REPORT

Nexant

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Large Customer Program Evaluation
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1 Overview

The Efficiency Maine Trust (Efficiency Maine) retained Nexant and Warren Engineering (collectively Nexant or the evaluation team) to evaluate the commercial demand side management (DSM) programs available through the 2014 and 2015 Large Customer Program for the period between September 1, 2013 and February 28, 2015. This report summarizes the evaluation which includes both process and impact findings of the 2014 – 2015 program cycle activities.

1.1 The Large Customer Program

Efficiency Maine uses its Large Customer Program to leverage private investments to achieve electrical and greenhouse gas savings. In the program, Efficiency Maine provides competitive grants for large-scale energy efficiency reduction projects. Target customers have an average demand above 400 kW and include hospitals, paper mills, large manufacturers, and organizations that have multiple facilities such as college campuses or grocery chains. The grants under the program are awarded primarily on the basis of annual kilowatt-hour per dollar of grant funds, while project readiness, economic viability, and other factors are also considered. Funding levels range from a minimum of $100,000 for electric and $50,000 GHG to a maximum of $1 million per facility or up to 50% of the total project costs. Funding levels were also floored at no more than a one year payback and capped at not paying more than 28 cents a kWh saved. For the period between July 1, 2013 and February 28, 2015, close to $4.9 million was paid in incentives for projects under the Large Customer Program. Large Customer Program awards have resulted in investments in cost-effective distributed generation, heat recovery technology, efficient drives, and processes.

On July 1, 2016, the program was renamed the Commercial and Industrial Custom Program and new eligibility criteria were established.

1.2 Evaluation Goals and Objectives

The following are goals and objectives established for the Large Customer Program evaluation:

- Ensure that the savings calculations and parameters (including impact factors and algorithms) used by Efficiency Maine in the “Efficiency Maine Reporting & Tracking System” (effRT) were accurate.
- Perform an impact evaluation to quantify and verify the energy and demand savings of the projects, in terms of both gross and net energy savings, and compare this with the claimed savings. Also included in the impact analysis is the evaluation of distributed energy capacity installed and generation achieved.
- Perform a cost-effective analysis of the projects and program based on the Total Resource Cost Test (TRC) and the Program Administrator Cost Test (PAC).

- Complete a process evaluation to measure freeridership and spillover, and to identify opportunities to improve the effectiveness and efficiency of the current program operations.

In order to achieve these goals, Nexant completed both a process and impact evaluation. For the impact evaluation, the net and gross program energy impacts were evaluated through a combination of engineering analysis and on-site measurement and verification of completed projects. Nexant completed a near-census evaluation of the program and developed verified savings estimates for completed projects. The gross program-reported savings were adjusted by a realization rate, which is the ratio of evaluation verified savings to the program-reported savings within the sample.

The process evaluation focused on program design and theory, implementation and delivery, and market feedback. The program was evaluated through interviews with pertinent program delivery staff and participants.

The net savings, which are an estimation of the portion of savings achieved as a direct result of program influence, were calculated by applying net-to-gross (NTG) scaling factor to the gross program-reported savings. In order to estimate NTG ratio, the evaluation team employed participant surveys to quantify the actual impacts of the programs in terms of freeridership and spillover. Freeridership refers to participants who would have taken action to reduce their energy use in the program's absence. Spillover refers to actions taken outside the program that reduce energy use, which are attributable to program participation.

1.3 Impact Evaluation Results

Nexant's primary goal was to verify and adjust the gross electric energy and demand (summer peak and winter peak) savings of the projects within the program. We completed measurement and verification (M&V) of a near-census, evaluating completed projects. A realization rate, which is the calculated ratio of the savings verified by Nexant ("ex-post") to the savings reported by Efficiency Maine ("ex-ante") for the projects within the projects evaluated, was calculated for the program. A realization rate of 100% indicates that Efficiency Maine and Nexant calculated the savings consistently; a value of less than 100% indicates that the reported savings are overstated; a value of greater than 100% indicates that the reported savings are understated.

The net impacts are a reflection of the degree to which the gross savings are a result of program efforts and funds. Nexant calculated the net savings by applying a NTG ratio to the gross savings. The scaling factor, along with the gross savings, was evaluated for the completed projects in the portfolio.

The accuracy of Efficiency Maine's reporting is best described through the program-level realization rate. Table 1-1 provides a summary of the realization rates observed for energy and demand savings and the net to gross ratio calculated for the program.

Table 1-1: Large Customer Program Realization Rates and Net to Gross Ratio

Program	Electric Energy Realization Rate	Electric Summer Demand Realization Rate	Electric Winter Demand Realization Rate	Natural Gas Energy Realization Rate	Net to Gross
Large Customers	96.5%	96.3%	93.8%	86.0%	92.5%

Table 1-2 summarizes Efficiency Maine's Large Customer Program gross and net energy and demand impacts. The methodology followed for obtaining these results is detailed in Section 2.

Table 1-2: Impact Evaluation Key Results

Savings Type	Ex-Post Electric Energy Savings (kWh)	Ex-Post Summer Demand Savings (kW)	Ex-Post Winter Demand Savings (kW)	Ex-Post Natural Gas Energy Savings (therms)
Gross	25,737,406	3,185	2,972	100,064
Net	21,842,772	2,945	2,749	92,539

1.4 Process Evaluation Results

Nexant conducted surveys with 19 program participants (10 via telephone and 9 during the on-site inspections conducted as part of the impact evaluation activities). In addition, we interviewed key program staff internal to the Large Customer Program at Efficiency Maine.

Interviews with program staff and participants revealed that Efficiency Maine has a deep understanding of their participants' needs, as well as the challenges they face in making energy efficiency commitments. In general, all members of the program implementation team provided positive assessments of the overall performance of the program, as did program participants. Participant surveys revealed that applicants considered Efficiency Maine's programs highly influential in decision-making process. This finding is in keeping with the NTG results and further corroborated by the high rate of repeat customers observed within the program.

Given the specific challenges in NTG assessment of complex energy efficiency projects, very large energy efficiency projects require the most detailed level of NTG analysis. Nexant used multiple sources of data on program influence, each of which were integrated to calculate a project-level NTG ratio in a transparent and defensible manner. The activities to collect data for the NTG ratio calculation were integrated with the activities and tasks to collect data for the overall impact evaluation.

Table 1-3: Net to Gross Freeridership and Spillover Components

Measure Category	Number of Respondents	Estimated Freeeridership	Estimated Participant Spillover	NTG Ratio
Large Customers	19	8.2%	0.7%	0.925

1.5 Cost-Effectiveness Results

This report contains estimates of program cost effectiveness in accordance with the California Standard Practice Manual (CSPM) via the PAC and TRC test methods. The TRC test measures the costs of the program to society as a whole by including both the participant and utility costs; the PAC measures the costs of the program from the program administrator's point of view by only including those costs incurred by the program administrator. A TRC ratio of greater than one is considered cost-effective to society; a PAC ratio of greater than one is considered cost-effective to the program administrator. Table 1-4 summarizes the results of the cost effectiveness assessments for the Large Customer Program via the PAC and TRC test methods.

Table 1-4: Cost Effectiveness Summary[1]

Stratum	Gross Results	Net Results
Program Administrator Cost (PAC)		
PAC Costs	-$6,434,636	-$7,640,353
PAC Benefits	$27,193,147	$29,018,343
PAC B:C Ratio	4.23	3.80
Total Resource Cost (TRC)		
TRC Costs	-$15,214,169	-$17,263,728
TRC Benefits	$27,193,147	$29,018,343
TRC B:C Ratio	1.79	1.68

The Large Customer Program proved to be cost-effective via both testing methods for the evaluation period.

[1] The PAC test only includes the costs to Efficiency Maine. The TRC test includes the costs to Efficiency Maine and the participant.

2 Methodology

Efficiency Maine retained Nexant to evaluate the commercial demand side management (DSM) programs available through the 2014 and 2015 Large Customer Program for the period between July 1, 2013 and February 28, 2015. This section summarizes the evaluation methodology which includes both process and impact approaches to evaluating the 2014 – 2015 program cycle activities.

