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August 1, 2013

Mark D. Marini, Secretary  
Commonwealth of Massachusetts  
Department of Public Utilities  
One South Station  
Boston, MA 02110

Re: Fitchburg Gas and Electric Light Company d/b/a Unitil, D.P.U. 13-\_\_

Dear Secretary Marini:

On behalf of Fitchburg Gas and Electric Light Company d/b/a Unitil (“Unitil” or the “Company”), enclosed please find the Company’s 2012 Annual Energy Efficiency Report for the Company’s electric energy efficiency program offerings. This report is being submitted pursuant to the Order in Fitchburg Gas and Electric Light Company d/b/a Unitil, D.P.U. 09-117 (2010).

Thank you for your attention to this matter. If you have any questions regarding this filing, please do not hesitate to contact me.

Very truly yours,



Kevin F. Penders

Enclosures

cc: Jeffrey M. Leupold, Hearing Officer  
Steven Venezia, Department of Energy Resources  
Matthew Saunders, Office of the Attorney General  
Jerrold Oppenheim, Low-Income Energy Affordability Network

**THE COMMONWEALTH OF MASSACHUSETTS  
DEPARTMENT OF PUBLIC UTILITIES**

D.P.U. 13-\_\_

**ON BEHALF OF FITCHBURG GAS AND  
ELECTRIC LIGHT COMPANY d/b/a UNITIL**

**APPEARANCE OF COUNSEL**

In the above referenced proceeding, I the undersigned hereby appear for and on behalf of Fitchburg Gas and Electric Light Company d/b/a Unitil.

Respectfully Submitted,



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Dated: August 1, 2013



*Fitchburg Gas and Electric  
Light Company*

**Annual Energy Efficiency Report for 2012**

Filed with the Massachusetts  
Department of Public Utilities and  
Department of Energy Resources

August 1, 2013

**Fitchburg Gas and Electric Light Company d/b/a Unitil  
2012 Energy Efficiency Annual Report**

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## I. INTRODUCTION

During program year 2012, the final year of implementation under the 2010-2012 three-year energy efficiency plans, the Massachusetts Energy Efficiency Program Administrators<sup>1</sup> (the “Program Administrators” or “PAs”) 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 Mid-Term Modification 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 also continued to engage in very high levels of integration, coordination and cooperation – all of which are hallmarks of the 2010-2012 three-year energy efficiency plan. 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.

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<sup>1</sup> 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.

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 Program Administrators and interested stakeholders in an ever changing marketplace.

The Program Administrators also 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 also 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. The PAs also 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 also devoted considerable time and effort in 2012 to developing their 2013-2015 energy efficiency plans. During the 2013-2015 planning 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 2010-2012.

Given the unprecedented nature of these efforts, and the ambitious goals established in the 2010-2012 plans, program year 2012 performance has been an outright success for energy efficiency in Massachusetts. Over the three years of the 2010-2012 energy efficiency 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 Company is pleased to provide its Energy Efficiency Annual Report (“Annual Report”) for 2012. The purpose of the Annual Report is to:

- Provide a comparison of the Company’s planned, preliminary year-end, and evaluated (where applicable) expenses, savings, and benefits at the portfolio, sector, and program levels for the program year.
- Identify significant<sup>2</sup> variances between the Company’s planned and evaluated costs, savings, and benefits for the program year, and discuss reasons for such variances.
- Discuss how program performance during the program year informs the Company’s proposed modifications to program implementation, if any, during upcoming years.
- Describe the EM&V activities undertaken by the Company that have not been included in previous Annual Reports, and explain how the results of the EM&V studies impact program cost-effectiveness.
- Describe the performance incentives that the Company proposes to collect.

B. Organization of Annual Report

The Company’s 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 addresses the performance incentives the Company proposes to collect.
- Section VI addresses energy efficiency audits conducted during the past five years.
- Section VII consists of Appendices A through F which provide further detailed supporting documentation for this report.

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<sup>2</sup> Unless otherwise noted, “significant” variances are defined throughout this Annual Report as variances of +/-20 percent or more between the planned and actual values.

C. Summary of Program Portfolio

Tables<sup>3</sup> 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
<b>Expenses</b>							
Total Program Costs	\$	\$ 5,704,822			\$ 4,097,072		-28%
Performance Incentive	\$	\$ 320,304			\$ 264,843		-17%
<b>Savings and Benefits</b>							
<b>Energy</b>							
Lifetime	MWh	116,661	74,507	-36%	71,601	-4%	-39%
Annualized	MWh	9,275	6,341	-32%	6,084	-4%	-34%
<b>Demand</b>							
Lifetime	kW	18,806	26,051	39%	26,455	2%	41%
<b>Annualized</b>							
Summer	kW	1,314	2,354	79%	2,402	2%	83%
Winter	kW	1,043	1,874	80%	2,160	15%	107%
Non-Electric Benefits (Lifetime)	\$	\$ 8,925,519	\$ 3,296,568	-63%	\$ 4,408,767	34%	-51%
<b>Cost-Effectiveness</b>							
TRC Benefits	\$	\$ 25,708,603			\$ 19,653,562		-24%
TRC Costs	\$	\$ 9,058,435			\$ 6,335,253		-30%
Net Benefits	\$	\$ 16,650,168			\$ 13,318,310		-20%
BCR		2.8			3.1		9%

Note: The Planned Values in Table I.A and all subsequent tables that contain Planned Values in this Annual Report (except as otherwise noted) were originally submitted to the Department on October 28, 2011 and revised on February 15, 2013 in Fitchburg Gas and Electric Light Company d/b/a Unitil, D.P.U. 11-110.

The Company continued to ramp up its energy efficiency programs in an effort to deliver greater savings and benefits for its customers. However, some sectors and programs were more successful than others compared to planned goals. As shown in Table 1.A above, significant<sup>2</sup> variances exist at the portfolio level between planned and evaluated values for:

- Total Program Costs
- Energy Savings
- Demand Savings
- Non-Energy Savings

For a more detailed discussion of the cause of variances in each sector please reference section II.A.1 for residential results, section II.B.1 for low-income results; and section II.C.1 for C&I results.

<sup>3</sup> The Company is also providing the Department with working Microsoft Excel spreadsheets for all of the tables included in this Annual Report. Such tables include all formulas and functions used in each table.

**Table I.B**

<b>Customer Sector Summary</b>				
Sector	Units	Planned Value	Evaluated Results	
			Value	% Change from Planned
<b>Residential</b>				
TRC Benefits	\$	\$ 10,114,014	\$ 3,363,154	-67%
TRC Costs	\$	\$ 2,450,368	\$ 1,518,418	-38%
Net Benefits	\$	\$ 7,663,646	\$ 1,844,736	-76%
BCR		4.1	2.2	-46%
<b>Low-Income</b>				
TRC Benefits	\$	\$ 2,050,722	\$ 1,193,947	-42%
TRC Costs	\$	\$ 619,385	\$ 522,368	-16%
Net Benefits	\$	\$ 1,431,336	\$ 671,579	-53%
BCR		3.3	2.3	-31%
<b>Commercial &amp; Industrial</b>				
TRC Benefits	\$	\$ 13,543,868	\$ 15,096,462	11%
TRC Costs	\$	\$ 5,988,682	\$ 4,294,467	-28%
Net Benefits	\$	\$ 7,555,186	\$ 10,801,995	43%
BCR		2.3	3.5	55%
<b>Total</b>				
TRC Benefits	\$	\$ 25,708,603	\$ 19,653,562	-24%
TRC Costs	\$	\$ 9,058,435	\$ 6,335,253	-30%
Net Benefits	\$	\$ 16,650,168	\$ 13,318,310	-20%
BCR		2.8	3.1	9%

Table I.B provides a summary of the sector-level planned and evaluated results for 2012. Significant variances exist for all metrics in the Residential sector; TRC Benefits, Net Benefits, and BCR in the Low-Income sector; and TRC Costs, Net Benefits and BCR in the C&I Sector.

- Residential: Within this sector, all but one program, Residential Appliances, contributed to the significant variance between Planned and Evaluated TRC Benefits. All but one program, Mass Save, contributed to the significant variance between Planned and Evaluated TRC Costs. Evaluated Net Benefits were significantly below planned for all programs except Residential Appliances. Please reference section II.A.2 for a more detailed discussion of the cause of the variances for this sector.
- Low-Income: Within this sector, both Low-Income New Construction and Low-Income Retrofit programs were under target, contributing to the variance between Planned and Evaluated TRC Benefits, Planned and Evaluated Net Benefits, and Planned and Evaluated BCR. Please reference section II.B.2 for a more detailed discussion of the cause of the variances for this sector.
- C&I: Within this sector, the Large C&I Retrofit Program contributed to the variance between Planned and Evaluated TRC Costs. Both C&I New Construction and C&I Retrofit contributed to the variance between Planned and Evaluated Net Benefits and BCR. Please reference section II.C.2 for a more detailed discussion of the cause of the variances for this sector.

**PA-Specific Highlights:**

During 2012, the Company continued to offer, as it has for over twenty years, a comprehensive portfolio of programs and initiatives that provided substantial benefits to residential, low income, and commercial and industrial customers. Over the last three years, 2010-2012, the Company expanded its programs to procure deeper and broader savings. These cost-effective programs promoted energy efficiency, assisted in transforming energy efficiency markets, and helped customers achieve permanent energy savings. In doing so, the Company continued to build upon established marketplace relationships, refined the focus of its programs to meet market-oriented objectives, and coordinated its activities with the other Program Administrators and market players. In addition, the Company's energy efficiency programs and services maximize the usage of competitive procurement processes and support the development of an enhanced energy services delivery infrastructure in Massachusetts. In implementing and administering these programs and services, Unital's overall goal continues to be to help its customers understand their energy consumption and use energy more efficiently.

In 2012, the Company's energy efficiency programs provided direct services to 485 single and multi-family customers in the residential sector. In addition to providing direct services, the Company's residential market transformation programs provided HVAC, ENERGY STAR lighting and appliance/product rebates for 26,079 products. The Company served 250 customers in the low income sector and a total of 105 customers in the commercial and industrial sector.

For further details, please reference sections II.A.1 through II.C.1.

II. PROGRAM PERFORMANCE

A. Residential Sector Programs

1. Summary

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

Residential Programs

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

Residential Pilots

- Deep Energy Retrofit

Tables II.A.1, II.A.2 and 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
<b>Expenses</b>							
Total Program Costs	\$	\$ 1,518,784			\$ 1,210,785		-20%
Performance Incentive	\$	\$ 131,852			\$ 52,625		-60%
<b>Savings and Benefits</b>							
<b>Energy</b>							
Lifetime	MWh	16,253	12,419	-24%	12,340	-1%	-24%
Annualized	MWh	1,687	1,409	-16%	1,365	-3%	-19%
<b>Demand</b>							
Lifetime	kW	5,887	1,238.1	-79%	1,016.5	-18%	-83%
<b>Annualized</b>							
Summer	kW	362	147.5	-59%	130.8	-11%	-64%
Winter	kW	383	274.3	-28%	330.1	20%	-14%
Non-Electric Benefits (Lifetime)	\$	\$ 6,917,941	\$ 2,073,216	-70%	\$ 1,900,435	-8%	-73%
<b>Cost-Effectiveness</b>							
TRC Benefits	\$	\$ 10,114,014			\$ 3,363,154		-67%
TRC Costs	\$	\$ 2,450,368			\$ 1,518,418		-38%
Net Benefits	\$	\$ 7,663,646			\$ 1,844,736		-76%
BCR		4.1			2.2		-46%

**Table II.A.2**

<b>Residential Sector Summary of End-Uses</b>				
<b>End Uses</b>	<b>Units (Lifetime)</b>	<b>Preliminary Year-End Results</b>	<b>Evaluated Results</b>	<b>% Change from Preliminary</b>
<b>Lighting</b>				
Energy	MWh	6,239	6,181	-1%
Demand	kW	557	540	-3%
NEB (Lifetime)	\$	\$ 50,011	\$ 48,782	-2%
<b>HVAC</b>				
Energy	MWh	3,992	3,971	-1%
Demand	kW	186	164	-12%
NEB (Lifetime)	\$	\$ 1,954,736	\$ 1,794,745	-8%
<b>Refrigeration</b>				
Energy	MWh	459	454	-1%
Demand	kW	57	58	0%
NEB (Lifetime)	\$	\$ 4,389	\$ 4,389	0%
<b>Hot Water</b>				
Energy	MWh	275	269	-2%
Demand	kW	352	29	-92%
NEB (Lifetime)	\$	\$ 64,079	\$ 52,519	-18%
<b>Process</b>				
Energy	MWh	1,455	1,464	1%
Demand	kW	84.77	225.93	167%
NEB (Lifetime)	\$	\$ -	\$ -	0%
<b>EndUse Behavior</b>				
Energy	MWh	-	-	0%
Demand	kW	-	-	0%
NEB (Lifetime)	\$	\$ -	\$ -	0%
<b>Total</b>				
Energy	MWh	12,419	12,340	-1%
Demand	kW	1,238	1,016	-18%
NEB (Lifetime)	\$	\$ 2,073,216	\$ 1,900,435	-8%

