



KEMA

New Hampshire Large Business Retrofit Program Impact Evaluation Final Report

New Hampshire Monitoring and
Evaluation Team

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SECTION 1 EXECUTIVE SUMMARY	4
1.1 Evaluation Objectives	4
1.2 Methods.....	5
1.3 Key Findings and Recommendations	6
1.3.1 Impact Evaluation Results	6
1.4 Recommendations.....	9
 SECTION 2 INTRODUCTION	 11
2.1 Project Objectives	11
2.2 Program Description	12
2.3 Overview of Approach.....	12
2.3.1 Impact Evaluation	12
2.3.2 Customer Response Assessment.....	13
2.4 Organization of the Remainder of the Report.....	13
 SECTION 3 ENERGY SAVING RESULTS	 14
3.1 Methodology	14
3.1.1 Sampling	14
3.1.2 Data Collection	18
3.1.3 Ratio Estimation Technique.....	20
3.2 Results.....	23
3.2.1 Overall and Utility Level Results.....	24
3.2.2 Measure Level Results	25
3.2.3 Measure Level Results By Utility	26
3.2.4 Tracked Versus Verified Energy Impacts	28
3.3 Tracked Versus Verified Savings	29
3.3.1 Verified Savings Estimates	29
3.3.2 Degree of Difference.....	30
3.3.3 Discrepancies	30
3.4 Review of Program Tracking System.....	32
3.5 Recommendations.....	34
 SECTION 4 CUSTOMER SATISFACTION AND PARTICIPANT FEEDBACK	 36
4.1 Customer Satisfaction	36
4.1.1 Customer Satisfaction with Program Services.....	36
4.1.2 Customer Satisfaction with Energy-Efficient Equipment Installed.....	38
4.2 Suggestions for Improvement.....	39
4.3 Recommendations.....	40

APPENDIX A QUESTIONNAIRE.....42

Informed Respondent.....43

Onsite Recruitment45

Verify Measure Installation46

Engineering Review.....48

Determine Program Impact on Decision to Install49

Satisfaction with Program.....52

This Executive Summary presents an overview of results for an impact evaluation of the New Hampshire Large Business Retrofit Program. This evaluation was conducted for three sponsoring New Hampshire electric utilities: Public Service Company of New Hampshire, New Hampshire Electric Cooperative, Inc., and Unitil Energy Systems, Inc. The program is administered by the New Hampshire investor owned electric utilities¹ and the New Hampshire Electric Cooperative, Inc. The program targets customers with demand of 100 kW and larger to replace inefficient equipment and systems. Prescriptive and custom rebates are offered as well as technical services, audits, and training seminars. Typical supported projects include: lighting, air compressors, variable frequency drives, energy management systems, motors and custom. During the period studied (calendar year 2004) the NH program supported 238 retrofit projects at 184 customer facilities.

1.1 EVALUATION OBJECTIVES

The principal objectives of this evaluation were to:

1. Determine total energy (kWh) savings associated with participating in the Large Business Retrofit Program during the implementation period beginning January 1, 2004, and ending December 31, 2004.
2. Explain the reasons for discrepancies between tracked and verified savings,² in terms of the main factors or components of the realization rate.³
3. Review the systems and methods used to track and calculate energy savings and make recommendations, as appropriate, regarding ways to improve the accuracy of reported energy savings.
4. Survey program participants to measure customer satisfaction with program services and the efficient equipment installed through the program.

¹ National Grid, Public Service Company of New Hampshire, Unitil Energy Systems.

² Throughout this report we will refer to preliminary estimates of savings entered in the sponsors' program-tracking databases as 'tracked savings.' We will refer to estimates of savings made on the basis of primary data collected expressly for this evaluation as 'verified savings.' As explained later, these terms refer to Gross Savings as that term is commonly used in energy efficiency program evaluation.

³ The term 'realization rate' refers to the ratio of verified to tracked savings.

1.2 METHODS

KEMA used the statistical procedure of ratio estimation to develop estimates of program gross impacts. There are two basic steps in the process.

1. ***Verify energy savings in a sample of participating facilities.*** For a sample of sites that participated in the project, KEMA estimated actual energy savings under current conditions. This can be accomplished in a number of ways. For larger projects that accounted for a significant portion of total tracked savings, KEMA developed and carried out customized on-site inspections to verify key parameters in the tracking system savings estimates. These included the type and number of measures actually installed, operating hours, equipment wattage, and so forth. For smaller projects, KEMA collected this information through telephone interviews conducted by an experienced energy engineer.
2. ***Expand sample results to the population of participants using ratio estimation.*** To estimate the total energy savings achieved by all participants, KEMA multiplied total tracked savings for all participants by the ratio of tracked savings to verified savings for the sample participants. The estimate of total savings arrived at through the application of the ratio estimator has a number of favorable statistical properties: its variance -- and therefore confidence intervals -- can be calculated; and its variance is lower than estimates developed through simple averaging of sample results.

KEMA estimated the factor used to adjust tracked savings (*Gross Savings Adjustment Factor*) by taking the product of two factors estimated directly from the sample data:

- *Installation Rate.* This factor adjusts the count of measures installed based on the results of the measure verification.
- *Engineering Verification Factor.* This factor adjusts the gross savings for changes based on KEMA engineers' review of assumptions used to develop the tracking system estimate and observations of equipment characteristics and facility operations at the sample sites.

KEMA was able to complete on-site verification studies and interviews at sites that represented 70 percent of total program savings. This provided sufficient observations of some individual measures to develop statistically significant estimates at the measure level, as well as at the program level.

Following the energy impacts section of the telephone survey, the KEMA engineer proceeded with a short sequence of questions to assess participant response to the program and the equipment installed.

1.3 KEY FINDINGS AND RECOMMENDATIONS

1.3.1 Impact Evaluation Results

The key findings of the impact evaluation are as follows.

Overall Program Savings

The New Hampshire Large Business Retrofit Program achieved a gross savings realization rate of 89 percent.⁴ That is, verified gross savings for the program equaled 89 percent of the tracked savings for the program as a whole.

- Verified annual savings amounted to 17,426,240 kWh/year, compared to 19,477,178 kWh/year in tracked savings.
- Verified lifetime savings amounted to 259,005,141 kWh/year, compared to 289,488,110 kWh/year in tracked savings and 251,654,313 kWh/year in savings filed with the Commission. Table 1–1 provides the lifetime tracked, filed and verified savings for the NH Large Business Retrofit Program by utility and overall.
- The 90 percent confidence interval on the realization rate was estimated to be 2.1 percent. That is, there is a 90 percent probability that actual verified savings for the year lie between 16.7 million kWh/year and 18.1 million kWh/year.
- Compared with other programs of this type evaluated by KEMA and others, this is a strong result.

Table 1-1. Tracked, Filed, and Verified Lifetime kWh Savings⁵

Utility	Tracked	Filed w/ Commission		Evaluation Verified			
		Realization Rate	Lifetime Gross kWh Savings	Method 1		Method 2	
				Realization Rate	Lifetime Gross kWh Savings	Realization Rate	Lifetime Gross kWh Savings
NHEC	9,462,455	100%	9,462,455	89%	8,466,063	89%	8,466,063
PSNH	236,461,230	84%	198,627,433	89%	211,561,968	94%	222,710,759
Unitil	43,564,425	100%	43,564,425	89%	38,977,110	89%	38,977,110
Total	289,488,110		251,654,313		259,005,141		270,153,932

⁴ PSNH currently uses a realization rate of 84 percent.

⁵ Table 1-1 provides evaluation verified gross kWh calculated in two ways. Method 1 is the product of the overall realization rate (89 percent) and tracked lifetime savings for each utility. In Method 2 the PSNH lifetime savings are calculated using the PSNH utility level result of 94 percent from Table 3-7. The NHEC and Unitil utility level results should be used with caution due to small sample sizes. Therefore in Method 2 we use the overall realization rate of 89 percent for Unitil and NHEC.

Energy Savings at the Measure Level

Table 1-2 displays estimated realization rates by measure type, along with the standard error of the estimate and the portion of total tracked program savings each measure accounts for.

Table 1-2. Realization Rate by Measure Type

Measure	Gross Savings Adjustment Factor (Realization Rate)	Standard Error of Realization Rate	% of Total Tracked Energy Savings
Air Compressor	94%	5.2%	19%
Energy Management System	114%	8.8%	6%
HVAC	11%	<0.1%	2%
Lighting	86%	4.2%	45%
Motors	100%	0.1%	1%
Industrial Process Improvement	74%	8.9%	15%
Variable Frequency Drives	99%	0.7%	12%
Weatherization	100%	n/a*	1%
Program Total	89%	2.1%	100%

* There was only one instance of this measure in the sample.

For most measure types, verified savings matched tracked savings fairly closely. The one exception was HVAC. HVAC equipment, however, accounted for only 6 of the 238 total measures assisted by the program and only 2 percent of total tracked program energy savings. The large deviation found in the sample sites were due primarily to overestimates of operating hours that were incorporated into the estimate of tracked savings for that particular project.

Reasons for Discrepancies between Verified and Tracked Savings

Table 1-3 displays the number of sample projects in which KEMA discovered discrepancies of various kinds between verified and tracked savings estimates of more than 10 percent. There were 33 such instances out of a sample of 75 installed measures. Fifteen of the 33 discrepancies were attributable to significant differences between logged (verified) operating parameters and estimates used to estimate tracked savings. This level of discrepancy is to be expected; it constitutes the primary justification for evaluations of this type. Nine of the 33 discrepancies were attributable to calculation or data entry errors in the development of tracked savings estimates. As discussed below in Section 1.4, KEMA has developed procedural recommendations to cut down on these kinds of errors, which can contribute to inaccurate indicators of the program's performance.

Table 1-3. Reasons for Discrepancies between Verified and Tracked Savings Estimates

Discrepancies	# of Projects		
	Verified > Tracked	Verified < Tracked	Total
Differences between logged parameters and estimated parameters			
Differences between logged parameters and estimated parameters	8	7	15
Calculation or entry errors			
Savings entered under wrong application number	1	1	2
Incorrect wattage estimates for lighting project	1	1	2
Multiplied savings of equipment by 3		1	1
Data entry error		1	1
Vendor-supplied calculation had error		1	1
Used incorrect quantity number in savings calc		1	1
Did not include load factor in calculation		1	1
Changes in equipment operation, counts, or assumptions			
Operating hours of installed equipment increased	1		1
Did not install all fixtures rebated		1	1
Initial parameter assumptions incorrect		2	2
Lack of savings information provided in the project paperwork			
Not enough information to recreate savings estimate		2	2
Not enough information to recreate savings estimate		1	1
Misinterpretation of customer-provided information			
Misinterpretation of vendor lighting inventory	1		1
Misinterpretation of air compressor cfm	1		1
Total by utility			
PSNH	12	15	27
Unitil	1	3	4
NHEC	0	2	2
Total for all	13	20	33

Assessment of Customer Response to the Program

Participant satisfaction with the Large Business Retrofit Program was very high. The evaluators asked program participants about their overall impression of the program and how satisfied their organization was with the program. With one exception, all of the participants had a positive impression of the program. Ninety-nine percent of the participants said that their organizations were satisfied with the program. *Program satisfaction levels above 90 percent are considered very good for an energy efficiency program and it is rare to find near universal levels of reported program satisfaction.* Customer comments regarding potential program improvements focused on strengthening communications with customers so that they can be more aware of the opportunities the program offers.

1.4 RECOMMENDATIONS

Most of KEMA's recommendations, based on our impact evaluation activities,⁶ focus on strengthening project management and tracking systems, as well as on increasing customer awareness of the program. The recommendations are provided at the overall level and not by utility. Therefore each recommendation may not apply to all three utilities. It is also important to note that a benefit-cost analysis was not performed on these recommendations.

