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## I. INTRODUCTION

In the first full year of the three-year energy efficiency plans, as reviewed and approved by the Department on January 28, 2010 in D.P.U. 09-116 through 09-127 (the "Gas and Electric Orders"), program year 2010 showed remarkable success with respect to goal attainment and achievement of real benefits for the environment and the economy in the Commonwealth of Massachusetts. Collectively, the Fitchburg Gas and Electric Company d/b/a Unitil (the "Company"), along with all the gas and electric distribution companies and municipal aggregators (together, the "Program Administrators" or "PAs") were able to deliver on their goals during program year 2010, as established in the Gas and Electric Orders, while maintaining the balance between meeting the budget for their programs and complying with the directives of the Green Communities Act in ensuring that they make available all cost-effective energy efficiency opportunities. Overall, the Company and other Program Administrators worked diligently with the Department of Public Utilities ("Department"), the Department of Energy Resources ("DOER"), the Energy Efficiency Advisory Council ("EEAC"), and other interested stakeholders to meet what were intentionally designed to be very challenging 2010 program year goals. In many cases, achievements in savings and benefits exceeded those goals. Program year 2010 performance showed that strong savings levels were achieved, that both residential and C&I program implementation showed strong results, and that the Program Administrators worked well to implement the programs in the field while also ramping up programs to unprecedented spending and savings levels so as to meet obligations not just for program year 2010, but for the full life of the three-year plans.

On a statewide basis, the results shown by the Program Administrators are generally at or in excess of initially projected amounts for annual MWh and therm goals. In fact, as noted by the EEAC in its recent 2010 annual report to the Massachusetts General Court and the Department, the combined efforts of the PAs resulted in enough savings to power 85,000 households and heat 14,000 homes annually. At the same time, the results show greenhouse gas emission reductions equivalent to the annual output of over 74,000 cars, and significant progress towards greenhouse gas, NO<sub>x</sub>, and SO<sub>2</sub> emission reductions. The ability to achieve or exceed nearly all of the statewide goals and targets, despite a very difficult economic climate in the Commonwealth, results in significant benefits for the environment, the economy, and end-use customers.

In addition, while working to achieve their programmatic goals for 2010, the Company and other Program Administrators have worked diligently to establish statewide marketing of energy efficiency program offerings through the use of the Mass Save label, which won the AESP Outstanding Achievement in Marketing and Communications Award based on work accomplished in 2010. Simultaneously, the Program Administrators have engaged in over 35 studies across a wide span of program sectors to ensure that the Evaluation, Monitoring, and Verification ("EM&V") elements of these program offerings remain a critical and vital tool to evaluate and transform measures in the future to meet demand in an ever-changing marketplace. The Company and other Program Administrators have worked diligently with financial institutions, and, through the partnership with the Massachusetts Bankers Association, worked to develop financing options to expand access to energy efficiency measures for customers in 2010, for the life of the three-year plans, and beyond.

The Company and other Program Administrators have continued to be engaged in the monthly EEAC process, and have worked collaboratively with each other and the EEAC's consultants to meet stringent reporting and data collection deadlines so as to adequately monitor and review where the Three-Year Plan efforts have succeeded,

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and where improvement could be anticipated for the future. Given the unprecedented nature of these efforts and the significantly ambitious goals established in the Three-Year Plans, the Company and other Program Administrators contend that the 2010 program year performance has been an unmitigated success and has in many ways exceeded the expectations for the first year of the Three-Year Plan. The Company and other Program Administrators continue to endeavor to achieve deeper savings from participating customers, and have worked to reach a broader range of customers for the implementation of all cost-effective energy efficiency program offerings.

## PURPOSE OF ANNUAL REPORT

The Company is pleased to provide its Energy Efficiency Annual Report (“Annual Report”) for 2010. The purpose of the Annual Report is to:

- Provide a comparison of the Company’s planned, preliminary year-end, and evaluated (where applicable) expenses, savings, and benefits at the portfolio, sector, and program levels for the program year.
- Identify significant variances between the Company’s planned and evaluated costs, savings, and benefits for the program year, and discuss reasons for such variances.
- Discuss how program performance during the program year informs the Company’s proposed modifications to program implementation, if any, during upcoming years.
- Describe the evaluation, measurement and verification (“EM&V”) activities undertaken by the Company (both individually and jointly with other Program Administrators (“PAs”)) 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.

## ORGANIZATION OF ANNUAL REPORT

The Company’s 2010 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 commercial and industrial (“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 provides detailed supporting documentation.

## SUMMARY OF PROGRAM PORTFOLIO

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

Tables 1 I.A and I.B provide summary information on program performance at the portfolio and customer sector levels, respectively. 2

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              | \$    | \$ 541,184    |                              |                       | \$ 818,700        |                           | 51%                   |
| Performance Incentive            | \$    | \$ 41,647     |                              |                       | \$ 51,679         |                           | 24%                   |
| <b>Savings and Benefits</b>      |       |               |                              |                       |                   |                           |                       |
| <b>Gas</b>                       |       |               |                              |                       |                   |                           |                       |
| Lifetime                         | Th    | 2,633,477     | 3,882,771                    | 47%                   | 3,397,213         | -13%                      | 29%                   |
| Annualized                       | Th    | 130,256       | 196,835                      | 51%                   | 171,676           | -13%                      | 32%                   |
| <b>Electric</b>                  |       |               |                              |                       |                   |                           |                       |
| Annualized Energy                | kWh   | 788           | -                            | -100%                 | -                 | 0%                        | -100%                 |
| <b>Annualized Demand</b>         |       |               |                              |                       |                   |                           |                       |
| Summer                           | kW    | 0.52          | -                            | -100%                 | -                 | 0%                        | -100%                 |
| Winter                           | kW    | 0.06          | -                            | -100%                 | -                 | 0%                        | -100%                 |
| Non-Gas/Electric Benefits (Life) | \$    | \$ 114,209    | \$ 44,838                    | -61%                  | \$ 44,838         | 0%                        | -61%                  |
| <b>Cost-Effectiveness</b>        |       |               |                              |                       |                   |                           |                       |
| TRC Benefits                     | \$    | \$ 3,087,339  |                              |                       | \$ 3,948,613      |                           | 28%                   |
| TRC Costs                        | \$    | \$ 917,418    |                              |                       | \$ 1,354,564      |                           | 48%                   |
| Net Benefits                     | \$    | \$ 2,169,921  |                              |                       | \$ 2,594,049      |                           | 20%                   |
| BCR                              |       | 3.4           |                              |                       | 2.9               |                           | -13%                  |

1 The Company is also providing the Department of Public Utilities (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.

2 The Planned Values in Table I.A and all subsequent tables which contain Planned Values in this Annual Report were originally filed in Fitchburg Gas and Electric Light Company, D.P.U. 09-127. See the Company's updated and final D.P.U. 08-50 Tables, dated January 21, 2010.

**Table I.B**

| <b>Customer Sector Summary</b>     |       |               |                   |                       |
|------------------------------------|-------|---------------|-------------------|-----------------------|
| Sector                             | Units | Planned Value | Evaluated Results |                       |
|                                    |       |               | Value             | % Change from Planned |
| <b>Residential</b>                 |       |               |                   |                       |
| TRC Benefits                       | \$    | \$ 502,352    | \$ 458,240        | -9%                   |
| TRC Costs                          | \$    | \$ 250,715    | \$ 390,847        | 56%                   |
| Net Benefits                       | \$    | \$ 251,637    | \$ 67,393         | -73%                  |
| BCR                                |       | 2.0           | 1.2               | -41%                  |
| <b>Low-Income</b>                  |       |               |                   |                       |
| TRC Benefits                       | \$    | \$ 331,296    | \$ 1,152,805      | 248%                  |
| TRC Costs                          | \$    | \$ 134,191    | \$ 189,095        | 41%                   |
| Net Benefits                       | \$    | \$ 197,105    | \$ 963,710        | 389%                  |
| BCR                                |       | 2.5           | 6.1               | 147%                  |
| <b>Commercial &amp; Industrial</b> |       |               |                   |                       |
| TRC Benefits                       | \$    | \$ 2,253,690  | \$ 2,337,568      | 4%                    |
| TRC Costs                          | \$    | \$ 532,511    | \$ 774,622        | 45%                   |
| Net Benefits                       | \$    | \$ 1,721,179  | \$ 1,562,946      | -9%                   |
| BCR                                |       | 4.2           | 3.0               | -29%                  |
| <b>Total</b>                       |       |               |                   |                       |
| TRC Benefits                       | \$    | \$ 3,087,339  | \$ 3,948,613      | 28%                   |
| TRC Costs                          | \$    | \$ 917,418    | \$ 1,354,564      | 48%                   |
| Net Benefits                       | \$    | \$ 2,169,921  | \$ 2,594,049      | 20%                   |
| BCR                                |       | 3.4           | 2.9               | -13%                  |

As shown in Table 1.A above, significant<sup>3</sup> variances exist at the portfolio level for:

- Total Program Costs, Performance Incentives, Lifetime Therms, TRC Benefits, TRC Costs, and Net Benefits between planned and evaluated values, and

Each sector contributed to these variances as follows:

- Residential Total Program Costs, Lifetime Therms, TRC Benefits, and Net Benefits: Please reference section II.A.1 for a more detailed discussion of the cause of the variances for this sector.
- Low Income Total Program Costs, Performance Incentives, Lifetime Therms, TRC Benefits, TRC Costs, and Net Benefits: Please reference section II.B.1 for a more detailed discussion of the cause of the variances for this sector.
- C&I Performance Incentive, Lifetime Therms, TRC Benefits, TRC Costs, and Net Benefits: Please reference section II.C.1 for a more detailed discussion of the cause of the variances for this sector.

<sup>3</sup> Unless otherwise noted, "significant" variances are defined throughout this Annual Report as variances of +/-20% or more between the stated values.



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

- Within the Residential sector, all programs contribute to the variance between planned and evaluated values. Please reference section II.A.2 for a more detailed discussion of the cause of the variances by program within this sector.
- Within the Low Income sector, all programs contribute to the variance between planned and evaluated values. Please reference section II.B.2 for a more detailed discussion of the cause of the variances by program within this sector.
- Within the C&I sector, all programs contribute to the variance between planned and evaluated values. Please reference section II.C.2 for a more detailed discussion of the cause of the variances by program within this sector.

#### PA-SPECIFIC HIGHLIGHTS

Overall, 2010 was a good year for the Company's gas programs with the portfolio maintaining a healthy BCR of 2.9. Total costs were 51% above planned, but pre-evaluated savings levels were consistent with the higher spending level. However, results of the many evaluation studies conducted during the year had a significant impact on evaluated savings which is reflected in the reduction of TRC Benefits. The Company will continue to work with the other PAs to address the recommendations from the studies.

## II. PROGRAM PERFORMANCE

### RESIDENTIAL SECTOR PROGRAMS

#### SUMMARY

During 2010 the Company implemented the following residential programs:

- Residential New Construction & Major Renovation
- Residential Heating and Water Heating Equipment
- Residential MassSave / Weatherization (1 – 4 Family)

Tables II.A.1 and II.A.2 provide summary information on the performance of the residential programs at the sector and program levels, respectively.

Section II.A.2 provides detailed information on the performance of each residential program.