**Table II.A.3**

<b>Residential Program Summary</b>				
Sector	Units	Planned Value	Evaluated Results	
			Value	% Change from Planned
<b>Residential New Construction &amp; Major Renovation</b>				
TRC Benefits	\$	\$ 2,754,889	\$ 404,352	-85%
TRC Costs	\$	\$ 772,171	\$ 150,299	-81%
Net Benefits	\$	\$ 1,982,718	\$ 254,052	-87%
BCR		3.6	2.7	-25%
<b>Residential Cooling and Heating Equipment</b>				
TRC Benefits	\$	\$ 80,318	\$ 69,446	-14%
TRC Costs	\$	\$ 90,969	\$ 66,417	-27%
Net Benefits	\$	\$ (10,651)	\$ 3,029	-128%
BCR		0.9	1.0	18%
<b>Residential Multifamily Retrofit 5+</b>				
TRC Benefits	\$	\$ 2,040,893	\$ 645,799	-68%
TRC Costs	\$	\$ 244,526	\$ 191,035	-22%
Net Benefits	\$	\$ 1,796,367	\$ 454,764	-75%
BCR		8.3	3.4	-59%
<b>Residential MassSave</b>				
TRC Benefits	\$	\$ 4,172,811	\$ 1,399,787	-66%
TRC Costs	\$	\$ 721,253	\$ 709,366	-2%
Net Benefits	\$	\$ 3,451,558	\$ 690,422	-80%
BCR		5.8	2.0	-66%
<b>Residential ENERGY STAR® Lighting</b>				
TRC Benefits	\$	\$ 784,555	\$ 573,044	-27%
TRC Costs	\$	\$ 318,196	\$ 196,350	-38%
Net Benefits	\$	\$ 466,359	\$ 376,694	-19%
BCR		2.5	2.9	18%
<b>Residential ENERGY STAR® Appliance</b>				
TRC Benefits	\$	\$ 280,548	\$ 270,726	-4%
TRC Costs	\$	\$ 160,205	\$ 90,564	-43%
Net Benefits	\$	\$ 120,342	\$ 180,161	50%
BCR		1.8	3.0	71%
<b>Hard-To-Measure Initiatives</b>				
TRC Costs	\$	\$ 143,048	\$ 114,386	-20%
<b>Total</b>				
TRC Benefits	\$	\$ 10,114,014	\$ 3,363,154	-67%
TRC Costs	\$	\$ 2,450,368	\$ 1,518,418	-38%
Net Benefits	\$	\$ 7,663,646	\$ 1,844,736	-76%
BCR		4.1	2.2	-46%

As shown in the above tables, there are significant variances between planned values and evaluated results in nearly all of the categories at the sector level. The primary reasons for the variances are the difference in planned compared to actual measure mix, as well as, the application of evaluation results for some programs. There are many variables behind the measure mix variability including participation rates, economic decisions by customers, and slow adoption of new products/program offerings. A detailed program-level discussion of the variances is found in Section II.A.

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

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## 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 and Major Renovation<sup>4</sup> - In 2012, with 121 communities adopting the Stretch Energy Code throughout the Commonwealth, 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 and more stringent code requirements. To address these barriers, the Program Administrators offered technical assistance as well as incentives to exceed the rising 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 (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 requirements of the new energy code. As of the 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 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 and 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 and Heating Equipment program, also known as the COOL Smart<sup>SM</sup> program. PAs held quality installation training sessions, including trainings on system design, duct diagnostics, brushless fan motors and ENERGY STAR Heating, Ventilation and Air Conditioning (“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 2100 HPWHs were installed in 2012, 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

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<sup>4</sup> Prior to 2012 the program was called Massachusetts New Construction with ENERGY STAR®.

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<sup>®</sup> fall conference.

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

Statewide, the Multi-Family Market Integrator continued to be a valuable resource to the multi-family program in 2012, as illustrated in 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.

- Mass Save – Program Year 2012 was the first full year of the new market model. Two groups of 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-\$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.

- ENERGY STAR Lighting - In 2012, the ENERGY STAR Lighting program produced strong results, with most of 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.

- **ENERGY STAR Appliances** – The 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. Statewide, pool pumps, computers, and ENERGY STAR televisions also performed well. Other measures, like 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.

## 2. Residential Programs

### a. Residential New Construction and Major Renovation

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

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

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

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 of field activities. The JMC utilized a market-based network of trained contractors who offered energy efficiency and rating services to homebuilders.

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

**Docket/Exhibit where the Program is Discussed and Approved:** The program was discussed in detail in the Company's 2010-2012 Three-Year Electric Energy Efficiency Plan, filed October 30, 2009. See Fitchburg Gas and Electric Light Company d/b/a Unitil, D.P.U. 09-117. The program was approved by the Department on January 28, 2010 in Fitchburg Gas and Electric Light Company d/b/a Unitil, D.P.U. 09-117.

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

**Table II.A.4**

Residential New Construction & Major Renovation							
Performance Category	Units	Planned Value	Preliminary Year-End Results		Evaluated Results		
			Value	% Change from Planned	Value	% Change from Preliminary	% Change from Planned
<b>Expenses</b>							
Total Program Costs	\$	\$ 200,000			\$ 85,631		-57%
Performance Incentive	\$	\$ 32,901			\$ 6,155		-81%
Participants	Units	111			3		-97%
Program Cost / Participant	\$	\$ 1,802			\$ 28,544		1484%
<b>Savings and Benefits</b>							
<b>Energy</b>							
Lifetime	MWh	1,352	3,794	181%	3,794	0%	181%
Annualized	MWh	103	164	58%	164	0%	58%
Average Measure Life	Yrs	13	23	77%	23	0%	77%
<b>Demand</b>							
Lifetime	kW	1,148.7	100.0	-91%	103.1	3%	-91%
<b>Annualized</b>							
Summer	kW	51.1	5.3	-90%	5.4	3%	-89%
Winter	kW	20.4	26.0	27%	26.0	0%	27%
Average Measure Life	Yrs	22	19	-16%	19	0%	-16%
Non-Electric Benefits (Lifetime)	\$	\$ 2,303,339	\$ 40,413	-98%	\$ 40,413	0%	-98%
<b>Cost-Effectiveness</b>							
TRC Benefits	\$	\$ 2,754,889			\$ 404,352		-85%
TRC Costs	\$	\$ 772,171			\$ 150,299		-81%
Net Benefits	\$	\$ 1,982,718			\$ 254,052		-87%
BCR		3.6			2.7		-25%

Variance Analysis: The following section discusses the variables associated with significant variances between planned and actual results.

- Total Program Costs: Expenditures for this program were significantly under budget in marketing, customer incentives, and M&E.
- Performance Incentive: The Performance Incentive for this program reflects the lower than expected achievement in TRC Benefits and Net Benefits.

- **Participants:** Low participation is due to challenging economic conditions in the new construction sector within the Company's service territory.
- **Program Cost/Participant:** The variance in the cost per participant is due to lower than expected participation which led to the program's fixed costs being distributed over a smaller pool of participants.
- **Energy Savings:** The greater than expected achievement between planned and actual savings resulted in large part because of a single project in which the home achieved a remarkably low HERS score in which a geothermal heat pump installation was completed
- **Demand Savings:** As with energy savings, the completion of a high efficiency, geothermal home resulted in higher than planned demand savings, particularly for winter demand. Summer demand was lower than planned due to the lack of homes completed with air conditioning.
- **Non-Electric Benefits:** The extraordinary underachievement of NEBs is due to several factors relating to low participation: lower actual fuel savings compared to planned, lower number of bulbs installed than planned, and application of per participant NEBs to a significantly lower number of completions than planned.
- **Cost Effectiveness:** The variance in benefits is attributable to the low program participation and costs, and low non-energy benefits, while the lower costs and overall BCR are related to the lower than planned participation, and unavoidable fixed program costs.

EM&V Studies included in this Annual Report that apply to the **Residential New Construction & Major Renovation Program.**

- *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 MA RNC Program. Incremental costs (costs above those of typical homes built outside the program) are estimated for single family, low-rise multifamily buildings of three or fewer stories, and mid- to high-rise multifamily 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.
- *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 increased for all energy-efficient light bulbs, including CFLs, LEDs, and fluorescent tubes, was 39% in 2013. The results of this study will increase energy savings by increasing the number of bulbs found in indoor fixtures. The study is discussed in more detail in Section III, Study 7.

**Changes resulting from Current Year Program Performance:** The Company regularly reviews best available information to adjust strategies in order to achieve energy efficiency goals. With respect to 2012 program performance information, the Company incorporated the best available information into its 2013-2015 energy efficiency plan. With respect to the results of EM&V studies that were completed for 2012, the Company will review those results and make any necessary adjustments to ensure it remains on track to achieve its goals for 2013-2105. The Company 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) (2013).

b. Residential Cooling and Heating Equipment

**Purpose/Goal:** The purpose of the Residential Cooling and Heating Equipment (“COOL Smart”) program was to raise residential consumer awareness and market share of properly installed high-efficiency cooling equipment and systems, and increase market share of ENERGY STAR furnaces equipped with an electronically commutated 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 the number of measures installed.

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 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 programs worked to procure a single, joint circuit rider to support both programs in the field. Program initiatives were also piggybacked onto the Residential New Construction and 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 training were jointly provided with GasNetworks.
- HES participants were referred to COOL Smart for HVAC measures using COOL Smart literature, which is part of the standard HES information package.

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

The program continued to use equipment distributors to assist customers with filling out their rebate forms, sell high-efficiency and QIV-related technology, and to provide indoor training labs for HVAC contractors.

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

**Docket/Exhibit where the Program is Discussed and Approved:** The program is discussed in detail in the Company's 2010-2012 Three-Year Electric Energy Efficiency Plan, filed October 30, 2009. See Fitchburg Gas and Electric Light Company d/b/a Unitil, D.P.U. 09-117. The program was approved by the Department on January 28, 2010 in Fitchburg Gas and Electric Light Company d/b/a Unitil, D.P.U. 09-117.

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

Table II.A.5

Residential Cooling and Heating Equipment							
Performance Category	Units	Planned Value	Preliminary Year-End Results		Evaluated Results		
			Value	% Change from Planned	Value	% Change from Preliminary	% Change from Planned
<b>Expenses</b>							
Total Program Costs	\$	\$ 65,000			\$ 63,434		-2%
Performance Incentive	\$	\$ 10,114			\$ 517		-95%
Participants	Units	78			93		19%
Program Cost / Participant	\$	\$ 833			\$ 682		-18%
<b>Savings and Benefits</b>							
<b>Energy</b>							
Lifetime	MWh	394	524	33%	462	-12%	18%
Annualized	MWh	23	41	80%	37	-9%	64%
Average Measure Life	Yrs	17	13	-26%	12	-3%	-28%
<b>Demand</b>							
Lifetime	kW	83.0	431.5	420%	66.0	-85%	-20%
<b>Annualized</b>							
Summer	kW	5.2	39.8	668%	5.1	-87%	-2%
Winter	kW	3.3	54.6	1544%	8.9	-84%	169%
Average Measure Life	Yrs	16	11	-32%	13	20%	-19%
Non-Electric Benefits (Lifetime)	\$	\$ 16,538	\$ 8,965	-46%	\$ 6,278	-30%	-62%
<b>Cost-Effectiveness</b>							
TRC Benefits	\$	\$ 80,318			\$ 69,446		-14%
TRC Costs	\$	\$ 90,969			\$ 66,417		-27%
Net Benefits	\$	\$ (10,651)			\$ 3,029		-128%
BCR		0.9			1.0		18%

Variance Analysis: The following section discusses the variables associated with significant variances between planned and actual results.

- Performance Incentive: The Performance Incentive for this program reflects underperformance in TRC Benefits and Net Benefits.

