	**92.66%**	**565,444**	**94.42%**	**533,892**

Table 23. Natural Gas Major Findings

End Use	Major Findings
Indoor Agriculture Lighting	Finding 1: For one project, the delivery team did not calculate a reheat penalty for all spaces in the facility.
Advanced HVAC Controls	Finding 1: One project did not account for the equipment running in an eco-mode, which increased the hours of operation. Finding 2: For one project, the proposed usage was found to be modeled inaccurately.
Indoor Lighting	Finding 1: One project utilized the CLIC Tool to complete the final analysis. The tool assumes that the facility's heating fuel is unknown and distributes the thermal penalty across four different heating fuels based on their distribution of use in the State of Maine, which only attributes 10% of the thermal penalty to natural gas. Furthermore, the CLIC tool does not convert the natural gas use from MMBTU to therms. Finding 2: For one project, the thermal penalties claimed to be in the unit of therms. However, when the evaluation team did the same calculations, they were found to be erroneous by a factor of 100 due to a missing MMBTU conversion and an incorrect ME TRM assumption.

Table 24. Unregulated Fuels Impacts by End Use

End Use	# of Measures	Ex Ante Unregulated Fuel Savings (MMBtu)	Unregulated Fuel RR	Gross Unregulated Fuel Savings (MMBtu)	NTG Ratio	Net Unregulated Fuel Savings (MMBtu)
Indoor Agriculture Lighting	28	(230)	101.15%	(233)	94.42%	(220)
Advanced HVAC Controls	12	1,810	310.95%	5,628	94.42%	5,314
Refrigerated Cases	8	567	96.46%	547	94.42%	516
Manufacturing Heat Recovery	6	88,158	99.01%	87,287	94.42%	82,416
Efficient HVAC Units	4	2,195	111.35%	2,444	94.42%	2,308
Efficient Snowmaking Equipment	4	1,252	88.85%	1,113	94.42%	1,051
Efficient Process Equipment	3	2,123	2.31%	49	94.42%	46
Weatherization	3	247	91.39%	226	94.42%	213
Lighting Controls	2	-	N/A	(110)	94.42%	(104)
Steam Boiler Improvements	1	418	88.71%	371	94.42%	350
Total	**71**	**96,540**	**100.81%**	**97,321**	**94.42%**	**91,891**

Table 25. Unregulated Fuels Major Findings

End Use	Major Findings
Advanced HVAC Controls	Finding 1: For one project, a supply air temperature reset measure was found to be part of the scope of work but not included in the original savings.
Efficient Process Equipment	Finding 1: For one project, the hours of operation were much lower than the ex ante calculations. Finding 2: For one project, the number of pieces of equipment produced each month and annually differed from the ex ante calculations.

Appendix B | Project-Level Reasons for Adjustment

Table 26. Reasons for Adjustment by Enrollment ID

Enrollment ID	kWh RR	W kW RR	S kW RR	Inaccurate assumptions	Calculation or Engineering Error	Operated or Installed Differently	Inaccurate baseline	Inaccurate energy model	No adjustments made
759247	N/A	N/A	N/A	2	0	0	0	0	0
798709	85%	119%	73%	3	1	0	0	0	0
805942	101%	101%	101%	0	2	1	0	0	0
807519	87%	100%	N/A	3	1	1	0	0	0
807642	104%	104%	104%	2	0	0	0	0	0
819595	187%	186%	187%	2	0	0	0	0	0
820802	100%	100%	100%	2	1	0	0	0	0
825437	113%	111%	115%	4	0	0	0	0	0
825444	91%	95%	214%	5	1	0	0	0	0
830482	94%	83%	95%	2	0	1	0	0	0
852363	96%	172%	100%	3	0	1	0	0	0
852407	110%	100%	100%	0	1	0	0	0	0
854919	67%	0%	104%	0	0	0	0	2	0
857552	122%	100%	98%	3	0	0	0	0	0
857568	100%	96%	104%	2	2	0	0	0	0
862040	92%	5%	11%	0	0	1	0	0	0
867135	82%	0%	95%	2	2	0	0	0	0
867146	85%	94%	85%	3	3	0	3	0	0
867157	98%	105%	100%	6	3	0	0	0	0
869913	64%	71%	38%	4	0	0	0	0	0