1. *Consider processes to improve accuracy of data entry, such as periodic reviews of the tracking system data.* A number of data entry errors were found that had an effect on the impact evaluation results. Two of the projects that received adjustments of over 50 percent in the engineering review may have been discovered during a periodic database assessment. A periodic assessment could identify large errors in data entry and calculation and may also identify projects that have received an incorrect measure description. Some processes to improve the quality of the data may already be in place or following a benefit-cost analysis the program may decide to let evaluation perform the data review process. However adding or expanding a review process has the potential to reduce surprises during the evaluation.
2. *Institute a calculation review process.* A second program administrator or engineer should perform a mid-level review of the energy savings calculations and data entries for participating projects. This is especially important for projects with large energy savings (e.g., over 100,000 kWh/yr). If a second engineer is not available it might be helpful for the engineer to discuss the calculations with a colleague that is not an engineer.
3. *Ensure that all installed projects have clear and verifiable energy savings calculations on file.* Clear calculations aid in quality control by exposing unreasonable assumptions and facilitate the review by a colleague or evaluation. They also act as a record of the relevant project parameters at the time the project is installed. A good record of pre-installation parameters results in high-quality, low-cost evaluations because missing calculations don't have to be recreated and the evaluation does not rely on the memory of past system performance.
4. *Require installing contractors to include verifiable savings calculations as part of the rebate applications.* At present, the energy savings calculations provided with the project paperwork primarily come from either the contractor or a program administrator. The contractor, however, has the best information on the project and the installation site and may be producing savings calculations already for the benefit of the customer. Contractors are profiting from the program but currently bear none of the cost. Requiring them to provide savings calculations reduces the workload on the program administrator and benefits customers that are not already receiving an energy analysis.
5. *Reevaluate current marketing and program notification efforts.* Increasing awareness of the program was the suggestion for program improvement that was most cited by participants. Upon reviewing the benefits and costs of this recommendation the program

⁶ A formal process evaluation was not performed as part of this evaluation.

managers need to consider the likelihood of lower customer satisfaction ratings if they increase marketing without increasing funding.

6. *Manage incentive funds to ensure availability over the program year.* A number of PSNH participants noted that program funding had run out before the end of the year and wanted funding to be available all year long. Realizing that increasing program funding levels may not be an option, the program should consider strategies for making existing program funds last longer. The utilities have caps on the amount of incentive dollars that a single participant can receive. Additional strategies used by states that have faced similar problems include:
 - a. Instituting per project and per contractor caps on incentive levels payouts;
 - b. Capping rebate levels for popular measure types such as lighting that tend to consume large quantities of program funds;
 - c. Instituting a rebate reservation process where contractors or end users must reserve incentive dollars ahead of time and have a certain period of time to use them or lose them.

These strategies not only make program funds last longer, but also ensure that they are distributed more equitably.

This report presents the results of an impact evaluation of the New Hampshire Large Business Retrofit Program for three sponsoring New Hampshire electric utilities: Public Service Company of New Hampshire, New Hampshire Electric Cooperative, Inc., and Unitil Energy Systems, Inc. The program is administered and implemented by the New Hampshire investor owned electric utilities⁷ and the New Hampshire Electric Cooperative, Inc.

The Large Business Retrofit Program is funded by the System Benefits Charge on commercial and industrial customers' electric bills and provides products and services tailored to large business customers. The program offers prescriptive and custom rebates as well as technical services, audits, and training seminars. Typical supported projects include: lighting, air compressors, variable frequency drives, energy management systems, motors and custom projects. During the period studied (calendar year 2004) the program supported 238 retrofit projects at 184 NH facilities.

In this section we review the project objectives, provide a brief description of the program, summarize the evaluation approach, and describe the organization of the remainder of the report.

2.1 PROJECT OBJECTIVES

The principal objectives of the project were:

1. Determine total energy (kWh) savings associated with participating in the Large Business Retrofit Program during the implementation period beginning January 1, 2004, and ending December 31, 2004.
2. Explain the reasons for discrepancies between tracked and verified savings,⁸ in terms of the main factors or components of the realization rate.⁹
3. Review the systems and methods used to track and calculate energy savings and make recommendations, as appropriate, regarding ways to improve the accuracy of reported energy savings.
4. Survey program participants to measure customer satisfaction with program services and the efficient equipment installed through the program.

⁷ National Grid, Public Service Company of New Hampshire, Unitil Energy Systems.

⁸ Throughout this report we will refer to preliminary estimates of savings entered in the sponsors' program-tracking databases as 'tracked savings.' We will refer to estimates of savings made on the basis of primary data collected expressly for this evaluation as 'verified savings.' As explained later, these terms refer to Gross Savings as that term is commonly used in energy efficiency program evaluation.

⁹ The term 'realization rate' refers to the ratio of verified to tracked savings.

2.2 PROGRAM DESCRIPTION

New Hampshire Large Business Retrofit Program is one of several CORE¹⁰ energy efficiency programs offered by the New Hampshire Electric Utilities¹¹ providing products and services tailored for business customers. The program is administered by the New Hampshire Electric Utilities and delivered directly to customers by the utilities' account executives and energy service representatives. The program targets customers with electric demands of at least 100 kW that are operating aging, inefficient equipment and systems. Prescriptive and custom rebates are designed to cover the lesser of a one year payback or 35 percent of total project costs (equipment and labor) up to the customer's incentive cap. Additional program services include energy audits, assistance with selecting energy efficient equipment, and training seminars.

Measures installed during the 2004 program year by the sponsoring utilities included: air compressors, lighting, motors, variable frequency drives (VFDs), HVAC, and energy management systems as well as other custom measures. According to the utilities' program-tracking databases, 184 New Hampshire facilities participated in the Large Business Retrofit Program and completed 238 projects with total annual savings of 19.5 GWh between January 1, 2004, and December 31, 2004.

2.3 OVERVIEW OF APPROACH

2.3.1 Impact Evaluation

KEMA used the statistical procedure of ratio estimation to develop estimates of program gross impacts. There are two basic steps in the process.

1. ***Verify energy savings in a sample of participating facilities.*** For a sample of sites that participated in the program, KEMA estimated actual energy savings under current conditions. This can be accomplished in a number of ways. For larger projects that accounted for a significant portion of total tracked savings, KEMA developed and carried out customized on-site inspections to verify key parameters in the tracking system savings estimates. These included the type and number of measures actually installed, operating hours, equipment wattage, and so forth. For smaller projects, KEMA collected this information through telephone interviews conducted by an experienced energy engineer.
2. ***Expand sample results to the population of participants using ratio estimation.*** To estimate the total energy savings achieved by all participants, KEMA multiplied total

¹⁰ The CORE Energy Efficiency Programs represent a coordinated effort by the New Hampshire electric utilities to offer the same programs statewide.

¹¹ National Grid, Public Service Company of New Hampshire, New Hampshire Electric Cooperative, Inc., Unitil Energy Systems, Inc.

tracked savings for all participants by the ratio of tracked savings to verified savings for the sample participants. The estimate of total savings arrived at through the application of the ratio estimator has a number of statistical and practical advantages over an estimate based on average savings per site or per unit of a particular kind of measure installed.

- The ratio estimation approach easily accommodates the diversity of measures installed through the program. For most measures, there are too few observations to generate useful estimates of savings per unit installed.
- The variance of the ratio estimator can be calculated, and, in most cases, it will be less than the variance of a mean-per-unit estimator with the same sample size.
- Ratio estimation makes best use of the high quality, but rather expensive, evaluation data provided from on-site inspections.

KEMA was able to complete on-site verification studies and interviews at sites that represented 70 percent of total program savings. Based on our experience, this is a very high proportion of savings and resulted in an overall estimate with a low margin of error. In this evaluation, the added bonus of such a large proportion of savings being included in the study was having sufficient observations of some individual measures to develop statistically significant estimates at the measure level.

2.3.2 Customer Response Assessment

Following the energy impacts section of the telephone survey, the KEMA engineer proceeded with a short sequence of questions to assess participant response to the program and the equipment installed. Participants were asked questions regarding their satisfaction with the program and the energy-efficient equipment they had installed. Reasons for satisfaction levels and suggestions for program improvement were also collected from participants.

New Hampshire regulators do not consider free ridership in assessing program savings therefore KEMA did not include a formal net savings analysis in this study.

2.4 ORGANIZATION OF THE REMAINDER OF THE REPORT

Section 3 of the report presents the evaluation methodology and the energy savings results. The sampling plan, data collection, and the ratio estimation technique employed to calculate the energy savings results are explained in detail. Following the methodology is the presentation of the energy-savings results. The results are provided for each utility and the overall program. An investigation into energy savings results by measure is also provided. After the results are discussions of the discrepancies between tracked and verified savings, program-tracking systems, and recommendations to improve the accuracy of reported energy savings.

Section 4 of the report provides results of the customer satisfaction levels and participant feedback questions. The participant survey instrument is included in Appendix A.

The primary objective of this evaluation is to calculate total energy (kWh) savings associated with participating in the Large C&I Retrofit Program during the implementation period beginning January 1, 2004, and ending December 31, 2004. This section of the report discusses the methods used to calculate energy savings, the energy savings results, and discrepancies between tracked and verified energy savings. The section concludes with a discussion of program tracking and recommendations to improve the accuracy of reported energy savings.

3.1 METHODOLOGY

3.1.1 Sampling

Sample Design. The main objective in designing the sample was to provide the best possible energy savings estimates for the overall program. Table 3–1 shows participant counts and tracking savings for the population and sample completes. The first stratum contains 51¹² participants that each account for at least 1 percent of total tracked savings.¹³ Together, the 51 largest participants account for 76 percent of the program’s tracked savings. Our plan was to attempt to recruit all of these participants for an on-site visit or, if unsuccessful, an engineering review over the phone. We began with the 14 participants with large tracking savings and proceeded to the 37 participants with medium tracking savings. Large tracking savings was defined as greater than 2 percent of the program’s tracked savings.

**Table 3-1
Program Population and Sample Completes**

Stratum	Program Population			Sample Completes		
	Tracked Savings	%Total kWh	# Participants	Tracked Savings	% Population kWh	# Participants
1 Top-51	14,761,507	76%	51	13,126,253	89%	41
2 Small NHEC	180,667	1%	4	120,780	67%	3
3 Small Unutil, PSNH	4,535,004	23%	129	322,639	7%	7
Total	19,477,178	100%	184	13,569,672	70%	51

The remaining two strata contain 133 small participants. Among the small participants, we decided to distinguish between small NHEC participants and other small participants to increase

¹² The original sample design included 52 participants in the large stratum. Through KEMA’s field data collection, we discovered that one participant had been misclassified and had actually participated in the New Construction program. KEMA removed that customer from the sample frame and reweighted the verification results appropriately. On KEMA’s request, the sponsors rechecked program records to ensure that no other customers had been thus misclassified.

¹³ A participant is a unique customer-location combination.

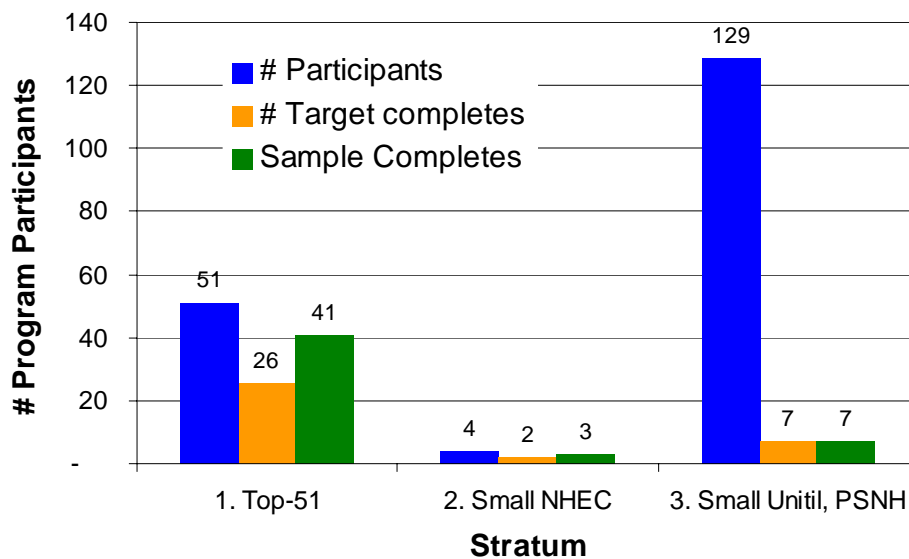
the likelihood NHEC participants would be included in the analysis. NHEC has a total of only six participants, two in the Top 51, and four small. Furthermore, the four small participants account for 29 percent of NHEC total tracking gross kWh savings. We attempted to complete an engineering review with each of the participants in the Small NHEC stratum and with seven participants in the small Unutil/PSNH stratum.