The evaluation team divided our approach into key tasks to meet the goals outlined:

- Ensure that the savings calculations and parameters (including impact factors and algorithms) used by Efficiency Maine in the "Efficiency Maine Reporting & Tracking System" (effRT) were accurate.
- Perform an impact evaluation to quantify and verify the energy and demand savings of the projects, in terms of both gross and net energy savings, and compare this with the claimed savings. Also included in the impact analysis is the evaluation of distributed energy capacity installed and generation achieved.
- Perform a cost-effective analysis of the projects and program based on the Total Resource Cost Test (TRC) and the Program Administrator Cost Test (PAC).
- Complete a process evaluation to measure freeridership and spillover and to identify opportunities to improve the effectiveness and efficiency of the current program operations.

2.1 Participation Summary

The Large Customer Program enrollments can be grouped into the following three groups:

- Distributed generation
- Large customer projects (the Large Customer enrollments account for 94% of the electric savings, as summarized in Table 2-1).
- Smaller custom projects completed by large customers defined as "Custom > 400 kW < $100k."

Table 2-1: Summary of Large Customer Program Enrollments

Type of Project	Number of Participants	Number of Enrollments	kWh Savings	Natural Gas Savings (therms)
Distributed Generation	1	1	952,854	0
Large Customers	14	17	26,248,360	116,353
Custom > 400 kW < $100k	4	5	734,819	0
TOTAL	**19**	**23**	**27,936,033**	**116,353**

The distributed generation enrollment accounts for 3.4% and the small custom enrollments completed by large customers account for the remaining 2.6% of kWh savings. All of the natural gas savings claimed by LCP came from a single Large Customer enrollment.

2.2 Process Evaluation

The process evaluation tells the customers' experience with the program and its energy savings benefits. The goal of process evaluation is to perform a systematic assessment of an energy efficiency program by generating feedback that achieves the following outcomes:

- Document program operations
- Recommend improvements to increase the program's efficiency and effectiveness
- Assess stakeholder satisfaction

Conducting the process evaluation associated with this project included to two primary activities: 1) a detailed review of program required processes, and 2) in-depth interviewing with staff and key project contacts.

Review program Documentation: This task included reviewing and documenting marketing and outreach activities, and the steps required for project scoping and installation. This information was used to develop a program process map and document the steps required to identify, scope, submit, and complete large project upgrades. We then used these to guide our interviews with staff and key contacts engaged with each project.

In-Depth Interviews: In cooperation with impact evaluation reviews, we conducted in-depth interviews with key contacts from each project evaluated. These interviews were conducted by telephone or during the site inspections included as part of the impact evaluation data collection activities. These interviews included questions designed to understand:

- The experience of moving through each of the program steps identified in the documentation review task
- Any areas of confusion or sources of delay
- Satisfaction with the program opportunity and experience with program representatives
- Indicators of potential free-ridership, as well as any possible spillover

2.3 Impact Evaluation

The primary determinants of the accuracy of an impact evaluation are the sample size and the level of rigor employed in collecting the data used for analysis. While a larger sample and more rigorous techniques increase the accuracy of the findings, they also incur higher costs. Given the limited participation in the Large Customer Program, Nexant was able to include nearly all participants in the sample. We utilized various levels of rigor in the analysis of each project by employing multiple evaluation techniques, including on-site inspections and measurements,

telephone surveys, documentation review, best practice review, and interviews with implementation staff and program participants.

The impact evaluation generally included the following steps, which are described in further detail throughout this report:

- **Develop Program/Measure-Specific M&V Plans:** Upon review of the program documents, a unique M&V plan was developed for each program and measure, including a metering protocol, as applicable. M&V methods for each measure type were developed with adherence to the International Performance Measurement and Verification Protocol (IPMVP).
- **Participant Surveys and On-site Inspections:** The file review for all evaluated projects included a desk review along with a telephone survey with the participant. For a portion of the reviewed projects, on-site audits and measurement further detailed the information obtained during the file review necessary to calculate energy savings.
- **Calculate Impacts and Analyze Load Shapes:** Data collected via the on-site visits, desk reviews, utility bill consumption analysis, and telephone surveys enabled the evaluation team to calculate gross verified energy and demand savings for each project or measure. Hourly load shapes are important in calculating system on-peak demand savings, especially when the measures installed have daily and seasonal variations in the operating schedule.
- **Estimate Net Savings**: Net impacts are a reflection of the degree to which the gross savings are a result of the program efforts and funds. Nexant estimated free-ridership and spillover for each evaluated project utilizing self-report methods through surveys with program participants. The ratio of net verified savings to gross verified savings is the net-to-gross ratio as an applied scaling factor to the reported savings.

Total program gross savings are adjusted using the following equation:[1]

$$kWh_{adj} = kWh_{rep} \cdot Realization\ Rate$$

Where:

kWh_{adj} = kWh adjusted by the impact team for the program, the gross impact

kWh_{rep} = *kWh reported for the program*

Realization rate = weighted average kWh_{adj} / kWh_{rep} for the research sample

[1] Demand (kW) savings are treated in a similar manner.

2.3.1 Measurement and Verification Details

Nexant reviewed the projects in the portfolio and determined a cutoff point of 1,000,000 kWh above which projects tended to be relatively complex. Projects with savings of less than 1,000,000 kWh were less complex and included mainly upgrades or retrofits to lighting, snow making equipment, variable frequency drives (VFDs), and compressors.

Projects below the cutoff point were supplemented with telephone interviews; projects above the threshold were further evaluated using various on-site measurement and verification (M&V) methods. On-site M&V was based on an initial screening call with the applicant to determine what information would be available on-site. Where available, Nexant reviewed customer trending information to help inform evaluation efforts. Where trending was unavailable, the evaluation team installed data loggers to capture the equipment's energy use over time.

During the commencing desk review phase, a Nexant engineer collected all project files from Efficiency Maine's online tracking system, "Efficiency Maine Reporting & Tracking System" (effRT), which generally included technical scoping assessments, incentive applications, cut sheets for equipment installed, assessment reports, invoices, and work order forms. The engineer documented all relevant findings from the project file and the evaluation activities in an enrollment-specific workbook, flagging parameters and assumptions deemed vital to the calculation of savings and areas of concern. Each enrollment-specific workbook included:

- General customer, facility, and project details
- Outline of methodology to be followed for savings calculations
- Customer supplied savings calculations
- Efficiency Maine provided ex-ante savings calculations
- Nexant ex-post savings calculations
- Summary of project costs
- Details of net-to-gross questionnaire responses
- Screenshot of effRT database

With a workbook created for each enrollment, Nexant called each customer to discuss the project further. Phone interviews included questions regarding the flagged areas of concern in the savings calculations, as well as the process evaluation and NTG questions further discussed in Section 2.3.2. The engineer also discussed the possibility of obtaining trending data with the customer.

Nexant conducted on-site inspections for nine enrollments to confirm the flagged areas of concern within the custom calculators. The field engineer created a site-specific measurement and verification plan (SSMVP) for each site. Information was gathered based on the specific characteristics of the custom technology evaluated, but generally included equipment counts, baseline and post-retrofit efficiencies, and the hours of operation, along with other characteristics necessary in order to verify energy savings. Where customers were trending

data, the SSMVP consisted of physical inspection of equipment and procurement of trending data. For those sites where no trending data was available, Nexant installed logging equipment for a period of up to six months in accordance with Section 10.2 of ISO-NE Manual M-MVDR. Nexant used the results of the data logging to create 8,760-hour load shapes for the equipment in question to supplement the savings calculation details obtained through effRT.

Results of the phone interviews, on-site inspection, trending data, and logger installation were input into the enrollment-specific calculators to assess the gross savings of each enrollment. Once each data collection and calculation tool was complete, Nexant created a roll-up file to extract and compile the ex-ante savings, ex-post savings, and net-to gross ratios from each enrollment-specific file. The ratio of the ex-post to ex-ante savings observed across all measure types in the project sample was set as the realization rate for the Large Customer Program.

Table 2-2 summarizes all of the enrolled projects during the evaluation period between July 1, 2013 and February 28, 2015, the reported energy savings, and the executed impact evaluation activity.