- **Energy Savings:** The positive variance between planned and actual savings is due primarily to an actual measure mix that differed from plan, particularly the addition of heat pump water heaters (HPWH) to the program in 2012. The Company was successful in promoting and rebating a significant number of HPWH, which accounted for 67% of total annual energy savings achieved. The application of evaluation results also increased savings for some measures. The average measure life is below planned due to the disproportionate effect of HPWH savings, which have a 10 year measure life. To a lesser extent, the application of evaluation results reduced the measure life for certain measures.
- **Demand Savings:** The positive variance between planned and actual winter demand is due primarily to winter peak savings associated with HPWH.
- **Non-Electric Benefits:** The lower than planned non-electric benefits are primarily due to the application of evaluation results, which decreased non-electric benefits for all measures
- **Cost Effectiveness:** The lower than planned TRC Costs is a result of the lower PI achieved compared to plan. Planned Net Benefits were negatively impacted by the removal of non-energy benefits associated with the CoolSmart Furnace Fan for GasNetworks rebated equipment, as was directed by the D.P.U. and as filed by the Company on February 13, 2013, D.P.U. 11-110. Actual Net Benefits were higher than Plan due to variances in the actual measures installed.

EM&V Studies included in this Annual Report that apply to the **Residential Cooling & Heating Equipment Program:**

- *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 Company was to increase energy savings and decrease 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 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. 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.

**Changes resulting from Current Year Program Performance:** The Company regularly reviews best available information to adjust strategies in order to achieve energy efficiency goals. With respect to 2012 program performance information, the Company incorporated the best available information into its 2013-2015 energy efficiency plan. With respect to the results of EM&V studies that were completed for 2012, the Company will review those results and make any necessary adjustments to ensure it remains on track to achieve its goals for 2013-2105. The Company 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) (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:** Residential multi-family facilities with five or more dwelling units were targeted by this program.

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

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 program is discussed in detail in the Company's 2010-2012 Three-Year Electric Energy Efficiency Plan, filed October 30, 2009. See Fitchburg Gas and Electric Light Company d/b/a Unitil, D.P.U. 09-117. The program was approved by the Department on January 28, 2010 in Fitchburg Gas and Electric Light Company d/b/a Unitil, D.P.U. 09-120.

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

**Table II.A.6**

Residential Multifamily Retrofit 5+							
Performance Category	Units	Planned Value	Preliminary Year-End Results		Evaluated Results		
			Value	% Change from Planned	Value	% Change from Preliminary	% Change from Planned
<b>Expenses</b>							
Total Program Costs	\$	\$ 200,000			\$ 150,077		-25%
Performance Incentive	\$	\$ 23,810			\$ 9,682		-59%
Participants	Units	32			244		663%
Program Cost / Participant	\$	\$ 6,250			\$ 615		-90%
<b>Savings and Benefits</b>							
<b>Energy</b>							
Lifetime	MWh	2,824	1,566	-45%	1,361	-13%	-52%
Annualized	MWh	236	227	-4%	198	-13%	-16%
Average Measure Life	Yrs	12	7	-42%	7	0%	-42%
<b>Demand</b>							
Lifetime	kW	1,285.5	58.2	-95%	63.1	9%	-95%
Annualized							
Summer	kW	66.8	8.4	-87%	9.0	7%	-87%
Winter	kW	83.1	16.8	-80%	59.6	254%	-28%
Average Measure Life	Yrs	19	7	-64%	7	1%	-64%
Non-Electric Benefits (Lifetime)	\$	\$ 1,419,729	\$ 496,402	-65%	\$ 495,839	0%	-65%
<b>Cost-Effectiveness</b>							
TRC Benefits	\$	\$ 2,040,893			\$ 645,799		-68%
TRC Costs	\$	\$ 244,526			\$ 191,035		-22%
Net Benefits	\$	\$ 1,796,367			\$ 454,764		-75%
BCR		8.3			3.38		-59%

**Variance Analysis:** The following section discusses the variables associated with significant variances between planned and actual results.

- Total Program Costs: Expenditures in this program were under budget for all categories.
- Performance Incentive: The Performance Incentive for this program reflects the lower than expected achievement in Savings, TRC Benefits and Net Benefits.
- Participants: The Company successfully completed major lighting retrofits at several large multifamily buildings in its service territory which served a significant number of units.

- **Program Cost/Participant:** The variance is a result of measure mix. The Company's plan included weatherization as well as refrigeration replacements which have much higher rebates per participant than the lighting retrofits that characterized the actual activity under this program.
- **Energy Savings:** The lower than planned energy savings is also attributable to measure mix. As described above, the Company planned for weatherization and refrigeration measures, which would have resulted in overall higher savings than the lighting measures that were actually installed. Additionally, the application of evaluation results increased the freeridership rate for lighting, which negatively impacted savings (*see* Appendix C Study 7 of the Company's 2011 Energy Efficiency Annual Report, D.P.U. 12-58).
- **Demand Savings:** As with energy, the installation of exclusively lighting measures resulted in lower than planned annual, lifetime, summer, and winter demand savings.
- **Cost Effectiveness:** See discussion above which resulted in lower than planned TRC Benefits, TRC Costs, and overall Net Benefits.

EM&V Studies included in this Annual Report that apply to the **Multi-Family Retrofit Program:**

- *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 increased for all energy-efficient light bulbs, including CFLs, LEDs, and fluorescent tubes, was 39% in 2013. The results of this study will increase energy savings by increasing the number of bulbs found in indoor fixtures. The study is discussed in more detail in Section III, Study 7.

**Changes resulting from Current Year Program Performance:** The Company regularly reviews best available information to adjust strategies in order to achieve energy efficiency goals. With respect to 2012 program performance information, the Company incorporated the best available information into its 2013-2015 energy efficiency plan. With respect to the results of EM&V studies that were completed for 2012, the Company will review those results and make any necessary adjustments to ensure it remains on track to achieve its goals for 2013-2105. The Company 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) (2013).

d. Residential Mass Save/Home Energy Services ("HES")

**Purpose/Goal:** The purpose of the Mass Save/HES program was to provide residential customers with energy efficiency recommendations and incentives 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.

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.

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

**Targeted End-Uses:**

- Lighting
- HVAC
- Hot Water
- Envelope
- Refrigeration

**Delivery Mechanism:** The Mass Save and Gas Weatherization programs were fully integrated in 2011 and were implemented by each PA's competitively procured lead vendor (see below). Currently, Unitil contracts with two Home Performance Contractors (HPCs) to provide "turnkey" audits and weatherization work. Given its size, Unitil does not have any Independent Insulation Contractors (IICs) under contract to implement this program.

Unitil serves as its own Lead Vendor and manages this program throughout its electric and gas service territories. As a lead vendor, the Company is responsible for managing and training market based participants such as participating IICs and HPCs. Additional lead vendor responsibilities include:

- Consistent statewide training
- Data reporting
- Achieving aggressive savings
- Customer satisfaction
- Quality control standards
- Scheduling requirements
- Technical assistance
- Maintaining and reporting health and safety information

Two groups of Mass Save participating contractors, HPCs and IICs, provided services in

addition to those services offered by the lead vendor. All participating contractors had to meet program eligibility and requirements. HPCs independently recruited customers, provided 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., a third-party Quality Control (“QC”) vendor responsible for performing QC inspections of program implementation vendors and participating contractors. The QC vendor provided valuable information and feedback to the Program Administrators on program successes and identified areas of possible improvement.

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

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

**Docket/Exhibit where the Program is Discussed and Approved:** The program is discussed in detail in the Company’s 2010-2012 Three-Year Electric Energy Efficiency Plan, filed October 30, 2009 and the Company’s 2012 RCS Budget Petition, filed November 1, 2011. See Fitchburg Gas and Electric Light Company, D.P.U. 09-117, and Fitchburg Gas and Electric Light Company, D.P.U. 11-RCS-02, respectively. The program was approved by the Department on January 28, 2010 in Fitchburg Gas and Electric Light Company, D.P.U. 09-117 and on December 27, 2011 in Fitchburg Gas and Electric Light Company, D.P.U. 11-RCS-02, respectively.

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

Table II.A.7

Residential MassSave							
Performance Category	Units	Planned Value	Preliminary Year-End Results		Evaluated Results		
			Value	% Change from Planned	Value	% Change from Preliminary	% Change from Planned
<b>Expenses</b>							
Total Program Costs	\$	\$ 571,736			\$ 579,829		1%
Performance Incentive	\$	\$ 51,202			\$ 23,858		-53%
Participants	Units	223			238		7%
Program Cost / Participant	\$	\$ 2,564			\$ 2,436		-5%
<b>Savings and Benefits</b>							
<b>Energy</b>							
Lifetime	MWh	3,819	773	-80%	598	-23%	-84%
Annualized	MWh	267	106	-60%	78	-26%	-71%
Average Measure Life	Yrs	14	7	-49%	8	5%	-46%
<b>Demand</b>							
Lifetime	kW	2,489.3	92.4	-96%	59.7	-35%	-98%
<b>Annualized</b>							
Summer	kW	120.3	11.6	-90%	5.1	-56%	-96%
Winter	kW	40.4	22.1	-45%	23.5	6%	-42%
Average Measure Life	Yrs	21	8	-61%	12	45%	-44%
Non-Electric Benefits (Lifetime)	\$	\$ 3,109,751	\$ 1,485,190	-52%	\$ 1,315,660	-11%	-58%
<b>Cost-Effectiveness</b>							
TRC Benefits	\$	\$ 4,172,811			\$ 1,399,787		-66%
TRC Costs	\$	\$ 721,253			\$ 709,366		-2%
Net Benefits	\$	\$ 3,451,558			\$ 690,422		-80%
BCR		5.8			2.0		-66%

Variance Analysis: The following section discusses the variables associated with significant variance between planned and actual results.

- Performance Incentive: The Performance Incentive for this program reflects the lower than expected achievement in Savings, TRC Benefits and Net Benefits.
- Energy Savings: The variance between planned and actual savings is due in part to measure mix, which included more non-electric projects and measures than planned. In addition, the application of evaluation results introduced a 36% realization rate to certain measures in the program, which further reduced overall energy savings. Finally, per unit savings for DWH measures and CFL bulbs declined compared to the planned unit savings as a result of the Home Energy Services Impact Evaluation (*see* Exhibit 1, Appendix P, Study 3 of the Company’s Three-Year Energy Efficiency Plan 2013-2015, D.P.U. 12-108).
- Demand Savings: As with energy, measure mix and evaluation results accounted for the lower than planned actual savings.
- Non-Electric Benefits: Non-Electric Benefits were impacted by the measure mix as well as the evaluation results described above, which reduced both the savings and the value of the savings. Additionally, the program applied revised load shapes to calculate energy

and demand benefits (*see* Appendix C Study 9 of the Company's 2011 Energy Efficiency Annual Report, D.P.U. 12-58).

- **Cost Effectiveness:** As described above, measure mix and the impact of evaluations on savings resulted in lower than planned TRC Benefits, Net Benefits, and program BCR.

EM&V Studies included in this Annual Report that apply to the **MassSave Program:**

- *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 Company'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 make 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.

**Changes resulting from Current Year Program Performance:** The Company regularly reviews best available information to adjust strategies in order to achieve energy efficiency goals. With respect to 2012 program performance information, the Company incorporated the best available information into its 2013-2015 energy efficiency plan. With respect to the results of EM&V studies that were completed for 2012, the Company will review those results and make any necessary adjustments to ensure it remains on track to achieve its goals for 2013-2105. The Company 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) (2013).

e. Residential ENERGY STAR Lighting

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

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

**Definition of Program Participant:** Participants are defined as the number of products purchased 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
LED's	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:** Residential lighting

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

A manufacturer/retailer outreach contractor recruited and trained retailers to participate in the program, placed point-of-purchase materials and rebate coupons in participating retail stores, oversaw the Negotiated Cooperative Promotions (“NCP”) process, and acted as a liaison for Program Administrators, manufacturers, and retailers.

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

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

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

**Docket/Exhibit where the Program is Discussed and Approved:** The program is discussed in detail in the Company’s 2010-2012 Three-Year Electric Energy Efficiency Plan, filed October 30, 2009. See Fitchburg Gas and Electric Light Company d/b/a Unitil, D.P.U. 09-117. The program was approved by the Department on January 28, 2010 in Fitchburg Gas and Electric Light Company d/b/a Unitil, D.P.U. 09-117.

