



New Hampshire Large Business Retrofit Program Impact Evaluation Final Report

New Hampshire Monitoring and
Evaluation Team

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KEMA



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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.