Table 2-2: Large Customer Program Enrollment Population and Impact Evaluation Activity

Enrollment Number	Project Description	Reported Energy Savings (kWh)[2]	% Savings of Sub-Total	Evaluation Activity
Distributed Generation				
13230	150 kW Cogen	952,854		Site visit
Large Customer Projects				
246584	Tissue Process Improvement	5,831,985	19.7%	Site visit
101887	Heat Exchange System	5,773,680	19.5%	Site visit
249209	Paint Booth with Recycled Air	3,409,143	11.5%	Site visit
13226	UV and Ozone Project	2,364,282	8.0%	Site visit
11830	Kiln Optimization	2,196,522	7.4%	Site visit
217225	Distribution Center Lighting Upgrade	1,200,507	5.3%	Site visit
101888	Cold Storage Refrigeration	1,168,630	3.9%	Site visit
101889	Water Cooled Chiller	1,117,232	3.8%	Site visit
245308	CRACs UPS LED lighting	769,733	2.6%	Desk review
101899	LED Case Lighting	718,287	2.4%	Desk review
101884	Refrigeration Lighting	694,062	2.3%	Desk review
247650	Sales Floor Lighting	659,191	2.2%	Desk review
258833	Pump VFD Lighting Retrofit	644,874	2.2%	Desk review
246673	Lighting Upgrade Compressed Air Optimization	908,805	3.1%	Not Sampled
223053	Lighting Upgrades	634,745	2.1%	Desk review
246673	Compressor Exterior LED lighting	625,894	2.1%	Desk review
101898	Primary Pump VFDs Lighting	583,814	2.0%	Desk review
Sub-Total		***29,301,386***	***100%***	
Custom > 400 kW < $100k				
264809	High Efficiency Snow Guns	282,453	38%	Desk review
281834	Process Fan VFDs	165,349	23%	Desk review
266269	High Efficiency Snow Guns	153,535	21%	Desk review
265107	HKD SV-10 Plus Snow Gun	82,143	11%	Desk review
283158	HKD SV-10 Plus Snow Gun	51,339	7%	Desk review
Sub-Total		***734,819***	***100%***	
TOTAL (Projects excluding DG)		***30,989,059***		

2.3.2 Net-to-Gross Methodology

Net savings are the savings directly attributable to a program and account for the actions that the participant would have taken in absence of the program (freeridership) and the actions taken by a participant outside of the program incentive (spillover). A program NTG ratio equals the net program energy and/or demand impact divided by the gross program energy and/or demand impact. We derived net savings—the savings directly attributable to the program—by adjusting the realized gross energy-savings estimates to account for freeridership, and spillover. These adjustment factors are consistent with the State and Local Energy Efficiency Action Network Program Impact Evaluation Guide[3] and the chapter on net savings in the Uniform Methods Project (UMP).[4]

Nexant utilizes an approach for NTG methodology based on guidance from relevant industry documents:

- EPA's Energy Efficiency Program Impact Evaluation Guide (the EPA Guide).[5]
- The National Renewable Energy Laboratory Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific (the "NREL Guide"). Chapter 23—Estimating Net Savings: Common Practices.[6]
- Energy Trust of Oregon Free Ridership Methodology, Phil Degens and Sarah Castor, June 4, 2008.

To assess the impact of a program, evaluators generally consider freeridership and spillover. The preferred and most inclusive definition of the NTG ratio is shown in the following equation:

$$NTG = 1 - Freeridership + Spillover$$

Freeridership refers to a participant who, on some level, would have acquired the energy-efficient equipment or taken action to reduce their energy use in the program's absence. The effect of freeriders reduces the gross savings attributable to the program.

Spillover refers to actions taken outside the program that reduce energy use, which are attributable to program participation. The effect of spillover increases the gross savings attributable to the program.

To calculate the NTG ratio, Nexant employed a modified version of the California Public Utility Commission's (CPUC) Large Nonresidential free ridership approach, as developed by the

[2] Energy savings are based on Efficiency Maine evaluation data and include 116,353 therms of energy, which was converted to the equivalent kWh (3,409,143 kWh).

[3] State and Local Energy Efficiency Action Network. Energy Efficiency Program Impact Evaluation Guide. December 2012.

4 Under the UMP, the U.S. Department of Energy is preparing a framework and set of protocols for determining the energy savings from specific energy efficiency measures and programs. These protocols present methods for evaluating gross energy savings for common residential and commercial measures offered through utility demand-side management (DSM) programs, and are written by technical experts within the field and reviewed by industry experts. (https://www1.eere.energy.gov/office_eere/de_ump.html)

[5] http://energy.gov/sites/prod/files/2013/11/f5/emv_ee_program_impact_guide.pdf, Chapter 5.

[6] http://www.nrel.gov/docs/fy14osti/62678.pdf.

CPUC nonresidential Net-to-Gross Ratio Working Group. Very large energy efficiency projects require the most detailed level of analysis, given the specific challenges in NTG assessment of large, complex energy efficiency projects supported by detailed assessments. Nexant used five sources of data on program influence, each of which were integrated to calculate a project-level NTG ratio in a transparent and defensible manner. To support this process, Nexant created a checklist of questions to be completed through data available from the file review and interviews, allowing the evaluator to identify the baseline conditions and decision-making sequence in addition to an assessment of program influence based on a standard NTG set. The five data sources are listed below:

- **Review Project Documentation:** Project files included various pieces of information relevant to the analysis of free ridership. Nexant reviewed the files for information about what the customer planned to do in the absence of the program opportunity and how the project economics (primarily payback) were affected by availability of program funding.
- **Implementation Staff Interviews:** Contacts were asked about their perceptions of program influence based on their interactions with customers or project representatives on specific projects. What concerns did customers have about complying with the requirements of the program? What, if any, specific equipment requirements were customers reluctant to accept?
- **Customer Key Contact Interviews:** As a critical source of information for very large projects, in-depth interviews were conducted with the people involved in the decision-making process behind the project at the customer site and the decision to pursue program funding and services. These interviews include questions about:
    - The sequence of events that led to participation. When did they become aware of the program funding opportunity and where in the project planning continuum were they at that point?
    - Other project objectives. Did the project solve operational or equipment problems?
    - The influence of program services in the decision-making process. How influential was the information provided by the audit, the credibility, or quality of technical assistance they received, the project funding available, or the opportunity to obtain higher efficiency equipment than they might have otherwise?
    - The age or condition of existing equipment. Was this an early replacement project? If not, what equipment would they have installed had they not received program assistance?
    - Financial criteria used to assess and approve projects. What internal rate of return is required for project approval? What payback period is required for project approval? Was there funding in their capital or operating budgets to complete this project in FY14 or FY15? If so, how did the project change as part of the assessment and project approval process required by Efficiency Maine?
    - Potential indications of spillover. What other actions, if any, has the organization undertaken to further improve the energy efficiency profile of their facilities

subsequent to participation in this program? To what extent were these improvements influenced by the experience of completing their Efficiency Maine project (including the influence of the technical assistance provided as well as any benefits realized since project completion.) Does the organization have plans to replicate the project at other sites, or complete additional projects within the next two years?

- Ratings of program influence. In addition to the nuanced information listed above, and to provide estimates consistent with the prior program evaluation, we also included four simple questions to quantify program influence: 1) Would the project have occurred within the same timeframe? 2) Would the project have had the same energy efficiency profile? 3) Would the project have been on the same scale (size)? 4) How important was the financial support received from the program?
- The activities to collect data for the NTG ratio calculation were integrated with the activities and tasks to collect data for the overall impact evaluation. Survey and data collection instruments were developed to ensure all the relevant data was collected efficiently and that contacts were only interviewed once, rather than multiple times. Finally, the NTG ratio obtained through the process evaluation was applied to the verified gross savings (ex-post) to determine the verified net savings.