**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              | \$    | \$ 185,691    |                              |                       | \$ 279,985        |                           | 51%                   |
| Performance Incentive            | \$    | \$ 6,033      |                              |                       | \$ 7,487          |                           | 24%                   |
| <b>Savings and Benefits</b>      |       |               |                              |                       |                   |                           |                       |
| <b>Gas</b>                       |       |               |                              |                       |                   |                           |                       |
| Lifetime                         | Th    | 394,957       | 616,700                      | 56%                   | 366,893           | -41%                      | -7%                   |
| Annualized                       | Th    | 20,584        | 32,263                       | 57%                   | 18,189            | -44%                      | -12%                  |
| <b>Electric</b>                  |       |               |                              |                       |                   |                           |                       |
| Annualized Energy                | kWh   | 788           | -                            | -100%                 | -                 | 0%                        | -100%                 |
| <b>Annualized Demand</b>         |       |               |                              |                       |                   |                           |                       |
| Summer                           | kW    | 0.52          | -                            | -100%                 | -                 | 0%                        | -100%                 |
| Winter                           | kW    | 0.06          | -                            | -100%                 | -                 | 0%                        | -100%                 |
| Non-Gas/Electric Benefits (Life) | \$    | \$ 2,859      | \$ 1,518                     | -47%                  | \$ 1,518          | 0%                        | -47%                  |
| <b>Cost-Effectiveness</b>        |       |               |                              |                       |                   |                           |                       |
| TRC Benefits                     | \$    | \$ 502,352    |                              |                       | \$ 458,240        |                           | -9%                   |
| TRC Costs                        | \$    | \$ 250,715    |                              |                       | \$ 390,847        |                           | 56%                   |
| Net Benefits                     | \$    | \$ 251,637    |                              |                       | \$ 67,393         |                           | -73%                  |
| BCR                              |       | 2.0           |                              |                       | 1.2               |                           | -41%                  |

**Table II.A.2**

| <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   | \$    | \$ 85,762     | \$ 10,328         | -88%                  |
| TRC Costs  | \$    | \$ 58,132     | \$ 31,387         | -46%                  |
| Net Benefits   | \$    | \$ 27,631     | \$ (21,059)       | -176%                 |
| BCR  |       | 1.5           | 0.3               | -78%                  |
| <b>Residential Heating and Water Heating</b>                   |       |               |                   |                       |
| TRC Benefits   | \$    | \$ 281,382    | \$ 263,642        | -6%                   |
| TRC Costs  | \$    | \$ 109,651    | \$ 259,083        | 136%                  |
| Net Benefits   | \$    | \$ 171,731    | \$ 4,559          | -97%                  |
| BCR  |       | 2.6           | 1.0               | -60%                  |
| <b>Residential MassSAVE (RCS) / Weatherization - 1-4 Units</b> |       |               |                   |                       |
| TRC Benefits   | \$    | \$ 135,208    | \$ 184,270        | 36%                   |
| TRC Costs  | \$    | \$ 71,168     | \$ 97,783         | 37%                   |
| Net Benefits   | \$    | \$ 64,040     | \$ 86,487         | 35%                   |
| BCR  |       | 1.9           | 1.9               | -1%                   |
| <b>Hard-To-Measure Initiatives</b>                             |       |               |                   |                       |
| TRC Costs  | \$    | \$ 11,764     | \$ 2,594          | -78%                  |
| <b>Total</b>   |       |               |                   |                       |
| TRC Benefits   | \$    | \$ 502,352    | \$ 458,240        | -9%                   |
| TRC Costs (incl HTM Initiatives)                               | \$    | \$ 250,715    | \$ 390,847        | 56%                   |
| Net Benefits   | \$    | \$ 251,637    | \$ 67,393         | -73%                  |
| BCR  |       | 2.0           | 1.2               | -41%                  |

The programs with significant variances between planned and evaluated values in Table II.A.1, and the reason for such variances include:

- Residential New Construction and Major Renovation: 2010 was the first year the Company offered this program to its gas customers. However, with the collapse of the housing market; there was limited interest in ENERGY STAR Homes and the program did not achieve its 2010 participation, savings, or BCR goals.
- Residential Heating and Water Heating: Results for this program were very strong during 2010. Application of evaluation results accounted for a significant drop in evaluated results.
- Residential MassSAVE / Weatherization 1-4 Units: Overall spending for this program was higher than planned in 2010. In addition, the average installed cost for complete projects was nearly double the planned project cost. The variance was due to measure mix between planned and actual.

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During 2010, the Company built upon existing residential programs and significantly expanded initiatives to increase participation in all residential programs. Selected highlights are presented below:

RESIDENTIAL NEW CONSTRUCTION & MAJOR RENOVATION – In 2010, the Massachusetts New Homes with ENERGY STAR program faced a market in which energy codes were changing, single family development remained slow, and opportunities to capture future energy savings were becoming increasingly difficult. To address these barriers the program engaged in code support activities and introduced several new marketing efforts including a lumberyard outreach series, increased e-mail marketing, and social media activity. Statewide, the program launched four new pilots, multi-family new construction, major renovations, lighting design and ENERGY STAR Version 3, to aid in identifying the next generation of energy savings opportunities. As a start-up during 2010, Unitil's New Construction Program had a rough start, however, statewide, the program increased market penetration while providing energy savings for homeowners and reducing peak demand. These efforts resulted in the program receiving its fourth consecutive ENERGY STAR award for Sustained Excellence in Program Delivery. Unitil expects this program to make a strong showing in 2011.

MULTI-FAMILY RETROFIT – Implementation of the Multifamily Market Integrator ("MMI") began in July 2010 and continued as a primary focus at all PA multi-family working group meetings to address start up tasks such as data tracking and reporting, and coordination with program vendors. A data gathering form was developed and used at intake to identify key customer facility data and eligibility, and forwarded to the appropriate vendor for customer contact. In addition, monthly activity reports were developed and reviewed, to track program progress. Unitil did not offer a multifamily retrofit program during 2010. Because of strong interest and high level of pipeline projects, the Company implemented a dedicated multifamily program in 2011 and is optimistic about its potential. Requests thru the MMI increased as customers utilized the new single telephone number. Energy efficient lighting retrofits was high in demand from this market sector.

MASS SAVE – An RFP for a new RCS Lead Vendor was initiated in the 4<sup>th</sup> quarter of 2010. A new RCS market model was implemented, fully integrating the Gas Weatherization program with RCS via mandatory audits. Over the course of the year, the program moved back to a single audit model as a result of lessons learned. A new 3rd party QA/QC vendor was into the RCS program after an RFP process. HEAT Loans were expanded to include micro loans (\$500 - \$2000).

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## RESIDENTIAL PROGRAMS

### RESIDENTIAL NEW CONSTRUCTION & MAJOR RENOVATION

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

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

**Definition of Program Participant:** A participant is defined as an individual address or location.

**Targeted End-Uses:** End uses targeted by the Residential New Construction & Major Renovation program included energy-efficient building shells, proper duct and air sealing techniques, quality installation of Heating, Ventilation, and Air Conditioning ("HVAC") equipment, increased use of energy-efficient lighting, energy efficient water and heating upgrades, and increased indoor air quality.

**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's contractor was responsible for tracking and reporting program activity. The contractor also conducted quality assurance/quality control of field activities and advised the JMC on necessary program changes and enhancements. The JMC utilized a market-based network of trained contractors who offered energy efficiency and rating services to homebuilders for a fee.

**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 Gas Energy Efficiency Plan, filed October 30, 2009, D.P.U. 09-127. The program was approved by the Department on January 28, 2010 in D.P.U. 09-127.

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

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

Table II.A.3

| 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                             | \$    | \$ 25,322     |                              |                       | \$ 27,550         |                           | 9%                    |
| Performance Incentive                           | \$    | \$ 845        |                              |                       | \$ -              |                           | -100%                 |
| Participants                                    | Units | 8             |                              |                       | 1                 |                           | -88%                  |
| Program Cost / Participant                      | \$    | \$ 3,165      |                              |                       | \$ 27,550         |                           | 770%                  |
| <b>Savings and Benefits</b>                     |       |               |                              |                       |                   |                           |                       |
| <b>Gas</b>                                      |       |               |                              |                       |                   |                           |                       |
| Lifetime  | Th    | 64,873        | 8,210                        | -87%                  | 8,210             | 0%                        | -87%                  |
| Annualized                                      | Th    | 2,637         | 336                          | -87%                  | 336               | 0%                        | -87%                  |
| Average Measure Life                            | Yrs   | 25            | 24                           | -1%                   | 24                | 0%                        | -1%                   |
| <b>Electric</b>                                 |       |               |                              |                       |                   |                           |                       |
| Annualized Energy                               | kWh   | 788.30        | -                            | -100%                 | -                 | 0%                        | -100%                 |
| Annualized Demand                               |       |               |                              |                       |                   |                           |                       |
| Summer  | kW    | 0.52          | -                            | -100%                 | -                 | 0%                        | -100%                 |
| Winter  | kW    | 0.06          | -                            | -100%                 | -                 | 0%                        | -                     |
| Non-Gas/Electric Benefits (Life)                | \$    | \$ 208        | \$ -                         | -100%                 | \$ -              | 0%                        | -100%                 |
| <b>Cost-Effectiveness</b>                       |       |               |                              |                       |                   |                           |                       |
| TRC Benefits                                    | \$    | \$ 85,762     |                              |                       | \$ 10,328         |                           | -88%                  |
| TRC Costs                                       | \$    | \$ 58,132     |                              |                       | \$ 31,387         |                           | -46%                  |
| Net Benefits                                    | \$    | \$ 27,631     |                              |                       | \$ (21,059)       |                           | -176%                 |
| BCR   |       | 1.5           |                              |                       | 0.3               |                           | -78%                  |

**Variance Analysis:**

- Total Program Costs: From a strictly numerical perspective, the variance between planned and actual program costs is not considered significant. This was the first year the Company had offered this program to its gas customers, but unfortunately, with the collapse of the housing market; there was limited interest in ENERGY STAR Homes. The program did not achieve its 2010 participation, savings, or BCR goals.

Compared to the three year budget of \$88,478, the cost variance for this program is 3%.

- Performance Incentive: The BCR for this program was less than 1.0, therefore PI was zero.
- Participants and Cost/Participant: See discussion above.
- Energy/Demand/ Non-Electric Benefits (“NEBs”): See discussion above. There was no change to the impact factors compared to the original three-year plan, therefore, evaluated results equal preliminary results.
- TRC Benefits/TRC Costs/Net Benefits: See discussions above. Although the actual BCR was less than one, the Company expects 2011 results to be much more robust. At this time, there is no intention to discontinue or curtail the program.

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**EM&V Studies included in this Annual Report that apply to this program:**

1. Massachusetts New Homes with ENERGY STAR® Mystery Shopping:

This study provided insight into the current marketing strategies of real estate agents listing ENERGY STAR homes, and the effect of program-sponsored trainings on these marketing strategies.

The results of this study did not impact the 2010 evaluated results.

This study is discussed in more detail in Section III.

2. The Massachusetts New Homes with ENERGY STAR® Program, 2011 Baseline Phase 1:

This study describes the planning process for the 2011 Baseline Study and the work done to develop a sample of eligible homes.

The results of this study did not impact the 2010 evaluated results.

This study is discussed in more detail in Section III.

3. The Massachusetts New Homes with ENERGY STAR® Program Estimated Maximum Potential Savings from Enhanced Compliance with the IECC 2009 Residential Building Code in Massachusetts:

This study estimated the maximum potential savings for the years 2011, 2012, and 2013 that might be achieved through promoting compliance with the newly-adopted IECC 2009 energy code for four measures—wall insulation, basement insulation, proper insulation of ducts in unconditioned spaces, and fifty percent high efficacy lamp requirement—in order to provide needed guidance to the PAs on the implementation and evaluation costs that might be justified.

The results of this study did not impact the 2010 evaluated results.

This study is discussed in more detail in Section III.

4. Estimated Net-To-Gross (NTG) Factors for the Massachusetts Program Administrators (PAs) 2010 Residential New Construction Programs, Residential and Multi-Family HEHE Gas Programs, and Commercial and Industrial Gas Programs:

This study estimated a NTG factors for Residential New Construction participant homes. The estimated NTG factor is 1.00, therefore there are no changes to program savings.

This study is discussed in more detail in Section III.

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**Changes Resulting from Current Year Program Performance:**

Due to the variation of savings results generated by homes in the various tiers during 2010, the tier structure was changed for 2011. The program now requires each qualifying home to obtain a minimum percent savings over the baseline for each of the incentive tiers. The intent of this change is to produce more consistency in the results.

At this time, no mid-term modification is planned as a result of the changes to the program.

Cost-Effectiveness: Although not cost-effective for 2010, at this time the Company does not intend to discontinue the ENERGY STAR Homes program during its three-year approval period. As discussed above, 2010 was the first year this program was offered and the Company believes its poor performance was due to economic conditions beyond its control. In fact, this program has proven to be cost-effective for the Company's electric division for many years.



