

**NSTAR Electric**  
**2011 Energy Efficiency Annual Report**

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## I. INTRODUCTION

In the second full year of the three-year energy efficiency plans, as reviewed and approved by the Department of Public Utilities (the “Department”) in D.P.U. 09-116 through 09-127 (the “Gas and Electric Orders”), program year 2011 continued to build on the successes of program year 2010 and showed remarkable success with respect to goal attainment and achievement of real benefits for the environment and the economy in the Commonwealth of Massachusetts. Among the many awards and accomplishments achieved during program year 2011, the American Council for an Energy-Efficient Economy ranked Massachusetts number one in the nation for its energy efficiency efforts. Collectively, the Program Administrators (“PAs”) were able to deliver on their goals during program year 2011, as established in the Gas and Electric Orders and as submitted in each PA’s 2011 Mid-Term Modifications filed on October 29, 2010, while maintaining the balance between meeting the budget for their programs and complying with the directives of the Green Communities Act in ensuring that they make available all cost-effective energy efficiency opportunities.

Overall, the PAs worked diligently with the Department, the Department of Energy Resources (“DOER”), the Energy Efficiency Advisory Council (“EEAC”), and other interested stakeholders to meet what were intentionally designed to be very challenging 2011 program year goals. In many cases, achievements in savings and benefits exceeded those goals. Program year 2011 performance showed that aggressive savings levels were achieved for Residential, Low-Income, and Commercial & Industrial (“C&I”) programs. PAs worked well to implement the programs in the field while also continuing the unprecedented ramp up of spending and savings levels for energy efficiency programs so as to meet goals not just for program year 2011, but for the full life of the three-year plans.

The accomplishments of 2011 were achieved despite a struggling economy, a stagnant new construction market, historically low natural gas prices and a significant increase in savings goals. In the wake of challenges, including record setting weather events, the PAs continued to proactively work toward developing new delivery techniques to reach untouched customer sets and to convince customers to move forward with commitments to invest in energy efficiency.

In addition to the achievements for each PA’s program implementation efforts, the PAs have made significant progress integrating gas and electric energy efficiency services, and remain committed to furthering progress in both the residential and non-residential sectors. While working to achieve their programmatic goals for 2011, the PAs have worked diligently to establish statewide marketing of energy efficiency program offerings through the use of the Mass Save<sup>®</sup> label, which won the Association of Energy Services Professionals (“AESP”) Outstanding Achievement in Marketing and Communications Award in 2011. Simultaneously, the PAs have engaged in 30 studies across a wide span of program sectors to ensure that the evaluation, measurement and verification (“EM&V”) elements of these program offerings remain a critical and vital tool to evaluate and transform measures in the future to meet demand in an ever changing marketplace. The PAs have worked diligently with financial institutions to explore outside financing options to better serve their C&I customers.

The PAs have continued to be engaged in the monthly EEAC process in 2011, and have worked collaboratively with the EEAC's consultants to meet stringent reporting and data collection deadlines so as to adequately monitor and review where the Plans' efforts have succeeded, and where improvement could be anticipated for the future. In all, while actively involved in program implementation efforts, the PAs have also been heavily immersed in the policy and planning that will allow for accurate data development, evaluation and measurement of successes and areas in need of modification, transparent codes and standards, and the framework necessary to ensure the ability to continue to offer successful and sustainable energy efficiency programs in the Commonwealth.

Given the unprecedented nature of these efforts and the significantly ambitious goals established in these Plans, the PAs contend that the 2011 program year performance has been an unmitigated success and has continued to exceed the expectations established by the Plan. The PAs continue their endeavors to achieve deeper savings from participating customers, and have worked to reach a broader range of customers for the implementation of all cost-effective program offerings.

A. Purpose of Annual Report

The Company is pleased to provide its Energy Efficiency Annual Report ("Annual Report") for 2011. The purpose of the Annual Report is to:

- Provide a comparison of the Company's planned, preliminary year-end, and evaluated (where applicable) expenses, savings, and benefits at the portfolio, sector, and program levels for the program year.
- Identify significant variances between the Company's planned and evaluated costs, savings, and benefits for the program year, and discuss reasons for such variances.
- Discuss how program performance during the program year informs the Company's proposed modifications to program implementation, if any, during upcoming years.
- Describe the EM&V activities undertaken by the Company that have not been included in previous Annual Reports, and explain how the results of the EM&V studies impact program cost-effectiveness.
- Describe the performance incentives that the Company proposes to collect.

B. Organization of Annual Report

The Company's 2011 Annual Report is organized as follows:

- Section I.C provides summary information on program performance at the portfolio and sector levels.

- Section II provides detailed information on program performance at the sector and program levels for the residential, low-income, and C&I sectors.
- Section III provides detailed information on the EM&V studies included in the Annual Report for each sector.
- Section IV addresses statutory budget requirements.
- Section V addresses the performance incentives the Company proposes to collect.
- Section VI addresses energy efficiency audits conducted during the past five years.
- Section VII consists of Appendices A through F which provide further detailed supporting documentation for this report.

C. Summary of Program Portfolio

The purpose of this section is to provide summary information on program performance at the portfolio and sector levels.

Tables<sup>1</sup> I.A and I.B provide summary information on program performance at the portfolio and customer sector levels, respectively.

<b>Table I.A: Program Portfolio Summary</b>							
Performance Category	Units	Planned Value	Preliminary Year-End Results		Evaluated Results		
			Value	% Change from Planned	Value	% Change from Preliminary	% Change from Planned
<b>Expenses</b>							
Total Program Costs	\$	174,801,084			114,506,957		-34%
Performance Incentive	\$	9,461,551			9,550,453		1%
<b>Savings &amp; Benefits</b>							
Energy							
Lifetime	MWh	4,747,880	4,669,780	-2%	5,245,046	12%	10%
Annualized	MWh	380,344	329,936	-13%	355,401	8%	-7%
Demand							
Lifetime	kW	778,991	722,188	-7%	589,438	-18%	-24%
Annualized							
Summer	kW	58,752	49,532	-16%	40,766	-18%	-31%
Winter	kW	35,244	41,601	18%	40,297	-3%	14%
NEB (Lifetime)	\$	79,363,473	-20,441,568	-126%	10,643,579	-152%	-87%
<b>Cost-Effectiveness</b>							
TRC Benefits	\$	705,999,415			644,737,184		-9%
TRC Costs	\$	259,503,037			165,136,955		-36%
Net Benefits	\$	446,496,377			479,600,229		7%
BCR	n/a	2.72			3.90		44%

<sup>1</sup> The Company is also providing the Department with working Microsoft Excel spreadsheets for all of the tables included in this Annual Report. Such tables include all formulas and functions used in each table.

Note: The Planned Values in Table I.A and all subsequent tables that contain Planned Values in this Annual Report (except as otherwise noted) were submitted to the Department as Attachment A to the Memorandum of Agreement on April 15, 2011 in NSTAR Electric, D.P.U. 10-146.

As shown in Table I.A, above, the Company experienced some significant<sup>2</sup> variances between planned, preliminary, and evaluated results at the portfolio level. First, actual total program costs were 34 percent lower than initially planned. The primary reason that costs were lower than planned was that large Combined Heat and Power (“CHP”) projects actually undertaken in 2011 offered very high savings at a lower cost than planned large retrofit projects. Lifetime Non-Energy Benefits (“NEBs”) also decreased 87 percent from planned to evaluated. This decrease in NEBs was due to the increased use of natural gas from the aforementioned CHP projects. Finally, the total demand and summer demand decreased by 24 and 31 percent, respectively. The majority of this variance occurred in the low-income and residential sectors due to the application of updated demand factors as a result of the evaluation study, the *Demand Impact Mode and User Guide*, which is discussed in greater detail in Section III, Study 9 and Appendix C, Study 9.

<b>Table I.B: Customer Sector Summary</b>				
<b>Sector</b>	<b>Units</b>	<b>Planned Value</b>	<b>Evaluated Results</b>	
			<b>Value</b>	<b>% Change from Planned</b>
<b>Residential</b>				
TRC Benefits	\$	137,213,609	185,659,849	35%
TRC Costs	\$	51,637,483	47,468,170	-8%
Net Benefits	\$	85,576,126	138,191,680	61%
BCR	n/a	2.66	3.91	47%
<b>Low-Income</b>				
TRC Benefits	\$	33,442,442	29,511,997	-12%
TRC Costs	\$	13,806,097	13,048,065	-5%
Net Benefits	\$	19,636,345	16,463,932	-16%
BCR	n/a	2.42	2.26	-7%
<b>C&amp;I</b>				
TRC Benefits	\$	535,343,363	429,565,338	-20%
TRC Costs	\$	194,059,457	104,620,720	-46%
Net Benefits	\$	341,283,906	324,944,617	-5%
BCR	n/a	2.76	4.11	49%
<b>TOTAL</b>				
TRC Benefits	\$	705,999,415	644,737,184	-9%
TRC Costs	\$	259,503,037	165,136,955	-36%
Net Benefits	\$	446,496,377	479,600,229	7%
BCR	n/a	2.72	3.90	44%

2 Unless otherwise noted, “Significant” variances are defined throughout this Annual Report as variances of +/-20 percent or more between the stated values.

As shown in Table I.B, above, a variance exists at the residential sector level in the TRC benefits and net benefits categories. The reason residential benefits and net benefits are 35 and 62 percent, respectively, more than planned is due to non energy impacts (“NEIs”) from the *Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts* (“NEI Study”), submitted in NSTAR Electric D.P.U. 11-106. This study updated the NEIs for the low-income and residential programs and had a large impact on overall residential and low-income sector benefits. The benefits from the NEI Study caused a net increase to residential benefits and a net decrease to low-income benefits. In 2011, supplemental research was conducted on non-energy impacts for low-income programs that included additional low-income benefits, clarifying and expanding the prior research performed in the NEI Study. The additional research focused on low-income lighting quality, refrigerator recycling, price hedging, and economic development. The results have a significant positive impact on the benefits attributable to low-income programs. For further information, please refer to Appendix C, Study 28.

To explain the variance in benefits for the evaluated results above, all the NEIs were applied to each residential and low-income program in an attempt to quantify the benefits to customers not currently being captured in the total resource costs test. The application of these residential NEIs increased the total evaluated benefits 35 percent for residential programs. These new benefits combined with minor cost decreases in several residential cost categories caused the net benefits to increase by 62 percent for the residential sector.

Additionally, as shown in Table I.B, above, a variance exists at the C&I sector level in the TRC benefits and total costs category. The reason TRC benefits are 20 percent less than the planned value is due to the natural gas usage from the large CHP projects which accounted for 426,640 MMBtu of increased natural gas usage, thus a negative benefit. The variance in total cost is also mostly due to CHP projects which were lower in cost than the planned value of most large C&I retrofit projects.

## II. PROGRAM PERFORMANCE

### **NSTAR Electric Performance Highlights**

NSTAR Electric-specific highlights for 2011, by sector, are briefly described below:

Residential and Low-Income – In 2011, the second year of the Three-Year Energy Efficiency Plan, NSTAR Electric built upon its successful first year of program implementation under the Plan despite facing many challenges and aggressive goals. The Company expanded and redesigned programs and initiatives (as described below) in 2011 in an attempt to increase participation in both the residential and low-income sectors with the desired effect of increasing overall savings.

Historically, the platform the Company has developed for acquiring increased savings cost-effectively has been based upon the following principles: (1) integrating gas and electric programs into a portfolio of fuel-neutral programs, to the extent practicable; (2)

concentrating on seamless delivery from the customer's perspective; (3) focusing on deeper penetration of energy efficiency with the introduction of innovative and targeted approaches and options; (4) assisting in the development of an expanded, trained workforce capable of providing consistent program messaging and services, while maintaining high quality; (5) collaborating with community organizations that have long-standing relationships with homeowners, tenants and small businesses in economically marginalized communities, and developing community-based outreach initiatives that implement a neighborhood approach to energy efficiency services. These principles were evident in the Company's existing homes, multi-family, low-income and new construction initiatives as they successfully addressed the energy efficiency needs of its customers.

Commercial and Industrial – Even with the aggressive goals established for 2011, NSTAR Electric Company's wide variety of well-established programs and its innovative new implementation strategies allowed its C&I customers to achieve permanent energy savings and the Company to come very close to reaching the challenging goals set for its New Construction and Major Renovation, Large Retrofit, and Small Retrofit programs. Due in part to a focus on negotiated incentives, C&I programs were well under budget in 2011 with participation rates exceeding 100 percent of goal in all programs except for New Construction and Major Renovation. Major new construction projects in the Boston metro area constitute a large portion of the New Construction and Major Renovation program's volume, and this program's performance continued to suffer from the downturn in the economy which began in 2008-2009 and was fully realized in 2011 due to the two to three year planning period often necessary for the development of new construction projects.

In an effort to address this issue, the Company tested several marketing strategies in 2011. These strategies, listed below, contributed to the Company's success in acquiring kWh savings in all C&I programs during particularly difficult economic times and will assist the Company in acquiring additional energy savings in years to come.

- **Upstream Lighting:** The Company's lead involvement in the development of the Upstream Lighting initiative positively affected customer participation in its service territory. With over 15 million kWh saved in 2011, the Company led the other Program Administrators in customer participation with the greatest uptake in participation taking place once LED lamps were introduced into the program in November.
- **MOUs and Roadmaps:** The Company continued to expand its MOU and Roadmap<sup>3</sup> strategy for its largest customers, successfully gaining new

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An increasingly important tool available to account executives managing the largest C&I customers is the Memorandum of Understanding ("MOU"). An MOU offers a way to document a mutual commitment between the customer and PA to work together to achieve mutually stated goals, through specific actions that are tailored to the customer's facilities over a multi-year planning horizon. As such, an MOU can set the stage for achieving deeper and more comprehensive energy efficiency savings, and is more likely to succeed than a "one measure" or "one year" approach. Typically, MOUs include participation by upper

long-term commitments from seven major corporations. In addition to the MOUs and Roadmaps signed in years prior, the seven new agreements are anticipated to contribute a great deal of energy savings in the years to come. Throughout 2011, savings from MOU customers alone contributed over 30 percent toward the Company's total energy savings.

- **Market Segmentation Model:** The Company worked to aggregate customer information (including usage, demand, and industry classification) into a new database which will allow the Company to better segment customers into niche markets and develop new comprehensive market strategies to best suit their energy efficiency needs.
  
- **Targeted Segment Initiatives:**
  - **Hotels:** Working in conjunction with the Upstream Lighting incentive, the Company used a dedicated sales force to install efficient LED lamps in hotel common areas across a targeted customer list of Boston hotels. Over 15 hotels participated in this initiative 2011 saving over 13 million kWh.
  
  - **Small Business:** An outbound telemarketing campaign was conducted with a sample of 5,000 small business customers. This resulted in 173 leads and 82 direct install audits conducted. According to the Company's direct install vendors, the quality of leads was vastly improved through this initiative compared to those generated by past services.
  
  - **Commercial Real Estate:** Significant research took place in 2011 in an attempt to effectively target this hard to penetrate sub-segment of customers. In addition, the Company fostered partnerships with the Green Ribbon Commission and several major commercial real estate firms which will serve to improve the Company's marketing strategy for this segment in years to come.
  
  - **Government:** The Company continued to work closely with the DOER's Green Communities Division in assisting municipal customers with the process of implementing cost-effective energy efficiency measures. Additionally, 2011 was a particularly unique year as the Company facilitated millions of dollars in ARRA funding by leveraging relationships with both the DOER and the Massachusetts Clean Energy Council.

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management, the establishment of specific, very aggressive energy efficiency saving targets, and measurement and verification strategies to document savings throughout the target facilities.

A. Residential Sector Programs

1. Summary

During 2011 the Company implemented the following residential programs and residential pilots:

Residential Programs

- Residential New Construction and Major Renovation
- Residential Cooling and Heating Equipment
- Residential Multi-Family Retrofit
- Residential Mass Save
- Residential ENERGY STAR<sup>®</sup> Lighting
- Residential ENERGY STAR Appliances

Residential Pilots

- Deep Energy Retrofit
- Residential New Construction and Major Renovation – Major Renovation Statewide Pilot
- Residential New Construction - Multi-Family (4-8 story) Statewide Pilot
- Residential New Construction – Lighting Design Statewide Pilot
- Community Based Pilots

Tables II.A.1 through II.A.3 provide summary information on the performance of the residential programs at the sector, end use, and program levels, respectively.

Sections II.A.2 and II.A.3 provide detailed information on the performance of each residential program and pilot program, respectively.

Table II.A.1: Residential Sector Summary							
Performance Category	Units	Planned Value	Preliminary Year-End Results		Evaluated Results		
			Value	% Change from Planned	Value	% Change from Preliminary	% Change from Planned
<b>Expenses</b>							
Total Program Costs	\$	42,832,529			39,010,990		-9%
Performance Incentive	\$	2,107,319			2,878,272		37%
<b>Savings &amp; Benefits</b>							
<b>Energy</b>							
Lifetime	MWh	513,444	716,671	40%	651,491	-9%	27%
Annualized	MWh	62,159	83,011	34%	74,226	-11%	19%
<b>Demand</b>							
Lifetime	kW	114,418	152,022	33%	75,084	-51%	-34%
<b>Annualized</b>							
Summer	kW	9,327	13,071	40%	8,035	-39%	-14%
Winter	kW	11,693	18,155	55%	17,680	-3%	51%
NEB (Lifetime)	\$	62,543,403	43,072,388	-31%	99,716,294	132%	59%
<b>Cost-Effectiveness</b>							
TRC Benefits	\$	137,213,609			185,659,849		35%
TRC Costs	\$	51,637,483			47,468,170		-8%
Net Benefits	\$	85,576,126			138,191,680		61%
BCR	n/a	2.66			3.91		47%

As shown in Table II.A.1 above, a variance exists at the residential sector level in the preliminary results in all categories. For the evaluated results there is a variance for lifetime energy savings, lifetime demand, winter demand, and non-energy benefits lifetime. As discussed above, there is also a variance in both the benefits and net benefits categories due to the NEI Study.

The overall reason all the preliminary values were greater than 20 percent than the planned values was a very successful customer response to the Company's residential programs. With the exception of residential new construction, the participation and savings for each residential program increased over the planned values in 2011. The ENERGY STAR lighting program specifically had a 40 percent increase in participation, a 44 percent increase in annual savings, and a 53 percent increase in lifetime savings. In the preliminary year-end results, the lighting program represents over 50 percent of the residential program total lifetime savings. There was also great demand and success with the administration of the multi-family program and measures in many areas of the NSTAR Electric service territory.

Evaluated savings results did not diverge significantly from preliminary values; however there was still an overall increase of 27 percent to lifetime savings which is primarily due to success of the installed measures in the lighting program as discussed above, as well as deeper measures being installed in the residential cooling and heating program and multi-family program. Additionally, the Company saw a change in its evaluated demand factors from the demand impact model which updated a majority of the energy and capacity demand factors. For further information, please refer to Appendix C, Study 9. Finally, the variance in benefits from planned values to evaluated values of 59 percent is due to the application of the NEI evaluation study. This study included many new benefits that were not previously included in residential

programs. For further information, please refer to the NEI Study in NSTAR Electric, D.P.U. 11-106.

A more detailed program-level discussion can be found in Section II.A.2.

<b>Table II.A.2: Residential Sector Summary of End Uses</b>				
End Uses	Units (lifetime)	Preliminary Year-End Results	Evaluated Results	% Change from Preliminary to Evaluated
<b>Lighting</b>				
Energy	MWh	594,320	537,750	-10%
Demand	kW	54,834	49,883	-9%
NEB	\$	4,217,099	3,826,008	-9%
<b>HVAC</b>				
Energy	MWh	40,126	38,398	-4%
Demand	kW	20,892	19,043	-9%
NEB	\$	7,217,829	14,306,915	98%
<b>Motors</b>				
Energy	MWh	52	52	0%
Demand	kW	3	36	1189%
NEB	\$	0	0	0%
<b>Refrigeration</b>				
Energy	MWh	38,091	26,364	-31%
Demand	kW	4,455	3,172	-29%
NEB	\$	0	479,442	0%
<b>Hot Water</b>				
Energy	MWh	568	473	-17%
Demand	kW	16	16	0%
NEB	\$	5,977,395	3,011,341	-50%
<b>Behavior</b>				
Energy	MWh	1,479	1,479	0%
Demand	kW	414	173	-58%
NEB	\$	0	46,172,882	0%
<b>Process</b>				
Energy	MWh	19,543	19,362	-1%
Demand	kW	10,476	2,262	-78%
NEB	\$	0	114,430	0%
<b>Envelope</b>				
Energy	MWh	22,492	27,612	23%
Demand	kW	60,933	500	-99%
NEB	\$	25,660,065	31,805,277	24%
<b>Total</b>				
Energy	MWh	673,157	603,037	-10%
Demand	kW	80,199	72,149	-10%
NEB	\$	17,412,323	21,623,706	24%

<b>Table II.A.3: Residential Program Summary</b>				
<b>Sector</b>	<b>Units</b>	<b>Planned Value</b>	<b>Evaluated Results</b>	
			<b>Value</b>	<b>% Change from Planned</b>
<b>Residential New Construction &amp; Major Renovation</b>				
TRC Benefits	\$	3,809,481	6,832,997	79%
TRC Costs	\$	2,922,257	3,553,373	22%
Net Benefits	\$	887,224	3,279,624	270%
BCR	n/a	1.30	1.92	48%
<b>Residential Cooling &amp; Heating Equipment</b>				
TRC Benefits	\$	4,010,230	9,224,304	130%
TRC Costs	\$	2,536,984	2,452,183	-3%
Net Benefits	\$	1,473,246	6,772,121	360%
BCR	n/a	1.58	3.76	138%
<b>Multi-Family Retrofit</b>				
TRC Benefits	\$	5,506,903	9,424,297	71%
TRC Costs	\$	4,495,150	4,597,245	2%
Net Benefits	\$	1,011,753	4,827,053	377%
BCR	n/a	1.23	2.05	67%
<b>MassSAVE</b>				
TRC Benefits	\$	83,003,380	102,708,357	24%
TRC Costs	\$	22,429,778	20,282,610	-10%
Net Benefits	\$	60,573,602	82,425,747	36%
BCR	n/a	3.70	5.06	37%
<b>ENERGY STAR Lighting</b>				
TRC Benefits	\$	34,208,558	50,564,752	48%
TRC Costs	\$	9,635,454	8,864,798	-8%
Net Benefits	\$	24,573,104	41,699,954	70%
BCR	n/a	3.55	5.70	61%
<b>ENERGY STAR Appliances</b>				
TRC Benefits	\$	6,675,057	6,905,142	3%
TRC Costs	\$	3,310,786	2,694,931	-19%
Net Benefits	\$	3,364,271	4,210,211	25%
BCR	n/a	2.02	2.56	27%

<b>Deep Energy Retrofit</b>				
TRC Benefits	\$	n/a	n/a	n/a
TRC Costs	\$	481,960	147,708	-69%
Net Benefits	\$	n/a	n/a	n/a
BCR	n/a	n/a	n/a	n/a
<b>Residential New Construction &amp; Major Renovation - Major Renovation statewide</b>				
TRC Benefits	\$	n/a	n/a	n/a
TRC Costs	\$	130,416	51,526	-60%
Net Benefits	\$	n/a	n/a	n/a
BCR	n/a	n/a	n/a	n/a
<b>Residential New Construction Multi Family (4-8 story) statewide pilot</b>				
TRC Benefits	\$	n/a	n/a	n/a
TRC Costs	\$	286,490	157,429	-45%
Net Benefits	\$	n/a	n/a	n/a
BCR	n/a	n/a	n/a	n/a
<b>Residential New Construction Lighting Design statewide pilot</b>				
TRC Benefits	\$	n/a	n/a	n/a
TRC Costs	\$	10,000	14,487	45%
Net Benefits	\$	n/a	n/a	n/a
BCR	n/a	n/a	n/a	n/a
<b>Community Based Pilot</b>				
TRC Benefits	\$	n/a	n/a	n/a
TRC Costs	\$	402,621	233,351	-42%
Net Benefits	\$	n/a	n/a	n/a
BCR	n/a	n/a	n/a	n/a
<b>Hard-to-Measure Initiatives</b>				
TRC Costs	\$	4,995,587	4,418,528	-12%
<b>TOTAL</b>				
TRC Benefits	\$	137,213,609	185,659,849	35%
TRC Costs	\$	51,637,483	47,468,170	-8%
Net Benefits	\$	85,576,126	138,191,680	61%
BCR	n/a	2.66	3.91	47%

The variances in Table II.A.2 are categorized by end use. It is difficult to isolate the reason for the change by end use because end uses stretch across many different programs that have various delivery methods, savings, NTG factors, NEBs, and costs. Therefore, these variances are explained in the context of program variances discussed below. The variances in Table II.A.3 are by program and are also discussed in detail below.

## Residential Sector Performance Highlights

During 2011, the Company built upon existing residential programs and significantly expanded initiatives to increase participation in all residential programs. Selected highlights are presented below:

- Residential New Construction and Major Renovation - In 2011, with over 100 communities adopting the Stretch Energy Code, this program, also known as Massachusetts New Homes with ENERGY STAR program, faced a market in which energy codes continued to change. Single family development remained slow, and opportunities to capture future energy savings were becoming increasingly difficult. To address these barriers, the program engaged in code support activities and offered technical assistance as well as incentives to meet this new code. The program also increased market penetration while providing energy savings for residents. During 2011, the program provided multiple trainings and participated in several recruitment events targeted at builders and allies new to performance-based construction. The program continued to participate in three pilots (multi-family new construction, major renovations, and lighting design) to aid in identifying the next generation of energy savings opportunities. Finally, the Program Administrators in western Massachusetts participated in the *Western Massachusetts Storm Recovery Program*. The storm recovery program contacted all of the communities affected by the tornado and distributed thousands of flyers to builders, building code offices, homeowners, tornado relief centers, town meetings/events and churches.
- Residential Cooling and Heating Equipment - The program, also known as the COOL Smart program, started the year with a strong volume of equipment rebate production for high efficiency equipment, and successfully achieved its 2011 equipment rebate goal. COOL Smart actively planned and conducted quality installation training sessions, including system design, duct diagnostics, brushless fan motors and ENERGY STAR Heating, Ventilation and Air Conditioning (“HVAC”) quality installation online training. The annual COOL Talk meeting was held at which program achievements were highlighted, HVAC contractor feedback obtained and a program preview of 2012 presented. Contractor outreach, training and education was enhanced through joint electric and gas integration through the establishment of circuit rider outreach for COOL Smart through the GasNetworks™ existing vendor, and joint participation of COOL Smart and GasNetworks at the Plumbing Heating Cooling Contractors Annual Trade Show and the annual GasNetworks fall conference. A request for proposals (“RFP”) was completed and a statewide vendor was selected for COOL Smart rebate processing.
- Multi-Family Retrofit - The Multi-Family Market Integrator continued to be an invaluable resource to the PA multi-family working group in 2011.

Monthly activity reports were developed to track program progress. The Multi-Family Market Integrator continued to report a trend of successfully enrolled facilities, which was the result of the relationships they have built with property owners, authorized representatives and property managers. In addition, the statewide Mass Save advertising campaign was noted as a source of program inquiry.

Most PAs were close to or exceeded program goals in 2011, with a strong enrollment and high level of pipeline projects into the residential multi-family retrofit program. The PAs continue to integrate the C&I program, where applicable, to better address the whole facility and maximize savings opportunities. Energy efficient lighting, instant savings measures, and weatherization were in high demand from this market sector.

- Mass Save – In 2011 the Mass Save/Residential Conservation Services program was fully integrated with the gas Weatherization program to provide customers with fuel blind energy services through the Home Energy Services (“HES”) program. Mid-year, the program transitioned to offering customers one comprehensive Home Energy Assessment (“HEA”) and incorporated additional market actors. Two groups of Mass Save participating contractors, Home Performance Contractors (“HPCs”) and Independent Installation Contractors (“IICs”), now provide services in addition to those offered by the lead vendor.

After the integration of additional contractors into the program, a Contractor Best Practices Working Group (“BPWG”) was developed to continue PA commitment to ongoing communication with participating contractors in the program. The group serves as a forum to provide an open line of communication between PAs, lead vendors, HPCs and IICs to discuss any matters related to the program with an independent third-party facilitator. BPWG achievements in 2011 include:

- Assistance with contractor permit acquisition and a continued focus on improving and streamlining the process
- Subsidized marketing materials offered to both IICs and HPCs
- A contractor portal on the Mass Save website for easy access to contractor relevant documents
- Development of a form and process for pricing adjustments
- Customer acquisition assistance for contractors bringing in customers who move forward implementing weatherization work
- Various lead vendor process enhancements
- Workforce development including subsidies for various trainings:

- Weatherization boot camps
- Combustion safety training
- Weatherization crew chief training
- Building analyst training

In 2011, the HEAT Loan program continued to offer micro loans (\$500-\$2,000) and the program has increased the amount that a property owner can borrow (\$2,000 - \$25,000). HEAT Loan offerings were extended to include many gas customers in municipal electric territory. Additionally, PAs saw an increase in both the average loan amount and the number of customers financing multiple measures.

- ENERGY STAR Lighting - In 2011, the ENERGY STAR Lighting program provided strong results for all the PAs, with all the PAs meeting or exceeding savings goals. LED fixtures were well received by customers, allowing the PAs to adjust rebate levels incrementally downward with minimum impact on sales. Specialty and “Hard-to-Reach” categories also performed well in most areas. The PAs transitioned to the new incentive fulfillment contractor in the last half of 2011 for most programs.
- ENERGY STAR Appliances – The ENERGY STAR Appliances program results varied by Program Administrator. ENERGY STAR refrigerators and freezers were once again strong performers for this program, with ENERGY STAR televisions also performing well. Other measures like computers, LCD monitors, pool pumps and room air conditioners lagged behind expectations due to rapid changes in technology and some products not meeting program criteria. The sales of Advanced Power Strips (Smart Strips) varied by PA, due mostly to retail availability. School fundraisers and “Pop-up” retail accounted for a large number of sales of this product. The refrigerator/freezer recycling program did not perform well for most PAs.

The PAs successfully transitioned all aspects of this program to the new incentive fulfillment contractor in the last half of 2011.

A more detailed discussion of each of the above programs follows.

2. Residential Programs

a. Residential New Construction and Major Renovation

**Purpose/Goal:** The purpose of the Residential New Construction and Major Renovation program was to capture lost opportunities, encourage the construction of energy-efficient homes, and drive the market to one in which new homes are moving towards net-zero energy.

**Targeted Customers:** The target market for this program included homebuilders, contractors, architects/designers, trade allies, Home Energy Rating System (“HERS”) raters, homebuyers, realtors, developers, low-income and affordable housing developers, code officials, and consumers in the market for new homes or major renovations.

**Definition of Program Participant:** A participant is defined as a unique electric account served under this program. For residential new construction the account represents a newly constructed dwelling unit.

**Targeted End-Uses:**

- Lighting
- HVAC
- Hot Water
- Envelope
- Refrigeration

**Delivery Mechanism:** The program was administered by each Program Administrator in its service territory and coordinated regionally through the Joint Management Committee (“JMC”). The JMC contractor was responsible for tracking and reporting program activity and advised the JMC on necessary program changes and enhancements. A separate third-party vendor conducted quality assurance/quality control of field activities. The JMC utilized a market-based network of trained contractors who offered energy efficiency and rating services to homebuilders.

**Significant Differences in Actual Program Design from Approved Program Design:** None.

**Docket/Exhibit where the Program is Discussed and Approved:** The program was discussed in detail in the Company’s 2010-2012 Three-Year Electric Energy Efficiency Plan, filed October 30, 2009. See NSTAR Electric, D.P.U. 09-120, Exhibit NSTAR-1, pages 121-130 (bates

numbering 00127-00136). The program was approved by the Department on January 28, 2010 in NSTAR Electric, D.P.U. 09-120.

Table II.A.4<sup>4</sup> provides information on the performance of the Residential New Construction and Major Renovation program.

Table II.A.4: Residential New Construction & Major Renovation							
Performance Category	Units	Planned Value	Preliminary Year-End Results		Evaluated Results		
			Value	% Change from Planned	Value	% Change from Preliminary	% Change from Planned
<b>Expenses</b>							
Total Program Costs	\$	1,451,898			1,167,410		-20%
Performance Incentive	\$	33,959			82,961		144%
Participants	unique accts	855			622		-27%
Program Cost / Participant	\$	1,698			1,877		11%
<b>Savings &amp; Benefits</b>							
<b>Energy</b>							
Lifetime	MWh	22,425	21,730	-3%	18,344	-16%	-18%
Annualized	MWh	1,920	2,185	14%	1,769	-19%	-8%
Average Measure Life	yrs	11.7	9.9	-15%	10.4	4%	-11%
<b>Demand</b>							
Lifetime	kW	4,780	5,665	19%	5,344	-6%	12%
<b>Annualized</b>							
Summer	kW	286	348	22%	309	-11%	8%
Winter	kW	346	384	11%	306	-20%	-12%
Average Measure Life	yrs	16.7	16.3		17.3		
NEB (Lifetime)	\$	724,819	1,673,472	131%	4,030,771	141%	456%
<b>Cost-Effectiveness</b>							
TRC Benefits	\$	3,809,481			6,832,997		79%
TRC Costs	\$	2,922,257			3,553,373		22%
Net Benefits	\$	887,224			3,279,624		270%
BCR	n/a	1.30			1.92		48%

For the Residential New Construction and Major Renovation program, the preliminary year-end results are not the same as the evaluated results, as there were several significant evaluation impacts that affected this program.

In addition, there were some significant variances in this program as discussed below.

Due to the new construction market being slower than expected, there were fewer homes built through this program than planned, so participation was 27 percent lower than projected. A greater than planned number of newly constructed homes had propane as their primary heating fuel, which contributed to a large increase in non energy benefits. Summer demand savings, on the other hand, increased due to a greater number of homes being built with central air-conditioning installed. The increase in both NEBs and summer demand led to an overall increase in the benefits for the program. With the increase in benefits, coupled with the slight decrease in spending (due to less participation), the overall net benefits for preliminary results were significantly higher than planned.

<sup>4</sup> For each program and pilot program, the Company has defined "participant", and updated the "units" column in the program or pilot program table to be consistent with that definition.

The evaluated data did not significantly change from planned values excepted for TRC benefits. This was in part due to the factors discussed above, but in addition the NEI Study included many new benefits associated with the new construction and renovation program that were not included in the planned value. These two factors increased the evaluated results 456 percent over the planned values. For further information on these NEI values, please refer to the NEI Study in NSTAR Electric, D.P.U. 11-106.

