

**Western Massachusetts Electric Company
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[®] 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.

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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.

Tables¹ I.A and I.B provide summary information on program performance at the portfolio and customer sector levels, respectively.

¹

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.

Table I.A: Program Portfolio Summary							
Performance Category	Units	Planned Value	Preliminary Year-End Results		Evaluated Results		
			Value	% Change from Planned	Value	% Change from Preliminary	% Change from Planned
Expenses							
Total Program Costs	\$	22,210,369			20,489,572		-8%
Performance Incentive	\$	1,522,166			1,385,212		-9%
Savings & Benefits							
Energy							
Lifetime	MWh	704,813	650,067	-8%	573,731	-12%	-19%
Annualized	MWh	58,125	54,257	-7%	47,881	-12%	-18%
Demand							
Lifetime	kW	113,673	94,360	-17%	83,060	-12%	-27%
Annualized							
Summer	kW	8,746	7,297	-17%	6,638	-9%	-24%
Winter	kW	7,943	7,220	-9%	6,660	-8%	-16%
NEB (Lifetime)	\$	15,302,900	18,646,449	22%	27,256,991	46%	78%
Cost-Effectiveness							
TRC Benefits	\$	107,481,988			104,178,409		-3%
TRC Costs	\$	31,828,535			29,464,033		-7%
Net Benefits	\$	75,653,453			74,714,376		-1%
BCR	n/a	3.38			3.54		5%

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 Western Massachusetts Electric Company, D.P.U. 10-149.

As shown in Table 1.A above, significant² variances exist at the portfolio level for:

- Summer and Lifetime kW between planned and evaluated values, and
- Non Electric Benefits (“NEBs”) between planned and preliminary, preliminary and evaluated and planned and evaluated values

The residential and C&I sectors were the main contributors to the kW variances noted above. The residential sector had a 37 percent lifetime kW decrease, while the C&I sector saw a 29 percent decrease in Summer kW and a 26 percent decrease in Lifetime kW. For a more detailed discussion of the cause of variances in each sector please reference section II.A.1 for residential results, section II.B.1 for low-income results; and section II.C.1 for C&I results.

Evaluation results were also the major contributing factor in the increase to TRC Benefits, Net Benefits, and a higher-than-forecasted BCR. The Company’s original forecast for Program Year 2011 included limited non-energy impacts (“NEIs”). After the completion of the Residential and Low-Income Non-Energy Impact study submitted in Western Massachusetts Electric Company, D.P.U. 10-112, (the “NEI Study”), the Company has included these impacts in its screening model, producing the higher benefits and net benefits for these programs.

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

Table I.B: Customer Sector Summary				
Sector	Units	Planned Value	Evaluated Results	
			Value	% Change from Planned
Residential				
TRC Benefits	\$	27,955,589	36,910,522	32%
TRC Costs	\$	7,547,559	9,281,189	23%
Net Benefits	\$	20,408,030	27,629,333	35%
BCR	n/a	3.70	3.98	7%
Low-Income				
TRC Benefits	\$	9,439,350	14,168,354	50%
TRC Costs	\$	3,113,403	3,199,555	3%
Net Benefits	\$	6,325,948	10,968,799	73%
BCR	n/a	3.03	4.43	46%
C&I				
TRC Benefits	\$	70,087,049	53,099,533	-24%
TRC Costs	\$	21,167,574	16,983,289	-20%
Net Benefits	\$	48,919,475	36,116,244	-26%
BCR	n/a	3.31	3.13	-6%
TOTAL				
TRC Benefits	\$	107,481,988	104,178,409	-3%
TRC Costs	\$	31,828,535	29,464,033	-7%
Net Benefits	\$	75,653,453	74,714,376	-1%
BCR	n/a	3.38	3.54	5%

As shown in Table 1.B above, significant variances exist at the sector level between planned and evaluated values for the following metrics: Residential TRC benefits and net benefits; Low-Income TRC benefits, net benefits, and BCR; and C&I benefits, costs and net benefits.

- In the residential sector both benefits and net benefits increased due to increased spending in several programs and the application of the values of NEIs to several of the programs. Evaluation results were also the major contributing factor in the increase to TRC Benefits, Net Benefits, and a higher-than-forecasted BCR. The Company's original forecast for Program Year 2011 did not include any NEIs. After the completion of the NEI Study, the Company has included these impacts in its screening model, producing the higher benefits realized for this program. Please refer to section II.A.2 for a more detailed discussion of the cause of the variances by program within this sector.
- Within the low-income sector, increased fossil fuel savings in the 1-4 Retrofit program is the primary contributing factor to the variance between planned and evaluated values. Please refer to section II.B.2 for a more detailed discussion of the cause of the variances by program within this sector.

- For the C&I sector reduced participation and spending in the Large Retrofit program was the primary factor leading to reduced benefits, net benefits and costs. Please refer to section II.C.2 for a more detailed discussion of the cause of the variances by program within this sector

II. PROGRAM PERFORMANCE

Western Massachusetts Electric Company (“WMECO”) Performance Highlights

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

Residential and Low-Income – In 2011, the second year of WMECO’s Three-Year Energy Efficiency Plan, the Company, along with other PAs in the Commonwealth, built upon existing programs and expanded initiatives to increase savings levels over those achieved in 2010. Existing programs that addressed potential energy and demand savings in both existing homes and new construction, which have a history of producing significant savings, were ramped up, and new initiatives were developed and implemented. The platform for increasing savings cost-effectively was based upon pursuing the following principles: (1) integrating gas and electric programs into a portfolio of fuel-neutral programs to the extent reasonable; (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) developing an expanded, trained workforce capable of providing consistent program messaging and services, while maintaining high quality levels; (5) collaborating with community-based organizations that have long-standing relationships with homeowners, tenants and small businesses in economically marginalized communities, and developing community-based pilot initiatives that implemented a neighborhood approach to energy efficiency services.

C&I – Even with the aggressive goals established for 2011, WMECO’s wide variety of well-established programs allowed its C&I customers to achieve permanent energy savings and the Company to reach some of the challenging goals set for its New Construction & Major Renovation, Large Retrofit and Small Retrofit programs. Sharing some program design and administrative responsibilities with all PAs under the seamless statewide program offerings in 2011 allowed WMECO staff to focus more on implementation issues and building the customer relationships necessary to increase program savings. Integration of gas and electric programs also help to archive customer savings in 2011.

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[®] Lighting
- Residential ENERGY STAR Appliances

Residential Pilots

- Deep Energy Retrofit
- Community Based
- Behavior Feedback

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
Expenses							
Total Program Costs	\$	5,842,991			7,099,621		21.5%
Performance Incentive	\$	429,263			498,053		16%
Savings & Benefits							
Energy							
Lifetime	MWh	115,969	140,218	20.9%	136,957	-2%	18%
Annualized	MWh	14,259	16,555	16%	15,750	-5%	10%
Demand							
Lifetime	kW	24,044	26,086	8%	15,205	-42%	-37%
Annualized							
Summer	kW	2,027	2,273	12%	1,699	-25%	-16%
Winter	kW	2,814	3,407	21.1%	3,722	9%	32%
NEB (Lifetime)	\$	12,127,627	10,264,173	-15%	19,506,104	90%	61%
Cost-Effectiveness							
TRC Benefits	\$	27,955,589			36,910,522		32%
TRC Costs	\$	7,547,559			9,281,189		23%
Net Benefits	\$	20,408,030			27,629,333		35%
BCR	n/a	3.70			3.98		7%

As shown in Table II.A.1 above, significant variances exist at the Residential sector level for:

- Lifetime MWh, and Winter kW between planned and preliminary values,
- Total Program Costs, Lifetime Demand, Winter Demand, NEBs and TRC benefits between planned and evaluated values, and
- Lifetime kW, Summer kW and NEBs between preliminary and evaluated values.

Note: The Company allocated performance incentive dollars in the original three-year plan to each sector based on its percentage of budget, then further to each program that yields benefits based on its percentage of the sector budget. In this report the Company has implemented a more current allocation method so that performance incentives are allocated to the programs most consistently with how the dollars are earned based on their total and net benefits achievement. Therefore, nearly every sector and program performance incentive variance will appear significant – not necessarily because of an actual variance, but rather because of the differing allocation methods between the plan and the report.

In general, under the new allocation method, the performance incentive amount should trend based on a program’s benefit and net benefit achievement. Please note that this allocation method variation has no impact on the performance incentive calculation itself, as the incentive is calculated at the portfolio level. For more information on the performance incentive calculation, and allocation to programs, please reference Appendix D.

Each program contributed to the variances noted above as follows:

- Residential New Construction and Major Renovation: This program yielded significant variances in all savings and benefits categories in both preliminary and year-end results. Please refer to section II.A.4 for a more detailed discussion of the cause of the variances in this program.
- Residential Cooling and Heating Equipment: This program yielded significant variances in all categories shown in the table above, due to high participation. Please refer to section II.A.5 for a more detailed discussion of the cause of the variances in this program.
- Multi-Family Retrofit: This program yielded significant negative variances in every category in the table shown above due to the fact that 2011 was the first year of implementation and outreach and recruitment of projects took longer than anticipated leading to fewer than planned completions. Please refer to section II.A.6 for a more detailed discussion of the cause of the variances in this program.
- Mass Save: This program yielded significant variances for lifetime kW, summer kW, winter KW and NEBs. Please refer to section II.A.7 for a more detailed discussion of the cause of the variances in this program.
- ENERGY STAR Lighting: This program yielded significant variances in Lifetime MWh, TRC Benefits and TRC costs. Please refer to section II.A.8 for a more detailed discussion of the cause of the variances in this program.
- ENERGY STAR Appliances: This program yielded significant variances in Program Costs, Participants, Lifetime and Annual MWh, summer, winter and lifetime kW, TRC Benefits and TRC costs. Please refer to section II.A.9 for a more detailed discussion of the cause of the variances in this program.

