Final Report:

The New Hampshire Electric Utilities' Low-income Retrofit Program – Impact Evaluation

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by

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EXECUTIVE SUMMARY

The Low-income Retrofit Program (marketed as the Home Energy Assistance Program) began on June 1, 2002, following approval from the New Hampshire Public Utility Commission (NHPUC) on May 30, 2002. This program is designed to help income-qualified customers manage their energy use and reduce their burden. The program is collaboratively implemented across governmental and community organizations. Community Action Agencies (CAAs) are charged with determining program eligibility through income levels and number of household members. Customers served by CAAs may be eligible for additional Department of Energy Weatherization Assistance (Wx) funding.

The program process includes customer intake, scheduling and performance of the audit, post-installation quality control (QC) activities (performed on 10% of participants), and job close out activities. The program offers improvements such as insulation, air sealing, thermostat replacement, electric hot water conservation measures, cost-effective appliance and lighting upgrades, and appropriate health and safety measures. The program also has a strong educational component that is designed to help low-income customers better understand their home and the factors that affect energy use. The program is coordinated closely with the Electric Assistance Program (EAP) in order to identify eligible customers.

The program is open to both single and multi-family households, regardless of heating fuel type. NH Utility personnel administer the program and contract out the delivery of program services.

Opinion Dynamics Corporation (ODC), along with GDS Associates, was hired by the NH Utilities to conduct an impact and process evaluation of the Home Energy Assistance Program. We evaluated the Home Energy Assistance Program in the service territories of Public Service of New Hampshire (PSNH), Unitil Energy Systems, Inc. (Unitil), New Hampshire Electric Cooperative Inc. (NHEC) and Granite State Electric Company (GSECO).

The six main objectives of the evaluation are:

- Determine total annual energy savings from the program;
- Explain reasons for discrepancies between each utility's tracked and verified savings;
- Review the systems and methodology currently employed;
- Review and verify electric and non-electric program savings estimates;
- Differentiate evaluated savings by utility service area;
- Identify other opportunities to improve household energy efficiency.

In support of this effort, the ODC team conducted the following data collection activities:

- In-depth interviews with utility program managers, Community Action Agencies (CAAs), and Action, Inc., a CAA located in Massachusetts which operates a similar program;
- "Ride-Alongs" with the Quality Control (QC) Contractor;
- Telephone survey with participating customers;
- In-depth interviews with participating property managers;
- On-site visits to participants' homes;
- Detailed review of energy savings calculations;