The Company's methodology allocated performance incentives achieved at the sector level to individual programs based on benefits and net benefits. Any variance in actual performance incentive allocations is directly linked to variances in evaluated benefits and net benefits in individual programs within a sector. These variances are not attributable to a change in performance incentive allocation methodology. In order to explain program performance incentive variance, please refer to the explanation of benefits and net benefits variances above.

The EM&V studies included in the Company's 2011 Annual Report that apply to this program are as follows:

*Study 1 - Massachusetts Residential New Construction Home Buyer Survey*

This study examined what buyers look for in a new home, awareness of ENERGY STAR homes, the role of ENERGY STAR certification in new home shopping, perceptions of ENERGY STAR homes, and reactions to recent changes in the program. The study also provides updates of similar surveys conducted in 2002, 2003, 2004, and 2006. The results of this study did not impact the 2011 evaluated results. This study is discussed in more detail in Section III, Study 1 and Appendix C Study 1.

*Study 2 - Massachusetts Residential New Construction Focus Groups with Participant Builders*

This study assessed participating builders' experience with the Program and their reactions to changes made in 2011 and changes which may be forthcoming in 2012. The results of this study did not impact the 2011 evaluated results. This study is discussed in more detail in Section III, Study 2 and Appendix C Study 2.

*Study 3 - Massachusetts Mini Baseline Study of Homes Built at the End of the 2006 IECC Cycle*

This study was conducted in partnership with DOER to assess compliance with basic building code prescriptive path requirements at the end of the 2006 International Energy

Conservation Code (IECC) code cycle, provide a preliminary assessment of how current new single-family residential building characteristics compare to current User Defined Reference Home (UDRH) inputs, and conduct audits of energy efficient lighting and appliances within the homes. The study also compared building practices, equipment efficiencies, and other characteristics in custom versus spec built homes. Results from this study reduced the electric savings based on the penetration rates of high efficiency lighting and appliances. This study is discussed in more detail in Section III, Study 3 and Appendix C Study 3.

#### Study 9 - *Demand Impact Model User Manual*

The Demand Impact Model User Manual was updated to reflect new load shape data, per-unit measure energy savings, and ISO-NE definitions of peak periods. The results of this study were applied to 2011 study results with the overall effect varying by PA. The Company saw a net increase in program savings for the 2011 evaluated results, however winter capacity declined 12 percent from planned and twenty percent from preliminary data. This study is discussed in more detail in Section III, Study 9 and Appendix C Study 9.

The program's performance and the results of the impact evaluations described above will be used to adjust the planning estimates for the program in the next three-year plan for 2013-2015. Changes to this program are not currently expected to result in a mid-term modification for the remainder of the current three-year plan. A mid-term modification was submitted for this program in the Company's 2012 Mid-Term Modification filed with the Department on October 28, 2011 in NSTAR Electric, D.P.U. 11-106.

The Residential New Construction program is cost effective with a BCR of 1.95.

#### b. Residential Cooling and Heating Equipment

**Purpose/Goal:** The purpose of the Residential Cooling and Heating Equipment ("COOL Smart") program was to raise residential consumer awareness and market share of properly installed high-efficiency cooling equipment and systems, and increase market share of ENERGY STAR ECM furnaces.

**Targeted Customers:** The program targeted residential customers in the market to purchase new or replacement HVAC equipment including new systems in existing and new homes (new systems); replacement systems in existing homes (new equipment/old systems), including the early

retirement of existing equipment; and improvements in operational systems in existing homes (new equipment/old systems). The program also targeted HVAC contractors and technicians; suppliers, manufacturers, and distributors of HVAC equipment; new-home builders; and remodeling contractors.

**Definition of Program Participant:** A participant is defined as a unique electric account served under this program.

**Targeted End-Uses:** HVAC

**Delivery Mechanism:** The program was administered by each Program Administrator in its service territory. Delivery was through a common vendor selected through a common RFP. Whenever possible, there was coordination with the related gas Program Administrator's initiatives. To this end, the COOL Smart and Gas Networks' High Efficiency Heating and Hot Water programs worked to procure a single, joint circuit rider to support both programs in the field. Program initiatives were also piggybacked onto the residential new construction and HES programs:

- Participating residential new construction program builders and their HVAC contractors were referred to the COOL Smart program for training and Quality Installation Verification ("QIV"). Whenever appropriate, these training were jointly provided with GasNetworks.
- HES participants were referred to COOL Smart for HVAC measures using COOL Smart literature, which is part of the standard HES information package.

Quality control follow-up inspections were performed by independent inspectors on up to 10 percent of installations to verify equipment installation and performance.

The program continued to use equipment distributors to process rebates, sell high-efficiency and QIV-related technology, and to provide indoor training labs for HVAC contractors.

**Significant Differences in Actual Program Design from Approved Program Design:** None.

**Docket/Exhibit where the Program is Discussed and Approved:** The program is discussed in detail in the Company's 2010-2012 Three-Year Electric Energy Efficiency Plan, filed October 30, 2009. See NSTAR Electric, D.P.U. 09-120, Exhibit NSTAR-1, pages 135-145 (bates numbering 00141-00151). The program was approved by the Department on January 28, 2010 in NSTAR Electric, D.P.U. 09-120.

Table II.A.5 provides information on the performance of the Residential Cooling and Heating Equipment program.

Table II.A.5: Residential Cooling & Heating Equipment							
Performance Category	Units	Planned Value	Preliminary Year-End Results		Evaluated Results		
			Value	% Change from Planned	Value	% Change from Preliminary	% Change from Planned
<b>Expenses</b>							
Total Program Costs	\$	2,177,734			2,098,963		-4%
Performance Incentive	\$	41,585			139,699		236%
Participants	unique accts	3,014			3,746		24%
Program Cost / Participant	\$	723			560		-22%
<b>Savings &amp; Benefits</b>							
Energy							
Lifetime	MWh	24,545	27,272	11%	27,087	-1%	10%
Annualized	MWh	1,436	1,525	6%	1,515	-1%	5%
Average Measure Life	yrs	17.1	17.9	5%	17.9	0%	5%
Demand							
Lifetime	kW	12,525	16,902	35%	15,066	-11%	20%
Annualized							
Summer	kW	900	965	7%	863	-11%	-4%
Winter	kW	203	332	64%	482	45%	138%
Average Measure Life	yrs	13.9	17.5		17.5		
NEB (Lifetime)	\$	(431,783)	(459,284)	6%	4,444,597	1068%	1129%
<b>Cost-Effectiveness</b>							
TRC Benefits	\$	4,010,230			9,224,304		130%
TRC Costs	\$	2,536,984			2,452,183		-3%
Net Benefits	\$	1,473,246			6,772,121		360%
BCR	n/a	1.58			3.76		138%

Preliminary year-end results are similar to evaluated results for the Residential Cooling and Heating Equipment program as there were no significant impact studies conducted that affected this program's savings.

Several of the performance categories listed above increased significantly from the planned value to the preliminary value. The reason for this is that there was a shift in the actual production levels and measure mix associated with this program. Much of the shift is attributable to higher efficient equipment installed than planned. Substantial increases in more efficient central air-conditioning with heat pumps, mini split heat pumps and other equipment caused savings and demand to significantly increase. The evaluated results were impacted by the demand impact model that increased many of the heating and duct sealing measures winter demand savings, and therefore lowering the amount attributed to summer demand. For further information, please refer to Appendix C, Study 9.

The NEI Study added new benefits from the measures installed in the Residential Cooling & Heating program that significantly increased the total NEBs and TRC benefits in this program. The increase to NEBs increased net benefits and BCRs significantly above planned values. For further information, please refer to the NEI Study submitted in NSTAR Electric, D.P.U. 11-106.

The Company's methodology allocated performance incentives achieved at the sector level to individual programs based on benefits and net benefits. Any variance in actual performance incentive allocations is directly linked to variances in evaluated benefits and net benefits in

individual programs within a sector. These variances are not attributable to a change in performance incentive allocation methodology. In order to explain program performance incentive variance, please refer to the explanation of benefits and net benefits variances above.

The EM&V studies included in the Company's 2011 Annual Report that apply to this program are as follows:

*Study 8 - Brushless Fan Motors Impact Evaluation*

This impact evaluation study was designed to quantify the energy savings associated with brushless fan motor (BFM) retrofits in residential HVAC applications. This study affected the 2011 Residential Cooling and Heating Equipment program by quantifying key metrics such as annual kWh savings and coincidence factors. The Company saw a small net decrease in evaluated results for 2011 for this measure. This study is discussed in more detail in Section III, Study 8 and Appendix C Study 8.

*Study 9 - Demand Impact Model User Manual*

The Demand Impact Model User Manual was updated to reflect new load shape data, per-unit measure energy savings, and ISO-NE definitions of peak periods. The results of this study were applied to 2011 study results with the overall effect varying by PA. The Company saw a net decrease in program savings for the 2011 evaluated results. This study is discussed in more detail in Section III, Study 9 and Appendix C Study 9.

*Study 14 - Heat Pump Water Heaters Evaluation of Field Installed Performance*

This technical evaluation of Heat Pump Water Heaters (HPWH) was designed to quantify the in-situation performance of three types of HPWHs. The study evaluated 14 different units over the course of a year and the results will be applied to future analysis of HPHWs. The results of this study do not affect program results for 2011. This study is discussed in more detail in Section III, Study 14 and Appendix C Study 14.

The program's performance and the results of the impact evaluations described above will be used to adjust the planning estimates for the program in the next three-year plan for 2013-2015. Changes to this program are not currently expected to result in a mid-term modification for the remainder of the current three-year plan.

The Residential Cooling and Heating program is cost effective with a BCR of 3.92.

c. Residential Multi-Family Retrofit

**Purpose/Goal:** The purpose of the Residential Multi-Family Retrofit program was to address the energy efficiency retrofit opportunities in facilities with five or more residential dwelling units in the market rate sector.

**Targeted Customers:** Residential multi-family facilities with five or more dwelling units were targeted by this program.

**Definition of Program Participant:** A participant is defined as a unique electric account served under this program.

**Targeted End-Uses:**

- Lighting
- HVAC
- Motors and Drives
- Refrigeration
- Domestic Hot Water
- Building Envelope
- End Use Behavior

**Delivery Mechanism:** The program was administered cooperatively by the gas and electric Program Administrators. The Multi-Family Market Integrator was responsible for facilitating the delivery of program services as well as acting as the conduit for participant inquiries to ensure that participants were not inconvenienced by having to contact multiple parties directly during the project lifecycle.

**Significant Differences in Actual Program Design from Approved Program Design:** None.

**Docket/Exhibit where the Program is Discussed and Approved:** The program is discussed in detail in the Company's 2010-2012 Three-Year Electric Energy Efficiency Plan, filed October 30, 2009. See NSTAR Electric, D.P.U. 09-120, Exhibit NSTAR-1, pages 181-195 (bates numbering 00187-00201). The program was approved by the Department on January 28, 2010 in NSTAR Electric, D.P.U. 09-120.

Table II.A.6 provides information on the performance of the Residential Multi-Family Retrofit program.

Table II.A.6: Multi-Family Retrofit							
Performance Category	Units	Planned Value	Preliminary Year-End Results		Evaluated Results		
			Value	% Change from Planned	Value	% Change from Preliminary	% Change from Planned
<b>Expenses</b>							
Total Program Costs	\$	4,434,968			4,780,974		8%
Performance Incentive	\$	46,144			118,013		156%
Participants	# of units	6,250			6,680		7%
Program Cost / Participant	\$	710			716		1%
<b>Savings &amp; Benefits</b>							
<b>Energy</b>							
Lifetime	MWh	40,702	90,754	123%	76,344	-16%	88%
Annualized	MWh	4,463	7,381	65%	6,113	-17%	37%
Average Measure Life	yrs	9.1	12.3	35%	12.5	2%	37%
<b>Demand</b>							
Lifetime	kW	4,806	4,297	-11%	3,632	-15%	-24%
<b>Annualized</b>							
Summer	kW	434	400	-8%	335	-16%	-23%
Winter	kW	852	843	-1%	724	-14%	-15%
Average Measure Life	yrs	11.1	10.7		10.9		
NEB (Lifetime)	\$	332,140	302,674	-9%	750,277	148%	126%
<b>Cost-Effectiveness</b>							
TRC Benefits	\$	5,506,903			9,424,297		71%
TRC Costs	\$	4,495,150			4,597,245		2%
Net Benefits	\$	1,011,753			4,827,053		377%
BCR	n/a	1.23			2.05		67%

There were large variances in several of the energy savings performance categories listed above. In 2011, the preliminary year-end results were higher than planned values due to significant installations of deeper measures in the multi-family program. Vendor reported data showed a very large increase in air sealing and insulation savings. In addition, the impact analysis captured savings for interior and exterior common area fixtures which have much higher hours of use than standard fixtures. There was a decline between planned and evaluated values for lifetime and annual MWh savings as well as a decline in energy demand savings. This was primarily due to the impact analysis that increased the free-ridership level for each measure between 15 to 24 percent. For further information on the free-ridership and multi-family impact algorithms, please refer to Section III, Study 7 and Appendix C, Study 7.

In addition to the factors discussed above, significant NEI benefits were associated with the installation of multi-family measures. These benefits were not previously included in this residential program. For further information, please refer to the NEI Study in NSTAR Electric, D.P.U. 11-106. Because of these increases to non-energy benefits, TRC benefits for the multi-family program increased significantly and therefore the net benefits and BCR are also significantly greater than planned.

The Company's methodology allocated performance incentives achieved at the sector level to individual programs based on benefits and net benefits. Any variance in actual performance incentive allocations is directly linked to variances in evaluated benefits and net benefits in individual programs within a sector. These variances are not attributable to a change in performance incentive allocation methodology. In order to explain program performance incentive variance, please refer to the explanation of benefits and net benefits variances above.

The EM&V studies included in the Company's 2011 Annual Report that apply to this program are as follows:

*Study 5 - Massachusetts Multifamily Market Characterization and Potential Study*

The primary objective of this market characterization study was to assess the potential energy efficiency savings available in multifamily buildings within Massachusetts. The results of this study did not impact the 2011 evaluated results but is being used to inform ongoing planning and program design. This study is discussed in more detail in Section III, Study 5 and Appendix C, Study 5.

*Study 6 - Massachusetts Multifamily Program Process Evaluation*

This study assessed program processes and developed recommendations for program improvement by interviewing program staff, implementation staff, and customers. The results of this study did not impact the 2011 evaluated results but is being used to inform ongoing program design. This study is discussed in more detail in Section III, Study 6 and Appendix C, Study 5.

*Study 7 - Massachusetts Multifamily Program Impact Analysis*

The objective of this impact evaluation was to provide program attribution information and a set of savings approaches that could be used by all PAs. These objectives were accomplished by interviewing key stakeholders, developing conclusions, and offering recommendations for future program improvement. 2011 results were negatively affected by the 18% free-ridership number derived from this study. This study is discussed in more detail in Section III, Study 7 and Appendix C, Study 7.

*Study 9 - Demand Impact Model User Manual*

The Demand Impact Model User Manual was updated to reflect new load shape data, per-unit measure energy savings, and ISO-NE definitions of peak periods. The results of this study were applied to 2011 study results with the overall effect varying by PA. The Company saw a net decrease in program savings for the 2011 evaluated results. This study is discussed in more detail in Section III, Study 9 and Appendix C, Study 9.

The program's performance and the results of the impact evaluations described above will be used to adjust the planning estimates for the program in the next three-year plan for 2013-2015.

Changes to this program are not currently expected to result in a mid-term modification for the remainder of the current three-year plan.

The Multi-Family Retrofit program is cost-effective with a BCR of 2.08.

d. Residential Mass Save (Home Energy Services)

**Purpose/Goal:** The purpose of the Mass Save/HES program was to provide residential customers with energy efficiency recommendations that enable them to identify and initiate the process of installing cost-effective energy efficiency improvements.

**Targeted Customers:** The HES target market is all non-low-income residential customers living in single-family houses or one- to-four-unit buildings that are not part of a larger site where an association exists (such as a condo association with multiple four-unit buildings). The program aims to reach the aforementioned customers who are interested in making their homes more energy efficient. The HES program is fuel-blind.

**Definition of Program Participant:** A participant is defined as a unique electric account served under this program. For this program a unique electric account is equal to a residential audit.

**Targeted End-Uses:**

- Lighting
- HVAC
- Hot Water
- Envelope
- Refrigeration

**Delivery Mechanism:** The Mass Save and gas Weatherization programs were fully integrated in 2011 and were implemented by each PA's competitively procured lead vendor. The PAs incorporated both HPCs (to provide audits and weatherization work) and IICs (to implement weatherization work) into the program.

The program was delivered by lead vendors selected through a competitive bidding process. Lead vendors were responsible for managing and training market based participants such as participating IICs and HPCs. Additional lead vendor responsibilities include:

- Consistent statewide training
- Data reporting

- Achieving aggressive savings
- Customer satisfaction
- Quality Control standards
- Scheduling requirements
- Technical Assistance
- Maintain and report health and safety information

Two groups of Mass Save participating contractors, HPCs and IICs, provided services in addition to those services offered by the lead vendor. All participating contractors had to meet program eligibility and requirements. HPCs independently recruited customers, provided HEAs and implemented weatherization measures. IICs provided installation of weatherization measures for those customers who received a HEA from the lead vendor. IICs also had the opportunity to independently recruit customers and refer them to the lead vendor for the HEA.

In order to receive incentives or program rebates, customers were required to have an HEA through either the PA's lead vendor or via a participating HPC to identify and prioritize all cost-effective energy efficiency improvements. Insulation work, whether performed by a HPC or IIC, had to have a quality control inspection performed by the PA-vendor or third-party vendor when the work was completed. This ensured high quality was maintained, and installations met Building Performance Institute standards or similar standards set by the PAs.

After a competitive bidding process, the gas and electric PAs contracted with Competitive Resources, Inc., a third-party Quality Control ("QC") vendor responsible for performing QC inspections of program implementation vendors and participating contractors. The QC vendor provided valuable information and feedback to the HES members on program successes and identified areas of possible improvement.

The HES members are working together toward a "best practices" approach to provide a more coordinated statewide training to reinforce quality installation techniques for the HES program. It is expected that training requirements for contractors to retain their status as a HES participating contractor will increase over time. Additionally, contractors must maintain a high level of customer satisfaction to continue in the program.

**Significant Differences in Actual Program Design from Approved Program Design:** None.

**Docket/Exhibit where the Program is Discussed and Approved:** The program is discussed in detail in the Company’s 2010-2012 Three-Year Electric Energy Efficiency Plan, filed October 30, 2009 and the Company’s 2011 RCS Budget Petition, filed November 1, 2010. See NSTAR Electric, D.P.U. 09-120, Exhibit NSTAR-1, pages 146-157 (bates numbering 00152-00163) and NSTAR Electric, D.P.U 10-RCS-04, respectively. The program was approved by the Department on January 28, 2010 in NSTAR Electric, D.P.U. 09-120 and on December 29, 2010 in NSTAR Electric, 10-RCS-04, respectively.

Table II.A.7 provides information on the performance of the residential Mass Save program.

Table II.A.7: MassSAVE							
Performance Category	Units	Planned Value	Preliminary Year-End Results		Evaluated Results		
			Value	% Change from Planned	Value	% Change from Preliminary	% Change from Planned
<b>Expenses</b>							
Total Program Costs	\$	18,482,937			15,902,365		-14%
Performance Incentive	\$	1,421,409			1,626,987		14%
Participants	unique accts	10,725			14,141		32%
Program Cost / Participant	\$	1,723			1,125		-35%
<b>Savings &amp; Benefits</b>							
Energy							
Lifetime	MWh	127,843	141,563	11%	123,456	-13%	-3%
Annualized	MWh	15,987	18,175	14%	15,031	-17%	-6%
Average Measure Life	yrs	8.0	7.8	-3%	8.2	5%	3%
Demand							
Lifetime	kW	60,280	71,163	18%	8,670	-88%	-86%
Annualized							
Summer	kW	3,628	4,257	17%	1,263	-70%	-65%
Winter	kW	2,636	3,180	21%	6,027	90%	129%
Average Measure Life	yrs	16.6	16.7		6.9		
NEB (Lifetime)	\$	59,838,740	38,556,913	-36%	87,050,721	126%	45%
<b>Cost-Effectiveness</b>							
TRC Benefits	\$	83,003,380			102,708,357		24%
TRC Costs	\$	22,429,778			20,282,610		-10%
Net Benefits	\$	60,573,602			82,425,747		36%
BCR	n/a	3.70			5.06		37%

Several of the performance categories listed above increased significantly from the planned value for the Mass Save program. Participation was 32 percent higher than planned resulting in an increase in home assessments, installed demand-related equipment, and lighting units installed over the planned values. This caused an increase in winter demand savings greater than 20 percent. At the same time, due to low oil use in NSTAR Electric’s service territory, less of the audits were installed in oil heated homes, and therefore oil benefits declined 44 percent from planned to preliminary, resulting in the 36 percent lower NEBs.

For the evaluated data, the Mass Save program saw a significant decrease in summer demand savings by 65 percent and increase in winter demand savings of 129 percent. The Demand impact model increased many of the lighting and heating measures winter demand savings, and therefore lowering the amount attributed to summer demand. This resulted in a decrease of 86 percent in overall lifetime demand savings because summer demand savings are weighted more

significant to lifetime electric demand. For further information, please refer to Appendix C, Study 9.

In addition to the factors discussed above, significant NEI benefits increase of 45 percent from planned to evaluated data associated with the installation of Mass Save measures. These benefits were not previously included in this residential program. For further information, please refer to NEI Study in NSTAR Electric, D.P.U. 11-106. Because of the overall increases to non-energy benefits along with the slightly lower costs, TRC benefits for the Mass Save program increased significantly and therefore the net benefits and BCR are also significantly greater than planned.

The EM&V studies included in the Company's 2011 Annual Report that apply to this program are as follows:

*Study 4 - Home Energy Services Net-to-Gross Evaluation*

The Home Energy Services (HES) program is synonymous with the Mass Save program. This impact evaluation determined measure-specific and program-level net-to-gross (NTG) ratios for the HES program. The information was gathered through Customer Self-Reporting and Statistical Market Share Modeling/Discrete Choice. The study determined a total average NTG ratio of 113%, but depending on measure mix, the net effect will vary for each PA. The Company's measure mix saw a decline in NTG for CLFs but a NTG increases to measures like insulation and air sealing, resulting in total savings slightly declining for the 2011 evaluated results. This study is discussed in more detail in Section III, Study 4.

*Study 9 - Demand Impact Model User Manual*

The Demand Impact Model User Manual was updated to reflect new load shape data, per-unit measure energy savings, and ISO-NE definitions of peak periods. The results of this study were applied to 2011 study results with the overall effect varying by PA. The Company saw a net decrease in evaluated program savings for the 2011 due to the allocation of savings from summer demand to winter demand for the Mass Save program. This study is discussed in more detail in Section III, Study 9.

*Study 13 - Home Energy Services Packaged Measure Pilot Evaluation*

This study was designed to evaluate a pilot initiative in the HES program that offered program participants a different incentive structure if they implemented a greater number of measures. Study conclusions and recommendations were based on interviews, surveys, and historical data. This study does not affect 2011

results. This study is discussed in more detail in Section III, Study 13.

The program’s performance and the results of the impact evaluations described above will be used to adjust the planning estimates for the program in the next three-year plan for 2013-2015. Changes to this program are not currently expected to result in a mid-term modification for the remainder of the current three-year plan.

The Mass Save program is cost effective with a BCR of 5.12.

e. Residential ENERGY STAR Lighting

**Purpose/Goal:** The purpose of the ENERGY STAR Lighting program was to increase consumer awareness of the importance and benefits of purchasing ENERGY STAR-qualified lighting products and expand the availability, consumer acceptance, and use of high-quality energy-efficient lighting technologies and controls.

**Targeted Customers:** All residential electric customers were targeted by this program.

**Definition of Program Participant:** A participant is defined as a unique electric account served under this program. In the case of upstream lighting, participants are determined by dividing units by an agreed upon factor per measure.

Residential Lighting Assumptions

2010 Lighting program	Widget per Participant
Screw-in Bulbs	8
Screw-in Bulbs - Hard to reach	4
Screw-in Bulbs (Specialty bulbs)	8
LED's	1
Indoor Fixture (incl. Torchieres)	2
Outdoor Fixture	2
LED Fixtures	1
Screw-in Bulbs - School Fundraiser	4

**Targeted End-Uses:** Residential lighting

**Delivery Mechanism:** This initiative utilizes upstream incentives and an online catalog channel, which dramatically increased sales and lowered costs of product for the customer.

A manufacturer/retailer outreach contractor recruited and trained retailers to participate in the program, placed point-of-purchase materials and rebate coupons in participating retail stores, oversaw the Negotiated

Cooperative Promotions (“NCP”) process, and acted as a liaison for Program Administrators, manufacturers, and retailers.

A rebate fulfillment contractor collected data and payment requests from manufacturers, retailers, and consumers, processed rebate coupons and NCPs, and provided documentation to the Program Administrators for program tracking and evaluation purposes.

An Internet/mail-order sales channel contractor purchased and stocked products offered through the catalog and the Mass Save website, staffed a toll-free line for customers, and processed catalog and website purchases.

**Significant Differences in Actual Program Design from Approved Program Design:** None.

**Docket/Exhibit where the Program is Discussed and Approved:** The program is discussed in detail in the Company’s 2010-2012 Three-Year Electric Energy Efficiency Plan, filed October 30, 2009. See NSTAR Electric, D.P.U. 09-120, Exhibit NSTAR-1, pages 164-172 (bates numbering 00170-00178). The program was approved by the Department on January 28, 2010 in NSTAR Electric, D.P.U. 09-120.

Table II.A.8 provides information on the performance of the Residential ENERGY STAR Lighting program.

Table II.A.8: ENERGY STAR Lighting							
Performance Category	Units	Planned Value	Preliminary Year-End Results		Evaluated Results		
			Value	% Change from Planned	Value	% Change from Preliminary	% Change from Planned
<b>Expenses</b>							
Total Program Costs	\$	7,675,157			7,840,243		2%
Performance Incentive	\$	485,097			816,736		68%
Participants	est. # of hhlds	148,700			207,758		40%
Program Cost / Participant	\$	52			38		-27%
<b>Savings &amp; Benefits</b>							
<b>Energy</b>							
Lifetime	MWh	246,791	377,100	53%	359,703	-5%	46%
Annualized	MWh	32,076	46,123	44%	43,638	-5%	36%
Average Measure Life	yrs	7.7	8.2	6%	8.2	1%	7%
<b>Demand</b>							
Lifetime	kW	26,224	38,719	48%	36,815	-5%	40%
Annualized							
Summer	kW	3,382	4,799	42%	4,535	-6%	34%
Winter	kW	6,889	9,776	42%	9,237	-6%	34%
Average Measure Life	yrs	7.8	8.1		8.1		
NEB (Lifetime)	\$	2,079,487	2,998,613	44%	2,846,056	-5%	37%
<b>Cost-Effectiveness</b>							
TRC Benefits	\$	34,208,558			50,564,752		48%
TRC Costs	\$	9,635,454			8,864,798		-8%
Net Benefits	\$	24,573,104			41,699,954		70%
BCR	n/a	3.55			5.70		61%

In the ENERGY STAR Lighting program, most of the results in both the preliminary year-end and evaluated performance categories have increased significantly over planned. As a result of the Company's very successful upstream lighting program, participation increased 40 percent over the planned goal. The Company experienced strong consumer demand for specialty lighting. The Company also introduced new LED technologies in 2011. Other key factors in the program's increased savings and participation rate can be attributed to an increase in new retail partners, increased product availability in big-box retail stores, and a robust marketing outreach campaign. The Company was able to keep total budget at the planned level with the only increase coming from the incentive budget to meet increase demand for lighting products. The significant increase in all savings, demand, and benefits categories was due to the increase in participation, with every category increasing by between 40 and 50 percent similar to the participation rate increase. There was no significant evaluation impact to the lighting program.

The net benefits and BCR exceed planned values. This is because the TRC benefits associated with the program are 48 percent higher than planned due to increase participation, combined with total program expenditures that did not increase over planned budget.

The Company's methodology allocated performance incentives achieved at the sector level to individual programs based on benefits and net benefits. Any variance in actual performance incentive allocations is directly linked to variances in evaluated benefits and net benefits in individual programs within a sector. These variances are not attributable to a change in performance incentive allocation methodology. In order to explain program performance incentive variance, please refer to the explanation of benefits and net benefits variances above.

The EM&V studies included in the Company's 2011 Annual Report that apply to this program are as follows:

*Study 9 - Demand Impact Model User Manual*

The Demand Impact Model User Manual was updated to reflect new load shape data, per-unit measure energy savings, and ISO-NE definitions of peak periods. The results of this study were applied to 2011 study results with the overall effect varying by PA. The Company saw a net decrease in program savings for the 2011 evaluated results. This study is discussed in more detail in Section III, Study 9.

*Study 10 - Massachusetts Consumer Survey Results 2011*

This multipart study assessed market research conducted for energy-efficient light bulbs, with particular emphasis on establishing a baseline at the onset of the changes in lighting standards resulting from the Energy Independence and Security Act of 2007 (EISA). The study primarily focuses on 100 Watt bulbs, but addressed customer attitudes towards CFL, customer knowledge of EISA standards, customers understanding and usage of current lighting technology, as well as potential stockpiling of

incandescent bulbs. This is only the first wave of the study, and more waves will follow up on other bulb wattages as the EISA standards take effect. The process evaluation has no impact on 2011 evaluated results. This study is discussed in more detail in Section III, Study 10.

The program's performance and the results of the impact evaluations described above will be used to adjust the planning estimates for the program in the next three-year plan for 2013-2015. Changes to this program are not currently expected to result in a mid-term modification for the remainder of the current three-year plan.

The Residential ENERGY STAR Lighting program is cost-effective with a BCR of 5.93.

f. Residential ENERGY STAR Appliances

**Purpose/Goal:** The purpose of the program was to increase consumer awareness of the importance and benefits of purchasing ENERGY STAR-qualified appliances and electronic products, and expand the availability, consumer acceptance, and use of high-quality energy-efficient technologies.

**Targeted Customers:** All residential electric customers were targeted by this program.

**Definition of Program Participant:** A participant is defined as a unique electric account served under this program. For the upstream component this program makes a one for one assumption for television products and two for one assumption for smart strips.

**Targeted End-Uses:**

- Refrigerators
- Freezers
- Televisions
- Room Air Cleaners
- Personal Desktop Computers
- LCD Computer Monitors
- Advanced Power Strips ("Smart Strips")
- Secondary refrigerators and freezers (recycling)
- Pool pumps

**Delivery Mechanism:** The program utilizes upstream incentives and mail-in rebates, which dramatically increased sales and lowered costs of product for customers.

A manufacturer/retailer outreach contractor recruited and trained retailers to participate in the program, placed point-of-purchase materials and rebate forms in participating retail stores, oversaw the NCP process for televisions, and acted as a liaison for Program Administrators, manufacturers, and retailers.

A rebate fulfillment contractor collected data and payment requests from manufacturers, retailers and consumers, processed rebate applications and NCPs, and provided documentation to the Program Administrators for program tracking and evaluation purposes.

For recycling, the customer contacted a vendor either via internet or telephone to schedule a pick-up. The vendor then issued an incentive payment to the customer and properly disposed of the appliance.

**Significant Differences in Actual Program Design from Approved Program Design:** None.

**Docket/Exhibit where the Program is Discussed and Approved:** The program is discussed in detail in the Company's 2010-2012 Three-Year Electric Energy Efficiency Plan, filed October 30, 2009. See NSTAR Electric, D.P.U. 09-120, Exhibit NSTAR-1, pages 173-178 (bates numbering 00179-00184). The program was approved by the Department on January 28, 2010 in NSTAR Electric, D.P.U. 09-120.

Table II.A.9 provides information on the performance of the Residential ENERGY STAR Appliances program.

Table II.A.9: ENERGY STAR Appliances							
Performance Category	Units	Planned Value	Preliminary Year-End Results		Evaluated Results		
			Value	% Change from Planned	Value	% Change from Preliminary	% Change from Planned
<b>Expenses</b>							
Total Program Costs	\$	2,302,761			2,198,005		-5%
Performance Incentive	\$	79,125			93,876		19%
Participants	# of rebates	24,600			33,189		35%
Program Cost / Participant	\$	94			66		-29%
<b>Savings &amp; Benefits</b>							
Energy							
Lifetime	MWh	51,139	58,252	14%	46,557	-20%	-9%
Annualized	MWh	6,277	7,622	21%	6,160	-19%	-2%
Average Measure Life	yrs	8.1	7.6	-6%	7.6	-1%	-7%
Demand							
Lifetime	kW	5,804	15,276	163%	5,558	-64%	-4%
Annualized							
Summer	kW	697	2,301	230%	732	-68%	5%
Winter	kW	767	3,640	375%	904	-75%	18%
Average Measure Life	yrs	8.3	6.6		7.6		
NEB (Lifetime)	\$	0	0	0%	593,872	0%	0%
<b>Cost-Effectiveness</b>							
TRC Benefits	\$	6,675,057			6,905,142		3%
TRC Costs	\$	3,310,786			2,694,931		-19%
Net Benefits	\$	3,364,271			4,210,211		25%
BCR	n/a	2.02			2.56		27%

The majority of the preliminary year-end and evaluated performance categories for the ENERGY STAR Appliances program were close to planned values. Participation increased by 35 percent, leading to an increase in annual savings of 21 percent. However, the major increase in participation was due to a 75 percent increase in purchases of smart strips. The preliminary data also showed a significant increase in all the demand savings categories, however when the evaluated demand savings are applied there are no significant changes to the planned data.

The NEI Study added new benefits from the measures installed in the ENERGY STAR Appliances program that significantly increased the total NEBs and TRC benefits in this program. The increase to NEBs increased net benefits and BCRs significantly above planned values. For further information, please refer to the NEI Study submitted in [NSTAR Electric, D.P.U. 11-106](#).

The EM&V studies included in the Company's 2011 Annual Report that apply to this program are as follows:

*Study 9 - Demand Impact Model User Manual*

The Demand Impact Model User Manual was updated to reflect new load shape data, per-unit measure energy savings, and ISO-NE definitions of peak periods. The results of this study were applied to 2011 study results with the overall effect varying by PA. The Company saw a net decrease in program savings for the 2011 evaluated results. This study is discussed in more detail in Section III, Study 9 and Appendix C Study 9.

