

**CONNECTICUT ENERGY EFFICIENCY BOARD**

# **EVALUATION STUDIES AND RESULTS, 2011**

**A REPORT TO THE ENERGY AND TECHNOLOGY COMMITTEE OF THE  
CONNECTICUT GENERAL ASSEMBLY**

**November 18, 2011**



The Energy Efficiency Board (EEB) is proud to present the first Annual Report of the studies, results and recommendations via the EEB program evaluation, measurement, and verification (EM&V) process. Connecticut has one of the longest EM&V histories, contributing to some of the nation's strongest efficiency programs.

EM&V is very important to the efficiency programs' successes. Evaluations are designed to be comprehensive, independent, actionable and cost-effective. Impact results provide verification that the Fund is being used appropriately and provides beneficial programs and savings. Recommendations also provide essential information on how programs can be improved, additional measures developed and customer needs met. The use of outside evaluators provides for independence and also allows Connecticut to take advantage of the successes and failures of other programs and jurisdictions.

What follows is a compilation of results and recommendations from studies completed in the last year. Among those studies are those completed under the auspices of the Regional EM&V Forum. The EEB EM&V evaluation process provides funding, leadership, and data, and reviews studies managed by Northeast Energy Efficiency Partnerships (NEEP).

Additionally, this report is intended to provide an introduction to the wide range of studies completed by the EEB. These current and new studies cover evaluations of program savings, customer and vendor reception to program offerings, assessment of new opportunities and examinations of what pockets of savings remain available in areas already covered.

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# Connecticut Energy Efficiency Board Evaluation 2011

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## INTRODUCTION

The Energy Efficiency Fund (EEF) and Utility Companies have a long history of providing efficiency programs to Connecticut energy consumers. An integral part of creating, delivering and maintaining quality programs is performing independent evaluations of programs and the markets they serve. The evaluators make recommendations for program modifications that are considered in prospective program development and implementation.

In 1998 the Energy Efficiency Board or EEB (previously the Energy Conservation Management Board) was formed and charged with responsibility to advise and assist the utility distribution companies in the development and implementation of comprehensive and cost-effective energy conservation and market transformation plans. Since that time, the EEB has worked closely with the Companies to ensure all evaluations are relevant, independent, cost-effective and meet the needs of program administrators and planners who are charged with achieving substantial public benefits. In 2005, The EEB formed an Evaluation Committee which works with an EEB Evaluation Consultant to oversee evaluation planning and completion. In 2009, the Department of Public Utility Control (DPUC) decided that the EEB's Evaluation Committee and their consultant would be independent from and totally responsible for all aspects of the evaluation process.

Since that time, the evaluation process and oversight have changed through additional Department of Public Utility Control (now Public Utility Regulatory Authority (PURA)) decisions which were adopted and extended by PA 11-80, sec. 33, amending Conn. Gen. Stat. sec. 16-245m, in 2011. PA 11-80 required an independent, comprehensive program evaluation, measurement and verification process to ensure the EEF's programs are administered appropriately and efficiently, comply with statutory requirements, programs and measures are cost effective, evaluation reports are accurate and issued in a timely manner, evaluation results are appropriately and accurately taken into account in program development and implementation, and information necessary to meet any third-party evaluation requirements is provided.

The essential information gained through studies such as those discussed in this report is provided very cost-efficiently. The planned **\$3.38 million** dollar 2012 budget for all evaluation and related research studies represents **2.7%** of the program costs of **\$124.69 million**.

Research completed within the evaluation group provides additional types of information. The current and future efficiency programs are developed, supported and improved through careful research into:

- Current market opportunities for program expansion
- New end uses and equipment that may be included cost-effectively, including assessment of the associated barriers for inclusion of each
- Customer segmentation and market research, including research into ownership patterns, and
- Examination of best practices in other jurisdictions

The EEB Evaluation Committee ensures the independence and objectivity of Evaluation Measurement and Verification (EM&V). It is critical that the programs be evaluated, measured, and verified in ways that provide confidence to the public that savings are real and enables the Companies and EEB to use savings estimates and Evaluator recommendations to improve and advance programs with full confidence.

## DEFINITION OF EVALUATION TYPES

There are many types of evaluation supported by EEF funding. Research studies assist regulators, policy makers, the EEB and program administrators to maintain excellent practices and develop new programming options to meet Connecticut's growing efficiency needs throughout program formation and evolution

**Market Assessments** examine overall market conditions related to energy efficiency products and services, including current standard practices, average efficiency of equipment, consumer purchasing practices, and identification of market barriers. The assessments ascertain the extent to which efficiency programs are likely to influence customer adoption of measures and practices. Assessments are conducted to identify effective ways to influence key market players to take efficiency actions and increase the breadth and depth of the actions taken.

**Impact Support Studies** assess the adequacy of engineering methodologies and background assumptions, supporting the Program Savings Document (PSD) and providing the foundation against which evaluations will assess program performance.

**Baseline Studies** provide direct impact support by assessing pre-conditions that will no longer be measureable after program interventions have occurred.

**Process Evaluations** determine the efficacy of program procedures and measures. Process Evaluations assess the interactions between program services and procedures and the customers, contractors, and participating ancillary businesses. Process evaluation is essential to support development of improved program delivery, increased cost effectiveness and customer satisfaction.

**Impact Evaluations** verify the magnitude of energy savings and the reasons for differences between projected and realized savings. The results and value of energy efficiency programs are reported to regulatory bodies, ISO-New England, Company management, and program planners and administrators. Many different types of impact studies may be completed including end-use metering, engineering modeling, billing analyses, participant interview, surveys and combinations of these.

**Evaluation Protocols** are produced within the Regional EM&V Forum to provide direction to states new to the evaluation process and to ensure consistency to all of the states within the Forum. Cost-effective regional evaluations are coordinated through the Forum. The EEB is an active participant in the EM&V Forum, providing leadership, quality control, data and funding to its efforts.

Collectively, these types of studies are sometimes referred to as Evaluation, Measurement and Verification (EM&V). The evaluation process is a critical tool to measure energy savings, as well as other key attributes of each program, to allow optimum program design and careful management of consumer conservation funds. The various types of evaluation studies are utilized to support ongoing improvement in program offerings and to measure the results of those programs. The audiences for evaluation include regulatory bodies, the regional electric system operator (ISO-New England), Company management and program planners and administrators, all of whom need the information to make decisions about program design and efficacy to enhance existing cost-effective programs and redesign program that are not cost-effective to make them successful. Evaluation research provides the basis for: determining program direction or focus; increasing participation and savings; expanding the reach of

programs, developing messaging more relevant to the non-participating customers where appropriate; reducing costs; and fine-tuning procedures.

## ORGANIZATION OF THE REPORT

The remainder of this report is organized in sections, based on the current status of the study.

Section 1 Completed Studies includes descriptions, costs and summary results from completed studies that were filed in the last 12 months. Links to the full reports are found at the end of each study description.

Section 2 Ongoing Studies includes study descriptions and costs for projects currently being completed. For most of these studies, reasonable estimates of completion dates can be provided as well.

Section 3 Studies in Development provides study goals, descriptions of the methods to be employed and costs to the extent these items are available. The studies in Section 3 will be initiated as soon as contracts are executed. The uncertainties around contracting impact the dates the projects can start, the length of time required to complete the study and, sometimes the methods that can be employed.

Section 4 EM&V Forum offers descriptions of studies completed within the regional EM&V Forum (Forum). Within the Forum, participating states pool monetary, data, and manpower resources to complete evaluation and other studies under the general management of the Northeast Energy Efficiency Partnerships (NEEP). For these studies, descriptions and results are available. However, individual project costs are not available because the Forum charges each state's energy Companies a yearly fee based on anticipated study costs across all studies and a management fee to fund the Forum. In Connecticut, these charges are paid through the Energy Efficiency Fund.

