

Non-Energy Impacts Provide Powerful Marketing Tools for Energy Efficiency Programs

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ABSTRACT

The value of energy efficiency investments extends beyond energy savings to include facility cost savings and production/revenue increases, non-energy impacts (NEIs). While rigorous quantification of non-energy impacts (NEIs) is becoming increasingly important for the evaluation of energy efficiency, NEIs can also provide valuable information for program implementers, looking to market program-supported technologies to end-users. This NEI marketing study demonstrates how NEI can help close the feedback loop between program evaluation and implementation. The current NEI Marketing study utilizes NEI information collected through a previous study, the 2012 Commercial and Industrial (C&I) Retrofit NEI Evaluation study which was the most comprehensive NEI evaluation studies to date.^{i, ii, iii} To obtain estimates of NEIs associated with program sponsored measures, the 2012 C&I Retrofit NEI Evaluation study captured a robust set of data through in-depth interviews regarding the specific facility cost and revenue changes resulting from the installation of that provides insight to segment-specific marketing messages. The present NEI marketing study leveraged this data to provide program sales and marketing staff with valuable selling points to address the industry specific needs of customers, and increase the value proposition of participating in efficiency programs. This study provided quantitative and qualitative evidence of the changes to internal and external labor, parts and supplies, waste management, sales revenue, and other reported cost and revenue changes that may result from installing energy efficient measures within various industries. It also captured important respondent information necessary to characterize NEIs realized by different types of customers.

Introduction

While NEIs have historically been used in program evaluation to provide a stream of benefits used in cost benefit analysis of existing programs, NEIs also provide an excellent way to create the feedback loop from evaluation to implementation. This study repurposed the data obtained through one of the most comprehensive NEI evaluation studies to date to provide valuable marketing information regarding non-energy benefits that may result from installing energy efficiency measures.

The overall goal of the NEI marketing study was to leverage data obtained from the Massachusetts 2012 C&I Retrofit NEI study to develop an industry-level analysis for program implementers, demonstrating the value proposition of energy efficiency programs beyond energy savings. Specifically, the re-analysis of the 2012 C&I Retrofit NEI study was used to:

- Identify statistically significant NEI categories and sub-categories by industry and energy type (electric, gas)
- Identify non-significant NEIs that are logically sound for any specific industry
- Review and summarize quantitative and qualitative descriptions of NEIs
- Present prominent NEI themes by industry for use in sales and marketing.

The NEI marketing study was designed to assist program implementers, who are engaged in the marketing of energy efficiency programs, to understand the specific cost and revenue changes reported by customers within 13 separate industries. This study helps close the feedback loop between program evaluation and implementation by leveraging data used to quantify NEIs for the evaluation of programs, and then re-analyzing that information to provide program sales and marketing staff valuable selling points that appeal to specific customer segments and increases the value proposition of participating in efficiency programs. This information will benefit utility programs that are implementing targeted marketing campaigns and niche programs to reach energy saving goals. We provide quantitative and qualitative information of the changes to internal and external labor, parts and supplies, waste management, sales revenue and other reported costs, and revenue changes that result from installation of energy efficient measures within each industry.

Review of 2012 C&I Retrofit NEI study

In 2012, the Evaluation team conducted a NEI study that successfully captured data from more than 500 C&I program participants regarding NEIs resulting from 788 prescriptive and custom electric and gas measures. While the purpose of the present NEI Marketing study was not to provide an extensive review of the data collection process used in the 2012 C&I Retrofit NEI Evaluation study, the following summary of the data collection process offers the necessary context to understand the approach used in the study. Our approach to estimating NEIs broke impacts into mutually exclusive categories that reflect separate cost and revenue (business impacts) resulting from the Program Administrators' (PAs) program-sponsored installed measures. Rather than rely on stated NEI estimates alone, we probed respondents for a deeper understanding of the impacts on specific costs and revenues. The key components of the methodology were as follows:

For prescriptive measures, we selected the sample of 297 and 153 electric and gas target completes, respectively, from the pool of respondents to the 2010 Massachusetts C&I Free-ridership/spillover study. Of those targeted completes, we were successful in completing 302 and 99 NEI interviews. For custom measures, due to the limited sample of custom projects in the 2010 Massachusetts C&I Free-ridership/spillover study, we supplemented the pool of respondents to the 2010 Massachusetts C&I Free-ridership/spillover study with additional sample from the population of custom measures installed in 2010. The target number of completed interviews for custom measures was 276 and 112 custom electric and gas completes of which we were successful in completing 310 and 151 NEI interviews.