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## RESIDENTIAL HEATING & WATER HEATING

**Purpose/Goal:** The purpose of the Residential Heating & Water Heating program was to overcome market barriers to the installation of energy efficient heating/hot water equipment and to increase program awareness among consumers, plumbing/heating contractors, and home builders/developers, by means of rebates, marketing, and training courses.

**Targeted Customers:** The program targeted residential home owners with natural gas heating/hot water heating equipment (both new construction and existing homes); home designers/architects; engineers, plumbing and HVAC contractors and technicians; high efficiency heating equipment and related parts/accessory suppliers, manufacturers, and distributors, and new home building and remodeling contractors.

**Definition of Program Participant:** Participation is defined as number of units rebated.

**Targeted End-Uses:** Residential space and water heating equipment fueled by natural gas.

**Delivery Mechanism:** The program was administered by each Program Administrator in its service territory and coordinated regionally through the GasNetworks collaborative. GasNetworks utilized a third-party contractor, secured through a competitive bidding process, to administer the rebate processing to customers. This vendor was also responsible for tracking and reporting program activity to the Program Administrators.

**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 Gas Energy Efficiency Plan, filed October 30, 2009, D.P.U. 09-127. The program was approved by the Department on January 28, 2010 in D.P.U. 09-127.

Table II.A.4 provides information on the performance of the Residential Heating & Water Heating Program.

Table II.A.4

| Residential Heating and Water Heating |       |               |                              |                       |                   |                           |                       |
|---------------------------------------|-------|---------------|------------------------------|-----------------------|-------------------|---------------------------|-----------------------|
| 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                   | \$    | \$ 86,325     |                              |                       | \$ 163,617        |                           | 90%                   |
| Performance Incentive                 | \$    | \$ 3,484      |                              |                       | \$ 4,903          |                           | 41%                   |
| Participants                          | Units | 86            |                              |                       | 179               |                           | 108%                  |
| Program Cost / Participant            | \$    | \$ 1,004      |                              |                       | \$ 914            |                           | -9%                   |
| <b>Savings and Benefits</b>           |       |               |                              |                       |                   |                           |                       |
| <b>Gas</b>                            |       |               |                              |                       |                   |                           |                       |
| Lifetime                              | Th    | 225,844       | 497,446                      | 120%                  | 213,141           | -57%                      | -6%                   |
| Annualized                            | Th    | 12,346        | 26,794                       | 117%                  | 11,378            | -58%                      | -8%                   |
| Average Measure Life                  | Yrs   | 18            | 19                           | 1%                    | 19                | 1%                        | 2%                    |
| <b>Electric</b>                       |       |               |                              |                       |                   |                           |                       |
| Annualized Energy                     | kWh   | -             | -                            | 0%                    | -                 | 0%                        | 0%                    |
| Annualized Demand                     |       |               |                              |                       |                   |                           |                       |
| Summer                                | kW    | -             | -                            | 0%                    | -                 | 0%                        | 0%                    |
| Winter                                | kW    | -             | -                            | 0%                    | -                 | 0%                        | 0%                    |
| Non-Gas/Electric Benefits (Life)      | \$    | \$ -          | \$ -                         | 0%                    | \$ -              | 0%                        | 0%                    |
| <b>Cost-Effectiveness</b>             |       |               |                              |                       |                   |                           |                       |
| TRC Benefits                          | \$    | \$ 281,382    |                              |                       | \$ 263,642        |                           | -6%                   |
| TRC Costs                             | \$    | \$ 109,651    |                              |                       | \$ 259,083        |                           | 136%                  |
| Net Benefits                          | \$    | \$ 171,731    |                              |                       | \$ 4,559          |                           | -97%                  |
| BCR                                   |       | 2.6           |                              |                       | 1.0               |                           | -60%                  |

**Variance Analysis:**

- Total Program Costs: In its July 26, 2010 Mid-term Modification filing (“2010 MTM”), D.P.U. 10-86, the Company requested additional funds to address significantly higher demand for this program. The Company subsequently withdrew its 2010 MTM proposal. However, rather than shutting the program down mid-year, the Company continued to honor rebate requests. While the 2010 variance is considered significant, compared to the three year budget of \$381,017, the 2010 cost variance for this program is 21%
- Performance Incentive<sup>5</sup>: Performance incentives for the savings and net benefits components for 2010 achieved exemplary. The Company achieved exemplary, design and threshold for one each of its four metrics but did not achieve threshold for one.
- Participants: Higher spending allowed for substantially more participation than planned.
- Cost/Participant: The variance is not considered significant.

5 In D.P.U. 09-127, the Company allocated the planned 2010 sector-level performance incentive to the individual programs based on program budget as percent of sector budget. Consistent with that methodology, the actual sector-level incentives were allocated to programs based on actual program costs as percent of actual sector costs.

- Gas Savings: The planned to preliminary savings variance is consistent with variances in spending participation. Application of evaluation results account for the variance between preliminary and evaluated.
- Non-Electric Benefits (“NEBs”): The variance is not considered significant.
- TRC Benefits/TRC Costs/Net Benefits: See discussions above. The actual BCR is close to 1.0 for this program due to impact factors resulting from the evaluation studies discussed below. At this time, there is no intention to discontinue or curtail the program.

**EM&V Studies included in this Annual Report that apply to this program:**

1. HEHE Process and Impact Evaluation:

This study evaluated the therms saved and the free-ridership rates for furnaces, boilers, indirect water heaters and on-demand tankless water heaters. The results of this study vary for each measure within the program.

The net effect of these results is to decrease program savings.

This study is discussed in more detail in Section III.

2. Estimated Net-To-Gross (NTG) Factors for the Massachusetts Program Administrators (PAs) 2010 Residential New Construction Programs, Residential and Multi-Family HEHE Gas Programs, and Commercial and Industrial Gas Programs:

This study estimated the NTG factors for HEHE measures that were not included in the HEHE Process and Impact Evaluation and spillover rates for those that were included in the study. NTG factors were determined for thermostats, storage water heaters and condensing gas water heaters. Spillover rates were estimated for furnaces and boilers. The results of this study vary for each measure within the program.

The net effect of these results is to increase/decrease program savings.

This study is discussed in more detail in Section III.

**Changes Resulting from Current Year Program Performance:**

Required design and/or implementation changes to this program as a result of the evaluations described above have yet to be determined. At this time, the Company does not intend to file a mid-term modification.

Cost-Effectiveness: The impacts of several evaluation studies on savings resulted a program that was barely cost-effective for 2010. As indicated above, program changes due the evaluation results have not yet been determined. At this time the Company does not intend to discontinue this program during the current three-year approval period.

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## RESIDENTIAL MASSSAVE / WEATHERIZATION

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

**Targeted Customers:** The customers targeted by the program were all non-low-income residential customers living in single-family houses or one- to-four-unit multi-family buildings, regardless of heating fuel, who were committed to making their homes more energy efficient.

**Definition of Program Participant:** A participant is defined as an individual account number.

**Targeted End-Uses:** End uses targeted by the program included the building envelope, HVAC/mechanical systems, water heating, appliances, lighting, and deeper retrofit measures.

**Delivery Mechanism:** The program was administered by each Program Administrator in its service territory and coordinated statewide through the Residential Management Committee (“RMC”). The RMC actively managed and steered the statewide MassSAVE program. The program was delivered by program vendors selected through a competitive bidding process.

In order to increase the number of energy efficiency contractors, the program offered an incentive/rebate to contractors who installed retrofit weatherization measures such as insulation and air sealing.

Customers were required to have a site visit, conducted by the Program Administrator’s vendor, to identify and prioritize all cost effective energy efficiency upgrades in order to receive incentives or a program rebate. All insulation work, whether performed by an authorized independent contractor or a vendor’s subcontractor, was inspected for quality control by the Program Administrator’s vendor when the work was completed. This ensured that, either through an authorized installer or the Program Administrator’s vendor, installations met Building Performance Institute standards or similar standards set by the Program Administrators.

The RMC members worked together towards a “best practices” approach to provide a more coordinated statewide training as a means to ensure correct installation techniques for the Residential Conservation Services (“RCS”)/MassSAVE Program.

Contractors must maintain a high level of customer satisfaction to continue in the program.

RMC applied a “best practices” approach to make quality control an integral part of the RCS/MassSAVE Program. The Program Administrators issued an RFP and selected a third-party Quality Control (“QC”) vendor responsible for performing QC inspections of program implementation vendors, subcontractors, and 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, D.P.U. 09-127. The program was approved by the Department on January 28, 2010 in D.P.U. 09-127.

Table II.A.5 provides information on the performance of the Residential MassSAVE / Weatherization Program.

**Table II.A.5**

| Residential MassSAVE (RCS) / Weatherization - 1-4 Units |       |               |                              |                       |                   |                           |                       |
|---|-------|---------------|------------------------------|-----------------------|-------------------|---------------------------|-----------------------|
| 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                                     | \$    | \$ 62,280     |                              |                       | \$ 86,224         |                           | 38%                   |
| Performance Incentive                                   | \$    | \$ 1,704      |                              |                       | \$ 2,584          |                           | 52%                   |
| Participants  | Units | 28            |                              |                       | 10                |                           | -64%                  |
| Program Cost / Participant                              | \$    | \$ 2,224      |                              |                       | \$ 8,622          |                           | 288%                  |
| <b>Savings and Benefits</b>                             |       |               |                              |                       |                   |                           |                       |
| <b>Gas</b>  |       |               |                              |                       |                   |                           |                       |
| Lifetime  | Th    | 104,240       | 111,044                      | 7%                    | 145,542           | 31%                       | 40%                   |
| Annualized  | Th    | 5,601         | 5,133                        | -8%                   | 6,475             | 26%                       | 16%                   |
| Average Measure Life                                    | Yrs   | 19            | 22                           | 16%                   | 22                | 4%                        | 21%                   |
| <b>Electric</b>   |       |               |                              |                       |                   |                           |                       |
| Annualized Energy                                       | kWh   | -             | -                            | 0%                    | -                 | 0%                        | 0%                    |
| Annualized Demand                                       |       |               |                              |                       |                   |                           |                       |
| Summer  | kW    | -             | -                            | 0%                    | -                 | 0%                        | 0%                    |
| Winter  | kW    | -             | -                            | 0%                    | -                 | 0%                        | 0%                    |
| Non-Gas/Electric Benefits (Life)                        | \$    | \$ 2,651      | \$ 1,518                     | -43%                  | \$ 1,518          | 0%                        | -43%                  |
| <b>Cost-Effectiveness</b>                               |       |               |                              |                       |                   |                           |                       |
| TRC Benefits  | \$    | \$ 135,208    |                              |                       | \$ 184,270        |                           | 36%                   |
| TRC Costs   | \$    | \$ 71,168     |                              |                       | \$ 97,783         |                           | 37%                   |
| Net Benefits  | \$    | \$ 64,040     |                              |                       | \$ 86,487         |                           | 35%                   |
| BCR   |       | 1.9           |                              |                       | 1.9               |                           | -1%                   |

**Variance Analysis:**

- Total Program Costs: While the 2010 variance for this program is considered significant, when compared to the three year program budget of \$296,402 (MassSAVE + Weatherization), the variance is 8%.
- Performance Incentive: Performance incentives for the savings and net benefits components for 2010 achieved exemplary. The Company achieved exemplary, design and threshold for one each of its four metrics but did not achieve threshold for one.
- Participants: Participation was lower than planned for this program in 2010. The primary reason is the higher average project costs – which was nearly double the planned value. Planned versus actual measure mix accounted for this variance.
- Cost/Participant: Higher cost per participant reflects higher projects cost as well as fewer customers.
- Gas Savings: The variance between planned and preliminary is not considered significant. Application of evaluation results account for the variance between preliminary and evaluated.
- Non-Gas/Electric Benefits (“NEBs”): The variance in non-gas/electric benefits is due primarily to measure mix.
- TRC Benefits/TRC Costs/Net Benefits: See discussions above.