The program's performance and the results of the impact evaluations described above will be used to adjust the planning estimates for the program in the next three-year plan for 2013-2015. Changes to this program are not currently expected to result in a mid-term modification for the remainder of the current three-year plan.

The residential ENERGY STAR Appliance program is cost-effective with a BCR of 2.58.

3. Residential Pilot Programs

a. Deep Energy Retrofit

**Description of Pilot/Specific Activities Intended to Study:** The Deep Energy Retrofit pilot was implemented to investigate the potential for energy savings of at least 50 percent of total on-site energy use through deep retrofits of existing residential buildings and to identify incremental savings and how to reduce the costs and challenges associated with deep retrofits.

**Why Implemented on Pilot Basis rather than as a Full Program:** This initiative was offered as a pilot in order for the Program Administrators to study a new approach to achieving energy savings. The Program Administrators analyze the information gathered from the pilot to determine market viability, cost-effectiveness, and, if applicable, adoption rates. Following completion of the pilot, the Program Administrators utilize these pilot results to determine the future of the pilot and whether it will be adopted either as a stand alone program or as an additional measure offering within an existing program.

**Targeted Customers:** The pilot targeted home owners, property owners, and property managers considering renovations and willing to invest in extensive carbon reductions. In addition, the pilot targeted advanced building remodelers, architects, designers, trade allies, and others involved in renovation or restoration of residential buildings.

**Definition of Pilot Program Participant:** A participant is defined as a unique electric account served under this program.

**Targeted End-Uses:**

- Lighting
- HVAC
- Hot Water
- Envelope
- End Use Behavior

**Delivery Mechanism:** Project design details and assistance to the Deep Energy Retrofit contractors performing the work the work was handled through technical specialist contractor, program manager and organizations under contract and/or utilizing DOE Building America funds.

**Significant Differences in Actual Program Design from Approved Program Design:** None.

**How Achievement of the Pilot's Stated Goal was Measured:** The overall goal of the Pilot was to attract participants into this "broader and deeper" energy-savings initiative, knowing that prohibitive costs and project complexities are barriers to deep energy retrofit participation. Ultimately, achievement of this goal is measured by the pilot's cost-effectiveness. It was determined that this pilot is not cost-effective and therefore is no longer being offered in 2012.

**Docket/Exhibit where the Program is Discussed and Approved:** The pilot is discussed in detail in the Company's 2010-2012 Three-Year Electric Energy Efficiency Plan, filed October 30, 2009. See NSTAR Electric, D.P.U. 09-120, Exhibit NSTAR-1, pages 158-163 (bates numbering 00164-00169). The program was approved by the Department on January 28, 2010 in NSTAR Electric, D.P.U. 09-120.

Table II.A.10 provides information on the performance of Deep Energy Retrofit pilot. Because of the nature of pilot programs, the table for this pilot program is incomplete with regard to savings and benefits. The Company has provided all information that is available.

Table II.A.10: Deep Energy Retrofit								
Performance Category	Units	Planned Value	Preliminary Year-End Results		Evaluated Results			
			Value	% Change from Planned	Value	% Change from Preliminary	% Change from Planned	
<b>Expenses</b>								
Total Program Costs	\$	481,960			147,708			-69%
Participants	unique accts	n/a			2			n/a
Program Cost / Participant	\$	n/a			73,854			n/a
<b>Savings &amp; Benefits</b>								
Energy								
Lifetime	MWh	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Annualized	MWh	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Average Measure Life	yrs	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Demand								
Lifetime	kW	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Annualized								
Summer	kW	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Winter	kW	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Average Measure Life	yrs	n/a	n/a	n/a	n/a	n/a	n/a	n/a
NEB (Lifetime)	\$	n/a	n/a	n/a	n/a	n/a	n/a	n/a
<b>Cost-Effectiveness</b>								
TRC Benefits	\$	n/a			n/a			n/a
TRC Costs	\$	481,960			147,708			-69%
Net Benefits	\$	n/a			n/a			n/a
BCR	n/a	n/a			n/a			n/a

Two Deep Energy Retrofit projects were completed in 2011. The total budget was 69 percent less than planned and participation was also lower than planned due to overall costs associated with this program, measure requirements, and the complexity of this type of project. These results fall in line with the Company’s expectations for participation. Factors such as prohibitive costs and project complexity were the overriding contributors to the low participation level.

The pilot continued in 2011 but, based on the results and recommendations from the evaluation, the pilot was discontinued in 2012. However, the Company budgeted funds in 2012 to honor any project commitments made in 2011. Based on lessons learned during the pilot, Program Administrators are in the process of developing a builder’s guide. This guide will be a critical component of the delivery of the 2013-2015 residential Deep Energy Retrofit measures and will be available from the Mass Save website for homeowners, designers, and contractors to help participants understand what is required to install Deep Energy Retrofit measures.

There was no EM&V study for this pilot in 2011.

b. Residential New Construction and Major Renovation – Major Renovation Statewide Pilot

**Description of Pilot/Specific Activities Intended to Study:** The pilot was implemented to capture lost opportunities and encourage energy efficient additions and renovations to existing homes.

**Why Implemented on Pilot Basis rather than as a Full Program:** This initiative was offered as a pilot in order for the Program Administrators to study a new approach to achieving energy savings. The Program

Administrators analyze the information gathered from the pilot to determine market viability, cost-effectiveness, and, if applicable, adoption rates. Following completion of the pilot, the Program Administrators utilize these pilot results to determine the future of the pilot and whether it will be adopted either as a stand alone program or as an additional measure offering within an existing program.

**Targeted Customers:** This program targeted customers who want to build an addition on their existing home.

**Definition of Pilot Program Participant:** A participant is defined as a unique electric account served under this program.

**Targeted End-Uses:**

- Lighting
- HVAC
- Hot Water
- Envelope

**Delivery Mechanism:** The Program Administrators, along with the JMC, included this pilot as an offering under the Massachusetts New Homes with ENERGY STAR program. This pilot combines elements of the Residential New Construction program (for the addition) and the Mass Save program (for the existing portion) to provide a comprehensive whole-house approach. Each home in the program had a HERS analysis performed in order to better understand the existing structure. Recommendations were provided to the homeowner for the existing portion (under a Mass Save model) and also to increase the energy efficiency of the new addition by the market-based rater in the program.

**Significant Differences in Actual Program Design from Approved Program Design:** During the course of the year, the pilot began to focus more extensively on contractors and expanded eligibility to include additional types of additions and rehabs.

**How Achievement of the Pilot's Stated Goal was Measured:** The overall goal of the pilot was to attract participants into this "broader and deeper" energy-savings initiative. Ultimately, achievement of this goal is measured by the pilot's cost-effectiveness.

**Docket/Exhibit where the Program is Discussed and Approved:** The pilot is discussed in detail in the Company's 2010-2012 Three-Year Electric Energy Efficiency Plan, filed October 30, 2009. See NSTAR Electric, D.P.U. 09-120, Exhibit NSTAR-1, pages 131-134 (bates

numbering 00137-00140). The program was approved by the Department on January 28, 2010 in NSTAR Electric, D.P.U. 09-120.

Table II.A.11 provides information on the performance of Residential New Construction and Major Renovation – Major Renovation Statewide Pilot. Because of the nature of pilot programs, the table for this pilot program is incomplete with regard to savings and benefits. The Company has provided all information that is available.

Table II.A.11: Residential New Construction & Major Renovation - Major Renovation statewide pilot								
Performance Category	Units	Planned Value	Preliminary Year-End Results			Evaluated Results		
			Value	% Change from Planned		Value	% Change from Preliminary	% Change from Planned
<b>Expenses</b>								
Total Program Costs	\$	130,416				51,526		-60%
Participants	unique accts	n/a				4		n/a
Program Cost / Participant	\$	n/a				12,882		n/a
<b>Savings &amp; Benefits</b>								
Energy								
Lifetime	MWh	n/a	n/a	n/a		n/a	n/a	n/a
Annualized	MWh	n/a	n/a	n/a		n/a	n/a	n/a
Average Measure Life	yrs	n/a	n/a	n/a		n/a	n/a	n/a
Demand								
Lifetime	kW	n/a	n/a	n/a		n/a	n/a	n/a
Annualized								
Summer	kW	n/a	n/a	n/a		n/a	n/a	n/a
Winter	kW	n/a	n/a	n/a		n/a	n/a	n/a
Average Measure Life	yrs	n/a	n/a	n/a		n/a	n/a	n/a
NEB (Lifetime)	\$	n/a	n/a	n/a		n/a	n/a	n/a
<b>Cost-Effectiveness</b>								
TRC Benefits	\$	n/a				n/a		n/a
TRC Costs	\$	130,416				51,526		-60%
Net Benefits	\$	n/a				n/a		n/a
BCR	n/a	n/a				n/a		n/a

Because there were only a limited number of completed projects in 2011, the major renovations pilot has been redesigned to be more contractor oriented, capture any size addition or partial gut renovation, and use certified building analysts and building envelope professionals in addition to home energy raters as verifiers for savings. With the intention to capture more than four projects, the limited number of completed projects is the primary reason for the 60 percent budget variance.

The redesign of the major renovations pilot was made in response to the Company's experience administering the pilot and preliminary findings from interviews conducted in October and December 2010.

The EM&V study included in the Company's 2011 Annual Report that applies to this pilot is as follows:

Study 11 - *Memo: Major Renovations Pilot Evaluation*

As follow up to the preliminary report on non-participant interviews issued in 2011, this memo briefly summarizes findings from interviews with homeowners, architects and builders involved with projects completed by the end of 2011. The memo focuses on satisfaction with the Pilot and suggestions for how the Pilot could be improved or made more user-friendly. In addition, it summarizes a discussion with a HERS rater who worked with 5 of the 11 completed projects. The results of this study did not impact the 2011 evaluated results. This study is discussed in more detail in Section III, Study 11 and Appendix C Study 11.

The Major Renovations Pilot will be discontinued as a pilot in the new construction program for the next three-year plan 2013-2015.

The Company decided a full evaluation of completed projects in 2011 was not necessary, primarily due to the changes made in the program. The Company will instead continue to monitor the projects that are currently in process to learn further how to integrate a model that remains cost-effective for the Mass Save or HES program in the next three-year plan. PAs anticipate offering deeper energy savings measures through the Mass Save program based upon lessons learned from the major renovation pilot evaluation. However, significant research is necessary to develop the trainings needed to build the contractor infrastructure to implement this initiative successfully.

c. Residential New Construction - Multi-Family (4-8 story) Statewide Pilot

**Description of Pilot/Specific Activities Intended to Study:** The pilot was implemented to broaden participation and achieve deeper savings in the multi-family new construction 4-8 story category through an incentive design that encourages such action.

**Why Implemented on Pilot Basis rather than as a Full Program:** This initiative was offered as a pilot in order for the Program Administrators to study a new approach to achieving energy savings. The Program Administrators analyze the information gathered from the pilot to determine market viability, cost-effectiveness, and, if applicable, adoption rates. Following completion of the pilot, the Program Administrators utilize these pilot results to determine the future of the pilot and whether it will be adopted either as a stand alone program or as an additional measure offering within an existing program.

**Targeted Customers:** This pilot targeted 4-8 story multi-family new construction projects.

**Definition of Pilot Program Participant:** Participants are defined as the number of dwelling units served under this program.

**Targeted End-Uses:**

- Lighting
- Hot Water
- HVAC
- Motors and Drives
- Envelope

**Delivery Mechanism:** This pilot was delivered by the Program Administrators and the statewide new construction program lead vendor.

**Significant Differences in Actual Program Design from Approved Program Design:** None.

**How Achievement of the Pilot's Stated Goal was Measured:** The overall goal of the pilot was to attract participants into this "broader and deeper" energy-savings initiative. Ultimately, achievement of this goal is measured by the pilot's cost-effectiveness.

**Docket/Exhibit where the Program is Discussed and Approved:** The pilot is discussed in detail in the Company's 2010-2012 Three-Year Electric Energy Efficiency Plan, filed October 30, 2009. See NSTAR Electric, D.P.U. 09-120, Exhibit NSTAR-1, pages 196-201 (bates numbering 00202-00207). The program was approved by the Department on January 28, 2010 in NSTAR Electric, D.P.U. 09-120.

Table II.A.12 provides information on the performance of Residential New Construction - Multi-Family (4-8 story) Statewide Pilot. Because of the nature of pilot programs, the table for this pilot program is incomplete with regard to savings and benefits. The Company has provided all information that is available.

Table II.A.12: Residential New Construction Multi Family (4-8 story) statewide pilot								
Performance Category	Units	Planned Value	Preliminary Year-End Results		Evaluated Results			
			Value	% Change from Planned	Value	% Change from Preliminary	% Change from Planned	
<b>Expenses</b>								
Total Program Costs	\$	286,490			157,429			-45%
Participants	# of units	n/a			427			n/a
Program Cost / Participant	\$	n/a			369			n/a
<b>Savings &amp; Benefits</b>								
Energy								
Lifetime	MWh	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Annualized	MWh	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Average Measure Life	yrs	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Demand								
Lifetime	kW	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Annualized								
Summer	kW	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Winter	kW	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Average Measure Life	yrs	n/a	n/a	n/a	n/a	n/a	n/a	n/a
NEB (Lifetime)	\$	n/a	n/a	n/a	n/a	n/a	n/a	n/a
<b>Cost-Effectiveness</b>								
TRC Benefits	\$	n/a			n/a			n/a
TRC Costs	\$	286,490			157,429			-45%
Net Benefits	\$	n/a			n/a			n/a
BCR	n/a	n/a			n/a			n/a

The Four to Eight Story Multi-Family New Construction pilot was introduced in January of 2010 and is set to expire at the end of 2012. The results of the pilot with regard to project and unit counts were very positive in 2011, coming in slightly higher than projected. In addition, the cost per dwelling unit was less than anticipated, which accounts for the 45 percent variance in program costs. The Company will continue to evaluate the pilot in 2012 and has already seen an increase in the number of participating projects.

The EM&V study included in the Company’s 2011 Annual Report that applies to this pilot is as follows:

*Study 12 - Massachusetts Residential New Construction Four to Eight Story Multifamily Pilot Interview Findings*

This study assessed the strengths and areas in need of improvement of the three year pilot that was introduced to serve smaller, four to eight story buildings that do not qualify for ENERGY STAR certification but are too small for commercial programs. The report focused on the lessons learned from the pilot about addressing the energy efficiency potential of the mid-rise multi-family new construction market. The results of this study did not impact the 2011 evaluated results. This study is discussed in more detail in Section III, Study 12 and Appendix C Study 12.

The multi-family statewide pilot will be discontinued as a pilot in the new construction program for the next three-year plan 2013-2015 and incorporated into a component of the new construction program.

The Company will continue to monitor the projects that are currently in process to learn further how to best integrate a model that remains cost-effective for the new construction program in the next three-year plan. PAs anticipate offering deeper energy savings from multi-family new construction measures through the new construction program based upon lessons learned from the multi-family pilot evaluation.

d. Residential New Construction Lighting Design – Statewide Pilot

**Description of Pilot/Specific Activities Intended to Study:** The Program Administrators worked with lighting designers and build/design teams to identify creative ways to approach energy savings through proper lighting design on a portfolio level.

**Why Implemented on Pilot Basis rather than as a Full Program:** This initiative was offered as a pilot in order for the Program Administrators to study a new approach to achieving energy savings. The Program Administrators analyze the information gathered from the pilot to determine market viability, cost-effectiveness, and, if applicable, adoption rates. Following completion of the pilot, the Program Administrators utilize these pilot results to determine the future of the pilot and whether it will be adopted either as a stand alone program or as an additional measure offering within an existing program.

**Targeted Customers:** The target audience for this pilot included homebuilders, contractors, architects/designers, trade allies, HERS raters, homebuyers, realtors, developers, low-income and affordable housing developers, and consumers in the market for new homes and or major renovations.

**Definition of Pilot Program Participant:** A participant is defined as a unique electric account served under this program.

**Targeted End-Uses:** Lighting and controls.

**Delivery Mechanism:** The Program Administrators, along with the JMC, included this pilot as an offering under the Massachusetts New Homes with ENERGY STAR program.

**Significant Differences in Actual Program Design from Approved Program Design:** None.

**How Achievement of the Pilot's Stated Goal was Measured:** The overall goal of the pilot was to attract participants into this "broader and deeper" energy-savings initiative. Ultimately, achievement of this goal is measured by the pilot's cost-effectiveness.

**Docket/Exhibit where the Program is Discussed and Approved:** The pilot is discussed in detail in the Company’s 2010-2012 Three-Year Electric Energy Efficiency Plan, filed October 30, 2009. See NSTAR Electric, D.P.U. 09-120, Exhibit NSTAR-1, page 130 (bates numbering 00136). The program was approved by the Department on January 28, 2010 in NSTAR Electric, D.P.U. 09-120.

Table II.A.13 provides information on the performance of Residential New Construction Lighting Design Statewide Pilot. Because of the nature of pilot programs, the table for this pilot program is incomplete with regard to savings and benefits. The Company has provided all information that is available.

Table II.A.13: Residential New Construction Lighting Design statewide pilot								
Performance Category	Units	Planned Value	Preliminary Year-End Results			Evaluated Results		
			Value	% Change from Planned		Value	% Change from Preliminary	% Change from Planned
<b>Expenses</b>								
Total Program Costs	\$	10,000				14,487		45%
Participants	unique accts	n/a				5		n/a
Program Cost / Participant	\$	n/a				2,897		n/a
<b>Savings &amp; Benefits</b>								
Energy								
Lifetime	MWh	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Annualized	MWh	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Average Measure Life	yrs	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Demand								
Lifetime	kW	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Annualized								
Summer	kW	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Winter	kW	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Average Measure Life	yrs	n/a	n/a	n/a	n/a	n/a	n/a	n/a
NEB (Lifetime)	\$	n/a	n/a	n/a	n/a	n/a	n/a	n/a
<b>Cost-Effectiveness</b>								
TRC Benefits	\$	n/a				n/a		n/a
TRC Costs	\$	10,000				14,487		45%
Net Benefits	\$	n/a				n/a		n/a
BCR	n/a	n/a				n/a		n/a

The Company exceeded its overall budget slightly because a greater number of projects were completed than anticipated in 2011. The five projects in the lighting design pilot resulted in new lighting technology being installed through the new construction program. The pilot continues to refine the lighting data tracking system and its baseline home reference standards. In 2011, homes in the pilot installed higher efficacy lamps and a higher percentage of controls than earlier participants. Although the sample size is very small, initial results have shown a significant increase in savings against the baseline home, and the Company has seen electric controls become a larger portion of the home’s total estimated lighting savings. Despite the increase in participation and enrolled projects, the PAs need more data and will continue to monitor and evaluate existing projects through the end of 2012.

The Company intends to continue evaluating the data from the pilot during the 2012 program year, and currently plans to include qualified cost effective light-emitting diodes (“LEDs”) and controls into its standard new construction program in the next three-year plan for 2013-2015.

There is no EM&V study associated with this pilot.

e. Community-Based Pilots

**Description of Pilot/Specific Activities Intended to Study:** The term “Community-Based Pilots” encompassed a number of unique partnerships in 2011 between the Program Administrators and local communities designed to harness the power of community-based outreach to achieve broader participation in the Commonwealth’s energy efficiency programs. NSTAR participated in a number of community initiatives in its service territory in 2011 including those in New Bedford, Brookline, Cambridge, Dartmouth, Lincoln, Needham, Newton, and Winchester. The Company also participated in a community based partnership in New Bedford and community mobilization initiatives in Chinatown and Chelsea.

**Why Implemented on Pilot Basis rather than as a Full Program:** The community-based initiatives were offered as pilots to assess the effectiveness of each partnership and determine their potential for replication.

**Targeted Customers:** The Program Administrators and interested stakeholders selected communities with the greatest opportunities for success, based on an assessment of the proposal submitted. Targeted customers varied by pilot, but in general included residential customers with incomes between 60 and 120 percent of median household income in their community.

**Definition of Pilot Program Participant:** Participants in this pilot are counted as participants in other programs such as Mass Save.

**Targeted End-Uses:** The end-uses targeted by the community based pilots included the same end-uses addressed under the Company’s existing audit and weatherization programs.

**Delivery Mechanism:** Program outreach was conducted by local community groups. Measures were installed through the Company’s existing lead vendors.

**Significant Differences in Actual Program Design from Approved Program Design:** None.

**How Achievement of the Pilot’s Stated Goal was Measured:** A multi-year evaluation of community based pilots was conducted by Opinion Dynamics Corporation to assess the effectiveness of these pilots and determine their potential for replication. This process evaluation is included with this Annual Report as Appendix C, Study 30.

**Docket/Exhibit where the Program is Discussed and Approved:** The pilot is discussed in detail in the Company’s 2010-2012 Three-Year Electric Energy Efficiency Plan, filed October 30, 2009. See NSTAR Electric, D.P.U. 09-120, Exhibit NSTAR-1, pages 115-118 (bates numbering 00121-00124). The program was approved by the Department on January 28, 2010 in NSTAR Electric, D.P.U. 09-120.

Table II.A.14 provides information on the performance of the Community Based pilot. Because of the nature of pilot programs, the table for this pilot program is incomplete with regard to savings and benefits. The Company has provided all information that is available.

Table II.A.14: Community Based Pilot							
Performance Category	Units	Planned Value	Preliminary Year-End Results		Evaluated Results		
			Value	% Change from Planned	Value	% Change from Preliminary	% Change from Planned
<b>Expenses</b>							
Total Program Costs	\$	402,621			233,351		-42%
Participants	see MassSave	n/a			n/a		n/a
Program Cost / Participant	\$	n/a			n/a		n/a
<b>Savings &amp; Benefits</b>							
Energy							
Lifetime	MWh	n/a	n/a	n/a	n/a	n/a	n/a
Annualized	MWh	n/a	n/a	n/a	n/a	n/a	n/a
Average Measure Life	yrs	n/a	n/a	n/a	n/a	n/a	n/a
Demand							
Lifetime	kW	n/a	n/a	n/a	n/a	n/a	n/a
Annualized							
Summer	kW	n/a	n/a	n/a	n/a	n/a	n/a
Winter	kW	n/a	n/a	n/a	n/a	n/a	n/a
Average Measure Life	yrs	n/a	n/a	n/a	n/a	n/a	n/a
NEB (Lifetime)	\$	n/a	n/a	n/a	n/a	n/a	n/a
<b>Cost-Effectiveness</b>							
TRC Benefits	\$	n/a			n/a		n/a
TRC Costs	\$	402,621			233,351		-42%
Net Benefits	\$	n/a			n/a		n/a
BCR	n/a	n/a			n/a		n/a

The reasons for the significant variance between planned and actual total program costs and TRC costs were: 1) delays in setting up the customer intake process for some initiatives, 2) several of the community outreach initiatives did not start until late 2011, and 3) one partner community dropped out of the program due to lack of support from volunteers. Each of these events led to lower expenditures in 2011 than was initially projected.

As stated above, NSTAR Electric Company participated in a number of community initiatives in its service territory in 2011 including those in New Bedford, Brookline, Cambridge, Dartmouth, Lincoln, Needham, Newton, and Winchester. The Company also participated in community mobilization initiatives in Chinatown and Chelsea. Community organizations conducted outreach activities to increase participation levels in the Mass Save 1-4 family and multi-family programs. In addition to helping residents save money and energy, the Chinatown and Chelsea initiatives sought to provide employment opportunities and career pathways for community residents who are trained and qualified to perform residential weatherization work.

Summary results of this pilot were not complete in time for this report due to the number of community initiatives being carried over into the 2012 program year. However, initial results indicate that participation levels will vary significantly based on location (urban or suburban), age and type of housing stock, consumer demographics, and overall level of the community's engagement. Initial results also indicate pre-weatherization barriers are more prevalent in urban environments, especially in inner-city housing stock thus creating additional challenges for implementing weatherization upgrades.

While the overall results and successes of these outreach activities varied, it has become evident that community engagement is an important component to enhancing the Company's ability to achieve greater program participation (e.g., Home Energy Services) and energy savings. The Company also recognizes there is no "one size that fits all" community engagement model. However, despite differences in size and scope the Company remains committed to working with various community organizations and partners for the remainder of this pilot in 2012 and beyond. As of this writing, the Company does not expect this pilot to become a stand alone program in the 2013-2015 Three-Year Plan but rather anticipates community based outreach initiatives to become an extension of its overall program level marketing and outreach strategies.

The EM&V study included in the Company's 2011 Annual Report that applies to this pilot is as follows:

*Study 30 – Community-Based Partnerships 2011 Evaluation Final Report*

The evaluation of community-based partnerships was intended to assess the effectiveness of such partnerships and determine the potential for replication and/or full-scale implementation of this type of pilot. The report builds upon an interim report issued in 2011 and presents the findings of the evaluation research conducted to date. This evaluation had no impact on the evaluated results. The study is discussed in more detail in Section III, Study 30 and Appendix C Study 30.

**B. Low-Income Sector Programs**

**1. Summary**

During 2011 the Company implemented the following low-income programs:<sup>5</sup>

- Low-Income Residential New Construction
- Low-Income 1-4 Family Retrofit
- Low-Income Multi-Family Retrofit

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<sup>5</sup> The Company did not offer any pilot programs in the low-income sector during 2011.

Tables II.B.1 through II.B.3 provide summary information on the performance of the low-income programs at the sector, end use, and program levels, respectively.

Section II.B.2 provides detailed information on the performance of each low-income program.

Table II.B.1: Low-Income Sector Summary							
Performance Category	Units	Planned Value	Preliminary Year-End Results		Evaluated Results		
			Value	% Change from Planned	Value	% Change from Preliminary	% Change from Planned
<b>Expenses</b>							
Total Program Costs	\$	12,980,072			11,565,948		-11%
Performance Incentive	\$	826,025			884,107		7%
<b>Savings &amp; Benefits</b>							
Energy							
Lifetime	MWh	112,267	97,595	-13%	114,476	17%	2%
Annualized	MWh	11,366	9,214	-19%	9,478	3%	-17%
Demand							
Lifetime	kW	12,533	10,710	-15%	8,957	-16%	-29%
Annualized							
Summer	kW	949	812	-14%	878	8%	-7%
Winter	kW	1,761	1,673	-5%	1,710	2%	-3%
NEB (Lifetime)	\$	19,989,883	21,082,326	5%	16,226,317	-23%	-19%
<b>Cost-Effectiveness</b>							
TRC Benefits	\$	33,442,442			29,511,997		-12%
TRC Costs	\$	13,806,097			13,048,065		-5%
Net Benefits	\$	19,636,345			16,463,932		-16%
BCR	n/a	2.42			2.26		-7%

As shown in Table II.B.1 above, a variance exists at the low-income sector level for evaluated lifetime energy demand. The reason the lifetime energy demand is significantly lower than planned is primarily driven by the Low-Income Single-Family program, which saw a pre-evaluated decline of 24 percent in lifetime energy demand. However the new demand factors in the demand impact model also decreased the evaluated results further for each low-income program. For further information, please refer to Appendix C, Study 9. There were no other significant variances for the low-income sector level totals.

A more detailed program-level discussion can be found in Section II.B.2.

<b>Table II.B.2: Low-Income Sector Summary of End Uses</b>				
<b>End Uses</b>	<b>Units (lifetime)</b>	<b>Preliminary Year-End Results</b>	<b>Evaluated Results</b>	<b>% Change from Preliminary to Evaluated</b>
<b>Lighting</b>				
Energy	MWh	54,407	78,647	45%
Demand	kW	5,255	4,851	-8%
NEB	\$	942,534	922,554	-2%
<b>HVAC</b>				
Energy	MWh	3,154	10,109	221%
Demand	kW	663	987	49%
NEB	\$	9,611,739	10,267,905	7%
<b>Behavior</b>				
Energy	MWh	5,450	987	-82%
Demand	kW	525	113	-79%
NEB	\$	9,075,995	3,681,896	-59%
<b>Refrigeration</b>				
Energy	MWh	34,418	24,709	-28%
Demand	kW	4,264	3,006	-30%
NEB	\$	1,268,676	1,218,518	-4%
<b>Hot Water</b>				
Energy	MWh	167	23	-86%
Demand	kW	3	0	-89%
NEB	\$	183,381	135,443	-26%
<b>Total</b>				
Energy	MWh	97,595	114,476	17%
Demand	kW	10,710	8,957	-16%
NEB	\$	21,082,326	16,226,317	-23%

<b>Table II.B.3: Low-Income Program Summary</b>				
<b>Sector</b>	<b>Units</b>	<b>Planned Value</b>	<b>Evaluated Results</b>	
			<b>Value</b>	<b>% Change from Planned</b>
<b>Low-Income Residential New Construction</b>				
TRC Benefits	\$	1,421,355	4,008,443	182%
TRC Costs	\$	860,970	1,439,578	67%
Net Benefits	\$	560,385	2,568,866	358%
BCR	n/a	1.65	2.78	69%
<b>Low-Income 1 to 4 Family Retrofit</b>				
TRC Benefits	\$	20,367,623	14,780,004	-27%
TRC Costs	\$	5,968,949	5,141,708	-14%
Net Benefits	\$	14,398,674	9,638,296	-33%
BCR	n/a	3.41	2.87	-16%
<b>Low-Income MultiFamily Retrofit</b>				
TRC Benefits	\$	11,653,464	10,723,549	-8%
TRC Costs	\$	6,458,864	6,181,801	-4%
Net Benefits	\$	5,194,600	4,541,749	-13%
BCR	n/a	1.80	1.73	-4%
<b>Hard-to-Measure Initiatives</b>				
TRC Costs	\$	517,314	284,978	-45%
<b>TOTAL</b>				
TRC Benefits	\$	33,442,442	29,511,997	-12%
TRC Costs	\$	13,806,097	13,048,065	-5%
Net Benefits	\$	19,636,345	16,463,932	-16%
BCR	n/a	2.42	2.26	-7%

The variances in Table II.B.2 are categorized by end use. It is difficult to isolate the reason for the change by end use because end uses stretch across many different programs that have various delivery methods, savings, NTG factors, NEBs, and costs. Therefore, these variances are explained in the context of program variances discussed below. The variances in Table II.B.3 are by program and are also discussed in detail below.

### Low-Income Sector Performance Highlights

During 2011, the PAs continued to leverage all applicable revenue streams available and built on the current Department of Housing and Community Development low-income energy efficiency program to deepen efficiency penetration consistent with a comprehensive, whole house/building approach. The program was able to leverage American Recovery and Reinvestment Act (“ARRA”) funds slated for Public Housing Authority heating system replacements by providing minimal co-payments toward upgrades. This allowed PAs to not only achieve significant savings at a lower cost, but also enabled ARRA funding to stretch further with the replacement

of more units. Some of the PAs were close to their goal in terms of therm/kWh savings as well as spending. However, some PAs were notably under in production and spending as a result of the extensive use of available ARRA funding instead of PA funds. Additionally, spending was affected by the composition of customers in each PA's service area, particularly the proportion of low-income customers in the territory.

2. Low-Income Programs

a. Low-Income New Construction

**Purpose/Goal:** The purpose of the Low-Income New Construction program was to encourage the construction of energy-efficient homes, and drive the market to one in which new homes are moving towards near-zero energy.

**Targeted Customers:** The target market for this program included homebuilders, contractors, architects/designers, trade allies, HERS raters, homebuyers, realtors, developers, low-income and affordable housing developers, code officials, and consumers in the market for new homes and/or major renovations.

**Definition of Program Participant:** A participant is defined as a unique electric account served under this program. For the low-income new construction the account represents a newly constructed dwelling unit.

**Targeted End-Uses:**

- Lighting
- HVAC
- Refrigeration
- Hot Water
- Envelope

**Delivery Mechanism:** The program is administered by each Program Administrator in its service territory and coordinated regionally through the JMC.

**Significant Differences in Actual Program Design from Approved Program Design:** None.

**Docket/Exhibit where the Program is Discussed and Approved:** The program is discussed in detail in the Company's 2010-2012 Three-Year Electric Energy Efficiency Plan, filed October 30, 2009. See NSTAR Electric, D.P.U. 09-120, Exhibit NSTAR-1, pages 202-208 (bates

numbering 00208-00214). The program was approved by the Department on January 28, 2010 in NSTAR Electric, D.P.U. 09-120.

Table II.B.4 provides information on the performance of the Low-Income New Construction program.

Table II.B.4: Low-Income Residential New Construction							
Performance Category	Units	Planned Value	Preliminary Year-End Results		Evaluated Results		
			Value	% Change from Planned	Value	% Change from Preliminary	% Change from Planned
<b>Expenses</b>							
Total Program Costs	\$	841,737			703,108		-16%
Performance Incentive	\$	19,233			138,461		620%
Participants	unique accts	816			464		-43%
Program Cost / Participant	\$	1,032			1,515		47%
<b>Savings &amp; Benefits</b>							
Energy							
Lifetime	MWh	5,508	4,962	-10%	3,315	-33%	-40%
Annualized	MWh	364	285	-22%	190	-33%	-48%
Average Measure Life	yrs	15.1	17.4	15%	17.4	0%	15%
Demand							
Lifetime	kW	1,243	1,239	0%	1,050	-15%	-16%
Annualized							
Summer	kW	63	58	-7%	48	-17%	-23%
Winter	kW	57	56	-2%	40	-29%	-31%
Average Measure Life	yrs	19.8	21.2		21.8		
NEB (Lifetime)	\$	680,952	769,460	13%	3,514,658	357%	416%
<b>Cost-Effectiveness</b>							
TRC Benefits	\$	1,421,355			4,008,443		182%
TRC Costs	\$	860,970			1,439,578		67%
Net Benefits	\$	560,385			2,568,866		358%
BCR	n/a	1.65			2.78		69%

In the case of the Low-Income Residential New Construction program, there are significant variances in both the preliminary year-end results and the evaluated results.

Due to the new construction market being slower than expected, fewer homes were built and the program had a 43 percent decline in participation in 2011. Despite this decline, there were higher tier and higher savings units certified as ENERGY STAR Homes than anticipated. This can be seen in the preliminary and lifetime savings as the deeper measures installed in the program have longer lifetime and higher energy savings than planned. However, the evaluated results show a decline in lifetime and annual savings due to the *Massachusetts Mini Baseline Study of Homes Built at the End of the 2006 IECC Cycle*. This evaluation studied average homes being built in Massachusetts and looked at average installation of several efficient electric measures that were being installed in a baseline home. The results of this study caused an increase to the free ridership to dishwashers, refrigerators, and lighting units that caused a decrease in lifetime and annual savings. For further information, please refer to Appendix C, Study 3. There was also a decrease to the summer and winter evaluated demand

factors which was a result of the new demand impact model. For further information, please refer to Appendix C, Study 9.