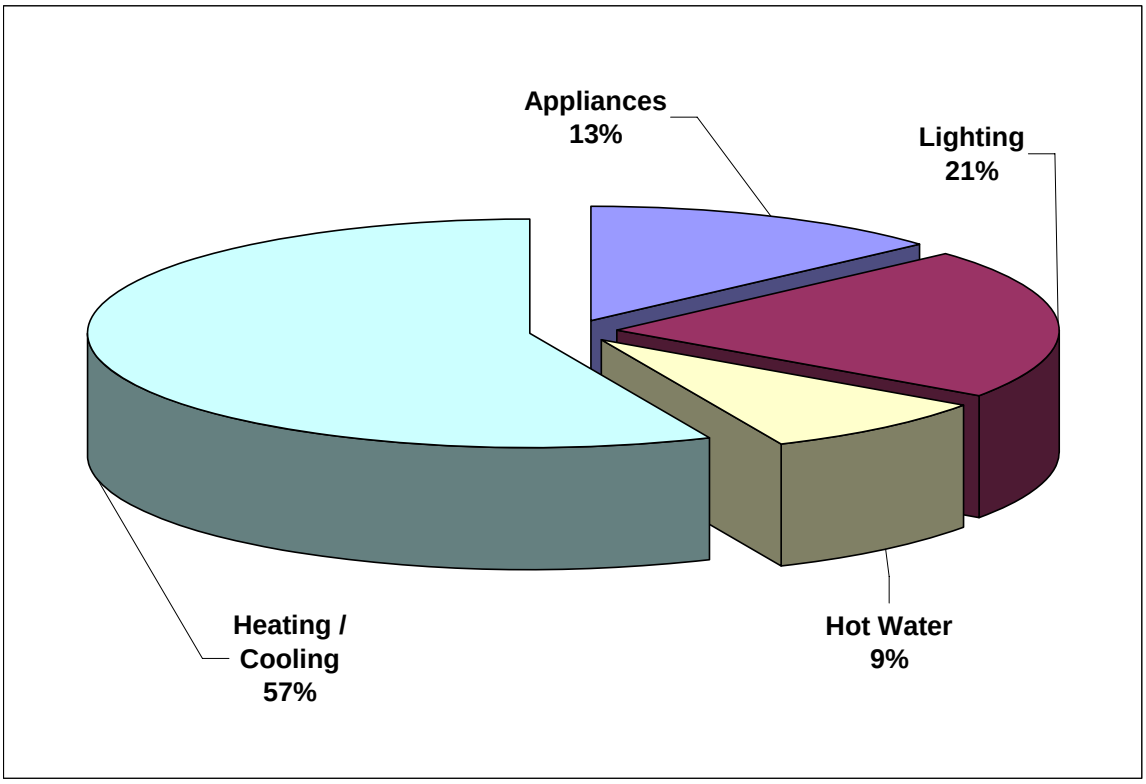
- Billing analysis.

Interviews were conducted with six utility program administrators (PAs) representing the four New Hampshire utilities, six CAAs, two representatives from Action Inc, the QC contractor and six multi-family property managers. We also spoke with 116 program participants regarding their prior knowledge of the HEA program, the benefits of the program, and their satisfaction with the program. An additional short survey was conducted in September with 86 of the original 116 respondents. Twenty-two (22) site surveys were conducted to gather information concerning quality of installation, retention of measures and satisfaction.

Program Impact Findings

To verify the program's annual energy savings, the ODC Team, led by GDS Associates, used information gathered through the data collection methods listed above, as they conducted an engineering review and electric billing analysis. In order to provide context for the findings, Figure ES-1 shows the breakdown of energy savings by measure type for the HEA program.