Sample Disposition. As shown in Table 3–2, we completed 31 on-site visits and a total of 51 participant surveys. Initially, we had counted on completing only 35 verification visits and phone interviews. We thus exceeded our sample design estimate by 16 surveys.¹⁴ One on-site visit was completed with a participant that did not complete a survey. Figure 3-1 shows the target and sample completes by stratum.

**Table 3-2
On-site and Survey Completes By Utility**

Utility	Program Population		On-site Completes	Survey Completes		
	# Participants	# Participants in Top51		Top51	Non Top51	Total
NHEC	6	2	1	1	3	4
PSNH	162	40	26	34	7	41
Unutil	16	9	4	6	0	6
Total	184	51	31	41	10	51

**Figure 3-1
Sample Completes By Stratum**



¹⁴ The on-site visit and survey completion for the misclassified New Construction Program company are included in the on-site and sample completes in Table 3–2.

Table 3-3 provides a breakdown of the types of data collection completed for the stratum 1 sample completes. Short-term monitoring equipment was installed for 59 percent of stratum 1 completes. Another 17 percent of stratum 1 sample completes received an on-site but the on-site surveyor was not able to install short-term monitoring equipment. The remaining stratum 1 sample completes did not receive an on-site visit.

**Table 3-3
Stratum 1 Data Collection**

Data Collection Category	Stratum 1 Sample Completes	
	# Participants	% Participants
On-site with monitoring ¹	24	59%
On-site with no monitoring ²	7	17%
Telephone interview only	10	24%
Stratum 1 Total	41	100%

¹Includes operating information from EMS and other systems.

²Spot measurements are included in this category.

The sample completes account for 70 percent of the program's total tracked savings. Table 3-4 shows the percent of tracked savings represented by the sample participants for each utility and for the overall program. These are all very high percentages relative to similar programs KEMA has evaluated.

**Table 3-4
Tracking Gross kWh Savings in Study**

Utility	Population Tracked Savings	Sample Completes	
		Tracked Savings	% Population kWh
NHEC	630,233	283,003	45%
PSNH	16,148,183	11,371,195	70%
Unitil	2,698,762	1,915,474	71%
Total	19,477,178	13,569,672	70%

Sample Coverage of Total Savings by Measure

As stated above, the primary objective of the sample design was to produce the best possible estimate for the overall program and not the best possible estimate by measure, despite our intentions to produce results based on measure type. As shown in Table 3-5, each measure type is represented in the sample in approximately the same proportion it represents in the population. For example, air compressors account for 19 percent of tracked savings and a corresponding 17 percent of the sample tracked savings. Furthermore, 62 percent of air compressor savings in the population are accounted for in the sample. These sample sizes will yield statistically meaningful estimates for most measures.

**Table 3-5
Distribution of Measures**

Measure	Population			Sample Completes			
	# Measures	Tracked Savings		# Measures	Tracked Savings		
		kWh	% Total kWh		kWh	% Total kWh	% Population kWh
Air Compressor	38	3,640,170	19%	11	2,257,456	17%	62%
EMS	12	1,095,797	6%	6	791,442	6%	72%
HVAC	6	321,109	2%	1	185,946	1%	58%
Lighting	139	8,824,198	45%	41	5,827,792	43%	66%
Motors	16	279,946	1%	3	82,044	1%	29%
Process	11	2,909,273	15%	7	2,800,918	21%	96%
VFD	15	2,244,462	12%	5	1,461,851	11%	65%
Weatherization	1	162,223	1%	1	162,223	1%	100%
Total	238	19,477,178	100%	75	13,569,672	100%	70%

Table 3–6 shows the distribution of measures in the population and sample by utility. The “other” classification for each utility includes:

NHEC: Weatherization;

PSNH: HVAC, Motors, EMS; and

Unitil: HVAC, VFD, Motors, EMS.¹⁵

As with Table 3–5, the similar distribution of total tracked savings in the population and the sample are evidence that our sample is representative of the distribution of measures across utility service territories. For example, PSNH lighting projects account for 35 percent of total program tracked savings and a corresponding 32 percent of the sample tracked savings. Furthermore, 64 percent of PSNH lighting savings in the population are accounted for in the sample. These sample sizes will yield statistically meaningful estimates for many of the PSNH measure categories. However, the small sample sizes in the NHEC and Unitil categories are a limiting factor.

¹⁵ These categories were suggested in the New Hampshire Large C&I Retrofit Program Impact Evaluation RFP.

**Table 3-6
Distribution of Measures By Utility**

Utility	Measure	Population				Sample Completes				
		# Measures	Tracked Savings			# Measures	Tracked Savings			
			kWh	% Utility kWh	% Total kWh		kWh	% Utility kWh	% Total kWh	% Population kWh
NHEC	Lighting	5	468,010	74%	2%	3	120,780	43%	1%	26%
	Other	1	162,223	26%	1%	1	162,223	57%	1%	100%
PSNH	Air Compressor	32	3,216,709	20%	17%	10	2,245,707	20%	17%	70%
	Lighting	129	6,861,043	42%	35%	35	4,373,614	38%	32%	64%
	Process	11	2,909,273	18%	15%	7	2,800,918	25%	21%	96%
	VFD	14	2,052,519	13%	11%	5	1,461,851	13%	11%	71%
	Other	28	1,108,639	7%	6%	8	489,105	4%	4%	44%
Unitil	Air Compressor	6	423,461	16%	2%	1	11,749	1%	0%	3%
	Lighting	5	1,495,145	55%	8%	3	1,333,398	70%	10%	89%
	Other	7	780,156	29%	4%	2	570,327	30%	4%	73%
Total		238	19,477,178		100%	75	13,569,672		100%	70%

3.1.2 Data Collection

A sample of the projects completed in the 2004 program year was selected for participant interviews and on-site verification. Prior to recruitment, we worked with the utilities to inform customers of this study in an effort to encourage them to participate if called. We suspect the success we had recruiting customers is in part due to the cooperation and assistance we received from the three utilities.

Participant Interviews

Following a review of project documentation and program-tracking data, a KEMA engineer prepared an interview script for each customer in the on-site sample. The interview addressed measure installation, project characteristics (e.g., quantities, equipment efficiencies, operating hours, etc.), and program process issues among other topics. Also included was a sequence of questions to assess customer satisfaction and gather participant feedback to be used for future program planning. Each participant interview was administered by a KEMA engineer.

A sample of smaller projects (based on energy savings) was selected to receive only the telephone interview. KEMA incorporated information collected from the telephone interviews into the engineering review of tracked savings calculations.

On-site Verification and Data Collection

A KEMA engineer used the information from the interview, the project documentation, and the program tracking data to develop the on-site analysis plan. This plan instructed the on-site surveyor on what data and measurements to collect.

Data collected during the on-site visits to support the engineering analysis of program savings included:

Verification of measure installation and operation. During the site visit, the on-site surveyor confirmed the type and quantity of equipment installed and verified any estimates used to characterize the equipment that was replaced. For example, in a typical lighting project, the surveyor would verify the number of fixtures installed, the type of fixture installed, the type of fixture replaced, and the number of fixtures replaced. In some cases, such as with occupancy sensors or variable speed drives, characteristics were gathered from existing equipment. However, in most retrofit cases the characterization of the previous equipment was based on the initial proposal submitted by the contractor or on the memory of the site contact.

Collection of equipment performance data. At some sites, spot measurements for electric current and voltage were made to verify the power use of a given piece of equipment at a given time. Estimates of the current and previous power use of the equipment were based on this information.

Collection of operating data for installed and related equipment. The on-site surveyor used short-term metering or monitoring as needed to determine the operating hours and, in some cases, the load profile of the installed equipment. A more detailed explanation of the collection methods follows. For some projects, related equipment was also monitored for cycle times or performance data to assist in calculating the energy savings of an overall system.

The on-site surveyor attempted to verify the operating hours of the equipment before and after installation using various options:

Automatic control or monitoring equipment. This is the first and generally most accurate option. Many energy management systems control or report the operating profiles or hours of use for lights, fans, and pumps. In other cases, monitoring equipment can report information like the volume of air produced by an air compressor or the amount of chilled water produced in a cooling system. This is the most accurate option because it reduces the possibility for data collection errors and usually produces data collected over a longer period of time.

KEMA-provided logging and monitoring equipment. For many projects, the operating hours before and after the installation are the same (i.e., retrofit lighting projects with no added control measures), so the hours logged by the data monitoring equipment post-installation can be used for both pre- and post-installation calculations. For lighting projects, the on-site surveyor installed time-of-use meters with photocells to measure when the lights were on and when they were off. For variable frequency drive (VFD) projects, the surveyor installed kW meters to measure the average true RMS power over a 15-minute interval. An ammeter was installed to measure electric current for projects like high efficiency motors.

Customer-reported operating schedules. Some equipment either did not have the same operating hours before and after installation or did not have a constant operating schedule represented by the logged period. For example, lighting projects with occupancy sensors will change the operating hours of the lights. Schools use all of their lights for a lot of

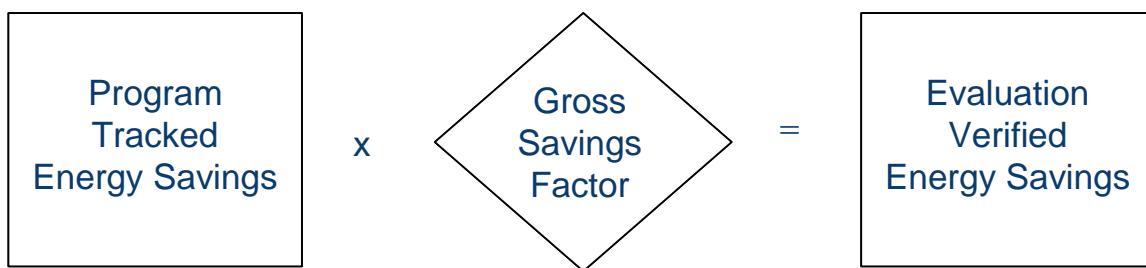
hours during the school year but not during the summer. In these situations, information was gathered from the site contact regarding the appropriate adjustments that could be applied to the logging data to correct for changes in the operating profile outside of the logged period. In extreme cases, logging equipment could not be installed on the equipment because it was inaccessible or it was too critical to a process to disconnect the equipment and install a logger. In these situations, information from the site contact informed our estimates of the operating profile.

In cases where monitoring equipment was installed, customers were visited twice by the on-site surveyor: first to collect the on-site data and install the monitors, and then again to remove them. Where monitoring over time was required, monitoring equipment was installed and left on-site for a period of two to three weeks.

3.1.3 Ratio Estimation Technique

The results of the telephone interview, engineering review, and on-site data were combined to create the gross savings adjustment factor. As shown in Figure 3-2 applying the gross savings adjustment factor to the tracked savings produces the estimate of verified gross savings.