The total resource costs increased by 67 percent due to a change in the incentive delivery method for this program. Low-income customers participating in the low-income program receive 100 percent of the incentives paid through the low-income program. Because builders receiving an incentive through this program are not low-income customers, low-income new construction builders were asked to pay a portion of the total cost for this program. This program design mirrors the existing structure of incentives offered to builders in the residential new construction program.

Significant NEI benefits associated with the installation of new home measures were included in the evaluated results increasing benefits by 416 percent from planned to evaluated data. These benefits were not previously included in this low-income program. For further information, please refer to the NEI study filed in NSTAR Electric, D.P.U. 11-106 and Appendix C, Study 28. Because of the overall increases to non-energy benefits along with only slightly higher costs, TRC benefits for the low-income new construction program increased significantly. This increase in TRC benefits caused the net benefits and BCR to increase significantly over planned values.

The Company's methodology allocated performance incentives achieved at the sector level to individual programs based on benefits and net benefits. Any variance in actual performance incentive allocations is directly linked to variances in evaluated benefits and net benefits in individual programs within a sector. These variances are not attributable to a change in performance incentive allocation methodology. In order to explain program performance incentive variance, please refer to the explanation of benefits and net benefits variances above.

The EM&V studies included in the Company's 2011 Annual Report that apply to this program are as follows:

*Study 1 - Massachusetts Residential New Construction Home Buyer Survey*

This study examined what buyers look for in a new home, awareness of ENERGY STAR homes, the role of ENERGY STAR certification in new home shopping, perceptions of ENERGY STAR homes, and reactions to recent changes in the program. The study also provides updates of similar surveys conducted in 2002, 2003, 2004, and 2006. The results of this study did not impact the 2011 evaluated results. This study is discussed in more detail in Section III, Study 1 and Appendix C Study 1.

*Study 2 - Massachusetts Residential New Construction Focus Groups with Participant Builders*

This study assessed participating builders' experience with the Program and their reactions to changes made in 2011 and changes which may be forthcoming in 2012. The results of this study did not impact the 2011 evaluated results. This study is discussed in more detail in Section III, Study 2 and Appendix C Study 2.

*Study 3 - Massachusetts Mini Baseline Study of Homes Built at the End of the 2006 IECC Cycle*

This study was conducted in partnership with DOER to assess compliance with basic building code prescriptive path requirements at the end of the 2006 International Energy Conservation Code (IECC) code cycle, provide a preliminary assessment of how current new single-family residential building characteristics compare to current User Defined Reference Home (UDRH) inputs, and conduct audits of energy efficient lighting and appliances within the homes. The study also compared building practices, equipment efficiencies, and other characteristics in custom versus spec built homes. Results from this study reduced the electric savings based on the penetration rates of high efficiency lighting and appliances. This study is discussed in more detail in Section III, Study 3 and Appendix C Study 3.

*Study 9 - Demand Impact Model User Manual*

The Demand Impact Model User Manual was updated to reflect new load shape data, per-unit measure energy savings, and ISO-NE definitions of peak periods. The results of this study were applied to 2011 study results with the overall effect varying by PA. The Company saw a net decrease in program savings for the 2011 evaluated results. This study is discussed in more detail in Section III, Study 9 and Appendix C Study 9.

The program's performance and the results of the impact evaluations described above will be used to adjust the planning estimates for the program in the next three-year plan for 2013-2015. Changes to this program are not currently expected to result in a mid-term modification for the remainder of the current three-year plan. A mid-term modification was submitted for this program in the Company's 2012 Mid-Term Modification filed with the Department on October 28, 2011 in NSTAR Electric, D.P.U. 11-106.

The Low-Income New Construction program is cost effective with a BCR of 3.16.

b. Low-Income 1-4 Family Retrofit

**Purpose/Goal:** The purpose of the Low-Income 1-4 Family Retrofit program was to increase energy efficiency and reduce the energy cost burden for income-eligible customers through the installation of electric energy efficiency measures to achieve deeper and broader energy savings consistent with a comprehensive, whole house approach.

**Targeted Customers:** This program targeted residential customers living in one- to four-unit dwellings who are at or below 60 percent of the state median income level and who are qualified to receive fuel assistance and/or utility discount rate(s). For two- to four- unit dwellings, 50 percent of the occupants must qualify as low-income.

**Definition of Program Participant:** A participant is defined as a unique electric account served under this program. The unique account is tied to the low-income audit.

**Targeted End-Uses:**

- Lighting
- Heating and Ventilation
- Refrigeration
- Hot Water
- Envelope

**Delivery Mechanism:** PAs used a lead vendor and/or worked closely with their respective Community Action Program (“CAP”) agencies on all aspects of the program design and implementation. All PAs worked in conjunction with the Low Income Energy Affordability Network (“LEAN”). The lead vendor/CAP agencies were responsible for providing coordination of energy efficiency services to the customers, working with installation contractors to ensure that the proper initiative guidelines were enforced, ensuring that the customers met the eligibility requirements for program participation, and providing the lead vendor/CAP and/or PA with the required documentation of all work performed.

**Significant Differences in Actual Program Design from Approved Program Design:** None.

**Docket/Exhibit where the Program is Discussed and Approved:** The program is discussed in detail in the Company’s 2010-2012 Three-Year Electric Energy Efficiency Plan, filed October 30, 2009. See NSTAR Electric, D.P.U. 09-120, Exhibit NSTAR-1, pages 209-216 (bates

numbering 00215-00222). The program was approved by the Department on January 28, 2010 in NSTAR Electric, D.P.U. 09-120.

Table II.B.5 provides information on the performance of the Low-Income 1 to 4 Family Retrofit program.

Table II.B.5: Low-Income 1 to 4 Family Retrofit							
Performance Category	Units	Planned Value	Preliminary Year-End Results		Evaluated Results		
			Value	% Change from Planned	Value	% Change from Preliminary	% Change from Planned
<b>Expenses</b>							
Total Program Costs	\$	5,455,643			4,650,971		-15%
Performance Incentive	\$	513,306			490,737		-4%
Participants	audits + fridges	2,200			2,662		21%
Program Cost / Participant	\$	2,480			1,747		-30%
<b>Savings &amp; Benefits</b>							
Energy							
Lifetime	MWh	57,658	45,734	-21%	38,162	-17%	-34%
Annualized	MWh	3,725	3,475	-7%	2,926	-16%	-21%
Average Measure Life	yrs	15.5	13.2	-15%	13.0	-1%	-16%
Demand							
Lifetime	kW	7,322	5,562	-24%	4,694	-16%	-36%
Annualized							
Summer	kW	450	394	-13%	368	-7%	-18%
Winter	kW	690	717	4%	431	-40%	-38%
Average Measure Life	yrs	16.3	14.1		12.8		
NEB (Lifetime)	\$	13,496,154	14,534,023	8%	10,013,660	-31%	-26%
<b>Cost-Effectiveness</b>							
TRC Benefits	\$	20,367,623			14,780,004		-27%
TRC Costs	\$	5,968,949			5,141,708		-14%
Net Benefits	\$	14,398,674			9,638,296		-33%
BCR	n/a	3.41			2.87		-16%

In the case of the Low-Income 1 to 4 Family Retrofit program, there was significant variance in many of the preliminary year-end results and evaluated results, as well as several impact studies conducted that affected this program.

Participation increased by 21 percent, however approximately 30 percent fewer refrigerators and heating systems were replaced through the low-income single family program. This led to a decline of 21 percent of lifetime savings and a 24 percent decline in lifetime energy demand savings for preliminary data. In the evaluated data The *Low Income Single Family Program Impact Evaluation* also lowered savings from heating systems and refrigerators for NSTAR electric which continued to decrease savings for lifetime and annual savings, as well as lifetime energy demand. For further information, please refer to Appendix C, Study 17. The program's winter demand savings were also impacted by the new demand impacts which decreased winter savings by 38 percent over planned values and 40 percent lower than preliminary values.

Finally, planned NEI benefits and evaluated benefits from the NEI study associated with the installation of single family low-income measures were refined and this had a net reduction to benefits from planned values. For further

information, please refer to Appendix C, Study 28. The reductions to energy savings measures, and non-energy benefits, caused the TRC benefits for the single family low-income program to decrease. Therefore this reduction in TRC benefits decreased both net benefits and the BCR lower than planned values.

The EM&V studies included in the Company's 2011 Annual Report that apply to this program are as follows:

*Study 9 - Demand Impact Model User Manual*

The Demand Impact Model User Manual was updated to reflect new load shape data, per-unit measure energy savings, and ISO-NE definitions of peak periods. The results of this study were applied to 2011 study results with the overall effect varying by PA. The Company saw a net decrease in program savings for the 2011 evaluated results. This study is discussed in more detail in Section III, Study 9 and Appendix C Study 9.

*Study 16 - Massachusetts 2011 Low-Income Program Process Evaluation*

This study assessed program processes with a particular focus on identifying similarities and differences in the perspectives and assumptions of program staff, implementation staff, and customers regarding program goals, design and implementation across the PAs. The study produced recommended improvements for process-related issues, identified areas where the program changed in 2011, and followed up on topics initially researched in 2010. This evaluation has no impact on 2011 evaluated results. This study is discussed in more detail in Section III, Study 16 and Appendix C Study 16.

*Study 17 – Low Income Single Family Program Impact Evaluation*

This impact evaluation quantified the gross per-unit savings generated by each low-income measure. The results of this study were applied to 2011 program results and were determined by utilizing both billing and engineering analyses. The impact of this study varied for each PA based on planning assumptions and measure mix. The 2011 evaluated results had a net decrease for the Company due to this study. This study is discussed in more detail in Section III, Study 17 and Appendix C Study 17.

*Study 28 - Additional Non-Energy Impacts for Low Income Programs*

This additional research clarified and expanded the research performed in the Residential and Low-Income Non-Energy Impacts Evaluation (filed in D.P.U 11 -106). Values were updated for certain additional Non-Energy Impacts. Savings were not impacted by this research; however, there was a net decrease to benefits for the Company from planned benefits. The additional research is discussed in more detail in Section III, Study 28 and Appendix C Study 28.

The program's performance and the results of the impact evaluations described above will be used to adjust the planning estimates for the program in the next three-year plan for 2013-2015. Changes to this program are not currently expected to result in a mid-term modification for the remainder of the current three-year plan.

The Low-Income Single Family program is cost effective with a BCR of 2.86.

c. Low-Income Multi-Family Retrofit

**Purpose/Goal:** The purpose of the Low-Income Multi-Family Retrofit program was to deliver energy efficient products and services directly to income-eligible residential customers living in multi-family facilities with five or more dwelling units.

**Targeted Customers:** The program targeted public housing authorities, non-profit housing developers, landlords, property managers, and residential customers at, or below, 60 percent of median income living in multi-family properties consisting of five or more units.

**Definition of Program Participant:** A participant is considered a unique electric account number served in a facility with five or more units.

**Targeted End-Uses:**

- Lighting
- Heating and Ventilation
- Refrigeration
- Hot Water
- Envelope

**Delivery Mechanism:** PAs used a lead vendor and/or worked closely with their respective CAP Agencies on all aspects of the program design and implementation. All PAs worked in conjunction with LEAN as well as the Multi-Family Advisory Committee comprised of LEAN, Community Development Corporations, Public Housing Authorities and other nonprofit owners of low-income non-institutional multi-family housing. The Multi-Family Advisory Committee was tasked with prioritizing low-income multi-family projects for each PA, using benchmarking software called WegoWise. The lead vendor/CAP agencies were responsible for providing coordination of energy efficiency services to the customers, working with installation contractors to ensure that the proper initiative guidelines were enforced, ensuring that the customers met the eligibility requirements for program participation as well as providing the lead vendor/CAP and/or PA with the required documentation of all work performed.

**Significant Differences in Actual Program Design from Approved Program Design: None.**

**Docket/Exhibit where the Program is Discussed and Approved:** The program is discussed in detail in the Company’s 2010-2012 Three-Year Electric Energy Efficiency Plan, filed October 30, 2009. See NSTAR Electric, D.P.U. 09-120, Exhibit NSTAR-1, pages 217-230 (bates numbering 00223-00236). The program was approved by the Department on January 28, 2010 in NSTAR Electric, D.P.U. 09-120.

Table II.B.6 provides information on the performance of the Low-Income Multi-Family Retrofit program.

Table II.B.6: Low-Income MultiFamily Retrofit							
Performance Category	Units	Planned Value	Preliminary Year-End Results		Evaluated Results		
			Value	% Change from Planned	Value	% Change from Preliminary	% Change from Planned
<b>Expenses</b>							
Total Program Costs	\$	6,165,378			5,926,891		-4%
Performance Incentive	\$	293,486			254,910		-13%
Participants	audits + fridges	3,980			5,236		32%
Program Cost / Participant	\$	1,549			1,132		-27%
<b>Savings &amp; Benefits</b>							
<b>Energy</b>							
Lifetime	MWh	49,101	46,898	-4%	72,999	56%	49%
Annualized	MWh	7,277	5,454	-25%	6,362	17%	-13%
Average Measure Life	yrs	6.7	8.6	27%	11.5	33%	70%
<b>Demand</b>							
Lifetime	kW	3,968	3,908	-2%	3,213	-18%	-19%
<b>Annualized</b>							
Summer	kW	436	360	-17%	462	29%	6%
Winter	kW	1,014	899	-11%	1,240	38%	22%
Average Measure Life	yrs	9.1	10.9		6.9		
NEB (Lifetime)	\$	5,812,777	5,778,843	-1%	2,697,998	-53%	-54%
<b>Cost-Effectiveness</b>							
TRC Benefits	\$	11,653,464			10,723,549		-8%
TRC Costs	\$	6,458,864			6,181,801		-4%
Net Benefits	\$	5,194,600			4,541,749		-13%
BCR	n/a	1.80			1.73		-4%

In the case of the Low-Income Multi-Family program, there was significant variance in many of the preliminary year-end results and evaluated results, as well as several impact studies conducted that affected this program.

Participation increased by 32 percent over planned, however the program was planned aggressively with a one to one ratio of audits to refrigerators and the Company actually installed approximately 40 percent fewer refrigerators than planned. This led to a decline of 25 percent of annual savings. At the same time, the program installed 210 more electric weatherization jobs than planned, and which has a long measure life, thus increasing the total measure life of the program by 27 percent. Similar to the Residential Multi-Family Low-Income program, the Company separated common area lighting fixtures into a separate

category to more accurately reflect the lighting measures individual costs and savings. The program's winter demand savings were also impacted by the new demand impacts which increased winter savings from the lighting measures by 22 percent over planned values and 40 percent higher than preliminary values.

Finally, planned NEI benefits and evaluated benefits from the NEI study associated with the installation of multi-family low-income measures were refined and this had a net reduction to benefits from planned values. For further information, please refer to Appendix C, Study 28.

The EM&V studies included in the Company's 2011 Annual Report that apply to this program are as follows:

*Study 5 - Massachusetts Multifamily Market Characterization and Potential Study*

The primary objective of this market characterization study was to assess the potential energy efficiency savings available in multi-family buildings within Massachusetts. The results of this study did not impact the 2011 evaluated results but is being used to inform ongoing planning and program design. This study is discussed in more detail in Section III, Study 5 and Appendix C Study 5.

*Study 9 - Demand Impact Model User Manual*

The Demand Impact Model User Manual was updated to reflect new load shape data, per-unit measure energy savings, and ISO-NE definitions of peak periods. The results of this study were applied to 2011 study results with the overall effect varying by PA. The Company saw a net increase/decrease in program savings for the 2011 evaluated results. This study is discussed in more detail in Section III, Study 9 and Appendix C Study 9.

*Study 16 - Massachusetts 2011 Low Income Program Process Evaluation*

This study assessed program processes with a particular focus on identifying similarities and differences in the perspectives and assumptions of program staff, implementation staff, and customers regarding program goals, design and implementation across the PAs. The study produced recommended improvements for process-related issues, identified areas where the program changed in 2011, and followed up on topics initially researched in 2010. This evaluation has no impact on 2011 evaluated results. This study is discussed in more detail in Section III, Study 16 and Appendix C Study 16.

*Study 28 - Additional Non-Energy Impacts for Low Income Programs*

This additional research clarified and expanded the research performed in the Residential and Low-Income Non-Energy Impacts Evaluation (filed in D.P.U

11-106). Values were updated for certain additional Non-Energy Impacts. Savings were not impacted by this research; however, there was a net increase/decrease to benefits for the Company. The additional research is discussed in more detail in Section III, Study 28 and Appendix C Study 28.

The program's performance and the results of the impact evaluations described above will be used to adjust the planning estimates for the program in the next three-year plan for 2013-2015. Changes to this program are not currently expected to result in a mid-term modification for the remainder of the current three-year plan.

The Low-Income Multi-Family Retrofit program is cost effective with a BCR of 1.72.

## C. Commercial and Industrial Sector Programs

### 1. Summary

During 2011 the Company implemented the following Commercial and Industrial ("C&I") programs and pilots:

#### C&I Programs

- C&I New Construction and Major Renovation
- C&I Large Retrofit
- C&I Small Retrofit

#### C&I Pilots

- Community Based Pilots

Tables II.C.1 through II.C.3 provide summary information on the performance of the C&I programs at the sector, end use, and program levels, respectively.

Sections II.C.2 and II.C.3 provide detailed information on the performance of each C&I program and pilot program, respectively.

Table II.C.1: C&I Sector Summary							
Performance Category	Units	Planned Value	Preliminary Year-End Results		Evaluated Results		
			Value	% Change from Planned	Value	% Change from Preliminary	% Change from Planned
<b>Expenses</b>							
Total Program Costs	\$	118,988,483			63,930,019		-46%
Performance Incentive	\$	6,528,207			5,788,074		-11%
<b>Savings &amp; Benefits</b>							
<b>Energy</b>							
Lifetime	MWh	4,122,169	3,855,514	-6%	4,479,079	16%	9%
Annualized	MWh	306,819	237,712	-23%	271,696	14%	-11%
<b>Demand</b>							
Lifetime	kW	652,040	559,456	-14%	505,397	-10%	-22%
<b>Annualized</b>							
Summer	kW	48,476	35,649	-26%	31,852	-11%	-34%
Winter	kW	21,791	21,773	0%	20,907	-4%	-4%
NEB (Lifetime)	\$	(3,169,813)	(84,596,282)	2569%	(105,299,032)	24%	3222%
<b>Cost-Effectiveness</b>							
TRC Benefits	\$	535,343,363			429,565,338		-20%
TRC Costs	\$	194,059,457			104,620,720		-46%
Net Benefits	\$	341,283,906			324,944,617		-5%
BCR	n/a	2.76			4.11		49%

As shown in Table II.C.1 above, significant<sup>6</sup> variances exist at the C&I sector level in the NEBs category. The reasons for the variance are:

- For the New Construction and Major Renovation program, changes in NEBs values are largely the result of decreases in lighting O&M and HVAC fossil fuel savings associated with lower energy savings.
- For the Large Retrofit program, changes in NEBs values are principally the result of increased fossil fuel use and O&M requirements associated with a very large CHP project.
- For the Small Retrofit program, changes in NEBs values are largely the result of decreased lighting heating penalties and O&M savings associated with lower energy savings and changes in the measure mix.

Variances in expenses, savings & budgets, and cost-effectiveness are mostly due to the following:

- The C&I New Construction & Major Renovation program is still struggling from a sluggish economy as is reflected by lower participation rates and new building construction in the state. Planning estimates reflect a more robust construction market than actually exists, and as a consequence some of the products which were anticipated to experience significant growth are showing negative changes, such as prescriptive HVAC products which account for the majority of the savings difference between planned and actual. To combat this, implementation departments initiated programs such as upstream lighting aimed at targeting a

<sup>6</sup> Unless otherwise noted, "Significant" variances are defined throughout this Annual Report as variances of +/-20 percent or more between the stated values.

broader market and increasing savings and has achieved success in its efforts. Factors contributing to the negative deltas in TRC benefits, TRC costs, and program costs include the lower participation rates described above resulting in lower incentive payments and associated customer contributions. Additionally, sales and technical expenses were lower than planned, due to a decrease in third party engineering and ramp-up of internal engineering review, and marketing expenses were lower due to a focus on internal marketing strategies and scheduling of statewide marketing efforts.

- The C&I Retrofit program experienced higher participation rates than planned, but production was still down as customers implemented smaller projects. Additionally, measure mixes varied significantly from planned, affecting both annual and lifetime savings. Specifically, prescriptive programs such as lighting and HVAC experienced noticeable drops in participation. However, large CHP projects in the program year provided a moderate offset to annual and lifetime savings losses in the other end-use categories. In regards to costs and benefits beyond what is described above regarding the New Construction program, large CHP implemented during the year was more cost-effective than other technologies, which produced savings at lower program costs.
- Similar to the large C&I Retrofit, the C&I Small Retrofit program participation rates exceeded planned, but smaller projects and a different measure mix resulted in lower annual and lifetime savings. However, because of the program's size and participation did not decrease as much as the other programs, the program did not have as much of an impact on reductions to costs and benefits.

A more detailed program-level discussion can be found below.

<b>Table II.C.2: C&amp;I Sector Summary of End Uses</b>				
<b>End Uses</b>	<b>Units (lifetime)</b>	<b>Preliminary Year-End Results</b>	<b>Evaluated Results</b>	<b>% Change from Preliminary to Evaluated</b>
<b>Lighting</b>				
Energy	MWh	1,260,127	1,306,471	4%
Demand	kW	252,406	224,383	-11%
NEB	\$	-924,525	-794,507	-14%
<b>HVAC</b>				
Energy	MWh	796,474	950,397	19%
Demand	kW	99,336	76,858	-23%
NEB	\$	8,118,928	10,847,550	34%
<b>Motors</b>				
Energy	MWh	130,277	184,795	42%
Demand	kW	4,672	10,460	124%
NEB	\$	0	0	0%
<b>Refrigeration</b>				
Energy	MWh	86,627	108,538	25%
Demand	kW	4,869	4,869	0%
NEB	\$	0	0	0%
<b>Hot Water</b>				
Energy	MWh	0	892	0%
Demand	kW	0	0	0%
NEB	\$	0	0	0%
<b>Process</b>				
Energy	MWh	45,012	32,212	-28%
Demand	kW	6,763	2,772	-59%
NEB	\$	0	0	0%
<b>Compressed Air</b>				
Energy	MWh	38,388	27,610	-28%
Demand	kW	3,120	2,848	-9%
NEB	\$	0	0	0%
<b>CHP</b>				
Energy	MWh	1,498,608	1,868,165	25%
Demand	kW	188,292	183,208	-3%
NEB	\$	-92,533,350	-115,352,074	25%
<b>Total</b>				
Energy	MWh	3,855,514	4,479,079	16%
Demand	kW	559,456	505,397	-10%
NEB	\$	-85,338,946	-105,299,032	-23%

<b>Table II.C.3: C&amp;I Program Summary</b>				
<b>Sector</b>	<b>Units</b>	<b>Planned Value</b>	<b>Evaluated Results</b>	
			<b>Value</b>	<b>% Change from Planned</b>
<b>C&amp;I New Construction and Major Renovation</b>				
TRC Benefits	\$	137,041,409	88,155,693	-36%
TRC Costs	\$	34,338,883	18,448,036	-46%
Net Benefits	\$	102,702,525	69,707,657	-32%
BCR	n/a	3.99	4.78	20%
<b>C&amp;I Large Retrofit</b>				
TRC Benefits	\$	308,530,815	263,080,370	-15%
TRC Costs	\$	125,448,136	56,737,703	-55%
Net Benefits	\$	183,082,679	206,342,667	13%
BCR	n/a	2.46	4.64	89%
<b>C&amp;I Small Retrofit</b>				
TRC Benefits	\$	89,771,139	78,329,275	-13%
TRC Costs	\$	32,283,542	27,648,856	-14%
Net Benefits	\$	57,487,598	50,680,418	-12%
BCR	n/a	2.78	2.83	2%
<b>Community Based Pilot</b>				
TRC Benefits	\$	n/a	n/a	n/a
TRC Costs	\$	481,909	151,262	-69%
Net Benefits	\$	n/a	n/a	n/a
BCR	n/a	n/a	n/a	n/a
<b>Hard-to-Measure Initiatives</b>				
TRC Costs	\$	1,506,987	1,634,864	8%
<b>TOTAL</b>				
TRC Benefits	\$	535,343,363	429,565,338	-20%
TRC Costs	\$	194,059,457	104,620,720	-46%
Net Benefits	\$	341,283,906	324,944,617	-5%
BCR	n/a	2.76	4.11	49%

The variances in Table II.C.2 are categorized by end use. It is difficult to isolate the reason for the change by end use because end uses stretch across many different programs that have various delivery methods, savings, NTG factors, NEBs, and costs. Therefore, these variances are explained in the context of program variances discussed below. The variances in Table II.C.3 are by program and are also discussed in detail below.

## C&I Sector Performance Highlights

During 2011, the Program Administrators built upon existing C&I programs and significantly expanded initiatives to increase participation across all C&I programs. Selected highlights are presented below:

- **Gas/Electric Integration** – Building on the transition which took place in 2010, gas and electric integration continued to grow and run more smoothly. Program Administrators identified multi-fuel leads and worked closely with their counterparts in the same service territory to develop combined gas and electric projects for their customers. With these advancements, the Program Administrators realized increased savings and participation in this program as vendors became more comfortable identifying and installing both electric and gas measures.
- **MOU Agreements** – The use of these innovative agreements, focused on long-term energy savings with large C&I customers, continued to expand across the Commonwealth in 2011. The adoption of MOUs by an increased number of customers in 2011 will serve to yield energy savings in years to come as the agreements ramp up, lifting performance of both New Construction/Major Renovation and Large Retrofit projects.
- **Upstream Initiative** – New Construction program savings were bolstered during the fourth quarter of 2011 largely due to the introduction of the Upstream Lighting initiative, which was launched in September of 2011. In just a few months, over \$5 million of customer incentives were applied to support the installation of over 340,000 High Performance T8, High Output T5, and LED lamps by the end of the year. Overall, the emergence and advancement of LED products helped programs evolve in 2011, as costs came down and products became more readily available and reliable.
- **Retrofit Sector Strategy** – Responding to the maturity of the Large Retrofit Program, the Program Administrators began to test new strategies focused on specific customer segments. These segment-specific offerings included an expanded variety of cost-effective solutions, many of which were non-lighting measures that, in addition to energy savings, provided additional customer benefits.

A more detailed program-level discussion can be found in the following sections.

## 2. C&I Programs

### a. C&I New Construction and Major Renovation

**Purpose/Goal:** The C&I New Construction and Major Renovation program was designed to optimize the efficiency of equipment, building design and systems in new construction and renovation of commercial, industrial, institutional and government facilities. Focusing on offering a comprehensive set of electric and gas efficiency options specific to the needs unique to each customer, the program also targeted the brief window of opportunity to install premium grade replacements when equipment fails or is near the end of its useful life. In doing so, the Program Administrators worked to ensure that the best practices propagated by the program are ultimately built into the evolution of better building requirements.

**Targeted Customers:** The target market for this program was all time-dependent gas and electric energy efficiency opportunities in the C&I sector – commercial, industrial, institutional, and government customers.

**Definition of Program Participant:** A program participant is defined as an individual project undertaken by a customer who has received a financial incentive for the completed implementation of one or more time-dependent electric energy efficiency measures. One customer may undertake multiple projects at different locations during the program year. Each project is, therefore, counted as an individual participant.

#### **Targeted End-Uses:**

- Lighting
- Motors & Drives
- HVAC
- Refrigeration
- Envelope
- Compressed Air
- Hot Water
- Process

**Delivery Mechanism:** The Program Administrators worked together to market and implement the program as a unitary statewide effort to maximize the acquisition of potential energy savings (gas and electric) in the ongoing market for new facilities and replacement equipment in the Commonwealth.

**Significant Differences in Actual Program Design from Approved Program Design: None.**

**Docket/Exhibit where the Program is Discussed and Approved:** The program is discussed in detail in the Company's 2010-2012 Three-Year Electric Energy Efficiency Plan, filed October 30, 2009. See NSTAR Electric, D.P.U. 09-120, Exhibit NSTAR-1, pages 243-254 (bates numbering 00249-00260). The program was approved by the Department on January 28, 2010 in NSTAR Electric, D.P.U. 09-120.

Table II.C.4 provides information on the performance of the C&I New Construction and Major Renovation program.

Table II.C.4: C&I New Construction and Major Renovation							
Performance Category	Units	Planned Value	Preliminary Year-End Results		Evaluated Results		
			Value	% Change from Planned	Value	% Change from Preliminary	% Change from Planned
<b>Expenses</b>							
Total Program Costs	\$	23,286,749			12,412,122		-47%
Performance Incentive	\$	1,777,297			1,208,110		-32%
Participants	# of projects	538			380		-29%
Program Cost / Participant	\$	43,284			32,663		-25%
<b>Savings &amp; Benefits</b>							
<b>Energy</b>							
Lifetime	MWh	1,041,372	664,972	-36%	720,466	8%	-31%
Annualized	MWh	61,700	39,458	-36%	41,853	6%	-32%
Average Measure Life	yrs	16.9	16.9	0%	17.2	2%	2%
<b>Demand</b>							
Lifetime	kW	184,534	96,176	-48%	77,111	-20%	-58%
Annualized							
Summer	kW	11,170	5,975	-47%	4,835	-19%	-57%
Winter	kW	3,433	2,043	-40%	1,905	-7%	-45%
Average Measure Life	yrs	16.5	16.1		15.9		
NEB (Lifetime)	\$	819,154	379,833	-54%	399,861	5%	-51%
<b>Cost-Effectiveness</b>							
TRC Benefits	\$	137,041,409			88,155,693		-36%
TRC Costs	\$	34,338,883			18,448,036		-46%
Net Benefits	\$	102,702,525			69,707,657		-32%
BCR	n/a	3.99			4.78		20%

The reasons for the significant variances between planned, preliminary year-end and evaluated values are as follows:

- Differences between planned and preliminary or evaluated energy and demand savings results are due to lower production than planned across most end-uses.
- Custom and prescriptive HVAC kWh savings accounts for 76 percent of the change between gross annualized planned and actual gross production.
- A favorable impact evaluation results for custom HVAC mostly accounted for improved savings by reducing the kWh delta between gross annualized planned and gross actual by roughly 15 percent.

- Lifetime demand and energy savings differences are largely due to the factors mentioned above in addition to the introduction of the upstream lighting initiative which carries a lower measure life than traditional downstream lighting products.
- The overall negative impact on lifetime savings for demand and energy is partially offset by a higher weighted measure life based on the actual 2011 measure mix than the planned 2011 measure mix.
- The demand savings difference between preliminary and evaluated is predominantly due to changes in lighting coincidence factors and realization rates for the custom lighting end-use.
- NEBs values are directly proportional to energy savings and therefore decreased as a consequence of lower program savings. Slightly higher end use NTG factors account for the marginally higher evaluated numbers.
- Differences in program costs, participants, TRC benefits and TRC costs between planned and actual results are predominantly due to lower than anticipated production for the program as lower participation translated into lower incentive payments, associated customer contributions, and sales and technical assistance spending.

The EM&V studies included in the Company's 2011 Annual Report that apply to this program are as follows:

*Study 20 - Impact Evaluation of 2010 Custom Process and Compressed Air Installations*

This study produced realization rates for annual kWh, summer on-peak and seasonal peak kW, and winter on-peak and seasonal peak kW for those custom projects in the Process and Compressed Air end-use category. The net effect on each PA's program is dependent on the previous realization rates being incorporated into each PA's screening tool, and may therefore differ. The net effect for the Company was to decrease compressed air savings and increase process energy savings for this program. The study is discussed in more detail in Section III, Study 20 and Appendix C Study 20.

*Study 21 - Impact Evaluation of 2010 Custom Lighting Installations*

This study produced realization rates for annual kWh, summer on-peak and seasonal peak kW, and winter on-peak and seasonal peak kW for those custom projects in the Lighting end-use category. The net effect on each PA's C&I New Construction and C&I Retrofit programs is dependent on the previous realization rates being incorporated into each PA's screening tool, and may therefore differ. The net effect for the Company was to decrease energy savings for this program. The study is

discussed in more detail in Section III, Study 21 and Appendix C Study 21.

*Study 22 - Massachusetts Large Commercial & Industrial Process Evaluation*

The study examines key process topics identified by the EEAC, PAs and the DOER including how to improve integration and coordination, concerns about the adequacy of staffing levels, how to achieve deeper savings, whether medium-sized C&I customers are being adequately served by the programs, the adequacy or program tracking databases, and program satisfaction. The results of this study did not impact the 2011 evaluated results. The study is discussed in more detail in Section III, Study 22 and Appendix C Study 22.

*Study 23 - HVAC Market Characterization and Penetration Analysis*

This study estimates the market penetration of energy-efficient equipment in the Massachusetts commercial HVAC market, gauges the level of large C&I program influence on market penetration, and characterizes the market for emergency replacement. The results of this study did not impact the 2011 evaluated results. The study is discussed in more detail in Section III, Study 23 and Appendix C Study 23.

The program's performance and the results of the impact evaluations described above will be used to adjust the planning estimates for the program in the next three-year plan for 2013-2015. Changes to this program are not currently expected to result in a mid-term modification for the remainder of the current three-year plan.

The C&I New Construction and Major Renovation program is cost effective with a BCR of 4.64.

b. C&I Large Retrofit

**Purpose/Goal:** The C&I Large Retrofit program focused on comprehensive gas and electric energy efficiency opportunities associated with mechanical, electrical, and thermal systems in existing commercial, industrial, governmental and institutional buildings. Through this program, technical assistance and incentives were provided to encourage retrofitting of equipment that continued to function, but was outdated and inefficient, and could be replaced with a premium efficient product. In addition, this program helped participants identify specific peak load management opportunities and assisted occupants in improving their ongoing operation and maintenance practices.

**Targeted Customers:** The target market for this program was all non-residential customers – commercial, industrial, governmental, and institutional.

**Definition of Program Participant:** A program participant is defined as an individual project undertaken by a customer who has received a financial incentive for the completed implementation of one or more electric energy efficiency measures. One customer may undertake multiple projects at different locations during the program year. Each project is, therefore, counted as an individual participant.