Table II.A.2: Residential Sector Summary of End Uses				
End Uses	Units (lifetime)	Preliminary Year-End Results	Evaluated Results	% Change from Preliminary to Evaluated
Lighting				
Energy	MWh	118,714	112,881	-5%
Demand	kW	12,152	11,324	-7%
NEB	\$	950,599	6,276,535	560%
HVAC				
Energy	MWh	14,525	17,425	20%
Demand	kW	13,063	2,921	-78%
NEB	\$	8,726,826	12,749,825	46%
Behavior				
Energy	MWh	213	213	0%
Demand	kW	60	24	-60%
NEB	\$	0	0	0%
Refrigeration				
Energy	MWh	6,512	5,763	-11%
Demand	kW	797	871	9%
NEB	\$	0	52,506	0%
Hot Water				
Energy	MWh	199	190	-4%
Demand	kW	9	11	18%
NEB	\$	586,748	427,238	-27%
Process				
Energy	MWh	54	484	793%
Demand	kW	5	55	922%
NEB	\$	0	0	0%
Total				
Energy	MWh	140,218	136,957	-2%
Demand	kW	26,086	15,205	-42%
NEB	\$	10,264,173	19,506,104	90%

Table II.A.3: Residential Program Summary				
Sector	Units	Planned Value	Evaluated Results	
			Value	% Change from Planned
Residential New Construction & Major Renovation				
TRC Benefits	\$	1,290,368	841,737	-35%
TRC Costs	\$	550,342	472,219	-14%
Net Benefits	\$	740,026	369,517	-50%
BCR	n/a	2.34	1.78	-24%
Residential Cooling & Heating Equipment				
TRC Benefits	\$	161,425	2,347,235	1354%
TRC Costs	\$	130,372	477,280	266%
Net Benefits	\$	31,052	1,869,955	5922%
BCR	n/a	1.24	4.92	297%
Multi-Family Retrofit				
TRC Benefits	\$	829,512	325,477	-61%
TRC Costs	\$	403,590	246,815	-39%
Net Benefits	\$	425,922	78,662	-82%
BCR	n/a	2.06	1.32	-36%
MassSAVE				
TRC Benefits	\$	14,229,723	19,174,990	35%
TRC Costs	\$	3,449,133	3,623,069	5%
Net Benefits	\$	10,780,590	15,551,921	44%
BCR	n/a	4.13	5.29	28%
ENERGY STAR Lighting				
TRC Benefits	\$	10,909,909	13,351,765	22%
TRC Costs	\$	2,017,519	3,150,202	56%
Net Benefits	\$	8,892,390	10,201,563	15%
BCR	n/a	5.41	4.24	-22%
ENERGY STAR Appliances				
TRC Benefits	\$	534,652	869,318	63%
TRC Costs	\$	270,902	605,089	123%
Net Benefits	\$	263,750	264,229	0%
BCR	n/a	1.97	1.44	-27%
Deep Energy Retrofit				
TRC Benefits	\$	0	n/a	n/a
TRC Costs	\$	135,721	77,518	-43%
Net Benefits	\$	n/a	0	n/a
BCR	n/a	n/a	0	n/a
Hard-to-Measure Initiatives				
TRC Costs	\$	504,673	507,254	1%
TOTAL				
TRC Benefits	\$	27,955,589	36,910,522	32%
TRC Costs	\$	7,547,559	9,281,189	23%
Net Benefits	\$	20,408,030	27,629,333	35%
BCR	n/a	3.70	3.98	7%

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, 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.

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 Western Massachusetts Electric Company, D.P.U. 09-118, Exhibit WMECO-1, pages 121-130 (bates numbering 00127-00136). The program was approved by the Department on January 28, 2010 in Western Massachusetts Electric Company, D.P.U. 09-118.

Table II.A.4³ 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
Expenses							
Total Program Costs	\$	407,502			354,957		-13%
Performance Incentive	\$	15,647			8,745		-44%
Participants	unique accts	67			62		-7%
Program Cost / Participant	\$	6,082			5,725		-6%
Savings & Benefits							
Energy							
Lifetime	MWh	1,498	2,090	40%	2,385	14%	59%
Annualized	MWh	117	153	30%	126	-18%	7%
Average Measure Life	yrs	12.8	13.7	7%	19.0	39%	49%
Demand							
Lifetime	kW	1,287	298	-77%	387	30%	-70%
Annualized							
Summer	kW	57	20	-66%	18	-7%	-68%
Winter	kW	28	34	20%	19	-45%	-34%
Average Measure Life	yrs	22.7	15.2		21.2		
NEB (Lifetime)	\$	972,974	336,072	-65%	559,675	67%	-42%
Cost-Effectiveness							
TRC Benefits	\$	1,290,368			841,737		-35%
TRC Costs	\$	550,342			472,219		-14%
Net Benefits	\$	740,026			369,517		-50%
BCR	n/a	2.34			1.78		-24%

An explanation of significant variances between planned, preliminary year-end and evaluated values follows.

- **Savings and Benefits:** Energy savings increased between planned and preliminary and planned and evaluated values due to the quantity of energy efficient light bulbs and fixtures installed per unit. Lifetime and summer demand savings decreased between planned and preliminary values due to an overall reduction in cooling savings for the participating homes. Winter demand savings increased

³ 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.

between planned and preliminary results due to the quantity of light bulbs and fixtures installed.

- Cost Effectiveness: TRC Benefits decreased to a greater extent than the program costs leading to a drop in the BCR from planned value of 2.34 to 1.78.
- Performance Incentives: 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.

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.

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.

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. This study is discussed in more detail in Section III, 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 Western Massachusetts Electric Company, D.P.U. 11-112.

The Residential New Construction program is cost-effective with a BCR of 1.78.

b. Residential Cooling & 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 Western Massachusetts Electric Company, D.P.U. 09-118, Exhibit WMECO-1, pages 135-145 (bates numbering 00141-00151). The program was approved by the Department on January 28, 2010 in Western Massachusetts Electric Company, D.P.U. 09-118.

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
Expenses							
Total Program Costs	\$	121,634			335,758		176%
Performance Incentive	\$	1,353			32,541		2306%
Participants	unique accts	190			816		329%
Program Cost / Participant	\$	640			411		-36%
Savings & Benefits							
Energy							
Lifetime	MWh	1,049	5,023	379%	7,076	41%	575%
Annualized	MWh	60	279	361%	393	41%	550%
Average Measure Life	yrs	17.3	18.0	4%	18.0	0%	4%
Demand							
Lifetime	kW	537	3,227	501%	2,676	-17%	398%
Annualized							
Summer	kW	32	179	460%	149	-17%	364%
Winter	kW	12	91	642%	137	50%	1011%
Average Measure Life	yrs	16.8	18.0		18.0		
NEB (Lifetime)	\$	(14,882)	(138,382)	830%	1,264,437	-1014%	-8596%
Cost-Effectiveness							
TRC Benefits	\$	161,425			2,347,235		1354%
TRC Costs	\$	130,372			477,280		266%
Net Benefits	\$	31,052			1,869,955		5922%
BCR	n/a	1.24			4.92		297%

An explanation of significant variances between planned, preliminary year-end and evaluated values follows.

- **Expenses:** Dramatically increased participation for high efficiency central air conditioning units, mini-split heat pumps and ECM motors for warm air furnaces led to the significant increases in total program costs and participation. Costs per participant were somewhat lower than planned due to the high percentage of ECM motors which have much lower TRC costs than either the central air conditioning system or mini split heat pumps.
- **Savings and Benefits:** Lifetime and Annual Energy and Demand Savings increased significantly due to combination of increased participation and the high number of ECM motors installed which provide very high kWh savings per participant. For the preliminary results the negative NEBs associated ECM motors increased significantly as 465 ECM motors were installed compared to 53 in the planning assumptions. NEBs increased significantly from the preliminary to evaluated numbers based on the NEI Study. This study attributes many benefits to the measures installed in the Residential Cooling and Heating program and 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 Western Massachusetts Electric Company, D.P.U. 11-112.

- Cost-Effectiveness: The significant increases in savings and benefits were much larger than the increase in Program costs leading to an increase in the BCR from the planned value of 1.24 to 4.92.
- Performance Incentives: 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 no net change 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. 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 Western Massachusetts Electric Company, D.P.U. 11-112.

The Residential Cooling and Heating program is cost-effective with a BCR of 4.92.

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 residential dwelling unit 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 Western

Massachusetts Electric Company, D.P.U. 09-118, Exhibit WMECO-1, pages 181-195 (bates numbering 00187-00201). The program was approved by the Department on January 28, 2010 in WMECO, D.P.U. 09-118.

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
Expenses							
Total Program Costs	\$	356,090			234,942		-34%
Performance Incentive	\$	9,569			2,755		-71%
Participants	# of units	340			137		-60%
Program Cost / Participant	\$	1,047			1,715		64%
Savings & Benefits							
Energy							
Lifetime	MWh	8,240	2,793	-66%	2,393	-14%	-71%
Annualized	MWh	533	197	-63%	167	-15%	-69%
Average Measure Life	yrs	15.5	14.2	-8%	14.3	1%	-8%
Demand							
Lifetime	kW	252	280	11%	84	-70%	-66%
Annualized							
Summer	kW	33	29	-11%	9	-69%	-73%
Winter	kW	86	77	-10%	17	-78%	-80%
Average Measure Life	yrs	7.6	9.6		9.4		
NEB (Lifetime)	\$	5,037	72,620	1342%	68,351	-6%	1257%
Cost-Effectiveness							
TRC Benefits	\$	829,512			325,477		-61%
TRC Costs	\$	403,590			246,815		-39%
Net Benefits	\$	425,922			78,662		-82%
BCR	n/a	2.06			1.32		-36%

An explanation of significant variances between planned, preliminary year-end and evaluated values follows.

- **Expenses:** Participation and spending were below planned levels as the program took longer than anticipated to get fully up and running. Cost per participant did increase as a program administration costs were spread over fewer customers than planned.
- **Savings and Benefits:** Preliminary and evaluated annual and lifetime energy savings decreased as fewer than planned electric weatherization measures were installed. NEB values increased related to water savings from high level of DWH measures. Evaluated demand savings decreased from preliminary values based on the *Demand Impact Model User Manual* (Study 9) which is discussed below.
- **Cost Effectiveness:** Benefits decreased by a higher percentage than costs which had a negative impact on the program BCR.