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
<b>Expenses</b>							
Total Program Costs	\$	\$ 206,000			\$ 137,008		-33%
Performance Incentive	\$	\$ 10,297			\$ 8,549		-17%
Participants	Units	30,409			25,001		-18%
Program Cost / Participant	\$	\$ 7			\$ 5		-19%
<b>Savings and Benefits</b>							
<b>Energy</b>							
Lifetime	MWh	5,789	3,834	-34%	4,191	9%	-28%
Annualized	MWh	827	584	-29%	599	3%	-28%
Average Measure Life	Yrs	7	7	-6%	7	7%	0%
<b>Demand</b>							
Lifetime	kW	642.1	412.2	-36%	438.9	6%	-32%
<b>Annualized</b>							
Summer	kW	91.7	62.8	-32%	62.7	0%	-32%
Winter	kW	186.9	125.6	-33%	158.7	26%	-15%
Average Measure Life	Yrs	7	7	-6%	7	7%	0%
Non-Electric Benefits (Lifetime)	\$	\$ 54,651	\$ 37,856	-31%	\$ 37,856	0%	-31%
<b>Cost-Effectiveness</b>							
TRC Benefits	\$	\$ 784,555			\$ 573,044		-27%
TRC Costs	\$	\$ 318,196			\$ 196,350		-38%
Net Benefits	\$	\$ 466,359			\$ 376,694		-19%
BCR		2.5			2.9		18%

Variance Analysis: The following section discusses the variables associated with significant variances between planned and actual results.

- **Total Program Costs:** The variance between planned and actual expenditures is attributed to lower than planned expenditures in marketing, customer incentives, and M&E. Actual expenditures for customer incentives were 50% lower than planned.
- **Performance Incentive:** The Performance Incentive for this program reflects the lower than expected achievement in Savings, TRC Benefits and Net Benefits.
- **Energy Savings:** The variance between planned and actual savings is due to fewer measures being rebated compared to plan. A deviation in planned measure mix also played a role lowering energy savings, notably a shortfall in the number of hard-to-reach (HTR) CFLs rebated. The HTR CFLs have a higher net-to-gross ratio than regular CFLs which means that more savings are realized per HTR bulb than a regular CFL. The shift to proportionately fewer HTR CFLs than regular CFLs resulted in lower savings per bulb than planned.
- **Demand Savings:** As with energy savings, the negative variance in demand savings is attributable to fewer measures rebated, and a measure mix that resulted in lower demand savings.
- **Non-Electric Benefits:** The variance between planned and actual benefits is due to fewer

measures being rebated and changes in measure mix. Notably, fewer fixtures were rebated compared to planned, which resulted in a lower per unit NEB.

- Cost Effectiveness: See discussion above which resulted in lower than planned TRC Benefits, TRC Costs, Net Benefits, and program BCR.

EM&V Studies included in this Annual Report that apply to the **ENERGY STAR Lighting Program:**

- 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 CFLs 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. The study also explored 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 increased for all energy-efficient light bulbs, including CFLs, LEDs, and fluorescent tubes, was 39% in 2013. The results of this study will increase energy savings 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 the Energy Independence and Security Act (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.

**Changes resulting from Current Year Program Performance:** The Company regularly reviews best available information to adjust strategies in order to achieve energy efficiency goals. With respect to 2012 program performance information, the Company incorporated the best available information into its 2013-2015 energy efficiency plan. With respect to the results of EM&V studies that were completed for 2012, the Company will review those results and make any necessary adjustments to ensure it remains on track to achieve its goals for 2013-2105. The Company 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) (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 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 rebated measure.

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 product for customers in 2012.

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

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

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

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

**Docket/Exhibit where the Program is Discussed and Approved:** The program is discussed in detail in the Company's 2010-2012 Three-Year Electric Energy Efficiency Plan, filed October 30, 2009. See Fitchburg Gas and Electric Light Company d/b/a Unitil, D.P.U. 09-117. The program was approved by the Department on January 28, 2010 in Fitchburg Gas and Electric Light Company d/b/a Unitil, D.P.U. 09-117.

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

**Table II.A.9**

Residential ENERGY STAR® Appliance							
Performance Category	Units	Planned Value	Preliminary Year-End Results		Evaluated Results		
			Value	% Change from Planned	Value	% Change from Preliminary	% Change from Planned
<b>Expenses</b>							
Total Program Costs	\$	\$ 133,000			\$ 80,420		-40%
Performance Incentive	\$	\$ 3,528			\$ 3,865		10%
Participants	Units	1,787			985		-45%
Program Cost / Participant	\$	\$ 74			\$ 82		10%
<b>Savings and Benefits</b>							
<b>Energy</b>							
Lifetime	MWh	2,076	1,927	-7%	1,933	0%	-7%
Annualized	MWh	231	288	25%	290	1%	26%
Average Measure Life	Yrs	9	7	-26%	7	0%	-26%
<b>Demand</b>							
Lifetime	kW	238.3	143.9	-40%	285.7	99%	20%
<b>Annualized</b>							
Summer	kW	27.2	19.6	-28%	43.4	121%	59%
Winter	kW	49.4	29.3	-41%	53.5	83%	8%
Average Measure Life	Yrs	9	7	-16%	7	-10%	-25%
Non-Electric Benefits (Lifetime)	\$	\$ 13,934	\$ 4,389	-68%	\$ 4,389	0%	-68%
<b>Cost-Effectiveness</b>							
TRC Benefits	\$	\$ 280,548			\$ 270,726		-4%
TRC Costs	\$	\$ 160,205			\$ 90,564		-43%
Net Benefits	\$	\$ 120,342			\$ 180,161		50%
BCR		1.8			3.0		71%

Variance Analysis: The following section discusses the variables associated with significant variances between planned and actual results.

- **Total Program Costs:** The variance between planned and actual program costs is attributed to lower than planned expenditures in marketing, customer incentives, and M&E. Actual expenditures for customer incentives were 64% below planned
- **Participants:** The Company has a limited appliance retailer presence and partnership opportunities in its service territory, which led to lower participation than planned.
- **Energy Savings:** The positive variance between planned and actual savings is due to measure mix. In particular, the Company rebated a significantly higher number of

televisions than planned, which carry high per unit savings. This also impacted the average measure life as televisions carry a lower measure life than refrigerators, for which fewer rebates were provided than planned.

- **Demand Savings:** Demand savings were impacted by measure mix and the application of revised load shapes that are used to calculate demand savings (*see* Appendix C Study 9 of the Company's 2011 Energy Efficiency Annual Report, D.P.U. 12-58).
- **Non-Energy Benefits:** The negative variance between planned and actual non-energy benefits is due entirely to measure mix – specifically the actual number of refrigerator and freezer recycling measures was significantly below planned. These are the only measures that have associated non-energy benefits.
- **Cost Effectiveness:** Lower program TRC Costs and higher Net Benefits resulted in a significantly higher actual BCR than planned.

EM&V Studies included in this Annual Report that apply to the **ENERGY STAR Appliances Program:**

There were no evaluation studies pertaining to this program during the 2012 calendar year.

**Changes resulting from Current Year Program Performance:** The Company regularly reviews best available information to adjust strategies in order to achieve energy efficiency goals. With respect to 2012 program performance information, the Company incorporated the best available information into its 2013-2015 energy efficiency plan. With respect to the results of EM&V studies that were completed for 2012, the Company will review those results and make any necessary adjustments to ensure it remains on track to achieve its goals for 2013-2105. The Company 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) (2013).

### 3. Residential Pilots

#### a. Deep Energy Retrofit

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

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

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

**Definition of 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 Deep Energy Retrofit contractors performing the work the work was handled through technical specialist contractor, program manager and organizations under contract and/or utilizing Department of Energy Building America funds.

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

**How Achievement of the Pilot's Stated Goal was Measured:** The overall goal of the pilot was to attract participants into this "broader and deeper" energy-savings initiative, knowing that costs and project complexities can be barriers to deep energy retrofit participation. Ultimately,

achievement of this goal is measured by the pilot's cost-effectiveness. Based on data collected by National Grid and shared with all Program Administrators, the incremental cost of the Deep Energy Retrofit measures are cost-effective when performed at the time of roof-replacement, siding-replacement, and basement-fitout.

The Company did not have any participants in the Deep Energy Retrofit Pilot in 2012.

**Docket/Exhibit where the Program is Discussed and Approved:** The pilot is discussed in detail in the Company's 2010-2012 Three-Year Electric Energy Efficiency Plan, filed October 30, 2009. See Fitchburg Gas and Electric Light Company d/b/a Unitil, D.P.U. 09-117. The program was approved by the Department on January 28, 2010 in See Fitchburg Gas and Electric Light Company d/b/a Unitil, D.P.U. 09-117.

B. Low-Income Sector Programs

1. Summary

During 2012 the Company implemented the following low-income programs and associated initiatives:<sup>5</sup>

- Low-Income Residential New Construction
- Low-Income Retrofit<sup>6</sup>
  - 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.

Table II.B.1

Low-Income Sector Summary							
Performance Category	Units	Planned Value	Preliminary Year-End Results		Evaluated Results		
			Value	% Change from Planned	Value	% Change from Preliminary	% Change from Planned
<b>Expenses</b>							
Total Program Costs	\$	\$ 585,000			\$ 479,971		-18%
Performance Incentive	\$	\$ 34,385			\$ 26,390		-23%
<b>Savings and Benefits</b>							
<b>Energy</b>							
Lifetime	MWh	1,808	1,347	-26%	1,116	-17%	-38%
Annualized	MWh	176	133	-24%	103	-23%	-42%
<b>Demand</b>							
Lifetime	kW	289.5	395.0	36%	360.6	-9%	25%
<b>Annualized</b>							
Summer	kW	20.4	23.9	17%	19.2	-20%	-6%
Winter	kW	30.0	35.6	19%	30.8	-13%	3%
Non-Electric Benefits (Lifetime)	\$	\$ 1,802,019	\$ 1,089,083	-40%	\$ 988,568	-9%	-45%
<b>Cost-Effectiveness</b>							
TRC Benefits	\$	\$ 2,050,722			\$ 1,193,947		-42%
TRC Costs	\$	\$ 619,385			\$ 522,368		-16%
Net Benefits	\$	\$ 1,431,336			\$ 671,579		-53%
BCR		3.3			2.3		-31%

<sup>5</sup> The Company did not offer any pilot programs in the low-income sector during 2012. However, low-income new construction customers were eligible for the residential Multi-Family 4-8 story pilot. Please see the residential pilot descriptions.

<sup>6</sup> 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.2**

<b>Low-Income Sector Summary of End-Uses</b>				
<b>End Uses</b>	<b>Units (Lifetime)</b>	<b>Preliminary Year-End Results</b>	<b>Evaluated Results</b>	<b>% Change from Preliminary to Evaluated</b>
<b>Lighting</b>				
Energy	MWh	686	487	-29%
Demand	kW	69.10	34.88	-50%
NEB (Lifetime)	\$	\$ 6,947	\$ 9,427	36%
<b>HVAC</b>				
Energy	MWh	425	411	-3%
Demand	kW	297.67	297.70	0%
NEB (Lifetime)	\$	\$ 1,054,353	\$ 950,843	-10%
<b>Refrigeration</b>				
Energy	MWh	187	176	-6%
Demand	kW	23.14	21.70	-6%
NEB (Lifetime)	\$	\$ 3,350	\$ 3,694	10%
<b>Hot Water</b>				
Energy	MWh	49	43	-13%
Demand	kW	5.11	6.36	24%
NEB (Lifetime)	\$	\$ 24,435	\$ 24,604	1%
<b>EndUse Behavior</b>				
Energy	MWh	-	-	0%
Demand	kW	-	-	0%
NEB (Lifetime)	\$	\$ -	\$ -	0%
<b>Total</b>				
Energy	MWh	1,347	1,116	-17%
Demand	kW	395.02	360.64	-9%
NEB (Lifetime)	\$	\$ 1,089,083	\$ 988,568	-9%

**Table II.B.3**

<b>Low-Income Program Summary</b>				
Sector	Units	Planned Value	Evaluated Results	
			Value	% Change from Planned
<b>Low-Income New Construction &amp; Major Renovation</b>				
TRC Benefits	\$	\$ 593,237	\$ 109,300	-82%
TRC Costs	\$	\$ 87,944	\$ 52,759	-40%
Net Benefits	\$	\$ 505,293	\$ 56,542	-89%
BCR		6.7	2.1	-69%
<b>Low-Income Retrofit (Includes LEAN Funding)</b>				
TRC Benefits	\$	\$ 1,457,484	\$ 1,084,646	-26%
TRC Costs	\$	\$ 496,441	\$ 461,064	-7%
Net Benefits	\$	\$ 961,043	\$ 623,583	-35%
BCR		2.9	2.4	-20%
<b>Hard-To-Measure Initiatives</b>				
TRC Costs	\$	\$ 35,000	\$ 8,546	-76%
<b>Total</b>				
TRC Benefits	\$	\$ 2,050,722	\$ 1,193,947	-42%
TRC Costs (incl HTM Initiatives)	\$	\$ 619,385	\$ 522,368	-16%
Net Benefits	\$	\$ 1,431,336	\$ 671,579	-53%
BCR		3.3	2.3	-31%

As shown, there are significant variances between planned values and evaluated results in nearly all of the categories at the sector level. The primary reasons for the variances are the difference in planned compared to actual measure mix as well as the application of evaluation results for some programs in this sector. A detailed program-level discussion of the variances is found in Section II.B.

