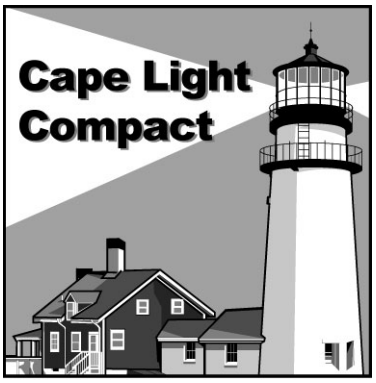

Cape Light Compact

Annual Report on Energy Efficiency Activities in 2012

Submitted to the
Massachusetts Department of Public Utilities
and the Massachusetts Department of Energy Resources
August 1, 2013

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I. INTRODUCTION

Cape Light Compact Overview

The Cape Light Compact ("Compact") is exceptionally pleased with the results of its 2010-2012 Three-Year Energy Efficiency Plan ("2010-2012 Three-Year Plan"), the first of such plans envisioned by the Green Communities Act. The Compact, along with the other Massachusetts Energy Efficiency Program Administrators (the "Program Administrators" or "PAs"),[1] diligently implemented their respective plans over the past three years, successfully achieving significant goals. The Compact doubled its benefits each year and doubled its savings from 2010 to 2012, all while keeping costs consistent with planned levels. The Compact and other Program Administrators also faced a number of challenges throughout the three-year term, including a depressed economy. Despite such challenges, the Cape Light Compact reached its plan goals through attentive program implementation, especially during this third year of the plan.

This Energy Efficiency Annual Report ("Annual Report") provides the results of the final year of the first three-year plan. As such, the Cape Light Compact takes this opportunity to reflect on the three years in total. The table below provides the Cape Light Compact's planned and actual expenditures, benefits, annual MWh savings, lifetime MWh savings, and benefit-cost ratios ("BCRs") at the sector level for the three years in total. As the table shows, the Compact almost met all of its goals at the sector level and in total. Specifically, at the portfolio level, the Compact spent 99 percent of its planned budget and achieved 82 percent of planned benefits, which results in a final BCR of 3.2 as compared to the planned BCR of 3.8. Annual and lifetime energy savings were also close to planned goal, as actual savings were 89 percent and 86 percent of planned goals, respectively.

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[1] The Massachusetts Program Administrators are: Bay State Gas Company d/b/a Columbia Gas of Massachusetts, The Berkshire Gas Company, Blackstone Gas Company, Cape Light Compact, Fitchburg Gas and Electric Light Company d/b/a Unitil, National Grid, New England Gas Company, NSTAR Electric Company, NSTAR Gas Company, and Western Massachusetts Electric Company.

Cape Light Compact 2010-2012 Summary Results					
	PA Costs	**Benefits**	**Annual MWh Savings**	**Lifetime MWh Savings**	**BCR**
Planned					
Residential	$ 29,938,315	$ 158,227,867	41,051	381,843	4.37
Low-Income	$ 7,826,419	$ 23,946,384	4,290	44,332	3.06
C&I	$ 18,980,086	$ 66,507,816	32,835	417,879	3.03
Total	**$ 56,744,820**	**$248,682,067**	**78,177**	**844,053**	**3.77**
Actual					
Residential	$ 31,850,580	$ 120,682,866	37,870	323,842	3.32
Low-Income	$ 7,395,926	$ 21,005,360	4,042	43,589	2.84
C&I	$ 17,050,091	$ 61,600,520	27,883	358,026	3.05
Total	**$ 56,296,597**	**$203,288,745**	**69,794**	**725,457**	**3.18**
Percent of Goal					
Residential	106%	76%	92%	85%	76%
Low-Income	94%	88%	94%	98%	93%
C&I	90%	93%	85%	86%	101%
Total	**99%**	**82%**	**89%**	**86%**	**84%**

Additionally, as noted in the Cape Light Compact's 2012 Mid-Term Modification ("MTM"), its 2012 MTM budget was determined using preliminary 2011 projected carryover (D.P.U. 11-116, Exh. B, at 1). This is because the Cape Light Compact developed the 2012 MTM with the intention of maintaining its three-year plan goals. Therefore, it is important to view this 2012 Annual Report within the context of the three-year plan, consistent with how the Cape Light Compact developed and implemented programs in 2012.

Statewide Overview

During program year 2012, the Program Administrators continued to build on the nationally acclaimed successes of program years 2010 and 2011. Among the many awards and accomplishments achieved during program year 2012, the American Council for an Energy-Efficient Economy ("ACEEE") ranked Massachusetts number one in the nation for its energy efficiency efforts for the second year in a row.

Most notably in 2012, the PAs successfully delivered on their very ambitious goals for the program year, as reviewed and approved by the Massachusetts Department of Public Utilities (the "Department") in D.P.U. 09-116 through 09-127 and as submitted in each PA's 2012 MTM dated October 28, 2011. The PAs were able to attain historic levels of energy savings while maintaining budgetary control and complying with the directive of the Green Communities Act to seek all cost-effective energy efficiency opportunities. The 2012 goals were intentionally designed to be very challenging stretch goals, and achievements in savings and benefits reached unprecedented levels in Massachusetts for residential, low-income, and commercial and industrial ("C&I") programs. The PAs successfully implemented their programs in the field while also continuing this unprecedented ramp-up of spending and savings levels for energy efficiency programs to meet goals not just for program year 2012, but for the full life of the three-year plans, and to sow the seeds for additional savings going forward.

The accomplishments of 2012 were achieved despite a slower-than-expected recovery in the economy, low natural gas prices, and a significant increase in savings goals. In the wake of these challenges, the PAs continued to proactively work toward developing new delivery methods to reach more customers and to encourage customers to move forward with greater commitments and investments in energy efficiency. For example, during 2012, the PAs focused on refining their marketing approach to achieve deeper savings from participating customers, and worked diligently to reach a broader range of customers to implement all cost-effective program offerings. The PAs also continued to develop new technologies and new initiatives in 2012 in order to expand programming efforts and achieve their goals.

The Program Administrators continued to engage in very high levels of integration, coordination, and cooperation – all of which are hallmarks of the 2010-2012 Three-Year Plans. Examples of this statewide coordination in 2012 include the establishment of consistent guidelines and protocols for delivery of the Voluntary Accelerated Rebate Pilot, which will be implemented in 2013, and continued expansion of upstream product offerings.

In 2012, the Program Administrators created the Evaluation Management Committee ("EMC"), similar to the successful C&I and Residential Management Committees. The EMC, comprised of PA representatives and the Massachusetts Energy Efficiency Advisory Council ("EEAC" or "Council") consultants, serves as a steering committee for statewide evaluation issues. The EMC plans, prioritizes, and delineates the research studies to be undertaken. The PAs worked together to engage in 25 studies across a wide span of program sectors in 2012, underscoring the fact that the evaluation, measurement, and verification ("EM&V") of these program offerings remains a critical and vital tool for both PAs and interested stakeholders in an ever-changing marketplace.

The Program Administrators continued to be actively engaged with the EEAC and worked collaboratively with the EEAC's consultants to meet detailed reporting and data collection deadlines in 2012. The PAs reviewed and expanded upon many areas of policy and reporting, including continuing accurate data development, evaluation and measurement of successes and areas in need of modification, transparent codes and standards, and building the framework necessary to ensure the ability to continue to offer successful and sustainable energy efficiency programs in the Commonwealth.

In addition, the PAs were at the forefront of creating a culture of sustainability through public education. In May 2012, the PAs hosted an Appreciative Inquiry Summit, the first of its kind for energy efficiency in Massachusetts, which provided a venue for a diverse array of nearly 300 key stakeholders, including customers, civic leaders, contractors, key trade allies, energy efficiency experts, and others, to provide the PAs with insights to guide efforts designed to continue to create a culture of sustainability in the Commonwealth. Additionally, some PAs hosted an Energy Efficiency Conference and Expo in 2012, which featured a full day of programming focused primarily on business and municipal customers.

Throughout 2012, the PAs continued their efforts to integrate gas and electric energy efficiency services and expand statewide marketing efforts, which, through the use of the Mass Save brand,

continued to be an integral part of promoting energy efficiency programs in Massachusetts. The 2012 marketing campaign introduced a renewed, simplified Mass Save message.

Simultaneously with the activities and achievements noted above, the Program Administrators devoted considerable time and effort in 2012 to developing their 2013-2015 Three-Year Energy Efficiency Plans ("2013-2015 Three-Year Plans"). During the 2013-2015 Three-Year Plan development process, each PA focused on increasing savings goals and reducing costs, streamlining the participation process in all sectors, and realigning outreach and delivery efforts to be more customer-focused, all of which built on the achievements and lessons learned from 2010 through 2012.

Given the unprecedented nature of these efforts, and the ambitious goals established in the 2010-2012 Three-Year Plans, program year 2012 performance has been an outright success for energy efficiency in Massachusetts. Over the term of the 2010-2012 Three-Year Plans, the Program Administrators have achieved unprecedented levels of savings and benefits within budget, and look forward to continuing these efforts and achieving additional successes going forward.

A. Purpose of Annual Report

The Cape Light Compact is pleased to provide its Annual Report for 2012. The purpose of the Annual Report is to:

- Provide a comparison of the Compact'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[2] variances between the Compact'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 Compact's proposed modifications to program implementation, if any, during upcoming years.
- Describe the EM&V activities undertaken by the Compact that have not been included in previous Annual Reports, and explain how the results of the EM&V studies impact program cost-effectiveness.
- If the Compact received performance incentives, they would be described in this Annual Report.[3]

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[2] Unless otherwise noted, "significant" variances are defined throughout this Annual Report as variances of +/-20 percent or more between the stated values.

[3] As a public entity and municipal aggregator, the Cape Light Compact does not collect any performance incentives. As such, this section of the Annual Report is not applicable to the Cape Light Compact.

B. Organization of Annual Report

The Compact's 2012 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 would address the Program Administrator's performance incentives if it applied to the Compact.
- Section VI addresses energy efficiency audits conducted during the past five years, where applicable.
- 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.

To better reflect a full year of planned program activity and a focus on three-year plan goals, the 2012 planned values in this report were derived by taking the difference between the Cape Light Compact's 2011 MTM (D.P.U. 10-147) and the Cape Light Compact's 2011 Annual Report (D.P.U. 12-54) and adding it as carryover to the Cape Light Compact's 2012 MTM (D.P.U. 11-116).

In 2012, the Cape Light Compact invested 53 percent more funds toward energy efficiency programs and services in our communities than in the 2011 program year. Since the passage of the Green Communities Act and implementation of all available cost-effective efficiency opportunities, the Compact expenditures have increased from approximately $5 million annually to over $25 million. This more than quintupling of investments in energy efficiency represents the Towns' and Counties' continued commitment to serving our customers.

The Cape Light Compact highlights just a few of the many accomplishments in this third year of its 2010-2012 Three-Year Plan:

- We celebrated the 2012 Northeast Energy Efficiency Partnerships ("NEEP") Business Leaders Award for Energy Efficiency for our customer, the Sea Crest Beach Hotel,[4] a premier lodging and conference destination in Falmouth, Massachusetts that made maximizing energy efficiency a top priority when undertaking a $15 million overhaul of the resort, with everything from new insulation and windows, high efficiency Heating, Ventilation and Air Conditioning ("HVAC") and lighting fixtures, to room occupancy sensors and water saving measures throughout the hotel.

- We received, along with other regional PAs, the 2012 ENERGY STAR® Award for Sustained Excellence for the Residential Products Initiative, and 2012 ENERGY STAR® for Homes Leadership in Housing Award.

- We completed a significant number of high-profile, large customer projects and commitments that more than doubled our large C&I program investments in 2012 over the prior year, including:

    - A new construction project that doubled the size of a major regional ice arena, without increasing energy costs – an estimated annual energy savings of more than 500,000 kWh through measures such as a new Green Machine refrigeration system that reduces the energy needed to freeze and condition the ice, building envelope improvements such as a low-emissivity (low-e) ceiling and 3.5-inch thick foam insulation in rink walls, and using rejected waste heat from the rink refrigeration system to help meet water heating load;

    - A state-of-the-art "tunnel" batch washer system installed at Cape Cod Commercial Linen Services – the largest on-Cape provider of commercial laundering services for the Cape and South Shore's large hospitality industry. The multi-chambered washer is almost 40 feet long and is estimated to save annually more than 100,000 kWh of electricity, 80,000 therms of natural gas, and over 20 million gallons of water;

    - Installation of two new 250-ton air-cooled optimized-IPLV screw chillers at one of Cape Cod's only two regional hospitals, with expected annual energy savings of more than 430,000 kWh; and

    - An Advanced Buildings project at Massachusetts Maritime Academy's new library building, the American Bureau of Shipping Information Commons, which houses the Academy's archives and museum, library, and 360-degree ship's bridge simulator, and includes geothermal heating and cooling and a day-lighting design with louvers on exterior windows.

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[4] For more information, see http://www.neep.org/neep-supporters/business-leadership/case-studies/sea-crest-beach-hotel.

- We signed a multi-year energy efficiency memorandum of understanding with one of the world's largest private, non-profit ocean research institutions.

Tables[5] I.A and I.B provide summary information on program performance at the portfolio and customer sector levels, respectively.

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	$	$ 26,305,442			$ 25,857,219		-2%
Performance Incentive	$	$ -			$ -		
Savings and Benefits							
Energy							
Lifetime	MWh	415,755	316,795	-24%	297,160	-6%	-29%
Annualized	MWh	37,601	31,061	-17%	29,219	-6%	-22%
Demand							
Lifetime	kW	142,011	63,459	-55%	55,202	-13%	-61%
Annualized							
Summer	kW	10,424	5,507	-47%	4,681	-15%	-55%
Winter	kW	7,536	6,119	-19%	6,540	7%	-13%
Non-Electric Benefits (Lifetime)	$	$ 73,611,079	$ 47,880,735	-35%	$ 53,481,943	12%	-27%
Cost-Effectiveness							
TRC Benefits	$	$ 141,263,773			$ 95,870,451		-32%
TRC Costs	$	$ 31,660,379			$ 29,661,637		-6%
Net Benefits	$	$ 109,603,394			$ 66,208,815		-40%
BCR		4.5			3.2		-28%

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

- All metrics between planned and preliminary values, except annualized energy and winter demand savings; and

- Most metrics between planned and evaluated values, with the exception of total program costs, winter demand savings, and Total Resource Cost ("TRC") costs.

With regard to the variances between planned and evaluated results, the Compact's 2012 planned values were developed as part of the Compact's 2012 MTM submitted in October of 2011, therefore the plan values do not reflect the results of evaluations contained in the Compact's 2011 Annual Report filed in August of 2012. The Compact's 2012 preliminary results update the planned values based on actual production, but do not reflect the results of evaluations. The

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5 The Cape Light Compact is also providing the Department of Public Utilities 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.

variances between preliminary and evaluated results are therefore attributable to evaluations contained in both the Compact's 2011 and 2012 Annual Reports.

Each sector contributed to these variances as follows:

- Residential (for lifetime energy, lifetime demand, summer demand, lifetime non-electric benefits ("NEB"), TRC benefits, net benefits, and BCR): Please reference section II.A.1 for a more detailed discussion of the cause of the variances for this sector.

- Low-Income (for lifetime demand, winter demand, lifetime NEB, TRC benefits, and net benefits): Please reference section II.B.1 for a more detailed discussion of the cause of the variances for this sector.

- C&I (total program costs, lifetime energy, annual energy, lifetime demand, summer demand, winter demand, and lifetime NEB): Please reference section II.C.1 for a more detailed discussion of the cause of the variances for this sector.

Table I.B

Customer Sector Summary				
Sector	Units	Planned Value	Evaluated Results	
			Value	% Change from Planned
Residential				
TRC Benefits	$	$ 95,793,864	$ 58,248,863	-39%
TRC Costs	$	$ 17,827,773	$ 17,998,699	1%
Net Benefits	$	$ 77,966,092	$ 40,250,164	-48%
BCR		5.4	3.2	-40%
Low-Income				
TRC Benefits	$	$ 13,114,967	$ 10,173,942	-22%
TRC Costs	$	$ 3,510,157	$ 3,079,664	-12%
Net Benefits	$	$ 9,604,810	$ 7,094,278	-26%
BCR		3.7	3.3	-12%
Commercial & Industrial				
TRC Benefits	$	$ 32,354,942	$ 27,447,646	-15%
TRC Costs	$	$ 10,322,449	$ 8,583,274	-17%
Net Benefits	$	$ 22,032,493	$ 18,864,372	-14%
BCR		3.1	3.2	2%
Total				
TRC Benefits	$	$ 141,263,773	$ 95,870,451	-32%
TRC Costs	$	$ 31,660,379	$ 29,661,637	-6%
Net Benefits	$	$ 109,603,394	$ 66,208,815	-40%
BCR		4.5	3.2	-28%

As shown in Table 1.B above, significant variances exist at the sector level between planned and evaluated values for residential TRC benefits, net benefits, and BCR; and low-income TRC benefits and net benefits. There are no significant variances at the C&I sector level.

- Within the residential sector, the Residential New Construction & Major Renovation, Residential Cooling & Heating Equipment, Residential Multi-Family Retrofit, Residential Mass Save, Residential ENERGY STAR® Lighting, and Residential ENERGY STAR® Appliances programs are contributing to the variance between planned and evaluated values. Please reference 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, the Low-Income Residential New Construction and Low-Income Retrofit programs are contributing to the variance between planned and evaluated values. Please reference section II.B.2 for a more detailed discussion of the cause of the variances by program within this sector.

- Within the C&I sector, the C&I New Construction and Major Renovation, C&I Large Retrofit, and C&I Small Retrofit programs are contributing to the variance between planned and evaluated values. Please reference section II.C.2 for a more detailed discussion of the cause of the variances by program within this sector.

II. PROGRAM PERFORMANCE

The purpose of this section is to provide detailed information on program performance at the sector and program levels for the residential, low-income, and C&I sectors.

A. Residential Sector Programs

1. Summary

During 2012, the Compact implemented the following residential programs and residential pilots:

Residential Programs

- Residential New Construction & Major Renovation
- Residential Cooling & Heating Equipment
- Residential Multi-Family Retrofit
- Residential Mass Save
- Residential ENERGY STAR® Lighting
- Residential ENERGY STAR® Appliances

Residential Pilots

- Residential Deep Energy Retrofit Pilot
- Residential New Construction – Major Renovation Statewide Pilot
- Residential New Construction – Multi-Family (4-8 story) Statewide Pilot
- Residential New Construction – Lighting Design Statewide Pilot
- Heat Pump Water Heater Pilot (Non-Statewide)
- Power Monitor Pilot (Cape Light Compact-Specific)

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.

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	$	$ 13,551,206			$ 15,463,471		14%
Performance Incentive	$	$ -			$ -		
Savings and Benefits							
Energy							
Lifetime	MWh	189,938	148,148	-22%	131,938	-11%	-31%
Annualized	MWh	18,937	17,196	-9%	15,756	-8%	-17%
Demand							
Lifetime	kW	73,380	19,970	-73%	13,319	-33%	-82%
Annualized							
Summer	kW	4,943	2,226	-55%	1,584	-29%	-68%
Winter	kW	3,748	3,849	3%	3,995	4%	7%
Non-Electric Benefits (Lifetime)	$	$ 64,313,812	$ 39,706,366	-38%	$ 42,323,495	7%	-34%
Cost-Effectiveness							
TRC Benefits	$	$ 95,793,864			$ 58,248,863		-39%
TRC Costs	$	$ 17,827,773			$ 17,998,699		1%
Net Benefits	$	$ 77,966,092			$ 40,250,164		-48%
BCR		5.4			3.2		-40%

Within the residential sector, the following programs are contributing to the variance between planned and evaluated values:

- Residential New Construction & Major Renovation (for all metrics except total program costs and TRC benefits): Please reference section II.A.3.a for a more detailed discussion of the cause of the variances for this program.

- Residential Cooling & Heating Equipment (for total program costs, lifetime demand, summer demand, winter demand, TRC costs, net benefits, and BCR): Please reference section II.A.3.b for a more detailed discussion of the cause of the variances for this program.

- Residential Multi-Family Retrofit (for lifetime energy, lifetime demand, summer demand, winter demand, lifetime NEB, TRC benefits, net benefits, and BCR): Please reference section II.A.3.c for a more detailed discussion of the cause of the variances for this program.

- Residential Mass Save (for lifetime energy, annual energy, lifetime demand, summer demand, winter demand, lifetime NEB, TRC benefits, net benefits, and BCR): Please reference section II.A.3.d for a more detailed discussion of the cause of the variances for this program.

- Residential ENERGY STAR® Lighting (for TRC costs and BCR): Please reference section II.A.3.e for a more detailed discussion of the cause of the variances for this program.

- Residential ENERGY STAR® Appliances (for total program costs, winter demand, lifetime NEB, TRC costs, net benefits, and BCR): Please reference section II.A.3.f for a more detailed discussion of the cause of the variances for 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
Lighting				
Energy	MWh	101,301	96,157	-5%
Demand	kW	10,927	8,883	-19%
Non-Electric Benefits (Lifetime)	$	$ 899,220	$ 867,730	-4%
HVAC				
Energy	MWh	16,909	14,233	-16%
Demand	kW	7,058	3,058	-57%
Non-Electric Benefits (Lifetime)	$	$ 3,136,346	$ 2,180,736	-30%
Motors & Drives				
Energy	MWh	1,880	1,777	-5%
Demand	kW	19	17	-12%
Non-Electric Benefits (Lifetime)	$	$ 1,956,071	$ 1,864,040	-5%
Refrigeration				
Energy	MWh	5,494	5,357	-2%
Demand	kW	662	671	1%
Non-Electric Benefits (Lifetime)	$	$ 62,681	$ 62,681	0%
Hot Water				
Energy	MWh	758	629	-17%
Demand	kW	22	16	-26%
Non-Electric Benefits (Lifetime)	$	$ 620,026	$ 510,769	-18%
Process				
Energy	MWh	3,642	3,642	0%
Demand	kW	382	573	50%
Non-Electric Benefits (Lifetime)	$	$ -	$ -	
Envelope				
Energy	MWh	17,901	9,881	-45%
Demand	kW	840	40	-95%
Non-Electric Benefits (Lifetime)	$	$ 33,032,023	$ 36,837,539	12%
Solar Hot Water				
Energy	MWh	263	263	0%
Demand	kW	60	60	0%
Non-Electric Benefits (Lifetime)	$	$ -	$ -	
Total				
Energy	MWh	148,148	131,938	-11%
Demand	kW	19,970	13,319	-33%
Non-Electric Benefits (Lifetime)	$	$ 39,706,366	$ 42,323,495	7%

Table II.A.3

Residential Program Summary				
Sector	Units	Planned Value	Evaluated Results	
			Value	% Change from Planned
Residential New Construction & Major Renovation				
TRC Benefits	$	$ 1,714,218	$ 2,035,784	19%
TRC Costs	$	$ 607,223	$ 313,685	-48%
Net Benefits	$	$ 1,106,996	$ 1,722,099	56%
BCR		2.8	6.5	130%
Residential Cooling & Heating Equipment				
TRC Benefits	$	$ 4,052,409	$ 3,389,839	-16%
TRC Costs	$	$ 1,043,958	$ 1,402,196	34%
Net Benefits	$	$ 3,008,451	$ 1,987,643	-34%
BCR		3.9	2.4	-38%
Residential Multi-Family Retrofit				
TRC Benefits	$	$ 2,023,476	$ 991,345	-51%
TRC Costs	$	$ 332,317	$ 294,409	-11%
Net Benefits	$	$ 1,691,158	$ 696,936	-59%
BCR		6.1	3.37	-45%
Residential Mass Save				
TRC Benefits	$	$ 77,606,063	$ 41,207,647	-47%
TRC Costs	$	$ 12,323,368	$ 12,790,951	4%
Net Benefits	$	$ 65,282,695	$ 28,416,696	-56%
BCR		6.3	3.2	-49%
Residential ENERGY STAR® Lighting				
TRC Benefits	$	$ 9,286,866	$ 9,497,716	2%
TRC Costs	$	$ 2,431,220	$ 1,782,287	-27%
Net Benefits	$	$ 6,855,645	$ 7,715,430	13%
BCR		3.8	5.3	40%
Residential ENERGY STAR® Appliances				
TRC Benefits	$	$ 1,110,834	$ 1,126,531	1%
TRC Costs	$	$ 342,803	$ 550,589	61%
Net Benefits	$	$ 768,031	$ 575,942	-25%
BCR		3.2	2.0	-37%

Table II.A.3

Residential Program Summary (continued)				
Sector	Units	Planned Value	Evaluated Results	
			Value	% Change from Planned
Residential Deep Energy Retofit Pilot				
TRC Benefits	$	n/a	n/a	
TRC Costs	$	$ 31,352	$ 11,747	-63%
Net Benefits	$	n/a	-n/a	
BCR		n/a	n/a	
Residential New Construction - Major Renovation Statewide Pilot				
TRC Benefits	$	n/a	n/a	
TRC Costs	$	$ 261,561	$ 88,883	-66%
Net Benefits	$	n/a	-n/a	
BCR		n/a	n/a	
Residential New Construction - MultiFamily (4-8 story) Statewide Pilot				
TRC Benefits	$	n/a	n/a	
TRC Costs	$	$ -	$ -	
Net Benefits	$	n/a	n/a	
BCR		n/a	n/a	
Residential New Construction - Lighting Design Statewide Pilot				
TRC Benefits	$	n/a	n/a	
TRC Costs	$	$ 16,660	$ -	-100%
Net Benefits	$	n/a	n/a	
BCR		n/a	n/a	
Heat Pump Water Heater Pilot (Non-Statewide)				
TRC Benefits	$	n/a	n/a	
TRC Costs	$	$ 213	$ -	-100%
Net Benefits	$	n/a	n/a	
BCR		n/a	n/a	
Power Monitor Pilot (Cape Light Compact-Specific)				
TRC Benefits	$	n/a	n/a	
TRC Costs	$	$ (569)	$ 41,288	7352%
Net Benefits	$	n/a	-n/a	
BCR		n/a	n/a	

Table II.A.3

Residential Program Summary (continued)				
Sector	Units	Planned Value	Evaluated Results	
			Value	% Change from Planned
Hard-To-Measure Initiatives				
TRC Costs	$	$ 437,667	$ 722,663	65%
Total				
TRC Benefits	$	$ 95,793,864	$ 58,248,863	-39%
TRC Costs	$	$ 17,827,773	$ 17,998,699	1%
Net Benefits	$	$ 77,966,092	$ 40,250,164	-48%
BCR		5.4	3.2	-40%

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

2. Residential Sector Performance Highlights

During 2012, the Program Administrators built upon existing residential programs and significantly expanded initiatives to increase participation in all residential programs. Selected highlights are presented below.

- Residential New Construction & Major Renovation[6] – In 2012, with 121 communities adopting the Stretch Energy Code, this program faced a market in which energy codes continued to change. Single family development picked up from previous years, but opportunities to capture future energy savings became increasingly difficult due to evolving code requirements. To address these barriers, the Program Administrators offered technical assistance as well as incentives to exceed the baseline. The PAs also increased market penetration while providing energy savings for residents. During 2012, the Program Administrators provided multiple trainings and participated in several recruitment events targeted at builders and trade allies new to performance-based construction. The PAs continued to participate in three pilots (Residential New Construction – Major Renovation Statewide Pilot; Residential New Construction – Multi-Family (4-8 story) Statewide Pilot; and Residential New Construction – Lighting Design Statewide Pilot) multi-family new construction, major renovations, and lighting design) to aid in identifying the next generation of energy savings opportunities. It is expected that builders will continue to look to the Program Administrators to provide training, technical assistance, and incentives to meet the new energy code. Atthe end of 2012, over 40 Home Energy Rating System ("HERS") companies participated in the program. Finally, the Program Administrators in western Massachusetts continued to participate in

[6] Prior to 2012, the program was called Massachusetts New Construction with ENERGY STAR®.

the *Western Massachusetts Storm Recovery Program*. The storm recovery program contacted all of the communities affected by the 2011 tornado and distributed thousands of flyers to builders, building code offices, homeowners, tornado relief centers, town meetings/events, and churches.

- Residential Cooling & Heating Equipment – In 2012, the Program Administrators exceeded their annual statewide goals for cooling equipment, duct sealing, and the early replacement of old, inefficient equipment in the Residential Cooling & Heating Equipment program, also known as the "COOL Smart" program. PAs held quality installation training sessions, including trainings on system design, duct diagnostics, brushless fan motors, and ENERGY STAR® HVAC quality installation. A customer incentive for specified eligible energy-efficient heat pump water heaters ("HPWH") installed to replace an existing electric water heater, or for new construction, was introduced in 2012. Over 2,100 HPWHs were installed in 2012 statewide, with retail stores stocking and heavily promoting this energy-saving measure. In October, the Program Administrators held their annual COOL Talk meeting. This event is a forum for the PAs to share the program offerings, as well as a chance for contractors to articulate their own experiences with the program. The PAs also continued to offer technical support to contractors engaged in quality efforts, and continued to participate in joint electric and gas integration at events such as the Plumbing Heating Cooling Contractors Annual Trade Show and the annual GasNetworks® fall conference.

- Residential Multi-Family Retrofit – At the conclusion of 2012, most PAs were close to or had already exceeded program goals. Energy-efficient lighting, instant savings measures, and weatherization continued to be in high demand. The multi-family working group, consisting of representatives from both residential and C&I, coordinated between the two sectors to deliver comprehensive, whole-facility energy efficiency services.

  The Multi-Family Market Integrator continued to be an invaluable resource to the multi-family program in 2012, as illustrated by a year-over-year increase of 25 percent in incoming calls for multi-family services. This trend of successfully enrolling facilities can be credited to capitalizing on previously established relationships with facility owners/property managers, as well as the increased effort to create brand recognition through statewide marketing efforts.

- Residential Mass Save – Program year 2012 was the first full year of the market model. Two groups of Residential Mass Save participating contractors, Home Performance Contractors ("HPCs") and Independent Installation Contractors ("IICs"), with over 90 contractor companies statewide, provided services in addition to those offered by the lead vendor.

  The Contractors Best Practices Working Group continued to highlight the PAs' commitment to ongoing communication with participating contractors in the program. The group served as a forum to provide an open line of communication between HPCs, IICs, lead vendors, and PAs to discuss any matters related to the program with an independent third-party facilitator.

In 2012, the HEAT Loan program continued to offer loans ($500 to $25,000), and the offerings were expanded to include central air conditioning and residential electric customers in individually metered condominium units. The PAs saw an increase in both the average loan amount and the number of customers financing multiple measures. In addition, the PAs implemented various initiatives throughout the year, including pre-weatherization and early boiler replacement incentives, sales and technical trainings, and marketing bonuses.

- Residential ENERGY STAR® Lighting – In 2012, the Residential ENERGY STAR® Lighting program produced strong results, with all the PAs meeting or exceeding savings goals. The ENERGY STAR® qualification of new LED products sparked new manufacturer interest in the Program Administrators' residential programs. Manufacturing partners were eager to create and enhance LED Negotiated Cooperative Promotions with new and existing retail partners. As a result of increased LED product availability, the Massachusetts Program Administrators were able to surpass their statewide LED bulb goal by 362 percent and their LED fixture goal by 98 percent.

- Residential ENERGY STAR® Appliances – The Residential ENERGY STAR® Appliances program results varied by Program Administrator and measure. ENERGY STAR® qualified refrigerators and freezers, as well as the second refrigerator and freezer recycling program, were once again strong performers for this program. Pool pumps, computers, and ENERGY STAR® televisions also performed well. Other measures, such as advanced power strips, LCD monitors, and room air cleaners, lagged behind expectations. The PAs introduced a short-term mark down of ENERGY STAR® room air conditioners with an Energy Efficiency Rating of 10.8 or higher through independent retailers.