Enrollment ID	kWh RR	W kW RR	S kW RR	Inaccurate assumptions	Calculation or Engineering Error	Operated or Installed Differently	Inaccurate baseline	Inaccurate energy model	No adjustments made
881781	77%	74%	74%	2	0	0	0	0	0
881822	26%	42%	59%	2	1	2	0	0	0
904384	41%	38%	42%	0	3	3	3	0	0
970224	102%	36%	287%	0	2	0	0	0	0
975418	83%	83%	80%	0	2	0	0	0	0
977288	N/A	N/A	N/A	0	1	0	0	0	0
977315	N/A	N/A	N/A	2	0	0	0	0	0
977362	N/A	N/A	N/A	2	0	0	0	0	0
978216	102%	100%	100%	1	0	1	0	0	1
978254	88%	127%	127%	4	0	0	0	0	0
980184	95%	44%	N/A	3	0	1	0	0	0
990600	100%	100%	100%	1	0	0	0	0	2
990603	N/A	N/A	N/A	1	0	0	0	1	0
991793	100%	100%	100%	0	0	0	0	0	2
994913	270%	512%	400%	2	1	0	2	0	0
998045	100%	100%	100%	0	0	0	0	0	3
1015883	N/A	N/A	N/A	0	0	0	0	1	0
1015883	N/A	N/A	N/A	0	0	0	0	0	1
1019994	88%	100%	100%	0	0	1	0	0	0
1019994	100%	N/A	100%	0	0	0	0	0	1
1031585	100%	100%	100%	0	0	0	0	0	2
1031634	N/A	N/A	N/A	1	1	0	0	1	0
1031634	N/A	N/A	N/A	1	1	0	0	1	0
1031635	150%	190%	189%	2	2	0	0	2	0

Enrollment ID	kWh RR	W kW RR	S kW RR	Inaccurate assumptions	Calculation or Engineering Error	Operated or Installed Differently	Inaccurate baseline	Inaccurate energy model	No adjustments made
1031635	157%	221%	916%	2	2	0	0	2	0
1034916	133%	193%	215%	3	4	0	0	0	0
1037536	N/A	N/A	N/A	1	1	0	0	1	0
1053380	75%	74%	74%	3	2	3	0	0	0
1059275	117%	N/A	N/A	3	0	1	0	0	0
1059275	19%	N/A	N/A	3	0	1	0	0	0
1059520	79%	N/A	N/A	2	0	1	0	0	0
1063787	115%	62%	124%	2	2	0	0	0	1
1085153	102%	96%	N/A	2	0	0	0	0	0
1085153	41%	82%	-26%	0	0	0	0	2	0
1088102	N/A	N/A	N/A	0	1	0	0	0	0
1089161	115%	114%	114%	0	0	0	2	0	0
1092260	110%	98%	162%	0	2	0	0	0	0
1092339	41%	N/A	N/A	3	0	0	0	0	0
1092382	596%	42%	56%	3	1	2	0	0	0
1120228	88%	50%	84%	0	0	0	0	0	0
1126749	75%	86%	86%	5	0	0	0	0	0
1126782	102%	104%	116%	0	0	0	0	2	0
1126833	191%	215%	0%	4	0	0	0	0	0
1131584	N/A	N/A	N/A	1	0	1	0	0	0
1132983	N/A	N/A	N/A	1	0	1	0	0	0
1149152	100%	100%	100%	0	0	0	0	0	0
1152729	163%	166%	166%	0	0	0	2	0	0
1152729	154%	154%	154%	0	0	0	2	0	0