2.3.2.1 Approach to Estimating Participant Freeridership

For the estimation of freeridership, Nexant followed an industry-standard approach where the overall freeridership score was derived from two independently calculated elements, each of which is worth half of the total score: a stated intention score and an influence score. Participant key contacts are interviewed and the responses are rated on a scale of zero to one and result in a participant being considered a full freerider (1), partial freerider (spectrum between 0 and 1), or non–freerider (0). There is an inherent risk of "self-report bias" in the self-report survey approach commonly used for estimating freeridership because the respondents are asked to describe hypothetical actions of what they would have done in the absence of the utility program. To address and mitigate the effects of self-report bias, Nexant uses a multi-step survey approach to estimate freeridership levels for each participant surveyed:

1. **Assess intention.** These questions ask respondents about the likelihood of carrying out the energy-efficiency measure without the program's support along with questions regarding the availability of funds and age/condition of replaced equipment; this is also known as counterfactual information (scored between 0 and 0.5).

2. **Assess influence.** These questions gather information regarding the rationale behind taking the energy-efficiency action to determine the program's direct influence (scored between 0 and 0.5).

Participant-level freeridership is calculated as the sum of the *intention* and *influence* components, resulting in a value between 0 and 1.0:

Freeridership = Intention + Influence

2.3.2.2 Approach to Estimating Participant Spillover

Participant spillover questions sought to determine if the customer invested in additional energy efficiency measures for which they did not receive any Efficiency Maine incentives, and asked for additional metrics for which attributable savings could be estimated. Participant spillover savings were included based on 1) survey responses indicating the installation of additional measures, and 2) the ability to quantify those savings. Only one participant reported making additional upgrades for which they did not receive any incentives; the evaluation team was able to estimate savings for this enrollment.

The customer associated with Enrollment ID 249209 is a global aviation services and aftermarket service provider with an aircraft painting facility located in Bangor, Maine. In 2014, the company applied for incentives through the Large Customer Program for installation of two gas-fired make-up air units (MAUs). The therm savings achieved through use of efficient MAUs was reported in the Large Customer Program. However, each MAU has five motors, each of which is equipped with a variable frequency drive (VFD). 249209 originally applied for incentives for the VFDs through the Business Incentives Program (Enrollment ID 212083), but the application was canceled as Efficiency Maine believed the savings were already counted in the Large Customer Program. As the enrollment through the Large Customer Program only contained the therm savings created by the MAUs, the electric savings achieved by the VFDs was never realized in any Efficiency Maine program. Nexant verified the sizes of the motors with the site contact at 249209, and calculated the savings achieved by the additional VFDs to be 166,409 kWh. This was translated to program spillover through Equation 1.

Equation 1: Spillover Percentage Estimate

$$= \frac{\sum Spillover\ kWh\ savings\ extrapolated\ to\ the\ participant\ population}{Evaluated\ program\ population\ kWh\ Savings}$$

2.3.2.3 Net-to-Gross Error Estimation

Relative precision is calculated as the margin of error over the point estimate mean NTG value of each measure category, as outlined in the following three equations:

Equation 2: Standard Error of the Mean

$$= \frac{Standard\ Deviation\ of\ the\ Sample}{\sqrt{(Sample\ Size)}}$$

Equation 3: Margin of Error

$$= z - value\ at\ 90\%\ confidence^{7} \times Standard\ Error\ of\ the\ Mean$$

Equation 4: Relative Precision

[7] Z=1.645

$$= \frac{Margin\ of\ Error}{Sample\ Mean}$$

2.4 Benefit-Cost Modeling

Efficiency Maine's online portal to the effRT database contains a module called the Cost Benefit Analysis Tool (CBAT), which is capable of running custom cost-benefit analyses based on multiple user inputs. Because of the sophistication of Efficiency Maine's tool, and the lack of project-level insight available to recreate it, Nexant opted not to create a parallel benefit-cost modeling tool. Instead, a rigorous evaluation of the tool was conducted, and Nexant ultimately used CBAT to run both the total resource cost (TRC) test and program administrator cost test (PAC).

2.4.1 CBAT Verification

CBAT is designed to provide a cost-benefit analysis for any number of programs through any date range using the following default schedules and user-defined inputs:

Programmed Values/Schedules

- Reported Savings
- Avoided energy costs
- Avoided capacity costs
- Line loss multiplier
- Incentive amounts
- Measure lives
- Incremental costs
- Measure-level energy period factors
- Measure-level realization rate
- Measure-level NTG ratios

User Inputs

- Test type (TRC or PAC)
- Savings type (Net or Gross)
- Date range of interest
- Discount rate
- Generation markup
- Program(s) of interest

Before using the tool for cost-benefit analysis, Nexant ran a series of tests to verify the tool was properly incorporating all schedules and values. Efficiency Maine provided Nexant with its 2015 avoided-costs schedule, and a document containing step-by-step instructions concerning CBAT programming. Nexant also downloaded all current and historical factor schedules for the time period of the evaluation from effRT. Nexant used Efficiency Maine's instructions to recreate the CBAT calculations in Microsoft Excel for comparison, and ran tests using small windows of time that included fewer than five projects each for verification. Key input parameters (i.e. savings type and discount rate) were changed across test runs to find errors that could have been associated with particular inputs. As errors were found, Nexant worked with Efficiency Maine to have them corrected until the results showed less than 1% error in all benefit and cost categories. Note that Nexant based their CBAT verification exercise on projects from the

Business Incentives Program as the Business Incentives Program contains more complex factor schedules. Table 2-3 shows the final results of the CBAT verification exercise.

Table 2-3: Errors Noted in CBAT Recreation

Benefit Type	Excel Calculation	CBAT Calculation	% Difference
Summer kW, Capacity	$133.51	$133.41	< 0.1%
Summer kW, T&D	$153.81	$153.69	< 0.1%
Summer kWh, Off-Peak	$201.80	$201.76	< 0.1%
Summer kWh, On-Peak	$370.85	$370.84	< 0.1%
Winter kW, Capacity	$104.07	$104.12	< 0.1%
Winter kW, T&D	$119.90	$119.95	< 0.1%
Winter kWh, Off-Peak	$784.25	$784.05	< 0.1%
Winter kWh, On-Peak	$1,271.11	$1,271.22	< 0.1%
Total Benefits	**$3,139.30**	**$3,139.04**	**< 0.1%**
Total Costs	**$1,929.79**	**$1,929.79**	**0%**
TRC Ratio	**1.63**	**1.63**	**< 0.1%**

Throughout the testing, Nexant only found one error within the CBAT module. Originally, CBAT did not apply line losses to demand calculations (although it did properly include them for energy calculations). Nexant presented this issue to Efficiency Maine, and it was corrected.

2.4.2 CBAT Adaptation for Evaluator Use

Using the roll-up tools that were previously used to aggregate savings, Nexant was able to create a Large Customer-specific factor table from the individual analysis workbooks. The Nexant-developed factor schedule includes realization rates, freeridership rates, and spillover rates. Coincidence factors and energy period factors were not altered from Efficiency Maine defaults as 8,760-hour load shapes were not created for all projects within the program. The custom factor schedule was uploaded to override the schedules previously in place by Efficiency Maine. Then CBAT was run, and benefits and costs were tabulated in a supplemental Microsoft Excel workbook. Program costs were found in the 2014 and 2015 annual reports. The program costs for the 2015 annual report had to be adjusted to reflect only the portion of the program year that was evaluated. The costs associated with the evaluation period were determined by the ratio of incentives paid out in the 2015 evaluation period and the total incentives paid out in 2015. These adjusted program costs were then manually input into CBAT. With all of the components assembled, the final TRC and PAC ratios were calculated directly in CBAT.

3 Process Evaluation

The process evaluation tells the customers' experience with the program and its energy savings benefits. The goal of the process evaluation is to perform a systematic assessment of the Large Customer Program by generating feedback that achieves the following outcomes:

- Document program operations
- Assess stakeholder program awareness and satisfaction
- Recommend improvements to increase the program's efficiency and effectiveness

These outcomes can inform program planning, existing program implementation, or efforts to redesign a program.

As part of the process evaluation for the Large Customer Program, Nexant interviewed Efficiency Maine staff, ERS program staff, and surveyed participating customers. The findings from these surveys and interviews are discussed in the following sections.

3.1 Staff Interviews

Nexant interviewed staff responsible for the Large Customer program at Efficiency Maine Trust and at ERS. The interviews lasted approximately 60 minutes and took place in June, 2015.