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

1. 2010 Net-to-Gross Findings: Home Energy Assessment:

This study evaluated the free-ridership and spillover rates for all customers participating in the Residential Conservation Services (RCS) program. Rates are determined for each of the following measures in the RCS program: Air Sealing, Insulation, Thermostats, Compact Fluorescent Lightbulbs (CFLs), Heating Systems, Refrigerators and Water Heaters.

The results of this study vary for each measure within the program. In some cases, the net effect of these results increased program savings and in other cases the net effect of these results decreased program savings.

This study is discussed in more detail in Section III.

2. Non-Electric Impact (NEI) Findings:

This memo reviews the non-electric impacts claimed for the Residential Conservation Services program. Non-electric impacts include the gas, oil, and propane savings claimed through the measures installed through the electric program.

The memo recommends that program administrators use vendor estimated data to calculate non-electric impacts. Unitil already uses vendor data to calculate its non-electric impacts, therefore no change is necessary.

This study is discussed in more detail in Section III.

3. Massachusetts 2010 Residential Retrofit and Low Income Evaluation: Mass Save

This study assessed program processes with a particular focus on identifying similarities and differences in the perspectives and assumptions of program staff, implementation staff, and customers regarding program goals, design and implementation across the PAs.

The process evaluation has no impact on the evaluated results.

This study is discussed in more detail in Section III.

4. Cross-Cutting Net-to-Gross Methodology Study for Residential Programs – Suggested Approaches:

The primary objective of this methodology study was to develop suggested approaches for consideration by the PAs for estimating net program impacts for the Massachusetts PAs' residential programs by reviewing the revised methodology report for C&I programs (2010) and adapting the decision framework and methodology guidelines to programs targeted to residential customers. The study team particularly sought to identify residential programs for which market-level approaches to measuring net-to-gross effects, rather than standard self-report methods, might be appropriate and feasible.

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The process evaluation has no impact on the evaluated results.

This study is discussed in more detail in Section III.

**Changes resulting from Current Year Program Performance:**

Required design and/or implementation changes to this program as a result of the evaluation results described above have yet to be determined

The results of the impact evaluation described above will be used to adjust the planning estimates for the program for 2012.

This program was cost-effective for 2010, and the Company does not intend to discontinue the program.

## LOW-INCOME SECTOR PROGRAMS

### SUMMARY

During 2010 the Company implemented the following low-income programs<sup>6</sup>:

- Low-Income 1-4 Family Retrofit

Tables II.B.1 and II.B.2 provide summary information on the performance of the low-income programs at the sector and program levels, respectively.

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

**Table II.B.1**

| Low-Income Sector Summary        |       |               |                              |                       |                   |                           |                       |
|----------------------------------|-------|---------------|------------------------------|-----------------------|-------------------|---------------------------|-----------------------|
| Performance Category             | Units | Planned Value | Preliminary Year-End Results |                       | Evaluated Results |                           |                       |
|                                  |       |               | Value                        | % Change from Planned | Value             | % Change from Preliminary | % Change from Planned |
| <b>Expenses</b>                  |       |               |                              |                       |                   |                           |                       |
| Total Program Costs              | \$    | \$ 129,898    |                              |                       | \$ 183,768        |                           | 41%                   |
| Performance Incentive            | \$    | \$ 4,293      |                              |                       | \$ 5,327          |                           | 24%                   |
| <b>Savings and Benefits</b>      |       |               |                              |                       |                   |                           |                       |
| <b>Gas</b>                       |       |               |                              |                       |                   |                           |                       |
| Lifetime                         | Th    | 174,160       | 882,071                      | 406%                  | 882,071           | 0%                        | 406%                  |
| Annualized                       | Th    | 9,278         | 35,753                       | 285%                  | 35,753            | 0%                        | 285%                  |
| <b>Electric</b>                  |       |               |                              |                       |                   |                           |                       |
| Annualized Energy                | kWh   | -             | -                            | 0%                    | -                 | 0%                        | 0%                    |
| <b>Annualized Demand</b>         |       |               |                              |                       |                   |                           |                       |
| Summer                           | kW    | -             | -                            | 0%                    | -                 | 0%                        | 0%                    |
| Winter                           | kW    | -             | -                            | 0%                    | -                 | 0%                        | 0%                    |
| Non-Gas/Electric Benefits (Life) | \$    | \$ 111,350    | \$ 43,320                    | -61%                  | \$ 43,320         | 0%                        | -61%                  |
| <b>Cost-Effectiveness</b>        |       |               |                              |                       |                   |                           |                       |
| TRC Benefits                     | \$    | \$ 331,296    |                              |                       | \$ 1,152,805      |                           | 248%                  |
| TRC Costs                        | \$    | \$ 134,191    |                              |                       | \$ 189,095        |                           | 41%                   |
| Net Benefits                     | \$    | \$ 197,105    |                              |                       | \$ 963,710        |                           | 389%                  |
| BCR                              |       | 2.5           |                              |                       | 6.1               |                           | 147%                  |

6 The Company did not offer any pilot programs in the low-income sector during 2010.



**Table II.B.2.**

| <b>Low-Income Program Summary</b>                   |       |               |                   |                       |
|---|-------|---------------|-------------------|-----------------------|
| Sector  | Units | Planned Value | Evaluated Results |                       |
|   |       |               | Value             | % Change from Planned |
| <b>Low-Income Singlefamily Retrofit - 1-4 Units</b> |       |               |                   |                       |
| TRC Benefits  | \$    | \$ 331,296    | \$ 1,152,805      | 248%                  |
| TRC Costs   | \$    | \$ 130,999    | \$ 186,053        | 42%                   |
| Net Benefits  | \$    | \$ 200,298    | \$ 966,752        | 383%                  |
| BCR   |       | 2.5           | 6.2               | 145%                  |
| <b>Hard-To-Measure Initiatives</b>                  |       |               |                   |                       |
| TRC Costs   | \$    | \$ 3,193      | \$ 3,042          | -5%                   |
| <b>Total</b>  |       |               |                   |                       |
| TRC Benefits  | \$    | \$ 331,296    | \$ 1,152,805      | 248%                  |
| TRC Costs (incl HTM Initiatives)                    | \$    | \$ 134,191    | \$ 189,095        | 41%                   |
| Net Benefits  | \$    | \$ 197,105    | \$ 963,710        | 389%                  |
| BCR   |       | 2.5           | 6.2               | 145%                  |

As shown in Tables II.B.1. and II.B.2., 2010 was a very robust year for the Company's Low Income Retrofit Program. In addition to weatherizing and/or upgrading heating systems in a number of single family homes, a 48 unit multifamily project was completed. As discussed below, the Company completed the multifamily project under its' single-family program as an interim step to implementing a multifamily program in 2011. A more detailed discussion can be found in Section II.B.

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## LOW-INCOME PROGRAMS

### LOW-INCOME 1-4 FAMILY RETROFIT

**Purpose/Goal:** The purpose of the Low-Income 1-4 Family Retrofit program was to increase energy efficiency and reduce the energy cost burden for income-eligible customers through education and the installation of electric and gas energy efficiency measures to achieve deeper and broader energy savings.

**Targeted Customers:** This program targeted residential electric customers using natural gas heating living in one- to four-unit dwellings who are at sixty percent (60%) of the state median income level.

**Definition of Program Participant:** A participant is defined as an individual account number.

**Targeted End-Uses:** Targeted end uses under this comprehensive, whole house approach included, but were not limited to, building shells, heating, domestic water heating, HVAC/mechanical systems, and general waste heat.

**Delivery Mechanism:** Program Administrators, when warranted, used a lead vendor to administer the program. The Program Administrators worked closely with their lead vendor and/or respective Network agencies on all aspects of the program design and implementation.

**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, D.P.U. 09-127. The program was approved by the Department on January 28, 2010 in D.P.U. 09-127.

Table II.B.3 provides information on the performance of the Low-Income Single Family Retrofit Program.

Table II.B.3

| Low-Income Singlefamily Retrofit - 1-4 Units |       |               |                              |                       |                   |                           |                       |
|--|-------|---------------|------------------------------|-----------------------|-------------------|---------------------------|-----------------------|
| 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                          | \$    | \$ 126,706    |                              |                       | \$ 180,726        |                           | 43%                   |
| Performance Incentive                        | \$    | \$ 4,293      |                              |                       | \$ 5,327          |                           | 24%                   |
| Participants                                 | Units | 27            |                              |                       | 67                |                           | 148%                  |
| Program Cost / Participant                   | \$    | \$ 4,693      |                              |                       | \$ 2,697          |                           | -43%                  |
| <b>Savings and Benefits</b>                  |       |               |                              |                       |                   |                           |                       |
| <b>Gas</b>                                   |       |               |                              |                       |                   |                           |                       |
| Lifetime                                     | Th    | 174,160       | 882,071                      | 406%                  | 882,071           | 0%                        | 406%                  |
| Annualized                                   | Th    | 9,278         | 35,753                       | 285%                  | 35,753            | 0%                        | 285%                  |
| Average Measure Life                         | Yrs   | 19            | 25                           | 31%                   | 25                | 0%                        | 31%                   |
| <b>Electric</b>                              |       |               |                              |                       |                   |                           |                       |
| Annualized Energy                            | kWh   | -             | -                            | 0%                    | -                 | 0%                        | 0%                    |
| Annualized Demand                            |       |               |                              |                       |                   |                           |                       |
| Summer                                       | kW    | -             | -                            | 0%                    | -                 | 0%                        | 0%                    |
| Winter                                       | kW    | -             | -                            | 0%                    | -                 | 0%                        | 0%                    |
| Non-Gas/Electric Benefits (Life)             | \$    | \$ 111,350    | \$ 43,320                    | -61%                  | \$ 43,320         | 0%                        | -61%                  |
| <b>Cost-Effectiveness</b>                    |       |               |                              |                       |                   |                           |                       |
| TRC Benefits                                 | \$    | \$ 331,296    |                              |                       | \$ 1,152,805      |                           | 248%                  |
| TRC Costs                                    | \$    | \$ 130,999    |                              |                       | \$ 186,053        |                           | 42%                   |
| Net Benefits                                 | \$    | \$ 200,298    |                              |                       | \$ 966,752        |                           | 383%                  |
| BCR  |       | 2.5           |                              |                       | 6.2               |                           | 145%                  |

**Variance Analysis:**

- **Total Program Costs:** In its 2010 MTM, D.P.U. 10-86, the Company requested additional funds to address multifamily housing projects screened within the statewide multifamily PHA/CDC program. At the time, the Company did not have a low income multifamily program in place and proposed to complete the projects under the umbrella of its Low Income 1-4 Unit program as an interim step. The Company subsequently withdrew its 2010 MTM proposal.  
While the 2010 variance for this program is considered significant, when compared to the three year program budget of \$487,820, the variance is 11%.
- **Performance Incentive:** Performance incentives for the savings and net benefits components for 2010 achieved exemplary, while the Company achieved exemplary and design for one each of its two metrics.
- **Participants:** Reflects the addition of a 6 building multifamily project.
- **Cost/Participant:** Reflects the addition of a 6 building multifamily project with lower average costs per unit (48 units).
- **Gas Savings:** Preliminary energy savings are higher than planned, reflecting higher participation. There was no change in impact factors, therefore, no variance between preliminary and evaluated.
- **Non-Electric Benefits (“NEBs”):** Are the result of higher participation/savings.
- **TRC Benefits/TRC Costs/Net Benefits:** See discussions above.

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

1. Final Report for Low Income Program – Massachusetts 2010 Residential Retrofit and Low Income Evaluation

For the 2010 process evaluation, the Cadmus team focused on assessing program processes and identifying similarities and differences between the perspectives and assumptions of program staff, implementation staff, and customers regarding program goals, design, and implementation. The Cadmus team also reviewed the process by which program data are collected, managed, and reported, including an assessment of the quality and consistency of the program data across PAs.

The results of this study did not impact the 2010 evaluated results.

This study is discussed in more detail in Section III.

**Changes resulting from Current Year Program Performance:**

Required design and/or implementation changes to this program as a result of the evaluation results described above have yet to be determined

This program was cost-effective for 2010, and the Company does not intend to discontinue the program.