Figure ES-1 Breakdown of Electric Savings for HEA Program

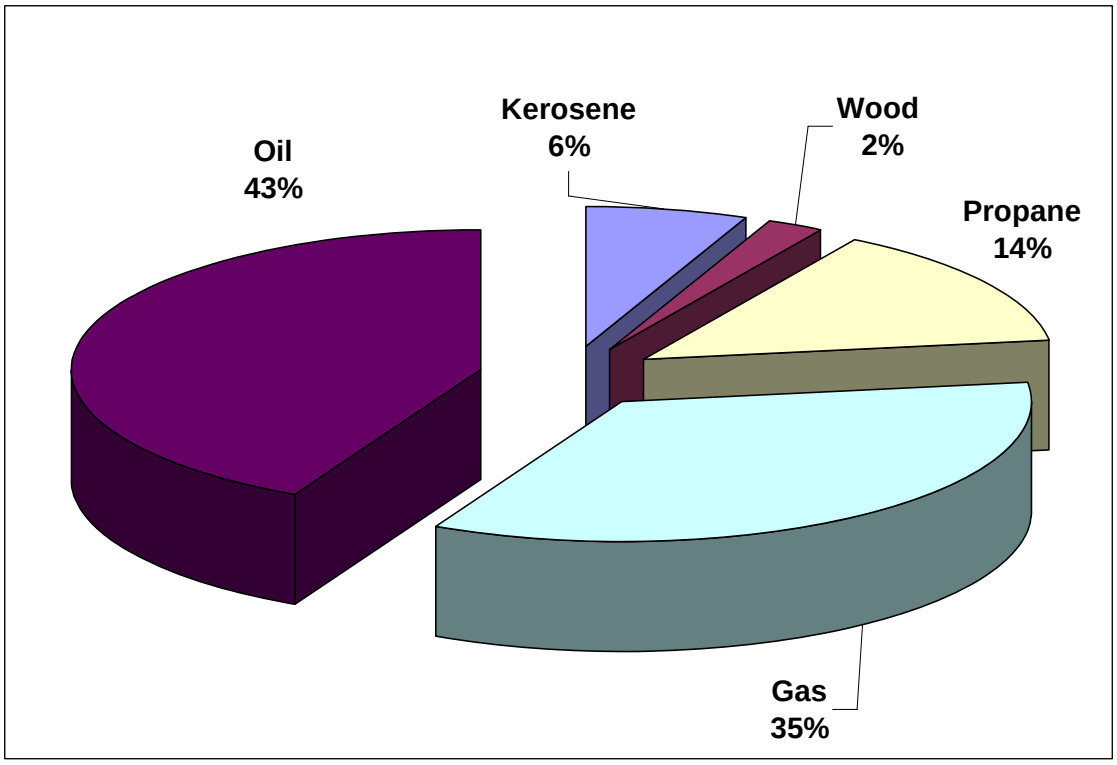


Realization rates associated with electric and fossil fuel savings for the HEA Program were calculated using the billing analysis and the engineering review. For the savings associated with fossil fuels, realization rates were estimated only through the comprehensive engineering review of reported savings, as a billing analysis was not conducted on the fossil fuel savings.[1] Figure

[1] Gas billing data was provided by Northern Utilities and KeySpan Energy Delivery at the request of PSNH and a billing analysis was attempted. However, statistically valid results could not be achieved.

ES-2 shows the breakdown of non-electric savings by fuel type for the HEA Program. The realization rates for electric and fossil fuel savings are displayed in Table ES-1 (page 6).

Figure ES-2 Breakdown of Non-Electric Savings by Fuel Type for HEA Program



There are important differences between the savings as evaluated using a billing analysis versus using an engineering review, which are summarized below:

Billing Analysis Attributes

- Encompasses entire program population
- Includes all electric use, including interactivity among measures
- Accounts for participants' behavior
- Does not offer measure-level detail
- Difficult to account for non-program changes in electric consumption (i.e., new appliances, more or less occupants, renovations, etc.)
- Does not indicate the factors underlying the realization rate.

Engineering Review Attributes

- Allows for measure-level detail
- Bases on site observations, telephone surveys, and standard engineering calculations
- Includes electric and fossil fuel measures, including interactivity among measures
- Provides good insights into program
- Limited number of site visits so that site-specific issues often cannot be extrapolated to entire program population
- Does not fully capture participant behaviors

Table ES-1 Realization Rates for the Home Energy Assistance Program

Service Territory		Net Estimates of Annual Savings		
		Billing Analysis Electric (kWh)	Engineering Review Electric (kWh)	Engineering Review Non-Electric (MMBTU)
PSNH	As Reported	2,417,513	2,417,513	8,952
	Realization Rate	63.0%	86.2%	98.2%
	Error Bound	4.2%	-	-
	As Evaluated	1,523,033	2,084,696	8,794
Until	As Reported	289,624	289,624	3,014
	Realization Rate	59.7%	91.2%	97.6%
	Error Bound	8.5%		
	As Evaluated	172,906	264,010	2,941
NHEC	As Reported	131,392	131,392	1,333
	Realization Rate	89.3%	88.8%	98.0%
	Error Bound	17.2%		
	As Evaluated	117,333	116,555	1,307
GSE	As Reported	62,410	62,410	1,203
	Realization Rate	91.1%	87.7%	99.8%
	Error Bound	51.6%		
	As Evaluated	56,856	54,712	1,189
NH Statewide	As Reported	2,900,939	2,900,939	14,503
	Realization Rate	64.5%	86.9%	98.1%
	Error Bound	6.2%		
	As Evaluated	1,871,106	2,519,972	14,234

Table ES-2 includes the electric realization rates as estimated through the billing analysis, including the upper and lower bounds at the 90% confidence level. Figure ES-3 shows this data graphically along with the realization rates resulting from the engineering review. Tables ES-3 and ES-4, on the following pages, illustrate the realization rates resulting from the engineering review. Further discussion of the strengths and weaknesses of the billing analysis versus the engineering review are included after the tables.