**Targeted End-Uses:**

- Lighting
- Motors and Drives
- HVAC
- Compressed Air and Processes
- Envelope
- Water Heating
- Combined Heat & Power

**Delivery Mechanism:** Program Administrator staff, trade allies and project administrators performed most sales, marketing, program administration, and implementation functions, while outside contractors were retained for technical review of applications, on-site energy analysis, technical and design assistance for comprehensive projects, project commissioning services, and the actual measure installations, including turn-key services.

**Significant Differences in Actual Program Design from Approved Program Design:** None.

**Docket/Exhibit where Program is Discussed and Approved:** The program is discussed in detail in the Company's 2010-2012 Three-Year Electric Energy Efficiency Plan, filed October 30, 2009. See NSTAR Electric, D.P.U. 09-120, Exhibit NSTAR-1, pages 231-242 (bates numbering 00237-00248). The program was approved by the Department on January 28, 2010 in NSTAR Electric, D.P.U. 09-120.

Table II.C.5 provides information on the performance of the C&I Large Retrofit program.

Table II.C.5: C&I Large Retrofit							
Performance Category	Units	Planned Value	Preliminary Year-End Results		Evaluated Results		
			Value	% Change from Planned	Value	% Change from Preliminary	% Change from Planned
<b>Expenses</b>							
Total Program Costs	\$	67,611,603			28,296,542		-58%
Performance Incentive	\$	3,588,572			3,605,616		0%
Participants	# of projects	890			914		3%
Program Cost / Participant	\$	75,968			30,959		-59%
<b>Savings &amp; Benefits</b>							
<b>Energy</b>							
Lifetime	MWh	2,449,032	2,659,142	9%	3,176,789	19%	30%
Annualized	MWh	195,319	156,301	-20%	183,864	18%	-6%
Average Measure Life	yrs	12.5	17.0	36%	17.3	2%	38%
<b>Demand</b>							
Lifetime	kW	335,559	360,981	8%	327,979	-9%	-2%
<b>Annualized</b>							
Summer	kW	26,945	21,662	-20%	19,207	-11%	-29%
Winter	kW	13,605	15,662	15%	13,931	-11%	2%
Average Measure Life	kW	12.5	16.7		17.1		
NEB (Lifetime)	yrs	(6,401,066)	(85,796,788)	1240%	(106,681,189)	24%	1567%
<b>Cost-Effectiveness</b>							
TRC Benefits	\$	308,530,815			263,080,370		-15%
TRC Costs	\$	125,448,136			56,737,703		-55%
Net Benefits	\$	183,082,679			206,342,667		13%
BCR	n/a	2.46			4.64		89%

The reasons for the significant variances between planned, preliminary year-end and evaluated values are as follows:

- Differences in annualized energy and demand savings between planned and actual are predominantly attributable to the prescriptive lighting and prescriptive HVAC end-uses, where production was substantially lower than planned.
- Annual net production for prescriptive lighting was approximately 67 percent lower than planned and prescriptive HVAC was 95 percent lower than planned.
- Large CHP projects offsets a substantial portion of the kWh savings delta between planned values and actual.
- Lifetime actual savings is higher than planned, while annualized savings is lower than planned, due to the impact of CHP which is approximately 42 percent of net annual kWh and due to the size of the projects installed in 2011 employed a higher measure life resulting in higher lifetime savings.
- Subsequently, CHPs upward impact on the average measure life of the program correlates with a downward impact on the total cost per participant, which is visible when comparing planned and actual measure lives.
- Dramatically lower NEBs are principally a consequence of increased fossil fuel use and O&M requirements associated with a very large CHP project. CHP

projects are projected to incur 426,640 MMBtu of increased natural gas usage, which is treated as negative benefit to non-electric resources.

- The 58 percent variance in budget was spread across all budget categories, which were lower than planned. Differences in total program and TRC costs are due to the introduction of CHP into the measure mix and lower actual production as reduced participation translated into lower incentive payments, associated customer contributions, and sales / technical assistance spending.

The EM&V studies included in the Company's 2011 Annual Report that apply to this program are as follows:

*Study 19 - 2010 Combined Heat and Power Impact Evaluation Methodology and Analysis Memo*

This study produced realization rates for annual kWh, therms, and fuel impacts for those CHP projects in the CHP end-use category. The net effect on each PA's program is dependent on the difference between the new realization rate and the previous realization rate incorporated into each PA's screening tool, and may therefore differ. The net effect for the Company was to increase energy savings for this program. The study is discussed in more detail in Section III, Study 19 and Appendix C Study 19.

*Study 20 - Impact Evaluation of 2010 Custom Process and Compressed Air Installations*

This study produced realization rates for annual kWh, summer on-peak and seasonal peak kW, and winter on-peak and seasonal peak kW for those custom projects in the Process and Compressed Air end-use category. The net effect on each PA's program is dependent on the previous realization rates being incorporated into each PA's screening tool, and may therefore differ. The net effect for the Company was to decrease compressed air energy savings and increase process energy savings for this program. The study is discussed in more detail in Section III, Study 20 and Appendix C Study 20.

*Study 21 - Impact Evaluation of 2010 Custom Lighting Installations*

This study produced realization rates for annual kWh, summer on-peak and seasonal peak kW, and winter on-peak and seasonal peak kW for those custom projects in the Lighting end-use category. The net effect on each PA's C&I New Construction and C&I Retrofit programs is dependent on the previous realization rates being incorporated into each PA's screening tool, and may therefore differ. The net effect for the Company was to increase energy savings for this program. The study is discussed in more detail in Section III, Study 21 and Appendix C Study 21.

### *Study 22 - Massachusetts Large Commercial & Industrial Process Evaluation*

The study examines key process topics identified by the EEAC, PAs and the DOER including how to achieve deeper savings, whether medium-sized C&I customers are being adequately served by the programs, the adequacy of program tracking databases, and program satisfaction. The results of this study did not impact the 2011 evaluated results. The study is discussed in more detail in Section III, Study 22 and Appendix C Study 22.

### *Study 23 - HVAC Market Characterization and Penetration Analysis*

This study estimates the market penetration of energy-efficient equipment in the Massachusetts commercial HVAC market, gauges the level of large C&I program influence on market penetration, and characterizes the market for emergency replacement. The results of this study did not impact the 2011 evaluated results. The study is discussed in more detail in Section III, Study 23 and Appendix C Study 23.

The program's performance and the results of the impact evaluations described above will be used to adjust the planning estimates for the program in the next three-year plan for 2013-2015. Changes to this program are not currently expected to result in a mid-term modification for the remainder of the current three-year plan.

The C&I Large Retrofit program is cost effective with a BCR of 4.64.

#### c. C&I Small Retrofit

**Purpose/Goal:** The primary objective of the C&I Small Retrofit Program was to provide cost-effective, comprehensive electric and gas retrofit services to business customers on a turnkey basis using the same delivery model throughout the Commonwealth.

**Targeted Customers:** The target market for this program included direct install retrofit business customers below 300kW.

**Definition of Program Participant:** A Program Participant is defined as a customer below 300kW in usage who has received turnkey retrofit services and incentive dollars through the C&I Small Retrofit Program. One customer may undertake multiple projects at different locations during the program year. Each project is, therefore, counted as an individual participant.

**Targeted End-Uses:**

- Lighting
- HVAC
- Hot Water
- Motors & Drives
- Refrigeration
- Envelope

**Delivery Mechanism:** Vendors were selected through a competitive bidding process to implement the program. These vendors marketed the program, performed facility audits, and offered recommendations to customers while completing audit forms and questionnaires. In addition, the same vendors purchased materials, installed measures, loaded data into a database, and prepared progress reports for the Program Administrators on a regular basis.

**Significant Differences in Actual Program Design from Approved Program Design:** None.

**Docket/Exhibit where Program is Discussed and Approved:** The program is discussed in detail in the Company's 2010-2012 Three-Year Electric Energy Efficiency Plan, filed October 30, 2009. See NSTAR Electric, D.P.U. 09-120, Exhibit NSTAR-1, pages 255-259 (bates numbering 00261-00265). The program was approved by the Department on January 28, 2010 in NSTAR Electric, D.P.U. 09-120.

Table II.C.6 provides information on the performance of the C&I Small Retrofit program.

Table II.C.6: C&I Small Retrofit							
Performance Category	Units	Planned Value	Preliminary Year-End Results		Evaluated Results		
			Value	% Change from Planned	Value	% Change from Preliminary	% Change from Planned
<b>Expenses</b>							
Total Program Costs	\$	26,101,235			21,435,229		-18%
Performance Incentive	\$	1,162,338			974,348		-16%
Participants	# of projects	2,692			2,969		10%
Program Cost / Participant	\$	9,696			7,220		-26%
<b>Savings &amp; Benefits</b>							
<b>Energy</b>							
Lifetime	MWh	631,765	531,400	-16%	581,824	9%	-8%
Annualized	MWh	49,799	41,953	-16%	45,980	10%	-8%
Average Measure Life	yrs	12.7	12.7	0%	12.7	0%	0%
<b>Demand</b>							
Lifetime	kW	131,947	102,299	-22%	100,308	-2%	-24%
<b>Annualized</b>							
Summer	kW	10,361	8,012	-23%	7,810	-3%	-25%
Winter	kW	4,753	4,068	-14%	5,071	25%	7%
Average Measure Life	yrs	12.7	12.8		12.8		
NEB (Lifetime)	\$	2,412,099	820,673	-66%	982,297	20%	-59%
<b>Cost-Effectiveness</b>							
TRC Benefits	\$	89,771,139			78,329,275		-13%
TRC Costs	\$	32,283,542			27,648,856		-14%
Net Benefits	\$	57,487,598			50,680,418		-12%
BCR	n/a	2.78			2.83		2%

The reasons for the significant variances between planned, preliminary year-end and evaluated values are as follows:

- Differences between energy savings were caused by reduced program level energy savings, partially offset by a 10 percent higher lighting realization rate. Similarly, summer and winter demand savings were also lower than planned, but were affected differently by impact evaluation study results. Summer coincidence factors for lighting fell by approximately 10 percent while winter coincidence factors increased by approximately 20 percent.
- Differences in NEBs are primarily the result of lower program level energy savings. NEBs are directly related to energy savings and therefore decreased. The increase in evaluated NEBs over preliminary NEBs is due to higher lighting realization rate mentioned above.
- The decreases in savings described above drove the decrease in benefits and net benefits, however the benefit cost ratio only changed by one percent.

The EM&V studies included in the Company's 2011 Annual Report that apply to this program are as follows:

*Study 18 - Non-Controls Lighting Evaluation for the Massachusetts Small Business Direct Install program: Multi-Season Study*

This study improved on the 2010 impact evaluation of annual energy savings and peak demand impacts for the retrofit installation of high-efficiency lighting fixtures through the C&I Small Retrofit program. Results from extended 2011 summer metering were added to winter metering from the 2010 study. Combining the two impact evaluations produced revised energy kWh and connected kW realization rates, summer and winter coincidence factors and HVAC interaction factors. The net effect for the Company was to decrease energy and summer demand savings, and increase winter demand savings for this program. Please refer to Section III for a more detailed discussion and to Study 18 in Appendix C for a full copy of the report.

The program's performance and the impact evaluation results described above will be used to adjust the planning estimates for the program in the next three-year plan for 2013-2015. Changes to this program are not currently expected to result in a mid-term modification for the remainder of the current three-year plan.

The C&I Small Retrofit program is cost effective with a BCR of 2.81.

### 3. C&I Pilot Programs

#### a. Community-Based Pilots

**Description of Pilot/Specific Activities Intended to Study:** The term "Community-Based Pilots" encompassed a number of unique partnerships in 2011 between the Program Administrators and local communities designed to harness the power of community-based outreach to achieve broader participation in the Commonwealth's energy efficiency programs. In 2011, the Company participated in a community based partnership in New Bedford.

**Why Implemented on Pilot Basis rather than as a Full Program:** The community-based initiatives were offered as pilots to assess the effectiveness of each partnership and determine their potential for replication.

**Targeted Customers:** The Program Administrators and interested stakeholders selected communities with the greatest opportunities for success, based on an assessment of the proposal submitted. Targeted customers varied by pilot, but in general included small commercial customers with an electric demand of less than 300 kW.

**Definition of Pilot Program Participant:** Participants in this pilot are counted as participants in other programs such as the Direct Install/Small Retrofit program.

**Targeted End-Uses:** The end-uses targeted by the community based pilots included the same end-uses addressed under the Company’s existing Direct Install/Small Retrofit program.

**Delivery Mechanism:** Program outreach was conducted by local community groups. Measures were installed through a local contractor under the direction of the Company’s existing lead vendors.

**Significant Differences in Actual Program Design from Approved Program Design:** None.

**How Achievement of the Pilot’s Stated Goal was Measured:** A multi-year evaluation of community based pilots was conducted by Opinion Dynamics Corporation to assess the effectiveness of these pilots and determine their potential for replication. This process evaluation is included with this Annual Report as Appendix C, Study 30.

**Docket/Exhibit where the Program is Discussed and Approved:** The pilot is discussed in detail in the Company's 2010-2012 Three-Year Electric Energy Efficiency Plan, filed October 30, 2009. See NSTAR Electric, D.P.U. 09-120, Exhibit NSTAR-1, pages 115-118 (bates numbering 00121-00124). The program was approved by the Department on January 28, 2010 in NSTAR Electric, D.P.U. 09-120.

Table II.C.7 provides information on the performance of the Community-Based pilot. Because of the nature of pilot programs, the table for this pilot program is incomplete with regard to savings and benefits. The Company has provided all information that is available.

Table II.C.7: Community Based Pilot Program							
Performance Category	Units	Planned Value	Preliminary Year-End Results		Evaluated Results		
			Value	% Change from Planned	Value	% Change from Preliminary	% Change from Planned
<b>Expenses</b>							
Total Program Costs	\$	481,909			151,262		-69%
Participants	TBD	n/a			n/a		n/a
Program Cost / Participant	\$	n/a			n/a		n/a
<b>Savings &amp; Benefits</b>							
Energy							
Lifetime	MWh	n/a	n/a	n/a	n/a	n/a	n/a
Annualized	MWh	n/a	n/a	n/a	n/a	n/a	n/a
Average Measure Life	yrs	n/a	n/a	n/a	n/a	n/a	n/a
Demand							
Lifetime	kW	n/a	n/a	n/a	n/a	n/a	n/a
Annualized	kW						
Summer	kW	n/a	n/a	n/a	n/a	n/a	n/a
Winter	kW	n/a	n/a	n/a	n/a	n/a	n/a
Average Measure Life	yrs	n/a	n/a	n/a	n/a	n/a	n/a
NEB (Lifetime)	\$	n/a	n/a	n/a	n/a	n/a	n/a
<b>Cost-Effectiveness</b>							
TRC Benefits	\$	n/a			n/a		n/a
TRC Costs	\$	481,909			151,262		-69%
Net Benefits	\$	n/a			n/a		n/a
BCR	n/a	n/a			n/a		n/a

The reasons for the significant variance between planned and actual total program costs and TRC costs is that the Company was unable to reach an agreement on pricing with the electrician hired by the community group to complete work in two out of three initial community mobilization initiatives contemplated when the 2011 budget was developed.

As stated above, NSTAR Electric participated in a community based partnership in New Bedford. Community organizations performed outreach to local businesses to increase participation levels in the Direct Install/Small Retrofit program. In addition to helping customers save money and energy, the initiative sought to provide employment opportunities and career pathways for community residents who are trained, licensed and qualified to perform commercial electrical installations.

While the overall results and successes of these outreach activities varied, it has become evident that community engagement is an important component to enhancing the Company's ability to achieve greater program participation and energy savings. The Company also recognizes there is no "one size that fits all" community engagement model. However, despite differences in size and scope the Company remains committed to working with various community organizations and partners for the remainder of this pilot in 2012 and beyond. As of this writing, the Company does not expect this pilot to become a stand alone program in the 2013-2015 Three-Year Plan but rather anticipates community based outreach initiatives to become an extension of its overall program level marketing and outreach strategies,

The EM&V study included in the Company's 2011 Annual Report that applies to this pilot is as follows:

*Study 30 – Community-Based Partnerships 2011 Evaluation Final Report*

The evaluation of community-based partnerships was intended to assess the effectiveness of such partnerships and determine the potential for replication and/or full-scale implementation of this type of pilot. The report builds upon an interim report issued in 2011 and presents the findings of the evaluation research conducted to date. This evaluation had no impact on the evaluated results. The study is discussed in more detail in Section III, Study 30 and Appendix C Study 30.

### III. EVALUATION MEASUREMENT AND VERIFICATION ACTIVITIES

#### A. Summary

The Massachusetts Program Administrators completed thirty evaluation studies for the 2011 Annual Report. The following is a statewide summary of the subset of these evaluation studies that had significant impact on the final evaluated data.

The studies that had the most significant impact for electric Program Administrators were:

- Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation and Additional Non-Energy Impacts for Low-Income Programs
- Low-Income Single Family Program Impact Evaluation
- Demand Impact Model User Manual
- Massachusetts Mini Baseline Study of Homes Built at the End of the 2006 IECC Cycle
- Massachusetts Multifamily Program Impact Analysis
- 2010 Combined Heat and Power Impact Evaluation Methodology and Analysis Memo

In the Massachusetts Special and Cross-Sector Studies area, *the Residential and Low Income Non-Energy Impacts (NEI) study* had a large impact on overall residential and low-income sector benefits based on the previously filed study in NSTAR Electric, D.P.U. 11-106. The supplemental research on non-energy impacts for low-income programs includes additional low-income benefits that clarifies and expands the prior research performed in the *Residential and Low-Income Non-Energy Impacts Evaluation*. The additional information focused on lighting quality, refrigerator recycling, price hedging, and economic development, and the results have a significant positive impact on the benefits attributable to low-income programs. Additional information on the updated non energy benefit values for the low-income program can be found in Appendix C, Study 28.

*The Low Income Single Family Program Impact Evaluation* quantified the gross per-unit savings generated by each low-income measure through billing and engineering analyses. Depending on planning assumptions and measure mix, this study had a different impact on each of the Program Administrators because the results varied by measure. This study is discussed in more detail in Appendix C, Study 17.

*The Demand Impact Model and User Manual* updated previous demand impact factors to reflect the most recent load shape data, per-unit measure energy savings, and ISO-NE definitions of peak periods. The results of this study were applied to 2011 study results with the overall effect varying by Program Administrators and by program. This study

had no impact on electric savings; it only changed demand and capacity factors. This study is discussed in more detail in Appendix C, Study 9.

*The Massachusetts Mini Baseline Study of Homes Built at the End of the 2006 IECC Cycle* was conducted in partnership with DOER to assess compliance with basic building code prescriptive path requirements at the end of the 2006 International Energy Conservation Code (IECC) code cycle. The report provides a preliminary assessment of how new single-family residential building characteristics compare to the current User Defined Reference Home baseline. The study compared efficiency lighting levels, building practices, equipment efficiencies, and other characteristics in custom versus spec built homes. The results from this study significantly reduced the electric savings based on the penetration rates of high efficiency lighting and appliances with NTG ratios between 79 percent and 11 percent. This study is discussed in more detail in Appendix C, Study 3.

*The Massachusetts Multifamily Program Impact Analysis* provides a set of savings approaches that can be used by all of the PAs as well as program attribution information. These objectives were accomplished by interviewing key stakeholders, analyzing the results, and offering recommendations for future program improvement. The overall impact of the report resulted in 2011 savings decreasing due to the 18 percent free-ridership number derived from this study. This study is discussed in more detail in Appendix C, Study 8.

*The 2010 Combined Heat and Power Impact Evaluation Methodology and Analysis Memo* was intended to determine kWh realization rates, thermal realization rates, and fuel impact realization rates at both the Program Administrator and statewide level. The kWh realization rate will inform the net savings calculations and the thermal realization rates and fuel impact realization will inform implementation and engineering accuracy of the project screening process. With the new impact results, the resulting realization rate for NSTAR Electric will increase net savings while the resulting realization rate for National Grid will decrease net savings. This study is discussed in more detail in Appendix C, Study 19.

Table III.A summarizes the EM&V studies that have not been included in previous Annual Reports. Please note: studies 24, 25, and 29 apply to gas energy efficiency programs and are, therefore, not included in the table below.

<b>Table III.A: Evaluation Studies in Annual Report</b>			
Studies	Location of Complete Study in Annual Report	Docket & Exhibit Approving Planned Evaluation Studies	Implemented as Approved? (yes/no)
<b>Residential Program Studies</b>			
Massachusetts Residential New Construction Home Buyer Survey	App. C, Study 1	Study is pending approval of the 2010 AR, D.P.U. 11-63 through D.P.U. 11-73 and D.P.U. 11-126	All studies are implemented as planned
Massachusetts Residential New Construction Focus Groups with Participant Builders	App. C, Study 2		
Massachusetts Mini Baseline Study of Homes Built at the End of the 2006 IECC Cycle	App. C, Study 3		
Home Energy Services Net-to-Gross Evaluation	App. C, Study 4	Study is pending approval of the 2011 MTM, D.P.U. 10-140 through D.P.U. 10-150	
Massachusetts Multifamily Market Characterization and Potential Study	App. C, Study 5		
Massachusetts Multifamily Program Process Evaluation	App. C, Study 6	Study is pending approval of the 2010 AR, D.P.U. 11-63 through D.P.U. 11-73 and D.P.U. 11-126	
Massachusetts Multifamily Program Impact Analysis	App. C, Study 7		
Brushless Fan Motors Impact Evaluation	App. C, Study 8	Study is pending approval of the 2011 MTM, D.P.U. 10-140 through D.P.U. 10-150	
Demand Impact Model User Manual	App. C, Study 9	Study is pending approval of the 2012 MTM, D.P.U. 11-106 through D.P.U. 11-116	
Massachusetts Consumer Survey Results 2011	App. C, Study 10	Study is pending approval of the 2010 AR, D.P.U. 11-63 through D.P.U. 11-73 and D.P.U. 11-126	
<b>Residential Pilot Studies</b>			
Major Renovations Pilot Evaluation	App. C, Study 11	Study is pending approval of the 2010 AR, D.P.U. 11-63 through D.P.U. 11-73 and D.P.U. 11-126	All studies are implemented as planned
Massachusetts Residential New Construction Four to Eight Story Multifamily Pilot Interview Findings	App. C, Study 12	Study is pending approval of the 2011 MTM, D.P.U. 10-140 through D.P.U. 10-150	
Home Energy Services Packaged Measure Pilot Evaluation	App. C, Study 13	Study is pending approval of the 2012 MTM, D.P.U. 11-106 through D.P.U. 11-116	
Heat Pump Water Heaters Evaluation of Field Installed Performance	App. C, Study 14	Study is planned but not yet submitted for approval	
Solar Hot Water Pilot Program Evaluation	App. C, Study 15	Study is pending approval of the 2012 MTM, D.P.U. 11-106 through D.P.U. 11-116	

Low-Income Program Studies			
Massachusetts 2011 Low Income Program Process Evaluation	App. C, Study 16	Study is pending approval of the 2012 MTM, D.P.U. 11-106 through D.P.U. 11-116	All studies are implemented as planned
Low Income Single Family Program Impact Evaluation	App. C, Study 17		
Commercial & Industrial Program Studies			
Non-Controls Lighting Evaluation for the Massachusetts Small Business Direct Install Program: Multi-Season Study	App. C, Study 18	Study is pending approval of the 2010 AR, D.P.U. 11-63 through D.P.U. 11-73 and D.P.U. 11-126	All studies are implemented as planned
2010 Combined Heat and Power Impact Evaluation Methodology and Analysis Memo	App. C, Study 19	Study is pending approval of the 2011 MTM, D.P.U. 10-140 through D.P.U. 10-150	
Impact Evaluation of 2010 Custom Process and Compressed Air Installations	App. C, Study 20	Study is pending approval of the 2010 AR, D.P.U. 11-63 through D.P.U. 11-73 and D.P.U. 11-126	
Impact Evaluation of 2010 Custom Lighting Installations	App. C, Study 21		
Process Evaluation of the Large Commercial and Industrial Energy Efficiency Programs	App. C, Study 22		
HVAC Market Characterization and Penetration Analysis	App. C, Study 23		
Special & Cross Sector Studies			
Massachusetts Three Year Cross-Cutting Behavioral Program Evaluation Integrated Report	App. C, Study 26	Study is pending approval of the 2011 MTM, D.P.U. 10-140 through D.P.U. 10-150	All studies are implemented as planned
Massachusetts Umbrella Marketing Evaluation Report	App. C, Study 27		
Additional Non-Energy Impacts for Low Income Programs	App. C, Study 28		
Community-Based Partnerships 2011 Evaluation Final Report	App. C, Study 30		

**B. Residential Studies**

**1. Massachusetts Residential New Construction Home Buyer Survey**

**Type of Study:** Market Assessment

**Objective of the Study:** Examine what buyers look for in a new home, awareness of ENERGY STAR homes, the role of ENERGY STAR certification in new home shopping, perceptions of ENERGY STAR homes, and reactions to recent changes in the program. The study also provides updates of similar surveys conducted in 2002, 2003, 2004, and 2006.

**Programs to which the Results of the Study Apply:**

- Residential New Construction & Major Renovation (Electric and Gas)
- Low-Income Residential New Construction (Electric)

**Recommendations Derived from the Study:** There are no recommendations. This study was informational, conducted to assess the role of energy efficiency in shopping for a newly constructed home as well as awareness and perceptions about the program.

#	Finding
1	The importance of getting a more efficient home with lower energy bills has steadily risen for all buyers of new homes from 2002 to 2010 with the mean ranking, using a scale from 0 to 10 where 0 is one of the least important factors and 10 is one of the most important factors, rising from 7.2 in 2002 to 9.0 in 2010.
2	Close to three out of five buyers of new homes are now aware of the ENERGY STAR label on new homes; this is more than twice the percentage who were aware at the time of the first Massachusetts home buyer survey in 2002; most of the increase in awareness occurred between 2006 and 2010.
3	Home buyers in 2010 are significantly more likely to discuss the energy efficiency of the new home, how much it would cost to heat and cool the home, and green building while shopping for or building a new home than they were in 2006. The percentage discussing energy efficiency in 2010 is 60% up from 37%; heating and cooling costs is 53% up from 25%; and green building is 26% up from 9%.
4	More than seven out of ten (72%) home buyers aware of ENERGY STAR homes believe they provide a little or a lot more value for the money, up from just over one-half (53%) in 2006.
5	Overall satisfaction with the program has remained high with nearly three-quarters of buyers of new ENERGY STAR homes who know they have ENERGY STAR homes saying they are 'satisfied' or 'extremely satisfied'. Asked to rate the importance of going through the Massachusetts program, after changes that do not require ENERGY STAR certification, three out of ten (30%) respondents say that going through the program would be very important if they were building or buying a new home today and an additional one-third (34%) believe program participation would be somewhat important.

**How the Study Came to the Recommended Conclusions:** Findings are based on telephone surveys of recent buyers of newly constructed homes in Massachusetts that were conducted from June through September of 2011. Surveys were completed with 100 households who had bought ENERGY STAR certified homes and 118 households who had bought homes that did not participate in the program.

**Explain Whether or Not the PA Decided to Adopt Recommendations from the Study, and Why:** Though there were no specific recommendations from this study, the Findings indicate a positive trend. This upward trend in the growing importance of energy efficiency in new home purchases is communicated through mid stream actors such as real estate agents and mortgage bankers/brokers about long term affordability. The program continues to tap into the strong ally relationships it has formed with the Real Estate and Mortgage industry to continue to provide trainings and marketing assistance on the importance of energy efficient new construction.

A copy of the complete study can be found in Appendix C, Study 1.

2. Massachusetts Residential New Construction Focus Groups with Participant Builders

**Type of Study:** Market Assessment

**Objective of the Study:** The objective of the study was to assess the participating builders' experience with the program and their reactions to changes made in 2011 and changes which may be forthcoming in 2012.

**Programs to which the Results of the Study Apply:**

- Residential New Construction & Major Renovation (Electric and Gas)
- Low-Income Residential New Construction (Electric)

**Recommendations Derived from the Study:**

#	Recommendation
1	Capitalize on the theme that the program differentiates home builders in a positive manner throughout the marketplace. – On-going task
2	Continue to educate home buying consumers on the characteristics of energy-efficient homes and potential savings associated with living in an energy-efficient home. – Working with Real Estate market – mid stream marketing.
3	If program Tiers and HERS rating scores are mentioned at all in marketing materials to the home-buying consumer, provide simple and clear explanations of their significance.
4	Incorporate additional educational information into marketing materials for program participants. Further outreach is necessary to raise the awareness of participant builders with respect to changes in the program.
5	If the shift to an open HERS rater market occurs, provide clear marketing materials to builders emphasizing the advantages offered by HERS raters. Builders should also be made aware that HERS raters operate in a competitive market, charging varying fees and offering different services.

**How the Study Came to the Recommended Conclusions:** Findings are based on two focus groups conducted in June of 2011 with home builders who participated in the program before 2011.

**Explain Whether or Not the PA Decided to Adopt Recommendations from the Study, and Why:** The program has incorporated the above recommendations as follows:

- By leveraging the National EPA ENERGY STAR Homes program websites Builder Partner Resource Center and Massachusetts specific builder marketing support, the program continues to assist and provide builder partners resources to stand out from their competitors. This is done through online support, marketing materials and through technical and sales trainings.
- Through the utilization of mid stream allies such as real estate professionals and mortgage brokers the program continues to educate the new residential home buying market on the benefits of purchasing an energy efficient new home. Value added benefits such as long term affordability, comfort and durability are discussed.
- Currently the program does not provide HERS Rating or Tier achievement directly to home buying consumers, however individual Raters may provide this information as part of their services, but this is decided outside of the programs requirements. All homes do receive a sticker indicating that it has participated in the program along with the final HERS Index and if it achieved ENERGY STAR.
- The program continues to provide several channels to distribute marketing materials, educational opportunities and programmatic updates. In 2011 the program launched a Massachusetts specific HERS Rater Website and Portal. The Portal allows program Raters to download the most recent program documentation, upload applications and incentive worksheets, report completions, view upcoming events and trainings and it also allows for the exchange of best practices and technical assistance on its message board. The program still also communicates information through email and fax blasts.
- Although the program currently provides Raters with an incentive to participate, the builder is made aware of this amount when they receive their participation confirmation letter. This shows not only the incentive the rater is receiving; it helps to establish a value and cost associated with the services provided. This will be beneficial in the upcoming years as the program moves towards decreasing Rater incentives.

A copy of the complete study can be found in Appendix C, Study 2.

3. Massachusetts Mini Baseline Study of Homes Built at the End of the 2006 IECC Cycle

**Type of Study:** Impact Evaluation

**Objective of the Study:** Homes were inspected between April and June of 2011 with three primary tasks in mind:

- Conducting a full HERS rating using REM/Rate software
- Filling out the 2006 IECC checklist developed by PNNL
- Providing program Sponsors with a mini baseline study of 50 non-ENERGY STAR-qualified homes completed at the end of the 2006 IECC code cycle

**Programs to which the Results of the Study Apply:**

- Residential New Construction & Major Renovation (Electric and Gas)
- Low-Income Residential New Construction (Electric)

**Results of the Study and How the Study Determined those Results:** This study was conducted in partnership with DOER to assess compliance with basic building code prescriptive path requirements at the end of the 2006 International Energy Conservation Code (“IECC”) code cycle, provide a preliminary assessment of how current new single-family residential building characteristics compare to current User Defined Reference Home (“UDRH”) inputs, and conduct audits of energy efficient lighting and appliances within the homes. The study also compared building practices, equipment efficiencies, and other characteristics in custom versus spec built homes.

#	Finding
1	Some current UDRH inputs may underestimate and others overestimate the energy efficiency of current building practices or equipment. Heating system efficiency inputs—the average efficiencies of gas (natural gas and propane) furnaces and boilers in inspected homes are higher than the current UDRH inputs, but wall, floor and ceiling insulation levels are lower.
2	The 2006 IECC prescriptive path insulation requirements for wood-frame walls, floors over unconditioned space and ceilings are, respectively, R-19, R-30 or cavity filled (minimum R-19), and R-38 with an allowance for R-30 in up to 500 feet of cathedral ceiling area. <i>(Note that a home failing to meet one or more 2006 prescriptive path requirements does not mean the home failed to comply with building code—the home may have complied under a performance-based compliance path that allows trade-offs.)</i> Most homes with wood framed walls

	(84%) had R-19 or higher insulation, 28% of homes with floors over unconditioned basements met the 2006 IECC prescriptive insulation requirement, 22% of homes with flat ceilings had R-38 or higher insulation, and no cathedral ceilings had R-38 insulation. However, 67% of homes with cathedral ceilings met the 2006 IECC prescriptive insulation requirement by having a total of 500 square feet or less of cathedral ceiling area insulated to R-30.
3	Twenty-one percent of the total number of bulbs counted in the non- ENERGY STAR Homes were energy efficient.
4	The majority of refrigerators and dishwashers installed in the non-ENERGY STAR homes were ENERGY STAR (73% and 89% respectively).

In most cases the difference between custom and spec homes is minimal. Custom homes tend to have higher R-value conditioned/ambient wall and flat ceiling insulation, while spec homes tend to have higher R-value floor and foundation wall insulation. Custom homes have slightly more efficient heating systems and spec homes have slightly more efficient water heating systems. Spec homes have lower duct leakage and air infiltration. Custom homes have more energy-efficient light bulbs and slightly higher percentages of ENERGY STAR refrigerators and dishwashers. As an overall indicator of a home’s energy efficiency, the HERS ratings conducted on the 50 inspected homes suggest there is little difference between the energy efficiency of custom homes (average HERS 85) and spec homes (average HERS 83); this difference is not statistically significant at the 90% confidence level.

**How the Results of the Study Impact each Identified Program’s Savings:** Due to the penetration rate of energy efficient bulbs and appliances program savings from these measures are reduced accordingly.

**Formulas Necessary to Understand the Impact of the Study on the PA’s Program(s):** The penetration rates are incorporated into the savings calculations as free-ridership, accordingly the appropriate formula is as follows:

$$\text{kWh savings} = (1 - \text{Free-ridership} + \text{Spillover})$$

$$\text{kW savings} = (1 - \text{Free-ridership} + \text{Spillover})$$

**If the Results of the Study Are Not Adopted by the PA, Fully Explain Why:** References to energy characteristics were not incorporated into the UDRH as this study looked at homes built under the 2006 IECC; the current code in Massachusetts is the 2009 IECC. The UDRH will be updated with results from the Full Baseline study, which looked at homes built under the 2009 IECC and will be completed during the summer of 2012.

A copy of the complete study can be found in Appendix C, Study 3.