3.1.1 Staff and Implementation

The Large Customer Program operates with an Efficiency Maine-based program manager, a third-party implementation team at ERS, and a review committee charged with reviewing and approving project funding recommendations.

The Efficiency Maine program manager manages all aspects of the program and provides oversight to the contracted implementation team. The program manager meets with customers and address questions from the review committee as appropriate to support the implementation team and coordinate activities between Efficiency Maine and ERS.

The third-party implementation team is responsible for day to day activities associated with customer outreach, project application review, the preparation of technical summaries for the program review committee, and overall project monitoring and support during project execution. At the end of a given project, implementation staff will conduct final inspections, obtain documentation, and reconcile any payments due. Engineering implementation staff can also provide scoping audits if requested and review all technical assistance studies in preparation for project application.

The review committee authorizes projects based on the information provided to them in documents that summarize the project scope, energy savings and other potential benefits, and customer commitment to completing the proposed scope of work.

3.1.2 Management and Oversight

At any given time, the program has about 25-30 projects in some stage of execution. Bi-weekly updates with the program team include Efficiency Maine and ERS staff, and allow attendees to review a list of projects (and potential projects), note the status of each and identify any items needing attention from either Efficiency Maine or the implementation team. Implementation staff report obtaining and reviewing detailed information on each project, a level of attention enabled by the small number of active projects at any time and the substantial project-level detail required for project approval and monitoring.

Efficiency Maine operates with two main tracking and accounting systems: effRT and Munis. Each serve a purpose and support milestone payments and overall accounting, however neither is designed to inform ongoing project and customer contact management. Because the projects funded by the Large Customer Program can involve complex upgrades to production equipment and long project time horizons, program staff have tested several tools designed to support on-going project tracking. In 2015, the team began using an online task manager application that allows users to monitor and update project milestones, identify delays, and ensure projects stay on track. This computer application also allows staff to upload reports and invoices and track items that would not necessarily qualify for subsidy, but inform overall project scope prior to official approval, such as scoping study or technical assistance audit results. effRT is used to track project documentation, while the on-line tool is used to track activity and responsibility.

3.1.3 Participation Process

Many projects will start with a scoping study or technical assistance audit that confirms project viability and provides details required for a robust application for program funds; although these studies are not required if the facility baseline documentation and engineering review provides inputs sufficient for application and eventual approval.

Paperwork requirements are relatively minimal until a project is identified. Program contacts report relying more heavily on cut sheets for proposed equipment and excel models used to estimate savings than on application paperwork. There are two levels of facility reviews that may occur depending on the information needed. A ***scoping audit*** is used to identify future opportunities and develop an overall understanding of the facility's billing and consumption profile and existing systems. A ***technical assessment*** is obtained by the facility directly and should provide information sufficient to support an immediate decision.

Implementation staff report that the scoping audit component is relatively new and not required—approximately half of the large customers considering projects need a scoping audit. Many already know what the energy savings will be and are looking for help to verify those savings and obtain financial assistance (which would typically occur in a technical assessment). The technical assessment is also not required. Staff estimate that about one-third obtained

incentives for a technical assistance study. Projects that are submitted but do not meet program criteria will be contacted and the customer alerted. Customers then have the option to revise their application, typically by providing additional information, revised costs, or more detailed data on energy use or equipment operations.

Applications are used to create a Technical Review Summary, which is submitted to the Efficiency Maine Large Customer Program Review Committee. The Review Committee looks for technical merit and likelihood of project success, as well as evidence that the project would not have gone forward without the program's financial assistance. Evidence of this includes payback calculations that demonstrate a payback period of greater than one year and qualitative statements about customer intent.

Once the project is approved by the Review Committee, the project is entered into effRT, the customer is notified and the contracting process begins. The program delivery team will navigate contracting with the customer guided by the assumptions in the Technical Review Summary. The contracting process can require iterations as project details can shift and affect cost and risk assumptions. Final contracting documents are recorded in Munis (effRT is used to track energy savings, while Munis tracks dollars and spending). With an executed contract in place, the customer will begin project construction and invoice the program according to the milestones identified in the contract.

Program contacts report that attrition has not been a major issue for the program, noting that projects rarely drop out of the program once a project has been approved. Project timeframes can range from 6 months to more than a year. Most projects take about 12 months from scoping, through technical assistance (including any required baseline metering and field work), project bidding and installation, to finalization and payment.

Customers are supported by the implementation delivery team and Efficiency Maine is typically able to stay out of the process. As one contact described, Efficiency Maine will get involved when things "get sticky"—most commonly if a customer determines that the grant amount is insufficient or is unhappy with a proposed award. According to program staff, the customers that access the Large Customer Program are typically good negotiators who are willing to appeal to different parties or move up the organizational decision-making chain if their needs are not met.

The program operates with established parameters designed to provide guidance for those involved and ensure that incentive levels are appropriate. These guidelines include:

- Capping project funding at 50% of project costs
- Establishing a payback floor of one year
- Paying no more than 28 cents a kWh saved

3.1.4 Marketing

Program staff has a list of all customers using 400kW or more in Maine, which is the entire population of eligible organizations. The first step in engagement is typically email or direct

phone contact to identify key contacts and provide information about Efficiency Maine in general and the program specifically. This is the primary method of outreach to new customers. Outreach to engineering and design firms that might be involved in industrial process improvements or other facility upgrades reminds these firms that resources exist to support high efficiency installations in their customers' facilities, identifies emerging projects, and influences project scoping activities. Finally, implementation staff possess deep knowledge of the large customers in Maine, having worked as account representatives for Maine utilities and on commercial efficiency programs in Maine for many years, and describe "high-touch, personalized" communication. If requested, program staff will provide a 45-minute presentation on the program opportunity and how it might benefit a given organization.

Given the limited set of eligible accounts, more general marketing activities are limited. Efficiency Maine will occasionally seek to generate earned media for high profile projects; however program contacts report the organization has not needed to do this in recent years.

In discussing how the program activities seek to minimize freeridership among large customers, program representatives describe pursuing projects that appear to require guidance or incentives, rather than every project they might be aware of. These projects typically require large investments on the customer's part and multiple levels of internal review and approval.

3.1.5 Assessment of Program Strengths

All members of the program implementation team provided positive assessments of the overall performance of the program. Program staff reported receiving positive feedback from facility staff at customer sites who appreciate the opportunity to leverage the Efficiency Maine funding to make enhancements to equipment and operations. One contact called it a "finely tuned machine" that allows a diversity of projects, customer types, and incentive structures and noted that the offer was a powerful tool to procure energy savings.

Other strengths included:

- Tools that increase confidence among all parties that the projected benefits will be realized. As one contact noted, this is important for minimizing the perception of risk in projects that can feel "all about risk." Having an independent third party providing validated engineering review and further approval by a review committee enhances the legitimacy of the project scopes.
- Scoping and technical assistance audits that provide information and guidance needed to effectively identify and complete projects.
- Payments that are based on expected performance, combined with technical assistance, provide solid evidence that the project will perform as expected and improve confidence among customer organizations.

3.1.6 Opportunities for Program Improvement

Suggestions provided for program improvement tended to focus on specific improvements to internal tracking steps. None of these suggestions included major overhauls in program

operations, instead focusing on improvements to existing systems. Potential improvements included:

- On-going improvements to tracking the status of contracts and payments in progress. Contracts are typically completed by ERS, sent to Efficiency Maine, forwarded to the customer, and returned to Efficiency Maine for execution. As discussed earlier, a new project management and collaboration software platform was deployed in 2015 to assist with tracking and coordination.
- Addressing a gap that can occur when the check payment date is not available to inform a query that must be run for the forward capacity report. The forward capacity report is built from the check paid date, if a copy of the check is not uploaded to effRT by Efficiency Maine staff, ERS must search for the information needed for the forward capacity report. The Large Customer Program is a relatively low volume program, so this issue is manageable. Nevertheless, this item emerged in discussions of potential program improvements.
- Efforts currently in place to identify additional projects from the current suite of eligible accounts could benefit from an “account management” approach in which program contacts establish a long-term relationship with customers, who rely on the program representative to be an energy expert. In this approach, program representatives work with customers to develop an energy improvement plan, establish appropriate project staging, and execute a series of projects that enable the organization to continuously improve its energy use profile over the long term.