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

### **Low-Income Sector Performance Highlights**

#### Low-Income Residential New Construction

The Low-Income Residential New Construction Program provided incentives to developers of 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 as well as the Massachusetts' Department of Health and Human Services' Low-Income Home Energy Assistance Program for their low-income energy efficiency programs. This collaborative 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 Retrofit 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 type of customer in its territory.

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

2. Low-Income Programs

a. Low-Income New Construction

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

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

**Definition of Program Participant:** A participant is defined as a unique electric account served under this program. For the low-income new construction program, the account represents 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 program is discussed in detail in the Company’s 2010-2012 Three-Year Electric Energy Efficiency Plan, filed October 30, 2009. See Fitchburg Gas and Electric Light Company d/b/a Unitil, D.P.U. 09-117. The program was approved by the Department on January 28, 2010 in Fitchburg Gas and

Electric Light Company d/b/a Unitil, D.P.U. 09-117.

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

**Table II.B.4**

Low-Income New Construction & Major Renovation							
Performance Category	Units	Planned Value	Preliminary Year-End Results		Evaluated Results		
			Value	% Change from Planned	Value	% Change from Preliminary	% Change from Planned
<b>Expenses</b>							
Total Program Costs	\$	\$ 78,000			\$ 35,294		-55%
Performance Incentive	\$	\$ 9,944			\$ 1,459		-85%
Participants	Units	30			10		-67%
Program Cost / Participant	\$	\$ 2,600			\$ 3,529		36%
<b>Savings and Benefits</b>							
<b>Energy</b>							
Lifetime	MWh	403	114	-72%	76	-33%	-81%
Annualized	MWh	39	15	-62%	10	-30%	-74%
Average Measure Life	Yrs	10	8	-25%	8	-4%	-28%
<b>Demand</b>							
Lifetime	kW	148.1	11.4	-92%	7.5	-34%	-95%
Annualized							
Summer	kW	8.3	1.5	-82%	1.1	-30%	-87%
Winter	kW	6.8	2.9	-58%	2.1	-27%	-69%
Average Measure Life	Yrs	18	8	-58%	7	-6%	-60%
Non-Electric Benefits (Lifetime)	\$	\$ 514,747	\$ 97,790	-81%	\$ 99,831	2%	-81%
<b>Cost-Effectiveness</b>							
TRC Benefits	\$	\$ 593,237			\$ 109,300		-82%
TRC Costs	\$	\$ 87,944			\$ 52,759		-40%
Net Benefits	\$	\$ 505,293			\$ 56,542		-89%
BCR		6.7			2.1		-69%

Variance Analysis: The following section discusses the variables associated with significant variances between planned and actual results.

- Total Program Costs: Expenditures in this program were under budget for all categories.
- Performance Incentive: The negative variance between planned and actual Performance Incentive is attributed to lower than planned actual savings, benefits and net benefits.
- Participants: This program was impacted by economic conditions, which resulted in very few low income new construction housing starts in the Company's service territory. The cost per participant was higher than planned due to the assignment of fixed program costs to those units that were completed.
- Energy Savings: The variance between planned and actual savings is due to fewer than planned projects and measures, including the installation of energy efficient appliances and lighting.
- Demand Savings: Demand savings are impacted by participant and measure mix and to a

lesser extent, the application of revised load shapes that are used to calculate demand savings (*see* Appendix C Study 9 of the Company's 2011 Energy Efficiency Annual Report, D.P.U. 12-58).

- Non-Electric Benefits: The variance between planned and actual benefits is due to low participation and measure mix.
- Cost Effectiveness: Low program TRC Benefits, TRC Costs, and Net Benefits resulted in a significantly lower actual BCR.

EM&V Studies included in this Annual Report that apply to the **Low-Income Residential New Construction Program**:

- *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 increased for all energy-efficient light bulbs, including CFLs, LEDs, and fluorescent tubes, was 39% in 2013. The results of this study will increase energy savings by increasing the number of bulbs found in indoor fixtures. The study is discussed in more detail in Section III, Study 7.
- *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 hours-of-use (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). This is a preliminary result; 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, Study 11.

**Changes resulting from Current Year Program Performance:** The Company regularly reviews best available information to adjust strategies in order to achieve energy efficiency goals. With respect to 2012 program performance information, the Company incorporated the best available information into its 2013-2015 energy efficiency plan. With respect to the results of EM&V studies that were completed for 2012, the Company will review those results and make any necessary adjustments to ensure it remains on track to achieve its goals for 2013-2015. The Company 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) (2013).

b. Low-Income Retrofit Program

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

The purpose of the Low-Income 1-4 Family Retrofit 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 Retrofit 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 Retrofit 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 LIMF Retrofit 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. The unique account is tied to the low-income energy audit.

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 (“LEAN”). 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 program is discussed in detail in the Company's 2010-2012 Three-Year Electric Energy Efficiency Plan, filed October 30, 2009. See Fitchburg Gas and Electric Light Company d/b/a Unitil, D.P.U. 09-117. The program was approved by the Department on January 28, 2010 in Fitchburg Gas and Electric Light Company d/b/a Unitil, D.P.U. 09-117.

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

**Table II.B.5**

<b>Low-Income Retrofit (Includes LEAN Funding)</b>							
Performance Category	Units	Planned Value	Preliminary Year-End Results		Evaluated Results		
			Value	% Change from Planned	Value	% Change from Preliminary	% Change from Planned
<b>Expenses</b>							
Total Program Costs	\$	\$ 472,000			\$ 436,132		-8%
Performance Incentive	\$	\$ 24,441			\$ 24,932		2%
Participants	Units	108			240		122%
Program Cost / Participant	\$	\$ 4,370			\$ 1,817		-58%
<b>Savings and Benefits</b>							
<b>Energy</b>							
Lifetime	MWh	1,405	1,232	-12%	1,040	-16%	-26%
Annualized	MWh	137	119	-14%	93	-22%	-32%
Average Measure Life	Yrs	10	10	1%	11	8%	9%
<b>Demand</b>							
Lifetime	kW	141.4	383.6	171%	353.1	-8%	150%
<b>Annualized</b>							
Summer	kW	12.1	22.4	86%	18.1	-19%	50%
Winter	kW	23.2	32.7	41%	28.7	-12%	24%
Average Measure Life	Yrs	12	17	46%	19	14%	66%
Non-Electric Benefits (Lifetime)	\$	\$ 1,287,272	\$ 991,293	-23%	\$ 888,738	-10%	-31%
<b>Cost-Effectiveness</b>							
TRC Benefits	\$	\$ 1,457,484			\$ 1,084,646		-26%
TRC Costs	\$	\$ 496,441			\$ 461,064		-7%
Net Benefits	\$	\$ 961,043			\$ 623,583		-35%
BCR		2.9			2.4		-20%

Variance Analysis: The following section discusses the variables associated with significant variances between planned and actual results.

- **Participants:** The Company successfully completed major lighting retrofits at two very large multifamily buildings in its service territory which served a significant number of units through the LI MF program. The LI SF program also exceeded its planned number of participants.
- **Energy Savings:** The negative variance between planned and actual savings is due to

measure mix and the application of deemed measure savings from the Low Income Single Family Program Impact Evaluation (*see* Appendix C Study 17 of the Company's 2011 Energy Efficiency Annual Report, D.P.U. 12-58).

- Demand Savings: The positive variance between planned and actual demand savings was the result of measure mix.
- Non-Electric Benefits: The variance between planned and actual non-energy benefits is due primarily to the measure mix in LI MF which planned for weatherization measures with fuel savings but had only installed lighting measures. The non-energy benefits in the LI SF program were lower than planned but not significantly.
- Cost Effectiveness: Lower than planned Net Benefits resulted in a lower actual BCR.

EM&V Studies included in this Annual Report that apply to the **Low-Income Retrofit Program**:

- *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 hours-of-use (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). This is a preliminary result; 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.

**Changes resulting from Current Year Program Performance:** The Company regularly reviews best available information to adjust strategies in order to achieve energy efficiency goals. With respect to 2012 program performance information, the Company incorporated the best available information into its 2013-2015 energy efficiency plan. With respect to the results of EM&V studies that were completed for 2012, the Company will review those results and make any necessary adjustments to ensure it remains on track to achieve its goals for 2013-2105. The Company 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) (2013).

C. Commercial and Industrial Sector Programs

1. Summary

During 2012 the Company implemented the following Commercial and Industrial (“C&I”) programs:

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

The Company 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.

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
<b>Expenses</b>							
Total Program Costs	\$	\$ 3,601,038			\$ 2,406,316		-33%
Performance Incentive	\$	\$ 154,066			\$ 185,828		21%
<b>Savings and Benefits</b>							
<b>Energy</b>							
Lifetime	MWh	98,600	60,741	-38%	58,145	-4%	-41%
Annualized	MWh	7,411	4,798	-35%	4,617	-4%	-38%
<b>Demand</b>							
Lifetime	kW	12,629.33	24,418	93%	25,078	3%	99%
<b>Annualized</b>							
Summer	kW	931.10	2,182	134%	2,252	3%	142%
Winter	kW	629.74	1,564	148%	1,799	15%	186%
Non-Electric Benefits (Lifetime)	\$	\$ 205,559	\$ 134,268	-35%	\$ 1,519,764	1032%	639%
<b>Cost-Effectiveness</b>							
TRC Benefits	\$	\$ 13,543,868			\$ 15,096,462		11%
TRC Costs	\$	\$ 5,988,682			\$ 4,294,467		-28%
Net Benefits	\$	\$ 7,555,186			\$ 10,801,995		43%
BCR		2.3			3.5		55%

**Table II.C.2**

<b>Commercial &amp; Industrial Sector Summary of End-Uses</b>				
<b>End Uses</b>	<b>Units (Lifetime)</b>	<b>Preliminary Year-End Results</b>	<b>Evaluated Results</b>	<b>% Change from Preliminary to Evaluated</b>
<b>Lighting</b>				
Energy	MWh	28,743	28,016	-3%
Demand	kW	7,093	6,623	-7%
NEB (Lifetime)	\$	\$ 134,268	\$ 681,558	408%
<b>HVAC</b>				
Energy	MWh	1,684	1,684	0%
Demand	kW	101	101	0%
NEB (Lifetime)	\$	\$ -	\$ 44,626	0%
<b>Motors</b>				
Energy	MWh	12,750	12,750	0%
Demand	kW	4,487	4,487	0%
NEB (Lifetime)	\$	\$ -	\$ 663,397	0%
<b>Refrigeration</b>				
Energy	MWh	226	226	0%
Demand	kW	22.98	22.98	0%
NEB (Lifetime)	\$	\$ -	\$ 10,029	0%
<b>Compressed Air</b>				
Energy	MWh	1,740	1,740	0%
Demand	kW	249.66	249.66	0%
NEB (Lifetime)	\$	\$ -	\$ -	0%
<b>Process</b>				
Energy	MWh	15,598	13,729	-12%
Demand	kW	12,464	13,594	9%
NEB (Lifetime)	\$	\$ -	\$ 120,153	0%
<b>Total</b>				
Energy	MWh	60,741	58,145	-4%
Demand	kW	24,418	25,078	3%
NEB (Lifetime)	\$	\$ 134,268	\$ 1,519,764	1032%

Table II.C.3

Commercial & Industrial Program Summary				
Sector	Units	Planned Value	Evaluated Results	
			Value	% Change from Planned
<b>Commercial &amp; Industrial New Construction &amp; Major Renovation</b>				
TRC Benefits	\$	\$ 2,710,839	\$ 6,219,491	129%
TRC Costs	\$	\$ 1,080,755	\$ 1,081,472	0%
Net Benefits	\$	\$ 1,630,084	\$ 5,138,019	215%
BCR		2.5	5.8	129%
<b>Commercial &amp; Industrial Large Retrofit</b>				
TRC Benefits	\$	\$ 6,127,407	\$ 5,293,383	-14%
TRC Costs	\$	\$ 3,123,909	\$ 1,601,838	-49%
Net Benefits	\$	\$ 3,003,498	\$ 3,691,545	23%
BCR		2.0	3.3	68%
<b>Commercial &amp; Industrial Small Retrofit</b>				
TRC Benefits	\$	\$ 4,705,622	\$ 3,583,587	-24%
TRC Costs	\$	\$ 1,719,018	\$ 1,574,986	-8%
Net Benefits	\$	\$ 2,986,604	\$ 2,008,601	-33%
BCR		2.7	2.3	-17%
<b>Hard-To-Measure Initiatives</b>				
TRC Costs	\$	\$ 65,000	\$ 36,171	-44%
<b>Total</b>				
TRC Benefits	\$	\$ 13,543,868	\$ 15,096,462	11%
TRC Costs (incl HTM Initiatives)	\$	\$ 5,988,682	\$ 4,294,467	-28%
Net Benefits	\$	\$ 7,555,186	\$ 10,801,995	43%
BCR		2.3	3.5	55%

There are significant variances between planned values and preliminary year-end results in nearly all of the categories at the sector level. The primary reasons for the variances are the difference in planned compared to actual measure mix, as well as, the application of evaluation results for some programs. There are many variables behind the measure mix variability including participation rates, economic decisions by customers, and ramping up of new products/program offerings.