Table ES-2 Electric Realization Rates from Billing Analysis

90%	Lower	Base	Upper
PSNH	58.9%	63.0%	67.2%
Unitil	51.2%	59.7%	68.2%
NHEC	72.2%	89.3%	106.5%
GSE	39.5%	91.1%	142.7%

Figure ES-3 Electric Realization Rates from Billing Analysis and Engineering Review

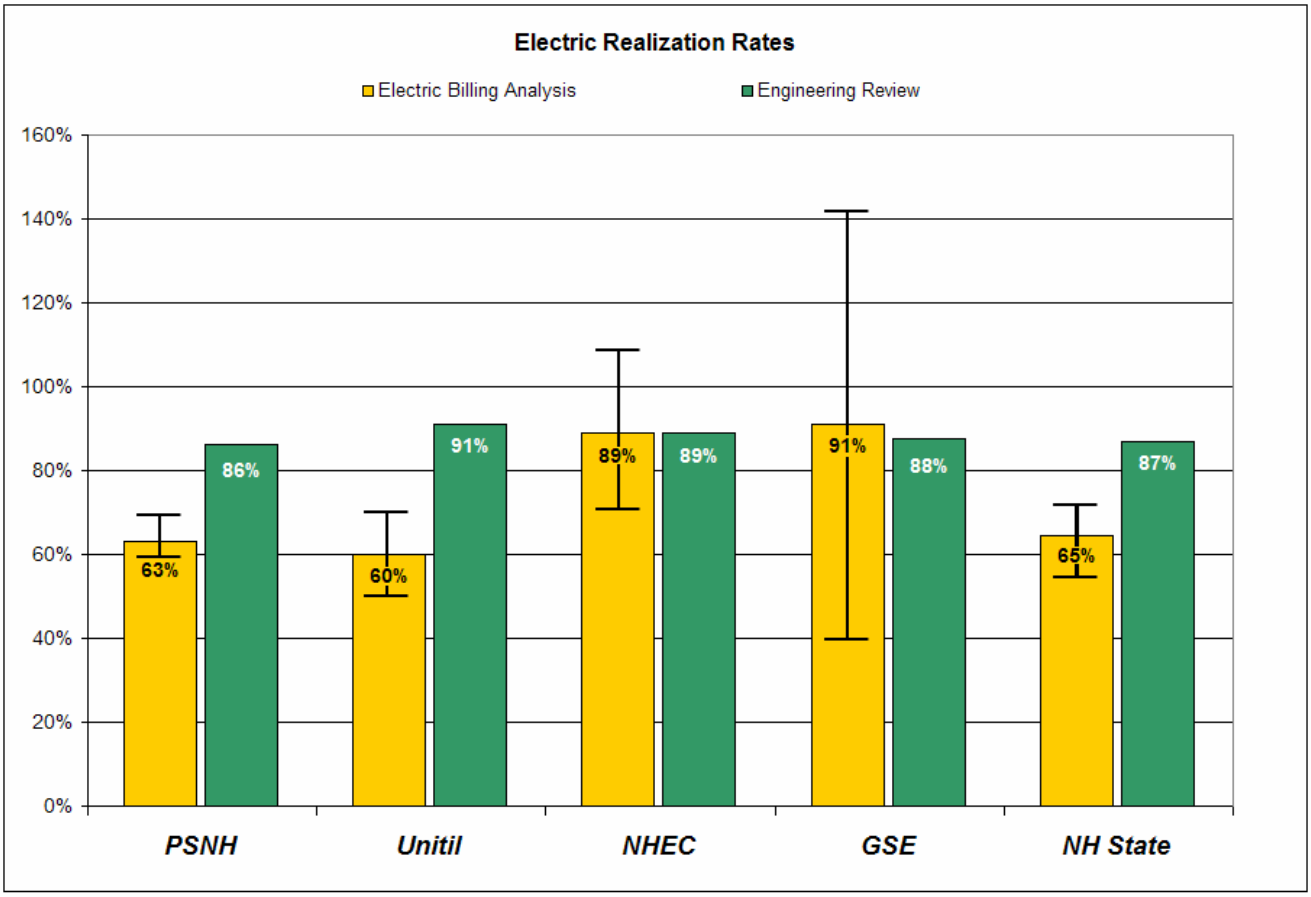


Table ES-3 Electric Savings Realization Rates based on Engineering Review

	Program Savings (kWh)	Retention Rate[2]	Adjusted Savings	Engineering Adjustment	Gross Savings (kWh)
PSNH					
- Lighting	409,280	80%	328,007	100%	328,007
- Refrigeration	287,767	100%	287,767	100%	287,767
- Water Heating	178,888	80%	142,715	100%	142,519
- Heating & Shell	1,541,578	98%	1,518,063	87%	1,326,402
PSNH Adjustment Rate					*86.2%*
Unitil					
- Lighting	135,983	89%	121,373	100%	121,373
- Refrigeration	43,199	100%	43,199	100%	43,199
- Water Heating	42,422	87%	37,109	100%	37,074
- Heating & Shell	68,020	99%	67,116	93%	62,364
Unitil Adjustment Rate					*91.2%*
NH Electric Coop					
- Lighting	46,344	80%	37,179	100%	37,179
- Refrigeration	38,826	100%	38,826	100%	38,826
- Water Heating	19,400	81%	15,846	100%	15,781
- Heating & Shell	26,822	99%	26,494	93%	24,769
NHEC Adjustment Rate					*88.7%*
Granite State Electric					
- Lighting	28,865	78%	22,531	100%	22,531
- Refrigeration	19,613	100%	19,613	100%	19,613
- Water Heating	8,449	84%	7,092	100%	7,085
- Heating & Shell	5,483	100%	5,483	100%	5,483
GSE Adjustment Rate					*87.7%*
Total Program Savings	**2,900,939**	**93.7%**	**2,718,110**	**92.7%**	**2,519,972**
% of Initial Savings	**100.0%**		**93.7%**		**86.9%**