## SECTION 1: COMPLETED STUDIES

### AWARENESS OF THE ENERGY EFFICIENCY FUND

OPINION DYNAMICS, \$36,000

In order to gauge the extent to which residential, industrial and commercial customers understand what the Energy Efficiency Fund is and what services the Fund supplies, the EEB Evaluation Committee retained Opinion Dynamics Corporation to conduct a market awareness study. A market awareness study uses interview, survey and focus group techniques to find out how people perceive the program or process of interest.

In this case, the study examined customer knowledge and perceptions of the Fund using an Internet panel survey with approximately 650 residents and 144 commercial customers, two-thirds of whom were participants. The goal was to ascertain to what extent people identified the efficiency programs with the Fund rather than with the Program Administrators (PA) that manage the Fund programs. This study was intended to provide a baseline against which progress can be measured.

The results from the residential survey suggest that Connecticut residents have a relatively low general awareness of both the Connecticut Energy Efficiency Fund (21%) and Connecticut Energy Efficiency Fund's logo (13%). Ninety-three percent of those who have participated in a Connecticut Energy Efficiency Fund program are either *very* or *somewhat* satisfied with their participation.

About one in five residential respondents (21%) reported being aware of Connecticut Energy Efficiency Fund (CEEF or the Fund) –with most citing a bill insert or advertisement as the source of their awareness.

Results of the 144 Commercial & Industrial surveys provided similar results. Again, nearly all program participants expressed satisfaction with their program experiences. A higher number of C&I customers (about 60%) reported that they were aware of the CEEF prior to taking part in the survey. This greater level of awareness is not surprising because most of the C&I study participants had previously participated in a program. However non-participant C&I customers also had higher recognition of the Fund than did the residential customers.

After offering a description of Connecticut Energy Efficiency Fund, customers were asked about their opinions about the Fund. The following, brief description of the Connecticut Energy Efficiency Fund was used:

The programs offered by CEEF are funded by a small charge (three-tenths of a cent per kilowatt-hour or kWh) on customers' bills. If you typically use 400 kWh per month, the cost for the Fund would be \$1.20.

Created to address Connecticut's rapidly growing energy needs and costs, the Connecticut Energy Efficiency Fund offers residents everything from incentives to replace energy-wasting appliances with newer, more efficient models, to rebates on energy-saving lighting products and air conditioners. For businesses, there are innovative programs to maximize energy efficiency, lower operating costs and improve productivity. The Connecticut Energy Efficiency Fund (Connecticut Energy Efficiency Fund) is the result of a partnership with the state's utility companies and funded by a small charge on customers' bills.

After being read a description of the CEEF, about three-quarters have a favorable opinion of it: 23% are very favorable, while 53% are somewhat favorable. Sixteen percent have an unfavorable opinion of the CEEF: 12% are not very favorable, while 4% are not at all favorable towards the organization. Among those who have participated in a CEEF program (n=165), 27% are very favorable towards the CEEF, 59% are somewhat favorable, 8% are not very favorable and 2% are not at all favorable.

Seventy-three percent of Commercial and Industrial customers largely agree. After being read a description of the CEEF, 42% have a very favorable opinion of it, while 31% have a somewhat favorable opinion. Twelve percent are not very favorable towards the CEEF, and 6% are not at all favorable. Sixteen percent don't know how to rate their opinion of the CEEF. Among those who have participated in a CEEF program, 55% have a very favorable opinion of the fund, while 26% have a somewhat favorable opinion. Five percent have a not very favorable opinion, while 3% have a not at all favorable opinion of the CEEF.

As a result of this study, the EEB and PAs are examining new ways to promote recognition of the Fund as provider of efficiency programs.

See [Awareness of the Energy Efficiency Fund](#)

## CUSTOMER RESPONSE TO THE ENERGY INDEPENDENCE AND SECURITY ACT (EISA) – FOCUS GROUPS

### THE NMR GROUP \$46,108

EISA 2007 sets new performance requirements for certain common light bulbs, requiring these bulbs become approximately 25-30% more efficient by 2012-2014. These new, increasingly stringent performance requirements do not ban incandescent bulbs. However, the requirements may result in market forces phasing out of incandescents and moving to Compact Fluorescent Lamp (CFL) and Light Emitting Diode (LED) technologies.

The transition period between the current market and the future offers opportunities to efficiency programs. As attention is focused on lighting efficiency, new products enter the market, the costs of today's newest products are reduced by increased production. Many customers will be need to make new choices for a product most had previously thought little about.

The subject study is the first of a series of market assessment studies on the consumer lighting market. Market Assessments examine pre-existing market conditions and ascertain the extent to which efficiency programs are likely to influence customer adoption of measures and practices. Market assessments examine overall market conditions related to energy efficiency products and services, including current standard practices, average efficiency of equipment, consumer purchasing practices, and identification of market barriers.

For this study, the NMR Group was retained to conduct a quick turn-around study to learn more about:

- Customers' expected response to the incandescent phase out
- Whether additional exposure to efficient lighting products makes customers more comfortable with their choices
- Customer needs for additional information on lighting including their reactions to new, required package labeling
- Additional programmatic changes that support customers as the markets change

A focus group design was chosen for the depth of information available, speed of execution and reasonable cost. In a focus group, a small group of people are brought together for a guided discussion of a topic. The information gained is far more nuanced than would be found in a survey approach, in part because the participants are able to engage with other study participants. Because focus groups employ small customer groups, it is important to conduct several groups to gain a fuller understanding of the issue studied. Often focus groups are paired with other techniques, such as surveys. Surveys may also precede focus groups, allowing questions or themes arising from the survey to be examined in more depth. Or, as in this case, the in depth information derived from the focus group can be tested against a broader statistical method.

For this study, six focus groups were completed with Connecticut residential customers - two focus groups with participants who used zero to five CFLs in their home (low users), two with those who used six to 15 CFLs (moderate users), and two with participants using more than 15 CFLs (high users).

## KEY FINDINGS

Some of the key findings emerging from the focus groups include the following:

- Focus group participants asserted that price was—and would remain—the most important factor they consider in selecting light bulbs. After learning more about the various types of bulbs, these customers expressed more willingness to look at lifecycle costs, but need help to make those comparisons quickly.
- High-use participants had already installed large numbers of energy efficient light bulbs in their homes – some indicated that they had replaced all the incandescents in their homes. Ten participants also had covered CFLs (CFLs that have a glass cover over the coils, allowing them to look more like traditional incandescent bulbs) installed in their homes. Very few participants used A-shaped halogen or A-shaped LED bulbs.
- Participants most often wished that the new Lighting Facts label incorporated a comparison of a CFL with its equivalent incandescent on the label, and provided recommended uses for the bulb.
- In light of the phase out of high wattage incandescent bulbs, most participants assumed they would switch to CFLs. Likewise, most indicated that were not and would not hoard incandescent bulbs, although a handful admitted they already were hoarding or most likely would hoard incandescents.
- After having the chance to assess several energy efficient light bulb choices, covered CFLs emerged as the preferred bulbs overall, though participants also liked the brightness of the halogen and the life of the LED.

## RECOMMENDATIONS

### IMPORTANCE OF PRICE IN SELECTING LIGHT BULBS

Focus group participants asserted that purchase price was—and would remain—the most important factor they consider in selecting light bulbs. Recommendations related to this key finding suggest the EEB and Companies continue to provide incentives for covered CFLs, and perhaps spiral CFLs. That would allow the shelf-price consumers see to remain competitive with A-shaped halogens.

The current, incented prices of LEDs remain beyond the comfort zone that most consumers are willing to pay for a light bulb; therefore, NMR recommends that the EEB and Companies target LED promotions to prior CEEF program participants who have already shown a propensity towards saving energy and adopting sometimes expensive, yet innovative, efficiency measures.

### SUPPLEMENTING THE FEDERALLY REQUIRED “LIGHTING FACTS” LABEL

Focus group participants indicated that the lighting facts label didn’t provide enough information to help customers choose the *best* bulb for their needs. Therefore, NMR recommends that the EEB and the Companies develop supplemental educational materials and point of purchase displays designed to help consumers interpret the terminology used on the Lighting Facts label, estimate the cost of operating the bulb in Connecticut, and select the bulb with the most desirable appearance, shape, and size.