3.1.7 Barriers for Large Customers

While program staff praised the program for its ability to encourage large energy saving projects and spur action among large customers, common barriers to energy efficiency investment remain, many of which have to do with the decision-making process at a given customer facility. Persistent barriers included:

- *Long payback periods.* Customers are looking for projects with rapid payback (such as 1-2 years), while many efficiency projects have payback periods of 3-5 years or even longer.
- *Competing business interests.* Even when projects are poised to improve efficiency and affect net earnings, companies focused on rapid increases in gross sales or revenues can sacrifice efficiency in an effort to continue to grow “top line” revenue.
- *Competing projects for capital available.* These organizations always operate with multiple potential projects competing for limited capital. A champion within the facility is often required to navigate internal politics associated with competing priorities.
- *Lack of staffing capacity.* Facility staff are often busy with their existing tasks and reluctant to take on additional work associated with overseeing a study and executing a project.
- *Access to capital.* Access to capital can refer to financing options as well as the overall capacity and willingness of the organization to carry debt or use existing funds.

3.1.8 Expectations for the Future

Efficiency Maine expects to continue to offer incentives to support Large Customer projects with no major changes anticipated beyond those outlined in Efficiency Maine's new three year plan, but uncertainty remains about the available annual budget. One contact described this as "monitoring the gas and brake pedals" to keep the project pipeline appropriately full. In future program years, staff expect to focus on outreach to hospital facilities and assist them with project identification activities and are exploring options for getting more rapid analysis of program and project data, given the long lead times and construction scheduling.

In 2015, staff reported receiving positive feedback about the program, particularly relative to the parallel Business Incentive Program's (BIP) measure suspension, which encouraged some customers to consider the Large Customer Program as an alternative. The program operated with restrictions that disallowed projects reaching less than $100,000 in incentives for electric and $50,000 in incentives for GHG and qualifying for the BIP. During the BIP measure suspension period however, large scale lighting projects were considered in the Large Customer program at reduced incentives.

3.2 Participant Surveys

Nexant completed participant interviews for each of the 19 evaluated participating enrollments. Questions asked throughout the interview focused on the following:

- The sequence of events that led to participation,
- Other project objectives,
- The influence of program services in the decision-making process,
- Financial criteria used to assess and approve projects,
- And potential indications of spillover.

In general, Efficiency Maine's implementation practices provided a positive experience for the program participants. Many applicants were repeat customers, and many commented that they had intentions of completing more projects through the Large Customer Program. Customers seemed particularly pleased with the amount of individual attention they received from the Efficiency Maine implementation team.

3.2.1 Program Awareness

Nexant gaged the level of program awareness by asking participants at what point during their project they became conscious of Efficiency Maine's Large Customer Program. Participants most commonly knew about the available funding prior to scoping the project with the majority of participants noting that they had participated in previous program years. Of the three participants who responded that they were unaware of the program prior to scoping the project, one participant noted being informed by the equipment manufacturer; another participant noted being informed of the program by the design engineer.

Table 3-1: Source of Awareness of Efficiency Maine Funding (n=22)

Source of Awareness	Number of Responses
After the project had been identified	0
During the process of identifying and scoping the project	1
During a scoping audit or other technical assistance	2
Prior to identifying the project	13
Don't know	1
No answer	5

3.2.2 Motivations and Corporate Policy

Nexant asked participants about any energy reduction goals and guidelines their company had in place in order to understand the customer's ongoing commitment to energy efficiency. The number of respondents to each question varied as some customers either refused to comment or did not know specifics to some of the questions. A summary of Nexant's findings regarding participants' corporate commitments to energy efficiency is presented in Table 3-2.

Table 3-2: Corporate Energy Efficiency Commitments (n=15)

Company Commitment	Percentage of Positive Responses
Formal purchasing guidelines prioritizing energy efficiency	7%
Informal purchasing guidelines prioritizing energy efficiency	13%
No purchasing guidelines prioritizing energy efficiency	80%

Nexant observed the general organized corporate commitment to energy efficiency to be relatively low. Many participants noted that projects were fueled by a desire to cut energy costs, but that no corporate structure governed the decisions. More commonly, it was noted that return on investment was only used to select one of several competing possible projects.

Nexant also asked participants what they would have done in the absence of the program. The most common response was that the project would have been completed, but with either a different scope or different timing. For example, for lighting measures, participants most commonly commented that rather than doing a large-scale retrofit, lighting equipment would have been upgraded piecemeal at failure. Similarly, the four participants completing snow-gun retrofits explained that they would have bought the same guns, but less of them.

Table 3-3: What Would Have Been Done in the Absence of LCP Funding (n=16)

Alternative Action	Percentage of Responses
Project would not have been completed	19%
Project would have been completed over a different timeline	19%
Project would have been completed with a different scope (size or efficiency)	50%
Project would have been completed as it was	13%

3.3 Summary

Interviews with program staff and participants revealed that Efficiency Maine has a deep understanding of their participants' needs, as well as the challenges they face in making energy efficiency commitments. In general, all members of the program implementation team provided positive assessments of the overall performance of the program, as did program participants. Participant surveys revealed that applicants considered Efficiency Maine's programs highly influential in decision-making process. This finding is in keeping with the NTG results summarized in Section 4.2, and further corroborated by the high rate of repeat customers observed within the program.

4 Impact Evaluation

4.1 Gross Impact Estimates

The impact evaluation was performed to evaluate the gross and net savings attributable to the Efficiency Maine Large Customer Program. The evaluation was divided into two research areas to determine gross and net savings (or impacts). Gross impacts are the energy and demand savings that are found at a customer site as the direct result of a measure implementation. Net impacts (explored in Section 4.2) are a reflection of the degree to which the gross savings are a result of the program efforts and funds.

4.1.1 Energy Impacts

The realization rates and gross energy impact estimates calculated as described in Section 2.3 are presented below in Table 4-1. In summary, the Large Customer Program saved almost 27 million kWh in ex-post gross savings with a realization rate of 97%. The evaluation strategy provided the evaluation with ±3% precision at the 90% confidence level[1].

Table 4-1: Gross Energy Impact Estimates

Program	Ex-Ante Savings (kWh)	Realization Rate (%)	Ex-Post Gross Savings (kWh)	Relative Precision at 90% Confidence (%)
Large Customers	27,936,021	96.5%	26,958,034	2.9%

As program participation included a diverse array of measures, there are limited overarching findings to present. On the whole, Nexant is confident in the verified savings estimates presented with only one concern that was observed in the multiple instances of snow-gun upgrades.

Snow gun performance data, even for new equipment, was not typically made available publically by manufactures. However, it is a key parameter in the estimation of savings and should be subject to review. Nexant did not find performance specifications in any of the project files for snow-gun projects. It appeared as though the implementer requested the documentation from the appropriate manufacturers, but never received any responses. With a lack of documented performance data available, Nexant was unable to complete a parallel review of the four affected projects, and therefore set the realization rate of all snow-gun projects to 100%.

It should be noted that the lack of documentation on the snow gun measures was the exception and not the norm. Most of the Large Customer enrollments were well supported by

[1] The observed precision at the 80% confidence level is ±2.2%.

documentation contained in the project files, including invoices, spec sheets, savings calculations, assumptions, and on-site inspection notes and checklists. Nexant believes this generally robust documentation substantiates Efficiency Maine's strong relationships with routine participants and the high level of accuracy in reported savings.

4.1.2 Summer Demand Impacts

Efficiency Maine's TRM defines the summer peak window as 1:00 PM to 5:00 PM on non-holiday weekdays in June, July, and August. The realization rates and gross demand impact estimates corresponding to this window are presented below in Table 4-2.

Table 4-2: Gross Summer Demand Impact Estimates

Program	Ex-Ante Savings (kW)	Realization Rate (%)	Ex-Post Savings (kW)	Relative Precision at 90% Confidence (%)[2]
Large Customers	3,462	96.3%	3,333	0.8%

As program participation included a diverse array of measures, there are limited overarching findings to present. On the whole, Nexant is confident in the verified summer demand savings estimates.