- Performance Incentives: 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 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 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. 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 Western Massachusetts Electric Company, D.P.U. 11-112.

The Multi-Family Retrofit program is cost-effective with a BCR of 1.32.

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.

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. See Western Massachusetts Electric Company, D.P.U. 09-118, Exhibit WMECO-1, pages 146-157 (bates numbering 00152-00163). The program was approved by the Department on January 28, 2010 in Western Massachusetts Electric Company, D.P.U. 09-118. Modified planned values were approved in D.P.U. 10-84.

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
Expenses							
Total Program Costs	\$	2,746,608			2,936,632		7%
Performance Incentive	\$	238,431			266,286		12%
Participants	unique accts	2,357			3,142		33%
Program Cost / Participant	\$	1,165			935		-20%
Savings & Benefits							
Energy							
Lifetime	MWh	20,579	22,768	11%	20,733	-9%	1%
Annualized	MWh	2,075	2,656	28%	2,232	-16%	8%
Average Measure Life	yrs	9.9	8.6	-14%	9.3	8%	-6%
Demand							
Lifetime	kW	12,869	11,075	-14%	1,172	-89%	-91%
Annualized							
Summer	kW	672	644	-4%	170	-74%	-75%
Winter	kW	251	430	71%	897	109%	258%
Average Measure Life	yrs	19.2	17.2		6.9		
NEB (Lifetime)	\$	10,454,566	9,173,524	-12%	16,769,479	83%	60%
Cost-Effectiveness							
TRC Benefits	\$	14,229,723			19,174,990		35%
TRC Costs	\$	3,449,133			3,623,069		5%
Net Benefits	\$	10,780,590			15,551,921		44%
BCR	n/a	4.13			5.29		28%

An explanation of significant variances between planned, preliminary year-end and evaluated values follows.

- Expenses: Participation in the Mass Save program increased from planned values due to aggressive outreach, and inclusion of home performance contractors in the second half of 2011. Cost per participant decreased as a smaller percentage of major measures were installed than had been planned.
- Savings and Benefits: Preliminary annual MWh and winter demand results increased due to increased installation of energy efficient lighting measures.

For the evaluated data, the Mass Save program saw a significant decrease in summer demand savings by 74 percent and increase in winter demand savings of 109 percent as the Demand Impact Model increased many of the lighting and heating measures' winter demand savings, while eliminating all summer demand savings related to weatherization and insulation measures. This resulted in a decrease of 89 percent in overall lifetime demand savings as lifetime demand savings are totally dependent on summer demand savings. For further information, please refer to Appendix C, Study.

In addition to the factors discussed above, significant NEI benefits increase of 83 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 Western Massachusetts Electric Company, D.P.U. 11-112. 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.

- Cost effectiveness: Overall TRC benefits increased by 35 percent while costs were five percent higher than planned. This led to a 28 percent increase in the program BCR

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 percent, but depending on measure mix, the net effect will vary for each 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 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 program benefits for the 2011 evaluated results. 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. 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 Western Massachusetts Electric Company, D.P.U. 11-112.

The Mass Save program is cost-effective with a BCR of 5.29.

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.

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 Western Massachusetts Electric Company, D.P.U. 09-118, Exhibit WMECO-1, pages 164-172 (bates numbering 00170-00178). The program was approved by the Department on January 28, 2010 in Western Massachusetts Electric Company, D.P.U. 09-118.

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
Expenses							
Total Program Costs	\$	1,307,942			2,085,881		59%
Performance Incentive	\$	158,202			179,687		14%
Participants	est. # of hhlds	106,667			54,359		-49%
Program Cost / Participant	\$	12			38		213%
Savings & Benefits							
Energy							
Lifetime	MWh	80,451	100,873	25%	97,969	-3%	22%
Annualized	MWh	10,970	12,582	15%	12,159	-3%	11%
Average Measure Life	yrs	7.3	8.0	9%	8.1	0%	10%
Demand							
Lifetime	kW	8,554	10,353	21%	9,938	-4%	16%
Annualized							
Summer	kW	1,168	1,310	12%	1,257	-4%	8%
Winter	kW	2,380	2,669	12%	2,561	-4%	8%
Average Measure Life	yrs	7.3	7.9		7.9		
NEB (Lifetime)	\$	709,932	820,340	16%	791,655	-3%	12%
Cost-Effectiveness							
TRC Benefits	\$	10,909,909			13,351,765		22%
TRC Costs	\$	2,017,519			3,150,202		56%
Net Benefits	\$	8,892,390			10,201,563		15%
BCR	n/a	5.41			4.24		-22%

An explanation of significant variances between planned, preliminary year-end and evaluated values follows.

- Expenses: The ENERGY STAR Lighting program costs saw a dramatic increase in actual versus planned levels as the purchases of higher costs specialty and LED bulbs along with fixtures greatly exceed planned values. The participation shown above is somewhat misleading as planning assumptions assumed approximately four light bulbs/fixtures per participant while the evaluated results use the statewide assumption of approximately eight lights/fixtures per participant. Overall the number of bulbs incented by the program was 93 percent of the planned value. Variances to program costs per participant are a result of their purchase of higher cost bulbs and fixtures.
- Savings and Benefits: Higher than planned levels of fixtures and LED bulbs which have long measure life increased both preliminary and evaluated Lifetime kWh savings and preliminary Lifetime Demand savings. Results from the ongoing evaluation of the program changed NTG ratios, accounted for the decreases between preliminary and evaluated savings results.
- Cost-Effectiveness: Total TRC costs decreased due to higher cost increasing and a greater rate than benefits.

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 small 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 4.24.

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.

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 Western Massachusetts Electric Company, D.P.U. 09-118, Exhibit WMECO-1, pages 173-178 (bates numbering 00179-00184). The program was approved by the Department on January 28, 2010 in Western Massachusetts Electric Company, D.P.U. 09-118.

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
Expenses							
Total Program Costs	\$	177,515			444,938		151%
Performance Incentive	\$	6,062			8,039		33%
Participants	# of rebates	1,556			3,857		148%
Program Cost / Participant	\$	114			115		1%
Savings & Benefits							
Energy							
Lifetime	MWh	4,152	6,671	61%	6,400	-4%	54%
Annualized	MWh	503	689	37%	673	-2%	34%
Average Measure Life	yrs	8.3	9.7	17%	9.5	-2%	15%
Demand							
Lifetime	kW	545	852	56%	947	11%	74%
Annualized							
Summer	kW	65	90	38%	95	6%	46%
Winter	kW	57	106	86%	92	-14%	60%
Average Measure Life	yrs	8.3	9.5		9.9		
NEB (Lifetime)	\$	0		0%	52,506	0%	0%
Cost-Effectiveness							
TRC Benefits	\$	534,652			869,318		63%
TRC Costs	\$	270,902			605,089		123%
Net Benefits	\$	263,750			264,229		0%
BCR	n/a	1.97			1.44		-27%

An explanation of significant variances between planned, preliminary year-end and evaluated values follows.

- Expenses: The higher than anticipated participation and total program costs were related to a fifteen fold increase in the number of refrigerator rebates, fourfold increase in smart strips and tenfold increase in high efficiency TVs above the planned levels. .
- Savings and Benefits: Annual and Lifetime Energy and Demand savings were also impacted by the high number of participants.
- Cost-Effectiveness: The program's TRC benefits and costs were also impacted by the higher than planned program participation. The product mix of actual measures versus planned measures also affected these values disproportionately. The program BCR decreased as TRC benefits increased at much lower rate than costs.
- Performance Incentives: 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 small net change 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 Western Massachusetts Electric Company, D.P.U. 11-112.

The residential ENERGY STAR Appliance program is cost-effective with a BCR of 1.44.

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 Western Massachusetts Electric Company, D.P.U. 09-118, Exhibit WMECO-1, pages 158-163 (bates numbering 00164-00169). The program was approved by the Department on January 28, 2010 in Western Massachusetts Electric Company, D.P.U. 09-118.

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	
Expenses								
Total Program Costs	\$	135,721			77,518			-43%
Participants	unique accts	n/a			3			n/a
Program Cost / Participant	\$	n/a			n/a			n/a
Savings & Benefits								
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
Cost-Effectiveness								
TRC Benefits	\$	n/a			n/a			n/a
TRC Costs	\$	135,721			457,804			237%
Net Benefits	\$	n/a			n/a			n/a
BCR	n/a	n/a			n/a			n/a

In 2011 the Company completed three Deep Energy Retrofit projects. Of the three projects completed, one began in 2009 and the other two started in 2010. Three additional applications were reviewed. Two were determined to not meet the savings criteria and one chose not to continue with their project. The projects overall were challenging as they took longer to complete and cost more than the homeowners and builders initially anticipated. The largest energy savings were found in older homes that had not already implemented many efficiency improvements.

There are no EM&V studies included in the Company's 2011 Annual Report that apply to this pilot.

A mid-term modification was submitted for this pilot in the Company's 2012 Mid-Term Modification filed with the Department on October 28, 2011 in Western Massachusetts Electric Company, D.P.U. 11-112.

b. 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 WMECO's service territory, the Company partnered with The Center for EcoTechnology ("CET") which continued to be engaged in conducting community based outreach strategies to educate and motivate residents of Pittsfield and surrounding communities to take advantage of available energy efficiency programs and take other steps to save energy. Outreach was also conducted by CET in additional targeted communities served by WMECO in the Pioneer Valley, including Amherst, Easthampton and Sunderland. In Springfield, the Company also partnered with the Alliance to Develop Power ("ADP") to develop additional outreach activities in selected neighborhoods.

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 Western Massachusetts Electric Company, D.P.U. 09-118, Exhibit WMECO-1, pages 158-163 (bates numbering 00164-00169). The program was approved by the Department on January 28, 2010 in Western Massachusetts Electric Company, D.P.U. 09-118.