### MATCHING BULBS TO SPECIFIC USES

Focus group attendees seemed to crave specific information on how to choose the best bulb for specific applications (e.g., indoor versus outdoor fixtures, dining versus cooking) or fit and appearance in fixtures and lamp shades. However, NMR’s research made clear that not all participants preferred the same bulb

for the same application or use. NMR believes the EEB and the Companies should proceed cautiously but consider using existing schemes developed by manufacturers as a starting point.

An additional recommendation suggests the EEB and Companies take extra steps to increase awareness about the existence of covered CFLs and their potential to alleviate the concerns some consumers have about the appearance and fit of spiral CFLs. A final recommendation in this area focused on expanding the models of A-shaped LEDs incented by the program to include those that lack the yellow filter which many focus group participants disliked.

See [EISA Lighting Focus Group](#)

## HOME ENERGY SOLUTIONS (HES) IMPACT EVALUATION

NEXANT, \$225,000

The HES impact evaluation was performed to verify the magnitude of energy savings and sources for differences between projected and realized savings

HES will be a primary vehicle to fulfill Connecticut's statutory goal of weatherizing 80% of existing homes by 2030 articulated in Public Act .11-80, section 33. The program has evolved – and will continue to evolve – to offer additional products and services to meet these goals. However this study is specific to the 2008 program year.

The 2008 program year was selected to employ a billing analysis as its main approach. Doing so required records of three years of energy usage, including a year of usage prior to the study year, the program study year and a year of usage for the year following the study year. In addition to the billing analysis, on-site inspections supported an engineering-based assessment.

In 2008, HES was available to all existing single-family properties. The objective of HES is to reduce total residential energy use through the comprehensive treatment of all single-family residential dwellings. In 2008, HES was described as a joint natural gas and electric offering promoted to high-use electric customers, customers with central air conditioning, and/or high-use natural gas customers, although all customers were eligible to participate

HES is an “umbrella” program comprised of two major components.

- *In-Home Energy Services* is the largest component of HES and provided (within program-defined limits) shell improvements through duct sealing, caulking and weatherstripping, CFLs, water fixture retrofits including faucet aerators and low flow showerheads, and pipe insulation. In addition, participants were also provided with information and education to help them further reduce energy consumption, including product offerings through the SmartLiving Catalog, energy-saving tips, online audit tools, and information on other efficiency programs and offerings. The second component at that time was called Tier 2.
- *Tier 2 services* included suggested additional improvements such as insulation, appliances, and improved windows where needed and economically viable. These follow-on measures would be selected and paid for by the participants, but EEF provided rebates for a portion of the costs. Savings from Tier 2 were not estimated independently in this study.

### STUDY GOALS

The study required collecting, analyzing and reporting results of the savings impacts from the HES program. The project was intended to produce energy saving impacts from HES participation and, to the extent feasible, from the individual natural gas and electric measures installed under the program.

The study produced energy use and savings information for both gas and electric measures and winter- and summer season load shapes for specified electric measures. Incorporation of gas savings required measurement of monthly and annual gas savings reductions (assuming thirty year normal temperatures) and projected peak day savings (assuming coldest day in thirty years).

### SUMMARY OF RESULTS

The table below summarizes the HES gross calculated savings and the gross measured savings for direct-install measures. Results are presented for the program as a whole with accompanying realization rates.

Independent estimates of savings from Tier 2 were not produced in this study Therefore, only Tier 1 savings estimates are shown below

#### 2008 HES Program Gross Impacts Summary

Metric	kWh	MMBtu	Summer Peak kW	Winter Peak kW
HES Claimed Savings	10,936,625	39,649	2,859	2,003 <sup>1</sup>
Realization Rate <sup>2</sup>	97.6%	107.5%	83.4%	91.9%
Relative Precision (80% Confidence)	±5.1%	± 45.4%	±16.7%	± 5.6%
Gross Measured Savings	10,679,399	42,614	2,385	1,841 <sup>1</sup>

<sup>1</sup> Savings only for CL&P. No values reported by other utilities.

<sup>2</sup> Realization rates are factors that represent the ratio of measured savings to savings calculated using program assumptions.

The engineering study concluded that the 2008 HES program resulted in 10,679,399 kWh gross annual energy savings and 2,385 kW gross summer capacity savings compared to 10,936,625 kWh annual energy savings and 2,859 kW summer capacity savings claimed by the program (direct install measures only).

#### RECOMMENDATIONS

Nexant recommends the following changes to the HES program:

1. Develop a well-organized enterprise relational database system at CL&P and Yankee Gas that more cleanly links gas and electric account data.
2. Create a consistent database system for all HES program administrators that allow the HES participant records from multiple companies to be compiled easily.
3. Marketing of the HES program should be redirected to attract a greater quantity of casual, less energy-conscious participants. HES marketing material should include more non-energy benefits such as better air quality, greater occupant comfort and more even temperature distribution. This would result in greater savings per home and more cost effective site-visits.
4. Estimates of recommended Tier 2 energy savings (in dollars) per measure should be included in marketing literature.
5. The program caps placed on CFLs in the UI HES program should be removed in order to capture the missed savings opportunities observed during home inspections.
6. The program caps placed on air sealing should be removed and replaced with a cap that considers both CFM improvement and ACH50. Contractors should be incentivized for CFM improvement on a \$/CFM basis, without limit, up to an ACH50 value of 10 that corresponds to LBL Leakage Class F
7. An incentive premium should be offered to contractors for self-generated leads.
8. To promote greater participation in Tier 2 offerings, contractors should be encouraged to follow up with homeowners approximately one month following the on-site assessment.

9. The application deadlines on Tier 2 offerings should be extended, to allow homeowners additional time to plan for large expenditures in their budgets.
10. The PSD savings calculations for pipe insulation and water measures should be revised according to the suggestions in the report..
11. Measures that achieve natural gas savings should be evaluated separately using an on-site inspection sample based on gas savings so that their impacts can be reported with better statistical precision.
12. Future evaluation studies should include a Net-to-Gross study to quantify market effects including free-ridership, spillover and snapback.
13. Tier 2 measures should be studied using an independent, statistically valid, home inspection sample.

See [HES Impact Evaluation](#)

## WRAP/UI HELPS IMPACT EVALUATION (HES – INCOME ELIGIBLE)

KEMA \$230,000

This impact study evaluated the 2007-2008 savings of the UI Helps and Weatherization Assistance Partnership (WRAP) Programs, currently provided under the name Home Energy Services – Income Eligible (HES-IE) For the program year studied, WRAP and UI Helps were separate programs, operated by United Illuminating (UI) and Connecticut Light and Power Company (CL&P), respectively. This Impact study was performed by KEMA Consulting (KEMA). Impact evaluations verify the magnitude of energy savings and sources for differences between projected and realized savings; reporting the results and value of energy efficiency programs to regulatory bodies, ISO-New England, utility management, and program planners and administrators. Many different types of impact studies may be completed including end-use metering, engineering modeling, billing analyses, participant interview, surveys, and combinations of all of these. This study was conducted using on-site metering and simulation modeling.

WRAP and UI Helps were designed to reduce total energy use and electric system peak demand in homes by direct measure installation; especially weatherization measures. These programs both provided weatherization measures to help renters and homeowners reduce their energy bills by making their homes more energy efficient. Services were provided to all customers who qualified regardless of heating fuel (including oil and propane). Each program's services were provided to customers with gross income at or below 60% of the state median income (the eligibility level for energy assistance), who spent a high portion of their annual income on energy and had not received energy conservation services within the prior 18 months and/or resided within Community Reinvestment Act areas. During the program on-site visit, participants received direct installation of CFL bulbs and fixtures, weatherization measures, low-flow showerheads and faucet aerators, and there was a "kitchen table wrap-up" which included review of what was done, other ways to save energy, and information regarding other available efficiency programs and online audit tools. . Through scheduled follow-up visits, qualified customers also received wall insulation, ceiling insulation, appliances, efficient windows and/or heating system repair or replacement (if they are heated with natural gas). All services were provided without charge.