* Note: Engineering adjustments to Heating & Shell measures include site-specific findings from site visits.

[2] Retention rates were calculated using a weighted average of the measure retention findings from the telephone and site surveys. The weighting used for all measures was 80% for the telephone survey results and 20% for site survey results due to the larger sample size in the telephone survey. However, for CFLs, a 60% weighting was attributed to the site surveys for reasons explained in Section 2.2.

Table ES-4 Fossil Fuel Realization Rates based on Engineering Review

	Program Savings (MMBTU)	Retention Rate	Adjusted Savings	Engineering Adjustment	Gross Savings (MMBTU)
PSNH					
- Lighting	0	NA	0	NA	0
- Refrigeration	0	NA	0	NA	0
- Water Heating	663	74%	489	100%	489
- Heating & Shell	8,289	100%	8,254	101%	8,305
PSNH Adjustment Rate					*98.2%*
Unitil					
- Lighting	0	NA	0	NA	0
- Refrigeration	0	NA	0	NA	0
- Water Heating	260	88%	229	100%	229
- Heating & Shell	2,755	100%	2,748	99%	2,713
Unitil Adjustment Rate					*97.6%*
NH Electric Coop					
- Lighting	0	NA	0	NA	0
- Refrigeration	0	NA	0	NA	0
- Water Heating	-6	124%	(8)	100%	-8
- Heating & Shell	1,339	100%	1,335	98%	1,315
NHEC Adjustment Rate					*98.0%*
Granite State Electric					
- Lighting	0	NA	0	NA	0
- Refrigeration	0	NA	0	NA	0
- Water Heating	66	78%	52	100%	52
- Heating & Shell	1,137	100%	1,137	100%	1,137
GSE Adjustment Rate					*98.8%*
Total Program Savings	**14,503**	**98.2%**	**14,236**	**100.0%**	**14,234**
% of Initial Savings	**100.0%**		**98.2%**		**98.1%**