4. 2011 Home Energy Services Net-to-Gross Evaluation

**Type of Study:** Impact Evaluation

**Objective of the Study:** To determine measure-specific and program-level net-to-gross (“NTG”) values for several of the measures installed in the Home Energy Services program using information gathered from program tracking systems, participant surveys, and non-participant surveys.

**Programs to which the Results of the Study Apply:**

- Mass Save (Electric)
- Weatherization (Gas)

**Results of the Study and How the Study Determined those Results:**

Measure Category	Measure	Participant Free-ridership	Participant Spillover	Non-participant Spillover	NTG
Direct Installs	CFL	29%	2.5%	N/R	73%
	Air Sealing	8%	8%	28%	129%
Measures for which an Incentive was Offered	Insulation	25%	20%	28%	123%
	Refrigerator	14%	N/R	N/A*	86%
Overall					113%

Note: N/R = Not Reported, N/A = Not Available

The evaluation findings are based on results from an array of data collection activities and evaluation tasks, including participant and non-participant surveys and self-report and discrete choice (DC)-based assessments of measure-level NTG ratios.

**How the Results of the Study Impact each Identified Program’s Savings:** The results of this study will be used to derive net energy savings by multiplying the gross reported savings by the NTG factors.

**Formulas Necessary to Understand the Impact of the Study on the PA’s Program(s):**

$$NTG = 1 - FR + PS + NPS$$

**Explain Whether or Not the PA Decided to Adopt Recommendations from the Study, and Why:** The results of the study are adopted with the following exception. The NTG factors for CFLs were also based on this study but modified by agreement with the EEAC consultants on July 2, 2012 to account for the potential of participants who

would have bought CFLs outside of the HES program but through the Upstream Lighting program, which was estimated to be 5%.

A copy of the complete study can be found in Appendix C, Study 4.

5. Massachusetts Multi-Family Market Characterization and Potential Study

**Type of Study:** Market Characterization

**Objective of the Study:** The objective of this study was to assess the potential energy efficiency savings available in multi-family buildings within Massachusetts. The results of this study will be used to inform ongoing energy efficiency planning and program design by identifying the quantity of available potential and determining how it is distributed across end uses in multi-family buildings.

**Programs to which the Results of the Study Apply:**

- Multi-Family Retrofit (Electric and Gas)
- Low-Income Multi-Family Retrofit (Electric and Gas)

**Recommendations Derived from the Study:** There are no recommendations from this study as the main purpose was to derive potential savings from multi-family buildings within Massachusetts.

**How the Study Came to the Recommended Conclusions:** Not Applicable.

**Explain Whether or Not the PA Decided to Adopt Recommendations from the Study, and Why:** Not Applicable.

A copy of the complete study can be found in Appendix C, Study 5.

6. Massachusetts Multi-Family Retrofit Program Process Evaluation

**Type of Study:** Process Evaluation

**Objective of the Study:** The objective of this study was to assess program processes and identify similarities and differences between the perspectives and assumptions of program staff, implementation staff, and customers regarding program goals, design, and implementation.

Primary activities for this study were: (1) report the opinions and perspectives gathered through the interview process; (2) draw conclusions based on the information obtained; and (3) offer specific, actionable recommendations for future program improvement.

**Programs to which the Results of the Study Apply:**

- Multi-Family Retrofit (Electric & Gas)

**Recommendations Derived from the Study:**

#	Recommendations
1	Develop a comprehensive statewide Multi-Family program marketing and outreach plan that leverages a range of channels to make initial contact with both property managers and tenants and condo owners.
2	Continue to simplify the process for property managers. Via the Mass Save and/or PA Multi-Family websites, provide prospective participants with more detail on exactly how the program works, what measures could be included, the incentive levels, and sample proposals, in advance of calling the MMI.
3	Consider the costs, benefits, and appropriate incentives for additional standard program measures.
4	With each thermostat, leave behind easy to understand programming instructions in multiple languages.
5	Research and test program design and financing options with the aim of both increasing program participation and increasing savings from each property.
6	Provide materials (technical specifications, instructions) and websites for program participants to obtain technical information on measures and ensure that participants understand that they can contact the MMI for technical support.
7	Track program participation with unique identifiers for the building/facility (facility ID) and participating tenant units (unit #s and/or electric and gas account numbers for individually metered units).

**How the Study Came to the Recommended Conclusions:** The process evaluation focused on two key activities: (1) Assessing program processes; and (2) Identifying similarities in and differences between the perspectives and assumptions of program staff, implementation staff, and customers regarding program goals, design, and implementation.

The focus of this study was to report the opinions and various perspectives gathered through interviews with program stakeholders. Conclusions and recommendations were developed based on diverse opinions and perspectives.

Evaluation Task	Details
PA Program Manager Interviews (n=6)	Provided insight into PA’s perspective of the Multi-Family program in 2011, the overall process of participation in the program, any changes that occurred over the last year, any issues or key topics that emerged, and the current status of the program.
Implementer and Multi-Family Market Integrator Interviews (n=4)	Provided insight into program implementation, the data collection and reporting process, and statewide program collaboration.
Literature Review / Benchmarking	Explored common industry practices and innovative approaches that are being undertaken by MF programs throughout North America.
Property Manager Survey (n=64)	Provided insight into satisfaction at the property management level, program delivery (in process), measure verification and persistence, and freeridership and spillover.
Tenant / Condo-owner Survey (n=73)	Provided insight into satisfaction at the individual tenant level, program delivery, verification and persistence of measures installed in tenant spaces, freeridership of tenant space CFLs, and spillover.
Property Manager Focus Group (n=9)	Provided additional insight into the validity of and rationales behind the measure verification, persistence, and net-to-gross results from the survey, as well as further discussion of key topics and testing alternative program design strategies identified during the literature review/benchmarking task
Program Database and Audit Data Review	Conducted a thorough review of program tracking databases, and a related review of program audit data not contained in the program tracking databases to determine what data are collected, understand the data details, determine the appropriate baseline for estimating measure-specific savings generated, and to determine the best way to aggregate and analyze the program data. The data review informed the subsequent engineering review (results of the engineering review are provided in a separate report.

**Explain Whether or Not the PA Decided to Adopt Recommendations from the Study, and Why:** All recommendations are being considered for adoption at this time. The PAs have not formally adopted or rejected any recommendations that require changes to program design and operations. Recommendations will be considered for implementation consistent with the 2013-2015 Three-Year Energy Efficiency Plan.

A copy of the complete study can be found in Appendix C, Study 6.

7. Massachusetts Multi-Family Retrofit Program Impact Analysis

**Type of Study:** Impact Analysis

**Objective of the Study:** This impact analysis has two primary objectives. First, the impact work aimed to provide a set of savings approaches (i.e., algorithms and deemed values) that can be used by all PAs (statewide) in future program years. Second, the analysis collected information to inform program attribution, including the measurement of installation rates, persistence, free-ridership, and spillover.

**Programs to which the Results of the Study Apply:**

- Multi-Family Retrofit Program (Gas and Electric)

**Results of the Study and How the Study Determined those Results:**

**Measure Installation, Persistence, and Freeridership**

Measure	PA Data Source	Installation Rate	Persistence Rate	FR (Weighted)	FR (n)
Common Area CFLs	All (except NSTAR)	91%	100%	31%	9
Dwelling CFLs	All (except NSTAR)	98%	99%	12%	3 <sup>1</sup>
Dwelling CFLs	All (except NSTAR)	98%	99%	51%	49
Other CFLs	NSTAR	89%	100%	27%	6
Common Area Lighting Fixtures	All PAs	100% <sup>2</sup>	99%	20%	27
Dwelling Lighting Fixtures	All PAs	99%	100%	16%	31
<b>Total Lighting (except CFLs in units where the occupant pays the electric bill)</b>		<b>96%</b>	<b>100%<sup>3</sup></b>	<b>18%</b>	<b>63</b>
Insulation/Air Sealing	All PAs	100%	100%	19%	22
Showerheads	Showerheads and aerators combined	100%	93%	15%	15
Aerators	Showerheads and aerators combined	100%	96%	15%	15
Programmable Thermostats	All PAs	100%	69% <sup>4</sup>	24%	20

<b>Total (All)</b>	<b>97%</b>	<b>100%<sup>3</sup></b>	<b>18%</b>	<b>63</b>
1. For property managers that pay for dwelling electricity; 2. One respondent reported installing more measures than PA participant tracking data, 100% assumes respondent recall was inaccurate; 3. PM and Tenant combination 4. Installed and programmed;				
<b>Based on PM Survey Responses</b>				
<b>Based on Tenant/Condo Owner Survey Responses</b>				

**Summary of Proposed Savings Approaches**

Measure Category	Primary Algorithm	Alternative Approach
Lighting – CFLs	$\Delta kWh = \frac{N \times (Watt_{pre} - Watt_{post}) \times Hrs}{1000}$	$\Delta kWh = \frac{N \times (Watt_{pre}) \times \Delta Watt_{eff} \times Hrs}{1000}$
Lighting – Linear Fluorescents	$\Delta kWh = \frac{(EFC_{pre} \times Watt_{pre}) - (EFC_{post} \times Watt_{post}) \times Hrs}{1000}$	Same algorithm, but deemed values are provided for baseline wattage and operational hours.
Lighting – LED Exit Signs	$\Delta kWh = \frac{N \times (Watt_{pre} - Watt_{post}) \times Hrs}{1000}$	Same algorithm but, some deemed input values are provided.
Lighting – Metal Halides	$\Delta kWh = \frac{(EFC_{pre} \times Watt_{pre}) - (EFC_{post} \times Watt_{post}) \times Hrs}{1000}$	Same algorithm, but deemed values are provided for baseline wattage and operational hours.
Lighting – Occupancy Sensors	$\Delta kWh = \frac{(Watt_{occupied}) \times Hrs \times \%}{1000}$	Same algorithm, but some deemed input values are provided.
Refrigerators	<p>Refrigerator Recycling</p> $\Delta kWh = \left[ \left( (kWh_{pre} - kWh_{post}) \times \frac{12 - R}{12} + (kWh_{pre} - kWh_{post}) \times \frac{R}{12} \right) \times F_{rec} \right]$ <p>No Recycling</p> $\Delta kWh = (kWh_{pre} - kWh_{post}) \times F_{rec}$	Same algorithm, but some deemed input values are provided.
Attic Insulation Basement Insulation Wall Insulation Insulation (gas)	$kWh_{annual} = \frac{\left( \frac{1}{R_{total}} - \frac{1}{R_{new}} \right) \times HDD_{24} \times Area}{1000000 \times \eta_{heat}}$	Same algorithm, but some deemed input values are provided.
Attic Insulation Basement Insulation Wall Insulation Insulation (electric)	<p>Air Conditioning Savings:</p> $kWh_{annual} = \frac{\left( \frac{1}{R_{total}} - \frac{1}{R_{new}} \right) \times CDD \times DCA \times Area}{1000 \times \frac{BTU}{kWh} \times \eta_{cool}}$ <p>Electric Heating Savings:</p> $kWh_{annual} = \frac{\left( \frac{1}{R_{total}} - \frac{1}{R_{new}} \right) \times HDD_{24} \times Area}{1000000 \times \eta_{heat}} \times 2.911$	Same algorithm, but some deemed input values are provided.
Other Insulation	Deemed annual kWh savings = 137 kWh.	

(electric)		
Other Insulation (gas)	Deemed annual MMBtu savings = 1.2 MMBtu.	
Air sealing (electric)	$\Delta kWh = \frac{Vol \times \Delta TACH \times 0.018 \times HDD \times \frac{24}{H_{heating}}}{2513}$	Same algorithm producing a deemed savings approach per 1000 ft <sup>2</sup> based on zip code and heating type
Air Sealing (gas)	$\Delta MMBtu = \frac{Vol \times \Delta TACH \times 0.018 \times HDD \times \frac{24}{H_{heating}}}{1000000}$	Same algorithm producing a deemed savings approach per 1000 ft <sup>2</sup> based on zip code and heating type
Thermostats (electric)	Deemed annual kWh savings = 282 kWh.	
Thermostats (gas)	Deemed annual MMBtu savings = 2.4 MMBtu.	
Heat pump tune-up	$\Delta kWh = 2 \times \frac{HDD_{heating}}{24} \times \left( \frac{1}{2500} \times Hours_{heating} + \frac{1}{2000} \times Hours_{heating} \right) \times \% \text{ savings}$ $\Delta kWh = 2 \times \frac{HDD_{heating}}{24} \times \left( \frac{1}{2500} \times Hours_{heating} + \frac{1}{2000} \times Hours_{heating} \right) \times \% \text{ savings}$	$\Delta kWh_{dwelling} = 180 \text{ kWh}$ $\Delta kWh_{CommonArea} = 325 \text{ kWh}$
Aerators (electric)	Deemed annual kWh savings = 41.7 kWh.	
Aerators (gas)	Deemed annual MMBtu savings = 0.36 MMBtu.	
Showerheads (electric)	Deemed annual kWh savings = 55.6 kWh.	
Showerheads (gas)	Deemed annual MMBtu savings = 0.48 MMBtu.	
Pipe Wrap (electric)	Deemed annual kWh savings = 55.6 kWh	
Pipe Wrap (gas)	Deemed annual MMBtu savings = 0.48 MMBtu.	
Tank Wrap (electric)	$\Delta kWh = kWh_{tank} \times \left( \frac{EF_{new} - EF_{old}}{EF_{old}} \right)$	Deemed savings per wrap = 31.5 kWh

These results were determined by reviewing program audit data and also reviewing the measure-specific engineering savings estimates contained in each PA’s program tracking database, and their relationships to the per unit values in PA Benefit-Cost Ratio (BCR) models and to the methods described in the Technical Reference Manual (TRM). Also, a review of third party algorithms from other Technical Resource Manuals or from recent studies to get another perspective of how various jurisdictions calculate savings for similar measures was conducted. These reviews included both local sources (within Massachusetts or New England PAs), as well as outside sources like the Database for Energy Efficient Resources (DEER), the Ohio TRM, and the New York TRMs.

**How the Results of the Study Impact each Identified Program’s Savings:**

The results of this study were used to derive net energy savings by multiplying the gross reported savings by the NTG factors. The impact of this study was a decrease in the reported net savings.

**Formulas Necessary to Understand the Impact of the Study on the PA's Program(s):**  
The report includes all required algorithms and calculations to interpret and verify results.

**If the Results of the Study Are Not Adopted by the PA, Fully Explain Why:** The NTG results were adopted. The proposed savings approaches will be used in 3-year planning.

A copy of the complete study can be found in Appendix C, Study #7.

#### 8. Brushless Fan Motors Impact Evaluation

**Type of Study:** Impact

**Objective of the Study:** To identify energy savings associated with BFM retrofits in residential HVAC applications, as installed through the Cool Smart program.

**Programs to which the Results of the Study Apply:**

- Residential Cooling and Heating Equipment (Electric)

**Results of the Study and How the Study Determined those Results:** This evaluation used on-site spot measurement and long-term metering of BFM retrofits to determine statistically significant savings ( $\pm 18\%$  at an estimated 90% confidence interval) for a sample of 26 pilot participants.

The summer demand coincidence factor was calculated using ISO-NE definitions of peak period. Both energy and demand savings included the cooling interactive effect. The following table summarizes the results.

#### **Brushless Furnace Motor Fan Motor Results**

Item	Evaluated Savings
Annual kWh motor savings	246 kWh
Direct motor savings kWh	219 kWh
Interactive cooling savings kWh	27 kWh
Interactive heating penalty (mmbtu)	-0.676 mmBtu
Connected kW	0.182 kW
CF – summer	0.26

Item	Evaluated Savings
CF – winter	0.25
Summer demand savings (kW)	0.047
Winter demand savings (kW)	0.038
Annual Equivalent Full Load Hr	1,493hrsmeasured

**How the Results of the Study Impact each Identified Program’s Savings:** Please refer to the tables in Sections II.A.5 for the program listed above.

**Formulas Necessary to Understand the Impact of the Study on the PA’s Program(s):** Not Applicable.

**If the Results of the Study Are Not Adopted by the PA, Fully Explain Why:** The results of the study are adopted.

A copy of the complete study can be found in Appendix C, Study 8.

9. Demand Impact Model Update User Manual

**Type of Study:** Impact

**Objective of the Study:** Update the existing residential demand impact model originally created by Quantec in 2001 with an improved interface and more recent Massachusetts- or New England-specific load shape data.

**Programs to which the Results of the Study Apply:**

- Residential New Construction & Major Renovation (Electric and Gas)
- Low-Income Residential New Construction (Electric)
- Residential Cooling & Heating Equipment (Electric)
- Multi-Family Retrofit (Electric Only)
- Mass Save (Electric)
- Behavior/Feedback Program (Electric Only)
- ENERGY STAR® Lighting (Electric)

- ENERGY STAR® Appliances (Electric)
- Low-Income Single Family Retrofit (Electric and Gas)
- Low-Income Multi Family Retrofit (Electric Only)

**Results of the Study and How the Study Determined those Results:** The updated model utilizes the best available load shape data, per-unit measure energy savings, and ISO-NE definitions of peak period to allow PAs to dynamically calculate demand impacts.

**How the Results of the Study Impact each Identified Program's Savings:** The model can be used to assess demand impacts for any of the Residential or Low-Income programs. This model will be utilized where demand impacts are not calculated in a typical impact evaluation. The results of this study only affect demand and energy calculations, not savings. Gas programs are minimally impacted by the outcome of this study.

**Formulas Necessary to Understand the Impact of the Study on the PA's Program(s):**  
Not Applicable

**If the Results of the Study Are Not Adopted by the PA, Fully Explain Why:** The results of the study are adopted.

A copy of the complete study can be found in Appendix C, Study 9.

10. Massachusetts Lighting Consumer Survey Report

**Type of Study:** Market Assessment

**Objective of the Study:** The objective of the study was to understand the market for energy-efficient light bulbs, with particular emphasis on establishing a baseline at the onset of the changes in lighting standards resulting from the Energy Independence and Security Act of 2007 (EISA), which went into effect on January 1, 2012.

**Programs to which the Results of the Study Apply:**

- Massachusetts ENERGY STAR Lighting Program (Electric)

**Recommendations Derived from the Study:**

#	Recommendation
1a	<p>The team will continue to track satisfaction with CFLs in the next two waves of the survey to be completed in mid- and late-2012. The evaluation team will continue to inquire what both satisfied and dissatisfied respondents like and do not like about CFLs in order to provide a more complete understanding of CFL satisfaction. The evaluation team will also ask respondents if they have recently shifted their opinion about CFLs and why.</p>
1b	<p>The PAs have little direct control over the persistent concerns about CFLs. The fact that they contain mercury, cannot dim as well as other bulb types, emit a different quality of light, and take a while to warm up represents limitations of the technology. However, at least for dimmability, warm-up time, and light quality, some bulbs suffer from these problems more than others. The PAs may want to continue to work with the program partners to support the highest quality CFLs on the market, perhaps holding additional focus groups or doing other types of consumer research to identify which bulbs those might be.</p>
1c	<p>At this time, the LEDs on the market meant to replace 40 Watt and 60 Watt incandescents do not save much more energy than CFLs, but they do address at least some of the concerns with them, including concerns about mercury, dimmability, and warm-up time. Of course, they also cost more than CFLs. Therefore, in trying to increase adoption of LEDs, the PAs may want to consider educational materials that highlight these advantages of LEDs, but in a manner that does not add to the denigration of CFLs.</p>
2a	<p>The PAs may consider increasing consumer education efforts regarding covered CFLs, as they are more difficult to distinguish from incandescents when simply looking at bulbs in the lighting aisle of the store. For example, signage at the point of purchase could note that the bulb is a CFL and that it can be used with a wider variety of fixtures.</p>
2b	<p>The PAs may also want to consider reclassifying this bulb from “specialty” to “covered standard”. Although the covered CFL is not the most common design, it does not have any “specialty” functions, such as being dimmable or fitting into a candelabra base. In fact, the covered CFL may offer the best opportunity to capture those customers who reject spirals for aesthetic or “fit in fixture” reasons. From an incentive and implementation perspective, the switch in classification may just be a matter of semantics, but from an evaluation and energy-savings</p>

	perspective, the covered CFL is most accurately grouped with other A-line bulbs and not with specialty bulbs, because, at least in the short-term, covered CFLs will usually replace A-line incandescents—and perhaps spiral CFLs—and not specialty incandescents.
3	Satisfaction with the dimming capabilities of CFLs has been a persistent concern among consumers and many program administrators as well. Current indications are that screw-in LEDs dim more consistently and to a greater degree than dimmable CFLs. Therefore, the PAs may consider removing dimmable CFLs from the list of products they support, and turn instead to LEDs as their preferred dimmable technology.
4	The PAs may want to consider placing a consumer education campaign that helps consumers make more informed bulb choices, rather than simply defaulting to the incandescent bulb with which they are most familiar. The best choice may not always be the most efficient one, but perhaps consumers who are considering stockpiling will learn that efficient bulb options to replace incandescents exist for nearly all of their lighting needs. Moreover, PA education on EISA standards and alternative bulb types may encourage consumers to choose efficient options over stockpiling or buying halogen bulbs.
5	The PAs may want to continue their efforts at helping consumers make the transition from thinking about Watts to thinking about lumens. Educational materials and point-of-purchase displays that show typical uses based on lumens provide one example.

**How the Study Came to the Recommended Conclusions:** The recommendations were based on information gathered during the data collection activities for the market assessment. This included an in-depth consumer surveys to track key indicators of the market for compact fluorescent lamps (“CFLs”), light emitting diodes (“LEDs”), and halogens as well as the impact of EISA. The survey was timed to coincide with the EISA-mandated onset of the phase-out of 100 Watt incandescent bulbs. The results provide a baseline understanding of these important indicators at the earliest stages of EISA; the evaluation team will field two additional surveys later in 2012 to track changes that may occur as EISA implementation continues.

**Explain Whether or Not the PA Decided to Adopt Recommendations from the Study, and Why:** Program Administrators plan to incorporate recommendation on continuing consumer education of more efficient light bulbs and supporting LED technology when applicable. Future studies will focus on analyzing the trend in CFL dissatisfaction to see if this is a persistence issues, but no changes will be made until more data is provided. Program Administrators will fully incorporate appropriate

lighting strategies based on the findings from the additional survey waves planned for 2013 as more EISA standards go into effect.

A copy of the complete study can be found in Appendix C, Study #10.

C. Residential Pilot Studies

11. Memo: Major Renovations Pilot Evaluation

**Type of Study:** Process Evaluation

**Objective of the Study:** As follow up to the preliminary report on non-participant interviews issued in 2011, this memo briefly summarizes findings from interviews with homeowners, architects and builders involved with projects completed by the end of 2011. The memo focuses on satisfaction with the Pilot and suggestions for how the Pilot could be improved or made more user-friendly. In addition, it summarizes a discussion with a HERS rater who worked with 5 of the 11 completed projects.

**Programs to which the Results of the Study Apply:**

- Residential New Construction & Major Renovation (Electric and Gas)
- Low-Income Residential New Construction (Electric)

**Recommendations Derived from the Study:**

#	Recommendation
1	Make requirements for participating in the Pilot clearer
2	Encourage further energy-efficiency upgrades and address smaller projects.
3	Make clear what programs a project qualifies for and if it can participate in multiple programs.
4	Speed up the administration process—minimize delays in issuing incentives.

**How the Study Came to the Recommended Conclusions:** Recommendations are based on findings from discussion with a HERS rater who worked with five of the eleven completed projects and in-depth interviews conducted with eight homeowners, three architects and three builders. In most cases the interviewees played more than one role on the projects they were involved in. For example, the owner may have been the architect and/or been the one who applied to participate in the Pilot. The builder may

have been hired by the applicant or submitted the application for the project to participate in the Pilot. The architect may have also been the general contractor or builder and may have submitted the application for the project to participate in the Pilot. All interviewees were asked to provide suggestions for how the Pilot could be improved or made more user-friendly.

**Explain Whether or Not the PA Decided to Adopt Recommendations from the Study, and Why:** The Major Renovations pilot went through an update in early 2012 to make adjustments based on lessons-learned and to address the findings from interviews with homeowners, architects and builders.

One adjustment was that the pilot became a contractor-focused program rather than a homeowner-focused program. The change was made in response to homeowner comments that the pilot requirements were unclear. Homeowners were struggling to understand and manage the technical requirements of the pilot, while a contractor should have greater familiarity with the requirements.

Another adjustment was that the eligibility requirements changed to allow major renovations of any size to participate. This change ensured there would not be a gap between the Home Energy Services program and the Major Renovations pilot, where people would not qualify for either program.

A copy of the complete study can be found in Appendix C, Study 11.

12. Massachusetts Residential New Construction Four to Eight Story Multi-Family Pilot Interview Findings

**Type of Study:** Process Evaluation

**Objective of the Study:** Assess the strengths and areas in need of improvement of the three year pilot that was introduced to serve smaller, four to eight story buildings that do not qualify for ENERGY STAR certification but are too small for commercial programs. The report focuses on the lessons learned from the pilot about addressing the energy efficiency potential of the mid-rise multi-family new construction market.

**Programs to which the Results of the Study Apply:**

- Residential New Construction & Major Renovation (Electric and Gas)
- Low-Income Residential New Construction (Electric)

**Recommendations Derived from the Study:**

#	Recommendation
1	Offer a performance-based program for the mid-rise multi-family new construction market, or possibly the entire multi-family market over three stories.
2	The pilot’s verification of ventilation and infiltration rates for individual units through the High Performance Building Adder is a positive innovation. Given that quality installation of insulation and air sealing have shown to be important in single family structures, multi-family programs should continue to fund and encourage these measures.
3	Offer a long-term program. Ideally, a program would run for a longer period of time and be renewed annually, so that prospective participants know that the program will be in place when their projects complete. With a longer-term program, implementers should focus their efforts on reaching projects at the earliest stage possible.
4	Try to identify and recruit more projects with less of an energy efficiency or green building tilt. Expanding relationship-based marketing focused on the design community would enable programs to reach more projects and provide the assistance they need to incorporate higher levels of energy efficiency.
5	Consider offering assistance and support for the design team, especially as more projects with less of a green tilt are recruited.
6	Consider efforts to address market concerns and misperceptions about energy-efficient building practices. Participant interviews identified a number of concerns particular to this market, notably that more efficient systems need more sophisticated staffs and training for building operation and that it would be more difficult to obtain replacement parts.

**How the Study Came to the Recommended Conclusions:** Recommendations are based on findings from fourteen interviews conducted with the pilot’s sponsors (three interviews), implementer (two interviews), and participants with completed projects (nine interviews representing fourteen projects). The interviews examined the pilot’s goals and objectives, the process of signing up and completing verification, outreach and the timing of projects served, the measures covered, the measures installed, barriers to energy efficient multi-family new construction, and satisfaction.

**Explain Whether or Not the PA Decided to Adopt Recommendations from the Study, and Why:** With the goal of transitioning the current Massachusetts Multi-Family New Construction Pilot to a full program, the following program design features which incorporate the above recommendations are being explored. The proposed program will

continue to provide a single point of contact for the participants and provide service for all fuel sources and meter configurations. To address the issue of long development timelines, a suite of program offerings will provide a stepped enrollment mechanism for pre-bid and post-bid projects. (The bid process is the project milestone after which efforts to influence energy efficiency are no longer possible.) The first offering will include a simple prescriptive application to service post-bid projects. The goal will be to maximize the capture of energy savings from established designs with a focus on residentially metered electric savings.

In tandem with this simple prescriptive offering, a whole building prescriptive program and an interactive savings tool are being developed for pre-bid projects. Third party verification and commissioning activities will continue to be incentivized. In total, these approaches will be capable of servicing multi-family projects from 4 stories and up. These combinations of measures, in conjunction with the transition mechanism, will allow the program to offer cost-effective incentives that will move projects to achieve higher levels of energy efficiency and pave the way to recruit and educate more first-time program participants.

A copy of the complete study can be found in Appendix C, Study 12.

13. 2011 Home Energy Services Packaged Measure Pilot Evaluation

**Type of Study:** Pilot Evaluation

**Objective of the Study:** The evaluation was a review to determine whether the additional customer incentives offered in an effort to achieve deeper savings at one time in the Home Energy Services program made a difference in the customer’s willingness to move forward with installation of energy efficient measures, meeting the pilot’s stated goal, as well as assessing the delivery of the pilot itself.

**Programs to which the Results of the Study Apply:**

- Mass Save (Electric)
- Weatherization (Gas)

**Recommendations Derived from the Study:**

#	Recommendation
1	The Cadmus Team suggests that if the PAs reissue the pilot, they consider additional package combinations, such as an all-insulation package. PAs might also consider a package option without the heating system requirement, which is the highest cost item.

2	The Cadmus Team suggests that the PAs and vendors market the pilot and continue to encourage the HES auditors to explain fully the benefits of the pilot when conducting HES audits.
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**How the Study Came to the Recommended Conclusions:** The recommendations are based on PA program manager interviews, program vendor staff interviews, participant and nonparticipant customer surveys, and a review of pilot and historical program data.

**Explain Whether or Not the PA Decided to Adopt Recommendations from the Study, and Why:**

1	If the PAs decide to reissue the pilot, additional package combinations will be discussed for appropriateness and cost effectiveness.
2	The PAs will look into the best approach for handling this recommendation if the pilot is reissued.

A copy of the complete study can be found in Appendix C, Study 13.

#### 14. Heat Pump Water Heaters Evaluation of Field Installed Performance

**Type of Study:** Technology Evaluation

**Objective of the Study:** The objective of this study was to quantify the in-situ performance of three types of heat pump water heaters (“HPWH”). The study was also meant to answer questions on the efficiency, reliability, and performance of the three types of HPWHs.

**Programs to which the Results of the Study Apply:** This is a new pilot measure that will not directly affect savings from any program during this annual report year. Going forward, this is likely to affect only electric programs.

**Results of the Study:** This study did not have recommendations per se, but rather quantified the results of HPWH use that can be used in the analysis of potential HPWH measures.

	Small Tank (50-60 gal)	Large Tank (80 gal)
Measure Life	10 years	10 years
Incremental Cost	\$1,510	\$2,610

Mean Annual kWh Saved over ERWH	1,687	2,670
<b>Annual Energy Usage</b>		
HPWH; Monitored (kWh)	734-4,035 [1643] <sup>1</sup>	1,200-2,040 [1579] <sup>1</sup>
ERWH; EF=0.91 (kWh)	1,898-5,813 [3330] <sup>1</sup>	3,110-6,078 [4249] <sup>1</sup>
Gas, Oil, or Propane; EF=0.56 (MMBTU)	1,289-3,105 [1950] <sup>1</sup>	1,880-3,226 [2410] <sup>1</sup>
Gas, Oil, or Propane; EF=0.67 (MMBTU)	957-2,664 [1577] <sup>1</sup>	1,510-2,757 [1987] <sup>1</sup>
Mean Winter Peak Demand Reduction over ERWH <sup>2</sup>	374.1 W	
Mean Summer Peak Demand Reduction over ERWH <sup>3</sup>	174.8 W	

<sup>1</sup> Minimum – Maximum [Mean]

<sup>2</sup> June-August, Weekdays, 1pm-5pm

<sup>3</sup> December – January, Weekdays, 5pm-7pm

**How the Study Determined Those Results:** The study came to its conclusions through evaluating the in-situ performance of three types of HPWH products. Fourteen units were monitored for over one year.

**Explain Whether or Not the PA Decided to Adopt Recommendations from the Study, and Why:** There are not any strict recommendations to adopt from this study but the PAs will use the results from this study in future analysis of HPWH measures.

A copy of the complete study can be found in Appendix C, Study 14

15. Solar Hot Water Program Pilot Evaluation

**Type of Study:** Pilot Evaluation

**Objective of the Study:** The objective was to evaluate this pilot program through billing analyses, surveys, on-site validations, and engineering reviews.

**Programs to which the Results of the Study Apply:**

- Residential Building Practices and Demonstration Program

**Results of the Study and How the Study Determined those Results:** Key findings of this evaluation include:

#	Finding
1	The SHW pilot program gross gas savings, based on engineering estimates and modeling, is predicted to be approximately 701 MMBTU/yr, with average savings of approximately 14.2 MMBTU/yr per program participant.
2	The SHW pilot program net gas savings, based on a billing analysis to account for takeback and other effects, is approximately 512 MMBTU/yr, with average savings of approximately 10.9 MMBtu/yr per program participant.
3	Site visits confirmed the quality of SHW installations, with the only consistent problem being the lack of a UV-resistant jacket over the foam insulation on outdoor piping. The most common non-plumbing issue observed was excessive shading of solar collectors.
4	The cost-effectiveness of SHW systems installed through this program is low, with simple post-rebate payback periods to customers of 50 years, on average. Some well loaded and well sited systems, however, achieved simple payback periods of 10 years. However, including O&M costs could extend these payback periods of a well loaded system to over 100 years and of a well sited system to over 20 years, respectively.

Data for this report were obtained through billing analyses, customer surveys, site visits, and engineering reviews of solar hot water systems installed through this program over the past several years.

**How the Results of the Study Impact each Identified Program’s Savings:** The Solar Hot Water Pilot program is a pilot program and is not currently reporting savings. As part of this evaluation, total program natural gas savings were calculated to be approximately 701 MMBTU/year.

**Formulas Necessary to Understand the Impact of the Study on the PA’s Program(s):** The report includes all required algorithms and calculations to interpret and verify results.

**If the Results of the Study Are Not Adopted by the PA, Fully Explain Why:** N/A

A copy of the complete study can be found in Appendix C, Study 15.

D. Low-Income Studies

16. Massachusetts 2011 Low-Income Program Process Evaluation

**Type of Study:** Process Evaluation

**Objective of the Study:** The focus for this process evaluation was to report the opinions and various perspectives gathered through interviews with program stakeholders. The key objectives for the 2011 program process evaluation were as follows:

- Follow up on topics discussed during the 2010 process evaluation, such as progress in standardization goals, internal and external QA/QC processes, and participant waitlists;
- Identify and discuss areas where the program changed in 2011 and reason(s) for the changes; and
- Recommend improvements for process-related issues and suggest ways to standardize or streamline processes between agencies/PAs.