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

3. Residential Programs

a. Residential New Construction & Major Renovation

Purpose/Goal: The purpose of the Residential New Construction & 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, 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 newly constructed dwelling unit.

Beginning in 2013, the Program Administrators will use consistent participant definitions, as set

forth in Appendix M to the 2013-2015 Three-Year Plan in D.P.U. 12-100 through 12-111.

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 ("QA/QC") 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 Cape Light Compact's 2012 plan was approved as part of its 2010-2012 Three-Year Plan (D.P.U. 09-119, January 28, 2010). Subsequently, the Cape Light Compact has filed updates to its three-year plan adjusting certain of its programs and pilots. These updates are referred to as the 2010 Mid-Year Revisions (D.P.U. 10-106, January 10, 2011), 2011 Mid-Term Modifications (D.P.U. 10-147, pending), and 2012 Mid-Term Modifications (D.P.U. 11-116, pending).

Table II.A.4 provides information on the performance of Residential New Construction & 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	$	$ 327,223			$ 313,685		-4%
Performance Incentive	$	$ -			$ -		
Participants	accts	43			198		360%
Program Cost / Participant	$	$ 7,610			$ 1,584		-79%
Savings and Benefits							
Energy							
Lifetime	MWh	6,207	5,409	-13%	4,897	-9%	-21%
Annualized	MWh	664	420	-37%	353	-16%	-47%
Average Measure Life	Yrs	9	13	38%	14	8%	49%
Demand							
Lifetime	kW	996	1,133	14%	1,345	19%	35%
Annualized							
Summer	kW	84	66	-21%	69	5%	-18%
Winter	kW	165	70	-57%	66	-7%	-60%
Average Measure Life	Yrs	12	17	45%	19	13%	64%
Non-Electric Benefits (Lifetime)	$	$ 864,073	$ 1,265,265	46%	$ 1,258,900	-1%	46%
Cost-Effectiveness							
TRC Benefits	$	$ 1,714,218			$ 2,035,784		19%
TRC Costs	$	$ 607,223			$ 313,685		-48%
Net Benefits	$	$ 1,106,996			$ 1,722,099		56%
BCR		2.8			6.5		130%

This program had 198 participants in 2012, which is more than double the amount of program participants in either 2010 or 2011. This increase in participants can be attributed to increased program recognition, as well as the recruitment of several large projects. Despite the general trend toward smaller single-family projects within the Compact's territory, there were a record number of large multi-family new construction projects. The number of participants per project was higher than expected, enabling the Cape Light Compact to keep costs low while reaching the increased volume of customers. The increase in participation and the size of the projects completed resulted in a decrease in program costs per participant.

Due to the nature of multi-family units, which generally install hard-wired fixtures, the number of compact fluorescents lamps ("CFLs") was less than expected. Thus, lifetime energy savings were in line with expectations, while annualized energy savings were lower than expected, which caused the average energy measure life to increase. Annualized summer and winter demand savings decreased, while lifetime demand savings increased slightly, which caused the average demand measure life to increase.

The decrease in annualized energy savings, annualized summer demand savings, and annualized winter demand savings can all be attributed to the decrease in anticipated lighting measures. While heating, cooling, and hot water measures tend to have higher savings per unit than lighting measures, the program initially planned to have a higher percentage of program savings provided by screw-in lighting measures. The increase in savings associated with the increase in heating,

cooling, and hot water measures installations was not significant enough to offset the decrease in savings associated with fewer lighting measure installations as compared to plan.

The lifetime NEBs increased due to the increase in heating measures installed. Heating measures provide substantive other resource and participant benefits.

As stated previously, the Compact's 2012 budget is a combination of carryover from 2011 and anticipated 2012 expenditures needed beyond the 2011 carryover. The actual TRC costs in 2011 were lower than originally projected in the 2011 MTM process. In 2012, the TRC costs continued to be lower than projected to achieve the savings.

Because the TRC benefits associated with the program increased while the TRC costs decreased, the net benefits and BCR were greater than planned, and the program was cost-effective.

The EM&V studies included in the 2012 Annual Report that apply to this program are as follows:

- *MA RNC Program Incremental Cost Report:* This report provides estimates of the incremental costs per square foot involved in building high efficiency homes that meet the criteria of the Residential New Construction & Major Renovation program. Incremental costs (costs above those of typical homes built outside the program) are estimated for single family, low-rise multi-family buildings of three or fewer stories, and mid- to high-rise multi-family buildings of four stories or more for each incentive option offered by the program. The study had no impact on savings. The study is discussed in more detail in Section III, Study 1.

The Compact regularly reviews best available information to adjust strategies in order to achieve energy efficiency goals. With respect to the 2012 program performance information, the Compact incorporated the best available information into its 2013-2015 Three-Year Plan. With respect to the results of EM&V studies that were completed for the 2012 Annual Report, the Compact will review those results and make any necessary adjustments to ensure it remains on track to achieve its goals for 2013 through 2015. The Compact will continue to monitor program performance to determine if any evaluation is significant enough to trigger a modification under the new MTM guidelines established in D.P.U. 11-120-A, Phase II (January 31, 2013).

b. Residential Cooling & Heating Equipment

Purpose/Goal: The purpose of the Residential Cooling & Heating Equipment program, also known as the 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® furnaces equipped with an electronically commuted motor.

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.

Beginning in 2013, the Program Administrators will use consistent participant definitions, as set forth in Appendix M to the 2013-2015 Three-Year Plan in D.P.U. 12-100 through 12-111.

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 Request for Proposal ("RFP"). Whenever possible, there was coordination with the related gas Program Administrator's initiatives. To this end, the COOL Smart and GasNetworks' High Efficiency Heating and Hot Water (also known as "HEHE") 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 & Major Renovation and Residential Mass Save/Home Energy Services ("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 trainings 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 assist customers with filling out their rebate forms, to 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 Cape Light Compact's 2012 plan was approved as part of its 2010-2012 Three-Year Plan (D.P.U. 09-119, January 28, 2010). Subsequently, the Cape Light Compact has filed updates to its three-year plan adjusting certain of its programs and pilots. These updates are referred to as the 2010 Mid-Year Revisions (D.P.U. 10-106, January 10, 2011), 2011 Mid-Term Modifications (D.P.U. 10-147, pending), and 2012 Mid-Term Modifications (D.P.U. 11-116, pending).

Table II.A.5 provides information on the performance of Residential Cooling & 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	$	$ 879,139			$ 1,182,706		35%
Performance Incentive	$	$ -			$ -		
Participants	accts	840			1,768		110%
Program Cost / Participant	$	$ 1,047			$ 669		-36%
Savings and Benefits							
Energy							
Lifetime	MWh	8,229	10,729	30%	9,698	-10%	18%
Annualized	MWh	577	705	22%	654	-7%	13%
Average Measure Life	Yrs	14	15	7%	15	-3%	4%
Demand							
Lifetime	kW	8,189	6,058	-26%	1,815	-70%	-78%
Annualized							
Summer	kW	694	483	-30%	116	-76%	-83%
Winter	kW	553	537	-3%	116	-78%	-79%
Average Measure Life	Yrs	12	13	6%	16	24%	32%
Non-Electric Benefits (Lifetime)	$	$ 1,641,687	$ 2,383,395	45%	$ 1,957,587	-18%	19%
Cost-Effectiveness							
TRC Benefits	$	$ 4,052,409			$ 3,389,839		-16%
TRC Costs	$	$ 1,043,958			$ 1,402,196		34%
Net Benefits	$	$ 3,008,451			$ 1,987,643		-34%
BCR		3.9			2.4		-38%

The significant variances for this program can be attributed to the change from the planned measure mix to the actual measure mix. The plan expected more cooling-only measures to be installed than heating/cooling and water heating measures, more energy savings were expected to be provided from the heating/cooling measures, and most of the demand savings were expected to be provided by water heating measures. During the program year, significantly more heating and motor measures and fewer cooling and water heating measures were installed than anticipated.

Program costs were higher than expected due to the increase in heating and motor measures, which tend to have higher incentive and TRC costs relative to cooling-only measures. There was a significant, unanticipated increase in participation due to the quantity of piggyback motor measures installed with gas heating systems. This increase in participation can likely be attributed to the successes of both the gas heating equipment and HEAT Loan programs. A larger increase in participants as compared to program costs caused the program costs per participant to decrease.

Lifetime and annualized energy savings were higher than planned due to the increase in heating and motor equipment and lower-than-expected installations of cooling equipment. Heating equipment typically provides greater energy savings per unit than cooling equipment.

The lifetime and summer demand savings were also impacted by the change in measure mix. Fewer cooling and water heating measures were installed as compared to plan, both of which strongly contributed to demand savings.

Lifetime NEBs were higher than expected due to the increase in motor installations. Motors provide the greatest NEBs as compared to heating or cooling measures.

Because the TRC benefits associated with the program decreased while the TRC costs increased, the net benefits and BCR were lower than planned, and the program was cost-effective.

The EM&V studies included in the 2012 Annual Report that apply to this program are as follows:

- *2012 Residential Heating, Water Heating, and Cooling Equipment Evaluation: Net-to-Gross, Market Effects, and Equipment Replacement Timing:* The study updated Net-to-Gross ("NTG") ratios for certain prescriptive equipment available in the Residential Heating & Water Heating and Residential Cooling & Heating Equipment programs. It also analyzed net market effects ("NME") and looked into the timing of equipment replacement. Results indicate that NTG ratios are slightly higher than previously estimated for many measures. Further, NME analyses and data provide qualitative evidence to support this finding. The study also found program-induced accelerated replacement of equipment that was not being captured in savings estimates; however, the level of replacement varied by equipment being installed. The net effect for the Compact was to decrease savings and benefits for the 2012 evaluated results. The study is discussed in more detail in Section III, Study 2.

- *Massachusetts Residential Non-Energy Impacts (NEIs): Deemed NEI Values Addressing Differences in NEIs for Heating, Cooling, and Water Heating Equipment that is Early Replacement Compared to Replace on Failure*: This memorandum provides adjusted deemed non-energy impacts ("NEI") values that address the differences in NEIs for residential heating, cooling, and water heating equipment that is early replacement compared to replace on failure. These deemed NEIs update the NEIs provided in the residential NEI report submitted by the PAs to the Department on August 15, 2011 in their 2010 Energy Efficiency Annual Reports in D.P.U. 11-63 through D.P.U. 11-73, and D.P.U. 11-126. The results of this study decreased net lifetime benefits for 2012 evaluated results. The study is discussed in more detail in Section III, Study 25.

The Compact regularly reviews best available information to adjust strategies in order to achieve energy efficiency goals. With respect to the 2012 program performance information, the Compact incorporated the best available information into its 2013-2015 Three-Year Plan. With respect to the results of EM&V studies that were completed for the 2012 Annual Report, the Compact will review those results and make any necessary adjustments to ensure it remains on track to achieve its goals for 2013 through 2015. The Compact will continue to monitor program performance to determine if any evaluation is significant enough to trigger a modification under the new MTM guidelines established in D.P.U. 11-120-A, Phase II (January 31, 2013).

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: This program targeted residential multi-family facilities with five or more dwelling units.

Definition of Program Participant: A participant is defined as a dwelling unit served under this program.

Beginning in 2013, the Program Administrators will use consistent participant definitions, as set forth in Appendix M to the 2013-2015 Three-Year Plan in D.P.U. 12-100 through 12-111.

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 Cape Light Compact's 2012 plan was approved as part of its 2010-2012 Three-Year Plan (D.P.U. 09-119, January 28, 2010). Subsequently, the Cape Light Compact has filed updates to its three-year plan adjusting certain of its programs and pilots. These updates are referred to as the 2010 Mid-Year Revisions (D.P.U. 10-106, January 10, 2011), 2011 Mid-Term Modifications (D.P.U. 10-147, pending), and 2012 Mid-Term Modifications (D.P.U. 11-116, pending).

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

Table II.A.6

Residential 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	$	$ 291,879			$ 285,688		-2%
Performance Incentive	$	$ -			$ -		
Participants	units	259			372		44%
Program Cost / Participant	$	$ 1,127			$ 768		-32%
Savings and Benefits							
Energy							
Lifetime	MWh	2,189	6,474	196%	5,017	-23%	129%
Annualized	MWh	462	598	30%	479	-20%	4%
Average Measure Life	Yrs	5	11	128%	10	-3%	121%
Demand							
Lifetime	kW	2,512	490	-81%	457	-7%	-82%
Annualized							
Summer	kW	142	60	-58%	63	6%	-56%
Winter	kW	159	114	-28%	389	242%	145%
Average Measure Life	Yrs	18	8	-54%	7	-12%	-59%
Non-Electric Benefits (Lifetime)	$	$ 1,430,068	$ 493,604	-65%	$ 413,591	-16%	-71%
Cost-Effectiveness							
TRC Benefits	$	$ 2,023,476			$ 991,345		-51%
TRC Costs	$	$ 332,317			$ 294,409		-11%
Net Benefits	$	$ 1,691,158			$ 696,936		-59%
BCR	n/a	6.1			3.4		-45%

In general, the Cape Light Compact does not have many traditionally defined Residential Multi-Family customers (for example, high rises and apartment complexes) in its territory. The majority of the Cape Light Compact's residential multi-family customers are condominium owners. While electric measures like lighting and thermostats are easily implemented in this market, there are more significant barriers to condominium owners for implementing weatherization measures. In many cases, they need to involve the condominium association in the decision making process in order to implement a majority of the recommended weatherization measures.

In 2011, this program fell short of its goals, and the Cape Light Compact aimed to make up for this shortfall in 2012 by installing more weatherization measures and a similar amount of lighting measures as actually installed in 2011. Over the course of 2012, the program ended up installing more lighting measures and fewer weatherization measures than anticipated. Overall, the program served more customers than expected. While costs were in line with planned program spending, the increased amount of participants resulted in lower program costs per participant.

Annualized and lifetime energy savings were higher than anticipated, with lifetime energy savings experiencing a greater increase; therefore, the average energy measure life was greater than anticipated. Annualized and lifetime demand savings were lower than anticipated, with lifetime demand savings experiencing a greater decrease; therefore, the average demand measure life was less than anticipated.

Energy savings were higher than expected due to the increase in lighting measures, as well as higher than anticipated savings per electric weatherization job. Lifetime, annualized summer, and annualized winter demand savings were all lower than planned because of the change in measure mix. As noted above, the program did not see as much weatherization work completed as expected. The Cape Light Compact continues to work with its implementation vendor to explore opportunities to increase whole-facility enrollment for condominium associations as well as increase implementation rates of recommended measures.

Lifetime NEBs were also impacted by the change in measure mix mentioned above. Weatherization measures have greater non-electric benefits than lighting measures. Fewer weatherization measures installed caused lifetime NEBs to decrease, which the increase in lifetime lighting NEBs did not offset.

TRC benefits decreased primarily due to the decrease in lifetime NEBs caused by the change in measure mix. TRC benefits associated with the program decreased more than TRC costs decreased, causing the net benefits and BCR to be lowered than planned. The program remained cost-effective.

There are no EM&V studies included in the 2012 Annual Report that apply to this program.

The significant variances from preliminary to evaluated results are attributable to the following evaluations filed with the Compact's 2011 Annual Report, D.P.U. 12-54: the Demand Impact Model (2011 Annual Report, Appendix C, Study 9), which updated load shapes and coincidence factors for the program; and the Multi-Family Program Impact Analysis (2011 Annual Report, Appendix C, Study 6), which collected information to inform program attribution, including measurement of installation rates, persistence, free-ridership, and spillover.

The Compact regularly reviews best available information to adjust strategies in order to achieve energy efficiency goals. With respect to the 2012 program performance information, the Compact incorporated the best available information into its 2013-2015 Three-Year Plan. With respect to the results of EM&V studies that were completed for the 2012 Annual Report, the Compact will review those results and make any necessary adjustments to ensure it remains on track to achieve its goals for 2013 through 2015. The Compact will continue to monitor program performance to determine if any evaluation is significant enough to trigger a modification under the new MTM guidelines established in D.P.U. 11-120-A, Phase II (January 31, 2013).

d. Residential Mass Save/Home Energy Services

Purpose/Goal: The purpose of the Residential 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 condominium 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.

Beginning in 2013, the Program Administrators will use consistent participant definitions, as set forth in Appendix M to the 2013-2015 Three-Year Plan in D.P.U. 12-100 through 12-111.

Targeted End Uses:

- Lighting
- HVAC
- Hot Water
- Envelope
- Refrigeration

Delivery Mechanism: Residential Mass Save/HES was implemented by each PA's competitively procured lead vendor.

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 Independent Installation Contractors and Home Performance Contractors. Additional lead vendor responsibilities included:

- Consistent statewide training
- Data reporting
- Achieving aggressive savings
- Customer satisfaction
- Quality control standards

- Scheduling requirements
- Technical assistance
- Maintaining and reporting health and safety information

Two groups of Residential 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 Home Energy Assessments ("HEAs"), and implemented weatherization measures. IICs provided installation of weatherization measures for those customers who received an 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 an HPC or IIC, is subject to quality control inspection(s) performed by the PA vendor or third-party vendor. This ensured that high quality was maintained, and that installations met Building Performance Institute standards or similar standards set by the PAs.

The gas and electric PAs remained under contract with Competitive Resources, Inc. ("CRI"), a third-party Quality Control vendor responsible for performing QC inspections of program implementation vendors and participating contractors. The QC vendor provided valuable information and feedback to the Program Administrators on program successes and identified areas of possible improvement.

The Program Administrators are working together toward a "best practices" approach to provide 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 Cape Light Compact's 2012 plan was approved as part of its 2010-2012 Three-Year Plan (D.P.U. 09-119, January 28, 2010). Subsequently, the Cape Light Compact has filed updates to its three-year plan adjusting certain of its programs and pilots. These updates are referred to as the 2010 Mid-Year Revisions (D.P.U. 10-106, January 10, 2011), 2011 Mid-Term Modifications (D.P.U. 10-147, pending), and 2012 Mid-Term Modifications (D.P.U. 11-116, pending).

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

Table II.A.7

Residential Mass Save							
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	$	$ 9,186,102			$ 10,629,241		16%
Performance Incentive	$	$ -			$ -		
Participants	accts	3,094			5,954		92%
Program Cost / Participant	$	$ 2,969			$ 1,785		-40%
Savings and Benefits							
Energy							
Lifetime	MWh	92,651	47,293	-49%	30,553	-35%	-67%
Annualized	MWh	6,055	5,036	-17%	3,460	-31%	-43%
Average Measure Life	Yrs	15	9	-39%	9	-6%	-42%
Demand							
Lifetime	kW	52,856	3,864	-93%	1,116	-71%	-98%
Annualized							
Summer	kW	2,799	501	-82%	164	-67%	-94%
Winter	kW	478	973	104%	1,091	12%	128%
Average Measure Life	Yrs	19	8	-59%	7	-12%	-64%
Non-Electric Benefits (Lifetime)	$	$ 59,762,375	$ 34,887,923	-42%	$ 38,015,752	9%	-36%
Cost-Effectiveness							
TRC Benefits	$	$ 77,606,063			$ 41,207,647		-47%
TRC Costs	$	$ 12,323,368			$ 12,790,951		4%
Net Benefits	$	$ 65,282,695			$ 28,416,696		-56%
BCR		6.3			3.2		-49%

In 2011, this program completed fewer insulation and air sealing jobs than originally planned, and installed more lighting measures than anticipated. In 2012, the transition to the market model led to a couple of delays in implementation as the program participants were not fully on board until the second quarter of 2012. Originally, the Cape Light Compact planned to compensate for the 2011 shift in measure mix by installing more insulation and air sealing and fewer lighting measures as compared to the 2011 Annual Report. During the course of 2012, however, the 2011 trends held constant as customers received lighting measures and thermostats (which have lower costs and shorter measures lives) through their assessments, but insulation and air sealing (which have higher costs and longer measure lives) were backlogged in 2012 as the transition was completed.

Participants in the Residential Mass Save program have steadily increased over the three-year period, with 2012 seeing the highest number of participants. The high number of participants in 2012 was partly due to the increase in the number of assessments because the Compact widely marketed the programs. The 2012 measure mix described above, combined with the increase in participants, resulted in lower program costs per participant than expected.

Annualized energy savings were not significantly impacted, whereas lifetime energy savings decreased significantly due to the decrease in weatherization measures. The increase in lighting measures allowed the annualized energy savings to remain in line with planned expectations. The increase in lighting measures, which have shorter measure lives than weatherization measures, reduced the average energy measure life.

The lifetime and annualized summer demand savings were lower than expected, while the annualized winter demand savings were higher than expected due to the measure mix mentioned above. Insulation and air sealing have greater summer-based savings since they provide savings during the hotter months, so the decrease in such measures decreased the lifetime and annualized summer demand savings. Lighting measures have greater winter-based savings since they are used more often during the darker months, so the increase in lighting measures increased the annualized winter demand savings. Lighting measures also have a comparably shorter measure life, which explains the reduction in average measure life on the demand side.

Lifetime NEBs were lower than expected due to the lower number of insulation and air sealing jobs, which save other fuels during the colder months and provide greater non-electric, non-resource benefits than lighting measures.

TRC benefits were lower than planned due to fewer weatherization jobs than expected. Because the total benefits associated with the program decreased while the total resource costs increased, the net benefits and BCR were lower than planned, though the program remained cost-effective.

The EM&V studies included in the 2012 Annual Report that apply to this program are as follows:

- *HES Realization Rate Results Memo:* This study produced PA-specific realization rates (the ratio of *ex ante* to *ex post* savings) used to adjust insulation and air sealing savings. The study decreased program savings for the Compact's 2012 evaluated results. The study is discussed in more detail in Section III, Study 3.

- *2012 Home Energy Services Pre-Weatherization Initiative Evaluation:* This evaluation assessed the impact of additional incentives on a customer's decision to overcome pre-weatherization barriers (overcoming these barriers makes them eligible to install certain recommended HES measures). The results of this study did not impact the 2012 evaluated results. The study is discussed in more detail in Section III, Study 9.

The variances from preliminary to evaluated results are also attributable to the following evaluations filed with the Compact's 2011 Annual Report, D.P.U. 12-54: the Demand Impact Model (2011 Annual Report, Appendix C, Study 9) which updated load shapes and coincidence factors for the program; and the 2011 Home Energy Services Net-to-Gross Evaluation (2011 Annual Report, Appendix C, Study 4).

The Compact regularly reviews best available information to adjust strategies in order to achieve energy efficiency goals. With respect to the 2012 program performance information, the Compact incorporated the best available information into its 2013-2015 Three-Year Plan. With respect to the results of EM&V studies that were completed for the 2012 Annual Report, the Compact will review those results and make any necessary adjustments to ensure it remains on track to achieve its goals for 2013 through 2015. The Compact will continue to monitor program performance to determine if any evaluation is significant enough to trigger a modification under the new MTM guidelines established in D.P.U. 11-120-A, Phase II (January 31, 2013).

e. Residential ENERGY STAR® Lighting

Purpose/Goal: The purpose of the Residential 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, as set forth below.

Residential Lighting Assumptions

2012 Lighting program	Widget per Participant
Screw-in Bulbs	8
Screw-in Bulbs - Hard to reach	4
Screw-in Bulbs - Specialty bulbs	8
LEDs	1
Indoor Fixture (incl. Torchieres)	2
Outdoor Fixture	2
LED Fixtures	1
Screw-in Bulbs - School Fundraiser	4

Beginning in 2013, the Program Administrators will use consistent participant definitions, as set forth in Appendix M to the 2013-2015 Three-Year Plan in D.P.U. 12-100 through 12-111.

Targeted End Uses: Lighting

Delivery Mechanism: This program utilizes upstream incentives and an online catalog channel.

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 Residential 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 Cape Light Compact's 2012 plan was approved as part of its 2010-2012 Three-Year Plan (D.P.U. 09-119, January 28, 2010). Subsequently, the Cape Light Compact has filed updates to its three-year plan adjusting certain of its programs and pilots. These updates are referred to as the 2010 Mid-Year Revisions (D.P.U. 10-106, January 10, 2011), 2011 Mid-Term Modifications (D.P.U. 10-147, pending), and 2012 Mid-Term Modifications (D.P.U. 11-116, pending).

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

Table II.A.8

Residential 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	$	$ 1,839,640			$ 1,782,287		-3%
Performance Incentive	$	$ -			$ -		
Participants	est. accts	62,996			64,913		3%
Program Cost / Participant	$	$ 29			$ 27		-6%
Savings and Benefits							
Energy							
Lifetime	MWh	71,838	70,109	-2%	73,639	5%	3%
Annualized	MWh	10,015	9,414	-6%	9,786	4%	-2%
Average Measure Life	Yrs	7	7	4%	8	1%	5%
Demand							
Lifetime	kW	7,522	7,569	1%	7,444	-2%	-1%
Annualized							
Summer	kW	1,056	1,017	-4%	1,026	1%	-3%
Winter	kW	2,124	2,033	-4%	2,168	7%	2%
Average Measure Life	Yrs	7	7	5%	7	-3%	2%
Non-Electric Benefits (Lifetime)	$	$ 622,008	$ 613,499	-1%	$ 614,983	0%	-1%
Cost-Effectiveness							
TRC Benefits	$	$ 9,286,866			$ 9,497,716		2%
TRC Costs	$	$ 2,431,220			$ 1,782,287		-27%
Net Benefits	$	$ 6,855,645			$ 7,715,430		13%
BCR		3.8			5.3		40%

This program was within goal for all metrics except TRC costs and BCR. TRC costs were lower than expected because of lower EM&V and incentive dollars needed to achieve the same level of savings.

Because the total benefits associated with the program increased while the TRC costs decreased, the BCR is greater than planned, and the program was cost-effective.

The EM&V studies included in the 2012 Annual Report that apply to this program are as follows:

- *Massachusetts Consumer Survey Results Winter-2012:* This consumer survey was performed in December 2012 and January 2013 with the objective of tracking key lighting market indicators and understanding likely and actual consumer responses to the increased lighting efficiency standards mandated by the Energy Independence and Security Act of 2007 ("EISA"). The results of this study did not impact the 2012 evaluated results. The study is discussed in more detail in Section III, Study 4.

- *Residential Lighting Shelf Survey and Pricing Analysis:* This evaluation included a light bulb shelf-stocking survey and a hedonic pricing regression analysis. The results of the shelf-stocking survey demonstrated that participating stores carry a greater proportion of energy-efficient compact fluorescent lamps and LEDs than incandescent or halogen bulbs. The results of this study did not impact the 2012 evaluated results. The study is discussed in more detail in Section III, Study 5.

- *Lighting Retailer, Supplier Perspectives on the Massachusetts ENERGY STAR® Lighting Program:* The study performed in-depth interviews with lighting manufacturers and high-level buyers and conducted surveys with store managers in order to understand their perceptions of the current impacts of EISA on the lighting market, as well as to explore the perspectives on the growing LED market and program impacts on the lighting market. The results of this study did not impact the 2012 evaluated results. The study is discussed in more detail in Section III, Study 6.

- *Lighting Onsite Inventory and Saturation Study:* The objective of this study was to perform lighting inventories and estimate socket saturations in Massachusetts homes. The study also examined lighting purchase behavior and searched for evidence of incandescent bulb stockpiling. Saturation for all energy-efficient light bulbs, including CFLs, LEDs, and fluorescent tubes, increased to 39 percent statewide in 2013. The results of this study will increase opportunities for energy saving opportunities by increasing the number of bulbs found in indoor fixtures. The study is discussed in more detail in Section III, Study 7.

- *Massachusetts ENERGY STAR® Lighting Program: Early Impacts of EISA*: The objective of this study was to interpret the results and effects of the first full-year of implementation of the increased lighting efficiency standards mandated by EISA on the Massachusetts residential lighting market. The results of this study did not impact the 2012 evaluated results. The study is discussed in more detail in Section III, Study 8.

The Compact regularly reviews best available information to adjust strategies in order to achieve energy efficiency goals. With respect to the 2012 program performance information, the Compact incorporated the best available information into its 2013-2015 Three-Year Plan. With respect to the results of EM&V studies that were completed for the 2012 Annual Report, the Compact will review those results and make any necessary adjustments to ensure it remains on track to achieve its goals for 2013 through 2015. The Compact will continue to monitor program

performance to determine if any evaluation is significant enough to trigger a modification under the new MTM guidelines established in D.P.U. 11-120-A, Phase II (January 31, 2013).

f. Residential ENERGY STAR® Appliances

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

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

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

Beginning in 2013, the Program Administrators will use consistent participant definitions, as set forth in Appendix M to the 2013-2015 Three-Year Plan in D.P.U. 12-100 through 12-111.

Targeted End Uses:

- Refrigeration
- Process

Delivery Mechanism: The program utilizes upstream incentives and mail-in rebates, which dramatically increased sales and lowered costs of products 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 Cape Light Compact's 2012 plan was approved as part of its 2010-2012 Three-Year Plan (D.P.U. 09-119, January 28, 2010). Subsequently, the Cape Light Compact has filed updates to its three-year plan adjusting certain of its programs and pilots. These updates are referred to as the 2010 Mid-Year Revisions

(D.P.U. 10-106, January 10, 2011), 2011 Mid-Term Modifications (D.P.U. 10-147, pending), and 2012 Mid-Term Modifications (D.P.U. 11-116, pending).

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

Table II.A.9

Residential 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	$	$ 280,339			$ 405,282		45%
Performance Incentive	$	$ -			$ -		
Participants	accts	14,749			3,542		-76%
Program Cost / Participant	$	$ 19			$ 114		502%
Savings and Benefits							
Energy							
Lifetime	MWh	8,824	8,135	-8%	8,134	0%	-8%
Annualized	MWh	1,163	1,023	-12%	1,023	0%	-12%
Average Measure Life	Yrs	8	8	5%	8	0%	5%
Demand							
Lifetime	kW	1,305	856	-34%	1,142	33%	-12%
Annualized							
Summer	kW	169	100	-41%	146	46%	-14%
Winter	kW	268	122	-55%	165	36%	-38%
Average Measure Life	Yrs	8	9	11%	8	-8%	1%
Non-Electric Benefits (Lifetime)	$	$ (6,399)	$ 62,681	1080%	$ 62,681	0%	1080%
Cost-Effectiveness							
TRC Benefits	$	$ 1,110,834			$ 1,126,531		1%
TRC Costs	$	$ 342,803			$ 550,589		61%
Net Benefits	$	$ 768,031			$ 575,942		-25%
BCR		3.2			2.0		-37%

In 2011, this program experienced greater demand in refrigerators and televisions and installed fewer room air conditioners and non-television process-related measures (e.g., computer monitors and smart strips) than expected. The Cape Light Compact increased its 2012 plan values for these measures in an attempt to make up for the 2011 shortfall. However, the 2012 program year did not meet its planned target for room air conditioners or non-television process-related measures, which impacted the costs and savings for this program. The Cape Light Compact continued to install more refrigerators and televisions in 2012 than initially planned.

As stated previously, the Compact's 2012 budget is a combination of carryover from 2011 and anticipated 2012 expenditures needed beyond the 2011 carryover. In 2011, this program expended more than originally forecasted in the 2011 MTMs, and the budget remaining for 2012 ended up being 45 percent lower than necessary to implement the program in 2012. As a result, this program was over budget for 2012.

In 2011, the program fell short of its overall participation goals due to the measure mix changes mentioned above, which the Cape Light Compact planned to make up in 2012. During 2012, the Cape Light Compact worked to launch a room air conditioner program that did not generate planned demand. In addition, with the advent of customers purchasing tablet-like devices, computer and monitor purchases were lower than expected. The 2012 participation level for this program, however, was consistent with the 2010 and 2011 participation levels.

The apparent increase in program costs and decrease in participants resulted in a higher program cost per participant.

Lifetime, annualized summer, and annualized winter demand savings all decreased relative to plan due to the change in measure mix mentioned above. Room air conditioners and non-television process measures were expected to make up the majority of program demand savings, but not as many measures were installed as planned.