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

### 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 three as eligible

for energy efficiency incentives under the Mass Save program.<sup>7</sup> Third, the energy use of major medical equipment in the healthcare sector, such as Magnetic Resonance Imaging (MRI) 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 for this analysis in 2012.<sup>8</sup>

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. 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 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 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.

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<sup>7</sup> Of the other 15 technologies considered by MTAC in 2012, three were denied approval; the remaining 12 were continued into 2013 for additional evaluation – either in field monitoring studies or because the MTAC was awaiting additional documentation from applicants.

<sup>8</sup> The final Fraunhofer report, presented in early 2013, demonstrated 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.

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 Q3/Q4 of 2012.

Quality control and quality assurance ("QA/QC") 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 CRI. Starting in the third quarter of 2012, CRI began inspecting five 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 also include HVAC measures 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 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** – NU and National Grid led an effort to characterize the market for energy efficiency for the term of the 2013-2015 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. NU 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.

## 2. C&I Programs

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

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

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

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

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

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

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

**Docket/Exhibit where the Program is Discussed and Approved:** The program is discussed in detail in the Company's 2010-2012 Three-Year Electric Energy Efficiency Plan, filed October 30, 2009. See Fitchburg Gas and Electric Light Company d/b/a Unutil, D.P.U. 09-117. The program was approved by the Department on January 28, 2010 in Fitchburg Gas and Electric Light Company d/b/a Unutil, D.P.U. 09-117.

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

Table II.C.4

Commercial & Industrial New Construction & Major Renovation							
Performance Category	Units	Planned Value	Preliminary Year-End Results		Evaluated Results		
			Value	% Change from Planned	Value	% Change from Preliminary	% Change from Planned
<b>Expenses</b>							
Total Program Costs	\$	\$ 529,706			\$ 539,242		2%
Performance Incentive	\$	\$ 33,310			\$ 79,504		139%
Participants	Units	12			21		74%
Program Cost / Participant	\$	\$ 43,844			\$ 25,678		-41%
<b>Savings and Benefits</b>							
<b>Energy</b>							
Lifetime	MWh	16,726	15,695	-6%	14,573	-7%	-13%
Annualized	MWh	1,115	1,263	13%	1,209	-4%	8%
Average Measure Life	Yrs	15	12	-17%	12	-3%	-20%
<b>Demand</b>							
Lifetime	kW	3,755	14,331	282%	15,444	8%	311%
Annualized							
Summer	kW	250	1,397	458%	1,509	8%	503%
Winter	kW	205	980	377%	1,202	23%	486%
Average Measure Life	Yrs	15	10	-32%	10	0%	-32%
Non-Electric Benefits (Lifetime)	\$	\$ -	\$ -	0%	\$ -	0%	0%
<b>Cost-Effectiveness</b>							
TRC Benefits	\$	\$ 2,710,839			\$ 6,219,491		129%
TRC Costs	\$	\$ 1,080,755			\$ 1,081,472		0%
Net Benefits	\$	\$ 1,630,084			\$ 5,138,019		215%
BCR		2.5			5.8		129%

Variance Analysis: The following section discusses the variables associated with significant variances between planned and actual results.

- Performance Incentive: This program earned more Performance Incentive than planned, due to greater TRC Benefits and Net Benefits resulting from the addition of the Bright Opportunities Upstream Lighting Program.
- Participants: The introduction of the Bright Opportunities Upstream Lighting Program contributed significantly to the positive variance between the planned and actual number of participants.
- Program Cost/Participant: The lower than planned variance is due to the Upstream Lighting Program, which carries much lower incentives per participant than other measures and which accounted for 33% of total program incentives.
- Average Measure Life: The variance is a result of the measure mix which included a significant number of Bright Opportunity lighting measures, which have a lower measure life than the projects which were originally planned for the program.
- Demand Savings: The significant and positive variance between planned and actual demand savings is directly attributed to the success of the Bright Opportunities Upstream Lighting Program which accounts for 96% of the actual demand savings. Planned savings did not anticipate the introduction of the upstream lighting program and was

based on the average savings per project completed at the time of planning. Bright Opportunities provided savings that exceeded the target demand savings. The application of evaluation results as described below further allocated savings to summer and winter periods although the impact was not significant.

- **Cost Effectiveness:** Higher than planned TRC Benefits can be attributed to the Bright Opportunities Program as well as the positive variance in Net Benefits and BCR.

**EM&V Studies included in this Annual Report that apply to the C&I New Construction and Major Renovation Program:**

- *Impact Evaluation of 2011-2012 Prescriptive VSDs*  
This study produced realization rates for annual kWh for prescriptive variable speed drives (VSDs). The study had no impact on program savings for the Company'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 (ALD) 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 Company was to decrease 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 Company 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 program, barriers to the adoption of efficient lighting technologies under this design, 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 compared to what would have been realized by the Company in the absence of the study. 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*  
The 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.

**Changes resulting from Current Year Program Performance:** The Company regularly reviews best available information to adjust strategies in order to achieve energy efficiency goals. With respect to 2012 program performance information, the Company incorporated the best available information into its 2013-2015 energy efficiency plan. With respect to the results of EM&V studies that were completed for 2012, the Company will review those results and make any necessary adjustments to ensure it remains on track to achieve its goals for 2013-2105. The Company 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) (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 an individual project undertaken by a customer who has received a financial incentive for the completed implementation of one or more electric energy efficiency measures. One customer may undertake multiple projects at different locations during the program year. Each project is therefore counted as an individual participant.

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 & Power

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

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

**Docket/Exhibit where Program is Discussed and Approved:** The program is discussed in detail in the Company's 2010-2012 Three-Year Electric Energy Efficiency Plan, filed October 30, 2009. See Fitchburg Gas and Electric Light Company d/b/a Unitil, D.P.U. 09-117. The program was approved by the Department on January 28, 2010 in Fitchburg Gas and Electric Light Company d/b/a Unitil, D.P.U. 09-117.

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

Table II.C.5

Commercial & Industrial Large Retrofit							
Performance Category	Units	Planned Value	Preliminary Year-End Results		Evaluated Results		
			Value	% Change from Planned	Value	% Change from Preliminary	% Change from Planned
<b>Expenses</b>							
Total Program Costs	\$	\$ 1,869,803			\$ 790,357		-58%
Performance Incentive	\$	\$ 76,205			\$ 65,433		-14%
Participants	Units	39			19		-51%
Program Cost / Participant	\$	\$ 48,402			\$ 41,598		-14%
<b>Savings and Benefits</b>							
<b>Energy</b>							
Lifetime	MWh	51,220	25,214	-51%	24,794	-2%	-52%
Annualized	MWh	3,938	1,996	-49%	1,948	-2%	-51%
Average Measure Life	Yrs	13	13	-3%	13	1%	-2%
<b>Demand</b>							
Lifetime	kW	3,799	5,618	48%	5,395	-4%	42%
<b>Annualized</b>							
Summer	kW	290	441	52%	417	-5%	43%
Winter	kW	229	408	78%	398	-2%	74%
Average Measure Life	Yrs	13	13	-3%	13	2%	-1%
Non-Electric Benefits (Lifetime)	\$	\$ 815	\$ 1,785	119%	\$ 1,039,011	58104%	127435%
<b>Cost-Effectiveness</b>							
TRC Benefits	\$	\$ 6,127,407			\$ 5,293,383		-14%
TRC Costs	\$	\$ 3,123,909			\$ 1,601,838		-49%
Net Benefits	\$	\$ 3,003,498			\$ 3,691,545		23%
BCR		2.0			3.3		68%

Variance Analysis: The following section discusses the variables associated with significant variances between planned and actual results.

- **Program Costs:** Due to the economic downturn, and the limited number of large commercial and industrial customers in our territory, many of whom have already invested in energy efficiency initiatives, the opportunity to incent additional commitments was limited. The result was a significant variance between planned and actual expenditures.
- **Participants:** Anticipated projects by a number of companies did not materialize due to financial constraints, leading to a variance in the number of participants.
- **Energy Savings:** Energy savings goals were based on a projected savings per project based on historical averages. With planned participation falling short for the reasons listed above, savings fell short as well. In addition, in 2012, the average project savings was lower than it had been in prior years, further reducing actual energy savings.
- **Demand Savings:** Actual project demand savings were higher than planned due to the completion of projects that had higher demand savings than had been the average when planning took place and goals were set. The application of evaluation results as described below further allocated savings to summer and winter periods although the impact was not significant since demand savings results were already higher than

planned.

- **Non-Electric Benefits:** The original plan anticipated a small amount of non-energy benefits associated with common area lighting in master metered multi-family buildings. Actual non-energy benefits realized through this program were not attributed to any common area lighting projects but instead to prescriptive and custom equipment. Non-energy benefits were applied based on evaluation studies that applied dollar values per kWh for equipment installed through the program (*see* Study 12 filed with the Company's Three Year Energy Efficiency Plan 2013-2015, D,P.U. 12-104).
- **Cost Effectiveness:** Lower than planned TRC Costs and relatively high Net Benefits resulting from high non-energy benefits, resulted in a higher than planned BCR.

EM&V Studies included in this Annual Report that apply to the **C&I Large Retrofit Program:**

- *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 Company'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 (ALD) 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 Company 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 Company was to increase energy savings for some measures but decrease them for other measures in 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

The 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.

**Changes resulting from Current Year Program Performance:** The Company regularly reviews best available information to adjust strategies in order to achieve energy efficiency goals. With respect to 2012 program performance information, the Company incorporated the best available information into its 2013-2015 energy efficiency plan. With respect to the results of EM&V studies that were completed for 2012, the Company will review those results and make any necessary adjustments to ensure it remains on track to achieve its goals for 2013-2105. The Company 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) (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 with average monthly demand of 300kW or less.

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

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.

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**Targeted End-Uses:**

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

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

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

**Docket/Exhibit where Program is Discussed and Approved:** The program is discussed in detail in the Company's 2010-2012 Three-Year Electric Energy Efficiency Plan, filed October 30, 2009. See Fitchburg Gas and Electric Light Company d/b/a Unitil, D.P.U. 09-117. The program was approved by the Department on January 28, 2010 in Fitchburg Gas and Electric Light Company d/b/a Unitil, D.P.U. 09-117.