**Programs to which the Results of the Study Apply:**

- Low-Income Single-Family Retrofit (Electric & Gas)
- Low-Income Multi-Family Retrofit (Electric & Gas)

**Recommendations Derived from the Study:**

Low-Income Single Family Program Process Evaluation Recommendations

#	Recommendation
1	If not already, all PAs should provide savings goals to their lead agencies to improve transparency between PAs and program implementers. Lead vendors should then provide all sub-agencies information about annual savings goals, especially in cases where it is a challenge to meet the PAs' savings goals. Furthermore, it may prove beneficial for all agencies to track certain savings performance indicators in a manner similar to that of how they track budgets and spending. If indicators for savings performance currently do not exist, this should be a topic for discussion in the Best Practices working group meetings.
2	The PAs should establish an approval system that does not cause significant delays the PAs ability to provide program budgets to implementers. The process should be set up in a way that PAs can provide contracts and budget information to the agencies in advance of program [start date] year, to provide services to customers in a timely and effective manner and ensure agencies can plan effectively. Multi-year contracts and budgets should be implemented, when possible, with any subsequent

	revisions negotiated in advance of existing contract expiration dates.
3	Through the Best Practices working group, standardize a streamlined approval process for repairs that works for the agencies and PAs.
4	Through the Best Practices working group (including the PAs), develop, document and put into practice both (a) a standardized definition of the waitlist; and (b) standardized methods for tracking and reporting this information. One suggested definition for wait list is the number of eligible low-income customers who have completed all the necessary paperwork to participate and are awaiting an audit.
5	Coordinated and developed through the Best Practices working group, PAs should investigate funding a statewide energy education curriculum, including leave-behind materials and energy saving tips. This effort should aim to increase the depth of energy savings resulting from behavior change, and provide thorough and consistent energy conservation messages to participants.
6	An assessment of necessary or recommended trainings should be discussed through the Best Practices Group to ensure quality auditors and contractors while also maintaining cost-effectiveness.
7	<p>Through the Best Practices working group (or sub-committee) including CRI and DHCD, discuss ways to further streamline the QA/QC process so it serves the needs of the PA-funded program while minimizing participant intrusion. The objectives of the discussion should be:</p> <ul style="list-style-type: none"> <li>a. Clearly articulate the objectives of multiple QA/QC visits to a participant's home.</li> <li>b. Establish the value of agencies conducting 100% post inspections versus redirecting resources to serve more homes.</li> <li>c. Determine where the objectives of the DHCD and CRI inspections align and identify if there are opportunities for collaboration and coordination.</li> <li>d. Assess how changes in federal funding levels are expected to affect DHCD inspections and what affect that has on collaboration or coordination opportunities.</li> </ul> <p>Findings from this discussion should be clearly documented and action items to improve QA/QC process should be adopted.</p>

Low-Income Multi-Family Retrofit Program Process Evaluation Recommendations

#	Recommendation
1	The LIMF Advisory Committee should encourage more standardization across PAs by developing standardized project screening criteria or a tool to determine savings and cost effectiveness for both gas and electric projects.
2	Identify one single representative program to remain involved with during the entire participation process with building managers. Consider looking to the Multi-Family Market Integrator used in the market rate multi-family program as a model.
3	Update program materials, including the Program Guide, and clarify the role of each PA's branded benchmarking software tool. To ensure continued participation and energy savings into the future, plan for the need to increase participation in the LIMF program by raising awareness among potential participants of their eligibility and the existence of the program. Facilitate this effort by developing marketing collateral, such as leave-behind materials, that help to clarify and differentiate the LIMF program eligibility and requirements from other potential funding sources that may commonly be offered to participants.
4	Develop data formats to track program savings and administer the program more consistently. To prepare for any future audit or evaluation efforts, all implementers should collect and store building manager contact information as part of the program tracking data, then share those details with the PAs.

**How the Study Came to the Recommended Conclusions:** The recommendations were developed through 77 interviews with program stakeholders.

**Explain Whether or Not the PA Decided to Adopt Recommendations from the Study, and Why:**

Low-Income Single-Family Program Process Evaluation Recommendations Responses:

#	Recommendation	PA Response
1	<p>If not already, all PAs should provide savings goals to their lead agencies to improve transparency between PAs and program implementers. Lead vendors should then provide all sub-agencies information about annual savings goals, especially in cases where it is a challenge to meet the PAs' savings goals. Furthermore, it may prove beneficial for all agencies to track certain savings performance indicators in a manner similar to that of how they track budgets and spending. If indicators for savings performance currently do not exist, this should be a topic for discussion in the Best Practices working group meetings.</p>	<p>PAs have been and will continue to provide savings goals to lead vendors to the best of their ability. Often, lead vendors not only manage the overall spend of the program between the various agencies implementing the program but also their performance as it relates to savings goals for PA's territory.</p>
2	<p>PAs should establish a system that does not cause significant delays to the PAs ability to provide program budgets to implementers. The process should be set up in a way that PAs can provide contracts and budget information to the agencies in advance of program [start date] year, to provide services to customers in a timely and effective manner and ensure agencies can plan effectively. Multi-year contracts and budgets should be implemented, when possible, with any subsequent revisions negotiated in advance of existing contract expiration dates.</p>	<p>The PAs are always willing to work with the DPU to establish a regulatory approval system that does not cause significant delays in program delivery.</p>
3	<p>Through the Best Practices working group, standardize a streamlined approval process for repairs that works for the agencies and PAs.</p>	<p>This recommendation is being considered for adoption at this time. The PAs have not formally adopted or rejected any recommendations that require changes to program design and operations.</p>
4	<p>Through the Best Practices working group (including the PAs), develop, document and put into practice</p>	<p>This recommendation is being considered for</p>

	<p>both (a) a standardized definition of the waitlist; and (b) standardized methods for tracking and reporting this information. One suggested definition for wait list is the number of eligible low-income customers who have completed all the necessary paperwork to participate and are awaiting an audit.</p>	<p>adoption at this time. The PAs have not formally adopted or rejected any recommendations that require changes to program design and operations.</p>
<p>5</p>	<p>Coordinated and developed through the Best Practices working group, PAs should investigate funding a statewide energy education curriculum, including leave-behind materials and energy saving tips. This effort should aim to increase the depth of energy savings resulting from behavior change, and provide thorough and consistent energy conservation messages to participants.</p>	<p>PAs are in process of reviewing current marketing collateral and energy education materials that is used by the PAs and/or agencies. Once the analysis of what is currently available is complete, the PAs will determine if the recommendation for the development and/or utilization of statewide materials should be adopted.</p>
<p>6</p>	<p>An assessment of necessary or recommended trainings should be discussed through the Best Practices Group to ensure quality auditors and contractors while also maintaining cost-effectiveness.</p>	<p>This recommendation is being considered for adoption at this time. The PAs have not formally adopted or rejected any recommendations that require changes to program design and operations.</p>
<p>7</p>	<p>Through the Best Practices working group (or sub-committee) including CRI and DHCD, discuss ways to further streamline the QA/QC process so it serves the needs of the PA-funded program while minimizing participant intrusion. The objectives of the discussion should be:</p> <ul style="list-style-type: none"> <li>• Clearly articulate the objectives of multiple QA/QC visits to a participant’s home.</li> <li>• Establish the value of agencies conducting 100% post inspections versus redirecting resources to serve more homes.</li> <li>• Determine where the objectives of the DHCD</li> </ul>	<p>This recommendation is being considered for adoption at this time. The PAs have not formally adopted or rejected any recommendations that require changes to program design and operations.</p>

	<p>and CRI inspections align and identify if there are opportunities for collaboration and coordination.</p> <ul style="list-style-type: none"> <li>Assess how changes in federal funding levels are expected to affect DHCD inspections and what affect that has on collaboration or coordination opportunities.</li> </ul> <p>Findings from this discussion should be clearly documented and action items to improve QA/QC process should be adopted.</p>	
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Low-Income Multi-Family Retrofit Program Process Evaluation Recommendations Responses:

#	Recommendation	PA Response
1	The LIMF Advisory Committee should encourage more standardization across PAs by developing standardized project screening criteria or a tool to determine savings and cost effectiveness for both gas and electric projects.	This recommendation is being considered for adoption at this time. The PAs have not formally adopted or rejected any recommendations that require changes to program design and operations.
2	Identify one single representative program to remain involved with during the entire participation process with building managers. Consider looking to the Multi-Family Market Integrator used in the market rate multi-family program as a model.	This recommendation is being considered for adoption at this time. The PAs have not formally adopted or rejected any recommendations that require changes to program design and operations.
3	Update program materials, including the Program Guide, and clarify the role of each PA's branded benchmarking software tool. To ensure continued participation and energy savings into the future, plan for the need to increase participation in the LIMF program by raising awareness among potential participants of their eligibility and the existence of the program. Facilitate this effort by developing marketing collateral, such as leave-behind materials,	PAs are in process of reviewing current marketing collateral and energy education materials that is used by the PAs and/or agencies. Once the analysis of what is currently available is complete, the PAs will determine if the

	that help to clarify and differentiate the LIMF program eligibility and requirements from other potential funding sources that may commonly be offered to participants.	recommendation for the development and/or utilization of statewide materials should be adopted.
4	Develop data formats to track program savings and administer the program more consistently. To prepare for any future audit or evaluation efforts, all implementers should collect and store building manager contact information as part of the program tracking data, then share those details with the PAs.	This recommendation is being considered for adoption at this time. The PAs have not formally adopted or rejected any recommendations that require changes to program design and operations.

A copy of the complete study can be found in Appendix C, Study 16.

17. Low-Income Single Family Program Impact Evaluation

**Type of Study:** Impact Evaluation

**Objective of the Study:** The objective of the study was to determine gross per-unit savings generated by each low-income program measure.

**Programs to which the Results of the Study Apply:**

- Low-Income Single Family Retrofit (Electric & Gas)

**Results of the Study and How the Study Determined those Results:** The PA-weighted Massachusetts-wide per-unit gross *ex post* energy savings (by measure and primary fuel type of treated homes) are summarized below.

Category	Measure	Natural Gas (Therms/year)	Electric (kWh/year)	Oil (MMBTUs/ year)
Insulation and Air Sealing	Insulation and Air Sealing (overall)	263*	1,616	28.1
	Air Sealing	105	501	9.9
	Attic Insulation	83	1,071	11.6

Category	Measure	Natural Gas (Therms/year)	Electric (kWh/year)	Oil (MMBTUs/ year)
	Wall Insulation	115	824	11.2
	Basement Ceiling Insulation	15	30	2.9
	Basement Wall Insulation	13	37	0.2
	Furnace Fan (due to weatherization)	206 (kWh)	--	224 (kWh)
	Cooling (due to weatherization)	138 (kWh)	--	153 (kWh)
Heating System	Heating System Replacement	199*	--	18.4
	Boiler Reset Controls	--	--	4.4
	Programmable Thermostat	--	--	3.1
	Furnace Fan (due to furnace replacement)	172 (kWh)	--	132 (kWh)
Appliances	Refrigerator Replacement	--	762	--
	Second Refrigerator Removal	--	1,180	--
	Freezer Replacement	--	239	--
	Window AC Replacement	--	204	--
Lighting	CFLs	--	45	--
	Torchieres	--	211	--
	Fixtures	--	140	--
Domestic Hot Water	Domestic Hot Water (overall)	5	128	0.7

Category	Measure	Natural Gas (Therms/year)	Electric (kWh/year)	Oil (MMBTUs/ year)
	Low-Flow Showerhead	9	188	1.1
	Faucet Aerator	2	40	0.2
	Pipe Wrap	4	41	0.4
Distribution	Duct Insulation	55	--	4.3
	Duct Sealing	33	--	3.3
Other	Baseload (TLC Kits)	--	25**	--

\* Indicates this number is based on billing analysis. All other measure results through engineering analysis (simulation or algorithms).

\*\* Reflects MA-wide average based on each PA's kit contents and participation.

**How the Results of the Study Impact each Identified Program's Savings:** Please refer to the table in Section II.B.5

**Formulas Necessary to Understand the Impact of the Study on the PA's Program(s):**  
A complete set of measure-specific engineering algorithms are provided in the appendix of the report.

**If the Results of the Study Are Not Adopted by the PA, Fully Explain Why:** The results of the study are adopted.

A copy of the complete study can be found in Appendix C, Study 17.

E. C&I Program Studies

18. Non-Controls Lighting Evaluation for the Massachusetts Small Business Direct Install Program: Multi-Season Study

**Type of Study:** Impact Evaluation

**Objective of the Study:** The impact evaluation was conducted to provide independent estimates of annual energy savings and peak demand impacts for the retrofit installation of high-efficiency lighting fixtures through the C&I Small Retrofit programs. The impact

evaluation focused on savings due to the equipment change only and does not include savings due to the installation of lighting controls.<sup>7</sup>

Through extended metering of lighting time-of-use, the study determined program realization rates for the following savings parameters:

- Annual energy savings (kWh)
- Annual energy savings during energy on-peak period (%)
- Summer and winter peak period demand reduction (kW)
- Annual heating gas and oil impact (MMBtu)

**Programs to which the Results of the Study Apply:**

- C&I Small Retrofit (Electric Only)

**Results of the Study and How the Study Determined those Results:** The impact factors for the statewide program are provided in Table 1. The table includes factors for adjusting the gross energy and peak demand savings and for estimating the gas and oil impacts of lighting fixtures measures implemented through the C&I Small Retrofit program.

Impact factors are provided separately for WMECO due to a difference in the methodology for estimating gross savings for the 2010 and 2011 programs.

The impact factors are based on post-retrofit verification, metering, and analysis performed at 126 participant sites statewide. Metering was performed at all 126 sample sites during winter 2010-2011 and at 26 sites with expected seasonal variation (e.g., schools and summer camps) during summer-fall 2011.

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<sup>7</sup> The impact evaluation of lighting control installations was conducted in *Small Business Direct Install Program: Pre/Post Lighting Controls Study*. June 2012.

Impact Factors:

Factor	Description	Statewide	WMECO
kWh RR	Energy realization rate <sup>i</sup>	96%	72%
HVAC <sub>ELEC</sub>	HVAC interaction factor, electric heat	106%	102%
<i>Total combined energy realization rate (kWh RR x HVAC<sub>ELEC</sub>)</i>		102%	73% <sup>iv</sup>
%kWh On-Peak	Percent energy savings on-peak	69%	70%
kW RR	Connected kW realization rate <sup>i</sup>	99%	98%
CF <sub>SP</sub>	Coincidence factor, summer peak <sup>ii</sup>	66%	60%
CF <sub>WP</sub>	Coincidence factor, winter peak <sup>ii</sup>	44%	43%
HVAC <sub>SP</sub>	HVAC demand interaction factor, summer on-peak	110%	111%
HVAC <sub>WP</sub>	HVAC demand interaction factor, winter on-peak	100%	97%
<i>Total combined summer kW realization rate (kW RR x CF<sub>SP</sub> x HVAC<sub>SP</sub>)</i>		72%	65%
<i>Total combined winter kW realization rate (kW RR x CF<sub>WP</sub> x HVAC<sub>WP</sub>)</i>		44%	41%
HVAC <sub>GAS</sub>	HVAC interaction factor, gas heat (MMBtu/kWh) <sup>iii</sup>	-0.001075	-0.000522
HVAC <sub>OIL</sub>	HVAC interaction factor, oil heat (MMBtu/kWh) <sup>iii</sup>	-0.000120	-0.000252

<sup>i</sup> Includes lighting impacts only; does not include HVAC interaction impacts.

<sup>ii</sup> Statewide coincidence factors are for on-peak capacity periods; WMECO coincidence factors are for seasonal peak periods.

<sup>iii</sup> HVAC gas and oil impacts are negative values because the reduction in lighting operation reduces waste heat generated in the space and results in an increase the space heating load.

<sup>iv</sup> The combined energy realization rate for WMECO is lower than the statewide average due to a different methodology for estimating HVAC interactive impacts. If WMECO changes its methodology to match that of the other PAs, this energy realization rate is no longer valid.

**How the Results of the Study Impact each Identified Program’s Savings:** Results of the study will be applied to update existing impact factors used in calculating small business program lighting fixture electric energy and demand savings. As applied the results will marginally decrease energy and summer demand savings and marginally increase winter demand savings.

**Formulas Necessary to Understand the Impact of the Study on the PA’s Program(s):** Program adjusted gross impacts are calculated by applying the total combined energy and demand realization rates to the program gross energy and demand tracking estimates, respectively:

Adjusted gross energy impacts are calculated by applying the kWh realization rate (kWh RR) and the HVAC electric interaction factor (HVAC<sub>ELEC</sub>) to the tracking gross energy savings.

$$Adjusted\ Gross\ kWh = Tracking\ Gross\ kWh * kWh\ RR * HVAC_{ELEC}$$

Similarly, summer and winter peak demand impacts are calculated by applying the connected demand realization rate (kW RR), peak coincidence factor (CF<sub>SP</sub> for summer, CF<sub>WP</sub> for winter) and HVAC demand interaction factor (HVAC<sub>SP</sub> for summer, HVAC<sub>WP</sub> for winter) to the tracking connected kW savings.

$$\text{Summer Peak kW} = \text{Tracking Gross kW} * \text{kW RR} * CF_{SP} * HVAC_{SP}$$

$$\text{Winter Peak kW} = \text{Tracking Gross kW} * \text{kW RR} * CF_{WP} * HVAC_{WP}$$

The statewide coincidence factors are based on the ISO-NE on-peak capacity periods; the WMECO coincidence factors are based on the ISO-NE seasonal peak capacity periods. A detailed description of the formulas for applying the impact factors in Table 1 is provided in the full report (see pages 3-4).

**If the Results of the Study Are Not Adopted by the PA, Fully Explain Why:** Results of the study have been adopted by MA Program Administrators

A copy of the complete study can be found in Appendix C, Study 18.

19. 2010 Combined Heat and Power Impact Evaluation Methodology and Analysis Memo

**Type of Study:** Impact Evaluation

**Objective of the Study:** The study was intended to produce kWh realization rates, thermal realization rates, and fuel impact realization rates at both the PA and statewide level. The kWh realization rate was meant to inform evaluation departments' net savings calculations while the thermal realization rates and fuel impact realization rates were produced to inform PA implementation and engineering departments regarding the accuracy of their project screening process.

**Programs to which the Results of the Study Apply:**

- C&I Retrofit (Electric Only)

**Results of the Study and How the Study Determined those Results:**

Summary of Realization Rates Program Administrator	Weighted Mean kWh Realization Rate	Weighted Mean Thermal Realization Rate	Weighted Mean Fuel Impact Realization Rate
NGRID	0.86 ± .08	1.01 ± .11	0.87
NSTAR	1.15 ± .16	1.03 ± .08	1.06
Prgm Avg	0.93 ± .07	1.01 ± .08	0.90

The study determined realization rates at the PA level and statewide level. A combination of onsite equipment verification, examination of operating conditions, interviews with site personnel, and equipment metering of 15 individual projects completed during 2010 was performed to inform modeling assumptions and determine realization rates. Metering was performed over a 6 month period, with at least 1 month of summer and 1 month of winter metering required for site inclusion in the evaluation. The results were extrapolated over the remainder of the 12 months to determine evaluated savings. PAs represented in the study sample were NSTAR and National Grid.

**How the Results of the Study Impact each Identified Program's Savings:** How the results impact each program's savings is a function of the previous realization rates that were being incorporated into each PA's savings models. Since this is the first time CHP has been evaluated, program administrators had been assuming a 100% kWh realization rate. With the new impact results, the resulting realization rate for NSTAR will increase net savings while the resulting realization rate for National Grid will decrease net savings.

**Formulas Necessary to Understand the Impact of the Study on the PA's Program(s):**  
Net Savings = Gross kWh Savings x Gross Realization Rate<sup>8</sup> x (1 – Freeridership Rate + Spillover Rate). Further information can be found in the Massachusetts Technical Reference Manual for Estimating Savings from Energy Efficiency Measures 2011 Program Year – Report Version.

**If the Results of the Study Are Not Adopted by the PA, Fully Explain Why:** N/A – This study has been adopted by both NSTAR and National Grid.

A copy of the complete study can be found in Appendix C, Study 19.

## 20. Impact Evaluation of 2010 Custom Process and Compressed Air Installations

**Type of Study:** Impact Evaluation

**Objective of the Study:** The study's objective was to produce both energy (kWh) and demand (kW) realization rates for program administrators' custom process and compressed air projects. A 90% confidence interval was set for energy and an 80% confidence interval was set for demand in the sample design. Realization rates were to be produced at the individual PA level and also at the statewide level.

**Programs to which the Results of the Study Apply:**

- C&I New Construction and Major Renovation (Electric Only)
- C&I Retrofit (Electric Only)

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Realization rate determined by this study.

**Results of the Study and How the Study Determined those Results:**

Overall Process Results	Annual MWh	% On-Peak MWh	On-Peak MWh	On-Peak Summer kW	On-Peak Winter kW	Summer Season Peak kW	Winter Season Peak kW
Total Tracking Savings	22,888	-	-	2,833	2,883	2,833	2,883
Total Measured Savings	17,434	-	-	2,324	2,531	2,381	2,573
Realization Rate	76.2%	-	-	82.0%	87.8%	84.0%	89.3%
Relative Precision at 90% Confidence	14.9%	-	-				
Error Bound at 90% Confidence	2,602	-	-				
Relative Precision at 80% Confidence				24.0%	20.4%	24.3%	20.6%
Error Bound at 80% Confidence				558	516	578	531
Error Ratio	0.74	-	-	1.30	1.23	1.26	1.21

Overall Compressed Air Results	Annual MWh	% On-Peak MWh	On-Peak MWh	On-Peak Summer kW	On-Peak Winter kW	Summer Season Peak kW	Winter Season Peak kW
Total Tracking Savings	6,064	-	-	756	746	756	746
Total Measured Savings	5,168	-	-	577	553	569	560
Realization Rate	85.2%	-	-	76.3%	74.1%	75.2%	75.1%
Relative Precision at 90% Confidence	24.6%	-	-				
Error Bound at 90% Confidence	1,274	-	-				
Relative Precision at 80% Confidence				28.6%	30.9%	27.8%	30.0%
Error Bound at 80% Confidence				165	171	158	168
Error Ratio	0.57	-	-	0.84	0.92	0.83	0.89

Compressed Air Results by PA	Annual MWh	% On-Peak MWh	On-Peak MWh	On-Peak Summer kW	On-Peak Winter kW	Summer Season Peak kW	Winter Season Peak kW
<b>National Grid</b>							
Total Tracking Savings	3,936	48.1%	1,893	485	476	485	476
Total Measured Savings	3,507	44.9%	1,575	381	395	367	402
Realization Rate	89.1%	93.4%	83.2%	78.6%	83.0%	75.6%	84.4%
Relative Precision at 90% Confidence	34.0%	-	33.8%				
Error Bound at 90% Confidence	1,191	-	532				
Relative Precision at 80% Confidence				40.3%	40.5%	39.9%	39.1%
Error Bound at 80% Confidence				154	160	146	157
Error Ratio	0.57	-	0.51	0.88	0.89	0.87	0.86
<b>NSTAR</b>							
Total Tracking Savings	1,170	-	-	143	144	143	144
Total Measured Savings	913	-	-	117	114	117	115
Realization Rate	78.0%	-	-	81.6%	79.2%	81.6%	79.6%
Relative Precision at 90% Confidence	45.1%	-	-				
Error Bound at 90% Confidence	412,081	-	-				
Relative Precision at 80% Confidence				34.6%	37.1%	34.7%	36.7%
Error Bound at 80% Confidence				40	42	41	42
Error Ratio	0.74	-	0.72	0.75	0.81	0.76	0.80
<b>WMECO</b>							
Total Tracking Savings	958	-	-	128	126	128	126
Total Measured Savings	747	-	-	78	44	85	43
Realization Rate	78.0%	-	-	61.3%	34.7%	66.8%	34.5%
Relative Precision at 90% Confidence	24.6%	-	-				
Error Bound at 90% Confidence	184	-	-				
Relative Precision at 80% Confidence				55.0%	95.9%	52.5%	98.0%
Error Bound at 80% Confidence				43	42	45	43
Error Ratio	0.32	-	-	0.80	1.42	0.75	1.43

The study determined realization rates at the PA level and statewide level. A combination of onsite equipment verification, examination of operating conditions, interviews with site personnel, and equipment metering of 28 custom process and 11 custom compressed air projects completed during 2010 was performed to inform modeling assumptions and determine realization rates. Metering was performed over a 3 month period, with the resulting data being extrapolated over the remainder of the 12 months to determine evaluated savings. PAs represented in the study sample were National Grid, NSTAR, Unutil and WMECO.

**How the Results of the Study Impact each Identified Program's Savings:** How the results impact each program's savings is a function of the previous realization rates that were being incorporated into each PA's savings models. For instance, if a PA had been carrying a higher realization rate than was produced in this study, the affected program's savings would decrease once the new realization rate was incorporated.

**Formulas Necessary to Understand the Impact of the Study on the PA's Program(s):** Net Savings = Gross Savings x Gross Realization Rate<sup>9</sup> x (1 – Freeridership Rate + Spillover Rate). Further information can be found in the Massachusetts Technical Reference Manual for Estimating Savings from Energy Efficiency Measures 2011 Program Year – Report Version.

**If the Results of the Study Are Not Adopted by the PA, Fully Explain Why:** N/A – This study has been adopted by all PAs.

A copy of the complete study can be found in Appendix C, Study 20.

## 21. Impact Evaluation of 2010 Custom Lighting Installations

**Type of Study:** Impact Evaluation

**Objective of the Study:** The study's objective was to produce both energy (kWh) and demand (kW) realization rates for program administrators' custom lighting projects. A 90% confidence interval was set for energy and an 80% confidence interval was set for demand in the sample design. Realization rates were to be produced at the individual PA level and also at the statewide level.

**Programs to which the Results of the Study Apply:**

- C&I New Construction and Major Renovation (Electric Only)
- C&I Retrofit (Electric Only)

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<sup>9</sup> Realization rate determined by this study.

**Results of the Study and How the Study Determined those Results:**

Statistic	Annual MWh	On-Peak Summer kW	On-Peak Winter kW	Summer Season Peak kW	Winter Season Peak kW
Total Tracking Savings	46,463	7,659	8,061	7,659	8,061
Total Measured Savings	45,696	7,166	7,392	7,056	7,056
Realization Rate	98.3%	93.6%	91.7%	92.1%	87.5%
Relative Precision at 90% Confidence	9.3%	9.3%	13.1%	9.7%	13.1%
Error Bound at 90% Confidence	4,259	669	966	685	923
Relative Precision at 80% Confidence	7.3%	7.3%	10.2%	7.6%	10.2%
Error Bound at 80% Confidence	3,319	521	752	534	719
Error Ratio	0.30	0.38	0.58	0.40	0.58

Statistic	Annual MWh	% On-Peak MWh	On-Peak MWh	On-Peak Summer kW	On-Peak Winter kW	Summer Season Peak kW	Winter Season Peak kW
<b>Cape Light Compact</b>							
Total Tracking Savings	31	-	-	-	-	-	-
Total Measured Savings	25	-	-	-	-	-	-
Realization Rate	79.5%	-	-	-	-	-	-
Relative Precision at 90% Confidence	0.0%	-	-	-	-	-	-
Error Bound at 90% Confidence	-	-	-	-	-	-	-
Relative Precision at 80% Confidence	0.0%	-	-	-	-	-	-
Error Bound at 80% Confidence	-	-	-	-	-	-	-
Error Ratio	0.00	-	-	-	-	-	-
<b>National Grid</b>							
Total Tracking Savings	9,109	44.3%	4,036	1,886	2,250	1,886	2,250
Total Measured Savings	8,922	47.9%	4,273	2,185	1,913	2,159	1,926
Realization Rate	97.9%	108.1%	105.9%	115.9%	85.0%	114.5%	85.6%
Relative Precision at 90% Confidence	5.9%	-	13.9%	9.5%	11.7%	10.0%	12.1%
Error Bound at 90% Confidence	529	-	595	207	225	216	232
Relative Precision at 80% Confidence	4.6%	-	10.9%	7.4%	9.2%	7.8%	9.4%
Error Bound at 80% Confidence	412	-	464	207	225	216	232
Error Ratio	0.16	-	0.33	0.25	0.33	0.26	0.34
<b>NSTAR</b>							
Total Tracking Savings	30,375	-	-	4,628	5,127	4,628	5,127
Total Measured Savings	30,915	-	-	3,938	4,280	3,815	3,950
Realization Rate	101.8%	-	-	85.1%	83.5%	82.4%	77.0%
Relative Precision at 90% Confidence	13.5%	-	-	14.9%	16.2%	15.3%	15.8%
Error Bound at 90% Confidence	4,182	-	-	586	694	582	622
Relative Precision at 80% Confidence	10.5%	-	-	11.6%	12.6%	11.9%	12.3%
Error Bound at 80% Confidence	3,259	-	-	457	541	454	485
Error Ratio	0.34	-	-	0.42	0.46	0.43	0.44
<b>WMECO</b>							
Total Tracking Savings	7,999	-	-	1,409	967	1,409	967
Total Measured Savings	7,139	-	-	1,351	1,385	1,364	1,346
Realization Rate	89.3%	-	-	95.9%	143.2%	96.8%	139.2%
Relative Precision at 90% Confidence	8.7%	-	-	19.4%	45.7%	21.7%	47.6%
Error Bound at 90% Confidence	619	-	-	262	633	296	640
Relative Precision at 80% Confidence	6.8%	-	-	15.1%	35.6%	16.9%	37.1%
Error Bound at 80% Confidence	482	-	-	204	493	231	499
Error Ratio	0.24	-	-	0.48	1.21	0.53	1.25

The study determined realization rates at the PA level and statewide level. A combination of onsite equipment verification, examination of operating conditions, interviews with site personnel, and equipment metering of 45 individual projects completed during 2010 was performed to inform modeling assumptions and determine realization rates. Metering was performed over a 3 month period, with the resulting data being extrapolated over the remainder of the 12 months to determine evaluated savings. PAs represented in the study sample were Cape Light Compact, National Grid, NSTAR and WMECO.

**How the Results of the Study Impact each Identified Program's Savings:** How the results impact each program's savings is a function of the previous realization rates that were being incorporated into each PA's savings models. For instance, if a PA had been carrying a higher realization rate than was produced in this study, the affected program's savings would decrease once the new realization rate was incorporated.

**Formulas Necessary to Understand the Impact of the Study on the PA's Program(s):** Net Savings = Gross Savings x Gross Realization Rate<sup>10</sup> x (1 – Freeridership Rate + Spillover Rate). Further information can be found in the Massachusetts Technical Reference Manual for Estimating Savings from Energy Efficiency Measures 2011 Program Year – Report Version.

**If the Results of the Study Are Not Adopted by the PA, Fully Explain Why:** N/A – This study has been adopted by all PAs.

A copy of the complete study can be found in Appendix C, Study 21.

## 22. Massachusetts Large Commercial & Industrial Process Evaluation

**Type of Study:** Process Evaluation

**Objective of the Study:** The study is a process evaluation of the Massachusetts Large Commercial and Industrial energy efficiency programs. The study examines key process topics identified by the EEAC, PAs and the DOER including how to improve integration and coordination, concerns about the adequacy of staffing levels, how to achieve deeper savings, whether medium-sized C&I customers are being adequately served by the programs, the adequacy or program tracking databases, and program satisfaction. This study was conducted on behalf of the PAs and the Energy Efficiency Advisory Council (“EEAC”).

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<sup>10</sup> Realization rate determined by this study.

**Programs to which the Results of the Study Apply:**

- C&I New Construction and Major Renovation (Electric & Gas)
- C&I Retrofit (Electric & Gas)

**Recommendations Derived from the Study:**

#	Recommendation
1	Target participants with more sophisticated audits and technical assistance.
2	PAs should be more proactive in reaching out to the trade allies.
3	The PAs need to simplify paperwork and accelerate rebate processing.
4	Reach out to trade ally organizations to disseminate program information and identify contractors who would promote the programs.
5	A standard lifecycle cost tool would probably be well-received.
6	Market the reduced interest financing option to dormant participants.
7	The vendor interviews reaffirmed previous process evaluation findings that PAs need to work closely with architects and engineers who specify the new construction and major renovation projects.
8	The PAs should implement a means of combining small jobs into a bigger pool.
9	The program needs to do a better job of warning program vendors about changes in program funding.
10	In order to clearly identify projects by end-use, the PARIS categories should be adopted, and data entry constrained to the following values.
11	Measure Categories should be used to indicate how projects are treated within these end-uses, according to the list of measures in the TRM.
12	A set of core data should be collected for all projects and included in tracking systems.
13	All data that is collected on customer application forms should be captured in tracking systems so that it is available for analysis.
14	Create or populate a field with consistent business type names.
15	Define Custom vs. Prescriptive projects based on savings calculation

16	Define C&I customer size categories by rate class instead of program.
17	Enter project data or create queries that extract files in such a way that each record represents a single customer site, project and type of measure.
18	Save the queries or code used to produce extract files from one year to the next.
19	Develop a statewide security policy and practice to allow all project and customer data to be delivered at once.
20	Build the capability to link gas and electric customer projects.
21	Provide a mechanism for linking billing and tracking data.
22	Add quality control through rule-based data entry screens that prevent invalid combinations of program, end use and measure category.
23	Calculate savings through lookup tables, wherever possible.
24	Provide premise number instead of account number where available.

**How the Study Came to the Recommended Conclusions:** The study draws on multiple sources of information including: In-depth interviews with EEAC consultants, C&I program managers and staff, participating and nonparticipating trade allies, trade association representatives, and participating customers; Focus group discussions with participating customers; Computer-Aid Telephone Interview (“CATI”) surveys with hundreds of participants including both recent (2010-2011) participants and “dormant” participants who have not participated in the C&I programs since 2008-2009; and an examination of the various PA program tracking databases.

**Explain Whether or Not the PA Decided to Adopt Recommendations from the Study, and Why:** As this report was recently issued, the recommendations are currently under consideration.

A copy of the complete study can be found in Appendix C, Study 22.

23. HVAC Market Characterization and Penetration Analysis – Final Report

**Type of Study:** Process Evaluation

**Objective of the Study:** The objective of the study was to estimate the market penetration of energy-efficient equipment in the Massachusetts commercial HVAC

market, gauge the level of large C&I program influence on market penetration, and characterize the market for emergency replacement.

**Programs to which the Results of the Study Apply:**

- C&I New Construction and Major Renovation (Electric & Gas)
- C&I Retrofit (Electric & Gas)

**Recommendations Derived from the Study:**

#	Recommendation
1	Consider raising efficiency levels for condensing gas boilers. Given the high market penetration for high-efficiency condensing gas boilers reported by both participating contractors (84%-90%) and non-participants (90%-100%), it appears that the program could benefit from raising efficiency levels.
2	Consider offering stocking incentives to distributors. One-half of respondents believe that availability is an important factor in selecting new equipment in emergency replacement situations. In order to ensure the wide availability of high-efficiency models, consider offering stocking incentives to distributors to maintain an inventory of high-efficiency equipment.