Refrigerators were the only measures that provide NEB benefits in this program. The 2012 planned NEBs are negative, because in 2011 the program provided more NEBs than anticipated such that the Cape Light Compact exceeded its NEB goals for the program before the start of 2012. The increase in refrigerator rebates in 2012 relative to plan resulted in an increase in lifetime NEBs.

TRC costs were higher than planned because of the increase in refrigerator rebates, which have higher customer costs relative to most other measures included in the program. Due to the higher TRC costs, the program's net benefits and BCR were lower than projected, although the program remained cost-effective.

There are no EM&V studies included in the 2012 Annual Report that apply to this program. The variances from preliminary to evaluated results are attributable to the Demand Impact Model evaluation that was filed in the Compact's 2011 Annual Report, D.P.U. 12-54 (2011 Annual Report, Appendix C, Study 9), which updated load shapes and coincidence factors for the program.

The Compact regularly reviews best available information to adjust strategies in order to achieve energy efficiency goals. With respect to the 2012 program performance information, the Compact incorporated the best available information into its 2013-2015 Three-Year Plan. With respect to the results of EM&V studies that were completed for the 2012 Annual Report, the Compact will review those results and make any necessary adjustments to ensure it remains on track to achieve its goals for 2013 through 2015. The Compact will continue to monitor program performance to determine if any evaluation is significant enough to trigger a modification under the new MTM guidelines established in D.P.U. 11-120-A, Phase II (January 31, 2013).

4. Residential Pilot Programs

The purpose of the Annual Report is to provide actual measured and verified cost, participation, savings, and benefits data on the performance of programs. To the extent that such final actual data for pilot programs is available, it is provided in this report.

a. Residential Deep Energy Retrofit Pilot

Description of Pilot/Specific Activities Intended to Study: The Residential 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 will analyze the information gathered from the pilot to determine market viability, cost-effectiveness, and, if applicable, adoption rates.

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

Beginning in 2013, the Program Administrators will use consistent participant definitions, as set forth in Appendix M to the 2013-2015 Three-Year Plan in D.P.U. 12-100 through 12-111.

Targeted End Uses:

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

Delivery Mechanism: Project design details and assistance to the Residential Deep Energy Retrofit Pilot contractors performing the work were handled through technical specialist contractor and program manager.

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 "deeper" energy-savings initiative, knowing that costs and project complexities can be barriers to deep energy retrofit participation. The Compact finished its last deep energy retrofit project in 2012.

Docket/Exhibit where the Program Is Discussed and Approved: The Cape Light Compact's 2012 plan was approved as part of its 2010-2012 Three-Year Plan (D.P.U. 09-119, January 28, 2010). Subsequently, the Cape Light Compact has filed updates to its three-year plan adjusting certain of its programs and pilots. These updates are referred to as the 2010 Mid-Year Revisions (D.P.U. 10-106, January 10, 2011), 2011 Mid-Term Modifications (D.P.U. 10-147, pending), and 2012 Mid-Term Modifications (D.P.U. 11-116, pending).

Table II.A.10 provides information on the performance of the Residential Deep Energy Retrofit Pilot. Because of the nature of the pilot programs, the table for this pilot program does not include savings and benefits. The Compact has provided all information that is available.

Table II.A.10

Residential Deep Energy Retrofit 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	$	$ 31,352			$ 11,747		-63%
Performance Incentive	$	n/a			$ -		
Participants	TBD	n/a			1		
Program Cost / Participant	$	n/a			$ 11,747		
Savings and Benefits							
Energy							
Lifetime	MWh	n/a	n/a		n/a		
Annualized	MWh	n/a	n/a		n/a		
Average Measure Life	Yrs	n/a	n/a		n/a		
Demand							
Lifetime	kW	n/a	n/a		n/a		
Annualized							
Summer	kW	n/a	n/a		n/a		
Winter	kW	n/a	n/a		n/a		
Average Measure Life	Yrs	n/a	n/a		n/a		
Non-Electric Benefits (Lifetime)	$	n/a	n/a		n/a		
Cost-Effectiveness							
TRC Benefits	$	n/a			n/a		
TRC Costs	$	$ 31,352			$ 11,747		-63%
Net Benefits	$	n/a			-n/a		
BCR		n/a			n/a		

The Cape Light Compact's evaluated total program costs were significantly lower than planned due to lower participation than anticipated. Planned budgets for 2010 and 2011 were not fully spent, and while there was interest in the program, uptake was not as high as expected. Challenges of participant planning, financing, and general project understanding continued. In 2012, there was one completed project.

There are no EM&V studies included in the 2012 Annual Report that apply to this pilot program.

b. Residential New Construction – Major Renovation Statewide Pilot

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

Why Implemented on Pilot Basis Rather than as a Full Program: This initiative was offered as a pilot in order for the Program Administrators to study a new approach to achieving energy savings. The Program Administrators analyzed 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 reviewed the results and determined to transition the pilot as part of the HES program.

Targeted Customers: This pilot targeted customers who were undergoing extensive renovations to their home and/or building an addition onto their existing home.

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

Delivery Mechanism: The Program Administrators, along with the JMC, originally included this pilot as an offering under the Massachusetts New Homes with ENERGY STAR® program, but subsequently determined it was more appropriate to offer the program as part of the HES program for 2013 through 2015. This pilot combines elements of the Residential New Construction & Major Renovation program (for the addition) and the HES program (for the existing portion) to provide a comprehensive whole-house approach. Each home in the pilot had an analysis performed in order to better understand the existing structure. Recommendations were provided to the homeowner for the existing portion of the home (under an HES model) and also to increase the energy efficiency of the new addition by a market-based rater in the program.

Significant Differences in Actual Program Design from Approved Program Design: During the course of 2012, the pilot focused more extensively on contractors and expanded eligibility to include additional types of additions and rehabs.

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

Docket/Exhibit where the Program Is Discussed and Approved: The Cape Light Compact's 2012 plan was approved as part of its 2010-2012 Three-Year Plan (D.P.U. 09-119, January 28, 2010). Subsequently, the Cape Light Compact has filed updates to its three-year plan adjusting certain of its programs and pilots. These updates are referred to as the 2010 Mid-Year Revisions (D.P.U. 10-106, January 10, 2011), 2011 Mid-Term Modifications (D.P.U. 10-147, pending), and 2012 Mid-Term Modifications (D.P.U. 11-116, pending).

Table II.A.11 provides information on the performance of the Residential New Construction – Major Renovation Statewide Pilot. Because of the nature of the pilot programs, the table for this pilot program does not include savings and benefits. The Compact has provided all information that is available.

Table II.A.11

Residential New Construction - Major Renovation Statewide Pilot							
Performance Category	Units	Planned Value	Preliminary Year-End Results		Evaluated Results		
			Value	% Change from Planned	Value	% Change from Preliminary	% Change from Planned
Expenses							
Total Program Costs	$	$ 261,561			$ 88,883		-66%
Performance Incentive	$	n/a			$ -		
Participants	accts	n/a			9		
Program Cost / Participant	$	n/a			$ 9,876		
Savings and Benefits							
Energy							
Lifetime	MWh	n/a	n/a		n/a		
Annualized	MWh	n/a	n/a		n/a		
Average Measure Life	Yrs	n/a	n/a		n/a		
Demand							
Lifetime	kW	n/a	n/a		n/a		
Annualized							
Summer	kW	n/a	n/a		n/a		
Winter	kW	n/a	n/a		n/a		
Average Measure Life	Yrs	n/a	n/a		n/a		
Non-Electric Benefits (Lifetime)	$	n/a	n/a		n/a		
Cost-Effectiveness							
TRC Benefits	$	n/a			n/a		
TRC Costs	$	$ 261,561			$ 88,883		-66%
Net Benefits	$	n/a			-n/a		
BCR		n/a			n/a		

The Cape Light Compact's actual total pilot costs were significantly lower than planned due to lower participation than anticipated. The planned budget for 2011 was not fully spent, resulting in a carryover into 2012. While there was interest in the pilot, uptake was not as high as expected. Challenges to the pilot included smaller-than-expected projects and coordinating with renovation schedules. The Compact continues to look at ways to address this market.

There are no EM&V studies included in the 2012 Annual Report that apply to this pilot program.

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

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

Why Implemented on Pilot Basis Rather than as a Full Program: This initiative was offered as a pilot in order for the Program Administrators to study a new approach to achieving energy savings. The Program Administrators analyzed the information gathered from the pilot to determine market viability, cost-effectiveness, and, if applicable, adoption rates. The Program Administrators utilized these pilot results and adopted this pilot into the Residential New Construction & Major Renovation program.

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

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

Targeted End Uses:

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

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

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

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

Docket/Exhibit where the Program Is Discussed and Approved: The Cape Light Compact's 2012 plan was approved as part of its 2010-2012 Three-Year Plan (D.P.U. 09-119, January 28, 2010). Subsequently, the Cape Light Compact has filed updates to its three-year plan adjusting certain of its programs and pilots. These updates are referred to as the 2010 Mid-Year Revisions (D.P.U. 10-106, January 10, 2011), 2011 Mid-Term Modifications (D.P.U. 10-147, pending), and 2012 Mid-Term Modifications (D.P.U. 11-116, pending).

Table II.A.12 provides information on the performance of the Residential New Construction – Multi-Family (4-8 story) Statewide Pilot. Because of the nature of the pilot programs, the table for this pilot program does not include savings and benefits. The Compact has provided all information that is available.

Table II.A.12

Residential New Construction - MultiFamily (4-8 story) Statewide Pilot							
Performance Category	Units	Planned Value	Preliminary Year-End Results		Evaluated Results		
			Value	% Change from Planned	Value	% Change from Preliminary	% Change from Planned
Expenses							
Total Program Costs	$	n/a			n/a		
Performance Incentive	$	n/a			n/a		
Participants	units	n/a			n/a		
Program Cost / Participant	$	n/a			n/a		
Savings and Benefits							
Energy							
Lifetime	MWh	n/a	n/a		n/a		
Annualized	MWh	n/a	n/a		n/a		
Average Measure Life	Yrs	n/a	n/a		n/a		
Demand							
Lifetime	kW	n/a	n/a		n/a		
Annualized							
Summer	kW	n/a	n/a		n/a		
Winter	kW	n/a	n/a		n/a		
Average Measure Life	Yrs	n/a	n/a		n/a		
Non-Electric Benefits (Lifetime)	$	n/a	n/a		n/a		
Cost-Effectiveness							
TRC Benefits	$	n/a			n/a		
TRC Costs	$	n/a			n/a		
Net Benefits	$	n/a			n/a		
BCR		n/a			n/a		

Though the Cape Light Compact supports this statewide pilot, it does not have enough multi-family (4-8 story) homes in its service territory to be able to participate in this pilot. Therefore, no budget was allocated to this pilot in the plan, and there are no results from 2012 to report.

There are no EM&V studies included in the 2012 Annual Report that apply to this pilot program.

d. Residential New Construction – Lighting Design Statewide Pilot

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

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

determine market viability, cost-effectiveness, and, if applicable, adoption rates. Following completion of the pilot in 2012, the Program Administrators incorporated this pilot into the Residential New Construction & Major Renovation program for 2013 through 2015.

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

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

Targeted End Uses: High efficiency lighting and controls.

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

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

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

Docket/Exhibit where the Program Is Discussed and Approved: The Cape Light Compact's 2012 plan was approved as part of its 2010-2012 Three-Year Plan (D.P.U. 09-119, January 28, 2010). Subsequently, the Cape Light Compact has filed updates to its three-year plan adjusting certain of its programs and pilots. These updates are referred to as the 2010 Mid-Year Revisions (D.P.U. 10-106, January 10, 2011), 2011 Mid-Term Modifications (D.P.U. 10-147, pending), and 2012 Mid-Term Modifications (D.P.U. 11-116, pending).

Table II.A.13 provides information on the performance of the Residential New Construction — Lighting Design Statewide Pilot. Because of the nature of the pilot programs, the table for this pilot program does not include savings and benefits. The Compact has provided all information that is available.

Table II.A.13

Residential New Construction - Lighting Design Statewide Pilot							
Performance Category	Units	Planned Value	Preliminary Year-End Results		Evaluated Results		
			Value	% Change from Planned	Value	% Change from Preliminary	% Change from Planned
Expenses							
Total Program Costs	$	$ 16,660			n/a		-100%
Performance Incentive	$	n/a			n/a		
Participants	accts	n/a			n/a		
Program Cost / Participant	$	n/a			n/a		
Savings and Benefits							
Energy							
Lifetime	MWh	n/a	n/a		n/a		
Annualized	MWh	n/a	n/a		n/a		
Average Measure Life	Yrs	n/a	n/a		n/a		
Demand							
Lifetime	kW	n/a	n/a		n/a		
Annualized							
Summer	kW	n/a	n/a		n/a		
Winter	kW	n/a	n/a		n/a		
Average Measure Life	Yrs	n/a	n/a		n/a		
Non-Electric Benefits (Lifetime)	$	n/a	n/a		n/a		
Cost-Effectiveness							
TRC Benefits	$	n/a			n/a		
TRC Costs	$	$ 16,660			n/a		-100%
Net Benefits	$	n/a			n/a		
BCR		n/a			n/a		

The Cape Light Compact's evaluated total program costs were significantly lower than planned because no customers participated in the pilot in 2012. Opportunities were limited in 2012. Many of the completed new construction projects were multi-unit, affordable housing. Because of the nature of these projects, there is not generally over-lighting or the need for a lighting designer. Other challenges to the pilot program included coordinating with the design and construction schedules for smaller projects.

There are no EM&V studies included in the 2012 Annual Report that apply to this pilot program.

e. Heat Pump Water Heater Pilot (Non-Statewide)

Description of Pilot/Specific Activities Intended to Study: This pilot was designed to study the reliability and energy savings of heat pump water heaters.

Why Implemented on Pilot Basis Rather than as a Full Program: This initiative was offered as a pilot in 2011 to determine if the initiative is cost-effective. In 2012, this measure is included in the Residential Cooling & Heating Equipment program.

Targeted Customers: This pilot targeted residential customers with stand-alone electric water heaters.

Definition of Pilot Program Participant: A participant is defined as a unique household served by the pilot program.

Targeted End Uses: Hot Water

Delivery Mechanism: The HPWHs were installed by a plumbing contractor in 2010. The units were monitored and evaluated by a third party contractor during 2011.

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

How Achievement of the Pilot's Stated Goal Was Measured: The pilot's stated goal was measured through an evaluation completed in June 2012 and filed with the Compact's 2011 Annual Report in D.P.U. 12-54 as described in Appendix C, Study 14. The overall performance of the HPWHs shows great promise. In general, these HPWHs were more than twice as efficient as a traditional electric resistance tank water heater. The evaluation found minimal issues with these new units, which performed with remarkable energy and cost savings as compared to electric resistance water heaters.

Docket/Exhibit where the Program Is Discussed and Approved: The Cape Light Compact's 2012 plan was approved as part of its 2010-2012 Three-Year Plan (D.P.U. 09-119, January 28, 2010). Subsequently, the Cape Light Compact has filed updates to its three-year plan adjusting certain of its programs and pilots. These updates are referred to as the 2010 Mid-Year Revisions (D.P.U. 10-106, January 10, 2011), 2011 Mid-Term Modifications (D.P.U. 10-147, pending), and 2012 Mid-Term Modifications (D.P.U. 11-116, pending).

Table II.A.14 provides information on the performance of the Heat Pump Water Heater Pilot. Because of the nature of the pilot programs, the table for this pilot program does not include savings and benefits. The Compact has provided all information that is available.

Table II.A.14

Heat Pump Water Heater Pilot (Non-Statewide)							
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	$	$ 213			n/a		-100%
Performance Incentive	$	n/a			n/a		
Participants	hhlds	n/a			n/a		
Program Cost / Participant	$	n/a			n/a		
Savings and Benefits							
Energy							
Lifetime	MWh	n/a	n/a		n/a		
Annualized	MWh	n/a	n/a		n/a		
Average Measure Life	Yrs	n/a	n/a		n/a		
Demand							
Lifetime	kW	n/a	n/a		n/a		
Annualized							
Summer	kW	n/a	n/a		n/a		
Winter	kW	n/a	n/a		n/a		
Average Measure Life	Yrs	n/a	n/a		n/a		
Non-Electric Benefits (Lifetime)	$	n/a	n/a		n/a		
Cost-Effectiveness							
TRC Benefits	$	n/a			n/a		
TRC Costs	$	$ 213			n/a		-100%
Net Benefits	$	n/a			n/a		
BCR		n/a			n/a		

The Cape Light Compact's Residential Heat Pump Water Heater Pilot concluded in 2011. In 2012, the Compact added heat pump water heaters as a measure in the Residential Cooling & Heating Equipment program.

There are no EM&V studies included in the 2012 Annual Report that apply to this pilot program.

f. Power Monitor Pilot (Cape Light Compact-Specific)

Description of Pilot/Specific Activities Intended to Study: In 2009, the Cape Light Compact conducted Phase I of this pilot, in an effort to gain insight to behavioral aspects of energy use. The Compact identified 91 participants on Cape Cod and Martha's Vineyard and installed an in-home energy monitoring system in each participant's home. The monitoring system enables the participant to view their electricity consumption in real time, displaying energy usage down to the minute. Participants had access to an online dashboard, which offered participants feedback on their energy consumption and demand, savings metrics in kWh, dollars, and carbon dioxide emissions, and opportunities to learn about and sign up for energy saving activities (e.g., unplugging chargers when not in use). Participants were also part of a social networking system with other pilot members.

In March of 2010, an independent third-party evaluation of Phase I was completed and included in the Cape Light Compact's 2009 Annual Report. The results of the evaluation indicated a

strong customer interest in the pilot, high levels of customer satisfaction with the pilot, and significant energy savings. On average, customers saved 9.3 percent, controlling for temperature differences and for other Cape Light Compact program activity. This is equivalent to 2.9 kWh of saved electricity per day.

In the fall of 2010, the Cape Light Compact supplemented its review of the pilot program with qualitative in-depth interviews of ten participants. The interviews were conducted by an independent third party and primarily discussed participants' thoughts and patterns of interaction with the monitoring system and their feedback regarding suggestions on changes or features they would like to see in the energy monitoring system. Findings from these interviews provided insight into how and why participants are motivated to stay engaged with the system over longer periods of time and provide further evidence to the evaluation's conclusions.

As a result of the findings in the report and follow up interviews, the Compact extended the pilot by offering Phase II in 2011 and 2012. Phase II of the pilot planned to include both residential and commercial participants but due to networking issues, there were no commercial participants. The purpose of Phase II and its associated evaluation is to provide the basis for determining whether to transition the pilot into a program. The evaluation of Phase II evaluates the savings associated with the pilot, as well as the persistence of the energy savings identified in Phase I.

Why Implemented on Pilot Basis Rather than as a Full Program: This initiative was offered as a pilot to determine if the initiative is cost-effective.

Targeted Customers: Phase I of this Pilot targeted year-round residential customers. Phase II of this pilot targeted year-round residential customers, as well as a few small commercial customers, but as noted above there were no commercial participants.

Definition of Pilot Program Participant: A participant is defined as a unique household in which pilot hardware was installed.

Targeted End Uses: The pilot targets all residential and commercial end uses through either motivating customers to change their behavior to save energy or to take energy saving actions.

Delivery Mechanism: The Cape Light Compact and its implementation vendor, Tendril, Inc., delivered this Pilot.

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

How Achievement of the Pilot's Stated Goal Was Measured: An evaluation of the pilot's first and second phases has been completed.

Docket/Exhibit where the Program Is Discussed and Approved: The Cape Light Compact's 2012 plan was approved as part of its 2010-2012 Three-Year Plan (D.P.U. 09-119, January 28, 2010). Subsequently, the Cape Light Compact has filed updates to its three-year plan adjusting certain of its programs and pilots. These updates are referred to as the 2010 Mid-Year Revisions

(D.P.U. 10-106, January 10, 2011), 2011 Mid-Term Modifications (D.P.U. 10-147, pending), and 2012 Mid-Term Modifications (D.P.U. 11-116, pending).

Table II.A.15 provides information on the performance of the Power Monitor Pilot. Because of the nature of the pilot programs, the table for this pilot program does not include savings and benefits. The Compact has provided all information that is available.

Table II.A.15

Power Monitor Pilot (Cape Light Compact-Specific)							
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	$	$ (569)			$ 41,288		7352%
Performance Incentive	$	n/a			$ -		
Participants	hhlds	n/a			365		
Program Cost / Participant	$	n/a			$ 113		
Savings and Benefits							
Energy							
Lifetime	MWh	n/a	n/a		n/a		
Annualized	MWh	n/a	n/a		n/a		
Average Measure Life	Yrs	n/a	n/a		n/a		
Demand							
Lifetime	kW	n/a	n/a		n/a		
Annualized							
Summer	kW	n/a	n/a		n/a		
Winter	kW	n/a	n/a		n/a		
Average Measure Life	Yrs	n/a	n/a		n/a		
Non-Electric Benefits (Lifetime)	$	n/a	n/a		n/a		
Cost-Effectiveness							
TRC Benefits	$	n/a			n/a		
TRC Costs	$	$ (569)			$ 41,288		7352%
Net Benefits	$	n/a			-n/a		
BCR		n/a			n/a		

The Cape Light Compact's 2012 actual total program costs were higher than anticipated because of statewide evaluation costs after implementation. In addition to the evaluation costs, 2012 also included costs to continue software support for the 365 participants in Phase I and Phase II.

The EM&V studies included in the 2012 Annual Report that apply to this program are as follows:

- *Massachusetts Cross-Cutting Behavioral Program Evaluation Integrated Report:* This report includes impact findings of behavior/feedback programs and pilots administered by National Grid, NSTAR, Western Massachusetts Electric Company, and the Cape Light Compact during the 2012 program year. It also includes process findings for the Compact's Smart Home Energy Monitoring Pilot ("SHEMP") from 2009 to 2012. The study also established savings estimate ratios to adjust implementer estimates in order to

report savings in future years. The study had no impact on savings for the Compact. The full report is included in Section III, Study 22.

g. 2012 Energy Education Activities

The Compact is committed to energy education and outreach to its community and continues to be a nationally recognized leader in the design and implementation of its energy education activities. As a unique energy efficiency administrator and municipal aggregator, the Compact strives to support the community in efforts to encourage the development of deeper and broader knowledge of energy efficiency technology and practices, moving towards an energy-literate society.

Toward this goal, the Compact's 2012 Energy Education Activities continued to see a substantial increase in its outreach efforts (see Appendix E5 for more detail). Highlights for 2012 include:

- Over 100 education-based presentations, field trips, and all-school Energy Carnivals: students learn the basic lessons of energy efficiency, energy forms, and energy sources in a first-hand, fun, and engaging way. Over 7,000 students and teachers were reached.
- A standards-based graduate level course for teachers to introduce and reinforce energy education concepts for the classroom.
- Three informal science educator workshops for science and nature center staff.
- A Teacher Workshop in partnership with NSTAR and National Energy Education Development Project ("NEED") and in-service training for school systems reaching over 200 teachers in the Compact's service territory.
- Sponsorship for five teachers to summer teacher training programs sponsored by NEED and KidWind.

For the ninth year in a row, the Compact was proud to have our schools recognized by the NEED and the MA DOER for their outstanding work in energy education outreach to their communities:

- **State Elementary Rookie of the Year** - The Forestdale School's 5th Grade
- **State Middle School of the Year** - Bourne Middle School's Energy Savers Club
- **National and State Elementary School of the Year** - Eastham Elementary School
- **State Senior School of the Year** - Sandwich High School
- **National and State Special Project of the Year** - Harwich Middle School

The Compact's greatest successes were seen with the "kids as teachers" model, where high school and middle school students were trained to present information on energy efficiency,

renewable energy, and related topics to younger students and community members. As evidenced in requested programs from year to year, schools have moved towards adopting energy education into their yearly scope and sequence of classroom activities and thus continue to reach more individuals.

The Compact continues its collaboration with NEED of Manassas, VA, a 501(C)3 non-profit educational organization affiliated with the Department of Energy in Washington, D.C. Using a model for science-based facts, the Compact and NEED created curriculum materials to align with the Massachusetts state standards for science and technology, allowing teachers to introduce lesson plans discussing energy efficiency and conservation.

C. Low-Income Sector Programs

1. Summary

During 2012, the Compact implemented the following low-income programs and associated initiatives: [7]

- Low-Income Residential New Construction
- Low-Income Retrofit[8]
    - Low-Income 1-4 Family
    - Low-Income Multi-Family

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/initiative levels, respectively.

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[7] The Compact did not offer any pilot programs in the low-income sector during 2012. However, low-income new construction customers were eligible for the Residential New Construction – Multi-Family (4-8 story) Statewide Pilot. Please see the residential pilot descriptions for more information.

[8] In their 2012 Mid-Term Modification filings, the Program Administrators proposed a consolidation of the low-income single-family retrofit and low-income multi-family retrofit programs in order to form one low-income retrofit program, noting the expected benefits of increasing flexibility to meet customer needs.

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	$	$ 3,510,157			$ 3,079,664		-12%
Performance Incentive	$	$ -			$ -		
Savings and Benefits							
Energy							
Lifetime	MWh	24,903	22,595	-9%	24,161	7%	-3%
Annualized	MWh	2,704	2,495	-8%	2,456	-2%	-9%
Demand							
Lifetime	kW	2,484	2,412	-3%	3,046	26%	23%
Annualized							
Summer	kW	253	230	-9%	253	10%	0%
Winter	kW	627	472	-25%	645	36%	3%
Non-Electric Benefits (Lifetime)	$	$ 10,178,854	$ 5,442,989	-47%	$ 7,148,611	31%	-30%
Cost-Effectiveness							
TRC Benefits	$	$ 13,114,967			$ 10,173,942		-22%
TRC Costs	$	$ 3,510,157			$ 3,079,664		-12%
Net Benefits	$	$ 9,604,810			$ 7,094,278		-26%
BCR		3.7			3.3		-12%

Within the low-income sector, the following programs are contributing to the variance between planned and evaluated values:

- Low-Income Residential New Construction (for total program costs, lifetime energy, annual energy, lifetime demand, summer demand, winter demand, lifetime NEB, TRC benefits, TRC costs, net benefits, and BCR): Please reference section II.B.a for a more detailed discussion of the cause of the variances for this program.

- Low-Income Retrofit (for lifetime demand, lifetime NEB, TRC benefits, and net benefits): Please reference section II.B.b for a more detailed discussion of the cause of the variances for this program.

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	8,281	8,737	6%
Demand	kW	780	450	-42%
Non-Electric Benefits (Lifetime)	$	$ 477,455	$ 554,350	16%
HVAC				
Energy	MWh	271	227	-16%
Demand	kW	29	29	0%
Non-Electric Benefits (Lifetime)	$	$ 885,586	$ 996,461	13%
Refrigeration				
Energy	MWh	11,752	7,948	-32%
Demand	kW	1,493	980	-34%
Non-Electric Benefits (Lifetime)	$	$ 524,847	$ 393,069	-25%
Hot Water				
Energy	MWh	26	6	-78%
Demand	kW	1	1	-57%
Non-Electric Benefits (Lifetime)	$	$ 23,331	$ 16,295	-30%
Process				
Energy	MWh	130	130	0%
Demand	kW	34	20	-41%
Non-Electric Benefits (Lifetime)	$	$ 6,217	$ 7,390	19%
End Use Behavior				
Energy	MWh	707	646	-9%
Demand	kW	68	101	48%
Non-Electric Benefits (Lifetime)	$	$ 33,937	$ 36,831	9%
Envelope				
Energy	MWh	1,429	6,467	353%
Demand	kW	5	1,465	26960%
Non-Electric Benefits (Lifetime)	$	$ 3,491,616	$ 5,144,217	47%
Total				
Energy	MWh	22,595	24,161	7%
Demand	kW	2,412	3,046	26%
Non-Electric Benefits (Lifetime)	$	$ 5,442,989	$ 7,148,611	31%

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	$	$ 44,988	$ 650,536	1346%
TRC Costs	$	$ 31,492	$ 57,743	83%
Net Benefits	$	$ 13,496	$ 592,793	4292%
BCR		1.4	11.3	689%
Low-Income Retrofit				
TRC Benefits	$	$ 13,069,979	$ 9,523,406	-27%
TRC Costs	$	$ 3,374,154	$ 2,966,819	-12%
Net Benefits	$	$ 9,695,825	$ 6,556,587	-32%
BCR		3.9	3.2	-17%
Hard-To-Measure Initiatives				
TRC Costs	$	$ 104,512	$ 55,101	-47%
Total				
TRC Benefits	$	$ 13,114,967	$ 10,173,942	-22%
TRC Costs (incl HTM Initiatives)	$	$ 3,510,157	$ 3,079,664	-12%
Net Benefits	$	$ 9,604,810	$ 7,094,278	-26%
BCR		3.7	3.3	-12%

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

2. Low-Income Sector Performance Highlights

During 2012, the Program Administrators built upon existing low-income programs and expanded initiatives to increase participation across the low-income programs. Selected highlights are presented below.

Low-Income Residential New Construction

The Low-Income Residential New Construction program provided incentives to low-income low-rise and high-rise projects. Incentives were based on final achieved and verified performance of the participating project. The program also provided additional incentives for high efficiency gas and cooling equipment, along with compact fluorescent lamps and appliance rebates.

Low-Income Retrofit

In 2012, the Program Administrators continued to leverage funds from the Department of Energy's Weatherization Assistance Program, which is administered by the Department of

Housing and Community Development, for their low-income energy efficiency programs. This approach provided simplicity through a seamless, integrated experience for the participants, deeper efficiency penetration consistent with a whole house/building approach, as well as the ability to reach as many low-income residents as practicable with the greatest amount of eligible services.

In addition to public housing authorities and non-profit facilities, "for profit" multi-family facilities were also eligible to participate in the Low-Income Multi-Family initiative in 2012, as long as 50 percent of the occupants qualified as low-income, and provided that the PA had budget dollars to serve this new market in its territory.

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

3. Low-Income Programs

a. Low-Income Residential New Construction

Purpose/Goal: The purpose of the Low-Income Residential New Construction program was to encourage the construction of energy-efficient homes, and to 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 newly constructed dwelling unit.

Beginning in 2013, the Program Administrators will use consistent participant definitions, as set forth in Appendix M to the 2013-2015 Three-Year Plan in D.P.U. 12-100 through 12-111.

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 Cape Light Compact's 2012 plan was approved as part of its 2010-2012 Three-Year Plan (D.P.U. 09-119, January 28, 2010). Subsequently, the Cape Light Compact has filed updates to its three-year plan adjusting certain of its programs and pilots. These updates are referred to as the 2010 Mid-Year Revisions (D.P.U. 10-106, January 10, 2011), 2011 Mid-Term Modifications (D.P.U. 10-147, pending), and 2012 Mid-Term Modifications (D.P.U. 11-116, pending).

Table II.B.4 provides information on the performance of Low-Income Residential 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	$	$ 31,492			$ 57,743		83%
Performance Incentive	$	$ -			$ -		
Participants	units	9			54		500%
Program Cost / Participant	$	$ 3,499			$ 1,069		-69%
Savings and Benefits							
Energy							
Lifetime	MWh	111	242	117%	174	-28%	56%
Annualized	MWh	14	17	27%	11	-37%	-20%
Average Measure Life	Yrs	8	14	71%	16	15%	96%
Demand							
Lifetime	kW	62	41	-35%	34	-17%	-46%
Annualized							
Summer	kW	3	2	-27%	2	-28%	-47%
Winter	kW	4	2	-43%	2	-25%	-57%
Average Measure Life	Yrs	19	17	-10%	19	14%	3%
Non-Electric Benefits (Lifetime)	$	$ 23,464	$ 633,713	2601%	$ 626,432	-1%	2570%
Cost-Effectiveness							
TRC Benefits	$	$ 44,988			$ 650,536		1346%
TRC Costs	$	$ 31,492			$ 57,743		83%
Net Benefits	$	$ 13,496			$ 592,793		4292%
BCR		1.4			11.3		689%

Building timelines and demands in the new construction program are difficult to predict in a given year. For example, no low-income new construction units were completed in 2011. However, as noted in the 2011 Annual Report, with production schedules that are tied to funding cycles, many low-income new construction projects began in 2011 with expected completion in 2012. As a result, 54 projects were completed in 2012, which is the most projects the Compact has completed in a single year during the three-year plan for this program.