## COMMERCIAL & INDUSTRIAL SECTOR PROGRAMS

### SUMMARY

During 2010 the Company implemented the following Commercial & Industrial (“C&I”) programs:

- C&I New Construction and Major Renovation
- C&I Large Retrofit
- C&I Direct Install

Tables II.C.1 and II.C.2 provide summary information on the performance of the C&I programs at the sector and program levels, respectively.

Sections II.C provide detailed information on the performance of each C&I program and pilot program, 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                    | \$    | \$ 225,595    |                              |                       | \$ 354,946        |                           | 57%                   |
| Performance Incentive                  | \$    | \$ 31,321     |                              |                       | \$ 38,865         |                           | 24%                   |
| <b>Savings and Benefits</b>            |       |               |                              |                       |                   |                           |                       |
| <b>Gas</b>                             |       |               |                              |                       |                   |                           |                       |
| Lifetime                               | Th    | 2,064,360     | 2,384,001                    | 15%                   | 2,148,249         | -10%                      | 4%                    |
| Annualized                             | Th    | 100,394       | 128,819                      | 28%                   | 117,734           | -9%                       | 17%                   |
| <b>Electric</b>                        |       |               |                              |                       |                   |                           |                       |
| Annualized Energy                      | kWh   | -             | -                            | 0%                    | -                 | 0%                        | 0%                    |
| Annualized Demand                      |       |               |                              |                       |                   |                           |                       |
| Summer                                 | kW    | -             | -                            | 0%                    | -                 | 0%                        | 0%                    |
| Winter                                 | kW    | -             | -                            | 0%                    | -                 | 0%                        | 0%                    |
| Non-Gas/Electric Benefits (Life)       | \$    | \$ -          | \$ -                         | 0%                    | \$ -              | 0%                        | 0%                    |
| <b>Cost-Effectiveness</b>              |       |               |                              |                       |                   |                           |                       |
| TRC Benefits                           | \$    | \$ 2,253,690  |                              |                       | \$ 2,337,568      |                           | 4%                    |
| TRC Costs                              | \$    | \$ 532,511    |                              |                       | \$ 774,622        |                           | 45%                   |
| Net Benefits                           | \$    | \$ 1,721,179  |                              |                       | \$ 1,562,946      |                           | -9%                   |
| BCR                                    |       | 4.2           |                              |                       | 3.0               |                           | -29%                  |

Table II.C.2

| 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   | \$    | \$ 311,264    | \$ 252,347        | -19%                  |
| TRC Costs  | \$    | \$ 89,196     | \$ 130,876        | 47%                   |
| Net Benefits   | \$    | \$ 222,068    | \$ 121,471        | -45%                  |
| BCR  |       | 3.5           | 1.9               | -45%                  |
| <b>Commercial &amp; Industrial Large Retrofit</b>                          |       |               |                   |                       |
| TRC Benefits   | \$    | \$ 1,830,885  | \$ 2,051,336      | 12%                   |
| TRC Costs  | \$    | \$ 411,686    | \$ 619,302        | 50%                   |
| Net Benefits   | \$    | \$ 1,419,199  | \$ 1,432,034      | 1%                    |
| BCR  | n/a   | 4.4           | 3.3               | -26%                  |
| <b>Commercial &amp; Industrial Direct Install</b>                          |       |               |                   |                       |
| TRC Benefits   | \$    | \$ 111,541    | \$ 33,885         | -70%                  |
| TRC Costs  | \$    | \$ 18,675     | \$ 22,490         | 20%                   |
| Net Benefits   | \$    | \$ 92,866     | \$ 11,395         | -88%                  |
| BCR  |       | 6.0           | 1.5               | -75%                  |
| <b>Hard-To-Measure Initiatives</b>   |       |               |                   |                       |
| TRC Costs  | \$    | \$ 12,955     | \$ 1,955          | -85%                  |
| <b>Total</b>   |       |               |                   |                       |
| TRC Benefits   | \$    | \$ 2,253,690  | \$ 2,337,568      | 4%                    |
| TRC Costs (incl HTM Initiatives)   | \$    | \$ 532,511    | \$ 774,622        | 45%                   |
| Net Benefits   | \$    | \$ 1,721,179  | \$ 1,562,946      | -9%                   |
| BCR  |       | 4.2           | 3.0               | -29%                  |

Overall, the C&I programs did well in 2010. At the sector level, the Company achieved its planned savings and TRC Benefit targets although costs were higher than budget due to higher than expected demand. New evaluation results reduced the evaluated savings nearly wiping out the incremental preliminary savings versus planned.

NEW CONSTRUCTION AND MAJOR RENOVATION – The program continues to experience high demand, exceeding its budget in 2010. Because of the wide selection of equipment offered through this program, planning the exact measure mix presented a challenge. Overall, program TRC costs were significantly higher than planned and net benefits were significantly lower than planned, which significantly lowered the BCR compared to the plan. The final measure mix and evaluation results conspired to impact program benefits and lifetime savings.

COMMERCIAL AND INDUSTRIAL LARGE RETROFIT – The program was over budget and saw higher than planned participation. Evaluated savings and benefits for the program were not significantly different from planned. TRC Costs were significantly higher than planned which impacted the BCR, lowering it significantly from planned.

COMMERCIAL AND INDUSTRIAL DIRECT INSTALL – This program in 2010 was a new offering for Unitil customers compared to the past delivery mechanism of a custom type retrofit program. Planning for this program presented challenges without a history of what had been done in the past. Overall program results were significantly different from the plan with savings and benefits significantly lower, but costs and participants significantly higher than planned.

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

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## COMMERCIAL & INDUSTRIAL PROGRAMS

### C&I NEW CONSTRUCTION & MAJOR RENOVATION

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

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

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

**Targeted End-Uses:** End uses targeted by the program included: lighting equipment and controls, lighting design, motors, variable speed drives, high performance HVAC equipment, chilled water systems/ refrigeration systems, building envelope measures, compressed air, high efficiency heating and water heating, and industry-specific gas and electric industrial processes. Site-specific custom measures, including CHP distributed generation, were also considered.

**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, D.P.U. 09-127. The program was approved by the Department on January 28, 2010 in D.P.U. 09-127.

Table II.C.3 provides information on the performance of the C&I New Construction and Major Renovation Program.

Table II.C.3

| 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   | \$    | \$ 51,521     |                              |                       | \$ 67,347         |                           | 31%                   |
| Performance Incentive                                       | \$    | \$ 4,213      |                              |                       | \$ 5,228          |                           | 24%                   |
| Participants  | Units | 2             |                              |                       | 16                |                           | 700%                  |
| Program Cost / Participant                                  | \$    | \$ 25,760     |                              |                       | \$ 4,209          |                           | -84%                  |
| <b>Savings and Benefits</b>                                 |       |               |                              |                       |                   |                           |                       |
| <b>Gas</b>  |       |               |                              |                       |                   |                           |                       |
| Lifetime  | Th    | 291,880       | 392,157                      | 34%                   | 241,070           | -39%                      | -17%                  |
| Annualized  | Th    | 11,770        | 18,596                       | 58%                   | 12,326            | -34%                      | 5%                    |
| Average Measure Life  | Yrs   | 25            | 21                           | -15%                  | 20                | -7%                       | -21%                  |
| <b>Electric</b>   |       |               |                              |                       |                   |                           |                       |
| Annualized Energy   | kWh   | -             | -                            | 0%                    | -                 | 0%                        | 0%                    |
| Annualized Demand   |       |               |                              |                       |                   |                           |                       |
| Summer  | kW    | -             | -                            | 0%                    | -                 | 0%                        | 0%                    |
| Winter  | kW    | -             | -                            | 0%                    | -                 | 0%                        | 0%                    |
| Non-Gas/Electric Benefits (Life)                            | \$    | \$ -          | \$ -                         | 0%                    | \$ -              | 0%                        | 0%                    |
| <b>Cost-Effectiveness</b>                                   |       |               |                              |                       |                   |                           |                       |
| TRC Benefits  | \$    | \$ 311,264    |                              |                       | \$ 252,347        |                           | -19%                  |
| TRC Costs   | \$    | \$ 89,196     |                              |                       | \$ 130,876        |                           | 47%                   |
| Net Benefits  | \$    | \$ 222,068    |                              |                       | \$ 121,471        |                           | -45%                  |
| BCR   |       | 3.5           |                              |                       | 1.9               |                           | -45%                  |

**Variance Analysis:**

- Total Program Costs: The variance between planned and actual costs for this program is primarily due to higher spending in customer incentives and PP&A costs than planned.  
Compared to the three year program budget of \$227,153, the variance is 7%.
- Performance Incentive: The Company achieved exemplary for the savings and net benefits components of its 2010 performance incentive but only achieved exemplary for one of its four C&I metrics. The Company did not achieve threshold for the other metrics.
- Participants: There were significantly more participants than planned. This program budget is small which can make it difficult to predict participation. One year, the Company may complete 1 or 2 very large projects and another year, like 2010, the Company may complete many smaller projects.
- Cost/Participant: Significantly more, smaller projects were completed during 2010 than planned. The planned program goals and targets were based on review of historic projects while preliminary results reflect what was actually installed.
- Gas Savings: The variance between preliminary and planned energy savings is consistent with the variance in program costs. Application of evaluation results account for the variance between preliminary and evaluated.
- Non-Electric Benefits ("NEBs"): The variance is not considered significant.
- TRC Benefits/TRC Costs/Net Benefits: See discussions above.



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**EM&V studies included in this Annual Report that apply to this program:**

1. Final Commercial New Construction Customer Quantitative Profile Project 1A New Construction Market Characterization.

The overarching objective of all LCIEC Market Characterization studies is: "To define the attributes of a specific market area in enough detail that the program planners and administrators can use the information for improving program implementation."

The results of this study did not impact the 2010 evaluated results.

This study is discussed in more detail in Section III.

2. Supply Chain Profile 1A New Construction Market Characterization

The overarching objective of all LCIEC Market Characterization studies is: "To define the attributes of a specific market area in enough detail that the program planners and administrators can use the information for improving program implementation."

The results of this study did not impact the 2010 evaluated results.

This study is discussed in more detail in Section III.

3. Final Report Project 1B Chain & Franchise Market Characterization

The overarching objective of all LCIEC Market Characterization studies is: "To define the attributes of a specific market area in enough detail that the program planners and administrators can use the information for improving program implementation."

The results of this study did not impact the 2010 evaluated results.

This study is discussed in more detail in Section III.

4. General Process Evaluation Final Report

The objective of this process evaluation was to look at ways to improve the design and delivery of Massachusetts C&I energy efficiency programs that would be applicable to multiple programs. Issues that the PAs and the EEAC were particularly interested in included how to increase program participation levels, how to obtain deeper energy savings from energy efficiency projects, how to improve the integration of electric and gas energy efficiency programs, and how to increase the general uniformity of program delivery across the state.

The results of this study did not impact the 2010 evaluated results.

This study is discussed in more detail in Section III.

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5. Estimated Net-to-Gross (NTG) Factors for the Massachusetts Program Administrators (PAs) 2010 Residential New Construction Programs, Residential HEHE and Multi-Family Gas Programs, and C&I Gas Programs.

The object of the study was to assist the Massachusetts PAs in identifying a reasonable estimated NTG factor for the 2010 Residential New Construction programs; C&I programs; Multi-Family Retrofit and Residential High Efficiency Heating and Water Heating programs.

The net effect of this study is to reduce gas savings for the measured installed.

This study is discussed in more detail in Section III.

6. Prescriptive Condensing Boiler Impact Evaluation Project 5 Prescriptive Gas

The objective of this impact evaluation was to develop annual gas savings impacts for all five size categories of prescriptive condensing boilers installed through the C&I gas programs.

The net effect of this study is to reduce gas savings for the measures installed.

This study is discussed in more detail in Section III.

**Changes resulting from Current Year Program Performance:**

The results of the impact evaluations described above will be used to adjust the planning estimates for the program for 2012. The Company is not expecting to make a mid-term modification to this program unless the overall variance over the three years exceeds 20%. Program design will continue to maximize electric and gas integration.