Table II.A.11 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.11: 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
Expenses								
Total Program Costs	\$	0				0		0%
Participants	see MassSave	n/a				n/a		n/a
Program Cost / Participant	\$	n/a				n/a		n/a
Savings & Benefits								
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
Cost-Effectiveness								
TRC Benefits	\$	n/a				n/a		n/a
TRC Costs	\$	0				0		0%
Net Benefits	\$	n/a				n/a		n/a
BCR	n/a	n/a				n/a		n/a

The Company did not budget specific dollars for the pilot in the 2011 MTM. Actual expenses shown in the table represent outreach costs during 2011. Efficiency measure cost and savings installed by customers that were driven to action by this pilot were capture in the Mass Save Home Energy Services Program.

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.

c. Behavior/Feedback Pilot

Purpose/Goal: The purpose of the Behavior Feedback program was to educate and motivate participating residents to take energy saving actions and behaviors within their homes.

Targeted Customers: The program targeted 10,000 residential single-family customers regardless of their energy use.

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

Targeted End-Uses: The program targeted changes in the behavior of customers regarding their energy usage.

Delivery Mechanism: Participants receive information on their household energy consumption compared to their previous years' consumption.

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

Docket/Exhibit where the Program is Discussed and Approved: A mid-term modification was submitted for this program in the Company's 2011 Mid-Term Modification, Exhibit H, filed with the Department on October 28, 2010.

Table II.A.12 provides information on the performance of the Behavior Feedback program.

Table II.A.12: Behavior/Feedback Pilot								
Performance Category	Units	Planned Value	Preliminary Year-End Results			Evaluated Results		
			Value	% Change from Planned		Value	% Change from Preliminary	% Change from Planned
Expenses								
Total Program Costs	\$	85,306				121,742		43%
Participants	unique accts	0				25,000		n/a
Program Cost / Participant	\$	n/a				n/a		n/a
Savings & Benefits								
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
Cost-Effectiveness								
TRC Benefits	\$	n/a				n/a		n/a
TRC Costs	\$	0				0		0%
Net Benefits	\$	n/a				n/a		n/a
BCR	n/a	n/a				n/a		n/a

WMECO's behavior feedback pilot, *Western Mass Saves*, provided WMECO customers with targeted, personalized recommendations for reducing their home electricity usage, encouraged them to commit to personal savings plans, and tracked their progress by analyzing their WMECO bills through a web portal service. When customers saved energy relative to a personal baseline determined by their usage during the previous 12 months, *Western Mass Saves* provided them with reward points for each kilowatt-hour they saved. Reward points could be used for discounts and merchandise from retailers in Western Massachusetts and beyond. (Customers were required to have 12 months of billing history at their current address to be eligible for rewards.)

The C3 (formerly E2.o) *Western Mass Saves* program was comprised of two primary elements: (1) an online web platform available to all WMECO customers; and (2) energy saving reports (mailers) distributed to randomly assigned treatment customers. In addition, the program utilized community based efforts to help further drive participation in the program, though this was a minor portion of the program efforts. Program participants fell into two classes: (1) "passive" participants that received the Energy Savings Report (ESR) but do not utilize the web portal; and (2) "activated" participants that actively opt-in to the web portal (either through the ESR or other marketing and outreach activities).

A mid-term modification was submitted for this pilot in the Company's 2012 Mid-Term Modification filed with the Department on October 28, 2011 in Western Massachusetts Electric Company, D.P.U. 11-112.

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

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

This second formal report of the three-year cycle evaluates the savings impacts of the behavior/feedback programs and pilots. The report also compares savings between opt-in and opt-out behavior programs and identifies savings from participation in other residential programs. The report includes a process evaluation of an opt-in Behavior/Feedback pilot and a demographic analysis of an opt-out program. This evaluation has no impact on the 2011 evaluated results. The study is discussed in more detail in Section III, Study 26.

A mid-term modification was submitted for this pilot in the Company's 2012 Mid-Term Modification filed with the Department on October 28, 2011 in Western Massachusetts Electric Company, D.P.U. 11-112.

B. Low-Income Sector Programs

1. Summary

During 2011 the Company implemented the following low-income programs:⁴

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

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
Expenses							
Total Program Costs	\$	2,927,646			2,938,181		0%
Performance Incentive	\$	185,757			261,374		41%
Savings & Benefits							
Energy							
Lifetime	MWh	26,652	31,539	18%	28,702	-9%	8%
Annualized	MWh	2,244	2,414	8%	2,187	-9%	-3%
Demand							
Lifetime	kW	3,052	3,677	20%	4,070	11%	33%
Annualized							
Summer	kW	237	257	9%	346	35%	46%
Winter	kW	492	472	-4%	288	-39%	-41%
NEB (Lifetime)	\$	6,305,988	10,012,622	59%	10,669,061	7%	69%
Cost-Effectiveness							
TRC Benefits	\$	9,439,350			14,168,354		50%
TRC Costs	\$	3,113,403			3,199,555		3%
Net Benefits	\$	6,325,948			10,968,799		73%
BCR	n/a	3.03			4.43		46%

As shown in Table II.B.1 above, significant variances exist at the low-income sector level for:

- Lifetime kW and NEBs between planned and preliminary values.
- Summer and Winter kW between preliminary and evaluated results
- Lifetime kW, summer and winter kW, NEBs, TRC benefits, Net benefits, and BCR between planned and evaluated values.

⁴ The Company did not offer any pilot programs in the low-income sector during 2011.

Table II.B.2: Low-Income Sector Summary of End Uses				
End Uses	Units (lifetime)	Preliminary Year-End Results	Evaluated Results	% Change from Preliminary to Evaluated
Lighting				
Energy	MWh	11,571	12,179	5%
Demand	kW	1,129	1,535	36%
NEB	\$	386,845	587,359	52%
HVAC				
Energy	MWh	1,239	3,995	222%
Demand	kW	612	1,003	64%
NEB	\$	8,278,605	7,368,845	-11%
Behavior				
Energy	MWh	1,006	182	-82%
Demand	kW	97	21	-78%
NEB	\$	374,067	1,127,944	202%
Refrigeration				
Energy	MWh	17,472	12,114	-31%
Demand	kW	1,817	1,487	-18%
NEB	\$	440,574	867,265	97%
Hot Water				
Energy	MWh	251	232	-7%
Demand	kW	22	24	8%
NEB	\$	532,530	717,648	35%
Total				
Energy	MWh	31,539	28,702	-9%
Demand	kW	3,677	4,070	11%
NEB	\$	10,012,622	10,669,061	7%

Table II.B.3: Low-Income Program Summary				
Sector	Units	Planned Value	Evaluated Results	
			Value	% Change from Planned
Low-Income Residential New Construction				
TRC Benefits	\$	176,907	1,259,687	612%
TRC Costs	\$	100,803	205,298	104%
Net Benefits	\$	76,103	1,054,388	1285%
BCR	n/a	1.75	6.14	250%
Low-Income 1 to 4 Family Retrofit				
TRC Benefits	\$	8,603,870	11,845,561	38%
TRC Costs	\$	2,761,094	2,650,213	-4%
Net Benefits	\$	5,842,776	9,195,348	57%
BCR	n/a	3.12	4.47	43%
Low-Income MultiFamily Retrofit				
TRC Benefits	\$	658,574	1,063,107	61%
TRC Costs	\$	187,858	306,638	63%
Net Benefits	\$	470,715	756,469	61%
BCR	n/a	3.51	3.47	-1%
Hard-to-Measure Initiatives				
TRC Costs	\$	63,647	37,405	-41%
TOTAL				
TRC Benefits	\$	9,439,350	14,168,354	50%
TRC Costs	\$	3,113,403	3,199,555	3%
Net Benefits	\$	6,325,948	10,968,799	73%
BCR	n/a	3.03	4.43	46%

Each program contributed to these variances as follows:

- Low-Income Residential New Construction: This program yielded significant variances in nearly all expenses, savings & benefits, and cost effectiveness categories in both preliminary and year-end results. Please reference section II.B.4 for a more detailed discussion of the cause of the variances in this program.
- Low-Income 1 to 4 Family Retrofit: This program yielded variances in the benefits, net benefits and cost effectiveness categories between planned and evaluated year-end results. Please reference section II.B.5 for a more detailed discussion of the cause of the variances in this program.
- Low-Income Multi-Family Retrofit: This program yielded significant variances in all expenses, savings & benefits, and cost effectiveness categories in both preliminary and year-end results. Please reference section II.B.6 for a more detailed discussion of the cause of the variances in this program.

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 residential dwelling unit served under this program.

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 Western Massachusetts Electric Company, D.P.U. 09-118, Exhibit WMECO-1, pages 202-208 (bates numbering 00208-00214). The program was approved by the Department on January 28, 2010 in Western Massachusetts Electric Company, D.P.U. 09-118.

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	
Expenses								
Total Program Costs	\$	98,671			180,672			83%
Performance Incentive	\$	2,133			24,626			1055%
Participants	unique accts	35			106			203%
Program Cost / Participant	\$	2,819			1,704			-40%
Savings & Benefits								
Energy								
Lifetime	MWh	231	1,809	684%	1,340	-26%		480%
Annualized	MWh	25	103	307%	74	-28%		193%
Average Measure Life	yrs	9.1	17.6	93%	18.1	3%		98%
Demand								
Lifetime	kW	213	825	288%	770	-7%		262%
Annualized								
Summer	kW	10	36	263%	33	-9%		231%
Winter	kW	5	22	397%	17	-25%		274%
Average Measure Life	yrs	21.3	22.7		23.3			
NEB (Lifetime)	\$	125,487	415,241	231%	1,031,861	148%		722%
Cost-Effectiveness								
TRC Benefits	\$	176,907			1,259,687			612%
TRC Costs	\$	100,803			205,298			104%
Net Benefits	\$	76,103			1,054,388			1285%
BCR	n/a	1.75			6.14			250%

An explanation of significant variances between planned, preliminary year-end and evaluated values follows.