Figure 3-2
Application of Gross Savings Adjustment Factor



The adjustment factors estimated from the data collection and analysis are as follows:

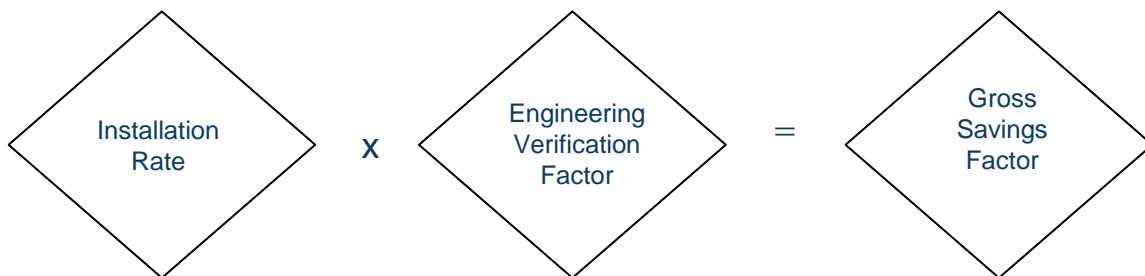
Installation rate. This factor adjusts the tracking estimate of gross savings for non-installation but does not correct for any other errors in the tracking estimate. It is the estimated fraction of tracked savings corresponding to measures actually installed. For the purposes of the installation rate, a measure is identified as either installed or not installed. Adjustments to the number of units installed for a particular measure are included in the engineering verification factor, not in the installation rate.

Engineering verification factor. This factor adjusts the tracking estimate of gross savings, after the application of the installation rate, to create verified savings. It is the estimated ratio of verified savings to tracked savings corresponding to the measures that were actually installed. Verified savings used to estimate this ratio are based on the results of an engineering review, which includes a review of how the tracked savings were calculated, on-site measurement and verification, and interviews with participants. For a given measure, verified savings may be higher or lower than the tracking estimate of gross savings for a variety of reasons, including data entry

errors in the program tracking database; survey responses indicating differences in the quantities installed, equipment efficiencies, and/or operating hours; and mistakes in the calculation of the tracking estimate. (The engineering verification factor takes into account corrections to the numbers of units installed for a particular measure.)

Gross savings adjustment factor. As shown in Figure 3-3 this factor combines the installation rate and the engineering verification factor. (It is the ratio of verified savings to tracked savings.) Gross savings was evaluated without regard to retention, that is, we assume the participants achieved the entire first year of savings.

Figure 3-3
Gross Savings Adjustment Factor Calculation



Evaluation resources were allocated to calculate the best possible adjustment factors for gross savings for the overall program. That is, we allocated the budget for on-site and telephone data collection to produce an estimate with the lowest expected variability for the population of measures installed by the three sponsors' programs considered as a whole. We provide gross savings results separately by utility and measure groupings. However, these estimates should be viewed with caution due to the small sample sizes for Unitil and NHEC.

Calculation of Adjustment Factors

The calculation of the adjustment factors uses appropriate weights corresponding to the sampling rate within each stratum. The two primary adjustment factors are the installation rate and the engineering verification factor. Each of these is calculated as a ratio estimator over the sample of interest (Cochran, 1977, p.165). The formulas for these factors are given below.

Notation

The following terms are used in calculating the adjustment factors:

G_{Tj} = tracking estimate of gross savings for project j

G_{Ij} = tracking estimate of gross savings for project j , adjusted for non-installation

G_{Vj} = verified gross savings for project j based on engineering review.

A denotes the sample.

Installation Rate

The installation rate R_I is calculated as:

$$R_I = \frac{\sum_{j \in A} G_{Ij}}{\sum_{j \in A} G_{Tj}}.$$

Engineering Verification Factor

The engineering verification factor R_V is calculated as:

$$R_V = \frac{\sum_{j \in A} G_{Vj}}{\sum_{j \in A} G_{Ij}}.$$

Standard Errors

The ratio estimator is calculated using a SAS[®] macro provided by SAS for ratio estimation by domains. The procedure also returns the standard error of the estimate. The standard error is calculated using two methods.

The first method recognizes the sample as drawn from a finite population: the projects completed within the analysis period (January 1, 2004–December 31, 2004) with associated energy impacts in the program-tracking database. This calculation uses the Finite Population Correction (FPC) factor. This factor is a reduction to the calculated variance that accounts for the fact that a relatively large fraction of the population of interest has been observed directly and is not subject to uncertainty. It is appropriate to apply precision statistics, such as confidence intervals, based on the standard error calculated in this manner when quantifying the results of the program during the study period only.

The second calculation treats the population of interest as essentially infinite. Thus, the projects completed to date and the sample selected from them is regarded as random instances of a virtually infinite number of projects that could have been completed under the program. In this case, the FPC is not included. It is appropriate to apply standard errors calculated in this manner when applying the verification factors developed from this study to tracked savings from other years to estimate verified savings in those years.

In this report, the sampling frame includes all projects completed within the analysis period (January 1, 2004–December 31, 2004) with energy impacts associated with the program-tracking database. We use the FPC when applying the calculated adjustment factors to that period. We would not use the FPC when applying these adjustment factors to savings outside the analysis period. In the results tables in the next section these standard errors are labeled “Extrapolated.”

Gross Verification Factor

The gross verification factor is the ratio of verified gross to tracking estimate of gross savings. This factor is calculated by chaining together the installation rate and the engineering verification factor:

$$R_G = R_I R_V = \left[\frac{\sum_{j \in A} G_{Ij}}{\sum_{j \in A} G_{Tj}} \right] \left[\frac{\sum_{j \in A} G_{Vj}}{\sum_{j \in A} G_{Ij}} \right]$$

This is an example of a chained ratio estimator using a nested sample. The standard error for the chained ratio is approximated by the formula:

$$SE(AB) \approx AB \sqrt{\left[\left(\frac{SE(A)}{A} \right)^2 + \left(\frac{SE(B)}{B} \right)^2 \right]}$$

(This formula overstates the actual standard error somewhat, because it ignores the correlation between the numerator of installation rate and the denominator of engineering verification rate, which reduces the variance of the product.)

3.2 RESULTS

This section provides the results of the impact evaluation. The results are provided for the overall program, each utility, and two groups of individual energy saving measures.

The adjustment factors consist of:

Installation Rate. This factor adjusts the gross savings for non-installation.

Engineering Verification Factor. This factor adjusts the gross savings for changes based on the engineering review.

Gross Savings Adjustment Factor. This factor combines the installation rate and the engineering verification factor. It is the product of the Installation Rate and the Engineering Verification Factor.

The results tables provide indicators of the statistical precision of the estimates, the standard errors, the confidence intervals, and sample sizes.

Sample sizes are provided only for the installation rate and the engineering verification factor.

Each table shows two standard error estimates for each adjustment factor. The standard error labeled “Jan04 – Dec04” is the standard error of the adjustment factor when it’s applied to program year 2004 tracking gross kWh savings. If these adjustment factors are applied to tracking savings after December 31, 2004 then the standard error labeled “Extrapolated” should be used.

The 90 percent confidence interval is provided for the engineering verification factor and the gross savings adjustment factor.¹⁶ The standard errors labeled “Jan04 – Dec04”

¹⁶ The lower bound is calculated by subtracting the product of the standard error and critical value from the estimate. The upper bound is calculated by adding the product of the standard error and the critical value to the estimate. The critical value is determined using the t=Distribution Table and the Degrees of Freedom (sample size minus 1).

were used to calculate the 90 percent confidence interval. The standard errors labeled “Extrapolated” should be used to calculate (using same adjustment factors) confidence intervals for projects installed outside of the analysis period. Confidence intervals are not provided for the installation rate because all projects in the sample were installed.

3.2.1 Overall and Utility Level Results

As shown in Table 3–7 the realization rate for the statewide program overall is 89 percent. We are 90 percent confident that the program overall gross savings adjustment factor is between 85.9 percent and 93 percent. All projects in the sample were verified as installed, resulting in a 100 percent installation rate, as shown in Table 3-8.

The PSNH results have much lower standard errors than NHEC and Unitil. Consequently its 90 percent confidence interval is considerably narrower. This is a result of the relative size of PSNH in terms of its contribution to total tracked savings. PSNH projects in the sample account for nearly 60 percent of total tracked savings. The NHEC and Unitil by utility level results should be used with caution due to small sample sizes. Compared with PSNH, the standard errors and corresponding confidence intervals are much higher and wider, respectively.

Unitil’s 49 percent gross savings adjustment factor is largely driven by the engineering verification information provided by one participant. The effect on the Unitil gross savings adjustment and engineering verification factors of this project is significant because projects implemented by this one participant accounted for 40 percent of Unitil’s tracked savings in the population and 60 percent of Unitil’s tracked savings in the sample. The effect of this project on the overall adjustment factor is less apparent because it is only 6 percent of total tracked savings.

Table 3-7
Gross Savings Adjustment Factors By Utility

Utility	Gross Savings Adjustment Factor	Standard Error		90% Confidence Interval	
		Jan04-Dec04	Extrapolated	Lower Bound	Upper Bound
NHEC	92%	4.3%	8.8%	81.4%	101.7%
PSNH	94%	1.9%	4.3%	91.0%	97.4%
Unitil	49%	6.7%	15.1%	35.9%	62.9%
Program Overall	89%	2.1%	4.7%	85.9%	93.0%

**Table 3-8
Installation Rates By Utility**

Utility	n	Installation Rate	Standard Error	
			Jan04-Dec04	Extrapolated
NHEC	4	100%	<0.1%	<0.1%
PSNH	65	100%	<0.1%	<0.1%
Unitil	6	100%	<0.1%	<0.1%
Program Overall	75	100%	<0.1%	<0.1%

**Table 3-9
Engineering Verification Factors By Utility**

Utility	n	Engineering Verification Factor	Standard Error		90% Confidence Interval	
			Jan04-Dec04	Extrapolated	Lower Bound	Upper Bound
NHEC	4	92%	4.3%	8.8%	81.4%	101.7%
PSNH	65	94%	1.9%	4.3%	91.0%	97.4%
Unitil	6	49%	6.7%	15.1%	35.9%	62.9%
Program Overall	75	89%	2.1%	4.7%	85.9%	93.0%

3.2.2 Measure Level Results

Adjustment factors by measure are presented in Tables 3–10 through 3–12. The sample produced statistically meaningful results for most measure categories. The realization rates are high for most measures with the exception of HVAC. The low HVAC realization rate is not a great concern because the measure accounts for only 2 percent of program savings and only one HVAC project was included in the analysis. A confidence interval for HVAC was not calculated because only one of the six HVAC projects in the population was included in the sample.