### STUDY GOALS

For each program, the primary objectives of this study were to: 1) derive new estimates of adjusted gross energy and demand savings realization rates based on coincidence factors derived during this study for each measure offered through the 2008 program, 2) review the formulas and calculations in the Program Savings Documentation (PSD), including coincidence factors used, and 3) recommend changes based on the study findings. . The results assessed:

- Electric energy savings by participant group (electric, gas, oil heat customers)
- Electric energy realization rates by measure type (insulation, infiltration, lighting, appliances, and water heating measures)
- Electric demand realization rates with summer and winter seasonal savings
- Gas savings by end use (insulation, infiltration, and water heating) including peak day savings (typical peak day and extreme peak day)
- Comprehensiveness of measure installations within program limits

## RESULTS

For this study separate results were provided separately by fuel for each measure type and for the program as a whole.

Table 1: Electric Energy and Seasonal Demand Savings Results

End-Use/Measure		Tracking Savings	Gross Savings	Realization Rate
Lighting*	Annual kWh	18,241,578	9,189,546	50.4%
	Summer kW	1,561.4	927.9	59.4%
	Winter kW	6,175.2	2,187.1	35.4%
Refrigeration	Annual kWh	4,926,756	4,840,498	98.2%
	Summer kW	669.2	887.0	132.5%
	Winter kW	473.2	513.6	108.5%
DHW	Annual kWh	3,271,135	2,208,998	67.5%
	Summer kW	282.8	257.6	91.1%
	Winter kW	418.6	335.9	80.2%
Heating	Annual kWh	2,785,498	4,036,641	144.9%
	Summer kW	4.1	427.3	N/A
	Winter kW	1,488.7	1,872.5	127.7%
Cooling	Annual kWh	159,291	84,744	53.2%
	Summer kW	264.2	193.7	73.3%
	Winter kW	0.0	0.0	N/A
Duct Sealing	Annual kWh	30	30	100.0%
	Summer kW	0.0	0.04	N/A
	Winter kW	0.01	0.001	N/A
Program Total				
Overall	Annual kWh	29,384,287	20,360,458	69.3%
	Summer kW	2,781.6	2,693.4	96.8%
	Winter kW	8,555.9	4,909.0	57.4%
*Large numbers of likely CFL removals resulted in the low realization rates shown. A follow-up study on persistence is now scheduled.				

Table 2 provides the natural gas realization rates as well as typical and extreme peak gas savings by measure type. Overall, the program realized 221.4% of the gas savings in the tracking system, driven by the finding that 15.5 linear feet of caulking per window/door was found while the tracking system assumed 1 linear foot would be installed.

Table 2: Natural Gas Savings Results

End-Use/Measure		Tracking Savings	Gross Savings	Realization Rate
DHW	Annual ccf	93,611	72,697	77.7%
	Typical Peak Day ccf	0	2,528	N/A
	Extreme Peak Day ccf	0	2,831	N/A
Heating	Annual ccf	91,248	336,621	368.9%
	Typical Peak Day ccf	0	2,848	N/A
	Extreme Peak Day ccf	0	4,888	N/A
Program Total				
Overall	Annual ccf	184,859	409,317	221.4%
	Typical Peak Day ccf	0	5,376	N/A
	Extreme Peak Day ccf	0	7,719	N/A

COMPREHENSIVENESS OF INSTALLATIONS

Comprehensiveness of measure installations was an important impact measurement. Of the 92 homes in the sample, most measures were found to be present as needed and within the program guidelines. Some opportunities remained. There were several possible reasons identified for encountered gaps. The first is funding. Funding for the program faced many fluctuations during the program year. Customers served during a low-funding period may not have been revisited when funds were restored. Time of year also affected installations, in particular for air conditioning replacement; program vendors would not necessarily know if room air conditioners were present during winter months when units were stored. Finally, the evaluation inspections occurred over a year after customer program participation; some measures may have been removed or failed between installation and contractor observation/ measurement. Table 3, below indicates measure opportunities found.

Table 3: Measure Opportunities at the Time of On-Site Visits, Per 92 Households

Program Measure	Typical Program Installations	# in Sample with Opportunity	Issues Encountered
Air Sealing	Caulking, Weather Stripping, Expanding Foam	5	Blower door results indicated that few air sealing needs existed at the time of site visits.
Appliances (Refrigerators)	ENERGY STAR units	3 (based on age) 14 (based on consumption)	Observed units with customer-reported ages at or beyond life expectancy were minimal for refrigerators (3) and freezers (1), but more significant for room air conditioners (18). KEMA estimated that 14 refrigerators would be likely candidates for replacement based upon an analysis of the rated consumption of those observed on-site.
Appliances (Freezers)		1	
Appliances (Room Air Conditioners)		18	
Attic Insulation	Install up to R-38 when less than R-19 is present.	11	Less than 6" (R-19) of insulation installed.
Wall Insulation	Cellulose fill	5	In five homes we were able to gather evidence that walls were not insulated through observation or customer report.
DHW (Aerators and Showerheads)	2.2 GPM Showerhead, 1.5 GPM Low-flow units	36	Observed Standard-flow units.
Gas Heating Systems	ES or other high performance standard	10 (out of 34 systems)	Observed units with customer-reported ages or observations that suggested that existing system(s) were at or beyond their life
Lighting	CFLs	34	Observed homes that had 6 or more incandescent bulbs installed.

#### KEMA'S RECOMMENDATIONS ON SAVINGS INPUTS AND DATA TRACKING

One of the objectives for this evaluation was to collect data to inform a process of improving program tracking estimates through a continual feedback loop. That is, this evaluation was intended to provide not only realization rates for the 2007 and 2008 tracked savings, but also to provide recommendations on how to make incremental improvements to the PSD inputs and calculation methods.

The paramount recommendation at the time of the study is to ensure there is a connection between the tracked savings and the PSD inputs, algorithms and savings estimates. This may include structuring the system to ensure it is gathering information so that the PSD can be applied. For example, to fully apply the PSD, the system needs to track the locations of all installed lighting products for the proper allocation of PSD room-specific hours of operation. Following this, other recommended PSD improvements can be put into place and can be expected to provide more accurate estimates of program impacts.

It is important to note that this evaluation was of 2007/2008 program activity and that some of these recommendations may already be underway, due to program improvements that are regularly undertaken by the utilities (such as tracking gas account numbers).

1. To facilitate future evaluations, KEMA recommends that, if not otherwise being done at this time, the tracking systems begin to carry gas account numbers and consistently carry the primary heating fuel types at participating homes.
2. To the extent that measure savings by infiltration versus insulation is of interest, the tracking systems should create separate categories for these measure groups. Currently, they are incorporated into the heating measure group.
3. Error ratios are used to determine needed sample sizes to target specific levels of precision around study results. In future studies of this program, the following error ratios can be used for purposes of sample sizing: 0.58 (kWh), 1.14 (Summer kW), 0.76 (Winter kW).
4. The Companies should use the savings calculations and assumptions provided in the most current version of the PSD when estimating program savings, revised as suggested in this report. This includes tracking the locations of all installed lighting products, so that the room-level hours of use estimates provided in the PSD can be applied.
5. The gross savings in this report includes adjustments due to installation and removal rates, among other factors that might affect persistence, since this study was performed two years after implementation. The PSD indicates that installation rates are also included as part of the net adjustment. Therefore, to calculate net savings from the gross savings provided in this report, it is only necessary to apply the free ridership and spillover factors, which are not embedded in the gross savings estimated in this report.
6. Less than 60% of the lighting reported in the tracking system for the sample was found in operation during the on-site visits. This suggests that a 75% installation rate (as currently quantified in the PSD) may be reasonable to continue to use. However, the PSD should assume that persistence after 2 years is approximately 60%.