- Participation and Expenses: Participation in this program was significantly higher than had been planned. The percentage of smaller multi-family units was significant leading to the high participation and smaller than expected cost per participant.
- Energy and Demand Savings: Preliminary results show very large increases in electric savings from higher participation and higher than planned quantities of refrigerators, dishwashers and lighting fixtures. The long measure lives of these

items lead to the very large increase in preliminary lifetime energy savings. 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

- Cost-Effectiveness: With the increase in savings much higher than the increase in program costs this program saw a significant increase in cost effectiveness to a BCR level of 6.14.
- Performance Incentives: 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.

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 - 112). Values were updated for certain additional Non-Energy Impacts. Savings were not impacted by this research; however, there was a small net decrease to benefits for the Company. The additional research is discussed in more detail in Section III, 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. 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 Western Massachusetts Electric Company, D.P.U. 11-112.

The Low-Income New Construction program is cost effective with a BCR of 6.14.

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.

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 Western Massachusetts Electric Company, D.P.U. 09-118, Exhibit WMECO-1, pages 209-216 (bates numbering 00215-00222). The program was

approved by the Department on January 28, 2010 in Western Massachusetts Electric Company, D.P.U. 09-118.

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
Expenses							
Total Program Costs	\$	2,608,947			2,431,740		-7%
Performance Incentive	\$	152,147			218,473		44%
Participants	audits + fridges	2,010			1,183		-41%
Program Cost / Participant	\$	1,298			2,056		58%
Savings & Benefits							
Energy							
Lifetime	MWh	24,475	23,106	-6%	21,993	-5%	-10%
Annualized	MWh	2,079	1,899	-9%	1,783	-6%	-14%
Average Measure Life	yrs	11.8	12.2	3%	12.3	1%	5%
Demand							
Lifetime	kW	2,762	2,619	-5%	2,683	2%	-3%
Annualized							
Summer	kW	220	202	-8%	278	37%	26%
Winter	kW	466	413	-11%	223	-46%	-52%
Average Measure Life	yrs	12.6	12.9		9.7		
NEB (Lifetime)	\$	5,728,180	9,308,107	62%	9,187,312	-1%	60%
Cost-Effectiveness							
TRC Benefits	\$	8,603,870			11,845,561		38%
TRC Costs	\$	2,761,094			2,650,213		-4%
Net Benefits	\$	5,842,776			9,195,348		57%
BCR	n/a	3.12			4.47		43%

An explanation of significant variances between planned, preliminary year-end and evaluated values follows.

- Expenses and Participation: The number of participants was much lower than planned as the CAP agencies focused on implementation of ARRA funded projects ahead of the April 30, 2012 deadline. The projects that were completed were higher cost per participant as deeper levels of weatherization were achieved.
- Savings and Benefits: Preliminary NEBs increased due to higher than planned oil savings from weatherization measures and heating system replacements. Summer kW increased while Winter kW decreased between preliminary and evaluated results due to the reduction in demand savings for CFL bulbs based on the evaluation results from the *Low Income Single Family Program Impact Evaluation (see Study 17)*
- Cost Effectiveness: The dramatic increase in NEBs as explained above drove total TRC benefits up, while costs maintained, therefore increasing net benefits as well. Overall the cost-effectiveness of the program increased significantly due to

the fact that deeper weatherization was achieved at the homes that were retrofitted.

- Performance Incentives: 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 winter demand 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 - 112). Values were updated for certain additional Non-Energy Impacts. Savings were not impacted by this research; however, there was a slight 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 Single Family program is cost effective with a BCR of 4.47.

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: Depending on the PA, a participant is considered either a dwelling unit or 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 Western Massachusetts Electric Company, D.P.U. 09-118, Exhibit WMECO-1, pages 217-230 (bates numbering 00223-00236). The program was approved by the Department on January 28, 2010 in Western Massachusetts Electric Company, D.P.U. 09-118.

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
Expenses							
Total Program Costs	\$	156,381			288,363		84%
Performance Incentive	\$	31,477			18,275		-42%
Participants	audits + fridges	161			242		50%
Program Cost / Participant	\$	971			1,192		23%
Savings & Benefits							
Energy							
Lifetime	MWh	1,947	6,625	240%	5,370	-19%	176%
Annualized	MWh	140	413	195%	330	-20%	136%
Average Measure Life	yrs	13.9	16.1	16%	16.3	1%	17%
Demand							
Lifetime	kW	77	234	202%	617	164%	698%
Annualized							
Summer	kW	6	18	184%	35	91%	444%
Winter	kW	22	37	67%	48	31%	119%
Average Measure Life	yrs	12.0	12.7		17.6		
NEB (Lifetime)	\$	452,321	289,274	-36%	449,888	56%	-1%
Cost-Effectiveness							
TRC Benefits	\$	658,574			1,063,107		61%
TRC Costs	\$	187,858			306,638		63%
Net Benefits	\$	470,715			756,469		61%
BCR	n/a	3.51			3.47		-1%

An explanation of significant variances between planned, preliminary year-end, and evaluated values follows

- Expenses: Spending and participation in the Low-Income Multi-Family program in 2011 increased significantly as the Company and the CAP agencies worked to ramp up implementation targeting projects with older refrigerators. Spending per customer increased as there were a very high percentage of participants that qualified for refrigerator replacement.
- Savings & Benefits: The increase in energy and demand savings from planning levels due to dramatic increase in refrigerator replacements. Preliminary measure lives and NEBs decreased from plan as there were less weatherization projects as the CAP agencies focused their weatherization efforts on ARRA funded projects. The program's demand savings were also impacted by the new demand impacts which increased winter savings from the lighting measures and summer savings for refrigerators. Finally, evaluated 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 increase to NEBs benefits from preliminary values. For further information, please refer to Appendix C, Study 28
- Cost-Effectiveness: The significant increase in benefits balanced out the increased cost for the program leading to a slight decrease in BCR.
- Performance Incentives: 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 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 in program savings for the 2011 evaluated results. This study is discussed in more detail in Section III, 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.

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 - 112). Values were updated for certain additional Non-Energy Impacts. Savings were not impacted by this research; however, there was a net increase to benefits for the Company. The additional research is discussed in more detail in Section III, 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 3.47.

C. Commercial & Industrial Sector Programs

1. Summary

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

C&I Programs

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

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
Expenses							
Total Program Costs	\$	13,439,732			10,451,770		-22%
Performance Incentive	\$	907,146			625,785		-31%
Savings & Benefits							
Energy							
Lifetime	MWh	562,191	478,310	-15%	408,072	-15%	-27%
Annualized	MWh	41,622	35,287	-15%	29,944	-15%	-28%
Demand							
Lifetime	kW	86,577	64,597	-25%	63,784	-1%	-26%
Annualized							
Summer	kW	6,482	4,767	-26%	4,594	-4%	-29%
Winter	kW	4,637	3,341	-28%	2,649	-21%	-43%
NEB (Lifetime)	\$	(3,130,715)	(1,629,135)	-48%	134,516	-108%	-104%
Cost-Effectiveness							
TRC Benefits	\$	70,087,049			53,099,533		-24%
TRC Costs	\$	21,167,574			16,983,289		-20%
Net Benefits	\$	48,919,475			36,116,244		-26%
BCR	n/a	3.31			3.13		-6%

Significant variances in the Expenses, Savings and Benefits, and Cost-Effectiveness categories, as shown in Table II.C.1 above, are mostly due to the following:

- The C&I New Construction & Major Renovation program experienced a small increase in participation with annual production showing slight increases while demand savings showed decreases due to an abundance of installations with lower demand savings. However, evaluation results drove demand savings higher. The program showed significant increases in cost effectiveness as customers installed more low costs measures such as lighting, while this did translate into higher negative NEBs values because of the associated heating penalty.
- The C&I Retrofit program experienced significantly lower participation rates than planned. Contrary to participation in the New Construction program, customers showed hesitation to investing in their facilities during the calendar year. Compounding the effect of lower participation is the fact that those customers that did participate chose to implement smaller projects, and evaluated results pushed results down even further. The effects of these factors are reflected in the cost, benefits, and program expense deltas.
- The C&I Small Retrofit program experienced a small increase in participation resulting in a significant increase in production. Increased participation in the small C&I program seems to illustrate the recurring theme that customers are focusing on smaller projects. Differences between actual and planned values are predominantly due to evaluation results, which decreased savings substantially.

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

Table II.C.2: C&I Sector Summary of End Uses				
End Uses	Units (lifetime)	Preliminary Year-End Results	Evaluated Results	% Change from Preliminary to Evaluated
Lighting				
Energy	MWh	308,650	243,036	-21%
Demand	kW	46,634	38,200	-18%
NEB	\$	-1,629,135	134,516	-108%
HVAC				
Energy	MWh	56,506	37,297	-34%
Demand	kW	8,156	7,123	-13%
NEB	\$	0	0	0%
Motors				
Energy	MWh	33,528	44,040	31%
Demand	kW	1,163	1,080	-7%
NEB	\$	0	0	0%
Refrigeration				
Energy	MWh	28,934	39,644	37%
Demand	kW	3,857	11,944	210%
NEB	\$	0	0	0%
Compressed Air				
Energy	MWh	22,635	20,733	-8%
Demand	kW	2,086	2,977	43%
NEB	\$	0	0	0%
Process				
Energy	MWh	28,059	23,322	-17%
Demand	kW	2,701	2,460	-9%
NEB	\$	0	0	0%
Total				
Energy	MWh	478,310	384,751	-20%
Demand	kW	64,597	61,325	-5%
NEB	\$	-1,629,135	134,516	-108%

Table II.C.3: C&I Program Summary				
Sector	Units	Planned Value	Evaluated Results	
			Value	% Change from Planned
C&I New Construction and Major Renovation				
TRC Benefits	\$	18,479,927	21,806,673	18%
TRC Costs	\$	3,649,686	3,304,485	-9%
Net Benefits	\$	14,830,241	18,502,188	25%
BCR	n/a	5.06	6.60	30%
C&I Large Retrofit				
TRC Benefits	\$	35,674,216	19,006,770	-47%
TRC Costs	\$	11,312,588	6,804,683	-40%
Net Benefits	\$	24,361,628	12,202,087	-50%
BCR	n/a	3.15	2.79	-11%
C&I Small Retrofit				
TRC Benefits	\$	15,932,907	12,286,091	-23%
TRC Costs	\$	6,048,880	6,760,007	12%
Net Benefits	\$	9,884,027	5,526,084	-44%
BCR	n/a	2.63	1.82	-31%
Community Based Pilot				
TRC Benefits	\$	n/a	n/a	n/a
TRC Costs	\$	0	0	0%
Net Benefits	\$	n/a	n/a	n/a
BCR	n/a	n/a	n/a	n/a
Hard-to-Measure Initiatives				
TRC Costs	\$	156,420	114,115	-27%
TOTAL				
TRC Benefits	\$	70,087,049	53,099,533	-24%
TRC Costs	\$	21,167,574	16,983,289	-20%
Net Benefits	\$	48,919,475	36,116,244	-26%
BCR	n/a	3.31	3.13	-6%

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.
- **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 & 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 Western Massachusetts Electric Company, D.P.U. 09-118, Exhibit WMECO-1, pages 243-254 (bates numbering 00249-00260). The program was approved by the Department on January 28, 2010 in WMECO, D.P.U. 09-118. Planned values were approved in D.P.U. 10-84.