This program was cost-effective for 2010, and the Company does not intend to discontinue the program.

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## C&I LARGE RETROFIT

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

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

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

**Targeted End-Uses:** Targeted end uses included, but were not limited to, lighting and lighting controls, motors and drives, HVAC equipment, energy management systems, compressed air and unique industrial processes. Targeted gas end uses included: building envelope and glazing, commercially sized heating and water heating equipment, system and building controls. Consideration was provided for any commercially available energy efficiency technology.

**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 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, D.P.U. 09-127. The program was approved by the Department on January 28, 2010 in D.P.U. 09-127.

Table II.C.4 provides information on the performance of the C&I Large Retrofit Program.

Table II.C.4

| 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                    | \$    | \$ 160,717    |                              |                       | \$ 269,890        |                           | 68%                   |
| Performance Incentive                  | \$    | \$ 25,425     |                              |                       | \$ 31,549         |                           | 24%                   |
| Participants                           | TBD   | 5             |                              |                       | 8                 |                           | 60%                   |
| Program Cost / Participant             | \$    | \$ 32,143     |                              |                       | \$ 33,736         |                           | 5%                    |
| <b>Savings and Benefits</b>            |       |               |                              |                       |                   |                           |                       |
| <b>Gas</b>                             |       |               |                              |                       |                   |                           |                       |
| Lifetime                               | Th    | 1,670,690     | 1,954,134                    | 17%                   | 1,875,412         | -4%                       | 12%                   |
| Annualized                             | Th    | 83,535        | 106,978                      | 28%                   | 102,668           | -4%                       | 23%                   |
| Average Measure Life                   | Yrs   | 20            | 18                           | -9%                   | 18                | 0%                        | -9%                   |
| <b>Electric</b>                        |       |               |                              |                       |                   |                           |                       |
| Annualized Energy                      | kWh   | -             | -                            | 0%                    | -                 | 0%                        | 0%                    |
| Annualized Demand                      |       |               |                              |                       |                   |                           |                       |
| Summer                                 | kW    | -             | -                            | 0%                    | -                 | 0%                        | 0%                    |
| Winter                                 | kW    | -             | -                            | 0%                    | -                 | 0%                        | 0%                    |
| Non-Gas/Electric Benefits (Life)       | \$    | \$ -          | \$ -                         | 0%                    | \$ -              | 0%                        | 0%                    |
| <b>Cost-Effectiveness</b>              |       |               |                              |                       |                   |                           |                       |
| TRC Benefits                           | \$    | \$ 1,830,885  |                              |                       | \$ 2,051,336      |                           | 12%                   |
| TRC Costs                              | \$    | \$ 411,686    |                              |                       | \$ 619,302        |                           | 50%                   |
| Net Benefits                           | \$    | \$ 1,419,199  |                              |                       | \$ 1,432,034      |                           | 1%                    |
| BCR                                    |       | 4.4           |                              |                       | 3.3               |                           | -26%                  |

**Variance Analysis:**

- Total Program Costs: In its July 26, 2010 MTM, D.P.U. 10-86, the Company requested additional funds to address stronger than anticipated demand in this program. The Company subsequently withdrew its 2010 MTM proposal.  
Compared to the three year program budget of \$647,007, the 2010 variance is 17%.
- Performance Incentive: The Company achieved exemplary for the savings and net benefits components of its 2010 performance incentive but only achieved exemplary for one of its four C&I metrics. The Company did not achieve threshold for the other metrics.
- Participants: Reflects the higher spending level.
- Cost/Participant: The variance is not considered significant.
- Gas Savings: The variance between preliminary and planned annualized savings is due to measure mix. The planned program goals and targets were based on review of historic projects while preliminary results reflect actual installations. Application of evaluation results account for the variance between preliminary and evaluated.
- Non-Electric Benefits (“NEBs”): The variance is not considered significant
- TRC Benefits/TRC Costs/Net Benefits: See discussions above.

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**EM&V studies included in this Annual Report that apply to this program:**

1. 2010 Residential New Construction Programs, Residential HEHE and Multi-Family Gas Programs, and C&I Gas Programs

The object of the study was to assist the Massachusetts PAs in identifying a reasonable estimated NTG factor for the 2010 Residential New Construction programs; C&I programs; Multi-Family Retrofit and Residential High Efficiency Heating and Water Heating programs.

The results of this study were to reduce savings for measured installed.

This study is discussed in more detail in Section III.

1. Cross Cutting C&I Free-Ridership and Spillover Methodology Study Final Report

The focus of this study was on the general methods for estimating what would have happened absent C&I programs in Massachusetts. The net program effect is the observed effect, less the estimate of what would have happened absent the program. The objectives of this study were to develop a standardized methodology for situations where C&I end-users are able to report on program impacts via self-report methods, and to provide a decision framework and guidelines for when the standardized self-report methodology is appropriate and when other methods need to be used (e.g., upstream programs).

The results of this study did not impact the 2010 evaluated results.

This study is discussed in more detail in Section III.

2. General Process Evaluation Final Report

The objective of this process evaluation was to look at ways to improve the design and delivery of Massachusetts C&I energy efficiency programs that would be applicable to multiple programs. Issues that the PAs and the EEAC were particularly interested in included how to increase program participation levels, how to obtain deeper energy savings from energy efficiency projects, how to improve the integration of electric and gas energy efficiency programs, and how to increase the general uniformity of program delivery across the state.

The results of this study did not impact the 2010 evaluated results.

This study is discussed in more detail in Section III.

**Changes resulting from Current Year Program Performance:**

The results of the impact evaluations described above will be used to adjust the planning estimates for the program for 2012. The Company is not expecting to make a mid-term modification to this program unless the overall variance over the three years exceeds 20%.

This program was cost-effective for 2010, and the Company does not intend to discontinue the program.

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## 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:** While 2010 stood as a transition year, all PAs moved toward targeting direct install retrofit business customers below 300kW.

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

**Targeted End-Uses:** Targeted end uses included a variety of comprehensive gas and electric measures including but not limited to: lighting and lighting controls, HVAC equipment, water heating, variable speed drives, and refrigeration, heating system controls, commercial dishwashing - water heating and potentially building 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, inputted 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 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, D.P.U. 09-127. The program was approved by the Department on January 28, 2010 in D.P.U. 09-127.

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

Table II.C.5.

| Commercial & Industrial Direct Install |       |               |                              |                       |                   |                           |                       |
|--|-------|---------------|------------------------------|-----------------------|-------------------|---------------------------|-----------------------|
| 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                    | \$    | \$ 13,357     |                              |                       | \$ 17,710         |                           | 33%                   |
| Performance Incentive                  | \$    | \$ 1,683      |                              |                       | \$ 2,088          |                           | 24%                   |
| Participants                           | Units | 2             |                              |                       | 13                |                           | 550%                  |
| Program Cost / Participant             | \$    | \$ 6,679      |                              |                       | \$ 1,362          |                           | -80%                  |
| <b>Savings and Benefits</b>            |       |               |                              |                       |                   |                           |                       |
| <b>Gas</b>                             |       |               |                              |                       |                   |                           |                       |
| Lifetime                               | Th    | 101,790       | 37,710                       | -63%                  | 31,767            | -16%                      | -69%                  |
| Annualized                             | Th    | 5,089         | 3,245                        | -36%                  | 2,740             | -16%                      | -46%                  |
| Average Measure Life                   | Yrs   | 20            | 12                           | -42%                  | 12                | 0%                        | -42%                  |
| <b>Electric</b>                        |       |               |                              |                       |                   |                           |                       |
| Annualized Energy                      | kWh   | -             | -                            | -                     | -                 | -                         | -                     |
| Annualized Demand                      |       |               |                              |                       |                   |                           |                       |
| Summer                                 | kW    | -             | -                            | -                     | -                 | -                         | -                     |
| Winter                                 | kW    | -             | -                            | -                     | -                 | -                         | -                     |
| Non-Gas/Electric Benefits (Life)       | \$    | \$ -          | \$ -                         | 0%                    | \$ -              | 0%                        | 0%                    |
| <b>Cost-Effectiveness</b>              |       |               |                              |                       |                   |                           |                       |
| TRC Benefits                           | \$    | \$ 111,541    |                              |                       | \$ 33,885         |                           | -70%                  |
| TRC Costs                              | \$    | \$ 18,675     |                              |                       | \$ 22,490         |                           | 20%                   |
| Net Benefits                           | \$    | \$ 92,866     |                              |                       | \$ 11,395         |                           | -88%                  |
| BCR                                    |       | 6.0           |                              |                       | 1.5               |                           | -75%                  |

**Variance Analysis:**

- Total Program Costs: The variance between planned to actual spending is due to the slight over spending in the customer incentive category.  
Compared to the three year program budget of \$50,542, the 2010 variance is 8%.
- Performance Incentive: The Company achieved exemplary for the savings and net benefits components of its 2010 performance incentive but only achieved exemplary for one of its four C&I metrics. The Company did not achieve threshold for the other metrics.
- Participants: Rebate costs associated with actual measures installed were much lower than planned allowing more customers to participate.
- Cost/Participant: The cost/participant was much lower than planned due to measure mix.
- Gas Savings: Planned savings was estimated based on historic projects while preliminary savings reflect the actual measures installed. Application of evaluation results account for the variance between preliminary and evaluated.
- Non-Electric Benefits (“NEBs”): The variance is not considered significant.
- TRC Benefits/TRC Costs/Net Benefits: See discussions above.

The large variance in the TRC Benefits and BCR is largely due to the variance in savings associated with the installed measures compared to plan. Application of evaluation results account for a small portion of the variance.

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**EM&V studies included in this Annual Report that apply to this program:**

1. Massachusetts Non-Residential Small Business Direct Install Program: Multi-Tier Structure Assessment 2010 Process Evaluation

The main objective of the Multi-Tier Program Structure Assessment is to document progress towards statewide integration of the C&I Direct Install programs during 2010, and to gauge customer interest in different program design options such as varying incentive levels, zero interest financing, and on-bill financing options. The assessment is also designed to gather information related to program satisfaction and awareness.

The results of this study did not impact the 2010 evaluated results.

This study is discussed in more detail in Section III.

2. Estimated Net-to-Gross (NTG) Factors for the Massachusetts Program Administrators (PAs) 2010 Residential New Construction Programs, Residential HEHE and Multi-Family Gas Programs, and C&I Gas Programs.

The object of the study was to assist the Massachusetts PAs in identifying a reasonable estimated NTG factor for the 2010 Residential New Construction programs; C&I programs; Multi-Family Retrofit and Residential High Efficiency Heating and Water Heating programs.

The results of this study were to reduce savings for measured installed.

This study is discussed in more detail in Section III.

3. Cross Cutting C&I Free-Ridership and Spillover Methodology Study Final Report

The focus of this study was on the general methods for estimating what would have happened absent C&I programs in Massachusetts. The net program effect is the observed effect, less the estimate of what would have happened absent the program. The objectives of this study were to develop a standardized methodology for situations where C&I end-users are able to report on program impacts via self-report methods, and to provide a decision framework and guidelines for when the standardized self-report methodology is appropriate and when other methods need to be used (e.g., upstream programs).

The results of this study did not impact the 2010 evaluated results.

This study is discussed in more detail in Section III.

**Changes resulting from Current Year Program Performance:**

The results of the impact evaluations described above will be used to adjust the planning estimates for the program for 2012. The Company is not expecting to make a mid-term modification to this program unless the overall variance over the three years exceeds 20%. Program design will continue to maximize electric and gas integration.

This program was cost-effective for 2010, and the Company does not intend to discontinue the program.



### III. EVALUATION MEASUREMENT AND VERIFICATION ACTIVITIES

#### SUMMARY

Table III.A summarizes the EM&V studies that have not been included in previous Annual Reports.