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

Table II.C.6

Commercial & Industrial Small Retrofit							
Performance Category	Units	Planned Value	Preliminary Year-End Results		Evaluated Results		
			Value	% Change from Planned	Value	% Change from Preliminary	% Change from Planned
<b>Expenses</b>							
Total Program Costs	\$	\$ 1,136,529			\$ 1,040,545		-8%
Performance Incentive	\$	\$ 44,551			\$ 40,892		-8%
Participants	Units	112			65		-42%
Program Cost / Participant	\$	\$ 10,148			\$ 16,008		58%
<b>Savings and Benefits</b>							
<b>Energy</b>							
Lifetime	MWh	30,654	19,832	-35%	18,778	-5%	-39%
Annualized	MWh	2,358	1,540	-35%	1,459	-5%	-38%
Average Measure Life	Yrs	13	13	-1%	13	0%	-1%
<b>Demand</b>							
Lifetime	kW	5,075.5	4,468.42	-12%	4,239.29	-5%	-16%
<b>Annualized</b>							
Summer	kW	390.4	344.25	-12%	326.63	-5%	-16%
Winter	kW	195.0	176.44	-10%	198.47	12%	2%
Average Measure Life	Yrs	13	13	0%	13	0%	0%
Non-Electric Benefits (Lifetime)	\$	\$ 204,744	\$ 132,483	-35%	\$ 480,753	263%	135%
<b>Cost-Effectiveness</b>							
TRC Benefits	\$	\$ 4,705,622			\$ 3,583,587		-24%
TRC Costs	\$	\$ 1,719,018			\$ 1,574,986		-8%
Net Benefits	\$	\$ 2,986,604			\$ 2,008,601		-33%
BCR		2.7			2.3		-17%

Variance Analysis: The following section discusses the variables associated with significant variances between planned and actual results.

- Participants: The planned number of participants and program cost per participant were based on the historical average for this program. Actual incentives per project were much higher in 2012 than in prior years
- Program Cost/Participant: The higher than planned cost per participant was to the result of higher than planned rebates associated with substantial lighting projects completed for public schools and other municipal buildings in the Company's service territory.
- Energy Savings: The negative variance between planned and actual energy savings is due to changes in measure mix compared to the original plan.
- Non-Electric Benefits: The variance between planned and actual non-energy benefits is attributable to the incorporation of evaluation results which apply dollar values per kWh for measures installed through the program (*see* Study 12 filed with the Company's Three Year Energy Efficiency Plan 2013-2015 , D,P.U. 12-104).

- **Cost Effectiveness:** Lower actual program savings resulted in a significant variance between planned and actual TRC Benefits and Net Benefits.

EM&V Studies included in this Annual Report that apply to the **C&I Small Retrofit Program:**

- *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*

The 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.

**Changes resulting from Current Year Program Performance:** The Company regularly reviews best available information to adjust strategies in order to achieve energy efficiency goals. With respect to 2012 program performance information, the Company incorporated the best available information into its 2013-2015 energy efficiency plan. With respect to the results of EM&V studies that were completed for 2012, the Company will review those results and make any necessary adjustments to ensure it remains on track to achieve its goals for 2013-2105. The Company 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) (2013).

### III. EVALUATION MEASUREMENT AND VERIFICATION ACTIVITIES

#### A. Summary

The Massachusetts Program Administrators completed 25 evaluation studies for the 2012 Energy Efficiency 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 the health care 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 a 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 (“NTG”) 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 (“NME”) 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 an 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 (“NEIs”) 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 program. 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<sup>®</sup> 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 highlight the effects of the first full-year of implantation of the increased lighting efficiency standards mandated by the Energy Independence and Security Act (“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 sixty-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 will not be understood on the lighting market—including on consumer lighting purchases and stockpiling behavior—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 Annual Report	Docket & Exhibit Approving Planned Evaluation Studies	Implemented as Approved? (yes/no)
<b>Residential Program Studies</b>			
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	
<b>Residential Pilot Studies</b>			
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	
<b>Low-Income Program Studies</b>			

**Table III.A**

<b>Evaluation Studies in Annual Report</b>			
<b>Studies</b>	<b>Location of Complete Study in Annual Report</b>	<b>Docket &amp; Exhibit Approving Planned Evaluation Studies</b>	<b>Implemented as Approved? (yes/no)</b>
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
<b>Commercial &amp; Industrial Program Studies</b>			
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	
<b>Special &amp; Cross Sector Studies</b>			
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	

**Table III.A**

Evaluation Studies in Annual Report			
Studies	Location of Complete Study in Annual Report	Docket & Exhibit Approving Planned Evaluation Studies	Implemented as Approved? (yes/no)
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 MA Residential New Construction (RNC) Program. Incremental costs above the costs of typical homes being built outside the program are estimated for single family (SF), low-rise multifamily buildings of three or fewer stories (MF 1-3), and mid- to high-rise multifamily 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
Multifamily 1-3 No Master Meter	\$ 0.10	\$ 1.50	\$ 0.65	\$ 1.18
Multifamily 1-3 Master Meter Gas	\$ 0.08	\$ 1.48	\$ 0.79	\$ 1.35
Multifamily 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
Multifamily 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 and 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 RNC 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 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 1: Average FR, SO, and NTG Estimates**

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

This study also addressed the Quality Installation Verification components of the Cool Smart Program.

Table 2 provides a summary of the QIV FR, SO, and NTG values as follows:

**Table 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
<b>Overall QIV</b>	<b>0.25</b>	<b>0.16</b>	<b>0.91</b>

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 3, participants replacing equipment early (4 or more years of remaining life) represent more than 30% of boiler and 23% of furnace installations, but just 8% 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%. There is virtually no early replacement among ductless mini-split installations. More than 95% 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% across all of the program’s major equipment measures.

**Table 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%

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

- Residential Cooling and Heating Equipment (CoolSmart) (Electric)

**Evaluation Recommendations and Program Administrator Response:** The following recommendations were made by the evaluators conducting this study. The initial response from the Company 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 (PA) 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)	<i>Ex Ante</i>	<i>Ex Post</i>	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
<b>Commonwealth-wide</b>	<b>4,749</b>	<b>±3%</b>	<b>183</b>	<b>139</b>	<b>0.76</b>

### Electric

PA	n	<i>Ex Ante</i>	<i>Ex Post</i>	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
<b>Commonwealth-wide</b>	<b>608</b>	<b>2,527</b>	<b>1,445</b>	<b>0.57</b>

### Heating Oil

PA	n	<i>Ex Ante</i>	<i>Ex Post</i>	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
<b>Commonwealth-wide</b>	<b>10,762</b>	<b>19.8</b>	<b>16.8</b>	<b>0.85</b>

### Propane

PA	n	<i>Ex Ante</i>	<i>Ex Post</i>	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
<b>Commonwealth-wide</b>	<b>391</b>	<b>15.4</b>	<b>12.8</b>	<b>0.83</b>

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

- Residential Mass Save (Home Energy Services) (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**

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

**5. Residential Lighting Shelf Survey and Pricing Analysis.**

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

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

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

**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%, which was statistically similar to the 26% 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% in 2013.

- LED saturation remained low, at 2% 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% of sockets remaining in homes could theoretically be filled with an energy efficient light bulbs; about 57% of the remaining potential rests with standard bulbs, while the other 43% 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 (Both)
- Low Income Residential New Construction (Electric)
- Multi-Family Retrofit (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**

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

### **B. Residential Pilot Studies**

## **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%, 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 (Home Energy Services) (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

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

### 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-senior (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 New Construction (Electric)
- Low-Income 1-4 Family Retrofit (Electric & Gas)
- Low-Income Multi-Family Retrofit (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. C&I Program Studies

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

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

**13. Prescriptive VSD Impact Evaluation**

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

**14. Impact Evaluation of 2010 Prescriptive Lighting Installations**

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

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

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

## **16. Process Evaluation of the 2012 Bright Opportunities Program**

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

## **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% of electric and 81% 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 (CHP) and heating, ventilation and air-conditioning (HVAC). While impact evaluations are underway for lighting and CHP, 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% of billing accounts could be assigned to a business type. However, it appears that while only 1.8% of electric accounts classified as healthcare participated, their average savings was 23%. Similarly for gas, of the 3% 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%, which is higher than the 1.6% 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 (C&I) 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, we found large discrepancies between the segments that the PAs felt they were managing and those we 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 our 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 5 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.**

E. Special & 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 Cape Light Compact (CLC) during the 2012 program year. It also includes process findings for CLC's Smart Home Energy Monitoring Pilot (SHEMP) from 2009 - 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% from program year (PY) 1 to PY2, and 16% from PY2 to PY3. Gas programs have demonstrated an average adjusted net savings gain of 20% from PY1 to PY2, and 23% 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%.

- 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 Mass Save program by 431 customers in 2012.
- CLC’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%-8.8% average savings per household. Comparatively, Energize savings estimates are significantly lower, ranging from 1.49%-1.99% average savings per household.
- CLC’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

CLC’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:

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

where:

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

$\alpha_t$  = Household-specific intercept

$\beta_1$  = Coefficient for the change in consumption between pre- and post-periods

$\beta_2$  = 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:

$$\text{Savings Estimate Ratio}_{u,c,f} = \frac{(\text{Estimated Modeled Savings}) = \sum_{i=0}^2 n * kWh Savings_{u,c,i,f}}{(\text{OPOWER Reported Savings}) = \sum_{i=0}^2 n * kWh Savings_{u,c,i,f}}$$

(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 Wooldige (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 CLC'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  $\alpha_{0t}$  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 1 if 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.

$\varepsilon_{kt}$  is the error term

In this model  $\alpha_1$  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 CLC's SHEMP Pilot -- Model 2:

$$Savings_{kt} = kWh_{kt} - \hat{kWh}_{kt}^C$$

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

where:

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

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

$kWh_{kt}^M$  = 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  $\mathbf{X}$  affecting energy use;

$\mathbf{X}_{kt}^M$  = the values of  $\mathbf{X}$  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  $\mathbf{X}$ .

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.

- CLC 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 CLC'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 CLC's 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% pre-campaign to 40% 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.

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

- Residential New Construction and Major Renovation (Electric & Gas)
- Residential Cooling and Heating Equipment (Electric & Gas)
- Residential Multi-Family Retrofit (Electric & Gas)
- Residential Mass Save (Home Energy Services) (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%) 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%). Just under half of residential (46%) 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% reporting that they have seen or heard the term before. This represents an increase since the last statewide marketing survey when awareness was 40%. Additionally, just over half of commercial customers (55%) 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 and Major Renovation (Electric & Gas)
- Residential Cooling and Heating Equipment (Electric & Gas)
- Residential Multi-Family Retrofit (Electric & Gas)
- Residential Mass Save (Home Energy Services) (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 (NEIs) 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 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<sup>9</sup>.

**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.

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<sup>9</sup> 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](http://www.ma-eeac.org/Docs/8.1_EMV%20Page/2011/2011%20Residential%20Studies/Mass%20Crosscutting%20NEIs%20Final%20Report%20081511.pdf))

**Savings Impact:**

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	Integrated Boiler /	Home Durability	Annual	\$0.72	33%	\$0.24	67.9%	\$0.39

Measure Category	Measure	NEI	Duration	Full NEI Value (\$/Year)	EE Portion of NEI	ROF NEI Value (\$/Year)	Percent ROF	Overall NEI Value (\$/Year)
System	Water Heater	Property Value Increase	One Time	\$29.17	50%	\$14.59		\$19.27
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

Measure Category	Measure	NEI	Duration	Full NEI Value (\$/Year)	EE Portion of NEI	ROF NEI Value (\$/Year)	Final Adjustment	Adjusted NEI Value (\$/Year)
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	Thermal	Annual	\$48.63	100%	\$48.63	- 2	\$24.32

Measure Category	Measure	NEI	Duration	Full NEI Value (\$/Year)	EE Portion of NEI	ROF NEI Value (\$/Year)	Final Adjustment	Adjusted NEI Value (\$/Year)
	or equal to 96% AFUE	Comfort						
		Health Benefits		\$1.56		\$1.56		\$0.78
	Furnaces greater than or equal to 95% AFUE	Thermal Comfort	Annual	\$48.63	100%	\$48.63	<b>+ 2</b>	\$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	<b>+ 2</b>	\$0.92
		Health Benefits		\$0.06		\$0.06		\$0.03

**Formulas Used in Impact Analysis:**

$$\text{Overall NEI Value} = [(EE \text{ Portion of NEI} * Full \text{ NEI Value}) * ROF\%] + [Full \text{ NEI Value} * (1 - ROF\%)]$$

**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 Residential Heating and Water Heating and Cool Smart programs evaluation,<sup>10</sup> the percentage of program participants that replaced failed systems was determined and the adjusted NEI values was attributed to these participants.

**A copy of the complete study can be found in Appendix C, Study 25.**

<sup>10</sup> 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.

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 for the next Annual Report.