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
Expenses							
Total Program Costs	\$	3,844,166			2,618,233		-32%
Performance Incentive	\$	252,094			285,891		13%
Participants	# of projects	117			128		9%
Program Cost / Participant	\$	32,856			20,455		-38%
Savings & Benefits							
Energy							
Lifetime	MWh	143,259	163,221	14%	169,117	4%	18%
Annualized	MWh	10,603	9,966	-6%	10,774	8%	2%
Average Measure Life	yrs	13.5	16.4	21%	15.7	-4%	16%
Demand							
Lifetime	kW	22,240	22,177	0%	31,046	40%	40%
Annualized							
Summer	kW	1,562	1,370	-12%	1,971	44%	26%
Winter	kW	1,165	815	-30%	925	14%	-21%
Average Measure Life	yrs	14.2	16.2		15.8		
NEB (Lifetime)	\$	-162,213	-315,701	95%	-192,221	-39%	18%
Cost-Effectiveness							
TRC Benefits	\$	18,479,927			21,806,673		18%
TRC Costs	\$	3,649,686			3,304,485		-9%
Net Benefits	\$	14,830,241			18,502,188		25%
BCR	n/a	5.06			6.60		30%

An explanation of significant variances between planned, preliminary year-end and evaluated values follows:

- Expenses: The Company realized a decrease in overall program expenses and costs per participant due to the installation of a mix measures that provided higher savings per dollar than had been originally been planned. For example, a higher percentage of lower cost lighting measures were installed, while higher cost process measures made up a smaller portion of the portfolio than had been planned.

- Savings and Benefits: The program experienced a slight increase in participation, resulting in modest increases to annual production. However, demand savings experienced a dip owing to the differences between the planned and actual measure mix which was weighted towards measures with lower demand savings. Evaluated demand savings experienced an increase due to new summer demand realization rates from EM&V studies. Efficient lighting results in a negative non-electric benefits (“NEBs”) due to the slight amount of additional gas or oil heating fuel required to offset the heat produced as compared to if less efficient lighting fixtures had been installed. The amount of actual negative NEBs was higher than planned as more new construction lighting was implemented in 2011 than had been assumed in planning
- Cost-Effectiveness: Customer costs were lower than planned due to the nature of the projects that were installed under this program in 2011. The decreased costs and higher energy and demand savings led to the 38 percent increase in the BCR.

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 increase 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 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 6.60.

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 Western Massachusetts Electric Company, D.P.U. 09-118, Exhibit WMECO-1, pages 231-242 (bates numbering 00237-00248). The program was approved by the Department on January 28, 2010 in Western Massachusetts Electric Company, D.P.U. 09-118. Planned values were approved in D.P.U. 10-84.

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
Expenses							
Total Program Costs	\$	5,448,834			3,387,703		-38%
Performance Incentive	\$	450,550			217,110		-52%
Participants	# of projects	185			151		-18%
Program Cost / Participant	\$	29,453			22,435		-24%
Savings & Benefits							
Energy							
Lifetime	MWh	303,860	179,700	-41%	151,689	-16%	-50%
Annualized	MWh	21,896	14,492	-34%	12,150	-16%	-45%
Average Measure Life	yrs	13.9	12.4	-11%	12.5	1%	-10%
Demand							
Lifetime	kW	36,333	19,902	-45%	17,293	-13%	-52%
Annualized							
Summer	kW	2,707	1,610	-41%	1,394	-13%	-49%
Winter	kW	2,154	1,248	-42%	937	-25%	-56%
Average Measure Life	kW	13.4	12.4		12.4		
NEB (Lifetime)	yrs	(2,448,558)	(704,616)	-71%	(228,315)	-68%	-91%
Cost-Effectiveness							
TRC Benefits	\$	35,674,216			19,006,770		-47%
TRC Costs	\$	11,312,588			6,804,683		-40%
Net Benefits	\$	24,361,628			12,202,087		-50%
BCR	n/a	3.15			2.79		-11%

An explanation of significant variances between planned, preliminary year-end and evaluated values follows.

- Expenses:** Overall program costs were significantly lower than planned due to economic uncertainty on the part of many customers who reported overall reluctance to invest in their facilities including energy efficiency projects. This hesitancy led to significantly lower customer participation. In addition, the program cost per participant was lower than planned as customers implemented smaller sized projects than were included in planning assumptions.

Savings and Benefits: Differences between planned and preliminary energy and demand savings decreased significantly due to program participation being much lower than planned. Negative NEBs values decreased for the same reason. Savings and benefits decreased additionally between preliminary and evaluated results due the inclusion of the results of the 2010 Commercial and Industrial Electric Program Free-ridership and Spillover Study (TetraTech, Study 30 submitted with the Company's 2010 Annual Efficiency Report in D.P.U. 11-69) as well as the 2011 custom lighting and 2011 process and compressed air impact evaluations described below.

- Cost-Effectiveness:** As is suggested above, benefits decreased mainly because of significantly lower production for the program with evaluation results pushing net numbers down even further. While decreased participation resulted in lower costs, the repercussions of lower participation affected the benefits more, resulting in a lower BCR.

- Performance Incentives: 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 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 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 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 2.79.

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 Western Massachusetts Electric Company, D.P.U. 09-118, Exhibit WMECO-1, pages 255-259 (bates numbering 00261-00265). The program was approved by the Department on January 28, 2010 in Western Massachusetts Electric Company, D.P.U. 09-118. Planned values were approved in D.P.U. 10-84.

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
Expenses						
Total Program Costs	\$	3,990,312			4,331,720	9%
Performance Incentive	\$	204,502			122,784	-40%
Participants	# of projects	390			457	17%
Program Cost / Participant	\$	10,232			9,479	-7%
Savings & Benefits						
Energy						
Lifetime	MWh	115,072	135,389	18%	87,266	-36%
Annualized	MWh	9,123	10,829	19%	7,020	-35%
Average Measure Life	yrs	12.6	12.5	-1%	12.4	-1%
Demand						
Lifetime	kW	28,004	22,517	-20%	15,445	-31%
Annualized						
Summer	kW	2,213	1,787	-19%	1,229	-31%
Winter	kW	1,318	1,278	-3%	786	-39%
Average Measure Life	yrs	12.7	12.6		12.6	
NEB (Lifetime)	\$	-519,944	-608,818	17%	555,052	-191%
Cost-Effectiveness						
TRC Benefits	\$	15,932,907			12,286,091	-23%
TRC Costs	\$	6,048,880			6,760,007	12%
Net Benefits	\$	9,884,027			5,526,084	-44%
BCR	n/a	2.63			1.82	-31%

An explanation of significant variances between planned, preliminary year-end and evaluated values follows.

- **Savings and Benefits:** The evaluated energy and demand savings reduction from the preliminary results reflect the inclusion of the results from the EM&V studies noted below. A comparison of planned and evaluated realization rates is presented in the following table.

Performance Category	Planned Value	Evaluated Value
Lighting kWh Realization Rate	103%	73%
kW Realization	103%	98%
Summer Coincidence Factor	100%	67%
Winter Coincidence Factor	70.5%	42%

- **Cost-effectiveness:** The reduction in TRC benefits, net benefits, and BCR correlates to the application of the C&I Small Retrofit EM&V study as explained above.

- Performance Incentives: 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 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 savings for this program as shown in the table above. 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 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 Small Retrofit Program is cost-effective with a BCR of 1.82.

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 Western Massachusetts Electric Company, D.P.U. 11-113. 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.

Table III.A: Evaluation Studies in Annual Report			
Studies	Location of Complete Study in Annual Report	Docket & Exhibit Approving Planned Evaluation Studies	Implemented as Approved? (yes/no)
Residential Program Studies			
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	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 Mini Baseline Study of Homes Built at the End of the 2006 IECC Cycle	App. C, Study 3	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	
Home Energy Services Net-to-Gross Evaluation	App. C, Study 4	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 Market Characterization and Potential Study	App. C, Study 5	Study is pending approval of the 2011 MTM, D.P.U. 10-140 through D.P.U. 10-150	
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	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	
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	

Residential Pilot Studies			
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	Study is pending approval of the 2012 MTM, D.P.U. 11-106	
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	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	
Process Evaluation of the Large Commercial and Industrial Energy Efficiency Programs	App. C, Study 22	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	
HVAC Market Characterization and Penetration Analysis	App. C, Study 23	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	
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	Study is pending approval of the 2011 MTM, D.P.U. 10-140 through D.P.U. 10-150	
Additional Non-Energy Impacts for Low Income Programs	App. C, Study 28	Study is pending approval of the 2011 MTM, D.P.U. 10-140 through D.P.U. 10-150	
Community-Based Partnerships 2011 Evaluation Final Report	App. C, Study 30	Study is pending approval of the 2011 MTM, D.P.U. 10-140 through D.P.U. 10-150	

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
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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 ¹
Dwelling CFLs	All (except NSTAR)	98%	99%	51%	49
Other CFLs	NSTAR	89%	100%	27%	6
Common Area Lighting Fixtures	All PAs	100% ²	99%	20%	27
Dwelling Lighting Fixtures	All PAs	99%	100%	16%	31
Total Lighting (except CFLs in units where the occupant pays the electric bill)		96%	100%³	18%	63
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% ⁴	24%	20