- Designed the research instruments, trained the interview staff, and oversaw quality control;
- Experienced DNV GL energy analysts conducted the semi-structured interviews;
- Collected data on NEI types and dollar values, and like and unlike spillover.
- Used ratio-estimation to calculate NEIs by reporting measure category or end-use, as was needed by the Massachusetts Program Administrators for their cost-benefit analysis.

The evaluation team captured NEI information for 789 prescriptive and custom electric and gas measures. Positive NEIs or non-energy benefits were realized for 58% of measures, while 3% of measures resulted in negative NEIs. An additional 40% of measures reported no positive or negative NEIs.

The NEI question battery was structured to prevent possible double counting across 13 NEI categories by presenting related categories sequentially for easier respondent recall. The evaluation team used additional closed-ended questions to assess whether the respondent experienced an increase or decrease in each affected NEI (e.g., an increase or decrease in operations and maintenance costs). Next, we used open-ended questions to ask respondents to provide the overall dollar impact associated with each NEI category. In some instances, respondents were able to provide NEI values and articulate reasons for these values

without further probing. However, in most cases, interviewers needed to guide respondents through a series of structured probes to determine whether respondents experienced any changes to various cost or revenue centers associated with each NEI category. For example, internal labor and external labor are separate cost centers associated with Operation and Maintenance (O&M) costs. Once the interviewer identified the impacted cost and revenue centers, deeper probes were used to determine the nature of those changes and specific metrics for quantifying the monetary and resource impacts of the installed measures. Table 1 presents the general probes for each NEI section.

Table 1. Non-Energy Impact Categories

NEI Category	Probes						
	Labor ¹	Parts / Materials	Training	Fuel ²	Water	Fees / Permits	Other
Operations & maintenance	✓	✓	✓	✓			✓
Administration	✓		✓				✓
Materials handling	✓						✓
Materials movement	✓	✓		✓			✓
Other labor	✓		✓				✓
Spoilage/Defects	✓	✓					✓
Water usage					✓		
Waste disposal	✓	✓				✓	✓
Fees						✓	✓
Other costs							✓
Sales							✓
Rent revenues							✓
Other revenues							✓

¹ Labor included internal and external labor and included probes for assessing fully loaded costs.

² Fuel included: natural gas, no. 2 distillate, no. 4 fuel oil, propane, wood, and kerosene.

Examples of specific probes for each NEI category included the following:

- Operations and maintenance: The interview guide included probes for internal labor, external labor, parts, training, fuel saved, and other O&M costs. For the labor and training subcategories, the interviewers attempted to get annual hours of increase or decrease and an hourly rate. For parts, interviewers attempted to quantify the number and type of parts that increased or decreased, and the unit cost of each. For training, interviewers attempted to quantify increases or decreases in training costs and whether these were one-time costs or recurring costs. For fuel, interviewers attempted to quantify specific changes (increase or decrease) in fuel usage. For other, interviewers asked the respondent if there were any other O&M related costs that increased or decreased that we had not yet covered.
- Administrative or other labor: This section included probes for internal labor, external labor, training, and other. The use of these specific probes was similar to their descriptions in the O&M section, except they were applied to administrative rather than O&M costs.
- Cost of supplies, materials and materials handling: This section included probes for internal labor, external labor, and other. The use of these probes was similar to their descriptions in the O&M section, except they were applied to materials handling rather than O&M costs.

- Waste disposal costs: The section included probes for waste materials, waste handling, permits, and other. For waste materials, the probes attempted to identify the type of material (e.g. carbon dioxide, sulfur dioxide, etc.) and quantify in units the increase or decrease in emission. For waste handling, the probes attempted to identify number of hours of labor, and the fully-loaded hourly costs for that labor, just like the internal or external labor costs in the O&M section. In the event that the respondent could not supply fully loaded hourly costs, interviewers attempted to gather enough information to allow us to impute it.

We used information collected through these interviews to develop standard formulas and metrics for each cost and revenue center (i.e., the cost or revenue items) impacted under each NEI category. Standardizing the formulas across multiple measures allowed analysts to evaluate each in terms of the necessary metrics (e.g., salary, hours, price), and the range of responses to those metrics (\$/hour). For example, Table 2 shows the standardized formulas for the Operation and Maintenance costs category, the most widely referenced NEI category.