Program costs increased due to the increase in completed projects. TRC costs increased for the same reason. The increase in participants caused the average program cost per participant to decrease.

Lifetime and annualized energy savings increased due to the increase in heating measures and refrigerators. The greater increase in lifetime energy savings relative to annualized demand savings resulted in an increased average energy measure life. Lifetime and annualized demand savings decreased due to fewer-than-expected cooling measure installations. The Cape Light Compact did not install quite as many screw-in lighting measures as anticipated for this program in 2012, which also contributed to the savings trends identified above.

Lifetime NEBs increased due to the increase in heating measures and dishwashers, both of which have comparably greater non-electric benefits (both resource and non-resource).

TRC benefits were also higher than expected due to the increase in participants. Because TRC benefits increased more than TRC costs, the net benefits and BCR also increased for the program. The program was robustly cost-effective.

The EM&V studies included in the 2012 Annual Report that apply to this program are as follows:

- *Status of Ongoing Low Income Lighting and Heating Metering Study:* This study assesses lighting hours of use ("HOU") and the prevalence of secondary heating in low-income households in Massachusetts. The two overarching objectives of the study are to determine a daily low-income-specific lighting hours of use value to replace the current assumption, and to determine the prevalence of low-income customers who use a secondary heating source to warm their homes (and how best to incorporate secondary heating usage into future evaluations). These results are preliminary; the study is ongoing and will be finalized by early September. The results of this study did not impact the 2012 evaluated results. The study is discussed in more detail in Section III, Study11.

The variances from preliminary to evaluated results are attributable to the following evaluations filed with the Compact's 2011 Annual Report, D.P.U. 12-54: The Massachusetts Mini Baseline Study (2011 Annual Report, Appendix C, Study 3), which reduced electric savings based on the penetration rates of high efficiency lighting and appliances; and the Demand Impact Model (2011 Annual Report, Appendix C, Study 9), which updated load shapes and coincident factors for the program.

The Compact regularly reviews best available information to adjust strategies in order to achieve energy efficiency goals. With respect to the 2012 program performance information, the Compact incorporated the best available information into its 2013-2015 Three-Year Plan. With respect to the results of EM&V studies that were completed for the 2012 Annual Report, the Compact will review those results and make any necessary adjustments to ensure it remains on track to achieve its goals for 2013 through 2015. The Compact will continue to monitor program

performance to determine if any evaluation is significant enough to trigger a modification under the new MTM guidelines established in D.P.U. 11-120-A, Phase II (January 31, 2013).

b. Low-Income Retrofit

Purpose/Goal: Two initiatives, the Low-Income 1-4 Family initiative and the Low-Income Multi-Family initiative, were incorporated in the Low-Income Retrofit program in 2012.

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

The purpose of Low-Income Multi-Family initiative 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 Low-Income 1-4 Family initiative targeted residential customers living in one- to four-unit dwellings who were at or below 60 percent of the state median income level and who qualified to receive fuel assistance and/or utility discount rate(s). For two- to four-unit dwellings, 50 percent of the occupants had to qualify as low-income.

The Low-Income Multi-Family initiative targeted public housing authorities, non-profit housing developers, for-profit housing developers, landlords, property managers, and residential customers at, or below, 60 percent of median income living in multi-family properties consisting of five or more units.

Definition of Program Participant: A participant is defined as a unique electric account served under this initiative for single-family units. A participant is defined as a dwelling unit served under this initiative for multi-family units.

Beginning in 2013, the Program Administrators will use consistent participant definitions, as set forth in Appendix M to the 2013-2015 Three-Year Plan in D.P.U. 12-100 through 12-111.

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. 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, and providing the 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 Cape Light Compact's 2012 plan was approved as part of its 2010-2012 Three-Year Plan (D.P.U. 09-119, January 28, 2010). Subsequently, the Cape Light Compact has filed updates to its three-year plan adjusting certain of its programs and pilots. These updates are referred to as the 2010 Mid-Year Revisions (D.P.U. 10-106, January 10, 2011), 2011 Mid-Term Modifications (D.P.U. 10-147, pending), and 2012 Mid-Term Modifications (D.P.U. 11-116, pending).

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

Table II.B.5

Low-Income 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	$	$ 3,374,154			$ 2,966,819		-12%
Performance Incentive	$	$ -			$ -		
Participants	accts	2,268			1,356		-40%
Program Cost / Participant	$	$ 1,488			$ 2,188		47%
Savings and Benefits							
Energy							
Lifetime	MWh	24,792	22,353	-10%	23,987	7%	-3%
Annualized	MWh	2,691	2,478	-8%	2,445	-1%	-9%
Average Measure Life	Yrs	9	9	-2%	10	9%	6%
Demand							
Lifetime	kW	2,422	2,371	-2%	3,012	27%	24%
Annualized							
Summer	kW	250	227	-9%	251	11%	0%
Winter	kW	623	470	-25%	643	37%	3%
Average Measure Life	Yrs	10	10	8%	12	15%	24%
Non-Electric Benefits (Lifetime)	$	$ 10,155,390	$ 4,809,276	-53%	$ 6,522,179	36%	-36%
Cost-Effectiveness							
TRC Benefits	$	$ 13,069,979			$ 9,523,406		-27%
TRC Costs	$	$ 3,374,154			$ 2,966,819		-12%
Net Benefits	$	$ 9,695,825			$ 6,556,587		-32%
BCR		3.9			3.2		-17%

Beginning in 2011, this program provided significantly higher incentives per home than planned due to a shift to more comprehensive visits designed to serve customers in one year instead of over the course of multiple years. In addition, American Recovery and Reinvestment Act funding increased the per participant incentive and as a result, fewer participants were served with the program budget as compared to plan.

Most of the program savings and benefits were consistent with the program goals, except for annualized winter demand savings and lifetime NEBs. Annualized winter demand savings were lower than expected due to a decrease in lighting measures, which typically provide more savings during winter months. Lifetime NEBs decreased due to a decrease in weatherization units, which typically provide substantive non-electric benefits (both resource and non-resource).[9]

TRC benefits were lower than expected due to the decrease in lighting and weatherization measures. Because TRC benefits decreased more than TRC costs decreased, the net benefits also decreased, although the program remained cost-effective.

The EM&V studies included in the 2012 Annual Report that apply to this program are as follows:

- *Status of Ongoing Low Income Lighting and Heating Metering Study:* This study assesses lighting hours of use and the prevalence of secondary heating in low-income households in Massachusetts. The two overarching objectives of the study are to determine a daily low-income-specific lighting HOU value to replace the current assumption, and to determine the prevalence of low-income customers who use a secondary heating source to warm their homes (and how best to incorporate secondary heating usage into future evaluations). These results are preliminary; the study is ongoing and will be finalized by early September. The results of this study did not impact the 2012 evaluated results. The study is discussed in more detail in Section III, Study11.

The variances from preliminary to evaluated results are attributable to the following evaluations filed with the Compact's 2011 Annual Report, D.P.U. 12-54: the Low Income Single Family impact evaluation (2011 Annual Report, Appendix C, Study 17), which quantified the gross per unit savings generated by each low-income measure; the Demand Impact Model (2011 Annual Report, Appendix C, Study 9), which updated load shapes and coincident factors for the program; and Additional Non-Energy Impacts for Low Income Programs (2011 Annual Report, Appendix C, Study 28), which updated certain non-energy impact factors.

The Compact regularly reviews best available information to adjust strategies in order to achieve energy efficiency goals. With respect to the 2012 program performance information, the Compact incorporated the best available information into its 2013-2015 Three-Year Plan. With

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[9] Note that in 2012, the Compact received a credit for two low-income multi-family gas weatherization projects that were initially billed as 2011 projects.

respect to the results of EM&V studies that were completed for the 2012 Annual Report, the Compact will review those results and make any necessary adjustments to ensure it remains on track to achieve its goals for 2013 through 2015. The Compact will continue to monitor program performance to determine if any evaluation is significant enough to trigger a modification under the new MTM guidelines established in D.P.U. 11-120-A, Phase II (January 31, 2013).

D. Commercial & Industrial Sector Programs

1. Summary

During 2012, the Compact implemented the following Commercial and Industrial programs:

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

The Compact did not offer any C&I pilots in 2012.

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.

The Cape Light Compact has a history of significant variances between planned and actual costs, savings, and benefits for its C&I programs. As a smaller Massachusetts PA, small absolute changes in total program costs, savings, and benefits can result in significant variances. As a result, relatively modest changes in the timing or scale and scope of a few projects can add up to a significant variance in total program costs, savings, and benefits. Also, the limited number of large C&I customers on Cape Cod and Martha's Vineyard make forecasts of expenditures, savings, and benefits for this sector particularly challenging.

Table II.C.1

Commercial & Industrial 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	$	$ 9,244,079			$ 7,314,084		-21%
Performance Incentive	$	$ -			$ -		
Savings and Benefits							
Energy							
Lifetime	MWh	200,914	146,052	-27%	141,061	-3%	-30%
Annualized	MWh	15,960	11,370	-29%	11,007	-3%	-31%
Demand							
Lifetime	kW	66,148	41,078	-38%	38,838	-5%	-41%
Annualized							
Summer	kW	5,228	3,051	-42%	2,844	-7%	-46%
Winter	kW	3,161	1,797	-43%	1,900	6%	-40%
Non-Electric Benefits (Lifetime)	$	$ (881,587)	$ 2,731,380	410%	$ 4,009,837	47%	555%
Cost-Effectiveness							
TRC Benefits	$	$ 32,354,942			$ 27,447,646		-15%
TRC Costs	$	$ 10,322,449			$ 8,583,274		-17%
Net Benefits	$	$ 22,032,493			$ 18,864,372		-14%
BCR		3.1			3.2		2%

Within the C&I sector, as shown below in Table II.C.3, the following programs are contributing to the variance between planned and evaluated values:

- C&I New Construction and Major Renovation (for total program costs, summer demand, winter demand, and lifetime NEB): Please reference section II.C.a for a more detailed discussion of the cause of the variances for this program.

- C&I Large Retrofit (for all metrics): Please reference section II.C.b for a more detailed discussion of the cause of the variances for this program.

- C&I Small Retrofit (for lifetime energy, annual energy, lifetime demand, summer demand, lifetime NEBs): Please reference section II.C.c for a more detailed discussion of the cause of the variances for this program.

Table II.C.2

Commercial & Industrial Sector Summary of End-Uses				
End Uses	Units (Lifetime)	Preliminary Year-End Results	Evaluated Results	% Change from Preliminary to Evaluated
Lighting				
Energy	MWh	89,808	86,744	-3%
Demand	kW	24,383	21,938	-10%
Non-Electric Benefits (Lifetime)	$	$ 548,073	$ 1,506,084	175%
HVAC				
Energy	MWh	17,632	17,632	0%
Demand	kW	9,236	9,338	1%
Non-Electric Benefits (Lifetime)	$	$ 1,636,090	$ 1,864,407	14%
Motors				
Energy	MWh	16,404	15,424	-6%
Demand	kW	5,640	5,640	0%
Non-Electric Benefits (Lifetime)	$	$ 43,221	$ 40,651	-6%
Refrigeration				
Energy	MWh	11,862	14,633	23%
Demand	kW	718	1,301	81%
Non-Electric Benefits (Lifetime)	$	$ -	$ 115,916	
Hot Water				
Energy	MWh	549	549	0%
Demand	kW	4	3.81	0%
Non-Electric Benefits (Lifetime)	$	$ 279,156	$ 279,156	0%
Compressed Air				
Energy	MWh	1,075	822	-24%
Demand	kW	239	202	-15%
Non-Electric Benefits (Lifetime)	$	$ -	$ -	
Process				
Energy	MWh	2,229	2,039	-8%
Demand	kW	359	266	-26%
Non-Electric Benefits (Lifetime)	$	$ -	$ -	
Process				
Energy	MWh	6,494	3,219	-50%
Demand	kW	499	148	-70%
Non-Electric Benefits (Lifetime)	$	$ 224,841	$ 203,623	-9%
Total				
Energy	MWh	146,052	141,061	-3%
Demand	kW	41,078	38,838	-5%
Non-Electric Benefits (Lifetime)	$	$ 2,731,380	$ 4,009,837	47%

Table II.C.3

Commercial & Industrial Program Summary				
Sector	Units	Planned Value	Evaluated Results	
			Value	% Change from Planned
C&I New Construction and Major Renovation				
TRC Benefits	$	$ 10,763,131	$ 10,234,128	-5%
TRC Costs	$	$ 2,182,204	$ 1,782,823	-18%
Net Benefits	$	$ 8,580,927	$ 8,451,306	-2%
BCR		4.9	5.7	16%
C&I Large Retrofit				
TRC Benefits	$	$ 9,258,879	$ 4,978,744	-46%
TRC Costs	$	$ 3,329,806	$ 2,263,111	-32%
Net Benefits	$	$ 5,929,073	$ 2,715,633	-54%
BCR		2.8	2.2	-21%
C&I Small Retrofit				
TRC Benefits	$	$ 12,332,931	$ 12,234,773	-1%
TRC Costs	$	$ 4,731,676	$ 4,434,988	-6%
Net Benefits	$	$ 7,601,255	$ 7,799,785	3%
BCR		2.6	2.8	6%
Hard-To-Measure Initiatives				
TRC Costs	$	$ 78,762	$ 102,352	30%
Total				
TRC Benefits	$	$ 32,354,942	$ 27,447,646	-15%
TRC Costs (incl HTM Initiatives)	$	$ 10,322,449	$ 8,583,274	-17%
Net Benefits	$	$ 22,032,493	$ 18,864,372	-14%
BCR		3.1	3.2	2%

Section II.C.2 provides detailed information on the performance of each C&I program.

2. C&I Sector Performance Highlights

During 2012, 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.

- Proactive Research of Emerging Technologies – In 2012, the Massachusetts Technical Advisory Committee ("MTAC"), the entity designed to field inquiries on the appropriateness of new technologies to be offered under the Massachusetts programs, achieved several key milestones. First, discussions were initiated in 2012 regarding the merger of the separate residential and C&I committees in order to evaluate promising new technologies in a consistent statewide manner. These committees merged in 2013.

Second, in 2012, the MTAC reviewed 18 commercial natural gas and electric technologies and approved 3 as eligible for energy efficiency incentives under the Residential Mass Save program.[10] Third, the energy use of major medical equipment in the healthcare sector, such as Magnetic Resonance Imaging machines and other energy intensive medical equipment, was evaluated. The MTAC provided the vehicle for investigating opportunities for this sector and contracted with the Fraunhofer Center for Sustainable Energy Systems ("Fraunhofer") for this analysis in 2012.[11]

Another important technology evaluated by the MTAC was rooftop unit controls for existing packaged cooling and heating equipment. C&I buildings typically have multiple packaged units with no control communication between these units. The potential for both natural gas and electric savings appears very promising, and initial inquiries indicate that there are thousands of applicable units in the Commonwealth that could benefit from this technology. The Cape Light Compact provided an initial test site in 2012, and the MTAC has hired an independent consulting engineer to perform before-and-after monitoring of this site. (A report was issued in the first quarter of 2013, and this technology went on to be approved for implementation later in 2013.)

- Refinements to Upstream Lighting Initiative – 2012 was the first full year of operation for the Upstream Lighting Initiative, known to customers as "Bright Opportunities." After a dramatic customer response upon roll-out in late 2011, the initiative continued to garner high volume throughout 2012, yielding over 21,000 participants and more than $18 million in buy-downs paid statewide for high efficiency linear fluorescents and LED lamps. During 2012, a number of new LED lamp types were added to the initiative, substantially expanding the variety of possible applications for participating customers to use this technology. By the second quarter, the LED product selection had been expanded to include A-lamps, PAR Lamps in three sizes, MR16s, and decorative fixture lamps for chandeliers.

  As part of the initiative's early success, program LED lamp prices dropped sufficiently enough that the PAs lowered incentives for certain lamps and enacted a minimum threshold customer contribution to ensure that the discounted product held value for participants, as manufacturers and distributors were able to lower their margins with increased volumes. Additionally, the PAs proactively addressed the rare earth shortage and the subsequent material price increases that impacted the lighting industry in late

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[10] Of the other 15 technologies considered by MTAC in 2012, three were denied approval; the remaining 12 technologies continued into 2013 for additional evaluation – either in field monitoring studies or because the MTAC was awaiting additional documentation from applicants.

[11] The final Fraunhofer report, presented in early 2013, demonstrated that savings opportunities exist primarily in powering down machinery between uses rather than making changes to equipment specifications for lower energy use during operation. Such changes to hospital operating protocols would require recertification of equipment operators and procedures, thus limiting the accessibility of such savings.

2011 and 2012. By monitoring market pricing changes, the PAs increased incentives for eligible linear fluorescent lamps to reduce the incremental cost between standard and high-efficiency lamps.

The high participation levels experienced in 2012 were the result of a number of promotional efforts undertaken by the PAs. A special college LED promotion led to 75,000 LED lamps being installed in college dorm rooms across Massachusetts. Another effort targeted state and municipal facilities and yielded more than 120,000 reduced wattage T8 lamps. *Preferred Distributor* recognition, along with higher incentives, was also developed to stimulate demand for the program's linear fluorescent products, resulting in an increase of 1 million units in the third and fourth quarters of 2012.

Quality assurance and quality control was another key component of this initiative in 2012. The PAs issued an RFP for a QA/QC vendor in early 2012 and awarded contract to Competitive Resources, Inc. Starting in the third quarter of 2012, CRI began inspecting 5 percent of participant sites on a monthly basis to verify the installation of lamps purchased through the program, as well as to gather field data on wattage of lamps replaced and customer satisfaction with the upstream products, particularly with regard to LEDs installed in dimming applications.

- Development of Upstream HVAC – In 2012, the PAs began development work to expand the upstream program to include HVAC measures also in 2013. The development team researched existing programs around the country, including having in-depth discussions with administrators in California who have a long standing successful upstream HVAC program. The team then decided to proceed with a concept that would take Residential Mass Save's existing Cool Choice program completely upstream, so that C&I customers seeking packaged HVAC or heat pump units could find higher efficiency units available at their distributor without having to pay a premium for that efficiency. A full scale C&I program RFP was issued in November 2012 (with the option to add a residential program at a later date), and bid proposals were received from three prospective suppliers. (Contract award and program launch occurred in the first half of 2013.)

- Market Characterization and Segmentation – Northeast Utilities and National Grid led an effort to characterize the market for energy efficiency for the term of the 2013-2015 Three-Year Plan, through a study performed by the consulting firm Point 380 in 2012. The Point 380 study results are, and will continue to be, used to inform the PAs "go-to-market" strategies by identifying the industries, building types, and end uses representing greater efficiency opportunities and thus warranting relatively greater attention and allocation of resources. The results also greatly support sales force planning, while enabling more relevant and effective value propositions to better meet specific customers' needs. The Point 380 materials were shared with all Program Administrators, who have each benefited from this effort. Northeast Utilities and National Grid made a joint presentation to the Council summarizing the Point 380 study, which is available at http://www.ma-eeac.org.

In order to achieve greater participation and savings, the Program Administrators have increasingly used market segmentation to inform go-to-market strategies. Based on the specific characteristics of defined segments, marketing approaches, delivery systems, value propositions, and offerings can be customized to better meet the needs and interests of individual companies in those segments. For example, the PAs began developing specific offerings and marketing collateral to better serve the needs of grocers.

- Appreciative Inquiry Summit – In May 2012, the PAs hosted an Appreciative Inquiry Summit, the first of its kind for energy efficiency in Massachusetts, which provided a venue for a diverse array of nearly 300 key stakeholders in attendance. Many C&I customers, contractors, and experts participated in this event and provided insight into their view of the programs and recommendations to improve the delivery of energy efficiency in Massachusetts.

- Development of the 2013-2015 Three-Year Energy Efficiency Plan – Throughout much of 2012, the PAs were actively involved in developing the 2013-2015 Three-Year Plan. Two primary focal points of the 2013-2015 Three-Year Plan were reviewed during this process in 2012, including: new strategies to increase breadth of participation, as well as the comprehensiveness of efficiency projects.

  The strategies explored included: expanded service offerings targeted at smaller customers to enable self-service participation options; community-based engagement built upon the Main Streets model; expanding the upstream delivery model to non-lighting technologies; greater use of segmentation approaches to develop customized offerings to encourage greater comprehensiveness among specific subsets of customers, such as hospitals and municipalities; an accelerated rebate pilot for the top five electric and gas customers; and exploration of options for inclusion of utility-owned LED street lighting in programs.

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

3. C&I Programs

a. C&I New Construction and Major Renovation

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

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

Definition of Program Participant:

- For the core downstream portion of the program, a participant is defined as one representative account number for each location/campus, by year, by program. A participant is an individual customer who has received a financial incentive for the completed implementation of one or more time-dependent electric energy efficiency measures and/or projects at a single site location during the program year. One customer may undertake multiple projects at that same location during the program year, but will still be counted as a single participant within the program.

- For the electric Upstream Lighting Initiative portion of the program, a participant is defined as a unique installation address or account number *in addition* to any participant already counted in the core downstream portion of the program.

Beginning in 2013, the Program Administrators will use consistent participant definitions, as set forth in Appendix M to the 2013-2015 Three-Year Plan in D.P.U. 12-100 through 12-111.

Targeted End Uses:

- Lighting
- Motors and 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 Cape Light Compact's 2012 plan was approved as part of its 2010-2012 Three-Year Plan (D.P.U. 09-119, January 28, 2010). Subsequently, the Cape Light Compact has filed updates to its three-year plan adjusting certain of its programs and pilots. These updates are referred to as the 2010 Mid-Year Revisions (D.P.U. 10-106, January 10, 2011), 2011 Mid-Term Modifications (D.P.U. 10-147, pending), and 2012 Mid-Term Modifications (D.P.U. 11-116, pending).

Table II.C.4 provides information on the performance of 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	$	$ 1,907,664			$ 1,476,579		-23%
Performance Incentive	$	$ -			$ -		
Participants	sites	83			315		280%
Program Cost / Participant	$	$ 22,984			$ 4,688		-80%
Savings and Benefits							
Energy							
Lifetime	MWh	72,014	60,250	-16%	59,247	-2%	-18%
Annualized	MWh	5,178	4,270	-18%	4,275	0%	-17%
Average Measure Life	Yrs	14	14	1%	14	-2%	0%
Demand							
Lifetime	kW	19,338	17,181	-11%	16,829	-2%	-13%
Annualized							
Summer	kW	1,408	1,097	-22%	1,068	-3%	-24%
Winter	kW	1,044	615	-41%	654	6%	-37%
Average Measure Life	Yrs	14	16	14%	16	1%	15%
Non-Electric Benefits (Lifetime)	$	$ (157,029)	$ (53,861)	66%	$ 274,560	610%	275%
Cost-Effectiveness							
TRC Benefits	$	$ 10,763,131			$ 10,234,128		-5%
TRC Costs	$	$ 2,182,204			$ 1,782,823		-18%
Net Benefits	$	$ 8,580,927			$ 8,451,306		-2%
BCR		4.9			5.7		16%

As was the case in 2011, in 2012, the C&I New Construction and Major Renovation program had many more participants than originally planned. However, in 2012 the program nearly doubled in overall size, with almost twice the expenditures, energy savings, and benefits of the 2011 program year.

Nonetheless, the 2012 program remained under budget because the cost per participant was substantially less than originally anticipated due to the addition of the Upstream Lighting Initiative to the program in late 2011. The Upstream Lighting Initiative has a different footprint for costs and savings as compared to the traditional downstream portion of the program. While the Upstream Lighting Initiative contributed the majority of additional program participants in 2012, it did so at a substantially lower incentive cost per participant than the core downstream portion of the program. In addition, incentives per participant in the core downstream portion of

the program were lowered by the fact that government projects (to which the Compact offers a higher incentive than for non-government projects) made up a smaller proportion of participants than planned for in 2012.

Within the core downstream portion of the program, a shift in measure mix toward increased HVAC and refrigeration occurred in 2012, driving some of the savings variances. Both annualized summer and winter demand savings were lower than planned for 2012, in part corresponding to reduced program spending, as well as the shift in measure mix away from lighting and toward HVAC and refrigeration. Winter demand savings were impacted more than summer demand savings, at 41 percent below planned, because HVAC measures have much lower winter coincidence factors, with the majority of their energy savings being tied to non-electric benefits.

By contrast, non-electric benefits were higher, or less negative, than planned for this program in 2012. This change is due to the other fuel benefits associated with HVAC measures.

Overall, the 2012 program remained cost-effective with an increased BCR due to lowered TRC costs relative to TRC benefits.

The EM&V studies included in the 2012 Annual Report that apply to this program are as follows:

- *Impact Evaluation of 2011-2012 Prescriptive VSDs:* This study produced realization rates for annual kWh for prescriptive Variable Speed Drives ("VSDs"). The study decreased program savings for the Compact's 2012 evaluated results. This study is discussed in more detail in Section III, Study 13.

- *Impact Evaluation of 2010 Prescriptive Lighting Installations:* This study evaluated the large C&I prescriptive lighting end use, which includes all lighting systems and controls, Advanced Lighting Design or performance lighting, and refrigerated LED case lights. The study presents realization rates for gross energy savings, on-peak and seasonal summer and winter demand savings, and coincidence factors at the statewide level using 12 months of metered data. The net effect for the Compact was to increase energy savings for this program. The study is discussed in more detail in Section III, Study 14.

- *Impact Evaluation of 2011 Custom Refrigeration, Motor and Other Installations:* This study produces realization rates for annual kWh, summer and winter peak kW, and percent on peak for the large C&I custom electric component of refrigeration, motors, and "other" measure types. The net effect for the Compact was to increase energy savings for this program. This study is discussed in more detail in Section III, Study 15.

- *Process Evaluation of the 2012 Bright Opportunities Program:* This study was a process evaluation of the Bright Opportunities Program, which provides upstream incentives to distributors of energy-efficient lamps and bulbs. The evaluation studied the design and delivery of the initiative, barriers to the adoption of efficient lighting technologies under this design, and advantages of an upstream design versus a downstream design, and

provided an estimated net-to-gross ratio based on free-ridership and spillover. The net-to-gross ratio impacted the 2012 savings and resulted in an overall decrease in savings for the Compact. The study is discussed in more detail in Section III, Study 16.

- *C&I Customer Profile Project:* This study characterizes the Massachusetts energy efficiency market by analyzing recent customer usage and program participation data. The study relied on comprehensive billing and tracking data for all C&I customers to estimate the extent to which customers of various sizes and types participated in energy efficiency programs in 2011. The results of this study did not impact the 2012 evaluated results. The study is discussed in more detail in Section III, Study 17.

- *Mid-Sized Customer Needs Assessment - Interim Results:* This study is investigating the extent to which current program offerings effectively serve the needs of mid-sized customers by conducting interviews with PAs and implementation contractors and analyzing available customer billing and tracking data to examine differences in participation rates across customer size groups. The interim results of this study do not impact the 2012 evaluated results. The study is discussed in more detail in Section III, Study 18.

The variances from preliminary to evaluated results are also attributable to the Commercial and Industrial Non-Energy Impact Study filed with the Compact's 2013-2015 Three-Year Plan, D.P.U. 12-107 (2013-2015 Three-Year Plan, Appendix P, Study 12), which revised program non-energy impact factors resulting in increased lifetime non-electric benefits.

The Compact regularly reviews best available information to adjust strategies in order to achieve energy efficiency goals. With respect to the 2012 program performance information, the Compact incorporated the best available information into its 2013-2015 Three-Year Plan. With respect to the results of EM&V studies that were completed for the 2012 Annual Report, the Compact will review those results and make any necessary adjustments to ensure it remains on track to achieve its goals for 2013 through 2015. The Compact will continue to monitor program performance to determine if any evaluation is significant enough to trigger a modification under the new MTM guidelines established in D.P.U. 11-120-A, Phase II (January 31, 2013).

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 one representative account number for each location/campus, by year, by program. A participant is an individual customer who has received a financial incentive for the completed implementation of one or more electric energy efficiency measures and/or projects at the same location during the program year. One customer may undertake multiple projects at that same location during the program year, but will still be counted as a single participant within the program.

Beginning in 2013, the Program Administrators will use consistent participant definitions, as set forth in Appendix M to the 2013-2015 Three-Year Plan in D.P.U. 12-100 through 12-111.

Targeted End Uses:

- Lighting
- Motors and Drives
- HVAC
- Compressed Air and Processes
- Envelope
- Water Heating
- Combined Heat and 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 Cape Light Compact's 2012 plan was approved as part of its 2010-2012 Three-Year Plan (D.P.U. 09-119, January 28, 2010). Subsequently, the Cape Light Compact has filed updates to its three-year plan adjusting certain of its programs and pilots. These updates are referred to as the 2010 Mid-Year Revisions (D.P.U. 10-106, January 10, 2011); 2011 Mid-Term Modifications (D.P.U. 10-147, pending) and 2012 Mid-Term Modifications (D.P.U. 11-116, pending).

Table II.C.5 provides information on the performance of 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	$	$ 2,687,252			$ 2,053,637		-24%
Performance Incentive	$	$ -			$ -		
Participants	sites	32			49		53%
Program Cost / Participant	$	$ 83,977			$ 41,911		-50%
Savings and Benefits							
Energy							
Lifetime	MWh	37,499	23,220	-38%	23,627	2%	-37%
Annualized	MWh	3,797	1,866	-51%	1,897	2%	-50%
Average Measure Life	Yrs	10	12	26%	12	0%	26%
Demand							
Lifetime	kW	24,104	6,981	-71%	6,510	-7%	-73%
Annualized							
Summer	kW	2,073	548	-74%	513	-7%	-75%
Winter	kW	1,409	413	-71%	420	2%	-70%
Average Measure Life	Yrs	12	13	10%	13	0%	9%
Non-Electric Benefits (Lifetime)	$	$ (19,412)	$ 456,807	2453%	$ 1,012,315	122%	5315%
Cost-Effectiveness							
TRC Benefits	$	$ 9,258,879			$ 4,978,744		-46%
TRC Costs	$	$ 3,329,806			$ 2,263,111		-32%
Net Benefits	$	$ 5,929,073			$ 2,715,633		-54%
BCR		2.8			2.2		-21%

In 2012, this program had a greater than 50 percent increase in participation over planned levels (almost double the number of participants in 2011), but spent only half as much per participant as expected, yielding a net reduction in overall spending by 24 percent from plan. In addition, the program achieved significantly lower savings than expected for spending levels. The latter savings variances were driven by two factors.

First, there was a change in customer mix, as government projects comprised a much larger portion of program spending than expected, utilizing 70 percent of program expenditures rather than the expected 40 percent. Since incentive levels are higher for government customers, the incentive dollars spent returned fewer savings than those for non-government customers, in this case yielding just over 40 percent of program savings as compared to non-government projects, which comprised approximately 30 percent of program spending in 2012 but produced close to 60 percent of program savings.

Second, there was a change in measure mix to higher cost HVAC measures, which impacted savings as compared to plan levels. HVAC measures were expected to comprise less than 40 percent of program spending but instead were 70 percent. At a significantly higher cost per kWh, these measures yielded less than 20 percent of program energy savings, driving the greater than 50 percent reduction in annualized energy savings as compared to plan. Lifetime energy savings saw less of a reduction from plan than annual energy savings because of the increase in average measure life associated with a greater number of HVAC measures installed with longer

measures lives. Demand savings saw an even more marked reduction from plan levels because of the significant HVAC activity. Lower winter demand savings are expected with more HVAC measures, because energy savings are dominated largely by non-electric savings in winter heating. In this program year, the summer demand savings were also lower because of the handful of large HVAC projects occurring in schools, where the summer peak coincidence is low compared to other facilities.