Enrollment ID	kWh RR	W kW RR	S kW RR	Inaccurate assumptions	Calculation or Engineering Error	Operated or Installed Differently	Inaccurate baseline	Inaccurate energy model	No adjustments made
1152729	106%	100%	100%	0	0	0	1	0	1
1152801	97%	98%	98%	2	0	0	0	0	0
1152802	96%	103%	103%	0	0	0	0	0	0
1152904	N/A	N/A	N/A	0	0	0	1	0	0
1155090	153%	138%	138%	0	0	0	0	0	0
1155827	86%	114%	114%	0	1	1	0	0	0
1157133	N/A	N/A	N/A	0	0	1	0	0	0
1157133	N/A	N/A	N/A	0	0	1	0	0	0
1159487	74%	74%	74%	0	0	2	0	0	0
1159487	74%	74%	75%	0	0	2	0	0	0
1162739	110%	97%	22%	4	2	0	0	0	0
1164847	75%	N/A	N/A	3	0	1	0	0	0
1165578	132%	60%	102%	1	2	1	1	0	0
1165686	98%	96%	96%	0	0	2	0	0	0
1167084	N/A	N/A	N/A	2	2	0	0	0	0
1168338	109%	99%	N/A	2	2	0	0	0	1
1169054	85%	102%	N/A	4	0	0	0	0	0
1169054	40%	82%	-26%	0	0	0	0	2	0
1172914	120%	133%	133%	2	0	0	0	0	0
1173191	N/A	N/A	N/A	2	0	0	0	0	0
1175664	86%	N/A	87%	6	0	0	0	0	0
1176223	119%	121%	121%	3	0	0	1	0	0
1178998	106%	118%	113%	1	1	0	0	0	0
1180516	94%	50%	50%	0	2	0	0	0	0

Enrollment ID	kWh RR	W kW RR	S kW RR	Inaccurate assumptions	Calculation or Engineering Error	Operated or Installed Differently	Inaccurate baseline	Inaccurate energy model	No adjustments made
1183630	112%	125%	125%	2	1	0	0	0	0
1187437	75%	75%	74%	1	0	1	0	0	0
1188228	102%	113%	112%	1	0	0	0	0	0
1188618	98%	102%	102%	0	0	2	0	0	0
1188733	46%	52%	48%	1	0	1	1	0	0
1190098	214%	82%	1204%	0	1	0	0	0	1
1191772	58%	57%	57%	2	0	0	0	0	0
1200635	103%	103%	103%	1	0	0	0	0	0
1200635	101%	103%	103%	1	0	0	0	0	0
1200954	72%	145%	73%	0	0	1	0	0	0
1205918	87%	0%	0%	2	0	0	0	0	0
1208190	112%	107%	107%	3	0	0	0	0	0
1208977	84%	N/A	N/A	2	0	1	0	0	0
1217542	N/A	N/A	N/A	4	0	0	0	0	0
1217542	N/A	N/A	N/A	4	0	0	0	0	0
1222059	121%	69%	93%	4	0	0	0	0	0
1228630	175%	N/A	54%	6	0	0	0	0	0
1233239	85%	85%	85%	1	0	0	0	0	0
1246123	N/A	N/A	N/A	2	1	0	0	0	0
1251668	169%	N/A	N/A	2	1	0	0	0	0
1261931	90%	N/A	N/A	1	0	0	0	0	0
1271260	113%	72%	72%	2	1	0	0	0	0
Total	**102%**	**136%**	**101%**	**184**	**63**	**40**	**19**	**17**	**16**

Appendix C | NTG Survey

Free Ridership

N1. In your own words, can you please describe the decision-making process for implementing this project? If needed: As a reminder, we're talking about the <Measure> project at <Address>.

[Interviewer Note: Compare response for N1 to Statement of Incentive Need to Proceed in project application and probe for any clarification if needed.]