Table 2. Example of Formulas Used to Calculate NEIs: Operations and Maintenance Cost Changes

NEI Category	Cost/Revenue Center	Formula	Measures using formula	Percent		
Operation and Maintenance	Internal Labor	(Hours per year due to Old Equipment - Hours per year due to New Equipment)*Unloaded wage per hour*Loaded factor	21	6%		
		(Hours per year due to Old Equipment - Hours per year due to New Equipment)*Loaded wage per hour	153	44%		
		(Hours per year due to Old Equipment - Hours per year due to New Equipment)* Times per year*Loaded wage per hour	11	3%		
		(Hours per year due to Old Equipment - Hours per year due to New Equipment)* Times per year*Unloaded wage per hour*Loaded factor	1	0%		
		Hours per year due to New Equipment*Loaded wage per hour	13	4%		
		Hours per year due to New Equipment* Unloaded wage per hour*Loaded Factor	2	1%		
		Hours per year due to Old Equipment*Loaded wage per hour	50	14%		
		Hours per year due to Old Equipment * Times per year * Loaded wage per hour	7	2%		
		Hours per year due to Old Equipment * Times per year * Unloaded wage per hour*Loaded Factor	6	2%		
		Hours per year due to Old Equipment * Unloaded wage per hour*Loaded Factor	3	1%		
		Don't Know	1	0%		
		No Calculation Required- Value stated upfront	79	23%		
		Operation and Maintenance Internal Labor Total			347	100%
	External Labor	(Hours per year due to Old Equipment - Hours per year due to New Equipment)* Cost per hour	24	4%		
		Cost per hour * Hours per year	26	4%		
		Cost per hour * Times per year	11	2%		
		Hours per year * Labor Costs	1	0%		
		Hours per year*Cost per hour * Times per year	17	3%		
		Labor costs * Times per year	38	6%		
		Times per year * Cost per hour * Labor costs	1	0%		
		No Calculation Required- Value stated upfront	550	82%		
		Operation and Maintenance External Labor Total			668	100%
		Parts and Supplies	Number of parts * Cost of Parts	89	81%	
	Cost of parts * Number of parts * Times per year		1	1%		
	Hours * Costs of Parts		1	1%		
	Times per year * Cost of parts		19	17%		
	Operation and Maintenance Parts and Supplies Total			110	100%	
	Training	Hours * Labor Costs	20	91%		
		hours * Times per year	1	5%		
		No Calculation Required- Value stated upfront	1	5%		
	Operation and Maintenance Training Total			22	100%	
	Other	No Calculation Required- Value stated upfront	6	100%		
		Operation and Maintenance Other Total			6	100%

We used these data to construct a robust database of NEIs that we then used to estimate statistically significant NEI estimates for 15 of 22 measure categories or end uses reported in the C&I NEI evaluation study. The respondent's knowledge of NEIs suggests that NEIs can be effective tools in marketing participation in energy efficiency programs. Positive NEIs result from decreased costs for maintenance, administration, and waste management. Similarly, positive NEIs also result from increased revenues from added sales or production increases. In constructing the database needed to produce NEI estimate for evaluation, 2012 C&I Retrofit NEI Evaluation Study produced a wealth of information that could assist program implementers and utilities to help promote energy efficiency programs and target customers. Rather than allow this information go to waste, the Evaluation team coordinated with program implementation to mine the database for insights that assist in marketing efforts. This was the basis for conducting the NEI Marketing study, which is discussed in the remainder of this paper.

Marketing Methodology

In this section we provide an overview of the steps in developing the marketing analysis. The marketing analysis relied exclusively on repurposing of data collected through the 2012 C&I retrofit NEI evaluation study. Prior to developing the marketing analysis, the Evaluation team solicited input from the PAs implementation staff to ensure the analysis provided implementation staff with the most valuable information for their marketing efforts. Through this effort we determined that the marketing NEI analysis should reflect the following criteria for reporting results:

1. NEI results should be presented by industry segment rather than measure category or end use – Implementation staff stressed the importance of industry-specific over measure messaging. To provide analysis at the industry level, the NEI marketing study leveraged self-reported industry classification from the obtained through the 2012 C&I retrofit interview process. Table 3 presents the number of measures used in the analysis by industry segment.