* Note: Engineering adjustments to Heating & Shell measures include site-specific findings from site visits.

While the electric billing analysis yielded statistically valid results that are partially explained by the engineering review, it is important to note that there are many uncertainties in estimating the *actual* savings associated with this comprehensive energy efficiency program. Based on the engineering review, site inspections, and cursory review of natural gas billing data, the primary drivers of the lower electric realization rates are as follows:

1. The 71% retention rate of compact fluorescent (CFL) bulbs due to hours of use assumptions which may be overstated in some cases.
2. The energy saving features of electronic programmable thermostats (i.e., setting back temperatures) do not appear to be used by a large percentage of participants. The telephone survey indicates that 70 percent of participants do not set back their thermostats and, based on the site inspection findings, this value could be lower.
3. Electronic thermostats are being installed to control electric heating that is used as a backup to fossil-fueled systems. This was witnessed at one multi-family development that included thirty-two units and two other single-family sites.
4. Electric savings have been estimated for thermal measures where savings are actually being realized by fossil fuel systems. This was found to be the case for sixteen multi-family units and was also indicated by a cursory review of gas billing data that was conducted (see the Billing Analysis section for details).
5. While TREAT (Targeted Residential Energy Analysis Tool) is a comprehensive and powerful residential modeling program, the estimated savings are based on auditor inputs, which may be erroneous in some cases due to data entry errors and/or an auditor's attempt to get measures to pass (as described in more detail later in this report).
6. Two of the four participants surveyed with multiple heating fuels in their homes stated that they use their electric heat more since participating in the program. While the two participants would not likely have a sizable impact on overall results, this may indicate a larger trend.

Participant Impacts Findings

Interviews were conducted with five utility program administrators (PAs) (representing four utilities), six community action agencies (CAAs), and two representatives from Action, Inc., the QC contractor, six multi-family property managers and 116 program participants.

Both the PAs and CAAs are well aware of the programs goals and objectives. All the CAAs acknowledge that the utilities' goals are to reduce the energy burden and associated costs to low-income customers by helping them to lower their energy use. Most CAAs said the HEA program supports their organizations' goals well.

Prioritization of customers appears to be a source of frustration between the utilities and the weatherization agencies, which each have different objectives to meet. This issue of different prioritization was mentioned by all the CAAs, and for some, seems to be a major issue. The CAAs say they have plenty of customers to whom they provide the services of the HEA program, but they may not be electric heat customers. The PAs try to seek out and enroll those customers that have electric heat, yet have not yet participated, or those that have high energy usage are on the Electric Assistance Program (EAP).

The TREAT and OTTER software packages play a large part in how this program is implemented and tracked. While some PAs like the software system because it simplifies billing, is easy to get reports from, and is easy to monitor production, a few thought it was very complex and difficult for auditors to use. All of the CAAs have used TREAT and OTTER and all reported that they were time-consuming and the learning curve was steep. Some questioned the accuracy of the savings estimates produced by TREAT and reported in OTTER[3].

Lost opportunities mentioned by CAAs and the QC Contractor includes base load measures in non-electrically heated homes, health and safety measures, foundation wall insulation, and basement insulation. Some CAAs said they would not go to a home just to do a base load audit[4]. This situation can occur when the home is in a service territory that does not allow shell measures to be installed on non-electrically heated homes, and the CAA is unable to use other funding sources for this client.