4.1.3 Winter Demand Impacts

Efficiency Maine's TRM defines the winter peak window as 5:00 PM to 7:00 PM on non-holiday weekdays in December and January. The realization rates and gross demand impact estimates corresponding to this window are presented below in Table 4-3.

Table 4-3: Gross Winter Demand Impact Estimates

Stratum	Ex-Ante Savings (kW)	Realization Rate (%)	Ex-Post Savings (kW)	Relative Precision at 90% Confidence (%)[3]
Large Customers	3,322	93.8%	3,114	2.0%

As program participation included a diverse array of measures, there are limited overarching findings to present. On the whole, Nexant is confident in the verified winter demand savings estimates.

4.2 Net Savings Estimates

Program intention and influence was assessed for each evaluated project to estimate freeridership for the program. Participant spillover questions were asked to identify if the customer invested in additional energy efficiency measures for which they did not receive any

[2] The observed precision surrounding the summer demand savings at the 80% confidence level is ±0.7%.

[3] The observed precision surrounding the winter demand savings at the 80% confidence level is ±1.5%

Efficiency Maine incentives. Only one participant reported making additional upgrades for which they did not receive any incentives.

The weighted average freeridership, spillover, and resulting net-to-gross ratio for the LCP program are summarized in Table 4-4.

Table 4-4: Net to Gross Freeridership and Spillover Components

Measure Category	Number of Respondents	Estimated Freeeridership	Estimated Participant Spillover	NTG Ratio
Custom rebates	19	0.082	0.007	0.925

The net energy impacts are the product of the calculated gross energy savings and the net-to-gross ratios. The net energy impacts for the LCP are summarized below in Table 4-5.

Table 4-5: LCP Verified Net and Gross Energy Impact Estimates

Program	Ex-Post Gross Energy Savings (kWh)	NTG Ratio	Ex-Post Net Energy Savings (kWh)
Large Customers	25,737,406	0.925	23,801,095

The NTG ratio of 92.5% indicates that Efficiency Maine's programs are highly influential in participant decisions to make energy efficient upgrades.

4.3 Cost-Effectiveness Assessment

Nexant analyzed the cost-effectiveness of the Large Customers Programs based on the Total Resource Cost Test (TRC) and the Program Administrator Cost Test (PAC). The TRC test measures the costs of the program to society as a whole by including both the participant and utility costs; the PAC measures the costs of the program from the program administrator's point of view by only including those costs incurred by the utility. A TRC ratio of greater than one is considered cost-effective to society; a PAC ratio of greater than one is considered cost-effective to the program administrator. Efficiency Maine currently utilizes the CPUC SPM Clarification Memo[4] for cost-effectiveness calculations, which clarifies how incentives to free riders should be treated in a TRC test to address a free rider cost advantage to rebate programs relative to

[4] SPM 2007 Clarification Memo From D.07-09-043; *see* http://www.cpuc.ca.gov/NR/rdonlyres/A7C97EB0-48FA-4F05-9F3D-4934512FEDEA/0/2007SPMClarificationMemo.doc.

direct install programs. The clarification is that incentives for free riders should be treated as a cost.

It should be noted that while the CPUC SPM is often utilized as a standard framework across North America, it is also often modified for jurisdictional use. Examples of subtle modifications to the CPUC SPM for local use include the use of gross versus net savings, inclusion of non-energy benefits, limitations on measure life, incremental costs, and how incentives paid to freeriders are or are not included as a program administrative costs. The section below details how Efficiency Maine currently defines cost effectiveness and how it is applied in this evaluation.

4.3.1 Total Resource Cost

The TRC test measures the net costs of a program as a resource option based on the total costs of the program, including both the participants' and the utility's costs. In general, it is the ratio of the discounted total benefits of the program to the discounted total costs over a specified time period. A benefit-cost ratio greater than one indicates that the program is beneficial to the utility and its ratepayers on a total resource cost basis.

The benefits calculated in the TRC test are the avoided supply costs, the reduction in transmission, distribution, generation, and energy costs valued at marginal cost for the periods when there is a load reduction. The costs associated with this test are the net programs costs paid by both the utility and the participants; this includes administration costs, non-freerider equipment costs, and freerider incentives which are sourced from EffRT.

In algebraic form:

$$Benefits = \sum_{t=1}^{n} \frac{UAC_t}{(1+d)^{t-1}}$$

$$Costs = \sum_{t=1}^{n} \frac{PRC_t + PCN_t + FRINC_t}{(1+d)^{t-1}}$$

$$TRC\ Ratio = \frac{Benefits}{Costs}$$

Where:

UAC_t = Utility (electric and gas) net avoided supply costs in *year t*

PRC_t = Program administrator program costs in *year t*

PCN_t = Net participant costs (equipment costs) in *year t*

$FRINC_t$ = Incentives paid to freeriders in *year t*

d = Nominal discount rate

4.3.2 Program Administrator Cost

The PAC test measures the net costs of a program as a resource option based on the costs incurred by the program administrator and excluding any net costs incurred by the participant. A benefit to cost ratio above one indicates that the program would benefit the administrator's cost environment.

Similar to the TRC test, the benefits calculated in the PAC test are the avoided supply costs of energy and demand. However, the net avoided supply costs for the PAC test include only the avoided costs of supplying electricity, not the avoided societal costs of natural gas, propane, or water. The costs associated with this test are the program costs incurred by the administrator and the incentives paid to the customers.

In algebraic form:

$$Benefits = \sum_{t=1}^{n} \frac{UAC_t}{(1+d)^{t-1}}$$

$$Costs = \sum_{t=1}^{n} \frac{PRC_t + INC_t}{(1+d)^{t-1}}$$

$$PAC\ Ratio = \frac{Benefits}{Costs}$$

Where:

UAC_t = Utility net avoided supply costs in *year t*

PRC_t = Program administrator program costs in *year t*

INC_t = Incentives paid to participants in *year t*

d = Nominal discount rate

4.3.3 Cost Effectiveness Inputs

The use of CBAT for cost effectiveness testing required the following inputs, which were provided by Efficiency Maine for Nexant's use:

- Generation Markup (8.00%)
- Discount Rate (2.43%)

Other inputs that are tracked and stored in EffRT for use by CBAT include:

- 2015 Avoided Energy Costs
- 2015 Avoided Capacity Costs

- Incentive Amounts
- Measure Life
- Measure Incremental Cost
- Measure Energy Period Factors

Program Delivery costs were taken from Efficiency Maine's 2014 and 2015 annual reports. Nexant adjusted the program costs in the 2015 annual report to reflect only the costs accrued during the evaluation period (July 1, 2014 through February 28, 2015). Nexant allocated the costs proportionately to the ratio of program incentives paid out within the evaluation period to those paid out in the full program year.

Table 4-6 summarizes the results of the cost effectiveness assessments for the Large Customer Program via the PAC and TRC test methods.

Table 4-6: Cost Effectiveness Summary[5]

Stratum	Gross Results	Net Results
Program Administrator Cost (PAC)		
PAC Costs	-$6,434,636	-$7,640,353
PAC Benefits	$27,193,147	$29,018,343
PAC B:C Ratio	4.23	3.80
Total Resource Cost (TRC)		
TRC Costs	-$15,214,169	-$17,263,728
TRC Benefits	$27,193,147	$29,018,343
TRC B:C Ratio	1.79	1.68

Nexant created a custom factor schedule to be loaded into CBAT based on the findings of the evaluation. The custom factor schedule includes only a realization rate and net-to-gross ratios as 8,760-hour load shapes were not created for all large customer projects. Nexant's custom factors used for cost-effectiveness calculations are summarized below in Table 4-7.

Table 4-7: Nexant Derived Factor Schedules

Program	Free-Ridership	Spillover	Energy RR	Demand RR
Large Customers	8.2%	0.7%	96.5%	94.6[6]%

[5] The PAC test only includes the costs to Efficiency Maine. The TRC test includes the costs to Efficiency Maine and the participant.

[6] Efficiency Maine uses Summer kW * 4/12 + Winter kW * 8/12 = 94.6%

4.3.4 TRC Testing

The benefits, costs, and associated TRC ratios for the evaluation period derived as described in Section 2.4.2 are presented below in Table 4-8. The reported values in the table were obtained through CBAT runs using Efficiency Maine's default factor schedules; the ex-post values are the result of CBAT runs using Nexant's custom factor schedules.