By contrast, the dominance of large HVAC projects in this program year drove the dramatically higher non-electric benefits than plan, yielding a nearly 2500 percent increase in NEBs in the form on non-electric heating fuel savings.

Overall, the program saw a larger reduction in TRC benefits than in TRC costs, resulting in a reduction in net benefits and to a lesser degree in BCR, though the program remained cost-effective.

The EM&V studies included in the 2012 Annual Report that apply to this program are as follows:

- *Impact Evaluation of 2011-2012 Prescriptive VSDs*: This study produced realization rates for annual kWh for prescriptive VSDs. The study decreased program savings for the Compact's 2012 evaluated results. This study is discussed in more detail in Section III, Study 13.

- *Impact Evaluation of 2010 Prescriptive Lighting Installations:* This study evaluated the large C&I prescriptive lighting end use, which includes all lighting systems and controls, Advanced Lighting Design or performance lighting, and refrigerated LED case lights. The study presents realization rates for gross energy savings, on-peak and seasonal summer and winter demand savings, and coincidence factors at the statewide level using 12 months of metered data. The net effect for the Compact was to increase energy savings for this Program. The study is discussed in more detail in Section III, Study 14.

- *Impact Evaluation of 2011 Custom Refrigeration, Motor and Other Installations:* This study produces realization rates for annual kWh, summer and winter peak kW, and percent on peak for the large C&I custom electric component of refrigeration, motors, and "other" measure types. The net effect for the Compact was to increase energy savings for this program. This study is discussed in more detail in Section III, Study 15.

- *C&I Customer Profile Project:* This study characterizes the Massachusetts energy efficiency market by analyzing recent customer usage and program participation data. The study relied on comprehensive billing and tracking data for all C&I customers to estimate the extent to which customers of various sizes and types participated in energy efficiency programs in 2011. The results of this study did not impact the 2012 evaluated results. The study is discussed in more detail in Section III, Study 17.

- *Mid-Sized Customer Needs Assessment - Interim Results:* This study is investigating the extent to which current program offerings effectively serve the needs of mid-sized

customers by conducting interviews with PAs and implementation contractors and analyzing available customer billing and tracking data to examine differences in participation rates across customer size groups. The interim results of this study do not impact the 2012 evaluated results. The study is discussed in more detail in Section III, Study 18.

Additionally, the variances from preliminary to evaluated results are attributable to the Commercial and Industrial Non-Energy Impact Study filed with the Compact's 2013-2015 Three-Year Plan, D.P.U. 12-107 (2013-2015 Three-Year Plan, Appendix P, Study 12), which revised program non-energy impact factors resulting in increased lifetime non-electric benefits.

The Compact regularly reviews best available information to adjust strategies in order to achieve energy efficiency goals. With respect to the 2012 program performance information, the Compact incorporated the best available information into its 2013-2015 Three-Year Plan. With respect to the results of EM&V studies that were completed for the 2012 Annual Report, the Compact will review those results and make any necessary adjustments to ensure it remains on track to achieve its goals for 2013 through 2015. The Compact will continue to monitor program performance to determine if any evaluation is significant enough to trigger a modification under the new MTM guidelines established in D.P.U. 11-120-A, Phase II (January 31, 2013).

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 300 kW.

Definition of Program Participant: A program participant is defined as one representative number (account number, location ID, or meter, as determined by each PA) for each location/campus, by year, by program. A participant is an individual customer that used less than 300 kW and has received turnkey retrofit services and incentive dollars through the C&I Small Retrofit program at the same location during the program year. One customer may undertake multiple program projects at that same location during the program year, but will still be counted as a single participant within the program.

Beginning in 2013, the Program Administrators will use consistent participant definitions, as set forth in Appendix M to the 2013-2015 Three-Year Plan in D.P.U. 12-100 through 12-111.

Targeted End Uses:

- Lighting
- HVAC

- Hot Water
- Motors and 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 Cape Light Compact's 2012 plan was approved as part of its 2010-2012 Three-Year Plan (D.P.U. 09-119, January 28, 2010). Subsequently, the Cape Light Compact has filed updates to its three-year plan adjusting certain of its programs and pilots. These updates are referred to as the 2010 Mid-Year Revisions (D.P.U. 10-106, January 10, 2011); 2011 Mid-Term Modifications (D.P.U. 10-147, pending) and 2012 Mid-Term Modifications (D.P.U. 11-116, pending).

All Fuels Comprehensive Retrofit Program (Cape Light Compact-specific Component of the C&I Small Retrofit Program)

In 2010, the Compact expanded its C&I Small Retrofit program to include cost-effective thermal measures designed to save oil, propane, and other unregulated fuels. These cost-effective measures mirrored those technologies identified as gas measures including, but not limited to: programmable thermostats, pre-rinse spray valves, pipe insulation, insulation, air sealing, EMS, hood controls, and other custom measures, as deemed appropriate. In 2011 and 2012, the Compact continued with its all fuels approach for this program.

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

Table II.C.6

C&I Small Retrofit							
Performance Category	Units	Planned Value	Preliminary Year-End Results		Evaluated Results		
			Value	% Change from Planned	Value	% Change from Preliminary	% Change from Planned
Expenses							
Total Program Costs	$	$ 4,570,401			$ 3,681,516		-19%
Performance Incentive	$	$ -			$ -		
Participants	sites	426			442		4%
Program Cost / Participant	$	$ 10,729			$ 8,329		-22%
Savings and Benefits							
Energy							
Lifetime	MWh	91,401	62,583	-32%	58,188	-7%	-36%
Annualized	MWh	6,985	5,234	-25%	4,835	-8%	-31%
Average Measure Life	Yrs	13	12	-9%	12	1%	-8%
Demand							
Lifetime	kW	22,706	16,915	-26%	15,499	-8%	-32%
Annualized							
Summer	kW	1,746	1,406	-20%	1,263	-10%	-28%
Winter	kW	708	769	9%	826	7%	17%
Average Measure Life	Yrs	13	12	-7%	12	2%	-6%
Non-Electric Benefits (Lifetime)	$	$ (705,146)	$ 2,328,434	430%	$ 2,722,962	17%	486%
Cost-Effectiveness							
TRC Benefits	$	$ 12,332,931			$ 12,234,773		-1%
TRC Costs	$	$ 4,731,676			$ 4,434,988		-6%
Net Benefits	$	$ 7,601,255			$ 7,799,785		3%
BCR		2.6			2.8		6%

In 2012, C&I Small Retrofit program spending, participation, and cost per participant were all much closer to plan than for the prior two years of the three-year plan. While the number of program participants exceeded the plan number, spending per participant was still sufficiently low enough to prevent the full budget from being expended. A key driver of this variance in spending per participant was the fact that government projects comprised a much smaller proportion of program participants and program spending than planned. Since the Compact pays a higher incentive for government projects, a significantly lower than expected proportion of government projects reduced per participant incentives from planned levels.

A change in measure mix in 2012 to more HVAC and envelope measures than planned (22 percent of program incentives as compared to 6 percent of plan) yielded lower than expected energy and demand savings, since these measures have higher acquisition costs per kWh. Lifetime energy and demand savings saw an even greater reduction from plan because of a decrease in overall measure life for the program year from 13 years to 12 years, resulting from this year's measure mix. In contrast, non-electric benefits were again significantly higher than plan, with an increase of over 400 percent. In 2012, this is due largely to other fuel savings from HVAC, envelope, and water heating measures, as well as unanticipated operation and maintenance savings from CFL lighting.

Overall, the program saw small changes to TRC benefits and TRC costs from plan, resulting in a stable, cost-effective BCR for 2012.

The EM&V studies included in the 2012 Annual Report that apply to this program are as follows:

- *Massachusetts Small Business Direct Install: 2010-2012 Impact Evaluations:* This report produced lighting fixture and lighting control measure realization rates for annual kWh and summer and winter peak kW, as well as on-peak coincidence factors. The net effect of these evaluations decreased energy and demand savings for these measures. The full report is discussed in Section III, Study 12.

- *C&I Customer Profile Project:* This study characterizes the Massachusetts energy efficiency market by analyzing recent customer usage and program participation data. The study relied on comprehensive billing and tracking data for all C&I customers to estimate the extent to which customers of various sizes and types participated in energy efficiency programs in 2011. The results of this study did not impact the 2012 evaluated results. The study is discussed in more detail in Section III, Study 17.

- *Mid-Sized Customer Needs Assessment - Interim Results:* This study is investigating the extent to which current program offerings effectively serve the needs of mid-sized customers by conducting interviews with PAs and implementation contractors and analyzing available customer billing and tracking data to examine differences in participation rates across customer size groups. The interim results of this study do not impact the 2012 evaluated results. The study is discussed in more detail in Section III, Study 18.

The variances from preliminary to evaluated results are also attributable to the Commercial and Industrial Non-Energy Impact Study filed with the Compact's 2013-2015 Three-Year Plan, D.P.U. 12-107 (2013-2015 Three-Year Plan, Appendix P, Study 12), which revised program non-energy impact factors resulting in increased lifetime non-electric benefits.

The Compact regularly reviews best available information to adjust strategies in order to achieve energy efficiency goals. With respect to the 2012 program performance information, the Compact incorporated the best available information into its 2013-2015 Three-Year Plan. With respect to the results of EM&V studies that were completed for the 2012 Annual Report, the Compact will review those results and make any necessary adjustments to ensure it remains on track to achieve its goals for 2013 through 2015. The Compact will continue to monitor program performance to determine if any evaluation is significant enough to trigger a modification under the new MTM guidelines established in D.P.U. 11-120-A, Phase II (January 31, 2013).

III. EVALUATION MEASUREMENT AND VERIFICATION ACTIVITIES

A. Summary

The purpose of this section is to provide detailed information on the EM&V studies included in the 2012 Annual Report for each sector.

The Massachusetts Program Administrators completed 25 evaluation studies for the 2012 Annual Report. The studies that had the most significant influence on the final evaluated data for electric Program Administrators were the:

- C&I Customer Profile Project study
- HES Realization Rate Results evaluation
- 2012 Residential Heating, Water Heating and Cooling Equipment Evaluation: Net-to-Gross, Market Effects, and Equipment Replacement Timing study
- Massachusetts ENERGY STAR® Lighting Program: Early Impacts of EISA study
- Process Evaluation of the 2012 Bright Opportunities Program

The C&I Customer Profile Project sought to characterize the Massachusetts energy efficiency market by looking at past customer participation, billing data, and customer usage. Overall, the study found the vast majority of savings in 2011 came from custom projects in the custom end use, which supports a continuation of impact evaluation work to verify these savings. In addition, the study made several other key observations. One, there is an indication of opportunity for more savings in some customer sectors, for example in the healthcare sector, where the percent of participating customers is low (1.8 percent of electric and 3 percent of gas) while the savings achieved by participating customers is higher than average. However, while the study identified areas which appear to represent opportunity, it did not seek to answer why participation was low in the sectors. Two, participation rates appeared to increase as account size increased for both gas and electric, reflecting the individualized attention paid to these customers by PA account managers. However, the average savings percent was found to be highest for small gas and electric customers. Finally, the participation rate for gas customers with the same electric PA was found to be 2.6 percent, which was higher than the 1.6 percent participation rate for those with different electric PAs. Additional information on this process evaluation is discussed in more detail in Appendix C, Study 17.

The HES Realization Rate study is a supplemental evaluation following up on the larger 2011 HES Impact Study, which was completed in 2012. This evaluation was needed to provide specific PA realization rates and account for improvements in some vendor software. The HES Realization Rate study targeted two measures: insulation and air sealing. As background, the savings for these measures are provided by the vendor, who utilizes proprietary software to calculate savings based on the existing conditions compared to the upgraded conditions. The study compared the vendor-calculated savings with calibrated engineering models developed by

the evaluation team in order to calculate realization rates. The study results showed overall higher savings and higher realization rates when compared with the 2011 impact study. This is due in part to increased adoption of recommended weatherization measures by study participants. This study is discussed in more detail in Appendix C, Study 3.

The 2012 Residential Heating, Water Heating and Cooling Equipment Evaluation: Net-to-Gross, Market Effects, and Equipment Replacement Timing Study sought to determine net-to-gross ratios and early replacement timing for measures in the Residential Heating and Water Heating and COOL Smart programs. The results indicated that the NTG ratios are slightly higher than previously estimated for many measures. Further, the Net Market Effects analyses and data show evidence that the primary cause of improved NTG ratios is the strong equipment rebate levels that moved the market towards higher tiered efficiency. The study also examined if the program incentives are causing the early replacement of existing equipment prior to failure, thus taking inefficient equipment offline before the end of its useful life. While the study showed program-induced early replacement occurring, the levels of such early replacement were not aligned with the non-energy impacts assigned to various measures. Overall, this resulted in a modest increase in savings from early replacement, but a sharp decrease in NEIs associated with several measures. This study is discussed in more detail in Appendix C, Study 2. The NEI application is discussed in more detail in Appendix C, Study 25.

The electric PAs conducted a process evaluation of the 2012 Bright Opportunities Program, which is a C&I Upstream Lighting Initiative. The preponderance of the evidence indicates that the Bright Opportunities Program is a well-designed and well-run program. The study showed generally high program satisfaction levels from end users and participating trade allies, lack of barriers to program participation, generally high program net-to-gross ratios, and also lack of significant complaints from program implementers. Interim gross impact evaluation results suggest that gross savings are being forecasted accurately. Additional information on this process evaluation and the updated NTG values are discussed in more detail in Appendix C, Study 16.

The Massachusetts ENERGY STAR® Lighting Program: Early Impacts of EISA Study sought to synthesize the results from the four lighting evaluation tasks reported separately (consumer survey, onsite saturation, shelf-stocking survey, and supplier interviews) as well as to highlight the effects of the first full year of implementation of the increased lighting efficiency standards mandated by the EISA on the Massachusetts residential lighting market. Through consumer and supplier surveys, the study found that consumers and suppliers report an increased availability of CFLs and LEDs on store shelves, and a decreased availability of filament incandescent bulbs. The various results did not provide full clarity on how EISA has changed the availability of A-line halogen incandescent bulbs, but the study speculates that most likely the availability increased in 2012. Another interesting finding of the study was regarding 100-watt incandescent bulbs. Even though their manufacture and import was banned in January 2012, a dwindling but still sizable number of these bulbs remained on store shelves throughout 2012, well after their EISA phase out. Finally, the 60 Watt incandescent bulbs fill 22 percent of all sockets in Massachusetts homes, making it the most popular bulb in homes. Therefore, the full impact of EISA on the lighting market—including on consumer lighting purchases and stockpiling

behavior—will not be understood until after the January 2014 phase-out of this bulb. This study is discussed in more detail in Appendix C, Study 8.

Table III.A summarizes the EM&V studies that have not been included in previous Annual Reports. Please note: studies 19, 20, and 21 apply to gas energy efficiency programs only and are, therefore, not included in the table below.

Table III.A

Evaluation Studies in Annual Report			
Studies	Location of Complete Study in Report	Docket and Exhibit Approving Planned Evaluation Studies	Implemented as Approved? (Y / N)
Residential Program Studies			
MA RNC Program Incremental Cost Report	App. C, Study 1	Study was approved in January 2013 with the 2013-2015 Three-Year Plan, D.P.U. 12-100 through D.P.U. 12-111	All Studies are implemented as planned
2012 Residential Heating, Water Heating and Cooling Equipment Evaluation: Net-to-Gross, Market Effects, and Equipment Replacement Timing	App. C, Study 2	Study was approved in January 2013 with the 2013-2015 Three-Year Plan, D.P.U. 12-100 through D.P.U. 12-111	
HES Realization Rate Results Memo	App. C, Study 3	Study was approved in January 2013 with the 2013-2015 Three-Year Plan, D.P.U. 12-100 through D.P.U. 12-111	
Massachusetts Consumer Survey Results Winter-2012	App. C, Study 4	Study was approved in January 2013 with the 2013-2015 Three-Year Plan, D.P.U. 12-100 through D.P.U. 12-111	
Residential Lighting Shelf Survey and Pricing Analysis	App. C, Study 5	Study was approved in January 2013 with the 2013-2015 Three-Year Plan, D.P.U. 12-100 through D.P.U. 12-111	
Lighting Retailer, Supplier Perspectives on the Massachusetts ENERGY STAR Lighting Program	App. C, Study 6	Study was approved in January 2013 with the 2013-2015 Three-Year Plan, D.P.U. 12-100 through D.P.U. 12-111	
Results of the Massachusetts Onsite Lighting Inventory	App. C, Study 7	Study was approved in January 2013 with the 2013-2015 Three-Year Plan, D.P.U. 12-100 through D.P.U. 12-111	
Massachusetts ENERGY STAR® Lighting Program: Early Impacts of EISA	App. C, Study 8	Study not submitted for approval	
Residential Pilot Studies			
2012 Home Energy Services Pre-Weatherization Initiative Evaluation	App. C, Study 9	Study was approved in January 2013 with the 2013-2015 Three-Year Plan, D.P.U. 12-100 through D.P.U. 12-111	All Studies are implemented as planned
Residential Lighting Controls Initiative Evaluation	App. C, Study 10	Study was approved in January 2013 with the 2013-2015 Three-Year Plan, D.P.U. 12-100 through D.P.U. 12-111	
Low-Income Program Studies			
Status of Ongoing Low Income Lighting and Heating Metering Study	App. C, Study 11	Study was approved in January 2013 with the 2013-2015 Three-Year Plan, D.P.U. 12-100 through D.P.U. 12-111	All Studies are implemented as planned

Table III.A

Evaluation Studies in Annual Report (continued)			
Studies	Location of Complete Study in Report	Docket and Exhibit Approving Planned Evaluation Studies	Implemented as Approved? (Y / N)
Commercial & Industrial Program Studies			
Massachusetts Small Business Direct Install: 2010-2012 Impact Evaluations	App. C, Study 12	Study was approved in January 2013 with the 2013-2015 Three-Year Plan, D.P.U. 12-100 through D.P.U. 12-111	All Studies are implemented as planned
Impact Evaluation of 2011-2012 Prescriptive VSDs	App. C, Study 13	Study was approved in January 2013 with the 2013-2015 Three-Year Plan, D.P.U. 12-100 through D.P.U. 12-111	
Impact Evaluation of 2010 Prescriptive Lighting Installations	App. C, Study 14	Study was approved in January 2013 with the 2013-2015 Three-Year Plan, D.P.U. 12-100 through D.P.U. 12-111	
Impact Evaluation of 2011 Custom Refrigeration, Motor and Other Installations	App. C, Study 15	Study was approved in January 2013 with the 2013-2015 Three-Year Plan, D.P.U. 12-100 through D.P.U. 12-111	
Process Evaluation of the 2012 Bright Opportunities Program	App. C, Study 16	Study was approved in January 2013 with the 2013-2015 Three-Year Plan, D.P.U. 12-100 through D.P.U. 12-111	
Customer Profile Project	App. C, Study 17	Study was approved in January 2013 with the 2013-2015 Three-Year Plan, D.P.U. 12-100 through D.P.U. 12-111	
Mid-Sized Customer Needs Assessment - Interim Results	App. C, Study 18	Study was approved in January 2013 with the 2013-2015 Three-Year Plan, D.P.U. 12-100 through D.P.U. 12-111	
Special & Cross Sector Studies			
Massachusetts Cross-Cutting Behavioral Program Evaluation Integrated Report	App. C, Study 22	Study was approved in January 2013 with the 2013-2015 Three-Year Plan, D.P.U. 12-100 through D.P.U. 12-111	All Studies are implemented as planned
2012 Massachusetts Statewide Marketing Campaign Evaluation Report	App. C, Study 23	Study was approved in January 2013 with the 2013-2015 Three-Year Plan, D.P.U. 12-100 through D.P.U. 12-111	
2013 Massachusetts Statewide Marketing Campaign: Pre-Campaign Snapshot	App. C, Study 24	Study was approved in January 2013 with the 2013-2015 Three-Year Plan, D.P.U. 12-100 through D.P.U. 12-111	
Massachusetts Residential Non-Energy Impacts (NEIs): Deemed NEI Values Addressing Differences in NEIs for Heating and Cooling Equipment that is Early Replacement Compared to Replace on Failure	App. C, Study 25	Study not submitted for approval	

B. Residential Program Studies

1. MA RNC Program Incremental Cost Report

Type of Study: Technology Evaluation

Evaluation Conducted by: NMR Group

Date Evaluation Completed: 6/11/2013

Evaluation Objective and High-Level Findings: This report provides estimates of the incremental costs per square foot involved in building high efficiency homes that meet the criteria of the 2013 Residential New Construction & Major Renovation program. Incremental costs above the costs of typical homes being built outside the program are estimated for single family (SF), low-rise multi-family buildings of three or fewer stories (MF 1-3), and mid- to high-rise multi-family buildings of four stories or more (MF 4+) for each of the incentive options offered by the program.

The evaluation provides the following incremental cost per square foot for homes built through the program.

MA RNC Single Family Incremental Costs	Prescriptive		Performance		
	I	II	Tier I	Tier II	Tier III
Single Family Detached	$1.54	$6.39	$1.19	$4.57	$9.33

MA RNC Multi-Family 1-3 story Incremental Costs	Prescriptive		Performance	
	I	II	Tier I	Tier II
Single Family Attached	$1.38	$5.61	$1.03	$1.27
Multi-Family 1-3 No Master Meter	$0.10	$1.50	$0.65	$1.18
Multi-Family 1-3 Master Meter Gas	$0.08	$1.48	$0.79	$1.35
Multi-Family 1-3 Story Overall	$0.60	$3.10	$0.86	$1.29

MA RNC Multi-Family 4+ story Incremental Costs	Residential In-Unit Prescriptive	Whole Bldg Simple Prescriptive	Whole Bldg Interactive Prescriptive
Multi-Family 4+ story	$0.14	$1.21	$1.65

MA RNC Incremental Costs by Sector	Single Family	Multi-Family 1-3 story	Multi-Family 4+ story
Overall Incremental cost/SF	$2.31	$0.95	$1.00

Programs to which the Results of the Study Apply:

- Residential New Construction & Major Renovation (Electric & Gas)

Evaluation Recommendations and Program Administrator Response: No recommendations were offered.

Explain Whether or Not the PA Decided to Adopt Recommendations from the Study: No recommendations were offered.

Savings Impact: The study had no impact on savings.

Formulas Used in Impact Analysis: Historical residential new construction program participant data was used to inform differential pricing estimates and weighting.

Application of Results: Retroactively.

How the Study Came to the Recommended Conclusions: No recommendations were offered.

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

2. 2012 Residential Heating, Water Heating, and Cooling Equipment Evaluation: Net-to-Gross, Market Effects, and Equipment Replacement Timing

Type of Study: Market Assessment, Market Characterization

Evaluation Conducted by: Navigant, ODC, and Cadmus

Date Evaluation Completed: 6/19/2013

Evaluation Objective and High-Level Findings: The objectives of this evaluation were to:

1. Determine free-ridership (FR), spillover (SO), and net-to-gross (NTG) values by program measure,
2. Estimate the net market effects (NME) for each measure, and
3. Estimate the timing of equipment replacement (ER) across early replacement, replace on failure (ROF), and "in-between" categories. There is also a fourth category ("new") which is either a first-time installation of the end use or new construction.

The high-level findings are as follows:

FR, SO, and NTG estimates for COOL Smart and Residential Heating and Water Heating (HEHE) equipment measures are shown in Table III.1. The results indicated that the NTG ratios are slightly higher than previously estimated for many measures. Further, the NME analyses and data provide qualitative evidence supporting this finding, and that the primary cause of improved NTG results is a better alignment of equipment efficiency tiers and associated rebate levels – and appropriate changes over time – to move the market.

Table III.1: Average FR, SO, and NTG Estimates

Measure	FR	SO	NTG
Boilers, AFUE 90-95.9%	0.32		**0.76**
Boilers, AFUE ≥96%	0.31	0.08	**0.77**
Boilers, Overall	0.31		**0.77**
Furnaces, AFUE ≥95%	0.41	0.22	**0.81**
Central Air Conditioners/Heat Pumps, SEER 14.5-14.9	0.35		**0.93**
Central Air Conditioners, SEER ≥16	0.42	0.28	**0.86**
Central Air Conditioners, Overall	0.40		**0.88**
Ductless Mini-Splits	0.45	0.07	**0.62**
Storage Water Heaters, Energy Factor ≥0.67	0.13	0.13	**1.00**
Tankless Water Heaters, Energy Factor ≤0.94	0.37		**0.89**
Tankless Water Heaters, Energy Factor ≥0.95	0.28	0.26	**0.98**
Tankless Water Heaters, Overall	0.32		**0.93**
Integrated Space Heaters/Water Heaters with a Condensing Boiler	0.34	0.08	**0.74**

This study also addressed the Quality Installation Verification components of the COOL Smart Program. Table III.2 provides a summary of the QIV FR, SO, and NTG values as follows:

Table III.2: Quality Installation Verification NTG

Measure	Average FR	Average SO	NTG
Manual J Central Air Conditioners and Heat Pumps	0.38	0.16	0.78
Manual J Heating	NA	0.15	NA
Airflow Testing/Duct Sealing	0.15	0.07	0.92
Refrigerant Testing	0.22	0.24	1.02
Overall QIV	**0.25**	**0.16**	**0.91**

The measures responsible for the majority of savings due to equipment installations in the HEHE and COOL Smart programs are central HVAC systems: natural gas boilers, natural gas furnaces, central air conditioning, and heat pumps. As shown in Table III.3, participants replacing equipment early (4 or more years of remaining life) represent more than 30 percent of boiler and 23 percent of furnace installations, but just 8 percent of central air conditioner and heat pump installations. Early replacement shares among integrated boiler/hot water units, storage water heaters, and tankless water heaters range from 20 to 33 percent. There is virtually no early replacement among ductless mini-split installations. More than 95 percent of these are either first-time cooling installations or are replacing window air conditioners. There are also a significant number of HEHE participants who are neither early nor replace-on-failure (ROF).

These in-between installation estimates range from 15 to 25 percent across all of the program's major equipment measures.

Table III.3. Equipment Replacement Timing in HEHE and COOL Smart Programs

Equipment Replacement Timing Shares				
Measure	**Early**	**New**	**ROF**	**In-Between**
Boiler	30.6%	0.0%	44.9%	24.5%
Furnace	23.1%	0.0%	61.5%	15.4%
Central Air Conditioner / Heat Pump	8.0%	50.4%	29.2%	12.4%
Ductless Mini-Split	2.5%	95.1%	0.0%	2.5%
Integrated Boiler / Water Heater	20.0%	0.0%	55.7%	24.3%
Storage Water Heater	33.3%	0.0%	50.0%	16.7%
Tankless Water Heater	28.0%	0.0%	54.8%	17.2%

Programs to which the Results of the Study Apply:

- Residential Cooling & Heating Equipment (COOL Smart) (Electric)

Evaluation Recommendations and Program Administrator Response: The following recommendations were made by the evaluators conducting this study. The initial response from the PAs to these recommendations is summarized below.

> **Recommendation 1:** The evaluators want to acknowledge the lack of consensus on NTG algorithms, and recommend that the PAs and EEAC develop clear protocols across all residential and non-residential program categories to look at NTG issues more holistically.

Explain Whether or Not the PA Decided to Adopt Recommendations from the Study: 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. The PAs are considering undergoing an initiative in the Cross Cutting Sector to encourage methodological consensus.

Application of Results: Retroactively.

How the Study Came to the Recommended Conclusions: The evaluators estimated measure-specific FR, SO, and NTG via what is commonly referred to as the Self-Report Approach (SRA). The SRA method was also used to estimate the NME and ER estimates. The evaluators relied on surveys with heating, cooling, and water heating distributors and contractors, as well as surveys with program participants.

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

3. Home Energy Services Realization Rate Calibration

Type of Study: Impact Evaluation

Evaluation Conducted by: The Cadmus Group, Inc.

Date Evaluation Completed: 6/28/2013

Evaluation Objective and High-Level Findings: The objective of the evaluation was to develop realization rates (the ratio of *ex ante* and *ex post* savings) that each Program Administrator could use to adjust insulation and air sealing savings, as estimated by the most recent home auditing software employed by each HES implementer, to more closely reflect evaluated savings.

The evaluation yielded the following realization rates by PA (where appropriate and when sufficient data were available) for each of the four assessed heating fuel types.

Natural Gas

PA	n	Model Precision (at 90% confidence)	*Ex Ante*	*Ex Post*	Realization Rate
Berkshire Gas	182	±17%	161	137	0.85
Columbia Gas	294	±10%	209	131	0.63
National Grid	2,889	±4%	188	140	0.74
New England Gas	18	±83%	107	119	1.11
NSTAR	1,344	±5%	165	139	0.84
Unitil	22	±21%	256	175	0.68
Commonwealth-wide	**4,749**	**±3%**	**183**	**139**	**0.76**

Electric

PA	n	*Ex Ante*	*Ex Post*	Realization Rate
Cape Light Compact	101	2,693	1,360	0.51
National Grid	383	2,423	1,459	0.60
NSTAR	124	2,712	1,468	0.54
Commonwealth-wide	**608**	**2,527**	**1,445**	**0.57**

Heating Oil

PA	n	*Ex Ante*	*Ex Post*	Realization Rate
Cape Light Compact	748	16.4	16.4	1.00
National Grid	5,365	18.9	16.7	0.88
NSTAR	4,192	19.8	16.8	0.85
Unitil	128	38.6	13.9	0.36
WMECo	329	34.7	19.0	0.55
Commonwealth-wide	**10,762**	**19.8**	**16.8**	**0.85**

Propane

PA	n	*Ex Ante*	*Ex Post*	Realization Rate
Cape Light Compact	70	14.3	12.2	0.86
National Grid	216	14.3	12.6	0.88
NSTAR	91	14.2	13.5	0.95
Unitil	5	63.2	12.7	0.20
WMECo	10	33.4	14.6	0.44
Commonwealth-wide	**391**	**15.4**	**12.8**	**0.83**

Programs to which the Results of the Study Apply:

- Residential Mass Save/HES (Electric & Gas)

Evaluation Recommendations and Program Administrator Response: No recommendations were offered.

Explain Whether or Not the PA Decided to Adopt Recommendations from the Study: No recommendations were offered.

Savings Impact: The PAs will use the results of this evaluation to retroactively adjust vendor provided *ex ante* savings estimates for insulation and air sealing measures.

Formulas Used in Impact and Process Analysis: The evaluation assessed *ex post* savings for both measures using two approaches: a billing analysis and an engineering analysis. A brief description of each follows:

- ***Billing Analysis.*** The evaluators developed a fixed-effects conditional savings regression model, using paired pre- and post-participation months to estimate savings for insulation and air sealing installed in homes heated by natural gas. The analysis utilized participation records from the High Efficiency Heating and Water Heating, COOL Smart, and Opower programs to ensure it did not misattribute the efficiency measures installed or behavioral changes resulting from those programs to the two HES measures.

- ***Engineering Analysis.*** For homes heated by electricity, heating oil, or propane, the evaluators estimated savings using PA- and fuel-specific U.S. Department of Energy (DOE-2) based simulation models, calibrated using each PA's average observed pre-program energy consumption. The simulation models were updated using detailed measure data and home characteristics recorded by HES implementers, as well as a variety of weather files selected to best represent each PAs service territory.

Application of Results: Retroactively.

How the Study came to the Recommended Conclusions: No recommendations were offered.