Table 3. Number of Customers Used to Estimate NEIs by Industry Segment*

Industry Segment	Enduse (Electric and Gas)										Total
	Building Envelope	Comprehensive	Compressed Air	HVAC	Lighting	Motors and Drives	Other	Process	Refrigeration	Water Heater	
Education	3		1	15	39	4	1	1	2		66
Food Sales	3			1	77		1		18		100
Food Service				1	1			1		5	8
Health Care				1	10						11
Lodging	25			31	12	2				23	93
Manufacturing	2		5	8	6	1		5			27
Mercantile				2	13				1	1	17
Office	2	1	1	14	25	5	2	1		2	53
Other				3	9	4					16
Public Assembly				3	5	1				2	11
Public Order and Safety				4	6						10
Religious Worship	1			2	1					1	5
Service		1		1	3					2	7
Unknown					5	1					6
Warehouse and Storage	1			1	3				17		22
Total	37	2	7	87	215	18	4	8	38	36	452

* Note: Customers providing responses for prescriptive and custom, electric and gas measures are combined

2. The unit of analysis should reflect distinct customers rather than individual measures – The unit of analysis for the 2012 study was the measure level because the PAs were interested in estimates of NEI per unit of energy savings for various measure categories or end uses. This worked well for NEI estimates used in the PA’s cost-effectiveness models that incorporate NEIs at that level. However, for marketing purposes, it is more appropriate to report NEIs at the customer level than the measure. From the end-user’s perspective, customers within an industry are likely to make similar energy efficiency investments, so the average cost and revenue changes resulting from that bundle of efficiency measures is more likely to represent the expected NEIs across the average bundle of measures. From the implementer’s perspective, rather than focus on a predetermined measure-level solution, implementation staff typically approaches customers with the objective of saving energy for the customer. This often consists of a multi-measure, custom, or comprehensive design approach. Therefore, the team determined that collapsing NEIs from the measure-level to the customer level was more beneficial for marketing purposes. However, using custom-level rather than measure-level results decreases the sample size and deflates the standard error from the customer’s perspective. In making this change, the Evaluation team needed to re-assess the statistical significance of NEI estimates at the customer level. As seen in Table 4, changing from the measure to the

customer level substantially reduced the number of observations in the analysis used to compute NEIs, potentially reducing statistical significance of NEI estimates.

Table 4. Number of measures and customers with non-zero NEIs by NEI sub-category

Electric	Customers	Measures
Internal Labor	120	180
External Labor	68	102
Parts and Materials	90	136
Training	1	2
Fuel	251	434
Gas	Customers	Measures
Internal Labor	33	90
External Labor	22	57
Parts and Materials	18	51
Training	3	18
Fuel	90	166

3. Presented NEIs in terms of the NEI sub-categories rather than NEI categories – The 2012 C&I retrofit NEI study showed that subcategories (internal labor, external labor, parts and supplies, etc.) were more recognizable to end-users than the NEI categories. While the latter were beneficial to ensure that respondents did not double count cost and revenue changes realized in different business units, respondents frequently conceptualized the NEIs in terms of the sub-categories. Table 4 below shows the relationship between NEI categories and sub-categories. DNV GL re-organized the NEI estimates to provide estimates at the sub-category level that more closely reflect meaningful facility changes for marketing purposes. While other NEI sub-categories were also captured by the interviews, the frequency in which these categories were reported was very limited. Therefore, our analysis focused on internal and external labor, parts and supplies, and training cost changes.

Table 4. Mapping NEI Sub-categories to NEI categories

NEI Sub-Category	NEI Category	Nature of Impact
Internal labor	Materials Movement	<ul style="list-style-type: none"> • Driver • Mechanic
	Waste Handling	<ul style="list-style-type: none"> • Labor
	Operations and Maintenance	<ul style="list-style-type: none"> • Parts replacement • Routine maintenance • Equipment diagnostics & repair • External labor coordination • Customer calls/complaints
	Administration	<ul style="list-style-type: none"> • Bill handling & remittance • Administrative tasks
	Materials Handling	<ul style="list-style-type: none"> • Loading dock labor • Other materials handling labor
	Other Labor	<ul style="list-style-type: none"> • Any other labor
	Other Costs	<ul style="list-style-type: none"> • Any other labor
External labor	Administration	<ul style="list-style-type: none"> • Contracted accounting • Contracted administration
	Operations and Maintenance	<ul style="list-style-type: none"> • Contractor visits
	Materials Handling	<ul style="list-style-type: none"> • Contracted load dock staff
	Other Labor	<ul style="list-style-type: none"> • Other contractor visits • Other external labor
	Materials Movement	<ul style="list-style-type: none"> • Contractor • Mechanic
Parts and supplies	Operations and Maintenance	<ul style="list-style-type: none"> • Parts replacement • New equipment parts • Avoided parts
	Materials Movement	<ul style="list-style-type: none"> • Fleet repair/maintenance • Fleet vehicle parts
Training	Operations and Maintenance	<ul style="list-style-type: none"> • External/internal classes • Instructor labor • Training materials
	Other Labor	<ul style="list-style-type: none"> • External classes • Instructors • Training materials