**How the Study Came to the Recommended Conclusions:** The evaluation included telephone interviews with commercial HVAC contractors and distributors in Massachusetts. The evaluation had a goal of completing 80 interviews, however only 51 were completed. Each respondent was asked to estimate the market penetration for their firm. This figure was then rolled up to estimate market penetration for the entire market.

**Explain Whether or Not the PA Decided to Adopt Recommendations from the Study, and Why:** As this report was recently issued, the recommendations are currently under consideration.

A copy of the complete study can be found in Appendix C, Study 23.

24. Prescriptive Gas Final Program Evaluation Report

**This study applies to gas energy efficiency programs only and is, therefore, not included in NSTAR Electric Company’s Annual Report.**

25. Impact Evaluation of 2010 Custom Gas Installations

**This study applies to gas energy efficiency programs only and is, therefore, not included in NSTAR Electric Company’s Annual Report.**

F. Special and Cross-Sector Studies

26. Massachusetts Three Year Cross-Cutting Behavioral Program Evaluation Integrated Report

**Type of Study:** Impact and Process Evaluation

**Objective of the Study:**

This report provides the findings from the 2011 annual impact and process evaluation of the Massachusetts Behavioral programs. This represents the second formal report of the three-year evaluation under the Massachusetts Cross-Cutting evaluation area. This report covers two of three behavior programs or pilots implemented between 2009 and 2011: the Behavior/Feedback programs administered by National Grid and NSTAR which are both implemented by OPOWER, and the Behavior/Feedback pilot administered by WMECo, called Western Mass Saves and implemented by C3.

The study evaluates the savings impacts of the two behavior programs or pilots during the 2011 program year. The report also includes a demographic analysis of the savings for the Behavior/Feedback program administered by National Grid. The report also includes a process evaluation of the Behavior/Feedback pilot administered by WMECo, which included a customer survey and web statistics.

Additionally, the report investigates a number of research questions related to behavior programs, such as: How do savings differ by opt-in or opt-out programs? Will the savings persist with or without treatment? Do these programs lead to additional participation in other programs and what are the associated energy savings? Are there specific population characteristics that lead to greater savings?

**Programs to which the Impact Results of the Study Apply:**

- Behavior/Feedback (Electric & Gas)

**Results of the Study and How the Study Determined those Results:**

Behavior/Feedback Electric Results:

PA	Cohort or Measure Name	Program Year	Base Usage	Annualized Net Savings per HH	Net Savings %	Total Evaluated Participants
National Grid	2009	PY2	10,825 kWh	223 kWh	2.06%	23,309

National Grid	2010	PY2	12,051 kWh	196 kWh	1.63%	67,980
National Grid	2010 Add	PY1	15,008 kWh	240 kWh	1.60%	23,557
National Grid	2011	PY1	9,767 kWh	134 kWh	1.37%	94,322

Behavior/Feedback Gas Results:

PA	Cohort or Measure Name	Program Year	Base Usage	Annualized Net Savings per HH	Net Savings %	Total Evaluated Participants
National Grid	2009	PY2	137.2 MMBTUs	1.72 MMBTU	1.25%	23,685
National Grid	2010	PY1	139.9 MMBTUs	1.69 MMBTU	1.21%	74,138
National Grid	2011	PY1	102.7 MMBTUs	1.02 MMBTU	0.99%	87,691
NSTAR	Wave I	PY1	55.7 MMBTUs <sup>a</sup>	0.53 MMBTU	0.94%	22,840
NSTAR	Wave II	PY1	121.5 MMBTUs	1.82 MMBTU	1.50%	22,108

Complete results of the impact evaluation can be found in Section 5 of “Massachusetts Three Year Cross-Cutting Behavioral Program Evaluation Integrated Report.”

Net program savings were determined by conducting billing analysis to estimate annual electric and therm savings. Average annual net savings attributable to the behavioral program were determined using a linear fixed effects regression analysis of customer billing data that included billing data from behavioral program participants (who received the Home Energy Reports), and a matched comparison group of residential customers. The billing analysis approach is described in Section 3.4 of “Massachusetts Three Year Cross-Cutting Behavioral Program Evaluation Integrated Report.”

In addition, net program savings were also determined by conducting a channeling analysis where net program savings determined by billing analysis were adjusted by factoring out deemed savings values counted in other programs. Therefore, the savings values cited here reflect only those program savings directly obtained by the Behavior/Feedback program, factoring out savings jointly attributable to the Behavior/Feedback program *and* other energy efficiency programs. This adjustment is described in Section 3.3 of “Massachusetts Three Year Cross-Cutting Behavioral Program Evaluation Integrated Report.”

**How the Results of the Study Impact each Identified Program’s Savings:** Please see Table II.A.08 in National Grid’s and Western Massachusetts Electric Company’s 2011 Energy Efficiency Annual Reports and Table II.A.9 in NSTAR Gas Company’s 2011 Energy Efficiency Annual Report.

**Formulas Necessary to Understand the Impact of the Study on the PA’s Program(s):** Please see the Massachusetts Technical Reference Manual for Estimating Savings from Energy Efficiency Measures 2011 Program Year – Report Version.

**If the Results of the Study Are Not Adopted by the PA, Fully Explain Why:**

Impact results for the Behavior/Feedback programs are being adopted.

**Programs to which the *Process* Results of the Study Apply:**

- Behavior/Feedback Pilots (Electric Only)
- Behavior/Feedback Programs (Electric & Gas)

**Recommendations Derived from the Study:**

The process evaluation identified recommendations in two areas: (1) program design and evaluation for opt-in programs, (2) evaluating persistence.

#	Recommendation
1	<p>Program design and evaluation for opt-in programs:</p> <ul style="list-style-type: none"> <li>• Waitlisted or delayed treatment participants should be used whenever possible to establish a comparison group.</li> <li>• In the absence of a waitlist or delayed treatment, Variability in Adoption (“VIA”) designs are the most appropriate for quasi-experiments.</li> <li>• Ensure that the “treatment effects” do not occur prior to treatment, indicating a pre-existing saving trajectory (no treatment effects seem to occur prior to treatment).</li> </ul>

	<ul style="list-style-type: none"> <li>• Employ surveys and other qualitative research techniques to assess what customers would have done in the absence of the program.</li> <li>• Evaluation must also consider the effects of feedback in keeping customers on a trajectory.</li> <li>• Consider adjusting the impact models to account for self-selection bias.</li> </ul>
2	<p>Evaluating persistence:</p> <ul style="list-style-type: none"> <li>• Persistence should be examined in two ways: (1) with program treatment, and (2) without program treatment.</li> <li>• All behavioral programs should be continually evaluated for persistence; however opt-in models have little data to date that document persistence beyond one year.</li> <li>• Evaluating/measuring participants' and non-participants' attitudes and intentions using a tested conceptual model can provide confidence in interpreting statistical results.</li> </ul>

**How the Study Came to the Recommended Conclusions:** The study developed the recommendations by researching and citing best practices for evaluating quasi-experimental design and persistence in behavior programs.

**Explain Whether or Not the PA Decided to Adopt Recommendations from the Study, and Why:**

The Company will adopt the recommendations from the study because they will help maintain evaluation best practices.

A copy of the complete study can be found in Appendix C, Study 26.

27. Massachusetts Umbrella Marketing Evaluation Report

**Type of Study:** Process Evaluation

**Objective of the Study:** The objective of this study was to establish baseline campaign awareness in advance of the 2012 marketing campaign. The report also builds on an interim evaluation of the 2010 Massachusetts Umbrella Mass Save Statewide Marketing

Campaign, which focused on documenting the campaign's organizational structure and initial strategy.

**Programs to which the Results of the Study Apply:**

- Residential New Construction & Major Renovation (Electric and Gas)
- Residential Cooling & Heating Equipment (Electric)
- Multi-Family Retrofit (Electric and Gas)
- Mass Save (Electric and Gas)
- Behavior/Feedback Program (Electric and Gas)
- ENERGY STAR® Lighting (Electric)
- ENERGY STAR® Appliances (Electric)
- Residential Heating and Water Heating (Gas)
- Weatherization Program (Gas)
- C&I New Construction & Major Renovation
- C&I Retrofit

**Recommendations Derived from the Study:** There are no recommendations from this report as it was designed to establish baseline campaign awareness.

**How the Study Came to the Recommended Conclusions:** Not Applicable

**Explain Whether or Not the PA Decided to Adopt Recommendations from the Study, and Why:** Not Applicable

A copy of the complete study can be found in Appendix C, Study 27.

28. Additional Non-Energy Impacts for Low-Income Programs

**Type of Study:** Impact

**Objective of the Study:** This study includes additional investigation that clarifies and expands the research performed in the Residential and Low-Income Non-Energy Impacts Evaluation. The additional information focused on refrigerator recycling, lighting quality, price hedging, and economic development.

**Programs to which the Results of the Study Apply:**

- Low-Income Single Family Retrofit (Electric and Gas)
- Low-Income Multi Family Retrofit (Electric and Gas)

**Results of the Study and How the Study Determined those Results:** The results have a positive impact on the benefits attributable to low-income programs. The results were arrived at through a process of meeting and building consensus among Program Administrators, LEAN, and the EEAC.

Lighting Quality:

Item	NEI
Increased Lighting Quality	\$56/participant

Refrigerator Recycling

Item	NEI
Avoided Landfill Space	\$1.06
Plastics & Glass Recycling	\$1.25
Incineration Insulating Foam	\$170.22

Price Hedging

Item	NEI
Hedge against volatile prices	\$0.76/MMBTU of gas
	\$0.005/kWh

Economic Development

Massachusetts – Gas Estimate					
Increase in GSP (Billion \$) (1)	Savings (Tbtu) (2)	Savings (therms) (3)	Economic output per therm (4)	11% for low income (5)	Inflated from 2008 to 2011\$ (6)

28	664	6,640,000,000	\$4.22	\$0.46	\$0.486
(1) Energy Efficiency: Engine of Economic Growth; ENE; October 2009; page 49.					
(2) Energy Efficiency in Massachusetts: Engine of Economic Growth; ENE; October 2009; page 2.					
(3) Tbtu times 10,000,000					
(4) Calculated as Increase in GSP/Savings (therms)					
(5) Multiply economic output per therm by 11%; assumes 11% inures to the benefit of low-income (the low-income fraction of population).					
(6) Uses an inflation rate of 1.85% from BCR models.					

Massachusetts – Electric Estimate				
Increase in GSP (Billion \$) (1)	Savings (GWh) (2)	Savings (kWh) (3)	Economic output per therm (4)	11% for low income (5) (6)
70	217,300	217,300,000,000	\$0.32	\$0.04
(1) Energy Efficiency: Engine of Economic Growth; ENE; October 2009; page 47.				
(2) Energy Efficiency in Massachusetts: Engine of Economic Growth; ENE; October 2009; page 2.				
(3) GWh times 1,000,000				
(4) Calculated as Increase in GSP/Savings (kWh)				
(5) Multiply economic output per therm by 11%; assumes 11% inures to the benefit of low-income (the low-income fraction of population).				
(6) Using an inflation rate of 1.85% from BCR models does not change the estimate of \$0.04/kWh from 2008 to 2011\$.				

**How the Results of the Study Impact each Identified Program's Savings:** This additional research will result in an increase in benefits in the low-income programs.

**Formulas Necessary to Understand the Impact of the Study on the PA's Program(s):** Not Applicable.

**If the Results of the Study Are Not Adopted by the PA, Fully Explain Why:** The results of the study are adopted.

A copy of the complete study can be found in Appendix C, Study 28.

29. 2011 Commercial and Industrial Natural Gas Programs Free-ridership and Spillover Study

**This study applies to gas energy efficiency programs only and is, therefore, not included in NSTAR Electric Company's Annual Report.**

30. Community Based Partnership Interim Process Evaluation

**Type of Study:** Process

**Objective of the Study:** The overall objective of this evaluation is to assess the effectiveness of each community-based partnership that falls within the scope of the evaluation and determine its potential for replication and/or full-scale implementation.

The *Community-Based Partnerships 2011 Evaluation Final Report* provides an overview of each effort's structure and performance against the goals, presents findings from the research activities conducted with a goal of providing feedback and identifying areas for program improvement. The report also presents comparative analysis of community-based efforts under evaluation with the goal of developing best practices for design and implementation of such efforts.

**Programs to which the Results of the Study Apply:**

- Renew Boston (Electric and Gas)
- New Bedford Community Mobilization Initiative (Electric and Gas)

**Recommendations Derived from the Study:**

#	Finding
1	Determine the goals of each community-based effort (and how it complements the overall portfolio) upfront.

2	Be strategic with the selection of communities.
3	Understand the targeted population and barriers that might prevent the achievement of goals. Clearly document how the community-based initiative seeks to intervene prior to launch.
4	Establish metrics before launching the effort, and track metrics consistently across community-based initiatives.
5	Consider most efficient and cost-effective delivery structure that would align with the effort's goals.
6	Require that all costs and resources required for support be clearly documented and tracked.
7	For future evaluation efforts explicitly evaluate participation trends; marketing efforts and conversion rates; and the full costs of these partnerships, including resources expended by the PAs, implementers and community groups.

**How the Study Came to the Recommended Conclusions:** The findings presented in the study were developed through analysis of program materials and tracking databases, in-depth interviews with the PA staff, in-depth interviews with program stakeholders and community groups, historical participation analysis (for one effort), and participant interviews. As part of the research, the evaluation team has also conducted a literature review of community-based programs implemented across the United States, and developed both partnership-specific logic models and an overarching theory of change for community-based partnerships.

**Explain Whether or Not the PA Decided to Adopt Recommendations from the Study, and Why:** These findings are targeted at future efforts, and will be considered by the PAs and interested stakeholders as additional efforts are launched.

A copy of the complete study can be found in Appendix C, Study 30.

#### G. Future Studies

Table III.B summarizes the studies expected to be included in next year's Annual Report. This table includes studies that apply to both electric and gas energy efficiency programs.

<b>Table III.B: Evaluation Studies in Next Annual Report</b>		
Studies	Docket & Exhibit Approving Planned Evaluation Studies	Expected to be Implemented as Approved? (yes/no)
<b>Residential Studies</b>		
RNC Net Impact Study	Study is planned but not yet submitted for approval	Yes
RNC Incremental Cost Study		
RNC Baseline Study/Code Compliance Assessment*	Study is pending approval of the 2011 MTM, D.P.U. 10-140 through D.P.U. 10-150	Yes
Home Energy Services: Contractor Charettes in Support of Lost Opportunity Metric*	Study is pending approval of the 2012 MTM, D.P.U. 11-106 through D.P.U. 11-116	Yes
Net-to-Gross study on Residential Cooling & Heating Equipment (Cool Smart)*	Study is pending approval of the 2010 AR, D.P.U. 11-63 through D.P.U. 11-73 and D.P.U. 11-126	Yes
Home Energy Services: Impact Evaluation*	Study is pending approval of the 2011 MTM, D.P.U. 10-140 through D.P.U. 10-150	Yes
Residential Lighting Consumer Survey Phase II	Study is pending approval of the 2010 AR, D.P.U. 11-63 through D.P.U. 11-73 and D.P.U. 11-126	Yes
Residential Lighting Shelf Stocking Survey		
Residential Lighting Supplier Interviews	Study is planned but not yet submitted for approval	Yes
Residential Lighting Onsite Saturation Study*	Study is pending approval of the 2012 MTM, D.P.U. 11-106	Yes
Lighting Sensitivity Analysis (EISA Baseline Study) 3YP Version*		

Consumer Electronics Saturation Study*	Study is planned but not yet submitted for approval	Yes
<b>Residential Pilot Studies</b>		
Process and Impact Evaluation of the WI FI Thermostat Pilot*	Study is pending approval of the 2012 MTM, D.P.U. 11-106 through D.P.U. 11-116	Yes
Electronically Commutated Motor (ECM) Circulator Pump Pilot Program*		
Impact Evaluation of the 2011-2012 Boiler Reset Control Pilot Program*	Study is planned but not yet submitted for approval	Yes
2012 Lighting Controls Pilot		
<b>Commercial &amp; Industrial Studies</b>		
Small C&I Billing Analysis	Study is pending approval of the 2011 MTM, D.P.U. 10-140 through D.P.U. 10-150	Yes
Small C&I Lighting Controls Impact Study*	Study is pending approval of the 2010 AR, D.P.U. 11-63 through D.P.U. 11-73 and D.P.U. 11-126	Yes
Large C&I - Prescriptive Measure Impact Evaluation (VSDs)	Study is pending approval of the 2011 MTM, D.P.U. 10-140 through D.P.U. 10-150	Yes
Large C&I - Potential Study to assess the mid-sized C&I customers	Study is pending approval of the 2012 MTM, D.P.U. 11-106 through D.P.U. 11-116	Yes
Large C&I - 2011 CHP Impact Evaluation	Study is planned but not yet submitted for approval	Yes
Large C&I - Custom Electric Impact Evaluation (Refrigeration, Motor, Other)		
Large C&I - Upstream Lighting Impact & Process Evaluation		
Large C&I - C&I Customer Profile		
Large C&I - Existing Building Market Characterization		
Large C&I - Lighting Controls Study		
Large C&I - Whole System Approach Assessment		
Large C&I - New Construction Market Characterization		

Large C&I - New Construction Baseline Code Compliance Study*	Study is pending approval of the 2011 MTM, D.P.U. 10-140 through D.P.U. 10-150	Yes
Large C&I - Prescriptive Measure Impact Evaluation (Lighting)*		
<b>Special &amp; Cross-Cutting Studies</b>		
Non-Energy Impacts 2011 - C&I*	Study is pending approval of the 2011 MTM, D.P.U. 10-140 through D.P.U. 10-150	Yes
Education Program Process (Literature Review)*	Study is planned but not yet submitted for approval	Yes
Residential Smart Energy Monitoring Pilot Impact Evaluation (CLC)	Study is pending approval of the 2011 MTM, D.P.U. 10-140 through D.P.U. 10-150	Yes
Community-Based Initiative: Northampton/Pittsfield	Study is planned but not yet submitted for approval	Yes
Umbrella Marketing Post-Campaign Study		
Job Creation Study*	Study is pending approval of the 2012 MTM, D.P.U. 11-106 through D.P.U. 11-116	Yes
*The PAs anticipate filing these studies with the 2013-15 Three Year Plan		

#### IV. STATUTORY BUDGET REQUIREMENTS

##### A. Introduction

The Green Communities Act requires that energy efficiency programs minimize administrative costs, utilize competitive procurement processes, and spend a certain amount on low-income programs. G.L. c. 25 §§ 19(a)-(c).

For each sector, Tables IV.A through IV.C summarize and compare planned and actual program planning and administration (“PP&A”) costs, outsourced activities, and budget allocation, respectively.

B. Minimization of Administrative Costs

The most significant factor in the PA approach to minimizing administrative costs in 2011 was the statewide collaborative process, which was used by the Program Administrators to coordinate planning, the adoption of consistent programs and processes, program design, EM&V studies, statewide marketing, regulatory proceedings, and the development and sharing of all best practices. Sharing of these costs, which would otherwise be borne by each Program Administrator individually, resulted in economies of scale that reduced the cost for each Program Administrator. For example, the joint release of many RFPs lead to minimization of administrative costs in that the costs for preparation and release of the RFPs were shared by the PAs. The Program Administrators also minimized administrative costs by coordinating energy efficiency program delivery, where appropriate, with other customer service activities such as customer acquisition, key account management and trade ally relationships.

Notwithstanding any appropriate coordination with other customer service departments, it was necessary and appropriate for all Program Administrators to maintain a skilled and dedicated administrative staff in order to ensure successful delivery of programs, compliance with the GCA, timely responses to the directives of the Council, Department, and DOER; and documentation and achievement of substantial savings. The Program Administrators sought to balance the need to minimize administrative costs to the extent prudent with the need to maximize program quality and oversight. Councilors have emphasized the need to devote sufficient administrative resources to successfully implement the aggressive programs called for in the 2010-2012 Three-Year Energy Efficiency Plan.

While the economies of scale and other steps taken by the PAs to minimize costs in 2011 were effective, and administrative costs incurred by the PAs are transparent and are presented in each Program Administrator's narrative and supporting tables (see Appendix B), exact quantification of the minimization of administrative costs is not possible in a meaningful way. This is because the continuous scaling up and evolution of the Program Administrators' energy efficiency plans make it impossible to establish a solid baseline for a comparison. When the variables are constantly (and necessarily) shifting, there is no opportunity to make a meaningful quantitative comparison or to estimate a counterfactual. Further, a direct quantitative comparison would not be useful because it would only provide a comparison of two points in time; the mandate of the GCA, however, is to seek administrative efficiencies, which is a continuous process that evolves along with energy efficiency planning and programming, whereas costs and administrative efficiency opportunities are always changing. The Program Administrators sought to minimize costs at all available opportunities, and not just from one point in time to another.

Table IV.A: Program Planning and Administration Costs						
Customer Sector / Program	Planned		Actual		Change from Planned to Actual	
	Value (\$)	% of Total Program Costs	Value (\$)	% of Total Program Costs	Value (\$)	% of Total Program Costs
<b>Residential</b>						
Residential New Construction & Major Renovation	90,120	6%	66,417	6%	-23,703	-1%
Residential Cooling & Heating Equipment	146,434	7%	108,056	5%	-38,378	-2%
Multi-Family Retrofit	283,411	6%	209,526	4%	-73,885	-2%
MassSAVE	1,184,117	6%	904,548	6%	-279,569	-1%
Behavior/Feedback Program	0	0%	0	0%	0	0%
ENERGY STAR Lighting	495,614	6%	367,737	5%	-127,877	-2%
ENERGY STAR Appliances	146,434	6%	108,205	5%	-38,229	-1%
Residential Education Program	61,964	7%	45,598	5%	-16,366	-1%
Workforce Development	0	0%	0	0%	0	0%
Heat Loan Program	0	0%	0	0%	0	0%
R&D and Demonstration	0	0%	0	0%	0	0%
Deep Energy Retrofit	31,960	7%	23,445	16%	-8,515	9%
Behavior/Feedback Pilot	0	0%	0	0%	0	0%
RNC - Major Renovation statewide pilot	0	0%	0	0%	0	0%
RNC Multi Family (4-8 story) statewide pilot	0	0%	0	0%	0	0%
RNC Lighting Design statewide pilot	0	0%	0	0%	0	0%
RNC V3 Energy Star Homes statewide pilot	0	0%	0	0%	0	0%
Heat Pump Water Heater Pilot	0	0%	0	0%	0	0%
Residential Technical Development	0	0%	0	0%	0	0%
Hot Roofs	0	0%	0	0%	0	0%
Home Automation	0	0%	0	0%	0	0%
Community Based Pilot	22,505	6%	16,860	7%	-5,645	2%
Statewide Marketing & Education	0	0%	0	0%	0	0%
EEAC Consultants	0	0%	0	0%	0	0%
DOER Assessment	261,942	100%	351,379	100%	89,437	0%
Sponsorships & Subscriptions	72,655	100%	69,954	100%	-2,701	0%
<b>Residential Total</b>	<b>2,797,156</b>	<b>7%</b>	<b>2,271,725</b>	<b>6%</b>	<b>-525,431</b>	<b>-1%</b>
<b>Low-Income</b>						
Low-Income Residential New Construction	67,961	8%	48,470	7%	-19,491	-1%
Low-Income 1 to 4 Family Retrofit	446,437	8%	318,364	7%	-128,073	-1%
Low-Income MultiFamily Retrofit	305,874	5%	217,604	4%	-88,270	-1%
Statewide Marketing & Education	0	0%	0	0%	0	0%
Low-Income Energy Affordability Network Funding	350,000	100%	101,136	100%	-248,864	0%
DOER Assessment	87,314	100%	117,126	100%	29,812	0%
<b>Low-Income Total</b>	<b>1,257,586</b>	<b>10%</b>	<b>802,701</b>	<b>7%</b>	<b>-454,885</b>	<b>-3%</b>
<b>Commercial &amp; Industrial</b>						
C&I New Construction and Major Renovation	2,209,545	9%	1,572,913	13%	-636,632	3%
C&I Large Retrofit	6,178,128	9%	4,637,031	16%	-1,541,097	7%
C&I Small Retrofit	803,188	3%	531,519	2%	-271,669	-1%
Community Based Pilot	128,847	27%	90,365	60%	-38,482	33%
Statewide Marketing & Education	0	0%	0	0%	0	0%
EEAC Consultants	0	0%	0	0%	0	0%
DOER Assessment	523,884	100%	702,757	100%	178,873	0%
Sponsorships & Subscriptions	483,103	100%	420,612	100%	-62,491	0%
<b>C&amp;I Total</b>	<b>10,326,695</b>	<b>9%</b>	<b>7,955,197</b>	<b>12%</b>	<b>-2,371,498</b>	<b>4%</b>
<b>GRAND TOTAL</b>	<b>14,381,437</b>	<b>8%</b>	<b>11,029,623</b>	<b>10%</b>	<b>-3,351,814</b>	<b>1%</b>

There are no increases greater than ten percent between planned and actual PP&A spending at the sector level.

C. Competitive Procurement

<b>Table IV.B: Outsourced &amp; Competitively Procured Services</b>									
Customer Sector	In-House Activities		Outsourced Activities						TOTAL Activities
			Competitively Procured		Non-Competitively Procured		Total Outsourced Activities		
	\$	% of Total Activities	\$	% of Total Outsourced	\$	% of Total Outsourced	\$	% of Total Outsourced	\$
<b>Residential</b>									
Planned	\$2,464,421	15%	\$13,470,370	95%	\$782,877	5%	\$14,253,247	85%	\$16,717,668
Actual	\$1,734,831	12%	\$11,893,446	94%	\$794,604	6%	\$12,688,050	88%	\$14,422,881
% Difference from Planned to Actual		-3%		-1%		1%		3%	
<b>Low-Income</b>									
Planned	\$855,265	19%	\$1,661,095	47%	\$1,880,751	53%	\$3,541,846	81%	\$4,397,111
Actual	\$575,601	15%	\$1,269,649	39%	\$1,951,823	61%	\$3,221,472	85%	\$3,797,073
% Difference from Planned to Actual		-4%		-7%		7%		4%	
<b>Commercial &amp; Industrial</b>									
Planned	\$15,842,391	43%	\$18,644,676	89%	\$2,349,588	11%	\$20,994,264	57%	\$36,836,655
Actual	\$11,577,683	54%	\$8,496,604	85%	\$1,548,458	15%	\$10,045,062	46%	\$21,622,745
% Difference from Planned to Actual		11%		-4%		4%		-11%	
<b>TOTAL</b>									
Planned	\$19,162,077	33%	\$33,776,141	87%	\$5,013,216	13%	\$38,789,357	67%	\$57,951,434
Actual	\$13,888,115	35%	\$21,659,698	83%	\$4,294,886	17%	\$25,954,584	65%	\$39,842,699
% Difference from Planned to Actual		2%		-4%		4%		-2%	

There are no significant variances between planned and actual outsourced and competitively procured activities.

D. Low-Income Spending

<b>Table IV.C: Customer Sector Budget Allocation</b>						
Customer Sector	Planned		Actual		Change from Planned to Actual	
	Total Program Costs	% of Total Program Costs	Total Program Costs	% of Total Program Costs	Value	% of Total Program Costs
Residential	\$42,832,529	25%	\$39,010,990	34%	-\$3,821,539	10%
Low-Income	\$12,980,072	7%	\$11,565,948	10%	-\$1,414,124	3%
Commercial & Industrial	\$118,988,483	68%	\$63,930,019	56%	-\$55,058,464	-12%
<b>TOTAL</b>	\$174,801,084	100%	\$114,506,957	100%	-\$60,294,126	0%

V. PERFORMANCE INCENTIVES

The performance incentive mechanism includes three components: the Savings Mechanism, the Value Mechanism, and other Performance Metrics. The Savings Mechanism provides an incentive for achieving dollar benefits from energy efficiency program efforts at or above threshold levels. The Value Mechanism provides an incentive for achieving net benefits equal to or in excess of the threshold level of performance. Performance metrics establish a focus on specified program outcomes or

plan development, with each metric stating the specific requirements for reaching each level of the metric. Table V summarizes the performance incentives earned by the Company by component for its successful delivery of energy efficiency programs in 2011.

<b>Table V: Performance Incentives Summary</b>				
<b>Incentive Components</b>	<b>Threshold</b>	<b>Design</b>	<b>Exemplary</b>	<b>Actual Incentive</b>
Savings Mechanism	3,494,501	4,659,334	5,824,168	4,229,661
Value Mechanism	2,358,243	3,144,324	3,930,405	3,347,072
Performance Metrics	1,243,419	1,657,892	2,072,366	1,973,721
Total Incentive (before-tax)	7,096,163	9,461,551	11,826,939	9,550,454
Total Incentive (after-tax)	4,312,693	5,750,258	7,187,822	5,804,288

The planned values referenced in the Performance Incentives Summary Table above were originally filed in the performance incentives model set forth at Attachment B to the Memorandum of Agreement filed with the Department on April 15, 2011 in NSTAR Electric, D.P.U. 10-146 (“2011 MOA”). The Company earned \$9,550,454 in actual before-tax incentives, which is 101 percent of the design level. After-tax performance incentives are calculated by multiplying the before-tax values by the reciprocal of the effective tax rate, 60.775 percent.

All supporting documentation for each performance incentive component, including detailed information on the Company’s clear and distinct role in achieving the performance metrics, is included in Appendix D, Sections 1 and 2. For the Savings component, evaluation results for only the residential sector required the EM&V impact bandwidth of +/- 25 percent of preliminary results. This concept was first introduced in Exhibit Common-27 Supplemental, filed on December 21, 2009 in NSTAR Electric, D.P.U. 09-120. On page 16 of this exhibit, the application of EM&V results to savings and benefits for purposes of the incentive calculation was discussed. With the new EM&V structure and forum in MA, and increased focus on evaluation particularly for the gas PAs, it was important for the PAs to have a bandwidth around the retrospective application of these EM&V findings. As a result, this page of the exhibit also discussed the impact of any change that resulted from the application of EM&V findings at the individual PA sector level would be limited to +/- 25 percent.

In the Department’s Three-Year Plan orders, D.P.U. 116 through D.P.U. 120, on page 124, the Department accepted the structure and the performance incentive components, including the EM&V contingencies outlined by the PAs.

For NSTAR Electric, the 25 percent bandwidth described above only came into play for the residential sector. As shown on Page 3 of Appendix D, Section 1, Performance Incentive Calculation, the residential sector had evaluated benefits which were 128 percent of preliminary benefits.

For the Savings and Value components of the performance incentive, the Company calculated its earned performance incentive in accordance with the incentive mechanism included in the 2011 MOA, using the post-evaluation benefits and taking into account the 25 percent EM&V impact bandwidth. The Company achieved 91 percent of its planned benefits and 106 percent of its planned net benefits at the portfolio level, surpassing the 75 percent threshold required in order to earn both the savings and value mechanisms of the performance incentive. Using evaluated results (subject to the +/- 25 percent impact bandwidth), the Company calculated the lifetime benefits and net benefits that each program achieved. The benefits were multiplied by the savings payout rate of \$0.0068961 and the net benefits were multiplied by the value payout rate of \$0.0065996, per the 2011 MOA. Although performance under both the Savings and Value Mechanisms is assessed at the portfolio level, this calculation was performed at the sector level, as shown in Appendix D, Section 1 to facilitate the allocation of earned performance incentives in the cost-effectiveness calculations. The incentive dollars earned from performance metrics were allocated to sectors consistent with the allocation presented in the 2011 MOA. A model illustrating the calculation of the performance incentives in accordance with this methodology is included in Appendix D, Section 1.

A summary of the Company’s performance for each Performance Metric is set forth below. Additional supporting documentation related to performance metrics is included in Appendix D, Section 2.

<b>RESIDENTIAL METRIC NUMBER AND NAME</b>	<b>ACHIEVEMENT LEVEL</b>	<b>NOTES</b>
1. MassSAVE/Weatherization: Deeper Savings {Electric & Gas} – Statewide	Exemplary  Exemplary	14% increase in installed major measures;  9% increase in average customer savings.
2. Community Initiatives {Electric & Gas} – Statewide	Exemplary	See Supporting Documentation
<b>LOW-INCOME METRIC NUMBER AND NAME</b>	<b>ACHIEVEMENT LEVEL</b>	<b>NOTES</b>
1. Hard to Reach Landlords {Electric & Gas} – Statewide	Exemplary	See Supporting Documentation
2. Best Practices Program Strategies Research & Technical Review of Potential New Measures	Exemplary	See Supporting Documentation
3. Multi-family Building Inventory	Exemplary	See Supporting Documentation

<b>COMMERCIAL &amp; INDUSTRIAL METRIC NUMBER AND NAME</b>	<b>ACHIEVEMENT LEVEL</b>	<b>NOTES</b>
1. Retrofit -- Depth of savings	Exemplary	X = 16; Y = 120% (at Exemplary) X*Y = 20 Achieved 21
2. New Construction -- Comprehensiveness and depth of savings	Exemplary	X = 37% (at Exemplary) Achieved 38%
3. Direct Install Electric & Gas Integration	Threshold	X = 12%; Z = 110% (at Threshold) X*Z = 13% Achieved 13%
4. Combined Heat & Power	Exemplary	X = 10; Y = 120% (at Exemplary) X*Y = 13 Achieved 14
<b>ALL SECTOR METRIC NUMBER AND NAME</b>	<b>ACHIEVEMENT LEVEL</b>	<b>NOTES</b>
1. Other Financing Capital	Threshold/Design	\$12,843,496
2. Cost Efficiency of Program Measures	Exemplary	5.87

VI. AUDITS

Please refer to the Company's 2010 Energy Efficiency Annual Report for information on audits related to the Company's energy efficiency activities during the last five years (2007-2011).

VII. APPENDICES

- A. Glossary of Defined Terms – includes Types of Costs in each Budget Category and a Glossary of Terms and Abbreviations.
- B. Cost-Effectiveness Supporting Tables and Documentation – includes the D.P.U. 08-50 Tables, the Screening Tool, and Technical Reference Manual.
- C. Program and Pilot Program EM&V Studies – includes evaluation studies for the residential, low-income, and C&I sector programs and pilot programs.
- D. Performance Incentives Supporting Documentation – includes documentation that supports the Company's determination of actual performance incentives earned through the performance metrics.

- E. Other Supporting Documentation – includes additional supporting documentation with regard to competitive procurement activities in 2010.
- F. Lost Base Revenue Information – includes a reference to the information on savings on which LBR is based.