In general, only moderate opportunities for infiltration, wall insulation, refrigerator, and freezer replacement were observed at the time of KEMA's on-site visits. Attic insulation and room air conditioner opportunities were relatively prevalent among major measures, while lighting and DHW direct install measures and infiltration measures also had modest installation opportunities noted at the time of our on-site visits. It should be noted that these were participants of the 2007 and 2008 program years, and that it was not until mid-2009 that these programs were fully operational, with funding and all measures approved for installation. Considering that some of these visits occurred up to 2-1/2 years after the

initial visit, some opportunities – particularly for infiltration and lighting – might be expected due to measure degradation or removal. Below we provide some recommendations, based upon observations at the time of our visits that are expected to improve program success in acquiring energy savings.

1. The Companies should begin to formally track all efficiency recommendations that are made, including those not subsequently implemented. To the extent possible, this tracking process should include the reasons why certain measures are refused or not otherwise installed. This would provide a foundation to assess what barriers are preventing recommended measures from being installed. This could be a short-term activity until barriers are identified and mitigation strategies are developed.
2. The Companies should reinforce the need for comprehensive direct measure installation to audit staff/vendors, especially with respect to lighting and DHW measures. While it is difficult to always know whether these measures were installed at the time of the initial visit and subsequently removed prior to our visit or if they were never installed, many participating homes were noted to have opportunities for both lighting and DHW measures at the time of our visits. In addition, many aerators reported as installed had GPM ratings that were higher than the 1.5 GPM assumed in the PSD. To the extent that these measures are intended to generate savings, and are expected to be directly installed at the time of the audit, steps should be taken to ensure optimal in-service rates and the installation of appropriate DHW measures.
3. Companies should consider taking GPM measurements of aerators and shower heads to ensure the appropriate baseline GPM is being used to calculate savings. This could be a simple bucket test performed as part of implementation. The PSD provides savings for several different GPM baseline conditions, however on-site assessment of the aerators and shower heads that are being replaced is necessary to ensure the use of the correct savings estimate.
4. The Companies should consider implementing a mail or phone-based QA/QC system on a short-term basis, in which a small sample of randomly selected participants are contacted to ensure lighting and DHW measure installations are being performed as well as to track program satisfaction. This system would be performed following measure installation and would be executed at a general home level and not a bulb or DHW unit level. The purpose of this activity would be to make a reasonable low cost effort to ensure that ongoing improvements in program satisfaction are sought, and to make certain that on a broad level, measures such as lighting and DHW are getting routinely installed.
5. Nearly three of every ten room air conditioners observed among the homes visited were noted to be beyond 10 years of age. They are likely good candidates for replacement. KEMA auditors often looked for units in storage areas to inquire about them and acquire nameplate information. These units may have been in storage at the time of the initial program audit, that is, during cold months.
6. Additionally, we identified several homes where there were opportunities for attic insulation at the time of our visit, although we did not assess whether wiring or other physical barriers might have prevented installation. Most of the room air conditioner and attic insulation opportunities were found in homes that were occupant-owned while gas fuel opportunities were more evenly split between occupants and landlords. We also identified ten homes where gas fuel furnaces appeared to have opportunities and moderate opportunities for air sealing. We recommend that the Companies work with the audit staff to ensure measure opportunity protocols are being followed for these measures (attic insulation, room air conditioners, gas fuel furnaces and air sealing).

See [WRAP and UI Helps Evaluation Report](#)

## IMPACT AND PROCESS EVALUATION OF THE ENERGY CONSCIOUS BLUEPRINT PROGRAM

GLOBAL ENERGY PARTNERS, \$645,000

The ECB program is an ongoing program designed to improve the energy efficiency of equipment purchases in C&I projects involving new construction, major renovation, tenant fit-outs, and equipment replacement/additions. Since these purchases are necessary parts of the projects, the ECB aims to influence equipment decisions during the design stage, capturing opportunities to improve energy efficiency that might otherwise be lost. The program is comprehensive, providing technical assistance and financial incentives to customers and their design and equipment contractors (trade allies) to increase the energy efficiency and performance of lighting systems; heating, ventilation and air conditioning (HVAC) systems; motors; industrial processes; and other energy use components of C&I buildings.

The ECB program is an established program at a crossroad. In 2010, an effort was undertaken by the EEB and the Companies to review and revise the direction of the program. The resulting “re-visioning” of the ECB gave the program a more forward-looking focus that emphasizes working more collaboratively with customers and their service trade allies to encourage ongoing efficiency improvements, beyond existing code and standard minimums in all parts of their operations.

The ultimate goal is to transform the market with beyond-code building design and equipment purchase practices. Thus, while the focus of this study was to evaluate the performance of the 2009 program, it was conducted with the intent to provide recommendations that will help the program move in the newly-defined direction.

Global Energy Partners was retained to provide a Process and Impact evaluation of the Energy Conscious Blueprint program. The objective of this study was to evaluate the energy impacts and processes of the ECB program in Program Year 2009, with the ultimate goal of providing recommendations to improve the program’s estimation of savings and effectiveness in future years. This evaluation had the following key purposes:

- Provide independent estimates of the program’s annual energy (kWh) savings, seasonal peak demand (kW) savings, and hourly load shape impacts, and compare the results to the Companies’ reported savings
- Assess program processes and activities and make recommendations to improve their effectiveness
- Recommend improvements to the Companies’ most recent PSD (2011 PSD) to enable more accurate projection of savings in future program years

## IMPACT RESULTS

Overall the Program Administrators were able to estimate savings reliably as shown in the table below. Across all end-use categories, realization rates (a comparison of expected saving compared with measured savings) were: 101% (energy, shown as kWh); 91% (summer peak capacity, shown as kW); and 110% (winter peak capacity). Considering each end-use category, realization rates for energy savings ranged from 77% for cooling to 134% for heating. The overall program results (without consideration of individual end-use) are the most appropriate results for reporting to ISO and PURA. The end-use category level results are most important for planning purposes.

### Adjusted Gross and Net Savings from the Energy Conscious Blueprint Program

Major Measure Group	Adjusted Gross Savings (annual kWh)	Free-Ridership Rate	Spillover Rate	Combined NTG Rate	Adjusted Net Savings (annual kWh)
CL&P projects					
Cooling	7,228,438	16.6%	0.2%	84%	6,042,974
Lighting	9,089,133	24.3%	1.3%	77%	6,998,633
Heating	1,832,442	8.3%	4.1%	96%	1,755,480
Process	7,417,909	15.3%	4.4%	89%	6,609,357
Other					
Motors	819,245	42.1%	0.7%	59%	480,077
Refrigeration	150,001	7.3%	54.9%	148%	221,402
All other	2,203,760	55.2%	7.1%	52%	1,143,752
UI projects					
Cooling—Unitary	1,128,801	45.2%	0.0%	55%	618,583
Cooling—Other	739,117	46.7%	7.4%	61%	448,644
Lighting	2,915,036	36.8%	0.7%	64%	1,862,708
Heating	134,946	13.5%	24.7%	111%	150,060
Process	4,237,407	3.9%	34.8%	131%	5,546,766
Other					
Custom	7,690,024	3.9%	34.8%	131%	10,066,241
Motors	372,781	41.0%	0.0%	59%	219,941
VFDs	1,557,002	24.7%	0.0%	75%	1,172,422
<b>TOTAL SAVINGS</b>	<b>47,516,042</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>43,337,039</b>

## PROCESS RESULTS

A major task of this evaluation was to provide the EEB and the Companies with an assessment of program operational practices as they contribute to or impede achievement of the program's key objectives. While impact results are retrospective and reflect the 2009 program year, the process results

reflect current program goals and the current views of customers, vendors, and program administrators to the program designs. Views of these parties may differ one from another; however conflicting viewpoints are valuable in determining program improvements large or small.