Intent Score

N2. If an Efficiency Maine incentive had not been awarded, do you think your company would have still moved forward with the project, installed a cheaper alternative, done nothing or something else?

1. Exactly the same thing
2. Installed equipment of the same level of efficiency but fewer units or at a later time
3. Installed something less efficient (including standard efficiency equipment or whatever is required by code)
4. Done nothing (i.e., kept existing equipment)
5. Something else (please specify)
6. Don't know

[ASK IF N2=1 or 2]

N3a. If the incentive had not been available, what is the likelihood you would have installed LESS efficient equipment than you did? Please use a scale of 0 to 10, where 0 means not at all likely and 10 means extremely likely.

[ASK IF N2=3, 4, or 5]

N3b. If this project had not been awarded an incentive, what is the likelihood you would have decided to install the EXACT SAME equipment? Please use a scale of 0 to 10, where 0 means not at all likely and 10 means extremely likely.

[ASK IF N2=2]

N4a. Without the incentive, and if you think your company would have still moved forward with the project, when would you have installed the equipment compared to the time you did?

1. Within 6 months
2. 6 months to less than 1 year
3. 1 year to less than 2 years
4. 2 years or later
5. Don't know

Program Influence Score

N5. Overall, how much would you say the program influenced your decision to install energy efficient equipment rather than a less efficient alternative? Please use a scale of 0 to 10, where 0 means not at all influential and 10 means extremely influential.

[ASK IF N5>5]

N6. What part of the program was most influential in your decision?

Payback Period

N7. What financial calculations does your company make before proceeding with implementing a project like this one? (E.g., project payback, return on investment, total out of pocket cost, net present value, etc.)

N8. What is the payback cut-off point your company uses before deciding to proceed with a capital investment like this one?

1. Less than 6 months
2. 6 months to less than 1 year
3. 1 year to less than 2 years
4. 2 years or to less than 3 years
5. 3 years to less than 5 years
6. 5 years or more
7. Don't know

N9. What was the estimated payback period (in months) for this project?

a. WITH the incentive from Efficiency Maine

b. WITHOUT the incentive from Efficiency Maine

Consistency Check

[ASK IF N3>7 AND N5>7]

N10a. In your previous responses, you said that you would have likely installed the equipment without the program incentive and also that the program was very influential in your decision. I want to check to see if I am misunderstanding your answers or if the questions may have been unclear. Can you please explain the role the program incentive played in your decision to install the efficient equipment?

[ASK IF N3<3 AND N5<3]

N10b. In your previous responses, you said that you would not have likely installed the equipment without the program incentive and also that the program was not very influential in your decision. I want to check to see if I am misunderstanding your answers or if the questions may have been unclear. Can you please explain the role the program incentive played in your decision to install the efficient equipment?

Spillover

SO1. Since your participation in the Efficiency Maine program, did you implement any ADDITIONAL energy efficiency improvements at this facility or at your other facilities located in Maine that did NOT receive incentives through an Efficiency Maine program?

a. What projects did you implement without an incentive?

Measure-Specific Questions [repeated for each spillover measure]

SO2. How influential was your experience in the Efficiency Maine program in your decision to implement these additional projects? Please use a scale of 0 to 10, where 0 is not at all important and 10 is extremely important.

SO3. Can you explain how your experience with the program influenced your decision to install these additional energy efficiency projects?

SO4. If you had not participated in the program, how likely is it that your organization would still have implemented the additional projects? Please use a 0 to 10 scale, where 0 means you definitely WOULD NOT have implemented this project and 10 means you definitely WOULD have implemented this project.

[ASK SO5 and SO6 IF SO2>5 OR SO4<5]

SO5. How many additional projects did you install? (e.g., how many light fixtures)

SO6. Examples of questions to further define the project(s) (as applicable):

a. Type
b. Efficiency
c. Size
d. Other attributes

SO7. Can you briefly explain why you decided to install these energy efficiency project(s) on your own, rather than going through an Efficiency Maine program?