4. Identify statistically significant or logically consistent NEIs by industry and NEI sub-category. We aggregated the NEI estimates to the industry, customer, and sub-category level then used the statistical procedure of ratio estimation to develop estimates of NEI per kWh or per therm, for electric and gas measures, respectively. We then expanded the sample results to the population of measures. This was accomplished by calculating the ratio of NEI (in dollars) to reported savings for the sample for non-zero NEI values. The calculation of the NEI adjustment factor used appropriate weights corresponding to the sampling rate. The adjustment factor was calculated as a ratio estimator over the sample of interest (Cochran, 1977, p.165). The formulas for these factors are given below. The NEI rate RI was calculated using:

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

Where:

GTj = tracking estimate of gross savings for measure j

GIj = evaluation estimate of gross non energy impacts for measure j

wAj = weighting factor for measure j used to expand the sample to the full population

After calculating the average NEI per kWh and NEI per therm and their respective standard errors, we identified NEI sub-categories within each industry segment that were statistically significant at the 90% confidence level. For those NEI subcategories that showed non-zero NEIs that were not statistically significant, we reviewed the interview responses to determine whether the qualitative descriptions provided logical explanations for changes a facility in a particular industry might expect.

5. Summarize NEI results by industry and NEI sub-category – Once we identified the statistically significant NEI sub-categories within each industry, the next step was to summarize the survey data for those sub-categories. For the NEI marketing analysis we summarized both quantitative and qualitative NEI results. These are discussed below.

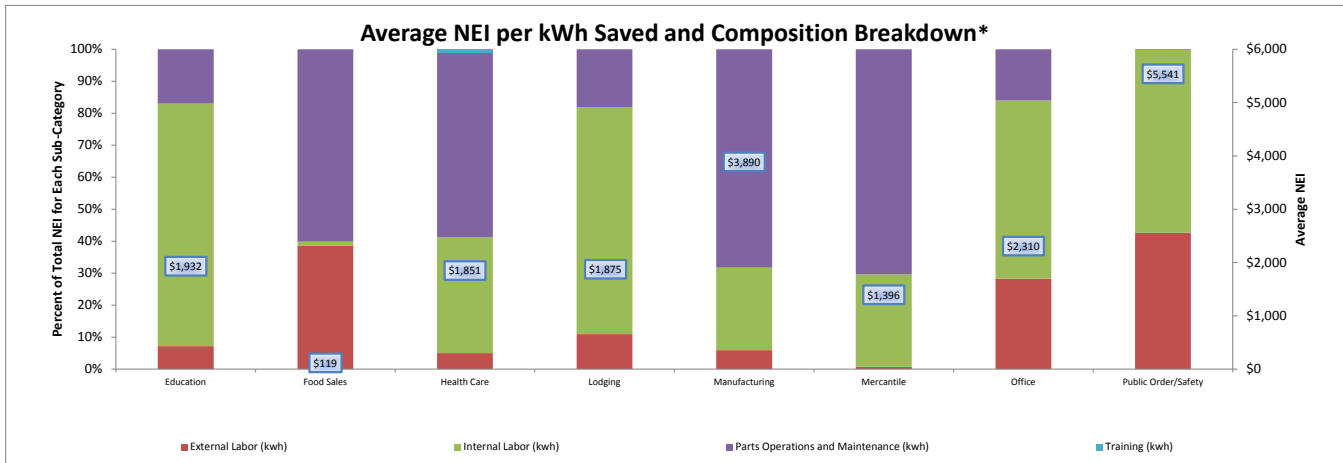
- Quantitative NEI results – We calculated the average NEI per kWh savings for electric measures and average NEI per therm savings per customer for gas measures at the NEI sub-category level for each industry. In order to show end-users the magnitude of the NEIs, we needed to impute a value for the energy savings. Therefore, we estimated high-, medium-, and low-point estimates for expected NEIs by assuming the 75th, 50th, and 25th percentile of energy savings.