For this portion of the study, Global Energy Partners first interviewed the Program Administrators and the EEB Technical consultant to collect information on their goals for the program and concerns they they would like explored in the evaluation. Then through independent examination of program data, customer and vendor interview and other research activities, Global assessed the current situation relative to the goals for the program, identifying both strengths and weaknesses. Finally, a series of steps were provided that would lead the program toward its goals. These recommendations are formative and intended to provide tools to improve program effectiveness. In addition to assessing the goals the program administrators expressed for the program, the process evaluation also examines issues such as data adequacy and accessibility as required by PURA.

There are several areas where the ECB program is progressing well:

- Trade allies like the program and feel it is good for their businesses. Trade allies and customers acknowledge the strong influence trade allies have on customer purchasing decisions and program participation. They feel the program is fuel neutral. They also believe the program makes the inclusion of controls and other high performance measures more attractive to customers. Trade allies are very supportive of project commissioning.
- Participating customers are generally satisfied with the program and report that it mostly meets their savings expectations. They often have been involved in programs in the past. For many customers, involvement in the program increases their knowledge of the benefits of energy efficiency and has improved the way they maintain and use their equipment. The majority of participants said they would consider making similar energy efficiency improvements in the future.

The evaluation also identified several challenges to meeting the programs objectives:

- The vast majority of participants surveyed indicated they got involved in the program before selecting their equipment, but far fewer seem to have been involved with it at the very outset of their projects. Survey responses indicate that half of the participants decide to participate after the design process is complete, suggesting that they are not made aware of the program early enough in the design process and/or they don't see and/or use the Company staff as a design resource.
- The program is not currently providing deep savings; that is, it is not capturing all or most opportunities through the initial contact. Moreover, while the program is capturing both electric and natural gas savings, it is not clear what the existing opportunities for additional savings currently are for either fuel type.
- Trade allies and customers report that first cost remains a barrier to fuller implementation. Some trade allies also suggest that changing incentive amounts and program rules cause them to avoid recommendation of a broader range of measures.

Global identified potential improvements to help the program make further progress toward the achievement of its goals. These include changes to the incentive structure, program promotion and implementation, and data collection/documentation.

**Recommendations for improving the incentive structure:**

1. Provide cash incentives to trade allies for building designs that include a range of energy efficiency improvements, using a sliding scale for improvement above an established baseline.
2. Introduction of tiered incentives, such that measures that are less known or have longer paybacks are more highly incented. Consider whether both customers and trade allies may be eligible for the incentives.
3. Include bonus incentives that may apply to both customers and trade allies, for certification as LEED or Green Globe buildings.

**Recommendations for improving the program promotion and outreach:**

1. Conduct a market characterization study to better identify additional electric measures that can provide significant savings as well as customer groups with greatest remaining potential for improving energy efficiency. Then develop measure-specific promotion and customer group-specific outreach strategies.
2. Strengthen relationships with trade allies, especially design contractors who are very involved at the earliest stages of projects and mechanical/electrical engineers and equipment contractors who are very influential in equipment selection. More actively promote and provide training and workshops to trade allies about the incentive and the program, the importance of getting to customers early in process, the benefits of high performance measures including controls, and provide guidance on design simulation modeling.
3. Provide specific training to customers that includes the value of project commissioning and the use of controls to improve occupant comfort and building energy efficiency.
4. Support customer efforts to set company energy goals, including working with them to create initial baselines as well as supplying (e.g. loan) data loggers as part of an energy information program that also includes energy goals and energy action plans.
5. Support joint events with DOE and others to increase company energy efficiency commitment levels.
6. Dedicate staff to conduct outreach with building architects and design engineers to understand the benefits of a long term energy efficiency strategy.
7. Promote the use of load management controls to customers in conjunction with available demand response and dynamic pricing programs.

**Recommendations for improving program implementation:**

1. Provide better support and a faster turn-around time during the design and bid process.
2. Develop a spreadsheet, software program, and/or online tools to help contractors accurately estimate the size and availability of incentives for specific measures.
3. Continue to increase the number of natural gas measures that are eligible for the program.

**Recommendations for improving program data collection and documentation:**

1. The Companies should use the same grouping of measures, and the same nomenclature for both the major measure categories and the individual measures themselves, in the electronic databases.
2. Record and clearly specify all of the measures installed and rebated under the program for each project. Whether as separate line entries or additional fields in the database, this should include standardized measure names plus notes that provide more detail on every one of the measures for each project.
3. Add identifying information about the location of equipment installations in all project files. At a minimum, provide identifiers such as the room name (e.g., conference room) or equipment number (e.g., RTU1).
4. Convert all paper information describing existing and new equipment, as well as savings and cost documents and project plans, to electronic files. The easiest, most commonly used, and least error-prone way to do this is to scan all the paper documents into a PDF file at the conclusion of each project and maintain an electronic library of project files.
5. Include the methodologies and assumptions used to calculate savings in the individual project files. When applicable, refer to the relevant sections in the PSD.
6. Follow the methodologies in the PSD for all prescriptive measures or clearly explain the rationale for using a different approach.

**Recommendations for improving the 2011 PSD:**

1. Develop, and include in the PSD, methodologies, assumptions, and formulas that are specific to the targeted population of customers in the ECB program (i.e., C&I new construction or major renovation).
2. Provide more information on how the savings are derived for custom measures, either in the PSD or in supporting documentation or software tools. This will enable a better understanding of the differences in the estimation methodologies between Company-reported and adjusted calculations and should help reveal causes of discrepancies.
3. For Lighting measures, consider a more accurate approach that involves assigning lighting groups to specific areas within the facility, then assigning operating hours to those specific areas based on the function of the particular space.
4. For Cooling and Heating measures, conduct a study to examine and possibly adjust cooling and heating full load hour assumptions for new construction projects.
5. Include more specific guidance on the calculation of savings for efficient air compressors.

See [Energy Conscious Blueprint Impact and Process Evaluation](#)

## SECTION 2: ONGOING STUDIES

### CL&P HOME ENERGY REPORT (HER) PROCESS AND IMPACT EVALUATION

NMR GROUP, \$252,700

The CL&P HER program is a multiyear pilot behavioral awareness program, proprietary to OPower. In this Pilot, customers were randomly selected to be part of either a treatment group (participants) or a control group (non-participants). Participants receive an energy report, either monthly or quarterly, describing the customer's energy usage compared to those of households with similar characteristics within a 2-mile radius. The report provides suggested actions participants can take to improve their ratings. The recommendations may include suggestions to replace inefficient appliances, alter how equipment is used, or participate in other EEF programs. A third participant group was been designated to stop receiving energy reports after 8 months, to test whether behavior changes persist after reminders cease.

The multiyear study will assess direct impacts of the program and determine strengths and weaknesses of its operations.

The goals of the study are to determine:

- Savings accruing to customers over the course of the pilot
- Actions customers take to achieve those savings
- Types of messages and ways of communicating those messages that are most likely to result in significant savings
- Whether customers continue social marketing after they are no longer reminded to do so
- Extent customers in the persistence group maintain program-induced savings when they no longer receive energy reports.

An initial process assessment has been completed and will be repeated later in the experiment. The impact assessment uses statistical techniques to relate billing data with customer characteristics, savings recommendations and the actions of the non-participant group to determine overall savings. Initial impact results for the spring and summer quarters will be completed near the beginning of November, 2011. The Persistence Assessment begins in October, 2011 with initial analysis in January 2012 and completion at least 6 months later.

### UI HOME ENERGY REPORT (HER) MARKET EVALUATION

NMR Group, \$78,030

UI's HERs program is a pilot behavioral awareness program, proprietary to OPower. In this pilot, customers were randomly selected to be part of either a treatment group (participants) or a control group (non-participants). Participants receive an energy report, either monthly or quarterly, describing the customer's energy usage and comparing it with those of households with similar characteristics within a 2-mile radius. The report provides suggested actions to improve their ratings. The recommendations may include suggestions to replace inefficient appliances, alter how equipment is used, or participate in other EEF programs.