Total (All)	97%	100%³	18%	63
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;				
Based on PM Survey Responses				
Based on Tenant/Condo Owner Survey Responses				

Summary of Proposed Savings Approaches

Measure Category	Primary Algorithm	Alternative Approach
Lighting – CFLs	$\Delta_{\text{SHP}} h = \frac{N \times (W_{\text{att}}_{\text{pre}} - W_{\text{att}}_{\text{post}}) \times \text{Hrs}}{1,000}$	$\Delta_{\text{SHP}} h = \frac{N \times (W_{\text{att}}_{\text{pre}}) \times \Delta W_{\text{att}} \times \text{Hrs}}{1,000}$
Lighting – Linear Fluorescents	$\Delta_{\text{SHP}} h = \frac{(\text{EFC}_{\text{pre}} \times W_{\text{att}}_{\text{pre}}) - (\text{EFC}_{\text{post}} \times W_{\text{att}}_{\text{post}}) \times \text{Hrs}}{1,000}$	Same algorithm, but deemed values are provided for baseline wattage and operational hours.
Lighting – LED Exit Signs	$\Delta_{\text{SHP}} h = \frac{N \times (W_{\text{att}}_{\text{pre}} - W_{\text{att}}_{\text{post}}) \times \text{Hrs}}{1,000}$	Same algorithm but, some deemed input values are provided.
Lighting – Metal Halides	$\Delta_{\text{SHP}} h = \frac{(\text{EFC}_{\text{pre}} \times W_{\text{att}}_{\text{pre}}) - (\text{EFC}_{\text{post}} \times W_{\text{att}}_{\text{post}}) \times \text{Hrs}}{1,000}$	Same algorithm, but deemed values are provided for baseline wattage and operational hours.
Lighting – Occupancy Sensors	$\Delta_{\text{SHP}} h = \frac{(W_{\text{att}}_{\text{occupied}}) \times \text{Hrs} \times \text{Op}}{1,000}$	Same algorithm, but some deemed input values are provided.
Refrigerators	<p><i>Refrigerator Recycling</i></p> $\Delta_{\text{SHP}} h = \left[\left((\text{SHP} h_{\text{pre}} - \text{SHP} h_{\text{rec}}) \times \frac{42 - 97}{12} + (\text{SHP} h_{\text{pre}} - \text{SHP} h_{\text{rec}}) \times \frac{8}{12} \right) \times F_{\text{rec}} \right]$ <p><i>No Recycling</i></p> $\Delta_{\text{SHP}} h = (\text{SHP} h_{\text{pre}} - \text{SHP} h_{\text{rec}}) \times F_{\text{rec}}$	Same algorithm, but some deemed input values are provided.
Attic Insulation Basement Insulation Wall Insulation Insulation (gas)	$\text{SHP} h_{\text{annual}} = \frac{\left(\frac{1}{R_{\text{pre}}} - \frac{1}{R_{\text{post}}} \right) \times \text{RDP} \times 24 \times \text{Area}}{100,000 \times \eta_{\text{gas}}}$	Same algorithm, but some deemed input values are provided.
Attic Insulation Basement Insulation Wall Insulation Insulation (electric)	<p><i>Air Conditioning Savings:</i></p> $\text{SHP} h_{\text{annual}} = \frac{\left(\frac{1}{R_{\text{pre}}} - \frac{1}{R_{\text{post}}} \right) \times \text{CDR} \times \text{DCA} \times \text{Area}}{1,000 \frac{\text{BTU}}{\text{KWH}} \times \eta_{\text{cool}}}$ <p><i>Electric Heating Savings:</i></p> $\text{SHP} h_{\text{annual}} = \frac{\left(\frac{1}{R_{\text{pre}}} - \frac{1}{R_{\text{post}}} \right) \times \text{RDP} \times 24 \times \text{Area}}{100,000 \times \eta_{\text{heat}}} \times \text{EHL}$	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)	$\Delta kWh = \frac{Vol \times \Delta RCH \times 0.018 \times HDD \times \frac{24}{7 \times Heating}}{2513}$	Same algorithm producing a deemed savings approach per 1000 ft ² based on zip code and heating type
Air Sealing (gas)	$\Delta MMBtu = \frac{Vol \times \Delta RCH \times 0.018 \times HDD \times \frac{24}{7 \times Heating}}{1000000}$	Same algorithm producing a deemed savings approach per 1000 ft ² 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	$kWh = 12 \frac{kWh}{\text{year}} \times \left(\frac{1}{2000} \times \text{Hours}_{\text{Heating}} + \frac{1}{2000} \times \text{Hours}_{\text{Cooling}} \right) \times \% \text{ savings}$ $MMBtu = kWh \times \left(\frac{1}{3600} \times \text{Hours}_{\text{Heating}} + \frac{1}{3600} \times \text{Hours}_{\text{Cooling}} \right) \times \% \text{ savings}$	$\Delta kWh_{\text{dwelling}} = 180 \text{ kWh}$ $\Delta kWh_{\text{CommonArea}} = 325 \text{ kWh}$
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)	$\Delta kWh = kWh_{\text{tank}} \times \left(\frac{EF_{\text{new}} - EF_{\text{old}}}{EF_{\text{old}}} \right)$	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

Item	Evaluated Savings
Interactive heating penalty (mmbtu)	-0.676 mmBtu
Connected kW	0.182 kW
CF – summer	0.26
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
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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.

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

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

¹ Minimum – Maximum [Mean]

² June-August, Weekdays, 1pm-5pm

³ 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 take back 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 Program 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">a. Clearly articulate the objectives of multiple QA/QC visits to a participant's home.b. Establish the value of agencies conducting 100% post inspections versus redirecting resources to serve more homes.c. Determine where the objectives of the DHCD and CRI inspections align and identify if there are opportunities for collaboration and coordination.d. Assess how changes in federal funding levels are expected to affect DHCD inspections and what affect that has on collaboration or coordination opportunities. <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 both (a) a standardized definition of the waitlist; and (b) standardized methods for tracking and reporting</p>	<p>This recommendation is being considered for adoption at this time. The PAs have not formally</p>

	<p>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>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"> • Clearly articulate the objectives of multiple QA/QC visits to a participant’s home. • Establish the value of agencies conducting 100% post inspections versus redirecting resources to serve more homes. • Determine where the objectives of the DHCD and CRI inspections align and identify if there are opportunities for collaboration and 	<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>coordination.</p> <ul style="list-style-type: none"> Assess how changes in federal funding levels are expected to affect DHCD inspections and what affect that has on collaboration or coordination opportunities. <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, that help to clarify and differentiate the LIMF program eligibility and requirements from other	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

	potential funding sources that may commonly be offered to participants.	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
	Wall Insulation	115	824	11.2
	Basement Ceiling	15	30	2.9

Category	Measure	Natural Gas (Therms/year)	Electric (kWh/year)	Oil (MMBTUs/year)
	Insulation			
	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
	Low-Flow Showerhead	9	188	1.1

Category	Measure	Natural Gas (Therms/year)	Electric (kWh/year)	Oil (MMBTUs/year)
	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.⁵

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.

⁵ 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 ⁱ	96%	72%
HVAC _{ELEC}	HVAC interaction factor, electric heat	106%	102%
<i>Total combined energy realization rate (kWh RR x HVAC_{ELEC})</i>		102%	73% ^{iv}
%kWh On-Peak	Percent energy savings on-peak	69%	70%
kW RR	Connected kW realization rate ⁱ	99%	98%
CF _{SP}	Coincidence factor, summer peak ⁱⁱ	66%	60%
CF _{WP}	Coincidence factor, winter peak ⁱⁱ	44%	43%
HVAC _{SP}	HVAC demand interaction factor, summer on-peak	110%	111%
HVAC _{WP}	HVAC demand interaction factor, winter on-peak	100%	97%
<i>Total combined summer kW realization rate (kW RR x CF_{SP} x HVAC_{SP})</i>		72%	65%
<i>Total combined winter kW realization rate (kW RR x CF_{WP} x HVAC_{WP})</i>		44%	41%
HVAC _{GAS}	HVAC interaction factor, gas heat (MMBtu/kWh) ⁱⁱⁱ	-0.001075	-0.000522
HVAC _{OIL}	HVAC interaction factor, oil heat (MMBtu/kWh) ⁱⁱⁱ	-0.000120	-0.000252

ⁱ Includes lighting impacts only; does not include HVAC interaction impacts.

ⁱⁱ Statewide coincidence factors are for on-peak capacity periods; WMECO coincidence factors are for seasonal peak periods.

ⁱⁱⁱ 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.

^{iv} 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_{ELEC}) to the tracking gross energy savings.

$$\text{Adjusted Gross kWh} = \text{Tracking Gross kWh} * \text{kWh RR} * \text{HVAC}_{ELEC}$$

Similarly, summer and winter peak demand impacts are calculated by applying the connected demand realization rate (kW RR), peak coincidence factor (CF_{SP} for summer,

CF_{WP} for winter) and HVAC demand interaction factor (HVAC_{SP} for summer, HVAC_{WP} for winter) to the tracking connected kW savings.

$$\text{Summer Peak kW} = \text{Tracking Gross kW} * \text{kW RR} * \text{CF}_{SP} * \text{HVAC}_{SP}$$

$$\text{Winter Peak kW} = \text{Tracking Gross kW} * \text{kW RR} * \text{CF}_{WP} * \text{HVAC}_{WP}$$

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

Program Average	<i>0.93 ± .07</i>	<i>1.01 ± .08</i>	<i>0.90</i>
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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 Rate⁶ 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:

⁶ Realization rate determined by this study.

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

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
National Grid							
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
NSTAR							
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
WMECO							
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, Unitil 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):

$$\text{Net Savings} = \text{Gross Savings} \times \text{Gross Realization Rate}^7 \times (1 - \text{Freeridership Rate} + \text{Spillover Rate})$$
 Further information can be found in the Massachusetts Technical Reference Manual for Estimating Savings from Energy Efficiency Measures 2011 Program Year – Report Version.