**Table 3-10
Gross Savings Adjustment Factors By Measure**

Measure	Gross Savings Adjustment Factor	Standard Error		90% Confidence Interval	
		Jan04-Dec04	Extrapolated	Lower Bound	Upper Bound
Air Compressor	94%	5.2%	11.2%	84.1%	103.1%
EMS	114%	8.8%	14.9%	95.9%	131.4%
HVAC	11%	<0.1%	<0.1%		
Lighting	86%	4.2%	8.9%	78.8%	93.0%
Motors	100%	0.1%	0.3%	99.4%	100.1%
Process	74%	8.9%	20.1%	56.9%	91.4%
VFD	99%	0.7%	1.5%	97.1%	100.2%
Weatherization	100%	na	na		
Program Overall	89%	2.1%	4.7%	85.9%	93.0%

Table 3-11
Installation Rates By Measure

Measure	n	Installation Rate	Standard Error	
			Jan04-Dec04	Extrapolated
Air Compressor	11	100%	<0.1%	<0.1%
EMS	6	100%	<0.1%	<0.1%
HVAC	1	100%	<0.1%	<0.1%
Lighting	41	100%	<0.1%	<0.1%
Motors	3	100%	<0.1%	<0.1%
Process	7	100%	<0.1%	<0.1%
VFD	5	100%	<0.1%	<0.1%
Weatherization	1	100%	na	na
Program Overall	75	100%	<0.1%	<0.1%

Table 3-12
Engineering Verification Factors By Measure

Measure	n	Engineering Verification Factor	Standard Error		90% Confidence Interval	
			Jan04-Dec04	Extrapolated	Lower Bound	Upper Bound
Air Compressor	11	94%	5.2%	11.2%	84.1%	103.1%
EMS	6	114%	8.8%	14.9%	95.9%	131.4%
HVAC	1	11%	<0.1%	<0.1%		
Lighting	41	86%	4.2%	8.9%	78.8%	93.0%
Motors	3	100%	0.1%	0.3%	99.4%	100.1%
Process	7	74%	8.9%	20.1%	56.9%	91.4%
VFD	5	99%	0.7%	1.5%	97.1%	100.2%
Weatherization	1	100%	na	na		
Program Overall	75	89%	2.1%	4.7%	85.9%	93.0%

3.2.3 Measure Level Results By Utility

Tables 3–13 through 3–15 present the measure level results by utility. Most of these results should be used with caution due to small sample sizes. However some of the PSNH sample sizes were large enough to yield meaningful results. The “other” classification for each utility includes:

NHEC: Weatherization;

PSNH: HVAC, Motors, EMS; and

Unitil: HVAC, VFD, Motors, EMS.¹⁷

Unitil’s 243 percent adjustment factor for air compressors has little effect on the overall program estimates but it merits some explanation. Unitil had only one air compressor project reviewed but that project received a large positive adjustment in energy savings. However, the project did not

¹⁷ By utility measure classification categories as suggested in New Hampshire Large C&I Retrofit Program Impact Evaluation RFP.

have large savings relative to other air compressor measures so it did not result in a large distortion of the overall engineering verification factor shown previously in Table 3–12. A similar effect can be seen in the Unutil adjustment factor for “Other” measures in Table 3–13. Although the gross savings adjustment factor of 71 percent is affected by the 11 percent verification factor in Table 3–12 of the previous section, it is also affected by a larger EMS project that did not receive an adjustment. The weighted effect of the two projects results in an adjustment factor that is not unreasonable.

Unutil’s 39 percent gross adjustment for lighting measures is based on three out of a total of five lighting projects completed by Unutil. Two of the three projects received a large adjustment during the engineering review. The Unutil lighting gross savings adjustment factor reflects the relatively large effect that those adjustments have on the Unutil lighting results. However, the five Unutil lighting projects account for only 17 percent of overall program tracked lighting savings, resulting in a relatively small effect on the engineering verification factor in Table 3-12.

Table 3-13
Gross Savings Adjustment Factors By Measure

Utility	Measure	Gross Savings Adjustment Factor	Standard Error		90% Confidence Interval	
			Jan04-Dec04	Extrapolated	Lower Bound	Upper Bound
NHEC	Lighting	85%	7.6%	15.3%	62.2%	106.9%
	Other	100%	na	na		
PSNH	Air Compressor	93%	5.3%	11.2%	83.3%	102.8%
	Lighting	96%	3.4%	7.3%	90.1%	101.6%
	Process	74%	8.9%	20.1%	56.9%	91.4%
	VFD	99%	0.7%	1.5%	97.1%	100.2%
	Other	116%	11.0%	17.4%	94.9%	136.8%
Unutil	Air Compressor	243%	<0.1%	<0.1%		
	Lighting	39%	4.6%	10.5%	25.0%	52.1%
	Other	71%	12.4%	28.1%	- 7.5%	149.4%
Program Overall		89%	2.1%	4.7%	85.9%	93.0%

Table 3-14
Installation Rates By Measure

Utility	Measure	n	Installation Rate	Standard Error	
				Jan04-Dec04	Extrapolated
NHEC	Lighting	3	100%	<0.1%	<0.1%
	Other	1	100%	na	na
PSNH	Air Compressor	10	100%	<0.1%	<0.1%
	Lighting	35	100%	<0.1%	<0.1%
	Process	7	100%	<0.1%	<0.1%
	VFD	5	100%	<0.1%	<0.1%
	Other	8	100%	<0.1%	<0.1%
Unutil	Air Compressor	1	100%	<0.1%	<0.1%
	Lighting	3	100%	<0.1%	<0.1%
	Other	2	100%	<0.1%	<0.1%
Program Overall		75	100%	<0.1%	<0.1%

Table 3-15
Engineering Verification Factors By Measure

Utility	Measure	n	Engineering Verification Factor	Standard Error		90% Confidence Interval	
				Jan04-Dec04	Extrapolated	Lower Bound	Upper Bound
NHEC	Lighting	3	85%	7.6%	15.3%	62.2%	106.9%
	Other	1	100%	na	na		
PSNH	Air Compressor	10	93%	5.3%	11.2%	83.3%	102.8%
	Lighting	35	96%	3.4%	7.3%	90.1%	101.6%
	Process	7	74%	8.9%	20.1%	56.9%	91.4%
	VFD	5	99%	0.7%	1.5%	97.1%	100.2%
	Other	8	116%	11.0%	17.4%	94.9%	136.8%
Unitil	Air Compressor	1	243%	<0.1%	<0.1%		
	Lighting	3	39%	4.6%	10.5%	25.0%	52.1%
	Other	2	71%	12.4%	28.1%	-7.5%	149.4%
Program Overall		75	89%	2.1%	4.7%	85.9%	93.0%

3.2.4 Tracked Versus Verified Energy Impacts

Tables 3–16 provides the annual kWh tracked and verified savings for the NH Large Business Retrofit Program overall. The program estimated 19.5 GWh of annual kWh savings compared with the evaluation verified savings of 17.4 GWh. Evaluation verified savings are calculated by multiplying the overall realization rate of 89 percent by the tracked savings.

Table 3-16
Annual Savings: Application of Adjustment Factors

	Realization Rate	Annual Gross kWh Savings	
		Tracked	Verified
NH Large C&I Retrofit Program	89%	19,477,178	17,426,240

Table 3–17 provides the lifetime tracked, filed and verified savings for the NH Large Business Retrofit Program by utility and overall. Evaluation verified lifetime savings are calculated by multiplying the realization rate by the tracked lifetime savings. This table shows evaluation verified gross kWh calculated in two ways. Method 1 is the product of the overall realization rate (89 percent) and tracked lifetime savings for each utility. In Method 2 the PSNH lifetime savings are calculated using the PSNH utility level result of 94 percent from Table 3-7. As mentioned in Section 3.2.1 the NHEC and Unitil utility level results should be used with caution due to small sample sizes. Therefore in Method 2 we use the overall realization rate of 89 percent for Unitil and NHEC. The program estimated 289.5 GWh of lifetime kWh savings compared with the evaluation verified savings of 259 GWh.

Table 3-17
Lifetime Savings: Application of Adjustment Factors

Utility	Tracked	Filed w/ Commission		Evaluation Verified			
		Realization Rate	Lifetime Gross kWh Savings	Method 1		Method 2	
				Realization Rate	Lifetime Gross kWh Savings	Realization Rate	Lifetime Gross kWh Savings
NHEC	9,462,455	100%	9,462,455	89%	8,466,063	89%	8,466,063
PSNH	236,461,230	84%	198,627,433	89%	211,561,968	94%	222,710,759
Unitil	43,564,425	100%	43,564,425	89%	38,977,110	89%	38,977,110
Total	289,488,110		251,654,313		259,005,141		270,153,932

3.3 TRACKED VERSUS VERIFIED SAVINGS

3.3.1 Verified Savings Estimates

A senior engineer conducted a review of the energy savings estimates for each project installed by customers that completed a telephone survey. The engineer used information from the telephone survey, the project paperwork, and the on-site visit (if applicable) to determine whether the savings in the tracking database were reasonable.

The review had two main components:

Evaluation of the calculation parameters. The engineer reviewed the parameters used in the energy savings equations to determine whether they were reasonable. Some parameters (i.e., motor power, operating hours) were reviewed through on-site measurements or logging. Other parameters were verified using secondary sources (i.e., light fixture wattage, cooling degree days). Customers who did not receive on-site visits had parameters verified by the site contact during the telephone survey.

Evaluation of the calculation method. The engineer reviewed the method used to calculate the energy savings. Most energy savings estimates can be calculated in a variety of ways and still produce reasonable, though not equal, energy savings values. The engineer reviewed the method used for each project to ensure that it followed the general conventions of energy savings calculations and could produce a reasonably accurate result.

For many projects, the engineering review process produced an energy savings estimate that differed from the estimate in the utilities' tracked savings. The tracking savings estimate was judged "reasonable" if the engineering estimate was within 10 percent of the tracking estimate. For example, suppose a lighting project received an on-site review complete with logged operating hours. The logged operating hours were used to calculate the energy savings during the engineering review. If the calculated energy savings were within 10 percent of the tracking estimate, the tracking estimate was deemed "reasonable" and the verified gross energy savings were set equal to the tracked savings. If the calculated savings were greater than 10 percent

different from the tracking estimate, then the tracking estimate was deemed “unreasonable” and the verified gross energy savings was set equal to the engineering review estimate.

3.3.2 Degree of Difference

Table 3–18 shows the degree of difference between the tracked savings and the verified savings for each installed project. For the most part, the tracked savings values were a reasonable estimate of the verified project savings. Over 50 percent of the projects show no change between the tracking savings and the verified savings. Nearly 65 percent of the projects had tracking savings estimates within 20 percent of the verified savings.

Table 3-18
Degree of Difference Between Tracked and Verified Savings

Percent change	# of Projects		
	Verified > Tracked	Verified < Tracked	Total
None	N/A	N/A	42
10% to 20%	4	4	8
20% to 30%	1	7	8
30% to 50%	2	2	4
50% to 100%	2	7	9
Greater than 100%	4	0	4
Total	13	20	75

Thirteen of the savings adjustments resulted in an increase of the project savings, while 20 resulted in a decrease. However, all of the projects that received large (>100 percent) adjustments resulted in an increase in project savings.

3.3.3 Discrepancies

Figure 3-4 and Table 3-19 display the number of sample projects in which KEMA discovered discrepancies of various kinds between verified and tracked savings estimates of more than 10 percent. There were 33 such instances out of a sample of 75 installed measures. Fifteen of the 33 discrepancies were attributable to significant differences between logged (verified) operating parameters and estimates used to estimate tracked savings. This level of discrepancy is to be expected; it constitutes the primary justification for evaluations of this type. For many of the adjusted projects, this was likely a result of poor information from the onsite customer or the contractor that provided the initial estimate. Many onsite personnel do not realize the actual effect of installing an occupancy sensor, for example, or the exact number of hours the cleaning crew leaves the lights on at night. In some cases, however, it was clear that further discussion with the onsite contact would have resulted in a more accurate estimate.

In three cases, the information provided for a given customer did not include enough information about the project or its parameters to allow the savings to be recreated. The documentation for two projects did not have any calculations to support the tracked savings. The documentation for one other project did not have information or parameters that could be easily verified by the customer contact. In all three cases, the verified savings were calculated based on the information that could be collected on-site or through conversations with the site contact.