Table III.A:

| Table III.A: Evaluation Studies in Annual Report   |   |   |                                   |
|--|---|---|-----------------------------------|
| Studies  | Location of Complete Study in Annual Report | Docket & Exhibit Approving Planned Evaluation Studies   | Implemented as Approved? (yes/no) |
| Residential Program Studies  |   |   |                                   |
| Massachusetts New Homes with ENERGY STAR Estimated Maximum Potential Savings from Enhanced Code Compliance with the IECC 2009 Residential Building Code in Massachusetts   | App. C, Study 1                             | Docket D.P.U. 09-127, 2010 – 2012 Massachusetts Joint Statewide Three-Year Gas Energy Efficiency Plan, October 29, 2009, Section II.H and pending D.P.U. 10-150 (Unitil’s 2011 MTM) | Yes                               |
| Massachusetts New Homes with ENERGY STAR Mystery Shopping  | App. C, Study 2                             |   | Yes                               |
| The Massachusetts New Homes with ENERGY STAR Program 2011 Baseline Phase 1: Completion of Planning   | App. C, Study 3                             |   | Yes                               |
| Massachusetts 2010 Residential Retrofit and Low-Income Evaluation - Brushless Fan Motors   | App. C, Study 4                             |   | Yes                               |
| Massachusetts 2010 Residential Retrofit and Low Income Evaluation: Mass Save   | App. C, Study 5                             |   | Yes                               |
| 2010 Net to Gross Findings: Home Energy Assessment   | App. C, Study 6                             |   | Yes                               |
| Non-Electric Impact (NEI) Findings for the 2010 Mass Save Home Energy Services (Mass Save) program   | App. C, Study 7                             |   | Yes                               |
| Massachusetts ENERGY STAR Lighting Program: 2010 Annual Report   | App. C, Study 8                             |   | Yes                               |
| Massachusetts Appliance Turn-in Program Evaluation Integrated Report Findings  | App. C, Study 9                             |   | Yes                               |
| Cross-Cutting Net-to-Gross Methodology Study for Residential Programs – Suggested Approaches (Final)   | App. C, Study 10                            |   | Yes                               |
| Estimated Net-To-Gross (NTG) Factors for the Massachusetts Program Administrators (PAs) 2010 Residential New Construction Programs, Residential HEHE and Multi-Family Gas Programs, and Commercial and Industrial Gas Programs | App. C, Study 11                            |   | Yes                               |

Table III.A:

| 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) |
| HEHE Process and Impact Evaluation  | App. C, Study 12                            | Docket D.P.U. 09-127, 2010 – 2012<br>Massachusetts Joint Statewide Three-Year Gas Energy Efficiency Plan, October 29, 2009, Section II.H and pending D.P.U. 10-150 (Unitil's 2011 MTM) | Yes                               |
| Residential Pilot Studies   |   |  |                                   |
| Massachusetts 2010 Residential Retrofit and Low Income Evaluation – Deep Energy Retrofit  | App. C, Study 13                            |  | Yes                               |
| Massachusetts New Homes with ENERGY STAR Process Evaluation of the Four to Eight Story Multi-Family New Construction Pilot Interim Findings | App. C, Study 14                            |  | Yes                               |
| The Massachusetts New Homes with ENERGY STAR Program Major Renovations Pilot Evaluation: Preliminary Report on Non-Participant Interviews   | App. C, Study 15                            |  | Yes                               |
| The Massachusetts New Homes with ENERGY STAR Program Version 3 Pilot Evaluation   | App. C, Study 16                            |  | Yes                               |
| Massachusetts Cross-Cutting Behavioral Process Evaluation   | App. C, Study 17                            |  | Yes                               |
| Low-Income Program Studies  |   |  |                                   |
| Massachusetts 2010 Residential Retrofit and Low Income Evaluation: Low Income   | App. C, Study 18                            |  | Yes                               |
| Commercial & Industrial Program Studies   |   |  |                                   |
| Non-Controls Lighting Evaluation for the Massachusetts Small Commercial Direct Install Program  | App. C, Study 19                            |  | Yes                               |
| Massachusetts Non-Residential Small Business Direct Install Program: Multi-Tier Structure Assessment 2010 Process Evaluation                | App. C, Study 20                            |  | Yes                               |
| Final Report HBL Market Effects Study Project 1A New Construction Market Characterization   | App. C, Study 21                            |  | Yes                               |
| FINAL Commercial New Construction Customer Quantitative Profile Project 1A New Construction Market Characterization                         | App. C, Study 22                            |  | Yes                               |
| Supply Chain Profile Project 1A New Construction Market Characterization  | App. C, Study 23                            |  | Yes                               |
| Final Report Project 1B Chain & Franchise Market Characterization   | App. C, Study 24                            |  | Yes                               |
| Impact Evaluation of 2009 Custom HVAC Installations   | App. C, Study 25                            |  | Yes                               |
| Final Report Project 1C Combined Heat & Power Market Characterization   | App. C, Study 26                            | Yes  |                                   |
| Project 6B Comprehensive Design Approach Process Evaluation   | App. C, Study 27                            | Yes  |                                   |

Table III.A:

| 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) |
| Impact Evaluation of 2008 and 2009 Custom CDA Installations                                | App. C, Study 28                            | Docket D.P.U. 09-127, 2010 – 2012 Massachusetts Joint Statewide Three-Year Gas Energy Efficiency Plan, October 29, 2009, Section II.H and pending D.P.U. 10-150 (Unitil's 2011 MTM) | Yes                               |
| Project 7 General Process Evaluation Final Report  | App. C, Study 29                            |   | Yes                               |
| 2010 Commercial and Industrial Electric Programs Free-ridership and Spillover Final Report | App. C, Study 30                            |   | Yes                               |
| C&I Lighting Measure Life and Persistence Project  | App. C, Study 31                            |   | Yes                               |
| C&I Lighting Loadshape   | App. C, Study 32                            |   | Yes                               |
| C&I Unitary HVAC Loadshape Project Final Report  | App. C, Study 33                            |   | Yes                               |
| Cross Cutting C&I Free Ridership and Spillover Methodology Study Final Report              | App. C, Study 34                            |   | Yes                               |
| Prescriptive Condensing Boiler Impact Evaluation Project 5 Prescriptive Gas                | App. C, Study 35                            |   | Yes                               |
| Special & Cross Sector Studies   |   |   |                                   |
| Industry Practices and Policies on Energy Efficient Program Rebate/Incentives              | App. C, Study 36                            |   | Yes                               |
| Community Based Partnership Interim Process Evaluation                                     | App. C, Study 37                            | Yes   |                                   |

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## RESIDENTIAL STUDIES

### MASSACHUSETTS NEW HOMES WITH ENERGY STAR ESTIMATED MAXIMUM POTENTIAL SAVINGS FROM ENHANCED CODE COMPLIANCE WITH THE IECC 2009 RESIDENTIAL BUILDING CODE IN MASSACHUSETTS (STUDY 1)

**Type of Study:** Other

**Objective of the Study:** The objective of this study was to estimate the maximum potential savings for the years 2011, 2012, and 2013 that may be achieved through promoting compliance with the newly-adopted International Energy Conservation Code ("IECC") 2009 energy code for four measures (wall insulation, basement insulation, proper insulation of ducts in unconditioned spaces, and fifty percent high efficacy lamp requirement) in order to provide needed guidance to the PAs on the implementation and evaluation costs that may be justified. Compliance enhancement efforts would focus on PAs' trainings of builders, subcontractors, and code officials as the potential savings presented in the report focus on homes that do not participate in the Massachusetts New Homes with ENERGY STAR Program.

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

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

**Recommendations Derived from the Study:** There are no recommendations from this study as the main purpose was to derive potential savings from code enhancement efforts for the measures mentioned above.

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

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

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

### MASSACHUSETTS NEW HOMES WITH ENERGY STAR MYSTERY SHOPPING (STUDY 2)

**Type of Study:** Other

**Objective of the Study:** This report presents the findings of ten mystery shopping visits to ENERGY STAR<sup>®</sup> homes conducted in the summer of 2010. The results presented provide insight into the current marketing strategies of agents listing ENERGY STAR homes, and the effect of program-sponsored trainings on these marketing strategies.

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

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

**Recommendations Derived from the Study:**

- Continue *Be a Star with ENERGY STAR* trainings. There was a noticeable difference in the knowledge of agents who had attended the training compared to those who had not. The agents who had attended training seemed to understand and market more aspects of their ENERGY STAR listings, and generally spent more time discussing the energy efficiency features of the home.
- Expand trainings to include builders. Builders are well versed in their homes' specific energy efficiency measures and the benefits of those measures, but that knowledge often was not passed on to the developments' sales representatives. Builders might benefit from training that provides guidance on how to train their own sales representatives to fully market the benefits of ENERGY STAR homes.
- Focus a portion of trainings on the HERS index and HERS ratings. All ENERGY STAR homes are not created equal, and agents should take advantage of the increased marketability of homes with low HERS ratings.
- Encourage agents to attend all of the inspection stages of an ENERGY STAR home. This will ensure that agents have a better understanding of both the components (e.g., insulation and duct work) of an ENERGY STAR home, and the thoroughness of the certification process. In addition, by attending the various inspection stages, agents are likely to gain a better understanding of the technical terms (e.g., blower door and duct blaster) that are associated with ENERGY STAR homes.
- Encourage agents to walk through an ENERGY STAR brochure or fact sheet with potential homebuyers. This simple step will guide potential buyers through the benefits of ENERGY STAR qualified homes, providing technical reference where needed, and it will ensure that the major bullet points of ENERGY STAR homes are covered during every showing.
- Encourage agents to build on consumers' preexisting knowledge of ENERGY STAR for appliances and electronics, emphasizing the value of the ENERGY STAR brand name. Agents might have better success marketing these homes by emphasizing to buyers that the ENERGY STAR label for homes is just an extension of the ENERGY STAR label they already know and trust, found on appliances, heating and cooling equipment, lighting and electronic products in their homes.

**How the Study Came to the Recommended Conclusions:** Recommendations are based on findings from ten mystery shopping visits to ENERGY STAR<sup>®</sup> homes, conducted in the summer of 2010. Four of the real estate and sales agents visited had recently attended a program- sponsored *Be a Star with ENERGY STAR* training session (these were the only attendees that had suitable homes for sale at the time of the visits). All ten agents visited were ranked on a scale of zero to ten, where zero was "not at all willing or knowledgeable" and ten was "extremely willing or knowledgeable" in the following four areas: knowledge of energy efficiency, knowledge of ENERGY STAR certification, willingness to use energy efficiency as a selling point, and willingness to use ENERGY STAR certification as a selling point.

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**Explain Whether or Not the PA Decided to Adopt Recommendations from the Study, and Why:** All recommendations above have been adopted and are being incorporated into the program through continuation and enhancement of various training efforts.

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

#### THE MASSACHUSETTS NEW HOMES WITH ENERGY STAR PROGRAM 2011 BASELINE PHASE 1: COMPLETION OF PLANNING (STUDY 3)

**Type of Study:** Baseline

**Objective of the Study:** This report describes the planning process for the 2011 Baseline Study and the work done to develop a sample of eligible homes to recruit from; on-site inspections will be conducted in the summer of 2011. This study will include on-site inspections of 100 non-ENERGY STAR homes built to meet the new IECC 2009 code, which became mandatory in Massachusetts on July 1, 2010. The results of this study will be used to update the baseline or User Defined Reference Home used in calculating Program savings and to assess building code compliance at the beginning of a code cycle.

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

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

**Recommendations Derived from the Study:** There are no recommendations from this study as the main purpose was to document the planning process of the Baseline study.

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

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

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

#### MASSACHUSETTS 2010 RESIDENTIAL RETROFIT AND LOW-INCOME EVALUATION - BRUSHLESS FAN MOTORS (STUDY 4)

**Type of Study:** Process

**Objective of the Study:** The report presents the results of the process evaluation of the Brushless Fan Motor ("BFM") component of the 2010 Cool Smart program. The objectives of the study were to determine the following: program processes, implementation strengths, and areas for improvements;

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program tracking data sufficiency; contractor practices, perceptions, and participation barriers; customer behavior, motivations, awareness, and satisfaction; program outreach and recruitment efficacy; and participants' potential changes in fan use, from pre- to post-installation.