The original expectation was for a single evaluation of both UI and CL&P's programs. However, UI decided to pursue a different model for its pilot. UI's main evaluation goals are to determine:

- Messages and message delivery vehicles, alone and in combination, that are most effective in producing energy efficiency actions among participants
- Participant use of the web interface including whether they find it to be easy to access, informative, and attractive
- Changes in knowledge, attitudes, and reported actions among participants as compared to non-participants
- Barriers to additional, more substantial energy efficiency behaviors - the extent to which participation in the pilot induces participation in other EEF programs
- Participant satisfaction with specific aspects of the program and the overall program Frequency and reasons for program drop-outs, including passive dropouts

This study is a Market Assessment. Market Assessments examine market conditions and ascertain the extent to which efficiency programs are likely to influence customer adoption of measures and practices. Careful market assessments are conducted to identify effective ways to influence key market players to take efficiency actions and to increase the breadth and depth of the actions taken.

For this study, NMR is using surveys and focus groups to assess customer reaction to and satisfaction with the program. Currently, the initial survey is complete and NMR has analyzed the results. Focus groups will begin shortly. Study completion date is March of 2012.

## RESIDENTIAL NEW CONSTRUCTION BASELINE

KEMA, \$209,800

The Residential New Construction Baseline project is being completed in cooperation with an effort begun in Massachusetts. Baseline studies provide direct impact support by assessing conditions that will no longer be measureable after program interventions have occurred.

While there are many common tasks across the various participating states, each state was able to select those activities important to them. Connecticut is focusing on an assessment of the extent to which:

- Non-program new residential construction meets current building codes;
- Customers seek out opportunities to select efficient systems; and
- Builders are making those opportunities available.

For this study, KEMA is conducting on-site inspections, checking appliance efficiencies, and providing direct measurement on 70 newly constructed homes. Homes in the sample are newly constructed, with building completion during 2010 and were not built through participation in the Companies' Residential New Construction (RNC) program. In addition to assessing non program-related construction efficiency in Connecticut, the EEB and Companies will to access additional information that will come through sharing data with the other participating states.

Inspection and measurement at non-program, newly-constructed homes are now complete. NMR is now analyzing the data to determine a reasonable baseline for new construction in Connecticut. The draft report is expected prior to the end of November, 2011.

## IMPACT EVALUATION OF THE OPERATIONS AND MAINTENANCE (O&M) SERVICES/RETROCOMMISSIONING (RCx) PROGRAM AND BUSINESS SUSTAINABILITY CHALLENGE (BSC) INITIAL IMPACT ASSESSMENT

MICHAELS ENERGY, \$375,000

The O&M Services program offers electric and natural gas incentives for C&I customers to improve operation and maintenance of their facilities to make them more energy efficient. RCx and BSC are both parts of the O&M Services program. The electric and natural gas Companies provide O&M evaluations and recommendations upon request, with the C&I customer being responsible for implementing the O&M improvements. Examples of such improvements include, but are not limited to, compressed-air system leak studies and repairs; retro-commissioning, additions, corrections, repairs to building management system control components. software programming to maximize operational efficiency, and system modifications to optimize performance.

The RCx program conducts an in-depth investigation of a facility's systems operations, focusing on integrating more efficient and effective instructions for the building management systems. The main objective of RCx is to find low-cost/no cost, non-capital, energy-efficient measures that will quickly and effectively result in energy savings for the building owner or tenant. The program targets Connecticut's larger C&I facilities, and the large institutional segments.

One of the primary components of the program's move toward helping customer take the lead in setting goals and managing actualization is the Business Sustainability Challenge (BSC). Initiated as a pilot in 2008, the BSC training and educational initiative provides an opportunity for customers to not only address their energy-management practices and investments, but also their long-term social, environmental and economic sustainability objectives through formal and informal education, plan development and implementation, and continuous improvement practices. The BSC trains, and educates medium-size to larger customers to integrate sustainability into their business practices and manage energy, carbon, waste and water resources.

The Companies offer different versions of BSC. CL&P offers a classroom approach and UI provides information to a smaller number of customers in more interactive cohorts. While the approaches differ, both follow the steps outlined below, using shared tools and resources:

- Obtain a commitment.
- Assess performance and set goals.
- Create a plan.
- Implement the plan.
- Evaluate the plan's progress.
- Recognize achievements.

- Re-assess the process.

This impact study focuses on engineering approaches. It will provide savings data to quantify savings benefits, including avoided capacity and energy costs resulting from energy savings during seasonal and on/off-peak periods, of efficient measures and processes developed in C&I facilities through the RCx/O&M Services programs. Because operations adjustments may not be maintained, persistence is a particular concern for this study. This study will inform the evolution of the program through BSC. For BSC, this project will examine the impacts made and the assistance C&I customers need to develop a culture of efficiency improvements. The study will use interview approaches to determine the extent to which participants have established attributes and practices that provide for culture change and long-run savings. The extent to which participating C&I customers have established savings metrics and completed benchmark analysis is an important component of the study.

Since many measures are weather sensitive, both winter and summer seasons must be incorporated into the study. The project will collect data through March of 2012 and will be complete mid-year 2012.

## SECTION 3: STUDIES IN DEVELOPMENT

The studies in this section are all part of a new research area approach to contracting for evaluation services. The research area approach selects a team of contractors to provide services for all studies in a particular area over a long period of time. In Connecticut's case, there are currently five research areas offering a breadth of studies over a three year period.

The approach has a number of advantages for EEF and the study contractors. It provides a degree of certainty that studies will be completed and work on studies will be available, but neither part is guaranteed. If a contractor is not performing, it will no longer be assigned work. Contractors may also decide to discontinue the relationship. Neither EEF nor a contractor has to spend the two month process typical for a Request for Proposal.

Contracting issues are greatly shortened; after the initial terms of a master services agreement are agreed to, new studies need only be assigned. Price certainty is also enhanced; contractors commit to a set of hourly rates that may grow on an agreed upon schedule, but cannot otherwise be raised.

The research area approach also allows increased flexibility. As new imperatives arise, a new study may be substituted for an existing one – even for a study currently in progress. Studies can be broken into several parts each with distinct time lines. A current example is the EISA study, which was separated into three projects, one of which is complete while others are not yet started.

The research areas and studies within each are described below.

### RESIDENTIAL RETROFIT AND RETAIL PRODUCTS/RESIDENTIAL NEW CONSTRUCTION AND EMERGING MEASURES RESEARCH AREAS

These two research areas have been combined for convenience because a single lead contractor was selected for both. The NMR Team (NMR Group, KEMA, Cadmus Group and Tetra Tech for Res Retrofit and NMR Group, KEMA, Cadmus Group and Dorothy Conant for Res New Construction) will share task and project responsibilities as suit each situation.

### EFFECTS OF EISA LIGHTING REQUIREMENTS ON RESIDENTIAL PROGRAMS

The EISA FOCUS GROUP component of this study was outlined as a completed study in Section 1.

#### RESIDENTIAL LIGHTING SATURATION

Completion of this study is required by the Public Utilities Regulatory Authority (PURA).. The study will examine the numbers and locations of common and specialty efficient lighting products to determine the extent substantial direct market intervention continues to be needed. NMR has provided a draft scope of work and will begin the study.

#### ASSESSMENT OF LIGHTING MARKETS

The next part of this project will employ survey and interview techniques with customers and vendors to further assess what program options are important and viable as the markets for lighting products change.

## RESIDENTIAL MEASURE PERSISTENCE

This study is intended to examine persistence (time still in service) for measures installed in (1) HES and (2) HES Income-Eligible. The most recent study on this topic was undertaken in 2007. Beyond the age of the existing information, the need for this study was made evident with the completion of the 2010 WRAP/UI Helps Impact Evaluation. That study found evidence that existing estimates developed for HES poorly matched what was found in limited income homes.

The Contractor is writing the scope of work for this project and developing data requirements both for development of the scope and completion of the study.