Figure 3-4
Number of Projects With Discrepancies Between Tracked and Verified Savings

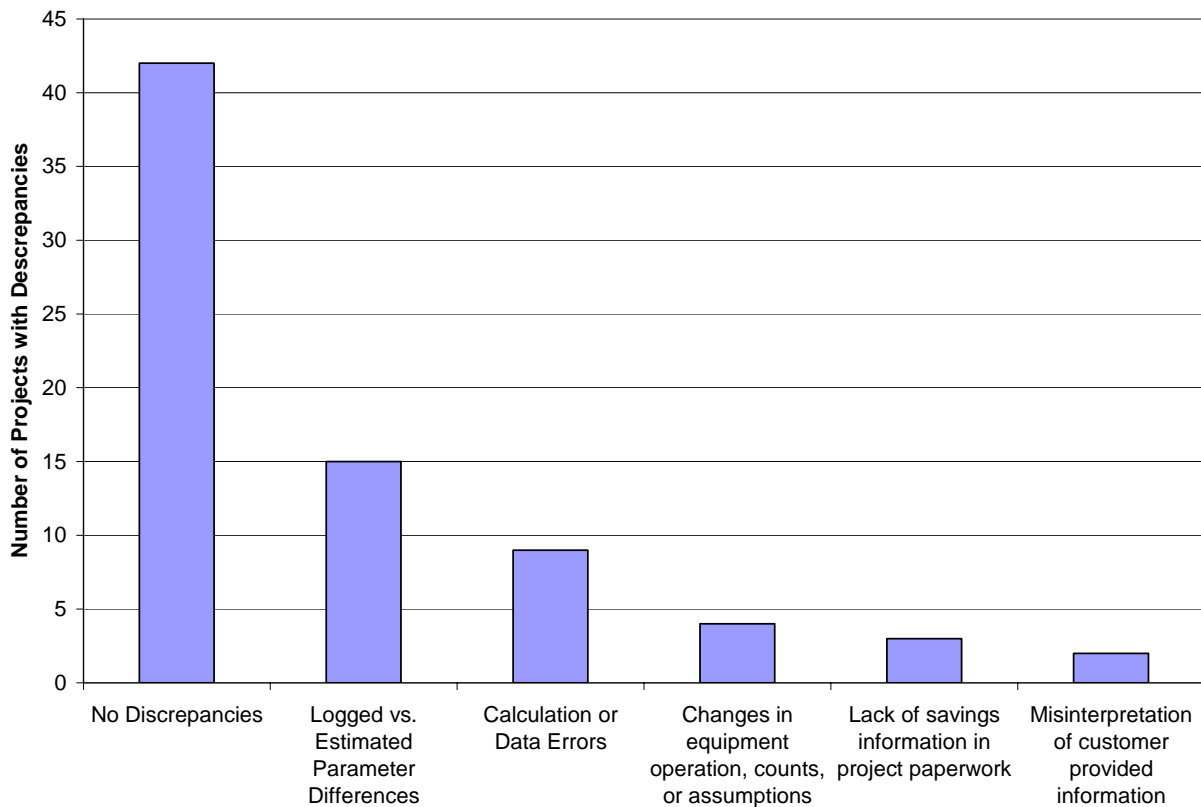


Table 3-19
Projects With Discrepancies Between Tracked and Verified Savings

Discrepancies	# of Projects			Utility
	Verified > Tracked	Verified < Tracked	Total	
Differences between logged parameters and estimated parameters				
Differences between logged parameters and estimated parameters	8	7	15	PSNH
Calculation or entry errors				
Savings entered under wrong application number	1	1	2	PSNH
Incorrect wattage estimates for lighting project	1	1	2	PSNH
Multiplied savings of equipment by 3		1	1	Unitil
Data entry error		1	1	PSNH
Vendor-supplied calculation had error		1	1	PSNH
Used incorrect quantity number in savings calc		1	1	NHEC
Did not include load factor in calculation		1	1	PSNH
Changes in equipment operation, counts, or assumptions				
Operating hours of installed equipment increased	1		1	PSNH
Did not install all fixtures rebated		1	1	PSNH
Initial parameter assumptions incorrect		2	2	Unitil
Lack of savings information provided in the project paperwork				
Not enough information to recreate savings estimate		2	2	PSNH
Not enough information to recreate savings estimate		1	1	NHEC
Misinterpretation of customer-provided information				
Misinterpretation of vendor lighting inventory	1		1	PSNH
Misinterpretation of air compressor cfm	1		1	Unitil
Total by utility				
PSNH	12	15	27	PSNH
Unitil	1	3	4	Unitil
NHEC	0	2	2	NHEC
Total for all	13	20	33	All

3.4 REVIEW OF PROGRAM TRACKING SYSTEM

A well-structured tracking system database and related data quality control procedures are critical to both the management and evaluation of custom rebate efforts such as the New Hampshire Large Business Retrofit Program. Evaluations based on verification procedures such as the ones discussed above rely heavily on data concerning measures installed, facility characteristics, and pre-existing conditions that are captured and stored in the database. By the same token, ongoing management efforts will be greatly supported by progress and exception reports that an accurate, well-structured tracking database can generate.

For the most part, the tracking databases submitted by the participating utilities contained the information needed to conduct a comprehensive evaluation. Each utility provided a separate database output with a unique design that they used to track the projects and customers that participated in the Large Business Retrofit Program. KEMA conducted a systematic review of the submitted tracking databases to identify potential areas for improvement.

Each database submitted by the utilities had some common and some unique elements. All three databases contained fields for project ID, customer name, participation dates, account number or customer ID, measure description, energy savings, project cost, and rebate amount. However, the three databases had different names for the common fields. There were also differences in the field formats and measure descriptions.

Each database contained information that was not in the other two. For example, the Unutil database had equipment specifications that were not available in the NHEC or PSNH databases. The PSNH database had summer and winter kW savings, while the Unutil database only had summer kW savings and NHEC had none. NHEC and Unutil databases had quantity information, but PSNH did not.

The following recommendations are based on our review of the tracking systems. The recommendations are provided at the overall level and not by utility. Therefore each recommendation may not apply to all three utilities. It is also important to note that a benefit-cost analysis was not performed on these recommendations.

Consider common database conventions or consistent field naming to be used by all utilities. Consistency across utilities will ease the way for future analysis and comparison. In particular, standardizing project ID classification and implementing logical and consistent measure descriptions across utilities allows for easy data consolidation across the program and helps to maintain data quality. Program information will be easier to collect, analyze, and disseminate.

Create more detailed measure descriptions or measure subgroups. The current measure descriptions are vague and do not describe the project that was installed as much as they describe the end use system. For example, a variable speed air compressor installation is listed under Air Compressor, but nothing in the description indicates that it is a VFD project. In contrast, various VFD motor projects addressed HVAC systems, but did not include measure information that would allow them to be associated with other HVAC measures. Lighting projects are identified as lighting, but there is no distinction made between a project that installs higher efficiency fixtures and one that installs automatic controls. More detailed descriptions will allow for a more complete and centralized picture of the projects that are actually installed through the program.

Include the quantity of equipment to aid in quality control. Adding the equipment quantity to the database provides another variable that can be used to assess project size. Combined with the energy savings, measure description, and project cost, a quick analysis of the tracking database can potentially identify large data entry or calculation errors.

Consider processes to improve accuracy of data entry, such as periodic reviews of the tracking system data. A number of data entry errors were found that had an effect on the impact evaluation results. There may be database design flaws that contribute to the frequency of these errors. For example, a discussion with a PSNH program administrator revealed that the PSNH database automatically populates the energy savings field with a "0" that must be deleted before the actual energy savings can be entered. Such errors in design can foster data entry errors.

Two of the projects that received adjustments of over 50 percent in the engineering review may have been discovered during a periodic database assessment. A periodic assessment could identify large errors in data entry and calculation and may also identify projects that have received an incorrect measure description. Some processes to improve the quality of the data may already be in place or following a benefit-cost analysis the program may decide to let evaluation perform the data review process. However adding or expanding a review process has the potential to reduce surprises during the evaluation.

3.5 RECOMMENDATIONS

This section provides recommendations based on our impact evaluation of the New Hampshire Large Business Retrofit Program. Similar to the tracking system recommendation provided in the previous section these recommendations are provided at the overall level and not by utility; and a benefit-cost analysis was not performed on these recommendations.

Institute a calculation review process. A second program administrator or engineer should perform a mid-level review of the energy savings calculations and data entries for participating projects. This is especially important for projects with large energy savings (e.g., over 100,000 kWh/yr). If a second engineer is not available it might be helpful for the engineer to discuss the calculations with a colleague that is not an engineer.

Ensure that all installed projects have clear and verifiable energy savings calculations on file. Clear calculations aid in quality control by exposing unreasonable assumptions and facilitate the review by a colleague or evaluation. They also act as a record of the relevant project parameters at the time the project is installed. A good record of pre-installation parameters results in high-quality, low-cost evaluations because missing calculations don't have to be recreated and the evaluation does not rely on the memory of past system performance.

Require installing contractors to include verifiable savings calculations as part of the rebate applications. At present, the energy savings calculations provided with the project paperwork primarily come from either the contractor or a program administrator. The contractor, however, has the best information on the project and the installation site and may be producing savings calculations already for the benefit of the customer. Contractors are profiting from the program but currently bear none of the cost. Requiring them to provide savings calculations reduces the workload on the program administrator and benefits customers that are not already receiving an energy analysis.

Use low-cost monitoring or logging equipment to determine the operating hours for large lighting projects. Based on our conversations with program participants, customers in New Hampshire are interested in knowing exactly how much energy their systems are consuming. Our experience also shows that they are not very accurate when reporting their lighting hours of use. Lighting time-of-use meters are inexpensive, sturdy, and easy to install because they collect data

using a photocell and are not connected to the power line. Using loggers to verify operating hours will produce more accurate savings estimates for the larger lighting projects and will provide reasonable and defensible data for evaluation purposes.

4

CUSTOMER SATISFACTION AND PARTICIPANT FEEDBACK

This section provides the results of the customer satisfaction and participant feedback questions. It discusses program participant satisfaction levels with both program services and the installed equipment. It also reviews participant suggestions for program improvements. Finally it makes recommendations for improvements in program delivery based on participant feedback.

4.1 CUSTOMER SATISFACTION

4.1.1 *Customer Satisfaction with Program Services*

Participant satisfaction with the Large Business Retrofit Program was very high. The evaluators asked program participants about their overall impression of the program and how satisfied their organization was with the program. With one exception, all of the participants had a positive impression of the program (Table 4–1).¹⁸ Ninety-nine percent of the participants said that their organizations were satisfied with the program (Table 4–2).¹⁹ Program satisfaction levels above 90 percent are considered very good for an energy efficiency program and it is rare to find near universal levels of reported program satisfaction.

As noted, there was one participant who was dissatisfied with the program. This participant wanted more advanced notice of funding availability and thought the timing of the program should be more flexible to accommodate his company’s fiscal year.

The tables also show that all three utilities had very high level of program satisfaction. There were some differences among the utilities in the percentage of participants who gave the highest satisfaction scores, but small samples sizes for NHEC and Unitil make comparisons less meaningful than they may appear. For example, at first glance it appears that PSNH had a much lower percentage of participants who were “very positive” about the program than the other two utilities. However, while PSNH’s 59 percent share is statistically different from Unitil’s 100 percent share, it is not statistically different than NHEC’s 75 percent share.²⁰ Similarly PSNH’s 61 percent share of “very satisfied” organizations is statistically different from NHEC’s 100 percent share but not statistically different from Unitil’s 80 percent share.

¹⁸ The term “positive” means the participant gave a score of 4 or 5 as to their overall impression of the program. They used a scale of 1 to 5 where 5 means “very positive” and 1 means “very negative.”

¹⁹ The term “satisfied” means the participant gave a score of 4 or 5 as to their organization’s satisfaction with the program. They used a scale of 1 to 5 where 5 means “very satisfied” and 1 means “not at all satisfied.”

²⁰ The statistical test used for these comparisons and all others in the chapter is the difference between two proportions at the 95 percent level of confidence ($p\text{-value}\leq 0.05$).