- Qualitative NEI results – To assist sales and marketing personnel in “telling the story behind the numbers,” DNV GL provided anecdotal information to support the quantified NEI estimates. During the interview process, energy analysts captured detailed information concerning the nature of changes to business operations resulting from the installed measures.

Results

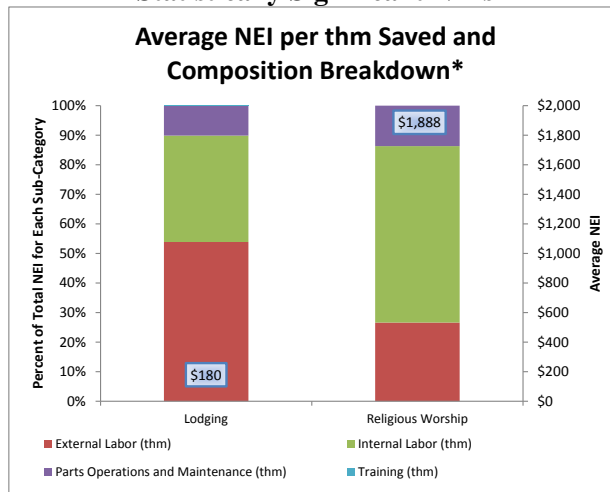
Figure 1 and Figure 2 below present the median NEI for electric and gas measures, respectively by industry. The figures also show the percent of each industry’s NEIs that are derived from internal labor, external labor, parts and supplies, and training. From Figure 1, we see that the highest median NEIs are reported by the public order/public safety, manufacturing and office segments. We also see that the sources for those NEIs varies considerably across these three segments, parts and supplies make up the largest share of the average NEI in the manufacturing sector, while internal labor constitutes nearly ½ of the NEIs from the other two sectors. External labor constitutes a largest share of the NEI from public order as a greater share of maintenance services for public institutions are likely outsourced compared to in the private sector. Further, facility staff in manufacturing settings are more often skilled in repair and maintenance of mechanical systems. Figure 2 shows that NEIs associated with gas measure NEIs range between \$0.40 per therm and \$1.00 per therm. External labor cost savings are the primary source of NEIs within the Education, Lodging, and Mercantile sectors. Figure 2 shows that statistically NEIs associated with gas measures were limited to just two industries, religious worship and lodging.

Figure 1. Electric overview of industries with statistically significant NEIs*



* Median NEI presented for each industry = NEI/kWh savings X Median Savings for the industry

Figure 2. Gas Overview of Industries with Statistically Significant NEIs



* Median NEI presented for each industry = NEI/therm savings X Median Savings for the industry

The following summarizes our analysis of the qualitative information captured by the 2012 C&I Retrofit NEI study provides the following insights into the specific cost and revenue changes within a number of industry sectors. We selected industries that were of particular interest to the PA's implantation staff.

Sources of NEIs in Education

The most prevalent NEIs in the Education sector resulted from following changes:

- Parts and supplies –New fixture required fewer bulb purchases; new HVAC requires fewer spare parts, saving on inventory and storage space; new windows led to no replacement of hardware on windows; building shell improvements eliminated need to purchase new insulation on a yearly basis.
- Internal labor – New lighting required less frequent replacement due to longer useful lives.
- External labor – Occupancy sensors save from cleaners not having to turn off the lights; new HVAC measures decrease the need for specialists to fix system; new equipment means few repairs.

Sources of NEIs in Healthcare

The most prevalent NEIs in the Healthcare sector resulted from following changes:

- Parts and supplies – No more need to replace thermostats due to electronic sensors; fewer lighting components needed on hand.
- Internal labor – Staff spend less time coordinating with vendors; less time spent changing out lighting ballasts and fixtures; fewer bills to pay which saves on invoicing time; less time receiving and stocking equipment.
- External labor – New system requires fewer contractor visits due to web monitoring.