## EFFICIENCY OPPORTUNITIES IN MULTIFAMILY

This market assessment and feasibility study will assess ways to reach and deepen multifamily efficiency options. The study will include site visits to assess common apartment configurations and efficient equipment saturation. The study will also examine barriers to implementation including conflicting incentives for landlords and tenants and payback requirements. This study has not yet begun.

## GROUND SOURCE HEAT PUMP STUDY

CL&P estimates they have helped install, or have in the pipeline, upwards of a 1,000 units; UI has a lesser number. This study will entail working with CEFIA to do an impact analysis for HVAC and water heating applications and carbon impact analyses. Currently, the Contractor is revising the Scope of Work to take into account additional information about the technology.

## EARLY REPLACEMENT OF GAS WATER HEATER/ FEASIBILITY OF ON-DEMAND UNITS

This study will be a market assessment study to examine the feasibility and likely cost efficiency of encouraging early replacement of inefficient gas water heaters and especially the benefits and costs of replacing these units with on-demand water heaters. Little work has been completed to date.

## EARLY REPLACEMENT OF ELECTRIC RESISTANCE WATER HEATER WITH HEAT PUMP WATER HEATERS

This will be a market assessment study to examine the feasibility and likely cost efficiency of encouraging early replacement of inefficient gas water heaters and the benefits and costs of replacing these units with on-demand water heaters. This project is in beginning stages.

## CROSS SECTOR STUDIES AREA

### ASSESSMENT OF THE 2012 PROGRAM SAVINGS DOCUMENT (PSD)

The result of the study will be a proposed next edition of the PSD. Additionally, the study will recommend new or additional studies needed to support Connecticut-based inputs to the PSD. The Scope of work is complete. Expected completion is January 2012

## **FREE RIDER & SPILLOVER (FR/SO) STUDY IN C&I PROGRAMS \$178,400**

This study had originally been proposed to start in 2012. However, Tetra Tech completed the last FR/SO study and did an excellent job. Contracting with them for this study allows for a consistent methodology to be employed. The SOW is now completed and is being formatted for UI's purchase order procedures. Completion date is expected to be April 2012.

## **REMAINING OPPORTUNITIES IN C&I LIGHTING**

This study is a market study to examine where remaining opportunities exist for efficient lighting. In addition to examining particular technologies, the study will examine the extent to which program barriers affect capture of these opportunities within individual customer types. As an initial stage, Tetra Tech will complete an assessment of lighting installations through all EEF C&I programs over the last five years. This activity will provide market intelligence into customer sectors and lighting technologies that are well-developed in the programs, as well as sectors and technologies that are under-represented. The project scope of work is under development.

## **SMALL C&I RESEARCH AREA**

### **IMPACT EVALUATION OF SMALL BUSINESS ENERGY ASSISTANCE PROGRAM (SBEA)**

An SBEA program impact evaluation was completed in 2009. In many program areas, it provided good impact values and collected large amounts of information on lighting and lighting controls. However, additional information on impacts from air-conditioning and refrigeration measures need to be collected as those areas were largely missed in the random sampling process.

The current impact evaluation will employ both billing and engineering approaches. Information from the two approaches will be combined to develop a coherent measurement of savings derived for the measures provided and from the program as a whole.

The scope of work for this study is in draft.

## SECTION 4: REGIONAL EM&V FORUM – 2010-2011

VARIOUS CONTRACTORS, \$166,400

### COMMERCIAL LIGHTING LOADSHAPE ESTIMATION – CONTINUED FROM 2010

This project involves the creation of a spreadsheet tool that can be used by members of the Regional EM&V Forum to calculate and quantify the hourly savings of efficient lighting measures installed at Commercial and Industrial facilities. The tool will generate 8760 commercial/industrial lighting load shapes (largely from secondary sources). KEMA was selected to complete the study. Assembling the available data is nearly complete, and the spreadsheet tool design is being coordinated with the Unitary HVAC study. This project is proceeding at a slower pace than originally anticipated, but it is now at a point where the majority of the data has been collected, and KEMA can estimate the schedule for the next steps with more certainty. KEMA has completed almost 75% of the on-sites needed for the study. KEMA intends to complete up to 66 more projects, of which 10 are already in the pipeline.

See [Commercial Lighting Loadshape](#)

### LOAD SHAPE ESTIMATION: HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

The objective of the study is the development of Unitary HVAC load factor data for every hour of the calendar year. The annual load shape data is adaptable to different program participant populations located within the service territories of Forum members; load shape data is weather-normalized in order to provide for calculation of aggregate load shapes reflecting weather conditions of different program administrator customer populations.

KEMA has collected and analyzed data from its metering effort and completed modeling tasks. It also developed the spreadsheet tool which was tested by a small subset of the subcommittee late last year. The Final Report was provided June 13, 2011. Additional loadshape studies are under consideration for 2012. The short list includes: Residential lighting (CFLs or CFLs and LEDs); Commercial LEDs; Commercial Refrigeration; and Data Centers.

See [Unitary HVAC Loadshape Estimation](#)

### C&I LIGHTING: MEASURE PERSISTENCE OF SAVINGS – CONTINUED FROM 2009/2010

The purpose of the study was to develop up-to-date impact parameters describing lighting measure persistence, *i.e.*, in place and operating over 5+ years based on field and survey samples. It also developed equipment life estimates from secondary sources (manufacturer reports). The value of this project to sponsors is that commercial lighting is the largest source of savings for most energy efficiency providers in the region. Multi-year persistence lends itself to regional study because the research is difficult, expensive and measures are consistent across locations.

KEMA developed the sample design for this project, based on data collected from EM&V Forum members in New England and New York. The results of this project deliver measure life estimates developed from models informed by primary data collected from programs in existence and measures installed for many years. The final report was provided on June 29, 2011.

See [Commercial Lighting Measure Persistence Study](#)

## COMMON EM&V METHODS AND SAVINGS ASSUMPTIONS – EMERGING TECHNOLOGIES

For 2011, development of common methods to evaluate and savings assumptions for PSD usage focuses on emerging technologies and the programs offering them. The project focus on developing common EM&V methods for emerging technologies and program designs (whole building single family and multifamily programs and programs addressing commercial lighting design). The initial list of technologies to examine includes: commercial lighting design programs, solid state lighting/LEDs (fixtures & screw-ins for residential and commercial); and Advanced/smart power strips.

See [Methods and Savings Assumptions](#)

## COMMON ENERGY EFFICIENCY REPORTING TOOL

The overall purpose of this study is to address growing interest in consistent reporting of electric and natural gas energy-efficiency program savings, costs and emission impacts across states in the region to help inform multiple energy and environmental policies, including:

- Climate change goals and air quality emission reductions, and associated planning;
- State procurement policies, energy-efficiency savings and associated economic goals; and
- Regional energy planning and forecasting purposes.

In 2010, NMR produced a set of guidelines. NEEP is incorporating revisions and definitions to the draft Guidelines with guidance from lead subcommittee members. Implementation of these guidelines is the focus in 2011.

See [Common Energy Efficiency Reporting Guidelines](#)

## INCREMENTAL COST STUDY (ICS) - CONTINUED FROM 2010

The objective of this Project is to develop incremental cost assumptions for a variety of efficiency measures. Navigant is the contractor selected for this project. The Incremental Cost Study is now complete, and the final report is posted to the Forum's Products and Guidelines webpage. This study determined the cost of material/equipment for baseline and efficient measures, the cost of baseline labor and, where appropriate, incremental costs of labor. The final report provides incremental cost results and describes the methods Navigant Consulting, the project contractor, employed to investigate and update incremental costs for a number of common energy efficiency measures.

The Incremental Cost project subcommittee is refining options for follow-on Incremental Cost research. It is considering options that can use the remainder of the 2010 Incremental Cost Study budget allocation and possibly 2011 Add-On Research funds, as well as options that may be included in the 2012 Forum agenda. The subcommittee has expressed support for sole sourcing this work to Navigant Consulting due to the cost and other advantages of leveraging Navigant's experience with the Incremental Cost Study. The Forum is currently considering additional measures to be included in this continuation.

See [Incremental Cost](#)