**Table 4-1
Participant's Overall Impression of the Program**

S1. Your overall impression of the program?	By Utility			Overall
	NHEC	PSNH	Unitil	
Very positive (5)	75%	59%	100%	62%
4	25%	40%	0%	38%
3	0%	0%	0%	0%
2	0%	1%	0%	1%
Very negative (1)	0%	0%	0%	0%
Total	100%	100%	100%	100%
# of respondents	4	35	5	44

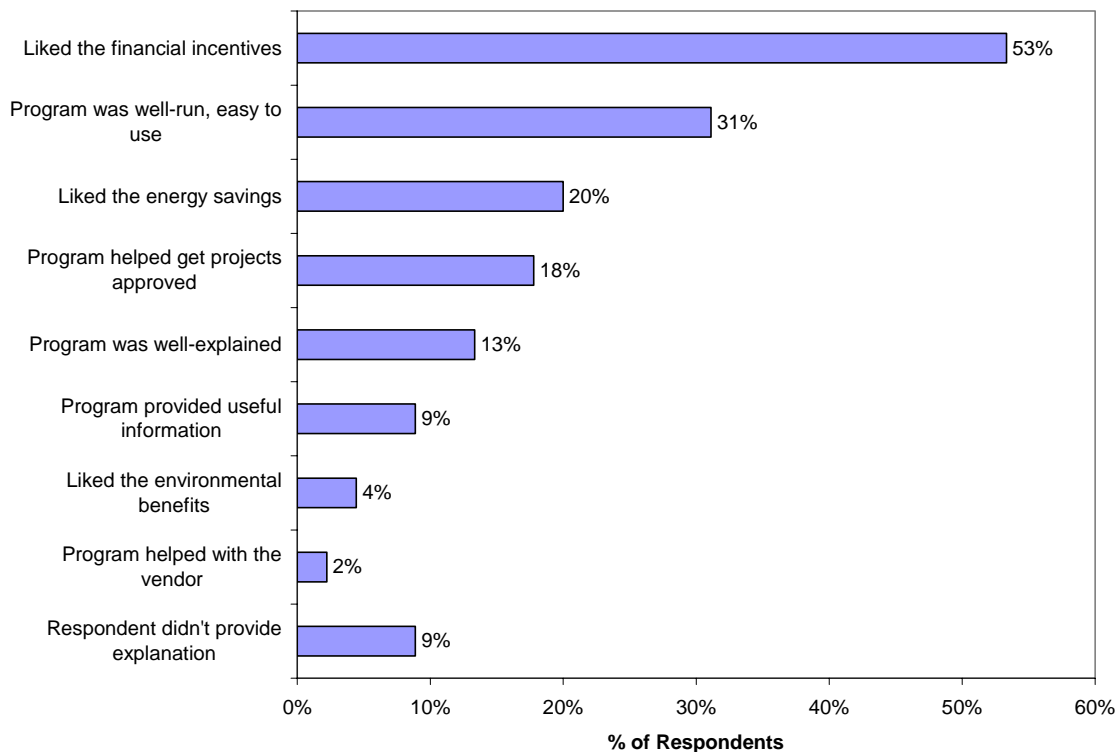
**Table 4-2
Organization's Satisfaction with the Program**

S2. How satisfied is your organization with the program?	By Utility			Overall
	NHEC	PSNH	Unitil	
Very satisfied (5)	100%	61%	80%	63%
4	0%	38%	20%	36%
3	0%	0%	0%	0%
2	0%	1%	0%	1%
Not at all satisfied (1)	0%	0%	0%	0%
Total	100%	100%	100%	100%
# of respondents	4	34	5	43

Participants were also asked why they said that their organizations were satisfied or unsatisfied with the program. KEMA sorted these open-ended responses into coherent response categories. Figure 4-1 shows that over half of the participants cited the financial incentives as a reason for their organization's satisfaction with the program. Some of the participants explained how the incentives helped "give initiative" to projects and helped them "sell projects to management that otherwise would not be done."

Almost of a third of the participants also cited the ease of using the program as a reason for their satisfaction. Many of these participants cited the utility account representatives as being helpful in filling out the paperwork and responding to any questions that they had. A couple of participants thought that the paperwork burden was light. Other popular reasons for satisfaction with the program included happiness with the energy savings resulting from projects, satisfaction with the way that the program helped get projects approved, and the belief that they received a good explanation of how the program worked.

Figure 4-1
Reasons for Organization's Satisfaction with Program



Note: There were a total of 45 respondents. The total percentage exceeds 100% because each respondent was allowed to give multiple reasons. Results are not weighted by strata.

4.1.2 Customer Satisfaction with Energy-Efficient Equipment Installed

Program participants were also asked whether they were satisfied with the performance of their energy-efficient equipment. All 47 respondents said that they were satisfied (Table 4–3). As noted, 20 percent of the participants cited happiness with their energy savings as a reason for their organization's satisfaction with the program. While all participants were satisfied with their equipment, a few of them were dissatisfied with their installation contractors, as the next section explains.

Table 4-3
Participant Satisfaction with EE Equipment

Z1. Are you satisfied with the performance of the energy efficiency improvements I named earlier?	By utility			Overall
	NHEC	PSNH	Unitil	
Yes	100%	100%	100%	100%
No	0%	0%	0%	0%
Total	100%	100%	100%	100%
# of respondents	4	38	5	47

4.2 SUGGESTIONS FOR IMPROVEMENT

Program participants were asked for suggestions on how to improve the program. Nearly half (47 percent) of them provided at least one suggestion. The most-cited suggestions were to increase marketing and awareness of the program (20 percent of participants) and increase program-funding levels (18 percent). Participants from all three utilities recommended increasing program marketing. In some cases, this recommendation was prompted by participants finding out about the program later than they would have liked to and not being able to take full advantage of it. Only PSNH customers recommended increasing program funding. A number of these PSNH participants noted that program funding had run out before the end of the year and wanted funding to be available all year long. A couple of the participants expressed concern that the state government would remove funds from the program.

Participants provided many other suggestions for program improvements. However, only one of these—improve explanation of program services—was cited by more than two participants. Table 4-4 shows all the suggested improvements.

Table 4-4
Suggestions for Program Improvements

Suggestion	# of participants	% of participants
Program marketing, information		
Increase marketing, awareness of program	9	20%
Improve explanation of program services	3	7%
More advanced notice of incentive availability	2	4%
Program funding		
Make more funds available	8	18%
Program delivery and process		
Work more closely with large energy users	2	4%
Reduce paperwork	2	4%
Simplify program requirements	2	4%
Make program timing more flexible	2	4%
Perform more energy audits	1	2%
Be more involved in project design phase	1	2%
Rebate characteristics		
Allow bigger rebates	1	2%
Add prescriptive rebates	1	2%
Work with vendors, contractors		
Provide help with problem contractors	2	4%
Certify installers	1	2%
Partner with vendors	1	2%
No recommendations provided	24	53%

Note: The total percentage exceeds 100% because each respondent was allowed to give multiple reasons. Results are not weighted by strata.

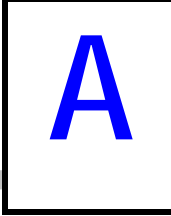
The program participants were also asked whether there was anything that the program could have done to increase their satisfaction with the performance of their energy efficiency improvements. Only three participants made suggestions. One PSNH participant wished the utility would make demand charts available for free, as they once did. Another PSNH participant was unhappy that the program didn't address other measures in his facility, mainly because the operating hours were too low. One Unitil participant was unhappy that a demand setting was not adjusted as he had requested.

4.3 RECOMMENDATIONS

The very high program satisfaction levels suggest that the program is working very well to satisfy current participants and there is no need for major changes. However, program participants pointed to two areas where the program could be improved.

- *Reevaluate current marketing and program notification efforts.* Increasing awareness of the program was the suggestion for program improvement that was most cited by participants. Participants from all three utilities suggested it. Upon reviewing the benefits and costs of this recommendation the program managers need to consider the likelihood of lower customer satisfaction ratings if they increase marketing without increasing funding.
- *Making program funds last longer.* A number of PSNH participants noted that program funding had run out before the end of the year and wanted funding to be available all year long. Realizing that increasing program funding levels may not be an option, the program should consider strategies for making existing program funds last longer. The utilities have caps on the amount of incentive dollars that a single participant can receive. Additional strategies used by states that have faced similar problems—such as California—include:
 - Instituting per project and per contractor caps on incentive levels payouts;
 - Capping rebate levels for popular measure types such as lighting that tend to consume large quantities of program funds;
 - Instituting a rebate reservation process where contractors or end users must reserve incentive dollars ahead of time and have a certain period of time to use them or lose them; and
 - Rationing program funds – e.g., releasing a certain percentage of program funds every quarter.

These strategies not only make program funds last longer, but also insure that they are distributed more equitably.



GENERAL INTERVIEWER INSTRUCTIONS

DO NOT READ THE LIST OF RESPONSES UNLESS INSTRUCTED TO DO SO.
NEVER READ “DON’T KNOW” OR “REFUSED.”

CERTAIN QUESTIONS **REQUIRE** RESPONSES TO BE CIRCLED OR RECORDED SPECIFICALLY BY MEASURE. THESE QUESTIONS EITHER HAVE RESPONSES IN TABLES WITH COLUMNS FOR INDIVIDUAL MEASURES SYSTEMS, OR ASK YOU TO DIFFERENTIATE RESPONSES BY MEASURE.

IT MAY BE NECESSARY TO INTERVIEW MORE THAN ONE PERSON AS ONE PERSON MAY NOT BE ABLE TO ANSWER ALL QUESTIONS. FOR THAT REASON CONTACT INFORMATION, INCLUDING DATES CALLED AND TO BE CALLED, SHOULD BE MAINTAINED BY THE INTERVIEWER.

TRY TO COMPLETE THE ENTIRE INTERVIEW. DISCONTINUE IF INTERVIEWEE BECOMES ANNOYED, BUT FIRST TRY TO SCHEDULE A TIME AT WHICH IT CAN BE COMPLETED.

BEFORE THE INTERVIEW, THE FOLLOWING **MUST BE PREPARED**:

1. INTERVIEWER NAME: _____
2. FROM THE ENGINEERING REVIEW SPREADSHEET
 - XENID: _____
 - STRATA: _____
 - UTILITY: _____
 - COMPANY NAME: _____
 - CONTACT NAME: _____
 - PHONE NUMBER: _____
3. FILL IN THE MEASURE TABLE (VERIFY MEASURE INSTALLATION SECTION) WITH INFORMATION INCLUDED IN THE ENGINEERING REVIEW SPREADSHEET. THE CURRENT TABLE ACCOMMODATES A LIMITED NUMBER OF MEASURES. IF NECESSARY, ADD ROWS TO THE TABLE OR PRINT ADDITIONAL COPIES OF THE TABLE.
4. SEE THE START OF EACH SECTION OF THE SURVEY FOR ADDITIONAL PRE-SURVEY PREP INSTRUCTIONS:

INFORMED RESPONDENT

[PRE-SURVEY PREP:

- FAMILIARIZE YOURSELF WITH THE CONTACT INFORMATION PROVIDED IN THE TRACKING DATABASE]

11. Hello, may I please speak with [WORK THROUGH CONTACT NAMES PROVIDED (<CONTACT NAME >) AND SUBSEQUENTLY OBTAINED]?

- Contact available..... [SKIP TO 12] 1
- Contact currently unavailable [ARRANGE CALL BACK] 2
- No contact3

11b. Are you the person responsible for facility management such as energy-efficiency or productivity improvements or the purchase of energy-using equipment?

- [RECORD NAME] _____
- Person responsible for facility management available 1
- Person responsible for facility management currently unavailable [ARRANGE CALL BACK] 2
- No person responsible for facility management [SKIP TO 17] 3
- Don't know [SKIP TO 17] -97
- Refused [SKIP TO 17] -98

12. Hello, my name is _____ and I'm calling from KEMA on behalf of <UTILITY>, your electric utility. <UTILITY> is conducting a study to verify energy savings from energy efficiency improvements installed through its energy efficiency program. You may have received a letter or a phone call from <UTILITY> informing you of this study. KEMA, an energy-consulting firm that specializes in on-site data collection, has been hired to collect on-site data and calculate energy savings for projects that received a rebate from <UTILITY>'s energy efficiency program. This is not a sales or marketing call. I would like to ask you about the equipment that was installed at your facility. This should take about fifteen minutes of your time. Your responses will be kept entirely confidential.