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

4. Massachusetts Consumer Survey Results Winter-2012

Type of Study: Market Assessment

Evaluation Conducted by: NMR Group

Date Evaluation Completed: 5/30/2013

Evaluation Objective and High-Level Findings: This consumer survey was performed in December 2012 and January 2013 with the objective of tracking key lighting market indicators and understanding likely and actual consumer responses to the increased lighting efficiency standards mandated by the Energy Independence and Security Act of 2007 (EISA).

Key findings include the following:

> **Conclusion 1:** Customer satisfaction with CFLs remains steady, with roughly one-half of respondents being "very satisfied" with the bulbs, and three out of four being "very or somewhat" satisfied. A persistent concern with CFLs in Winter 2012 relates to their mercury content and disposal issues.

Conclusion 2: The study results show that those households using many CFLs (experts) demonstrated a high level of lighting "savvy" compared to those households using few or none of the bulbs (novices).

Conclusion 3: Consumers seem to like the idea of LED bulbs but remain concerned about the high price point. Consumers seem particularly optimistic about the LED's lack of mercury and better dimming performance compared to CFLs.

Conclusion 4: No bulb stands out as the likely "standard" replacement to the incandescent being phased out by EISA, but consumers tended to prefer a "higher wattage" incandescent for replacement of 75 Watt incandescents over other bulb types.

Conclusion 5: Consumers remain relatively unaware of A-line CFLs.

Conclusion 6: About one-fifth of consumers say they would consider stockpiling bulbs, but only 9 percent admit to stockpiling 100 Watt incandescents in 2012.

Conclusion 7: Consumers are becoming more familiar with the term "lumens" and understand that it means light output or brightness, but they still buy bulbs based on wattage or wattage equivalence.

Programs to which the Results of the Study Apply:

- Residential ENERGY STAR® Lighting (Electric)

Evaluation Recommendations and Program Administrator Response: The following recommendations were made by the evaluators conducting this study. The initial response from the Program Administrator to these recommendations is summarized below.

Recommendation 1: The evaluators suggest continued tracking of CFL satisfaction throughout future consumer surveys in order to see if satisfaction remains stable in the post-EISA period, when CFLs will face serious competition from less efficient screw-in halogen bulbs and very efficient and long-lasting screw-in LED bulbs.

Recommendation 2: Despite evidence that some consumers are having difficulties finding 100 Watt incandescent bulbs on store shelves, one-half of shoppers for these bulbs were able to buy them. Therefore, if they are not already doing so, when developing energy and demand savings assumptions post-EISA, the PAs should consider assuming that the former "baseline" incandescent bulbs will remain available for at least one year and not adjust their delta Watts to account for lower energy use of halogens or other bulb types until after that year.

Explain Whether or Not the PA Decided to Adopt Recommendations from the Study: 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. The PAs will continue to track the lighting market to evaluate the impact of EISA.

Savings Impact: There are no savings impacts.

Formulas Used in Impact Analysis: There are no savings impacts.

Application of Results: Prospectively

How the Study Came to the Recommended Conclusions: The study relied on a telephone survey of randomly selected customers of each Program Administrator in Massachusetts. The evaluators surveyed a total of 600 customers. The study used the Statistical Package for Social Sciences (SPSS) to analyze the data, yielding descriptive statistics to summarize survey responses.

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

5. Residential Lighting Shelf Survey and Pricing Analysis

Type of Study: Market Assessment

Evaluation Conducted by: NMR Group

Date Evaluation Completed: 6/8/2013

Evaluation Objective and High-Level Findings: This evaluation involved the performance of a light bulb shelf-stocking survey and a hedonic pricing regression analysis. The results of the shelf-stocking survey demonstrated that participating stores carry a greater proportion of energy-efficient CFLs and LEDs over incandescent or halogen bulbs. Moreover, the proportion of shelf space devoted to energy-efficient bulbs has increased in partner stores since 2010. Program incentives serve to reduce the price of specialty and standard CFLs by about $1.00 to $2.00, but there is evidence that the program partners are not passing along the full incentive to consumers. The report suggests supplementary approaches to estimating the impact of the program on in-store prices that could be implemented early in the next evaluation cycle.

Programs to which the Results of the Study Apply:

- Residential ENERGY STAR® Lighting (Electric)

Evaluation Recommendations and Program Administrator Response: This study did not offer any recommendations.

Explain Whether or Not the PA Decided to Adopt Recommendations from the Study: This study did not offer any recommendations.

Savings Impact: There are no savings impacts.

Formulas Used in Impact Analysis: There are no savings impacts.

Application of Results: Prospectively.

How the Study Came to the Recommended Conclusions: No recommendations were offered.

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

6. Retailer, Supplier Perspectives on the Massachusetts ENERGY STAR® Lighting Program

Type of Study: Technology Evaluation

Evaluation Conducted by: NMR Group

Date Evaluation Completed: 6/12/2013

Evaluation Objective and High-Level Findings: The objective of this study was to perform in-depth interviews with lighting manufacturers and high-level buyers and to conduct surveys with store managers in order to understand their perceptions of the current impacts of EISA on the lighting market, as well as to explore the perspectives on the growing LED market and program impacts on the lighting market.

Major conclusions of this extensive research effort included the following, but additional important findings can be found in the full report:

- **Impacts of EISA of Bulb Stocking and Sales**: Participating suppliers and store managers generally believed that their stocking and sales of CFLs and LEDs had increased since EISA, while those of incandescent bulbs had decreased. Most also thought that the stocking and sales of halogen bulbs had remained about the same.

- **Stockpiling of Incandescent Bulbs**: The suppliers did not all agree on whether stockpiling was a concern. Only 107 of the 240 store managers thought EISA had changed consumers' bulb purchasing habits and, of these 107, just 22 percent noted stockpiling behavior among these habits. Suppliers who had noted stockpiling argued that both consumers and retailers exhibited the behavior and that it applied more to 60 Watt bulbs than to 75 Watt or 100 Watt.

- **Concerns about Halogen Market Share**: Suppliers believed that the removal of program supports for CFLs and LEDs would increase the likelihood that consumers would choose halogen bulbs instead of CFLs and LEDs to replace incandescent bulbs. They even feared that some consumers may backslide from CFLs and LEDs to halogens, as halogens are being promoted as "energy-efficient."

- **Sales of LED bulbs**: Over one-half of store managers said they sold LEDs bulbs (although some may have sold non-ENERGY STAR® models), with A-line, spot/reflectors, and nightlights being the most commonly sold styles. About one-half of

the managers characterized LED sales as either good or excellent. General purpose bulbs tended to be the best sellers.

- **Barriers to LED sales**: Both stores that currently carry and those that have decided not to carry LEDs cite the high price of the bulbs as the greatest barriers to increased sales. However, they also remained optimistic about future LED sales based on the expectation that prices would continue to fall and the technology would continue to improve.

Programs to which the Results of the Study Apply:

- Residential ENERGY STAR® Lighting (Electric)

Evaluation Recommendations and Program Administrator Response: The study did not offer any recommendations.

Explain Whether or Not the PA Decided to Adopt Recommendations from the Study: The study did not offer any recommendations.

Savings Impact: There are no savings impacts.

Formulas Used in Impact Analysis: There are no savings impacts.

Application of Results: Prospectively.

How the Study Came to the Recommended Conclusions: Although there are no recommendation conclusions, the study relied on ten in-depth interviews with lighting manufacturers and high-level retail buyers, as well as telephone surveys with 240 participating store managers. Interviewees and survey respondents were asked questions about the lighting market, their experience with the program, changing lighting technology, and their estimation of the impacts of EISA.

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

7. Lighting Onsite Inventory and Saturation Study

Type of Study: Technology Evaluation

Evaluation Conducted by: NMR Group

Date Evaluation Completed: 6/7/2013

Evaluation Objective and High-Level Findings: The objective of this study was to perform lighting inventories and estimate socket saturations in Massachusetts homes. The study also examined lighting purchase behavior and searched for evidence of incandescent bulb stockpiling.

The main conclusions of the study are as follows:

- Most households used at least one CFL in 2013, even if some of them were dissatisfied with the products or not even aware they were using CFLs.
- The percentage of sockets filled with CFLs in 2013 was 28 percent, which was statistically similar to the 26 percent observed in 2009. The stagnation in CFL saturation can in part be explained by households replacing burned out CFLs with newly purchased CFLs.
- Saturation of all energy-efficient light bulbs, including CFLs, LEDs, and fluorescent tubes, increased to 39 percent in 2013.
- LED saturation remained low, at 2 percent of the total, but doubled from Spring 2012 to Spring 2013. Most LEDs were the under-the-cabinet type, not A-shaped bulbs.
- About 61 percent of sockets remaining in homes could theoretically be filled with an energy-efficient light bulb; about 57 percent of the remaining potential rests with standard bulbs, while the other 43 percent rests with specialty applications (i.e., dimmable or three-way control or does not have the A-shape).
- Households stored about two CFLs on average in 2013.
- The average onsite household bought about three CFLs in 2012—two of them were standard CFLs and one was a specialty CFL.
- The evaluators found evidence of stockpiling of incandescent bulbs; households stored an average of four incandescent bulbs, particularly 60 Watt bulbs. However, none of the onsite participants tied this behavior to EISA but instead explained that they just like to have extra bulbs on hand.

Programs to which the Results of the Study Apply:

- Residential ENERGY STAR® Lighting (Electric)
- Residential New Construction & Major Renovation (Both)
- Low-Income Residential New Construction (Electric)
- Multi-Family (Both)

Evaluation Recommendations and Program Administrator Response: The following recommendations were made by the evaluators conducting this study. The initial response from the Program Administrator to these recommendations is summarized below.

Recommendation 1: Continue tracking the Massachusetts lighting market through regular consumer surveys, onsite saturation studies, shelf stocking surveys, and supplier interviews.

Recommendation 2: The PAs should perform a net-to-gross study, as one has not been performed since 2010. This study will help to clarify whether current program-supported sales are helping to prevent backsliding to incandescents or incandescent halogen bulbs or whether they represent a high amount of free-ridership.

Explain Whether or Not the PA Decided to Adopt Recommendations from the Study: 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.

The PAs will continue to track the lighting market to evaluate the impact of EISA. The PAs will also continue to work within the EMC to determine the correct timing to conduct a NTG study on the evolving lighting market.

Savings Impact: The report estimated the number of bulbs in indoor fixtures for all bulb types to be 1.49.

Formulas Used in Impact Analysis: There are no savings impacts, but PAs will update the assumed number of bulbs for indoor fixtures to be 1.49.

Application of Results: Retroactively.

How the Study Came to the Recommended Conclusions: The study involved performing onsite visits to 150 homes in Massachusetts. Trained technicians took detailed notes about all lighting sockets and light bulbs found in the home, including bulbs found in storage. Households also provided information on when and where they purchased bulbs, why they stored bulbs, and the intended use of bulbs found in storage. The evaluators analyzed the data in Excel spreadsheets and in the Statistical Package for Social Sciences (SPSS) to arrive at the study conclusions.

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

8. Massachusetts ENERGY STAR® Lighting Program: Early Impacts of EISA

Type of Study: Technology Evaluation

Evaluation Conducted by: NMR Group

Date Evaluation Completed: 6/12/2013

Evaluation Objective and High-Level Findings: The objective of this study was to identify what the results from the four lighting evaluation tasks reported separately (consumer survey, onsite saturation, shelf-stocking survey, and supplier interviews) tell us about the effects of the first full-year of implementation of the increased lighting efficiency standards mandated by the Energy Independence and Security Act on the Massachusetts residential lighting market. The key conclusions of the study include the following:

- **Awareness of EISA:** Fewer than one-half of consumers were aware of the increased lighting efficiency standards mandated by EISA; about two-third of program participating store managers were aware of EISA.

- **Bulb Availability:** Consumers and suppliers report—and the shelf-stocking survey confirms—an increased availability of CFLs and LEDs on store shelves. At the same time, the availability of filament incandescent bulbs has decreased. The various results did not provide clarity on how EISA has changed the availability of A-line halogen incandescent bulbs, but it is most likely that it has also increased. Even though their manufacture and import was banned in January 2012, a dwindling but still sizable number of 100 Watt incandescent bulbs remained on store shelves throughout 2012.

- **Bulb Purchase Behavior:** The onsite saturation study conducted in early 2013 did not show significant changes in the types of bulbs observed in Massachusetts household when compared to 2012. In general, the consumer survey and the supplier interviews point to increased purchases of CFLs and LEDs, decreased purchases of incandescents, and stable purchases of halogen bulbs.

- **Stockpiling of Incandescents:** The evaluators did not find evidence of widespread stockpiling of incandescent bulbs, but there were indications that some households—and retailers—had engaged in the behavior. The limited stockpiling that is occurring tends to be focused on 60 Watt incandescent bulbs and not on the already phased-out 75 Watt and 100 Watt incandescents.

- **Big Unknown – 60 Watt Incandescent Phase-out:** 60 Watt incandescent bulbs fill 22 percent of all sockets in Massachusetts homes, making this the most popular bulb in use in homes. Hence, we will not be able fully to understand the effect of EISA on the lighting market—including on consumer lighting purchases and stockpiling behavior—until after the January 2014 phase-out of this bulb.

Programs to which the Results of the Study Apply:

- Residential ENERGY STAR® Lighting (Electric)
- Residential New Construction & Major Renovation (Electric)
- Residential Mass Save/HES (Electric)
- Residential Multi-Family Retrofit (Electric)
- Low-Income Residential New Construction (Electric)
- Low-Income 1-4 Family (Electric)
- Low-Income Multi-Family (Electric)

Evaluation Recommendations and Program Administrator Response: The following recommendations were made by the evaluators conducting this study. The initial response from the Program Administrator to these recommendations is summarized below.

These recommendations are in addition to the ones submitted in individual task reports.

> **Recommendation 1:** The PAs should track the lighting markets in select comparison areas with varying levels and models of residential lighting programs.
>
> **Recommendation 2:** The PAs should continue rebates for standard CFLs and LEDs at least through 2015 (one year after 40 and 60 Watt incandescent phase-out) in order to keep more energy-efficient bulbs on shelves and prevent backsliding of the market to halogen incandescents.
>
> **Recommendation 3:** The PAs should continue efforts to educate consumers about new lighting terminology such as lumens and light temperature, how to select the best bulb, and the variety of highly energy-efficient light bulbs available to meet residential lighting needs.

Explain Whether or Not the PA Decided to Adopt Recommendations from the Study: 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.

However, the PAs have committed to increase education efforts to improve consumer education, as stated in their approved three-year plan.

Savings Impact: There are no savings impacts.

Formulas Used in Impact Analysis: There are no savings impacts.

Application of Results: Prospectively.

How the Study Came to the Recommended Conclusions: The evaluators performed telephone surveys, in-home onsite lighting inventories, in-store shelf-stocking studies, and in-depth interviews and surveys with suppliers to arrive at these conclusions. More detail on each of these methods can be found in their individual report templates.

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

9. 2012 Home Energy Services Pre-Weatherization Initiative Evaluation

Type of Study: Process Evaluation

Evaluation Conducted by: The Cadmus Group, Inc.

Date Evaluation Completed: 4/19/2013

Evaluation Objective and High-Level Findings: The objective of the evaluation was to assess the impact of initiative additional incentives on customer's decision to overcome pre-weatherization barriers (which then made them eligible to install certain recommended HES measures). The initiative targeted three common, low-cost pre-weatherization barriers: evidence of knob and tube wiring, general combustion safety, and improper dryer venting. The evaluation also assessed the delivery of the initiative itself. Key conclusions included:

Conclusion 1: The initiative data did not show a significant change in the measure adoption rate for National Grid and NSTAR customers who faced the knob and tube wiring barrier. Although these findings suggest that the initiative may not have influenced the measure adoption rate, it is important to remember that the provided data only represent a subset of HES customers, and the evaluators' analysis was limited to two PAs and only one barrier.

Conclusion 2: While the turnkey option offers customers easy access to approved contractors, the PAs and lead vendors that offered the turnkey option were uncertain of the delivery option's long-term viability. These PAs and lead vendors cited difficulties identifying and enrolling contractors given the limited financial opportunities for these contractors. In other words, the level of work for contractors generated by the initiative (to inspect knob and tube wiring and clear other pre-weatherization barriers) was not substantial enough to interest and enlist a sufficient number of approved turnkey contractors. PAs and lead vendors also cited the administrative burden, such as managing and updating the list of qualified contractors willing to participate in the program, as a challenge to turnkey viability. Further, according to Phase 2 participant survey respondents, only a small number of participants used this delivery option.

Conclusion 3: Non-participants indicated confusion about what the initiative actually covered for knob and tube wiring. During the survey, even after being told the incentive was only to check the wiring, non-participants still wanted a higher incentive; they were not able to differentiate between the cost of the inspection and the cost of potentially replacing the knob and tube wiring (if live).

Conclusion 4: PA stakeholders and customers that employed a 30-day deadline for initiative enrollment indicated that additional time would have helped. Specifically, survey respondents that were given the 30-day deadline indicated that the timeframe presented a challenge for addressing the initiative barriers (12 percent, n=13). However, an analysis of acceptance rates revealed that customers who were given a 30-day deadline had higher acceptance rates than those offered the 90-day deadline.

Conclusion 5: Interviews with PAs and lead vendors indicate that elements of the initiative's design and delivery varied across PAs. Examples of variation included marketing materials, participant forms, incentive amounts, and the timing of when participants received the rebate for clearing a barrier.

Programs to which the Results of the Study Apply:

- Residential Mass Save/HES (Electric & Gas)

Evaluation Recommendations and Program Administrator Response: The following recommendations were made by the evaluators conducting this study.

> **Recommendation 1:** The evaluators suggest that the PAs should work closely with their lead vendors to determine the long-term viability and effectiveness of the turnkey option.
>
> **Recommendation 2:** The evaluators suggest that the PAs identify ways to better communicate what the cost of checking knob and tube actually covers and how it differs from the cost to actually replace the knob and tube wiring.
>
> **Recommendation 3:** The evaluators suggest that the PAs consider a compromise deadline of 45 or 60 days that keeps some of the benefits of the immediacy of the deadline, but makes it more realistic for customers to meet the deadline.
>
> **Recommendation 4:** While some variation may be necessary, the evaluators suggest that the PAs should discuss these variations, determine best practices, and standardize design and delivery as much as possible across the state.

Explain Whether or Not the PA Decided to Adopt Recommendations from the Study: In an effort to standardize design and delivery, the PAs have adopted a 60 day deadline for acceptance of the incentive. All other recommendations are being considered for adoption at this time. The PAs have not formally adopted or rejected any of the other recommendations that require changes to program design and operations.

Savings Impact: There are no savings impacts.

Formulas Used in Impact and Process Analysis: There are no savings impacts.

Application of Results: Prospectively.

How the Study Came to the Recommended Conclusions: The Pre-Weatherization Initiative evaluation included PA program manager interviews, program vendor staff interviews, 118 participant and nonparticipant customer surveys, and a review of pilot and historical program data. Based on information obtained through these data collection methods, the evaluators used their professional judgment and experience evaluating energy efficiency programs to offer recommendations aimed at improving program processes where appropriate.

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

10. Residential Lighting Controls Initiative Evaluation

Type of Study: Process Evaluation

Evaluation Conducted by: The Cadmus Group, Inc.

Date Evaluation Completed: 6/5/2013

Evaluation Objective and High-Level Findings: This evaluation was performed between August 2012 and May 2013. The objectives of the evaluation were to analyze the energy-saving potential of replacing traditional dimming switches with advanced dimming controls and to investigate the compatibility of those controls with efficient bulb technologies. Key conclusions included:

> **Conclusion 1:** The compatibility of dimming controls and LEDs was an issue. Participants, implementation staff, and program managers all noted difficulties finding working combinations of dimmers and bulbs.
>
> **Conclusion 2:** Survey and metering data revealed that some participants operated their lights more after installation of the new dimmers and bulbs; however, savings still resulted since savings were largely driven by the lamp replacement.
>
> **Conclusion 3:** In order for an impact evaluation of lighting use with dimmer replacements to be successful, it is important to have detailed tracking of implementation activities, including an equipment inventory with product specifications; a time-stamped contact log of all customer interactions; and a dated tracking matrix showing what equipment was replaced or adjusted at each appointment.

Programs to which the Results of the Study Apply:

- N/A (Study results not applied to any program)

Evaluation Recommendations and Program Administrator Response: Due to the inconclusive findings, the evaluation did not include formal recommendations.

Explain Whether or Not the PA Decided to Adopt Recommendations from the Study: There are no recommendations for the PA to adopt.

Savings Impact:

Savings Category	Total Verified Gross Impacts	Average Impact per Site
Demand Impacts	2.11 kW	0.26 kW
Energy Savings	1,987 kWh/yr	248 kWh/yr

Formulas Used in Impact Analysis: A combined approach of field data collection and laboratory testing was used to estimate energy and demand savings.

- **On-site inventory:** Pre- and post-installation information was collected for the fixtures and controls in each participant's room or area of interest.

- **Pre- and post-metering:** Meters were deployed at participant sites prior to the installation of dimmer controls and bulbs. These loggers recorded illuminance levels from the lamps controlled by the dimmers for six to eight weeks before and after measure installation.

- **Lab testing of dimmer controls:** Laboratory testing was used to analyze the relationship between power and illuminance (lumens per square foot) and the dimmer switch settings.

- **Analysis:** The illuminance field data, the laboratory power data, and other supporting information were synthesized to analyze the energy impacts of the initiative. Operating hours for each group of bulbs attached to a lighting control were calculated, both at a gross, on-off level, as well as at each discrete dimmable level. Gross energy savings were calculated by aggregating metered hours of use at each dimmable level with the laboratory-tested energy used at that level. The reported demand impacts are the difference between the pre- and post-install maximum wattage values. Coincident peak demand impacts were not estimated or reported.

Application of Results: Results from the initiative will not be applied because results were inconclusive and because the initiative was not associated with an existing program.

How the Study Came to the Recommended Conclusions: The study included 16 participants who agreed to have their existing dimming controls and bulbs exchanged for new controls and LED bulbs through the initiative. Meters were installed on the affected controls and bulbs for six weeks before and after the installation of new measures. Data collected from these meters were mapped to laboratory testing data that triangulated illuminance, power, and dimmer position for each dimmer/bulb combination. Results from the mapping were used to calculate energy and demand savings.

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

C. Low-Income Program Studies

11. Low Income Hours of Use and Heating Study

Type of Study: Impact Evaluation

Evaluation Conducted by: The Cadmus Group, Inc.

Date Evaluation Completed: 6/28/2013

Evaluation Objective and High-Level Findings: The objective of the study is to assess lighting hours of use (HOU) and the prevalence of secondary heating among low income customers. The study is currently underway and will be completed by September 6, 2013.

While the study is ongoing, the evaluators can offer the following preliminary findings at this time:

- The preliminary low-income-specific HOU of 2.66 is slightly less than the current program assumption of 2.8 hours/day.
- Low-income seniors use their lights less (2.12 hours per day) than low-income non-seniors (2.88).
- Homes with secondary heating sources appear to supplement their primary heating when heating their home. As a result, future evaluations should consider the impact of program measures on both primary and secondary heating.

The following caveats are important to consider given the study's status:

- The study is ongoing and all preliminary findings are subject to change. The evaluators do not anticipate significant changes to the key results presented in this memo, but acknowledge these results may shift slightly following a complete review process.
- The preliminary findings may also change based on agency's bulb installation practices. Discussions to date indicate that some agencies may install efficient lighting in any available sockets, while others may target specific high-use room or fixture types. The agency's collective installation practices have ramifications on the appropriateness of the preliminary HOU of 2.66, which represents average usage across all sockets in low income homes.

Programs to which the Results of the Study Apply:

- Low-Income Residential New Construction (Electric)
- Low-Income 1-4 Family (Electric & Gas)
- Low-Income Multi-Family (Electric & Gas)

Evaluation Recommendations and Program Administrator Response: No recommendations were offered, but the status memo does state that future low income impact evaluations should include secondary heating fuels when estimating total program savings.

Explain Whether or Not the PA Decided to Adopt Recommendations from the Study: The PAs will include secondary heating fuels where appropriate in future low income impact evaluations.

Savings Impact: No savings impacts are offered at this time.

Formulas Used in Impact and Process Analysis: The preliminary study findings are based on analysis of 261 site visits at randomly sampled low-income customer homes across the Commonwealth of Massachusetts.

At each home, trained technicians completed a whole-home lighting inventory and installed up to 10 lighting loggers per home. The technicians also installed a meter that assesses thermostat usage (for both manual and programmable thermostats) and meters that monitored heating equipment. In total, more than 2,000 lighting loggers and 800 meters were installed on heating equipment and collected usage information from November 29, 2012 through May 2, 2013.

The raw data collected through this robust metering process were reviewed, weighted, and annualized to estimate annual usage.

Application of Results: Prospectively.

How the Study Came to the Recommended Conclusions: No formal recommendations were offered.

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

D. Commercial and Industrial Program Studies

12. Massachusetts Small Business Direct Install: 2010-2012 Impact Evaluations

Type of Study: Impact Evaluation

Evaluation Conducted by: The Cadmus Group, Inc. and Navigant

Date Evaluation Completed: 1/29/2013

Evaluation Objective and High-Level Findings: The Cadmus Group and Navigant Consulting prepared this summary evaluation report. This summary evaluation report compares the results of two previously filed impact evaluations with a billing analysis conducted in 2012 for the C&I Small Retrofit program, and recommends the appropriate program impact factors for future years. The objectives from each evaluation were:

Non-Controls Lighting Evaluation for the Massachusetts Small Business Direct Install Program: Multi-Season Study. This study was conducted during 2010-2011 and filed with the 2011 annual report. 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.

The study showed a statewide combined energy realization rate (included HVAC interaction) of 102 percent, combined summer coincidence factor of 72 percent, and combined winter coincidence factor of 44 percent for non-controlled lighting fixture retrofit projects.

Small Business Direct Install Program**:** Pre/Post Lighting Controls Study. This study was conducted during 2011-2012 and filed with the 2013-2015 Three-Year Plan. The impact evaluation was conducted to provide independent estimates of annual energy savings and peak demand impacts for the retrofit installation of lighting control installations through the C&I Small Retrofit programs. The impact evaluation focused on savings due to the installation of lighting controls only and does not include savings due to the retrofit of associate lighting fixtures.

The study showed a statewide combined energy realization rate (included HVAC interaction) of 42 percent, combined summer coincidence factor of 17 percent, and combined winter coincidence factor of 11 percent for retrofit lighting occupancy sensor installations.

Billing Analysis. This study's goal was to assess the overall energy impact of all C&I Small Retrofit program projects, including non-lighting projects, implemented in 2010 and 2011.

The study found a statewide program energy realization rate of 66 percent. However, through internal consultation and further analysis, the evaluators concluded that the result was influenced by exogenous factors for which the study could not control, and that the true realization rate was higher than 66 percent.

The summary report recommended that the program use the evaluation results based on the metering study results: statewide combined energy realization rate for lighting fixtures of 102 percent and statewide combined energy realization rate for lighting controls of 42. For non-lighting measures, it was recommended to maintain existing evaluation results.

Programs to which the Results of the Study Apply:

- C&I Small Retrofit (Electric)

Evaluation Recommendations and Program Administrator Response: The following recommendations were made by the evaluators conducting this study. The initial response from Program Administrators to these recommendations is summarized below.

Note: The recommendations from the Multi-Season study were included in the evaluation summary for that report, filed with the 2011 annual report. This evaluation summary includes only the recommendations from the Pre/Post Lighting Controls Study and the Billing Analysis.

> **Recommendation 1:** Based on the Pre- and Post-Installation Lighting Occupancy Sensor study: The wide-ranging patterns of pre-installation HOU, including some lighting systems that operated less frequently before the controls were installed, were a surprise to the PAs and the evaluators, and were only detected with pre-installation metering. For future evaluations of control-based efficiency measures, the PAs should

continue to perform pre- and post-installation metering studies in order to capture the true impacts.

Recommendation 2: Based on the Billing Analysis: If the PAs are to continue using billing analysis as a method for estimating savings achieved by the SBDI Program, we strongly recommend that more detailed information be collected from program participants, particularly building occupancy and vacancy. If obtaining such data is not feasible, the evaluators recommend that the PAs consider using billing analyses only in cases where it is highly unlikely that any exogenous factors correlate with the implementation of energy conservation measures. In practice, billing analyses would likely only be appropriate in cases where participants are highly homogenous and have consistent patterns of consumption (e.g., all participant buildings are government offices).

Explain Whether or Not the PA Decided to Adopt Recommendations from the Study: 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.

Future evaluations of the types described above may incorporate these recommendations, based on the types of customers being studied, uncertainty around existing equipment and operations, and the additional cost and time necessary to collect more detailed information.

Savings Impact: The evaluation results for lighting fixture installations are similar to previous evaluations, which have consistently verified energy and demand realization rates close to 100 percent. The summer and winter peak coincidence factors were also similar to previous years.

The evaluation results for lighting control installations are much lower than previously estimated, primarily due to findings regarding the pre-retrofit operating hours. However, these results had poor precision due to the variation in the site-level realization rates.

Formulas Used in Impact Analysis: 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:

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.

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.

Application of Results: Retroactively.

How the Study Came to the Recommended Conclusions: The billing analysis was conducted for all projects implemented in 2010 and 2011, using participant tracking and usage data

provided by each PA and performing data screening and analysis methods to estimate the program realization rate for the statewide program, each measure category, and each PA.

During the analysis, the evaluators identified irregularities in the participant billing data and identified potential sources of bias in the results due to omitted variables. The team surmised that the most likely drivers of the unexpectedly low realization rates were (1) changes in economic activity, (2) changes in facility occupancy rates, and/or (3) changes in the program participant and/or project characteristics. The team determined that appropriate data to control for these effects were not available and would be difficult and expensive to research.

The team conducted additional research to explain the results and concluded that there was sufficient rationale to reject the results of the billing analysis. These findings included:

1. Evidence of increases in commercial vacancies in Massachusetts over the past four years, including the program years of interest for the evaluation,
2. Observed correlations between building vacancies and participation in commercial retrofit efficiency programs, based on contemporaneous research performed in California by the Cadmus Group, and
3. Demonstration that the absence of participant-specific details on vacancies (and thus not being able to control for it within the model) results in biased parameter estimates in this study.

Based on these findings and additional discussions with the Program Administrators and EEAC Consultants, the evaluators recommended rejecting the billing analysis results and maintaining the results of the metering studies.

A discussion of these findings and the final recommendation is documented in the memorandum "2012 Billing Analysis Findings and Recommendations," dated October 24, 2012.

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

13. Prescriptive VSD Impact Evaluation

Type of Study: Impact Evaluation

Evaluation Conducted by: DNV KEMA

Date Evaluation Completed: 5/9/2013

Evaluation Objective and High-Level Findings: This report presents the results of the Impact Evaluation of Prescriptive Variable Speed Drives conducted by DNV KEMA and DMI between 2011 and 2012. The objective of this impact evaluation is to begin to quantify how well prescriptive VSD installations are performing and to estimate the energy and demand savings resulting from a sample of 26 VSDs installed in Massachusetts between 2011 and 2012 using

both pre- and post-installation metering. Data collected as part of this evaluation is intended to be used to help inform the savings factors used in future updated TRMs.

Key findings include the following:

- Annual kWh realization rate was 94 percent with a relative precision of +/- 23 percent at the 80 percent confidence interval.
- Failure to install controls or configure manual VSD speeds is the most common reason for a poor realization ratio.
- Automatic controls are required by the prescriptive VSD applications but are infrequently installed.
- VSD installations were observed to replace existing and failed VSDs and received incentives.
- A small number of motor types are miscategorized. For example, a swimming pool circulation pump was categorized as a hot water circulating pump.
- Manually set fixed VSD speeds are common. This results in constant post-retrofit power demand and very high summer demand reduction realization ratios.
- In some cases, comparable energy savings could have been achieved through proper balancing and without a VSD installation. This approach would be less costly and achieve faster payback periods.
- The TRM assumes that hot water pumps will operate during summer months and chilled water pumps operate during winter months. In most cases, these seasonal motor types were shut down and did not operate during the off seasons.
- Summer kW reductions were significantly higher than predicted by the TRM due to the post-retrofit motor operating with manual controls at constant input kW.