Sources of NEIs in Lodging

The most prevalent NEIs in the Lodging sector resulted from following changes

- Parts and supplies – New machines and systems require less day-to-day maintenance; Technological improvements mean that issues can be solved remotely; new products last longer than old versions; Motor belt lives increase from 6 months to 18 months.
- Internal labor – Building shell improvements resulted in decrease time maintaining building and less ice damage and leaks to deal with during the winter; new HVAC system requires less management and repairs; HVAC controls eliminate the need for staff to set temperatures manually; problems can be fixed remotely and there is no longer a need to send someone to the problem area.; newer lighting last longer and do not need to be replaced as regularly.
- Administration – Fewer issues require less paperwork to complete.

Sources of NEIs in Food Sales

The most prevalent NEIs in the Food Sales sector resulted from following changes

- Parts and supplies –Less product spoilage/product loss.
- Internal labor – Decrease restocking time, saved over 50% in costs, lower costs associated with stocking shelves due to less spoilage, less general maintenance (Electric).
- External labor – Decrease number of contractor visits.

Sources of NEIs in Manufacturing

The most prevalent NEIs in the Manufacturing sector resulted from following changes:

- Internal labor – Electrician used to have to vacate 150 people for 30 minutes 6 times a month to change out fixtures and ballasts(electric); no longer running around checking on equipment due to complaints; less time spent maintaining lighting; fewer internal repairs with high end equipment; overall increase in worker activity due to new lighting; less lost down time due to machines breaking down.
- Administration – Installed measures resulted in less time processing work orders.

Office

The most prevalent NEIs in the Office sector resulted from following changes:

- Parts and supplies – Have not had to purchase any replacement bulbs since new installation.
- Internal labor – New lighting has less fixtures to maintain and requires less time spent changing out bulbs, this also results in less time filling out paperwork and processing complaints; controls do not require maintenance of thermostats.
- External labor – New HVAC system is more reliable which saves on maintenance.
- Revenue – Increased comfort due to more consistent heating; decreased turnover of the building and fewer tenant issues.

Summary

This paper presents a summary of research designed to provide sales and marketing representatives with a tool for communicating possible NEIs that may result from installed measures. Our analysis repurposed a robust dataset developed for the evaluation of energy-efficiency programs to provide program implementers with industry-specific NEIs presented in terms that end users actually think about their business needs. For many of the NEIs identified, the primary sources of value were derived from internal and external labor cost savings, or reduced need for parts and supplies. These cost savings largely result from the relatively high quality of energy efficient equipment. As programs incentivize participants to use energy efficient appliances, fixtures, or controls, they are installing high-end equipment. That equipment tends to last longer and requires less maintenance. This translates into direct cost savings for internal and external labor, but also lower costs for parts and supplies, and reduces administrative costs for ordering and processing invoices. This analysis clearly demonstrates that the value proposition for program implementers and even equipment manufacturers extends far beyond energy savings. Finally, this analysis offers an example of a successful feedback loop between program evaluation and implementation.

Limitations

We recognize the following limitations of this study that should be considered when leveraging material contained in the presentation:

- Values and anecdotal information presented in this study reflect the mix of measures and participants contained in the 2011 program tracking data. The “types of changes reported” should serve as talking points of what other participants have experienced, given the measures they installed and the specific operating procedures at their facility.
- Due to substantial variation in the magnitude of gas NEIs and the relatively limited sample size, this study was not able to identify statistically significant NEIs for gas measures for most industry sectors. However, the 2012 C&I retrofit NEI study did find statistically significant NEIs for a range of prescriptive and custom measure categories. Further analysis would be required to combine NEIs across similar industry segments to provide statistically significant results at the most appropriate level of industry segmentation.
- The following factors may limit the applicability of NEI estimates in other jurisdictions:

- Values were specific to Massachusetts customers. For example, the general cost of labor in Massachusetts may be higher than that in a Midwestern state.
- The mix of measures assumes C&I programs that are retrofits, which consisted of a mix of early replacement and replace on failure measures. Additional steps should be taken to address new construction.
- Certain territories in Massachusetts that are demographically unique should consider adjusting NEI estimates to reflect differences in the mix of measures within the territories relative to the state as a whole.

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ⁱⁱⁱ *Stevens, Noel, Kimberly Crossman, Pam Rathbun, Miriam Goldberg, and Ben Jones. Non-energy impacts of C&I energy efficiency measures provide substantial program benefits above carbon reduction*. Paper presented at IEPPEC. Berlin. 2014.