14. According to <UTILITY> records, during 2004 your facility...[SEE THE RECID TABLE IN THE VERIFY MEASURE INSTALLATION SECTION FOR THE <SAMPLE DATA> REFERRED TO HERE] made the following energy efficiency improvement[/S]:

[LIST ALL IMPROVEMENTS]

Do you recall installing <MEASURE> through the utility’s energy efficiency program?

Yes (all or some)..... [RECORD NAME (if not provided by utility) BELOW THEN SKIP TO NEXT SECTION] 1

No.....2

RESPONDENT NAME: _____

Don’t know -97

Refused -98

16. Do you know who is likely to recall installing [THIS/THESE] energy efficiency improvement[/S] through the utility’s energy efficiency program?

Yes [RECORD NAME BELOW THEN START OVER AGAIN WITH 11] 1

ADDITIONAL CONTACTS:

No.....2

Don’t know -97

Refused -98

16b.[CHECK TO MAKE SURE ALL CONTACTS HAVE BEEN TRIED.]

Not all contacts have been tried..... [START OVER AGAIN WITH 11] 1

All contacts have been tried.....2

17. Thank you very much for your time today. Those are all the questions I have.

No one familiar with decision..... [END INTERVIEW] 1

ONSITE RECRUITMENT

R1. We would like to send a trained technician to your site to collect data and verify energy savings of the energy efficiency measure(s) you installed through the program. If you participate in this study you will receive a one-page site report summarizing and documenting the gross savings results. It will also explain any differences between estimated and actual energy savings associated with your project. May we schedule an on-site visit with you? [NOTE TO ENGINEER: PROVIDE CUSTOMER WITH A BRIEF DESCRIPTION OF WHAT AN ON-SITE AT THEIR LOCATION WOULD ENTAIL. THIS DESCRIPTION SHOULD BE SPECIFIC TO THE MEASURES INSTALLED AT THE CUSTOMER’S SITE. MENTION LENGTH AND NUMBER OF VISITS, LOGGERS, WHETHER AN ELECTRICIAN WILL BE NEEDED (IF AN ELECTRICIAN IS NEEDED AND THE CUSTOMER DOES NOT HAVE ONE THEN WE WILL HIRE ONE. THE NEED FOR AN ELECTRICIAN MAY NOT BE DETERMINED UNTIL THE SITE PLAN IS DEVELOPED. ALTERNATIVE PLANS MAY ALSO BE DEVELOP TO AVOID THE NEED OF AN ELECTRICIAN), ETC.]

Yes [SKIP TO R4] 1

No 2

R2. Although you are not able to participant in the on-site portion of this study, would you be willing to answer some questions over the phone regarding your project and interactions with <UTILITY>’s energy efficiency program?

Yes [SKIP TO y0] 1

No 2

R3. Thank you for your time. Good-bye.

R4. First, I need to confirm the address of your facility. Is it [READ ADDRESS]?
 [RECORD ANY MINOR CORRECTIONS]:
 Street address: _____
 City, State, Zip: _____

R5. [SCHEDULE VISIT] _____

R6. Who should the technician ask for when they visit?
 [RECORD NAME] _____

R7. Thank you for your help with this study. _____ will be the technician visiting your facility.

[Provide customer with your contact information.]

In preparation for the on-site visit we would like to ask you some questions over the phone regarding your project and interactions with <UTILITY>’s energy efficiency program.

VERIFY MEASURE INSTALLATION

[PRE-SURVEY PREP

DETERMINE PHRASING: y0, y1c, y1d, y2

- y0: ONLY 1 OR MORE THAN 1 ENERGY EFFICIENCY IMPROVEMENT (I.E., MEASURE). SEE THE MEASURE TABLE BELOW.
- y1c, y2: BE AWARE THAT DURING THE SURVEY YOU WILL HAVE TO SPECIFY THE ENERGY EFFICIENCY IMPROVEMENT(S). SEE THE MEASURE TABLE BELOW.]

y0. First, I want to confirm that the equipment I named earlier has been installed.

[SEE y1c AND y1d IN MEASURE TABLE.]

y2. [IF y1c = "no"]

We understood that the project was completed. Can you tell me if the [<MEASURE>] is going to be installed and when it will be completed?

[RECORD RESPONSE y2_d] _____

Don't know -97

Refused -98

[IF LAST MEASURE, CONTINUE ON TO NEXT SECTION, ELSE START AGAIN AT QUESTION y1c.]

Measure Table

MEASURE DESCRIPTION BASED ON TRACKING DATABASE	y1c1-6	y1d1-6	<XENID>	MEASURE#
y1c. Has the following energy efficiency improvement or something similar to it been made: _____				
		y1d [IF y1c = "yes"] About what month and year was the improvement made?		
	Yes.....1 No.....2 Don't know...-97 Refused.....-98	Month: Year: Don't know...-97 Refused.....-98		1
	Yes.....1 No.....2 Don't know...-97 Refused.....-98	Month: Year: Don't know...-97 Refused.....-98		2
	Yes.....1 No.....2 Don't know...-97 Refused.....-98	Month: Year: Don't know...-97 Refused.....-98		3
	Yes.....1 No.....2 Don't know...-97 Refused.....-98	Month: Year: Don't know...-97 Refused.....-98		4

ENGINEERING REVIEW

e1. What is the primary use of the facility where these measures were installed?

Don't know	-97
Refused	-98

e2. How many full-time employees are at this facility?

Don't know	-97
Refused	-98

PREPARE QUESTIONS TO BE ASKED BASED ON THE REVIEW OF THE DOCUMENTATION IN ORDER TO VERIFY ENERGY SAVINGS. FOR EXAMPLE,

- QUANTITIES,
- EQUIPMENT EFFICIENCIES,
- OPERATING HOURS,
- AND OTHER ASSUMPTIONS IT IS MOST IMPORTANT TO ASK THE CUSTOMER ABOUT

REGARDING EQUIPMENT REPLACED, IF ANY, AND EQUIPMENT INSTALLED.

ADDITIONAL SURVEY INSTRUCTIONS:

1. ASK THE ENGINEERING REVIEW QUESTIONS ONLY FOR THOSE MEASURES THAT WERE IN FACT IMPLEMENTED.

IF NO MEASURES WERE IN FACT IMPLEMENTED, SKIP TO SATISFACTION WITH PROGRAM SECTION.

2. IF THE RESPONDENT CANNOT ANSWER SOME OF THE ENGINEERING REVIEW QUESTIONS, FIND OUT WHO CAN. FINISH THE SURVEY WITH THE CURRENT RESPONDENT AND THEN ASK THE NEW RESPONDENT THE REMAINING ENGINEERING REVIEW QUESTIONS.

[RECORD NEW ENGINEERING REVIEW RESPONDENT(S):]

DETERMINE PROGRAM IMPACT ON DECISION TO INSTALL

“Now, I want to ask questions about your satisfaction with the energy efficiency improvements, and about your decisions to go forward with them. [IF MULTIPLE MEASURES IMPLEMENTED] Where your answers differ between the improvements, please let me know.”

- z1. Are you satisfied with the performance of the energy efficiency improvements I named earlier? Why not?
- | | |
|-------------------------------|-----|
| Yes | 1 |
| No..... | 2 |
| [DESCRIBE WHY NOT z1_d] _____ | |
| _____ | |
| Don't know | -97 |
| Refused | -98 |
- z2. Is there anything else you think the Program might have done that would have increased your satisfaction with the performance of [NOT WITH PROGRAM PARTICIPATION] those improvements?
- | | |
|-----------------------|-----|
| Yes | 1 |
| [DESCRIBE z2_d] _____ | |
| _____ | |
| No..... | 2 |
| Don't know | -97 |
| Refused | -98 |
- z3. What first made your organization start thinking about installing these improvement(s) at this facility?
- | | |
|--|-----|
| [DESCRIBE z3_d, BEING SURE TO IDENTIFY TO WHAT MEASURES RESPONSES APPLY] _____ | |
| _____ | |
| Don't know | -97 |
| Refused | -98 |
- z4. Did the Program provide your organization with any new information for the improvement(s) I named earlier?
- | | |
|---|-----|
| Yes | 1 |
| [DESCRIBE INFO z4_d, BEING SURE TO IDENTIFY TO WHAT MEASURES RESPONSES APPLY] _____ | |
| _____ | |
| No..... | 2 |
| Don't know | -97 |
| Refused | -98 |

z5. Before you installed these improvement(s), had your organization installed any similar improvements at this or any other facility without receiving a rebate or services like those from the utility program? What type of improvements?

- Yes 1
 [DESCRIBE TYPE z5_d] _____

- No..... 2
- Don't know -97
- Refused -98

z6. Since your participation in the program, has your company/facility purchased and installed any high efficiency equipment on its own for this or other locations served by your company?

- Yes 1
 [ASKE THEM TO LIST EQUIPMENT z6_d] _____

- [SKIP TO Z8]
- No..... 2
- Don't know -97
- Refused -98

z7. Will you consider installing similar energy efficiency improvements in the future in this or other facilities? Why not?

- Yes 1
- No..... 2
 [DESCRIBE WHY NOT z7_d, BEING SURE TO IDENTIFY TO WHAT MEASURES RESPONSES APPLY] _____

- Don't know -97
- Refused -98

z8. If you had not received the services from the utility Program, would your company/facility have installed the same or similar high efficiency equipment on its own?

- Yes 1
- No..... 2
- Don't know -97
- Refused -98

z9. Will you consider installing similar improvements in the future without assistance from the Program? Why not?

Yes1

No.....2

[DESCRIBE WHY NOT z9_d] _____

Don't know -97

Refused -98

[z10 ASK FOR EACH MEASURE IMPLEMENTED]

z10. [PARTICIPATION HERE REFERS TO ANY & ALL ASSISTANCE PROVIDED BY PROGRAM]
 If you had not participated in the utility's rebate program, how likely would you have been to undertake the energy efficiency improvements you made in 2004? Would you say you would have been...

RESPONSE	MEASURE#1 z10 1	MEASURE#2 z10 2	MEASURE#3 z10 3	MEASURE#4 z10 4
Very likely	1	1	1	1
Somewhat likely	2	2	2	2
Not very likely	3	3	3	3
Very unlikely	4	4	4	4
Don't know	-97	-97	-97	-97
Refused	-98	-98	-98	-98

SATISFACTION WITH PROGRAM

From now on, when answering my questions, please consider all your organization’s interactions with the program. That is, please consider interactions with the program regarding any energy efficiency improvement—whether implemented or not—as well as any other interactions with the program.”

s1. I’d like to know your overall impression of the Program, based on anything you may have seen or heard. On a scale of 1 to 5, where 5 means Very Positive and 1 means Very Negative, what is your overall impression of the Program? Please give me a number between 1 and 5 to tell me your overall impression.

1 (very negative)	1
2.....	2
3.....	3
4.....	4
5 (very positive)	5
Don’t know	-97
Refused	-98

s2. Using a scale of 1 to 5, where 1 means not at all satisfied and 5 means very satisfied, how satisfied is your organization with the Program?

1 (not at all satisfied).....	1
2.....	2
3.....	3
4.....	4
5 (very satisfied)	5
Don’t know	[SKIP TO s3] -97
Refused	[SKIP TO s3] -98

o11. Why do you say that?

Don’t know	[SKIP TO s3] -97
Refused	[SKIP TO s3] -98

s4. Do you have any suggestions on how <UTILITY> could improve the energy efficiency program or have any additional comments you would like to make about the program?

Don’t know	[SKIP TO s3] -97
Refused	[SKIP TO s3] -98

Thanks very much for your time today. Good-bye.