Programs to which the Results of the Study Apply:

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

Evaluation Recommendations and Program Administrator Response: The following recommendations were made by the evaluators conducting this study. The initial response from the Program Administrator to these recommendations is summarized below.

> **Recommendation 1:** Many VSDs are installed but never utilized. The motors were observed to operate at 60 Hz after the installation. Post-inspections should be performed to ensure that automatic controls are installed as required by the prescriptive applications.

Recommendation 2: VSD installation dates were found to vary significantly from installation of control sequences. In the majority of installations, the VSD was installed several weeks or months before any type of control sequence was implemented. During this period, VSDs would typically operate at 60 Hz. The standard protocol for this evaluation was to await confirmation of the controls installation rather than encourage the installation by calling for updates. In some cases, DMI installed kW meters for the pre-retrofit condition, but VSDs were never installed. It is recommended that a six-month follow-up is performed before the full incentive is paid so that proper operation can be confirmed.

Recommendation 3: Multiple instances were observed in which the VSD retrofit was replacing an existing drive. In all of these cases, the facility operator reported that the existing drives were failing and had operational issues. It appeared that these failing VSDs were approximately 15 years old or more. The prescriptive VSD application states that incentives are not available to VSDs replacing existing drives. Evaluated savings for two of these installations were found to be small or even zero based on metering data. It is recommended that a pre-inspection is done to identify whether or not an existing VSD is being replaced.

Recommendation 4: In at least one, case energy savings resulted primarily due to proper balancing rather than VSD control of the motor. Prior to the VSD retrofit, a chilled water pump was providing an excess of water to end users and the motor was observed to operate at over 100 percent load. The VSD installation was used to essentially balance the chilled water flow. This resulted in significant energy savings, the majority of which could have been achieved simply through balancing and without installation of a VSD. It is recommended that a pre-inspection be done to identify cases in which a VSD might not be the most economical solution.

Recommendation 5: Even though the energy realization rate of 94 percent was good for a program like this, the individual metered VSD energy realization rates varied from -2 percent to 407 percent. The -2 percent case was the only one that was negative, but 15 drives had a realization rate less than 100 percent. The remaining ten drives had a realization rate greater than 100 percent, and in most cases, they were significantly greater. It is recommended that this realization rate be applied to the TRM energy savings estimates as an immediate step.

Recommendation 6: The PAs and EEAC should also look to improve upon the motor level savings assumptions following the completion of the current Northeast Energy Efficiency Partnerships VSD Load Shape study expected to be completed in late 2013. This study includes post-installation metering on hundreds of drives, which would help to refine the TRM savings assumptions for certain motor, and possibly building types.

Recommendation 7: The TRM claims summer kW reductions for hot water pumps and winter kW reductions for chilled water pumps. In most cases, hot water pumps were observed to be shut down for the summer months and chilled water pumps shut down for winter months. It is not expected that this would apply to all of these motor types, but

based on the sample observed in this evaluation, it appears that the TRM should be adjusted downwards. Currently, it appears that the TRM assumes 100 percent of these motors will operate during their off-seasons. It is recommended that the TRM be reviewed, and appropriate adjustments be made to ensure that demand savings are realistic for certain measure types. Consider near-zero summer kW reduction for hot water pumps and near-zero winter kW reduction for chilled water pumps.

Recommendation 8: Summer On-Peak kW reductions in the TRM are generally very close to zero for motor types not related to heating. This seems to be a reasonable assumption for motors with automatic controls as it would be expected that an appropriately-sized motor would operate near full load on a design day; however, the evaluation observed significantly more motors with manual controls than expected, with the motors operating below full-load input kW. Since the TRM predicts near-zero summer kW reductions, this results in very high realization ratios. It is recommended the PA's examine the TRM summer On-Peak kW reduction values for accuracy.

Recommendation 9: It is not recommended that the realization rates for demand savings from this study are applied to the TRM due to the poor precisions. However, we think that the observations noted above, plus the results of the aforementioned NEEP study, can be used together to improve upon the savings estimates in the TRM.

Explain Whether or Not the PA Decided to Adopt Recommendations from the Study: 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.

Savings Impact: While the overall realization ratio is close to 100 percent, there is a significant variation at the motor level, and many motors are either close to 0 percent or much higher than 100 percent. Overall, the onsite savings were lower than the tracking estimates with a realization rate of 94 percent.

Formulas Used in Impact Analysis: A custom 8,760 hour spreadsheet model was used for each motor metered. Savings were typically developed using time-of-use trends, while very few were developed using outdoor air temperature trends depending on the operation of the motor and VSD.

Application of Results: Retrospectively

How the Study Came to the Recommended Conclusions: This study attempted to obtain pre- and post-installation metering on retrofit VSD installations. The recommended sample size of 44 drives was not achieved due to several issues involved in trying to obtain pre-installation metering. The final sample size was 26 drives. Evaluators conducted pre- and post-metering on each of the 26 drives using true power meters. Savings were developed by comparing the metered pre-installation energy use and the metered post-installation energy use, and annualized in an 8,760 hour spreadsheet model.

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

14. Impact Evaluation of 2010 Prescriptive Lighting Installations

Type of Study: Impact Evaluation

Evaluation Conducted by: DNV KEMA

Date Evaluation Completed: 6/21/2013

Evaluation Objective and High-Level Findings: This document summarizes the work performed by DNV KEMA between 2011 and 2013 to quantify the actual energy and demand savings of 56 prescriptive lighting projects installed through the PAs' C&I New Construction and Major Renovation and C&I Large Retrofit programs in 2010. Note that this document presents the final results following 12 months of metering for the four prescriptive lighting categories of interest, systems, controls, Advanced Lighting Design, and refrigerated LED case lighting.

The final study results, produced following 12 months of monitoring, will be used to determine the final realization rates for prescriptive lighting energy efficiency projects installed in the C&I New Construction and Major Renovation and C&I Large Retrofit programs in 2012. This report presents realization rates for gross energy savings and savings factors at the statewide level using 12 months of metered data collected from each site. These savings factors should be applied to future Technical Reference Manual (TRM) updates. Key findings include the following:

- Lighting systems energy kWh realization rate including HVAC interactive effects was 112.3 percent with a relative precision of +/-7.9 percent at the 90 percent confidence interval.
- Lighting controls energy kWh realization rate including HVAC interactive effects was 72.0 percent with a relative precision of +/-23.2 percent at the 90 percent confidence interval.
- Advanced Lighting Design energy kWh realization rate including HVAC interactive effects was 124.6 percent with a relative precision of +/-7.6 percent at the 90 percent confidence interval.
- Refrigerated LED case lighting systems energy kWh realization rate including HVAC interactive effects was 94.3 percent with a relative precision of +/-6.3 percent at the 90 percent confidence interval.
- A comparison of 3-month metering interim results vs. 12-month metering results showed that energy savings were generally overestimated in the 3-month analysis. The comparison analysis also found that the most representative 3-month metering period occurred between September and November.

Programs to which the Results of the Study Apply:

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

Evaluation Recommendations and Program Administrator Response: The following recommendations were made by the evaluators conducting this study. The initial response from the Program Administrator to these recommendations is summarized below.

General Lighting:

Recommendation 1: For future lighting impact evaluations, three-month data collection should be sufficient to estimate annual energy savings. It is recommended that the PAs consider monitoring for a minimum of three months. Also consider including a winter or summer month in that period if possible.

Lighting Systems:

Recommendation 2: It is recommended that the lighting systems component of the TRM be updated to reflect these new results.

Recommendation 3: It is recommended that the PAs continue to use site specific data when estimating lighting hours of use.

Lighting Controls:

Recommendation 4: Depending on the outcome of the current lighting controls market study, a pre/post-metering lighting controls study may be needed in the future.

Recommendation 5: To help implementation and TA vendors and produce more reliable estimates of hours reduced, it is recommended that the PAs consider requiring pre-installation metering to establish an estimate of baseline hours.

Recommendation 6: Until a new pre/post-lighting controls impact evaluation is done, it is recommended that the lighting controls component of the TRM be updated to reflect these new results.

Advanced Lighting Design:

Recommendation 7: It is recommended that for all Advanced Lighting Design projects, the PAs try to collect the final lighting as-built, which would be used to adjust the proposed connected kW savings.

Recommendation 8: It is recommended that the PAs and EEAC consider updating the TRM using these realization rates and savings factors.

Refrigerated LED Case Lighting:

Recommendation 9: This report recommends that the TRM be updated to utilize a refrigeration system efficiency of 1.9 kW/Ton. This value is based on a larger proportion of lower temperature freezer cases than cooler cases found in these applications.

Recommendation 10: It is recommended that in all future freezer/cooler case LED lighting applications, lighting controls be considered.

Explain Whether or Not the PA Decided to Adopt Recommendations from the Study: 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.

Savings Impact: Results from this study will be applied to the gross energy and demand savings to produce net energy and demand savings adjusted for actual conditions found in the field, such as technology, documentation, quantity, operation, interactive HVAC effects, and coincidence with system the peak.

Formulas Used in Impact Analysis:

Summer Coincidence Factor = Summer Coincidence * Summer kW HVAC Interactive Effect Factor

Gross Adjusted Summer kW = Gross kW * Connected kW Realization Rate * Summer Coincidence Factor

Winter Coincidence Factor = Winter Coincidence * Winter kW HVAC Interactive Effect Factor

Gross Adjusted Winter kW = Gross kW * Connected kW Realization Rate * Winter Coincidence Factor

kWh Realization Rate = Connected kWh Realization Rate * Hours-of-Use Realization Rate * kWh HVAC Interactive Effect Factor

Gross Adjusted kWh = Gross kWh * kWh Realization Rate

Application of Results: Retrospectively

How the Study Came to the Recommended Conclusions: Data collection included 12 months of metering using mostly time-of-use lighting loggers. The sample was designed to achieve 90/10 percent precision for energy savings for each measure. The sample sizes were 34 lighting systems, 26 lighting controls, and 10 advanced lighting design and 10 refrigerated LED lighting sites.

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

15. Impact Evaluation of 2011 Custom Refrigeration, Motor and Other Installations

Type of Study: Impact Evaluation

Evaluation Conducted by: DNV KEMA

Date Evaluation Completed: 6/18/2013

Evaluation Objective and High-Level Findings: This document summarizes the work performed by DNV KEMA, DMI, and SBW Consulting during 2012 and 2013 to quantify the actual energy and demand savings due to the installation of 48 custom refrigeration, motor, and other (RMO) measures installed through the PAs' C&I New Construction and Major Renovation and C&I Large Retrofit programs in 2011.

The objective of this impact evaluation is to provide verification or re-estimation of electric energy and demand savings estimates for 48 custom RMO projects installed in 2011 through site-specific inspection, monitoring, and analysis. The results of this study will be used to determine the final realization rates to be applied to custom RMO energy efficiency measures installed in the C&I New Construction and Major Renovation and C&I Large Retrofit programs in 2012. This evaluation report presents realization rates for gross energy savings for all PAs. It also provides realization rates for on-peak summer and winter demand savings for all PAs except for Western Massachusetts Electric (WMECo). For WMECo, realization rates for summer and winter seasonal peak savings are provided. For National Grid, realization rates for percent on-peak energy savings are also provided. Realization rates for each of these parameters are also provided at the statewide level.

Key findings include the following:

Custom Refrigeration:

Statewide energy kWh realization rate of 110.5 percent with a relative precision of +/-12.2 percent at 90 percent confidence.

National Grid energy kWh realization rate of 118.8 percent with a relative precision of +/-17.7 percent at 90 percent confidence.

NSTAR energy kWh realization rate of 112.7 percent with a relative precision of +/-5.7 percent at 90 percent confidence.

Cape Light Compact energy kWh realization rate of 75.0 percent with a relative precision of +/-73.2 percent at 90 percent confidence.

WMECo energy kWh realization rate of 65.8 percent with a relative precision of +/-18.3 percent at 90 percent confidence.

Custom Motor:

Statewide energy kWh realization rate of 91.4 percent with a relative precision of +/-3.7 percent at 90 percent confidence.

National Grid energy kWh realization rate of 88.5 percent with a relative precision of +/-4.8 percent at 90 percent confidence.

NSTAR energy kWh realization rate of 134.2 percent with a relative precision of +/-0.0 percent at 90 percent confidence.

WMECo energy kWh realization rate of 77.7 percent with a relative precision of +/-0.0 percent at 90 percent confidence.

Custom Other:

Statewide energy kWh realization rate of 61.4 percent with a relative precision of +/-1.9 percent at 90 percent confidence.

National Grid energy kWh realization rate of 31.0 percent with a relative precision of +/-4.3 percent at 90 percent confidence.

WMECo energy kWh realization rate of 270.7 percent with a relative precision of +/-0.0 percent at 90 percent confidence.

Programs to which the Results of the Study Apply:

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

Evaluation Recommendations and Program Administrator Response: The following recommendations were made by the evaluators conducting this study. The initial response from the Program Administrator to these recommendations is summarized below.

Statewide:

Recommendation 1: Make sure customers and TA vendors understand they need to be prepared to provide assistance if their project is selected for evaluation.

Recommendation 2: Ensure sufficient time is allowed for logging data for projects with seasonal variability.

Recommendation 3: All PAs should require more complete pre-retrofit or baseline documentation.

Recommendation 4: PAs should work together to require consistent methodologies and documentation for similar projects across different PAs.

Recommendation 5: Consider specifying documentation requirements for compressed air leak repairs.

Recommendation 6: Consider more of a whole system approach for grouping measures for evaluation.

Recommendation 7: Require TA vendors to provide metering for retrofit projects.

Recommendation 8: Consider specifying TA verification of savings via commissioning, and in some cases, pre/post-metering for specific measures.

Cape Light Compact:

Recommendation 9: Perform closer review of large savings measures.

Recommendation 10: Include interactive refrigeration savings.

National Grid:

Recommendation 11: Require adequate savings documentation.

Recommendation 12: Verify proposed load assumptions as part of the final inspection of new construction projects.

Recommendation 13: Verify proposed item count assumptions as part of the final inspection.

Recommendation 14: Verify plant operating hours using whole building interval data.

Recommendation 15: Ensure consistent use of data throughout the calculations.

NSTAR:

Recommendation 16: Provide sufficient documentation for understanding the determination of measure savings.

Explain Whether or Not the PA Decided to Adopt Recommendations from the Study: 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.

Savings Impact: Custom refrigeration savings were generally greater than tracking assumptions with a statewide realization rate of 110.5 percent. Custom motor savings were somewhat lower than tracking estimates with a statewide realization rate of 91.4 percent. Custom other had a low realization rate of 61.4 percent due to some underperforming sampled sites.

Formulas Used in Impact Analysis: Evaluated savings were developed using custom analysis methods which were similar to the methods to develop tracking estimates.

Application of Results: Retrospectively

How the Study Came to the Recommended Conclusions: Data collection included true power metering, amperage metering and time-of-use metering. In some cases, the evaluation relied on existing customer metering when necessary. The sample was designed to achieve 90/20 percent precision for energy savings for each measure and each PA. The sample sizes were 28 refrigeration sites, 13 motor sites, and 7 other sites.

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

16. Process Evaluation of the 2012 Bright Opportunities Program

Type of Study: Process Evaluation

Evaluation Conducted by: DNV KEMA

Date Evaluation Completed: 6/14/2013

Evaluation Objective and High-Level Findings: The evaluation objectives included:

- Determining whether this program, which is brand-new, is appropriately designed;
- Determining whether the program is being delivered in an efficient/effective manner;
- Providing estimates of net-to-gross ratios for the program net of free-ridership; and
- Providing preliminary estimates of participant spillover for the program.

The high-level findings included:

- The preponderance of the evidence indicates that the Bright Opportunities Program is a well-designed and well-run program. This evidence includes:
    - Generally high program satisfaction levels from end users and participating trade allies;
    - Lack of barriers to program participation (beyond unawareness of the program);
    - Generally high program net-to-gross ratios; and
    - Lack of significant complaints from program implementers.
- The recommended net-to-gross ratios for the lighting products discounted by the program were 82 percent for LED bulbs and 74 percent for linear fluorescent lamps. The evaluation calculated the participant spillover to be not statistically different from zero.

Programs to which the Results of the Study Apply:

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

Evaluation Recommendations and Program Administrator Response: The following recommendations were made by the evaluators conducting this study. The initial response from the Program Administrator to these recommendations is summarized below.

Recommendation 1: Do more marketing of the program, especially to end users.

Recommendation 2: Encourage participating trade allies to do more to educate their customers about the source and size of the buy-down discounts.

Recommendation 3: Do more consumer education about the use of LED bulbs with dimmer switches.

Explain Whether or Not the PA Decided to Adopt Recommendations from the Study: 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.

Savings Impact: The recommended net-to-gross ratios for the lighting products discounted by the program were 82 percent for LED bulbs and 74 percent for linear fluorescent lamps. The evaluation calculated the participant spillover to be not statistically different from zero.

Formulas Used in Impact Analysis:

Net Summer kW Savings = Gross Adjusted Summer kW * Net-to-Gross ratio

Net Winter kW Savings = Gross Adjusted Winter kW * Net-to-Gross ratio

Net kWh Savings = Gross Adjusted kWh * Net-to-Gross ratio

Application of Results: Retroactively

How the Study Came to the Recommended Conclusions: Data collection activities included:

- Conducting interviews with staff from the program and from Ecova, the main implementation contractor;
- Completing telephone surveys with 200 program participants; and
- Conducting in-depth interviews with 25 participating lighting distributors, 8 nonparticipating lighting distributors, and 25 participating lighting contractors.

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

17. C&I Customer Profile Project

Type of Study: Market Characterization

Evaluation Conducted by: DNV KEMA

Date Evaluation Completed: 6/20/2013

Evaluation Objective and High-Level Findings: The primary goals of the C&I Customer Profile project were to:

- Characterize the Massachusetts energy efficiency market by analyzing recent customer usage and program participation data.
- Collect comprehensive billing and tracking data for all C&I customers to develop a single database to provide a consistent source of program tracking and billing data to support ongoing evaluation efforts.
- Estimate the extent to which customers of various sizes and types participated in energy efficiency programs during 2011.
- Document the processes used to consolidate and normalize PA data, and recommend enhancements to tracking systems to improve accuracy of results in future studies.

Highlights of the results of the analyses of participation by sector include:

- Custom vs. Prescriptive: The vast majority of savings in 2011 came from custom projects (64 percent of electric and 81 percent of gas). This would support a continuation of impact evaluation work of customer projects to ensure that methods used to calculate savings are effective.
- End Uses: On the electric side, the end use categories with the highest 2011 savings were lighting, combined heat and power, and HVAC. While impact evaluations are underway for lighting and combined heat and power, it has been several years since the last HVAC study. For gas projects, most 2011 savings came from HVAC.
- Business Type: The reliability of the estimated participation and savings rates by business type is limited by the fact that only 59 percent of billing accounts could be assigned to a business type. However, it appears that while only 1.8 percent of electric accounts classified as healthcare participated, their average savings was 23 percent. Similarly for gas, of the 3 percent of accounts classified as healthcare and education, the average savings was high. This may indicate the potential for significantly more savings in these sectors.
- Account Size: Participation rates increase as account size increases for both gas and electric, reflecting the individualized attention paid to these entities by PA account

managers. However, the average savings percent is highest for small gas and electric accounts.

- Same PAs: The participation rate for gas customers with the same electric PA is 2.6 percent, which is higher than the 1.6 percent participation rate for those with different electric PAs. This may be an indication of the challenges faced in coordinating marketing efforts between PAs.

Programs to which the Results of the Study Apply:

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

Evaluation Recommendations and Program Administrator Response: The following recommendations were made by the evaluators conducting this study. The initial response from the Program Administrator to these recommendations is summarized below.

Recommendation 1: Standardization of tracking database information about end uses and building types would increase the accuracy of any information derived from the records received.

Recommendation 2: In order to evaluate overall customer participation, it is necessary to build the capability to link accounts across fuels.

Recommendation 3: Leverage the baseline information collected here for other market characterization projects and efforts to estimate savings opportunities in each sector.

Recommendation 4: Incorporate checks to ensure that account numbers entered into tracking systems are accurate, and correspond to those in billing systems.

Recommendation 5: If there is a need for more reliable information by business type, explore services and software to use names and addresses to lookup business type rather than relying on PA designations.

Recommendation 6: Build on this one-year snapshot with additional data going forward to accumulate program participation history.

Explain Whether or Not the PA Decided to Adopt Recommendations from the Study: 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.

Savings Impact: Not applicable. This is a market characterization study.

Formulas Used in Impact Analysis: Not applicable. This is a market characterization study.

Application of Results: Prospectively

How the Study Came to the Recommended Conclusions: The project involved the collection, organization, and analysis of 2011 energy efficiency project tracking data and billed energy usage for all Massachusetts Commercial and Industrial gas and electric customers. The statewide database developed from this project has already provided information upon which other C&I impact and process evaluation work has been based. Once the data were collected and consolidated, it was analyzed to produce summaries that characterize the current energy efficiency market in Massachusetts.

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

18. Mid-Sized Customer Needs Assessment - Interim Results

Type of Study: Market Characterization

Evaluation Conducted by: DNV KEMA

Date Evaluation Completed: 6/28/2013

Evaluation Objective and High-Level Findings: This study provides results to date for the Massachusetts Mid-Sized Customer Needs Assessment for 2011 C&I customers. The study aims to investigate the extent to which current program offerings effectively serve the needs of mid-sized customers. In addition, if it is found that mid-sized customers or pockets of customers are underserved, the study will explore whether variations to existing program offerings or additional programs would be needed to optimally serve these customers. DNV KEMA completed research activities that addressed the following three objectives:

- Determine how Massachusetts PAs currently address mid-sized customers;
- Identify and describe the population of mid-sized customers across PAs (on-going);
- Estimate program participation rates for the largest, smallest, and mid-sized customers.

Programs to which the Results of the Study Apply:

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

Evaluation Recommendations and Program Administrator Response: The following preliminary recommendations were made by the evaluators conducting this study. The initial response from the Program Administrator to these recommendations is summarized below.

Recommendation 1: *Improve processes for linking multiple accounts to customers* – The PA's ability to accurately and consistently classify customers depends upon their ability to track multiple account customers within and across PAs. The PAs employ a range of tools to help them link customers; however, these tools did not provide sufficient support to enable the research team to link account representatives to the accounts they manage by account number. Moreover, the evaluators found large discrepancies between the segments that the PAs felt they were managing and those the evaluators were able to match with account representatives.

Recommendation 2: *Standardize classification and marketing approaches to multi-account customers* – The research found that multiple account customers were treated differently across PAs, and also within a PA, across customers. The lack of standardized approaches for treating multiple account customers limits the ability to isolate segments of customers based on size and complicates the PA's ability to effectively market to those customers.

Recommendation 3: *Link electric and gas customers* – Because much of the identification and marketing to Direct Install customers is handled through the electric PAs, the gas-only PAs lose some autonomy regarding how their customers are marketed. Consequently, some large gas customers are not identified until after they receive Direct Install prescriptive solutions from installation contractors. Improved coordination of tracking systems across PAs would reduce the risk of this occurring. DNV KEMA found that the PA's ability to link accounts across firms is constrained by legal privacy issues that must be addressed before this will be possible.

Explain Whether or Not the PA Decided to Adopt Recommendations from the Study: 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.

This memorandum provides preliminary results of this mid-sized customer needs assessment. The findings were limited to those relating to the in-depth interviews with PA staff and implementation contractors, and limited analysis of the C&I Customer Profile Project database. Continued research efforts include a detailed data mining exercise to investigate the relationship between in-depth interview responses and the customer billing and program tracking records, as well as implementation of a survey of participants and non-participants to test various hypotheses developed based on the PA interviews and data analysis conducted to date. Results of these analyses will be reported in the final report, which is expected to be completed in the second half of 2013.

Savings Impact: Not applicable. This is a market characterization study.

Formulas Used in Impact Analysis: Not applicable. This is a market characterization study.

Application of Results: Prospectively

How the Study Came to the Recommended Conclusions: Interviews with each PA and five implementation contractors provided a set of criteria used to segment customers by size. In addition to reviewing the interview findings, DNV KEMA used the available customer billing and tracking data to examine differences in participation rates across the three size groups.

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

19. Impact Evaluation of 2011 Prescriptive Gas Measures

This study applies to gas energy efficiency programs only and therefore is not included in the Electric PAs' Energy Efficiency Annual Reports.

20. Standard Boiler Research Plan and Interview Results Memo

This study applies to gas energy efficiency programs only and therefore is not included in the Electric PAs' Energy Efficiency Annual Reports.

21. Impact Evaluation of 2011 Custom Gas Installations

This study applies to gas energy efficiency programs only and therefore is not included in the Electric PAs' Energy Efficiency Annual Reports.

E. Special and Cross Sector Studies

22. Massachusetts Cross-Cutting Behavioral Program Evaluation Integrated Report

Type of Study: Impact and Process Evaluation

Evaluation Conducted by: Opinion Dynamics with Navigant Consulting and Evergreen Economics

Date Evaluation Completed: 6/20/2013

Evaluation Objective and High-Level Findings: This report includes impact findings of behavior/feedback programs and pilots administered by National Grid, NSTAR, Western Massachusetts Electric Company (WMECo), and the Cape Light Compact during the 2012 program year. It also includes process findings for the Cape Light Compact's Smart Home Energy Monitoring Pilot from 2009 to 2012.

The evaluation includes the following findings:

- The 2012 impacts for the National Grid and NSTAR behavior/feedback programs range from 41 kWh to 258 kWh per household for the electric cohorts and from 0.28 MMBtus to 1.90 MMBtus for the gas cohorts.

- Opower electric programs have demonstrated an average adjusted net savings gain of 27 percent from program year (PY) 1 to PY2, and 16 percent from PY2 to PY3. Gas programs have demonstrated an average adjusted net savings gain of 20 percent from PY1 to PY2, and 23 percent from PY2 to PY3.

- Since 2009, the National Grid and NSTAR behavior/feedback programs using Opower have channeled 24,122 additional participants into other residential programs and resulted in a savings of 5,298 MWh and 28,581 MMBtus. The additional savings are a result of the Opower program driving increased participation in other residential programs.

- For National Grid and NSTAR behavior/feedback programs, the report provided savings estimate ratios to adjust implementer estimate of savings based on comparison of treatment and control group usage for each month of participation. The savings estimates range between 90-111 percent.

- The WMECo program achieved a total overall savings of 2,263 MWh in 2012 attributable to "passive" participants that receive energy saving reports (mailers), and "activated" participants that interact with an online web platform.

- The WMECo program has had a substantial positive impact on participation in other energy efficiency programs. For instance, online activation of the web portal has increased participation in the Residential Mass Save program by 431 customers in 2012.

- The Compact's SHEMP Pilot using the Tendril in-home displays had significant savings differences between the older Legacy cohort and the more recent Energize cohort. Legacy customers' savings range from 7.8 percent to 8.8 percent average savings per household. Comparatively, Energize savings estimates are significantly lower, ranging from 1.49 percent to 1.99 percent average savings per household.

- The Compact's SHEMP Pilot had differences between Legacy and Energize cohorts' cross-program participation levels. Legacy customers demonstrated a sharp increase in cross-program participation during the Legacy participation period. Energize customers' monthly cross-program participation dropped during the treatment period.

Programs to which the Results of the Study Apply:

- Behavior/Feedback (Electric & Gas)

Evaluation Recommendations and Program Administrator Response: There were no recommendations as part of this report.

Explain Whether or Not the PA Decided to Adopt Recommendations from the Study: Not applicable.

Savings Impact: For the National Grid and NSTAR behavior/feedback programs, the net savings increase or decrease slightly compared to the 2012 TRM for various cohorts. Please see Table 2 on page 10 in the report for additional information.

Similarly for WMECo, net savings increase or decrease compared to planned values, with passive participants exhibiting increased savings while activated participants exhibiting decreased savings. Please see Table 14 in the report for additional information.

The Compact's SHEMP pilot results do not impact savings.

Formulas Used in Impact Analysis:

Impact analysis for Behavior/Feedback programs using Opower HER, and for passive participants in the WMECo program:

$$ADC_{it} = \alpha_i + \beta_1 Post_t + \beta_2 Treatment_i \cdot Post_t + \varepsilon_{it} \qquad \text{(Equation 1)}$$

where:

ADC_{it} = Average daily consumption (kWh) for household i at time t

α_i = Household-specific intercept

β_1 = Coefficient for the change in consumption between pre- and post-periods

β_2 = Coefficient for the change in consumption for the treatment group in the post-period compared to the pre-period, and to the comparison group. This is the basis for the net savings estimate.

Please refer to section 3.1.2 of the report for additional information.

Developing Savings Estimate Ratio for Behavior/Feedback programs using Opower HER:

$$\textbf{Savings Estimate Ratio}_{u,f} = \frac{(Estimated\ Modeled\ Savings) = \sum_{i=0}^{3} n * kWh\ Savings_{u,ci,f}}{(OPOWER\ Reported\ Savings) = \sum_{i=0}^{3} n * kWh\ Savings_{u,ci,f}}$$

(Equation 3)

where:

n is the average number of participants in a given cohort
u is a given utility
c is a given cohort
i is a given time period
f is a given fuel type

Please refer to section 3.1.2 of the report for additional information.

Impact Analysis for WMECo's Activated Participants:

The matching method was employed to calculate savings for WMECo's activated participants. The matching method follows the approach summarized in Imbens and Woolridge (2009) and applied in Abadie and Imbens (2011). In this model, the effect of the activation in month *t* is the difference between the energy use of participant *k* and its estimated counterfactual (baseline) consumption.

Impact Analysis for the Compact's SHEMP Pilot -- Model 1:

$$kWh_{kt} = \alpha_{0t} + \alpha_1 Treatment_{kt} + \alpha_2 PREkWh_{kt} + \sum_{j=1}^{J} \beta^j EE_{kt}^j + \varepsilon_{kt}$$

where:

kWh_{kt} is the average daily electricity use by household k during month t;

all Greek characters denote coefficients to be estimated, and in particular α_{0t} is a monthly fixed effect.

$Treatment_{kt}$ is an indicator variable taking a value of 1 if customer k is a SHEMP participant, and 0 otherwise;

$PREkWh_{kt}$ is the average daily electricity use by household k during the most recent month before household k enrolled in SHEMP that is also the same calendar month as month t. For instance, if household k enrolled in August 2011, the value of $PREkWh_{kt}$ for June 2012 is June 2011.

EE_{kt}^j is an indicator variable for energy efficiency program j, taking a value of 1if customer k is in the program in period t and 0 otherwise. In the analysis we consider four EE programs (that is, J=4), denoted by the following variables in regression results reported in Appendix C (of the Evaluation Report):

LISF= Low Income Single Family program;

MFR= Multi-Family Retrofit program;

RHE= Residential Home Energy program;

RP= Residential Products program.

ε_{kt} is the error term

In this model α_1 indicates average daily savings generated by the program for participants over the course of the initiative.

Please refer to section 3.3.4 of the report for additional information.

Impact Analysis for the Compact's SHEMP Pilot -- Model 2:

$$Savings_{kt} = kWh_{kt} - \widehat{kWh}^{C}_{kt}$$
$$\widehat{kWh}^{C}_{kt} = kWh^{M}_{kt} + \hat{\beta}\left(\mathbf{X}_{kt} - \mathbf{X}^{M}_{kt}\right)$$

where**:**

kWh_{kt} = the average daily electricity use by household *k* during month t;

$\widehat{kWh}^{C}_{kt}$ = the estimated counterfactual energy use by household *k* during month *t*;

kWh^{M}_{kt} = the energy use by household *k*'s match during month *t*;

$\mathbf{X}_{kt}$ = the values for household *k* in month *t* of the independent variables **X** affecting energy use;

$\mathbf{X}^{M}_{kt}$ = the values of **X** in month *t* for household *k's* match.