Most participants were satisfied with the overall program, with 80% rating their satisfaction as a 5,6 or 7 on a 7-point scale, where 7 means *very satisfied*. Property managers indicated that they were also satisfied with the program and very appreciative of all that the program offered.

Satisfaction among participants varied based on specific parts of the audit process (Table ES-5) and measures installed (Table ES-6). While customer savings perceptions were surveyed, these responses were not matched one-on-one with installed measures and therefore it was not possible to compare customer perceptions with actual bill impacts.

[3] As discussed in Section 3 of this study, TREAT has been reviewed and was found to provide reasonable savings estimates. However, accuracy in any modeling software is highly dependent on the expertise of the auditor.

[4] Base load audit refers to audits that are conducted on non-electrically heated homes where the focus is on electric measures such as lighting and refrigeration.

Table ES-5 Satisfaction with Audit Process
(percentage rating a 5, 6 or 7 on a 7-point satisfaction scale)

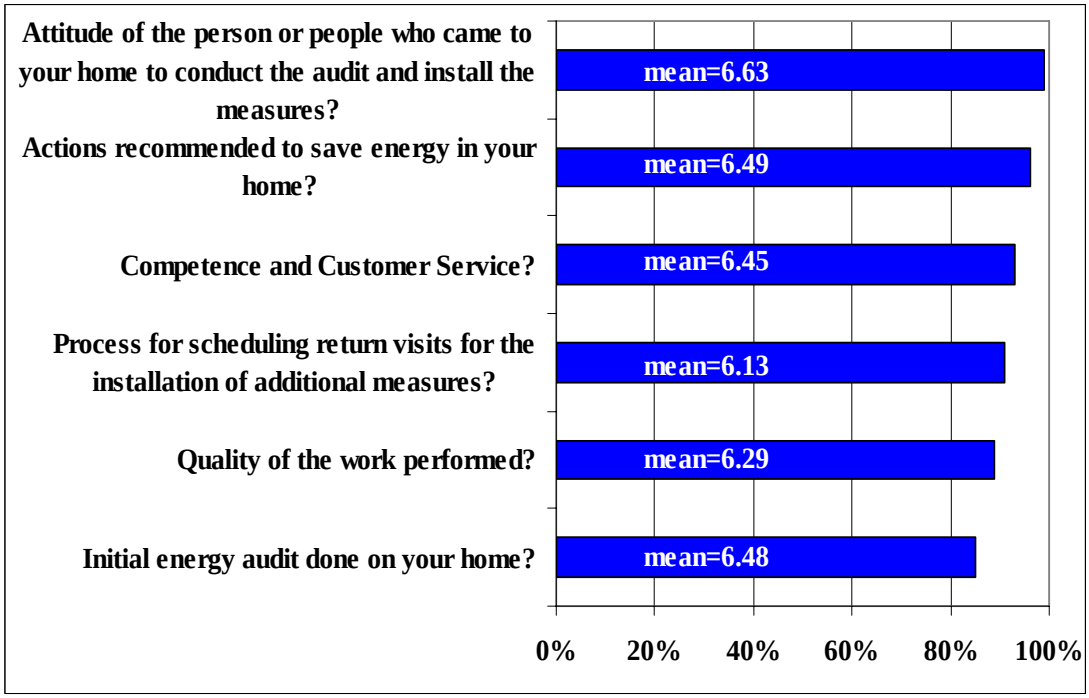
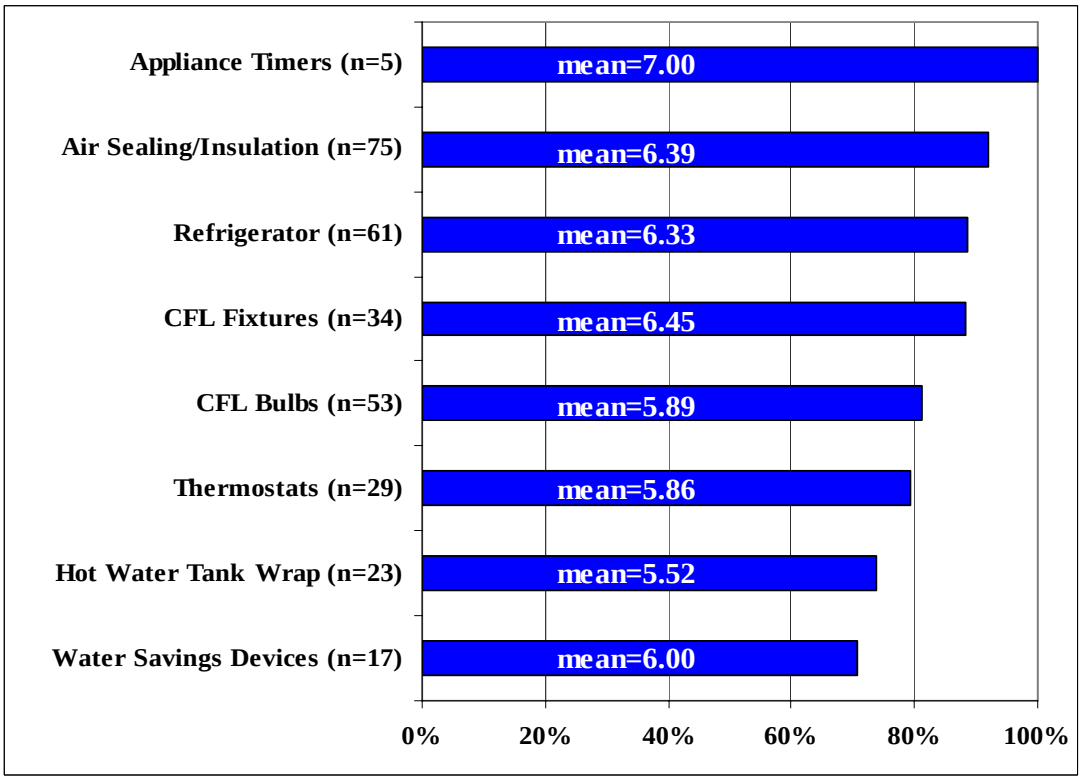