⁷ Realization rate determined by this study.

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)

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
Cape Light Compact							
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	-	-	-	-	-	-
National Grid							
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
NSTAR							
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
WMECO							
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 Rate⁸ 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”).

Programs to which the Results of the Study Apply:

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

⁸ Realization rate determined by this study.

- 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 ^a	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"> • Waitlisted or delayed treatment participants should be used whenever possible to establish a comparison group. • In the absence of a waitlist or delayed treatment, Variability in Adoption (“VIA”) designs are the most appropriate for quasi-experiments. • 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). • Employ surveys and other qualitative research techniques to assess what customers would have done in the absence of the program.

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

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.

Table III.B: Evaluation Studies in Next Annual Report		
Studies	Docket & Exhibit Approving Planned Evaluation Studies	Expected to be Implemented as Approved? (yes/no)
Residential Studies		
RNC Net Impact Study	Study is planned but not yet submitted for approval	Yes
RNC Incremental Cost Study	Study is planned but not yet submitted for approval	Yes
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	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 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 through D.P.U. 11-116	Yes
Lighting Sensitivity Analysis (EISA Baseline Study) 3YP Version*	Study is pending approval of the 2012 MTM, D.P.U. 11-106 through D.P.U. 11-116	Yes
Consumer Electronics Potential Study	Study is pending approval of the 2012 MTM, D.P.U. 11-106 through D.P.U. 11-116	Yes
Consumer Electronics Saturation Study*	Study is planned but not yet submitted for approval	Yes

Residential Pilot Studies		
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*	Study is pending approval of the 2012 MTM, D.P.U. 11-106 through D.P.U. 11-116	Yes
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	Study is planned but not yet submitted for approval	Yes
Commercial & Industrial Studies		
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)	Study is planned but not yet submitted for approval	Yes
Large C&I - Upstream Lighting Impact & Process Evaluation	Study is planned but not yet submitted for approval	Yes
Large C&I - C&I Customer Profile	Study is planned but not yet submitted for approval	Yes
Large C&I - Existing Building Market Characterization	Study is planned but not yet submitted for approval	Yes
Large C&I - Lighting Controls Study	Study is planned but not yet submitted for approval	Yes
Large C&I - Whole System Approach Assessment	Study is planned but not yet submitted for approval	Yes
Large C&I - New Construction Market Characterization	Study is planned but not yet submitted for approval	Yes
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)*	Study is pending approval of the 2011 MTM, D.P.U. 10-140 through D.P.U. 10-150	Yes
Special & Cross-Cutting Studies		
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	Study is planned but not yet submitted for approval	Yes
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
Residential						
Residential New Construction & Major Renovation	85,730	21%	72,657	20%	-13,073	-1%
Residential Cooling & Heating Equipment	6,595	5%	36,729	11%	30,134	6%
Multi-Family Retrofit	75,285	21%	51,532	22%	-23,753	1%
MassSAVE	103,648	4%	218,971	7%	115,323	4%
Behavior/Feedback Pilot	6,595	8%	50,573	42%	43,978	34%
ENERGY STAR Lighting	98,344	8%	166,598	8%	68,255	0%
ENERGY STAR Appliances	39,568	22%	55,141	12%	15,573	-10%
Residential Education Program	0	0%	0	0%	0	0%
Workforce Development	13,189	38%	0	0%	-13,189	-38%
Heat Loan Program	0	0%	18,689	4%	18,689	4%
R&D and Demonstration	0	0%	0	0%		
Deep Energy Retrofit	8,189	6%	4,072	5%	-4,117	-1%
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%
Community Based Pilot	0	0%	0	0%	0	0%
Statewide Marketing & Education	0	0%	0	0%	0	0%
EEAC Consultants	0	0%	0	0%	0	0%
DOER Assessment	0	0%	49,450	100%	49,450	100%
Sponsorships & Subscriptions	44,477	100%	0	0%	-44,477	-100%
Residential Total	481,619	8%	724,411	10%	242,792	2%
Low-Income						
Low-Income Residential New Construction	10,654	11%	40,905	23%	30,251	12%
Low-Income 1 to 4 Family Retrofit	234,071	9%	328,112	13%	94,041	5%
Low-Income MultiFamily Retrofit	25,793	16%	56,365	20%	30,572	3%
Statewide Marketing & Education	0	0%	0	0%	0	0%
Low-Income Energy Affordability Network Funding	39,698	100%	10,779	100%	-28,919	0%
DOER Assessment	23,949	100%	26,627	100%	2,678	0%
Low-Income Total	334,164	11%	462,787	16%	128,623	4%
Commercial & Industrial						
C&I New Construction and Major Renovation	459,834	12%	317,918	12%	-141,916	0%
C&I Large Retrofit	516,670	9%	448,593	13%	-68,077	4%
C&I Small Retrofit	353,733	9%	333,400	8%	-20,333	-1%
Community Based Pilot	0	0%	0	0%	0	0%
Statewide Marketing & Education	0	0%	0	0%	0	0%
EEAC Consultants	0	0%	0	0%	0	0%
DOER Assessment	102,640	100%	114,115	100%	11,475	0%
Sponsorships & Subscriptions	0	0%	0	0%	0	0%
C&I Total	1,432,877	11%	1,214,026	12%	-218,851	1%
GRAND TOTAL	2,248,660	10%	2,401,224	12%	152,564	2%

The Company did not experience any variances greater than ten percent between planned and actual PP&A spending at the sector level.

C. Competitive Procurement

Table IV.B: Outsourced & Competitively Procured Services									
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 Activities	\$
Residential									
Planned	\$417,359	20%	\$1,633,465	100%	\$0	0%	\$1,633,465	80%	\$2,050,824
Actual	\$724,411	26%	\$2,112,953	100%	\$0	0%	\$2,112,953	74%	\$2,837,364
% Difference from Planned to Actual		5%		0%		0%		-5%	
Low-Income									
Planned	\$276,290	25%	\$163,939	19%	\$678,097	81%	\$842,037	75%	\$1,118,326
Actual	\$462,787	41%	\$653,403	100%	\$0	0%	\$653,403	59%	\$1,116,190
% Difference from Planned to Actual		17%		81%		-81%		-17%	
Commercial & Industrial									
Planned	\$1,437,864	55%	\$1,129,182	96%	\$41,395	4%	\$1,170,577	45%	\$2,608,441
Actual	\$1,214,026	62%	\$754,667	100%	\$0	0%	\$754,667	38%	\$1,968,694
% Difference from Planned to Actual		7%		4%		-4%		-7%	
TOTAL									
Planned	\$2,131,513	37%	\$2,926,586	80%	\$719,492	20%	\$3,646,079	63%	\$5,777,592
Actual	\$2,401,224	41%	\$3,521,024	100%	\$0	0%	\$3,521,024	59%	\$5,922,247
% Difference from Planned to Actual		4%		20%		-20%		-4%	

The Company did not experience any significant variances between planned and reported outsourced activities and competitively procured activities.

D. Low-Income Spending

Table IV.C: Customer Sector Budget Allocation						
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	\$5,842,991	26%	\$7,099,621	35%	\$1,256,631	8%
Low-Income	\$2,927,646	13%	\$2,938,181	14%	\$10,535	1%
Commercial & Industrial	\$13,439,732	61%	\$10,451,770	51%	-\$2,987,962	-10%
TOTAL	\$22,210,369	100%	\$20,489,572	100%	-\$1,720,797	0%

As shown in Table IV.C, the Company met the minimum statutory requirement by spending 14% of energy efficiency funds in the low-income customer sector.

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 VII summarizes the performance incentives earned by the Company by component for its successful delivery of energy efficiency programs in 2011.

Table V: Performance Incentives Summary				
Incentive Components	Threshold	Design	Exemplary	Actual Incentive
Savings Mechanism	532,006	709,341	886,676	681,673
Value Mechanism	399,158	532,210	665,263	518,660
Performance Metrics	210,462	280,616	350,769	184,879
Total Incentive (before-tax)	1,141,625	1,522,167	1,902,708	1,385,212
Total Incentive (after-tax)	693,823	925,097	1,156,371	841,863

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 Western Massachusetts Electric Company, D.P.U. 10-149 (“2011 MOA”). The Company earned \$1,385,212 in actual before-tax incentives, which is 91 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 Western Massachusetts Electric Company, D.P.U. 09-118. 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 Western Massachusetts Electric Company, 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.

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.

RESIDENTIAL METRIC NUMBER AND NAME	ACHIEVEMENT LEVEL	NOTES
1. MassSAVE/Weatherization: Deeper Savings {Electric & Gas} – Statewide	Did not achieve	
2. Community Outreach {Electric & Gas} – Statewide	Exemplary	See supporting documentation
LOW-INCOME METRIC NUMBER AND NAME	ACHIEVEMENT LEVEL	NOTES
1. Hard to Reach Landlords {Electric & Gas} – Statewide	Design	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
COMMERCIAL & INDUSTRIAL METRIC NUMBER AND NAME	ACHIEVEMENT LEVEL	NOTES
C&I #1 Retrofit -- Depth of savings	Did not achieve	
C&I #2 New Construction -- Comprehensiveness and depth of savings	Did not achieve	
C&I #3 Direct Install Electric and Gas Integration	Did not achieve	
C&I #4 Combined Heat & Power	Did not achieve	
ALL SECTOR METRIC NUMBER AND NAME	ACHIEVEMENT LEVEL	NOTES
1. “Other financing capital” metric	Design/Exemplary	Y = \$5,031,084; (123%)
2. Cost Efficiency of Program Expenditures	Design/Exemplary	5.32; (104%)

VI. AUDITS

The following audits (internal and external) that relate to the Company's energy efficiency activities have been conducted during the last five years (2007-2011):

Audit 1: WMECO Energy Efficiency Programs (EEPs) Audit

This was an audit of WMECO's Energy Efficiency Programs conducted by the Northeast Utilities Internal Audit Department in 2009. A full copy of the audit report was provided in the Company's 2010 Annual Report.

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.