$\hat{\beta}$ = the factors used to adjust household *k*'s energy use to reflect differences between household *k* and its match in the value of **X.**

Please refer to section 3.3.4 of the report for additional information.

Application of Results:

- The National Grid and NSTAR Behavior/Feedback results will be applied in the 2012 Annual Report.
- The National Grid and NSTAR Behavior/Feedback savings estimate ratio will be applied in 2013 and going forward.
- The WMECo Behavior/Feedback results will be applied in the 2012 Annual Report.
- The Compact's SHEMP is a pilot program that will not directly affect savings for any program during this annual report year.

How the Study Came to the Conclusions: For the National Grid and NSTAR Behavior/Feedback programs and WMECo passive participants, the evaluation developed its savings estimate based on a billing analysis of the entire program population and its randomly assigned control groups using a linear fixed effects regression. A channeling analysis was then performed to determine what portion of HER savings, as measured through the billing analysis, were captured in other programs. For more information, please see section 3.1 of the study.

For the WMECo Western Mass Saves (WMS) activated participants, the matching method was employed to calculate savings. More details can be found in Section 3.2.2 of the study.

For the Compact's SHEMP pilot process evaluation, the evaluation findings are based on a literature review, survey research from pre- and post-treatments surveys, and an additional survey to a comparison group. For the Compact impact analysis, the evaluation uses a billing analysis of the opt-in treatment group to a matched comparison group. For more information, please see section 3.3 of the study.

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

23. 2012 Massachusetts Statewide Marketing Campaign Evaluation Report

Type of Study: Market Assessment

Evaluation Conducted by: Opinion Dynamics Corporation

Date Evaluation Completed: 1/11/2013

Evaluation Objective and High-Level Findings: This report presents results from the post-2012 statewide umbrella marketing survey effort conducted by Opinion Dynamics. The primary goal of this research is to enable the PAs to track changes in Mass Save awareness over time, as well as to measure the effectiveness of the campaign. As such, this report presents the results from residential and C&I quantitative surveys conducted immediately following the 2012 campaign, which ran from April 2 to August 19, 2012. A comparison of results from the pre- and post-campaign surveys indicates that there have been some changes in Mass Save awareness or familiarity as a result of 2012 campaign activities. However, there are differing results within the residential and commercial populations.

Overall, the team found divergent results within the residential and C&I populations, with C&I customers showing greater changes in awareness and other metrics over time. For example, there has been a significant increase in Mass Save awareness among C&I customers compared to awareness prior to the 2012 campaign launch. The August 2012 survey shows that awareness among C&I customers has risen from 33 percent pre-campaign to 40 percent post-campaign. However, awareness of and familiarity with Mass Save has not changed significantly among residential PA customers since the pre-campaign survey. In addition, there has been little change in residential familiarity compared to the 2010 baseline study conducted by the campaign implementer.

Programs to which the Results of the Study Apply:

- Residential New Construction & Major Renovation (Electric & Gas)
- Residential Cooling & Heating Equipment (Electric & Gas)
- Residential Multi-Family Retrofit (Electric & Gas)
- Residential Mass Save/HES (Electric & Gas)

- Residential ENERGY STAR® Lighting (Electric)
- Residential ENERGY STAR® Appliances (Electric)
- C&I New Construction and Major Renovation (Electric & Gas)
- C&I Large Retrofit (Electric & Gas)
- C&I Small Retrofit (Electric & Gas)
- Behavior/Feedback Program (Electric & Gas)

Evaluation Recommendations and Program Administrator Response: There were no recommendations from this report, as it was designed to track changes in awareness from the campaign and to measure the campaigns effectiveness.

Explain Whether or Not the PA Decided to Adopt Recommendations from the Study: Not applicable.

Savings Impact: No savings impact.

Formulas Used in Impact Analysis: Not applicable.

Application of Results: Prospectively.

How the Study Came to the Recommended Conclusions: A telephone survey was conducted with a random sample of 402 residential customers between August 20 and September 9, 2012, immediately following the conclusion of the 2012 marketing campaign. The sample of customers was based on files that the PAs provided to the evaluators, which merged PA Customer Information System (CIS) data with program tracking databases to develop a master file of all PA residential customers. The evaluators used the merged customer database to create a sample frame containing all unique residential accounts with valid contact information. From this frame, a random sample was created and survey quotas set for each PA combination, in proportion to their representation in the overall population to ensure that the sample was representative of the overall customer base.

Weights were developed and applied to the residential telephone survey data to match the composition of customers within the Massachusetts population based on home ownership.

The evaluators also conducted a telephone survey among PA business customers to assess changes in awareness, familiarity, and associations with Mass Save. The team surveyed a simple random sample of 295 C&I customers in August and September 2012. The fielding of the survey was timed to take place immediately following the 2012 marketing campaign. The team based the sample of C&I customers on customer files provided by the PAs. Given the lack of readily available population-level data on Massachusetts businesses, the evaluators conducted an unweighted analysis of the commercial survey data.

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

24. 2013 Massachusetts Statewide Marketing Campaign Pre-Campaign Results

Type of Study: Market Assessment

Evaluation Conducted by: Opinion Dynamics Corporation

Date Evaluation Completed: 6/5/2013

Evaluation Objective and High-Level Findings: This report presents results from the pre-2013 statewide umbrella marketing survey effort conducted by Opinion Dynamics. The goal of the research is to document current levels of awareness of Mass Save against which to measure changes over time.

The pre-campaign survey indicates that unaided awareness of Mass Save among residential customers remains moderate (36 percent) and has not changed since the post 2012 campaign survey. Further, consistent with prior surveys, the percentage of residential customers who consider themselves somewhat or very familiar with Mass Save remains relatively low (19 percent). Just under half of residential (46 percent) customers aware of Mass Save identify utilities or energy efficiency service providers as sponsors.

Among C&I customers, unaided awareness of Mass Save is moderate, with 47 percent reporting that they have seen or heard the term before. This represents an increase since the last statewide marketing survey when awareness was 40 percent. Additionally, just over half of commercial customers (55 percent) aware of Mass Save identify utilities or energy efficiency service providers as sponsors.

Programs to which the Results of the Study Apply:

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

- C&I Small Retrofit (Electric & Gas)
- Behavior/Feedback Program (Electric & Gas)

Evaluation Recommendations and Program Administrator Response: There were no recommendations from this report, as it was designed to establish baseline campaign awareness.

Explain Whether or Not the PA Decided to Adopt Recommendations from the Study: Not applicable.

Savings Impact: No savings impact.

Formulas Used in Impact Analysis: Not applicable.

Application of Results: Prospectively.

How the Study Came to the Recommended Conclusions: Evaluators conducted a telephone survey with a random sample of 504 residential PA customers. The team drew the sample from multiple data files provided by the PAs. The team integrated customer data to create a sample frame containing all unique residential accounts with valid contact information. From this frame, the team drew a random sample and set survey quotas for each PA combination in proportion to their representation in the overall population to ensure that the sample was representative of the overall customer base.

Similar to the 2012 surveys, the team developed and applied weights to the residential telephone survey data to match the composition of customers within the Massachusetts population based on homeownership.

The team also surveyed a random sample of 456 PA C&I customers in March of 2013. The team drew the sample of C&I customers from customer data provided by the PAs.

Given the lack of readily available population-level data on Massachusetts businesses, the evaluators did not weight the results of the commercial survey. However, the team also considered whether weighting the survey results to those from the first survey with this group was necessary. The team determined that it was appropriate to leave the data unweighted due to the fact that the team spoke with similar firms across each of the survey waves, and the fact that there is no consistent or significant relationship between any of the firmographics and Mass Save awareness across the waves.

A copy of the complete study can be found in Appendix C, Study 24.

25. Massachusetts Residential Non-Energy Impacts (NEIs): Deemed NEI Values Addressing Differences in NEIs for Heating, Cooling, and Water Heating Equipment that is Early Replacement Compared to Replace on Failure

Type of Study: Impact Evaluation

Evaluation Conducted by: NMR Group

Date Evaluation Completed: July 15, 2013

Evaluation Objective and High-Level Findings: Non-Energy Impacts associated with heating, cooling, and water heating equipment may differ according to whether the program-sponsored equipment is an early replacement measure, a measure that is replacing failed equipment, or replacing equipment that was scheduled to be replaced.

This memorandum provides adjusted deemed NEI values that address the differences in NEIs for residential heating, cooling, and water heating equipment that is early replacement compared to replace on failure. These deemed NEIs update the NEIs provided in the residential NEI report submitted to the PAs on August 15, 2011.[12]

Programs to which the Results of the Study Apply:

- Residential Cooling & Heating Equipment (Electric)
- Residential Heating and Water Heating (Gas)

Evaluation Recommendations and Program Administrator Response: The study did not offer any recommendations.

Explain Whether or Not the PA Decided to Adopt Recommendations from the Study: The study did not offer any recommendations.

Savings Impact:

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[12] NMR Group, Inc. (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for the Electric and Gas Program Administrators of Massachusetts. (http://www.ma-eeac.org/Docs/8.1_EMV%20Page/2011/2011%20Residential%20Studies/Mass%20Crosscutting%20NEIs%20Final%20Report%20081511.pdf)

Measure Category	Measure	NEI	Duration	Full NEI Value ($/Year)	EE Portion of NEI	ROF NEI Value ($/Year)	Percent ROF	Overall NEI Value ($/Year)
Cooling System	Central Air Conditioner/ Heat Pump	Noise Reduction	Annual	$2.83	67%	$1.90	35.4%	$2.50
		Home Durability	Annual	$1.54	33%	$0.51		$1.17
		Property Value Increase	One Time	$62.65	50%	$31.33		$51.56
Heating and Cooling System	Ductless Mini-Split	Noise Reduction	Annual	$1.42	67%	$0.95	1.3%	$1.41
		Home Durability	Annual	$1.98	33%	$0.65		$1.96
		Property Value Increase	One Time	$80.69	50%	$40.35		$80.19
Heating System	Boilers between 90 and 96% AFUE	Home Durability	Annual	$17.42	33%	$5.75	86.5%	$7.33
		Property Value Increase	One Time	$678.52	50%	$339.26		$385.23
	Boilers greater than or equal to 96% AFUE	Home Durability	Annual	$17.42	33%	$5.75	86.8%	$7.30
		Property Value Increase	One Time	$678.52	50%	$339.26		$384.21
	Furnaces greater than or equal to 95% AFUE	Home Durability	Annual	$17.42	33%	$5.75	88.4%	$7.10
		Property Value Increase	One Time	$678.52	50%	$339.26		$378.61
Heating and Hot Water System	Integrated Boiler / Water Heater	Home Durability	Annual	$0.72	33%	$0.24	67.9%	$0.39
		Property Value Increase	One Time	$29.17	50%	$14.59		$19.27

Measure Category	Measure	NEI	Duration	Full NEI Value ($/Year)	EE Portion of NEI	ROF NEI Value ($/Year)	Percent ROF	Overall NEI Value ($/Year)
Hot Water System	Storage Water Heater	Home Durability	Annual	$2.13	33%	$0.70	58.4%	$1.30
		Property Value Increase	One Time	$82.56	50%	$41.28		$58.47
	Tankless Water Heater	Home Durability	Annual	$2.13	33%	$0.70	63.4%	$1.23
		Property Value Increase	One Time	$82.56	50%	$41.28		$56.39
Cooling System	Central Air Conditioner / Heat Pump	Thermal Comfort	Annual	$3.92	100%	$3.92	÷ 2	$1.96
		Health Benefits		$0.13		$0.13		$0.07
Heating and Cooling System	Ductless Mini-Split	Thermal Comfort	Annual	$5.05	100%	$5.05	÷ 2	$2.53
		Health Benefits		$0.16		$0.16		$0.08
Heating System	Boilers between 90 and 96% AFUE	Thermal Comfort	Annual	$48.63	100%	$48.63	÷ 2	$24.32
		Health Benefits		$1.56		$1.56		$0.78
	Boilers greater than or equal to 96% AFUE	Thermal Comfort	Annual	$48.63	100%	$48.63	÷ 2	$24.32
		Health Benefits		$1.56		$1.56		$0.78
	Furnaces greater than or equal to 95% AFUE	Thermal Comfort	Annual	$48.63	100%	$48.63	÷ 2	$24.32
		Health Benefits		$1.56		$1.56		$0.78
Heating and Hot Water System	Integrated Boiler / Water Heater	Thermal Comfort	Annual	$1.83	100%	$1.83	÷ 2	$0.92
		Health Benefits		$0.06		$0.06		$0.03

Formulas Used in Impact Analysis:

$$Overall\ NEI\ Value = [(EE\ Portion\ of\ NEI * Full\ NEI\ Value) * ROF\%] + [Full\ NEI\ Value * (1 - ROF\%)]$$

Application of Results: Retroactively

How the Study Came to the Recommended Conclusions: First, NMR developed a method based on industry knowledge and published literature in order to attribute a portion of the NEIs associated with heating, cooling, and water heating systems to the measure's "newness" and a portion to the measure for being energy-efficient.

Second, using the attribution factors, NMR estimated the value of the portion of NEIs for heating, cooling, and water heating measures associated with the energy efficiency of the measure for systems that are replaced on failure. Then, using data from the current HEHE and COOL Smart evaluation,[13] the percentage of program participants that replaced failed systems was determined and the adjusted NEI values were attributed to these participants.

A copy of the complete study can be found in Appendix C, Study 25.

F. Future Studies

Table III.B summarizes the studies expected to be included in next year's Annual Report. There are a number of other studies which have been identified and are in the process of being scoped; however, it is not known at this time whether they will be completed in time for the next Annual Report.

[13] Cadmus. 2013. 2012 Residential Heating, Water Heating, and Cooling Equipment Evaluation: Net-to-Gross, Market Effects, and Equipment Replacement Timing (Draft Final Report). June 2013. Prepared for The Electric and Gas Program Administrators of Massachusetts.

Table III.B

Evaluation Studies in Next Annual Report		
Studies	Docket and Exhibit Approving Planned Evaluation Studies	Expected to be Implemented as Approved? (Y / N)
Residential Studies		
Residential New Construction Net Savings	Study was approved in January 2013 with the 2013-2015 Three Year Plan. D.P.U. 12-100 through D.P.U. 12-111	Yes
Multifamily Process Evaluation	Study is planned but not yet submitted for approval.	Yes
Home Energy Services Home Performance Contractor and Lead Vendor Analysis	Study is planned but not yet submitted for approval.	Yes
Regional Hours of Use Lighting Logger Study	Study was approved in January 2013 with the 2013-2015 Three Year Plan. D.P.U. 12-100 through D.P.U. 12-111	Yes
LED Market Effects Baseline Study (Residential and C&I)	Study is planned but not yet submitted for approval.	Yes
Understand Current Stagnation of Lighting Saturation	Study is planned but not yet submitted for approval.	Yes
Lighting Market Assessment	Study is planned but not yet submitted for approval.	Yes
Incremental Cost Assessment for Lighting and Products	Study is planned but not yet submitted for approval.	Yes
Top 10 Products Impact Assessment	Study is planned but not yet submitted for approval.	Yes
Low-Income Studies		
Low Income Hours of Use	Study was approved in January 2013 with the 2013-2015 Three Year Plan. D.P.U. 12-100 through D.P.U. 12-111	Yes
Low Income Multi-family Impact Scoping Study	Study is planned but not yet submitted for approval.	Yes

Table III.B

Evaluation Studies in Next Annual Report (continued)		
Studies	Docket and Exhibit Approving Planned Evaluation Studies	Expected to be Implemented as Approved? (Y / N)
Commercial & Industrial Studies		
Mid-Sized Customer Needs Assessment - Final Report	Study was approved in January 2013 with the 2013-2015 Three Year Plan. D.P.U. 12-100 through D.P.U. 12-111	Yes
CHP Impact Evaluation	Study was approved in January 2013 with the 2013-2015 Three Year Plan. D.P.U. 12-100 through D.P.U. 12-111	Yes
Existing Buildings Market Characterization	Study was approved in January 2013 with the 2013-2015 Three Year Plan. D.P.U. 12-100 through D.P.U. 12-111	Yes
Whole System Approach Study	Study was approved in January 2013 with the 2013-2015 Three Year Plan. D.P.U. 12-100 through D.P.U. 12-111	Yes
Codes & Standards Research using Existing New Construction Data	Study was approved in January 2013 with the 2013-2015 Three Year Plan. D.P.U. 12-100 through D.P.U. 12-111	Yes
Lighting Controls Scoping Study	Study was approved in January 2013 with the 2013-2015 Three Year Plan. D.P.U. 12-100 through D.P.U. 12-111	Yes
LED Market Effects Baseline Study (Residential and C&I)	Study is planned but not yet submitted for approval.	Yes
Market Assessment of Roof Top Units	Study is planned but not yet submitted for approval.	Yes
Learning from Successful Projects	Study is planned but not yet submitted for approval.	Yes
Documentation of Program Administrator Differences	Study is planned but not yet submitted for approval.	Yes
C&I Customer Profile - 2012 Data	Study is planned but not yet submitted for approval.	Yes
Characterization of Supply Side Population	Study is planned but not yet submitted for approval.	Yes
Commercial Real Estate Market Characterization	Study is planned but not yet submitted for approval.	Yes
Process Evaluation of Direct Install Delivery Method	Study is planned but not yet submitted for approval.	Yes
Impact Evaluation of Custom HVAC Installations	Study is planned but not yet submitted for approval.	Yes
Impact Evaluation of Prescriptive Non-Lighting Installations	Study is planned but not yet submitted for approval.	Yes
Special & Cross-Cutting Studies		
2013 Massachusetts Statewide Marketing Campaign Post-Campaign Results	Study was approved in January 2013 with the 2013-2015 Three Year Plan. D.P.U. 12-100 through D.P.U. 12-111	Yes
Efficient Neighborhoods Plus	Study is planned but not yet submitted for approval.	Yes
Serrafix CMI (Northampton/Pittsfield)	Study was approved in January 2013 with the 2013-2015 Three Year Plan. D.P.U. 12-100 through D.P.U. 12-111	Yes
Brand Assessment Analysis of Gas Networks and CoolSmart	Study is planned but not yet submitted for approval.	Yes
New Construction Non Energy Impact Study	Study is planned but not yet submitted for approval.	Yes
Analysis of Non Energy Impacts for C&I Marketing	Study is planned but not yet submitted for approval.	Yes
Top Down Net to Gross Scoping Study	Study is planned but not yet submitted for approval.	Yes
Codes and Standards Scoping Study	Study is planned but not yet submitted for approval.	Yes

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

General Laws c. 25, § 19(a) requires the Department, when authorizing energy efficiency programs, to ensure that such programs minimize administrative costs to the fullest extent practicable. Administrative costs, also commonly referred to as PP&A costs, have traditionally been defined as all in-house and outsourced costs associated with planning activities and program administration. These include costs associated with developing program plans and day-to-day program administration, including labor, overhead costs, and any regulatory costs associated with energy efficiency activities.

The most significant factor in the PA approach to minimizing administrative costs is the statewide collaborative process, which is 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, results in economies of scale that reduce the cost for each Program Administrator. For example, joint releases of Requests for Proposals RFPs lead to minimization of administrative costs in that the cost for preparation and release of the RFP are shared by the PAs. The Program Administrators also minimize 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.

Another factor in the Compact's efforts to control administrative costs is its grassroots service to the community through its volunteer, appointed Town or County Governing Board Members. These Board Members bring their expertise to community civic and business outreach events, provide guidance to staff on policies and new innovative initiatives, and support the multiple Town Energy Committees to inform and encourage participation in energy efficiency programs—all through volunteer service at no cost to ratepayers.

Notwithstanding any appropriate coordination with other customer service departments, it is 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 Green Communities Act; timely responses to the directives of the Council, Department, and

DOER; and documentation and achievement of substantial savings. The Program Administrators seek to balance the need to minimize administrative costs to the extent prudent with the need to maximize program quality and oversight. EEAC councilors have emphasized the need to devote sufficient administrative resources to successfully implement the aggressive programs called for in the three-year plans.

While the economies of scale and other steps taken by the PAs to minimize costs are effective, and administrative costs incurred by the PAs are transparent and are presented in each Program Administrator's narrative and supporting tables, 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 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 Green Communities Act, 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 seek to minimize costs at all available opportunities, and not just from one point in time to another.

Table IV.A provides a summary of the percent change in actual Program Planning and Administration Costs relative to plan at the program, sector, and portfolio levels.

Table IV.A

Program Planning and Administration Costs						
Customer Sector / Program	Planned		Actual		Change from Planned to Actual	
	Value ($)	% of Total Program Costs from Planned	Value ($)	% of Total Program Costs from Planned	Value	% Change -- Plan to Actual
Residential						
Residential New Construction & Major Renovation	$ 10,195	3.1%	$ 11,516	3.7%	$ 1,321	0.6%
Residential Cooling & Heating Equipment	$ 27,638	3.1%	$ 50,310	4.3%	$ 22,672	1.1%
Multi-Family Retrofit	$ 3,116	1.1%	$ 11,710	4.1%	$ 8,593	3.0%
MassSAVE	$ 264,467	2.9%	$ 479,810	4.5%	$ 215,343	1.6%
Behavior/Feedback Program	n/a	n/a	n/a	n/a		
ENERGY STAR Lighting	$ 60,461	3.3%	$ 70,215	3.9%	$ 9,754	0.7%
ENERGY STAR Appliances	$ 10,777	3.8%	$ 12,307	3.0%	$ 1,530	-0.8%
Residential Education Program	$ -	-	$ -	-		
Workforce Development	$ -	-	$ -	-		
Heat Loan Program	$ -	-	$ -	-		
R&D and Demonstration	n/a	n/a	n/a	n/a		
Deep Energy Retrofit	$ (2,655)	8.5%	$ 455	3.9%	$ 3,110	-4.6%
Power Monitor Pilot	$ (19,360)	3400.4%	$ 1,598	3.9%	$ 20,958	-3396.5%
Residential New Constr & Maj Reno - SW Pilot	$ (151)	0.1%	$ 2,790	3.1%	$ 2,941	3.1%
Residential New Constr MF (4-8 story) SW Pilot	$ -	-	$ -	-		
Residential New Constr Lighting Design SW Pilot	$ (309)	1.9%	$ -	-	$ 309	-1.9%
Residential New Constr V3 EStar Homes SW Pilot	$ -	-	$ -	-		
Heat Pump Water Heater Pilot	$ -	-	$ -	-		
Residential Technical Development	$ -	-	$ 577	4.2%	$ 577	4.2%
Hot Roofs	$ -	-	$ 1,051	4.7%	$ 1,051	4.7%
Home Automation	$ -	-	$ -	-		
Community Based Pilot	n/a	n/a	n/a	n/a		
Statewide Marketing & Education	$ -	-	$ -	-		
EEAC Consultants	$ -	-	$ -	-		
DOER Assessment	$ 11,826	100.0%	$ 99,782	100.0%	$ 87,957	0.0%
Sponsorships & Subscriptions	$ 3,483	100.0%	$ 18,889	100.0%	$ 15,406	0.0%
Residential Total	$ 369,489	2.7%	$ 761,010	4.9%	$ 391,521	2.2%
Low-Income						
Low-Income Residential New Construction	$ 696	2.2%	$ 2,697	4.7%	$ 2,002	2.5%
Low-Income Retrofit	$ 2,616	0.1%	$ 116,508	3.9%	$ 113,892	3.8%
Statewide Marketing & Education	$ -	-	$ -	-		
Low-Income Energy Affordability Network Funding	$ -	-	$ -	-		
DOER Assessment	$ 11,821	100.0%	$ 18,258	100.0%	$ 6,437	0.0%
Low-Income Total	$ 15,133	0.4%	$ 137,463	4.5%	$ 122,331	4.0%
Commercial & Industrial						
C&I New Construction and Major Renovation	$ 133,862	7.0%	$ 62,537	4.2%	$ (71,324)	-2.8%
C&I New Construction and Major Renovation - Gvmt	n/a	n/a	n/a	n/a		
C&I Large Retrofit	$ 211,694	7.9%	$ 90,470	4.4%	$ (121,224)	-3.5%
Large C&I Retrofit - Government	n/a	n/a	n/a	n/a		
C&I Small Retrofit	$ 78,276	1.7%	$ 164,633	4.5%	$ 86,358	2.8%
C&I Small Retrofit - Government	n/a	n/a	n/a	n/a		
Community Based Pilot	n/a	n/a	n/a	n/a		
Statewide Marketing & Education	$ -	-	$ -	-		
EEAC Consultants	$ -	-	$ -	-		
DOER Assessment	$ 32,619	100.0%	$ 50,537	100.0%	$ 17,918	0.0%
Sponsorships & Subscriptions	$ 143	100.0%	$ 11,828	100.0%	$ 11,685	0.0%
Commercial & Industrial Total	$ 456,593	4.9%	$ 380,006	5.2%	$ (76,588)	0.3%
Grand Total	$ 841,215	3.2%	$ 1,278,479	4.9%	$ 437,264	1.7%

The Cape Light Compact 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 provides a summary of the percent change in actual cost allocations to in-house and outsourced activities (including competitively procured and non-competitively procured activities) relative to plan at the sector and portfolio levels.

Table IV.B
Outsourced and Competitively Procured Services

Customer Sector	In-House Activities		Outsourced Activities						Total Activities
			Competitively Procured		Non-Competitively		Total Outsourced		
	($)	% of Total Activities	($)	% of Total Outsourced	($)	% of Total Outsourced	($)	% of Total Activities	($)
Residential									
Planned	$ 222,401	8%	$ 1,906,828	75%	$ 638,406	25%	$ 2,545,234	92%	$ 2,767,635
Actual	$ 961,368	32%	$ 1,720,753	82%	$ 366,336	18%	$ 2,087,089	68%	$ 3,048,457
% Planned to Actual		24%		8%		-8%		-24%	
Low-Income									
Planned	$ (20,644)	-3%	$ 295,687	35%	$ 539,549	65%	$ 835,235	103%	$ 814,592
Actual	$ 178,406	23%	$ 527,439	88%	$ 69,835	12%	$ 597,275	77%	$ 775,681
% Planned to Actual		26%		53%		-53%		-26%	
Commercial & Industrial									
Planned	$ 475,203	26%	$ 1,114,971	82%	$ 248,605	18%	$ 1,363,576	74%	$ 1,838,779
Actual	$ 480,389	41%	$ 557,472	80%	$ 136,923	20%	$ 694,395	59%	$ 1,174,784
% Planned to Actual		15%		-1%		1%		-15%	
Total									
Planned	$ 676,960	12%	$ 3,317,486	70%	$ 1,426,559	30%	$ 4,744,045	88%	$ 5,421,006
Actual	$ 1,620,163	32%	$ 2,805,665	83%	$ 573,094	17%	$ 3,378,759	68%	$ 4,998,922
% Planned to Actual		20%		13%		-13%		-20%	

The residential sector experienced significant variances between planned to actual for in-house activities and total outsourced activities. The low-income sector experienced significant variances between planned to actual for all outsource categories.

There was a shift from outsourced activities to in-house activities across all sectors. In general, many of the shifts in costs are a product of the three-year plan approach employed by the Cape Light Compact to develop its 2012 planned values. The Cape Light Compact started 2012 with negative in-house cost values for a number of programs within a number of budget categories, implying that the in-house budgets for these programs were overspent prior to 2012. However, because the Cape Light Compact attempts to outsource as many activities as possible, most of the in-house costs are fairly consistent year-to-year, and have experienced steady growth over time. The negative planned values skew the percent variances, indicating the shift from outsourced activities to in-house activities, when in fact the Cape Light Compact was planning for its typical annual in-house costs.

Outsourced EM&V costs were significantly lower than planned for all sectors. As the Cape Light Compact did not know the exact cost of EM&V when it filed its plan, it assumed that 4 percent of its total budget would be spent on EM&V activities. However, the Cape Light Compact did not need to leverage all of the money set aside for EM&V due to the fact that most studies were conducted and cost-shared on a statewide basis among PAs, and as a result were less costly for each PA.

Outsourced STAT costs were also lower than planned due to the planning method described above. Additionally, certain STAT costs were allocated based on program incentives, which explains the shift of in-house costs from the C&I sector to the residential sector.

In-house PP&A and marketing costs were significantly higher than planned, as internal resources were leveraged more than planned. The Cape Light Compact did not know the exact in-house PP&A and marketing costs that would be needed when it filed its plan, and the assumptions made did not reflect the actual requirements.

In terms of the shift from non-competitive to competitive procurement, low-income experienced an increase in competitive procurement due to the fact that more outsourced costs were leveraged by implementation vendors that were competitively procured.

D. Low-Income Spending

Table IV.C provides a summary of the percent change in actual costs at the sector and portfolio levels relative to plan.

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	Total Program Costs	% of Total Program Costs
Residential	$ 13,551,206	52%	$ 15,463,471	60%	$ 1,912,265	8%
Low-Income	$ 3,510,157	13%	$ 3,079,664	12%	$ (430,493)	-1%
Commercial & Industrial	$ 9,244,079	35%	$ 7,314,084	28%	$ (1,929,995)	-7%
Total	$ 26,305,442	100%	$ 25,857,219	100%	$ (448,223)	0%

The statutory requirement regarding the low-income budget is as follows:

"Electric and gas energy efficiency program funds shall be allocated to customer classes, including the low-income residential subclass, in proportion to their contributions to those funds; provided, however, that at least 10 per cent of the amount expended for electric energy efficiency programs and at least 20 per cent of the amount expended for gas energy efficiency programs shall be spent on comprehensive low-income residential demand side management and education programs."[14]

The low-income budget represents greater than 10 percent of the amount expended for electric energy efficiency programs by the Cape Light Compact. Therefore, the Cape Light Compact met the low-income budget statutory requirement this year.

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[14] Massachusetts Session Laws. Chapter 169. An Act Relative to Green Communities. Approved by the Governor July 2, 2008. Available at: http://www.malegislature.gov/Laws/SessionLaws/Acts/2008/Chapter169. Section 19. (c).

V. PERFORMANCE INCENTIVES

The purpose of this section is to address the performance incentives that each PA proposes to collect. As a public entity and municipal aggregator, the Cape Light Compact does not collect performance incentives. As such, this section is not applicable to the Cape Light Compact.

VI. AUDITS

The purpose of this section is to address audits conducted during the past five program years.

In accordance with the Administrative Services Agreement between Barnstable County and the Cape Light Compact, the Cape Light Compact's funds are managed by Barnstable County. Under this service, the Cape Light Compact's energy efficiency funds are included as part of the Barnstable County audit.

In 2013, the Compact engaged Sullivan, Rogers & Company to perform financial statement audits of the Compact for calendar years 2009 through 2012 and thereafter.

Initial results from the financial statement audits revealed an error in the Compact's expenses from previous years. The expenses provided in the Cape Light Compact's 2011 Annual Report erroneously included an additional $82,335 as part of the Block Grant expenditures. The $82,335 expense was thought to have been incurred during the 2011 program year. It was therefore recovered through the 2011 carryover component of the Cape Light Compact's 2012 EERF, which went into effect July 1, 2012. This error was discovered during preparation of the Cape Light Compact's 2013-2015 EERF filing, approved by the Department on April 1, 2013. The Compact corrected for this error in its 2013-2015 EERF filing by reducing the expenditures included in the 2012 carryover, which incorporates the 2011 carryover, by $82,335.

VII. APPENDICES

The purpose of this section is to provide detailed supporting documentation.

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 Compact's determination of actual performance incentives earned though the performance metrics.

E. Other Supporting Documentation – Includes additional supporting documentation with regard to competitive procurement activities in 2012.

F. Lost Base Revenue Information – Includes a reference to the information on savings on which LBR is based.