Table III.B: Evaluation Studies in Next Annual Report		
Studies	Docket & Exhibit Approving Planned Evaluation Studies	Expected to be Implemented as Approved? (yes/no)
<b>Residential Studies</b>		
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
<b>Residential Pilot Studies</b>		
<b>Low-Income Studies</b>		
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
<b>Commercial &amp; Industrial Studies</b>		
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
<b>Special &amp; Cross-Cutting Studies</b>		
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 Program Planning & Administration (“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.

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. 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.

Please refer to Table IV.A

Table IV.A

Program Planning and Administration Costs						
Customer Sector / Program	Planned		Actual		Change from Planned to Actual	
	Value (\$)	% of Total Program Costs	Value (\$)	% of Total Program Costs	Value	% Change -- Plan to Actual
<b>Residential</b>						
New Construction	\$ 10,488	5.2%	\$ 16,053	18.7%	\$ 5,565	13.5%
Cooling and Heating	\$ 3,835	5.9%	\$ 2,875	4.5%	\$ (960)	-1.4%
Multifamily Retrofit	\$ 9,988	5.0%	\$ 7,754	5.2%	\$ (2,234)	0.2%
MassSave	\$ 44,200	7.6%	\$ 36,523	6.3%	\$ (7,678)	-1.3%
ENERGY STAR® Lighting	\$ 11,296	5.5%	\$ 14,350	10.5%	\$ 3,054	5.0%
ENERGY STAR® Appliance	\$ 6,804	5.1%	\$ 7,987	9.9%	\$ 1,183	4.8%
Residential Education	\$ -	0.0%	\$ -	0.0%	\$ -	0.0%
HEAT Loan	\$ 5,267	6.4%	\$ 363	0.4%	\$ (4,904)	-5.9%
R&D and Demonstration	\$ -	0.0%	\$ -	0.0%	\$ -	0.0%
DEEP Energy Retrofit	\$ 518	10.0%	\$ -	0.0%	\$ (518)	-10.0%
Statewide Education	\$ -	0.0%	\$ -	0.0%	\$ -	0.0%
EEAC Consultants	\$ -	0.0%	\$ -	0.0%	\$ -	0.0%
DOER Assessment	\$ 10,365	100.0%	\$ 7,854	100.0%	\$ (2,511)	0.0%
Residential Total	\$ 102,762	6.8%	\$ 93,759	7.7%	\$ (9,003)	1.0%
<b>Low-Income</b>						
New Construction	\$ 4,920	6.3%	\$ 4,301	12.2%	\$ (620)	5.9%
Low Income Retrofit	\$ 31,352	6.6%	\$ 26,437	6.1%	\$ (4,914)	-0.6%
Statewide Education	\$ -	0.0%	\$ -	0.0%	\$ -	0.0%
LEAN	\$ 5,800	40.0%	\$ 3,183	100.0%	\$ (2,617)	60.0%
DOER Assessment	\$ 5,500	100.0%	\$ 3,927	100.0%	\$ (1,573)	0.0%
Low-Income Total	\$ 47,572	8.1%	\$ 37,848	7.9%	\$ (9,724)	-0.2%
<b>Commercial &amp; Industrial</b>						
New Construction	\$ 28,824	5.4%	\$ 29,856	5.5%	\$ 1,031	0.1%
Large C&I Retrofit	\$ 103,893	5.6%	\$ 98,892	12.5%	\$ (5,001)	7.0%
Small C&I Retrofit	\$ 62,037	5.5%	\$ 58,352	5.6%	\$ (3,685)	0.1%
Statewide Education	\$ -	0.0%	\$ -	0.0%	\$ -	0.0%
EEAC Consultants	\$ -	0.0%	\$ -	0.0%	\$ -	0.0%
DOER Assessment	\$ 15,000	0.0%	\$ 14,400	100.0%	\$ (600)	100.0%
Commercial & Industrial Total	\$ 209,754	5.8%	\$ 201,500	8.4%	\$ (8,255)	2.5%
Grand Total	\$ 360,088	6.3%	\$ 333,106	8.1%	\$ (26,981)	1.8%

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

C. Competitive Procurement

**Table IV.B**

Outsourced and Competitively Procured Services									
Customer Sector	In-House Activities		Outsourced Activities						Total Activities
	(\$)	% of Total Activities	Competitively Procured		Non-Competitively Procured		Total Outsourced		(\$)
			(\$)	% of Total Outsourced	(\$)	% of Total Outsourced	(\$)	% of Total Activities	
			<b>Col. A</b>						<b>Col. B</b>
Residential									
Planned	\$ 359,437	64%	\$ 177,763	88%	\$ 23,272	12%	\$ 201,035	36%	\$ 560,472
Actual	\$ 277,363	59%	\$ 185,429	96%	\$ 7,854	4%	\$ 193,284	41%	\$ 470,647
% Planned to Actual		-5%		8%		-8%		5%	
Low-Income									
Planned	\$ 168,046	71%	\$ 8,524	13%	\$ 59,558	87%	\$ 68,082	29%	\$ 236,128
Actual	\$ 95,202	61%	\$ -	0%	\$ 60,914	100%	\$ 60,914	39%	\$ 156,116
% Planned to Actual		-10%		-13%		13%		10%	
Commercial & Industrial									
Planned	\$ 980,121	89%	\$ 109,192	87%	\$ 15,833	13%	\$ 125,025	11%	\$ 1,105,146
Actual	\$ 635,309	80%	\$ 144,979	91%	\$ 14,400	9%	\$ 159,378	20%	\$ 794,687
% Planned to Actual		-9%		4%		-4%		9%	
Total									
Planned	\$ 1,507,604	79%	\$ 295,479	75%	\$ 98,663	25%	\$ 394,142	21%	\$ 1,901,746
Actual	\$ 1,007,874	71%	\$ 330,408	80%	\$ 83,168	20%	\$ 413,576	29%	\$ 1,421,450
% Planned to Actual		-8%		5%		-5%		8%	

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

D. Low-Income Spending

**Table IV.C**

Customer Sector Budget Allocation						
Customer Sector	Planned		Actual		% Change from Planned to Actual	
	Total Program Costs	% of Total Program Costs	Total Program Costs	% of Total Program Costs	Total Program Costs	% of Total Program Costs
Residential	\$ 1,518,784	26.6%	\$ 1,210,785	29.6%	\$ (307,999)	2.9%
Low-Income	\$ 585,000	10.3%	\$ 479,971	11.7%	\$ (105,029)	1.5%
Commercial & Industrial	\$ 3,601,038	63.1%	\$ 2,406,316	58.7%	\$ (1,194,722)	-4.4%
Total	\$ 5,704,822	100.0%	\$ 4,097,072	100.0%	\$ (1,607,749)	0.0%

As shown in Table IV.C, the Company met the minimum statutory requirement by spending 12 percent of energy efficiency funds in the low-income customer sector.

V. PERFORMANCE INCENTIVES

The performance incentive mechanism includes three components: the Savings Mechanism, the Value Mechanism, and other Performance Metrics. The Savings Mechanism provides an incentive for achieving dollar benefits from energy efficiency program efforts at or above threshold levels. The Value Mechanism provides an incentive for achieving net benefits equal to

or in excess of the threshold level of performance. Performance metrics establish a focus on specified program outcomes or plan development, with each metric stating the specific requirements for reaching each level of the metric. Table V summarizes the performance incentives earned by the Company by component for its successful delivery of energy efficiency programs in 2012.

**Table V**

<b>Performance Incentives Summary</b>				
Incentive Components	Threshold	Design	Exemplary	Actual Incentive
Savings Mechanism	\$ 127,998	\$ 170,664	\$ 213,331	\$ 130,469
Value Mechanism	\$ 81,834	\$ 109,112	\$ 136,390	\$ 101,041
Performance Metrics	\$ 30,395	\$ 40,527	\$ 50,659	\$ 33,334
Total Incentive (before-tax)	\$ 240,228	\$ 320,304	\$ 400,379	\$ 264,843
Total Incentive (after-tax)	\$ 145,938	\$ 194,584	\$ 243,231	\$ 160,892

  

Effective Tax Rate:	39.25%
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The planned values referenced in the Performance Incentives Summary Table above were originally filed in the performance incentives model set forth at Exhibit D, Attachment 2 to the Company's 2012 Mid-Term Modification filed with the Department on October 28, 2011 in Fitchburg Gas and Electric Light Company d/b/a Unitil, D.P.U. 11-110 ("2012 MTM"). The Company earned \$264,843 in actual before-tax incentives, which is 83 percent of design level. The tax rate used to calculate the after-tax total incentive is 0.3925.

All supporting documentation for each performance incentive component, including detailed information on the Company's clear and distinct role in achieving the performance metrics, can be found in Appendix D.

For the Savings and Value components of the performance incentive, the Company calculated its earned performance incentive in accordance with the incentive mechanism included in the 2012 MTM, using the post-evaluation benefits. The Company achieved 76 percent of its planned benefits and 93 percent of its planned net benefits at the portfolio level, surpassing the 75 percent threshold required in order to earn both the savings and value mechanisms of the performance incentive. Using evaluated results, the Company calculated the lifetime benefits and net benefits that each program achieved. The benefits were multiplied by the savings payout rate of \$0.006638419 and the net benefits were multiplied by the value payout rate of \$0.00649511 per the 2012 MTM. Although performance under both the Savings and Value Mechanisms is assessed at the portfolio level, this calculation was done at the sector level, as shown in Appendix D, to facilitate the allocation of earned performance incentives in the cost-effectiveness calculations. The incentive dollars earned from performance metrics were allocated to sectors consistent with the allocation presented in the 2012 MTM. A model illustrating the calculation of the performance incentives in accordance with this methodology is included in Appendix D, Section 1.

A summary of the Company's performance for each Performance Metric is set forth below. Achievement of performance metrics relate to the metrics filed in Exhibit D, Attachment 1 to the

2012 MTM. Additional supporting documentation related to performance metrics is included at Appendix D, Section 2.

**FITCHBURG GAS AND ELECTRIC LIGHT COMPANY  
2012 SUMMARY OF PERFORMANCE METRIC ACHIEVEMENT**

<b>RESIDENTIAL METRIC NUMBER AND NAME</b>	<b>ACHIEVEMENT LEVEL</b>
1. Mass Save/Weatherization: Deeper Savings [Electric & Gas] – Statewide	Design (100%)
2. Mass Save/Weatherization: Lost Opportunity/ Market Opportunity [Electric & Gas] – Statewide	Exemplary (125%)
<b>LOW-INCOME METRIC NUMBER AND NAME</b>	<b>ACHIEVEMENT LEVEL</b>
1. Best Practices Program Strategies Research & Technical Review of Potential New Measures [Electric & Gas] – Statewide	Exemplary (125%)
2. Multi-family Building Inventory [Electric & Gas] – Statewide	Exemplary (125%)
<b>COMMERCIAL &amp; INDUSTRIAL METRIC NUMBER AND NAME</b>	<b>ACHIEVEMENT LEVEL</b>
C&I #1 Retrofit -- Depth of savings	Below Threshold (0%)
C&I #2 New Construction -- Comprehensiveness and depth of savings	Below Threshold (0%)
C&I #3 Direct Install Electric and Gas Integration	Below Threshold (0%)
C&I #4 Combined Heat & Power	N/A – Unitil did not participate in this metric
<b>OTHER FUNDING METRIC NUMBER AND NAME</b>	<b>ACHIEVEMENT LEVEL</b>
1. “Other financing capital” metric	Exemplary (125%)
2. Cost Efficiency of Program Expenditures	Design (104%)

## VI. AUDITS

Please refer to the Company's 2011 Energy Efficiency Annual Report for information on audits related to the Company's energy efficiency activities during the last five years (2008-2012).

## VII. APPENDICES

- A. Glossary of Defined Terms – includes Types of Costs in each Budget Category and a Glossary of Terms and Abbreviations.
- B. Cost-Effectiveness Supporting Tables and Documentation – includes the D.P.U. 08-50 Tables, the Screening Tool, and Technical Reference Manual.
- C. Program and Pilot Program EM&V Studies – includes evaluation studies for the residential, low-income, and C&I sector programs and pilot programs.
- D. Performance Incentives Supporting Documentation – includes documentation that supports the Company's determination of actual performance incentives earned through the performance metrics.
- E. Other Supporting Documentation – includes additional supporting documentation with regard to competitive procurement activities in 2012.
- F. Lost Base Revenue Information – includes a reference to the information on savings on which LBR is based.