Table 4-8: Program TRC Results by Year

	Gross Ex-Ante	Gross Ex-Post	Net Ex-Ante	Net Ex-Post
July, 2013 – June, 2014	1.84	1.66	1.31	1.59
July, 2014 – February, 2015	2.10	1.83	1.84	1.76
Total TRC Ratio	**2.04**	**1.79**	**1.79**	**1.68**

Overall the Large Customers Program proved to be cost effective via the TRC test method for each year, and over the entire evaluation period.

4.3.5 PAC Testing

The reported and verified PAC ratios for the evaluation period derived as described in Section 2.4.2 are presented below in Table 4-9. The reported values in the table were obtained through CBAT runs using Efficiency Maine's default factor schedules; the ex-post values are the result of CBAT runs using Nexant's custom factor schedules.

Table 4-9: Program PAC Results by Year

	Gross Ex-Ante	Gross Ex-Post	Net Ex-Ante	Net Ex-Post
July, 2013 – June, 2014	3.21	2.88	2.63	2.71
July, 2014 – February, 2015	5.56	4.84	4.43	4.51
Total PAC Ratio	**4.82**	**4.23**	**3.86**	**3.80**

Again, the Large Customers Program proved to be cost effective via the PAC test method for each year, and over the entire evaluation period.

4.3.6 Cost Effectiveness Adjustments

In addition to customary program administration and delivery costs, the benefit cost calculation for the Large Customer Program includes an additional item in the amount of $917,265.00. This figure represents funds that were originally paid as a customer incentive to support a combined heat and power (CHP) project at Lincoln Paper and Tissue LLC. The project was part of the reconfiguration of mill operations driven by a 2013 boiler explosion limited the mill's ability to make its own pulp therefore fundamentally altering production processes within the mill.[7] In the absence of the pulp process, steam loads were insufficient to support the back-pressure turbine and produce electricity on site. The inability to self-generate electricity made the mill less economically competitive. Efficiency Maine provided the mill with a $917,265.00 incentive

[7] http://bangordailynews.com/2013/12/11/business/lincoln-paper-mill-to-lay-off-200-workers-indefinitely-due-to-boiler-explosion/

payment (enrollment number 258817) to help secure a $4.4 Million turbine upgrade project. Within a few months of the project's completion however, the mill filed for bankruptcy protection and its assets including the newly commissioned turbine were sold at auction. Because of the brief period that the project actually operated, Efficiency Maine did not claim any electric energy savings from the project in its annual report and the incentive dollars were moved to the program costs in both the TRC and PAC tests. This single project's financial commitment represented a significant share of the program's total operating budget. While the ultimate outcome was unfortunate for Efficiency Maine, it was catastrophic for the mill's employees. It is understood that at the time when Efficiency Maine benchmarked Lincoln Paper and Tissue's financial performance against industry accepted ratios, their performance was better than the industry average. In addition, the CEO of Lincoln Paper and Tissue spoke to Efficiency Maine's review committee and presented evidence that the company was going to use the insurance settlement to restructure their debt and continue to offer a competitive product. Based on information provided by Efficiency Maine, Nexant feels that Efficiency Maine did their due diligence in running financial reports for this project and could not have predicted that the mill would close down at the time the incentive was approved and paid.

4.4 Findings and Recommendations

Most of the Large Customer enrollments were well supported by documentation contained in the project files, including invoices, spec sheets, savings calculations, assumptions, and on-site inspection notes and checklists. Nexant believes this generally robust documentation substantiates Efficiency Maine's strong relationships with routine participants and the high level of accuracy in reported savings, represented through a realization rate close to 100% for energy and demand savings. The program offered a diverse mix of measures and Efficiency Maine continues to work to diversify the program through targeting a higher number of smaller projects to further increase their confidence in the reported savings.

Based on the findings from the evaluation, Nexant recommends that Efficiency Maine update the Large Customer TRM to reflect the values reported in Table 4-10, as applicable.

Table 4-10: Impact Evaluation Results

Program	Electric Energy Realization Rate	Electric Summer Demand Realization Rate	Electric Winter Demand Realization Rate	Natural Gas Energy Realization Rate	Freerider-ship	Spillover
Large Customers	96.5%	96.3%	93.8%	86.0%	8.2%	0.7%

Appendix A Participant Survey Instrument

Interviewer note: our overarching objectives are to 1) understand what would have likely happened without Efficiency Maine, and 2) understand their experience with the program.]

A.1 Project Identification

At what point did you become aware of the potential for funding from Efficiency Maine?
[Record open ended response verbatim. Use probes below as needed to understand project sequence.]

a) Did you hear about the Efficiency Maine funding:

b) After the project had been identified?

c) During the process of identifying and scoping the project?

d) During a scoping audit or other technical assistance?

e) Prior to identifying the project (could have heard in prior years, or had prior projects, or heard about the opportunity)

Did you receive a scoping audit or other technical assistance during the project development phase?

If yes: Who conducted this?

Did this project solve operational or equipment problems? [Probe to understand what problems, including if prior equipment had failed.]

[If prior equipment had not failed] How long might the previous equipment have stayed in place?

A.2 Organization Priorities & Motivations

I have a few questions about how projects like this are generally handled by your organization…

Does your organization have…

Aspect	1/Yes	2/No	98/DK	99/RF
a. An energy manager				
b. Formal purchase guidelines that prioritize or encourage energy efficiency?				
c. Informal purchase guidelines that prioritize or encourage energy efficiency?				
d. Long term plans for major equipment replacements?				
e. A goal for reducing energy consumption?				
f. Minimum payback or return on investment thresholds for projects under consideration?				

[ASK IF0 E = YES]
You indicated your company has a goal for energy use reduction. What is your company's energy reduction goal? [Goals can be expressed as a percentage reduction, or a number, or achieving a certification or label]:

[OPEN-ENDED RESPONSE]
Don't know
Refused

[ASK 0-0 ONLY IF0 F= YES]
You indicated your company has a minimum expected payback or return on investment threshold for projects under consideration.

Is there a price/cost threshold that requires payback calculations?

[SINGLE RESPONSE]
Yes
No, everything requires payback calculations, regardless of the amount
Other response: [RECORD VERBAITM RESPONSE]
Don't know
Refused

[ASK IF 0 = YES]
What is the payback threshold?

One year or less
Two years or less
Three years or less
Other: [RECORD VERBAITM RESPONSE]
Don't know
Refused

[ASK IF 0 = YES]
Are there exceptions to this requirement?

Yes
No

Don't know
Refused

[ASK IF 0 = YES]
Under what scenarios are exceptions considered?

[OPEN-ENDED RESPONSE]
Don't know
Refused

[ASK ALL]
Does your organization have a cost threshold above which someone higher in the organization must approve the decision?

[SINGLE RESPONSE]
Yes
No
Everything requires approval, regardless of the amount
I'm the owner/manager or person that provides approval
Don't know
Refused

[ASK IF 0=YES]
What is the threshold?

[OPEN-ENDED RESPONSE]
Don't know
Refused

A.3 NTG & Spillover

If your organization had not received financial assistance from Efficiency Maine, would this project have gone forward?

1. If yes: Would the project have occurred within the same timeframe?
2. If yes: Would the project have had the same energy efficiency profile?
3. If yes: Would the project have been on the same scale (size)?

If your organization had not received funding from Efficiency Maine, would it have had the funds to cover the entire cost of the project?

Using a 1-to-5 scale, where 1 means not at all important and 5 means very important, how important was:

1. The financial support received from the program?
2. Information provided from scoping or technical audits?
3. The project review and vetting process provided by Efficiency Maine?

Since completing this project, has your organization undertaken other projects to further improve the energy efficiency profile of your facility or other facilities?

1. If yes: did your experience with this project influence these other projects or upgrades?

Does your organization have plans to replicate this project at other sites in the next two years?

Does your organization have plans to complete additional projects within the next two years?

Do you have any suggestions for how Efficiency Maine could improve this program for organizations like yours?

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