Table ES-6 Satisfaction with Measures
(percentage rating a 5, 6 or 7 on a 7-point satisfaction scale)



Although the program includes a large educational component, some program administrators do not feel education is emphasized enough in the actual program implementation. The telephone survey of participants shows that a high percentage of them will follow the field representatives' recommendations for saving energy, but the survey also shows that less than half of the respondents recall the field representative explaining the importance of most recommendations.

Recommendations

Based on the research mentioned above, we offer the following recommendations:

- To improve CFL retention, promote more selective installation of CFL's, especially in elderly units. For example, in elderly customer's homes, the preferences of the customer should be solicited (i.e., are they interested in new lighting) and also higher wattage CFL's should be considered as low light levels are a common complaint among the elderly;
- For electronic thermostats, install non-programmable models with large, simple displays and selectively install programmable thermostats where participants request them. The savings will be lower, but should be enough to keep thermostats as a measure in the program, given their relatively low cost;
- Consider a calibrated engineering approach for the next impact evaluation. This approach may be a more expensive option, but is better suited to the unique issues encountered with a comprehensive program like HEA. Calibrated engineering would involve comprehensive analysis on a sample of homes that would effectively recreate the initial audit and re-calibrate assumptions based on post-installation utility data.;
- Increase focus on explaining the customer's usage and educating customers on how much each appliance costs to operate and teaching them ways to reduce their usage;
- Have auditors spend more time with customers explaining "no cost" ways to save electricity;
- Consider developing savings estimates for the educational component of the program;
- Offer one-on-one TREAT and OTTER training to auditors.