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

- Residential Cooling and Heating Equipment (Electric)

**Recommendations Derived from the Study:**

- Consider including a unique participation identifier (such as an ID number), BFM manufacturer and model numbers (which would prove helpful for verification purposes); and add a parameter to capture numbers of motors incented per home (which would help indicate if contractors are paid for more than two motors per home).
- Explore options for making program participation more cost-effective for contractors. For example, consider allowing contractors to bill customers for parts or labor that exceed a "typical" installation.

**How the Study Came to the Recommended Conclusions:** The process evaluation of the BFM included: in-depth telephone interviews with program administrator and implementer staff; qualitative in-depth interviews with participating and nonparticipating (in the Cool Smart BFM program component) HVAC contractors; and surveys with participating customers. In addition to the primary data collection the study reviewed BFM program materials addressing marketing, implementation, and the participant database. Based on the information obtained, the Cadmus team used its professional judgment and evaluation experience to offer recommendations aimed at improving program processes where appropriate.

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

- To assist with future evaluation needs, the PAs will work with the implementation vendors and internal support groups to ensure that all appropriate data is collected. If the data is captured early on this could potentially minimize data requests and on-site visits to customer homes.
- The PAs, together with the implementation vendor and other trade allies, including HVAC distributors, will explore market opportunities and implementation strategies to enhance contractor participation.

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

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## MASSACHUSETTS 2010 RESIDENTIAL RETROFIT AND LOW INCOME EVALUATION: MASS SAVE (STUDY 5)

### **Type of Study:** Process

Objective of the Study: For the 2010 process evaluation, the Cadmus team focused on assessing program processes and identifying similarities and differences between the perspectives and assumptions of program staff, implementation staff, and customers regarding program goals, design, and implementation. The Cadmus team also reviewed the process by which program data are collected, managed, and reported, including an assessment of the quality and consistency of the program data across PAs.

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

- MassSAVE (Electric & Gas)

### **Recommendations Derived from the Study:**

- Due to concerns among all stakeholders, the potential integration of Home Performance Contractors (“HPCs”) should occur slowly and in collaboration with PAs, vendors, and program contractors. Clear protocols for and expectations regarding program delivery by HPCs should be developed and disseminated.
- Consider developing a standard set of tasks and responsibilities assigned to contractors installing measures in a customer’s home, uniform across all PA territories. These would include how jobs are presented to contractors, contractors’ responsibilities, and reports and invoices contractors are expected to submit to vendors upon completion of jobs.
- Explore opportunities to assist customers in addressing health and safety issues, as well as knob and tube wiring removal, to further eliminate barriers and improve participation rates. The Cadmus team suggests expanding the existing financing options to cover these critical pre-participation issues.
- Develop a standardized identification system for participants, premises, projects, and measures. The consistent use of customer and premise identification associated with the tracking record will allow tracking of historic program activity and activity in other programs.
- Ensure a minimum set of fields is collected and maintained for future evaluation work (see Appendix H).
- Maintain a data dictionary for all critical program datasets that includes all field definitions, value definitions, and the sources of the data. The data dictionaries should be provided as part of all data requests, allowing evaluators (or any other third-party) to decode field names and data values efficiently. The data dictionaries would also ensure internal knowledge of the database is not lost in the event of critical personnel turnover.
- Develop and employ a standardized measure naming convention. The Technical Reference Manual (“TRM”) could be used as the basis for standard names. This convention would allow for improved evaluability and add transparency to the measure-tracking process. The Cadmus team specifically recommends a four-part measure naming convention, which includes varying levels of detail for



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each program stakeholder, denoting the measure's end-use, group, type, and detail. Such a measure naming convention would clearly relate each measure in the program tracking data to its TRM counterpart.

- Revisit customer service and follow-up strategies. Although all vendors reported use of a rigorous follow-up procedure, and vendors ensure customer support is readily available when customers call, additional customer service in the form of outreach, regular check-ins, and follow-up phone calls could improve participation and satisfaction.
- Consider offering incentives to auditors based on implementation percentages or another participation goal designed to increase follow-through participation.

**How the Study Came to the Recommended Conclusions:** The RCS program evaluation included PA program manager interviews, program vendor staff interviews, program contractor interviews, PA data manager interviews, a data review, and participant interviews. Based on information obtained from these stakeholders, the Cadmus team used its professional judgment and experience evaluating energy efficiency programs to offer recommendations aimed at improving program processes where appropriate.

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

- The integration of HPCs began with a small pilot in 2010. In 2011, the introduction of additional HPCs is being rolled out using information gained from the 2010 pilot. Clear energy assessment, software use and reporting guidelines are in place.
- The PAs have developed consistent statewide material and installation standards, as well as, Energy Assessment standards.
- The PAs are also exploring the opportunity to expand financing to include the mitigation of health and safety barriers. This will require regulatory approval and will be addressed using proper regulatory avenues.
- The PAs are working with the evaluation team to ensure they are better able to aggregate and/or compare measure savings in the future, where possible.
- The PAs are developing concrete follow up strategies to ensure constant follow up communication with customers. Many PA lead vendors have already established follow up protocols.
- The Company currently offers incentives to auditors. CSG auditors are compensated based on performance and the Company intends on providing a customer acquisition marketing bonus to independent installation contractors and HPCs who solicit a customer and facilitate a completed weatherization job.

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

## 2010 NET TO GROSS FINDINGS: HOME ENERGY ASSESSMENT (STUDY 6)

**Type of Study:** Impact

**Objective of the Study:** The objective of the study was to develop Net-to-Gross (“NTG”) estimates for the Home Energy Services program at the measure level. The Home Energy Services program incorporates both Mass Save and the gas Weatherization programs. The research was designed to include freeridership, participant spillover and non-participant spillover in the analysis.

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

- MassSAVE (Electric & Gas)
- Weatherization (Gas)

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

| 2010 Home Energy Services NTG Findings |                         |                            |                       |                           |      |
|--|-------------------------|----------------------------|-----------------------|---------------------------|------|
| Measure Category                       | Measure                 | Participant Free-Ridership | Participant Spillover | Non-Participant Spillover | NTG  |
| CFL Direct Installs                    | CFL                     | 22%                        | 19%                   | 0%                        | 97%  |
| Direct Installs                        | Air Leak Sealing        | 7%                         | 0%                    | 0%                        | 93%  |
|  | Programmable Thermostat | 11%                        | 0%                    | 0%                        | 89%  |
| Incented Measures                      | Heating System          | 28%                        | 0%                    | 0%                        | 72%  |
|  | Insulation              | 20%                        | 8%                    | 50%                       | 138% |
|  | Refrigerator            | 5%                         | 0%                    | 0%                        | 95%  |
|  | Water Heater            | 25%                        | 0%                    | 0%                        | 75%  |
| Overall                                |                         | 18%                        | 7%                    | 23%                       | 112% |

The 2010 Home Energy Services program NTG estimates are based on three combined approaches:

**Customer Self-Reports:** Customer self-reported Free Rider (“FR”) and Participant Spillover (“SP”) through surveys of 2010 RCS (electric) and gas Weatherization participants. As shown in Table 1, this analysis considered all program measures. A survey of 1,200 electric and 400 gas participants informed the analysis.

**Statistical Market Share Modeling:** Discrete choice modeling of FR and Non Participant Spillover (“NPS”) used 400 gas Weatherization participant and 400 nonparticipant surveys. This analysis did not include the 1,200 electric participants surveyed in fall 2010, as the questionnaire used was not designed for these models. The 2010 NTG analysis also focused on insulation and duct

sealing/duct insulation (collectively referred to as insulation), the most important measures in terms of savings.

*Trade Ally Research:* Interviews with more than 30 insulation contractors focused on participant and nonparticipant insulation installations, and attribution of self-reported nonparticipant jobs as spillover.

Final participant FR, PS, NPS, and NTG values are composite estimates (rather than a simple average) of the various research methods employed. The estimates were developed using a triangulation process, incorporating the Cadmus teams' experience, professional judgment, and understanding of the programs.

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

**Formulas Necessary to Understand the Impact of the Study on the PA's Programs:**

$$\text{NTG} = 1 - [\text{participant freeridership}] + [\text{participant spillover}] + [\text{nonparticipant spillover}]$$

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

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

## NON-ELECTRIC IMPACT (NEI) FINDINGS FOR THE 2010 MASS SAVE HOME ENERGY SERVICES (MASS SAVE) PROGRAM (STUDY 7)

**Type of Study:** Impact

**Objective of the Study:** The study summarized Cadmus' review of the non-electric impacts ("NEIs") claimed for the 2011 Mass Save Home Energy Services ("Mass Save") program by the PAs. For the purpose of this study, NEIs were defined as program-driven effects on the consumption of energy other than electricity, such as natural gas (not claimed by a gas PA), water, fuel oil and propane.

Cadmus' review consisted of determining the source of the current NEI values and independently estimating measure-specific NEIs, using the best available PA program data and secondary sources to assess the reasonableness of the current values.

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

- MassSAVE (Electric Only)

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**Results of the Study and How the Study Determined those Results:** The review consisted of determining the source of the current NEI values and independently estimating measure-specific NEIs, using the best available PA program data and secondary sources to assess the reasonableness of the current values.

It was determined that the current PA NEI values were generated based on summaries of audit tool outputs for each program home. These values were driven by inputs from MassSave vendors regarding home characteristics for participants realizing NEIs. These are primarily from program homes for which the primary space heating fuel is neither electricity nor natural gas. An independent assessment of NEI estimates was conducted and found the current vendor-provided values were reasonable.

**How the Results of the Study Impact each Identified Program's Savings:** Please see Table II.A.6.

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

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

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

## MASSACHUSETTS ENERGY STAR LIGHTING PROGRAM: 2010 ANNUAL REPORT (STUDY 8)

**Type of Study:** Impact

**Objective of the Study:** The primary objectives of this impact evaluation was to estimate net-to-gross ratios ("NTGR") for all markdown compact fluorescent lamps ("CFLs"), including separate estimates for spiral and specialty bulbs and bulbs targeted at hard-to-reach ("HTR") customers. The evaluators were also charged with assessing the PAs' current working definition of HTR customers and understanding market segmentation related to HTR customers. The evaluators also described the current state of the market for CFLs and other efficient lighting technologies, comparing to results from prior years when possible.

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

- Residential ENERGY STAR Lighting Program (Electric)

**Results of the Study and How the Study Determined those Results:** The evaluators recommend using a 0.43 NTGR for spiral CFLs and 0.60 for specialty CFLs, or 0.47 overall for the 2009 and 2010 program years. The evaluators came to this recommendation through the results of five different NTGR estimation methods completed for the 2009 and 2010 Massachusetts ENERGY STAR lighting program: 1) conjoint study, 2) multistate modeling, 3) revealed preference, 4) supplier interviews, and 5) willingness to pay. The evaluators then convened a Delphi panel and provided each panelist with the results of these studies as well as background information on the history of the Massachusetts ENERGY STAR lighting program and trends in NTG ratios for Massachusetts and other states. The Delphi panel responded to an initial request to estimate NTG ratios for spiral, specialty, and overall CFLs, and then had the opportunity to

revise their estimates after reviewing the responses of their fellow panelist. The final NTGR estimates from the Delphi panel serve as the evaluation-recommended NTGR. The methods did not provide conclusive evidence to support a recommendation of a NTGR for HTR customers. The PAs and EEAC consultants have agreed to use the 0.60 specialty NTGR for HTR customers.

**How the Results of the Study Impact each Identified Program's Savings:** Please see Table II.A.7.

**Formulas Necessary to Understand the Impact of the Study on the PA's Programs:**

$$\text{Net Savings} = \text{Gross Savings} * \text{In Service Rate} * \text{NTGR.}$$

The planning NTGR value will be updated with the evaluated NTGR results. Markdown spirals will go from .30 to .43, specialty markdown bulbs change from 0.8 to 0.6, and HTR markdown bulbs change from 0.7 to 0.6.

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

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

## MASSACHUSETTS APPLIANCE TURN-IN PROGRAM IMPACT EVALUATION FINAL (STUDY 9)

**Type of Study:** Impact and Process

**Objective of the Study:** The Massachusetts Appliance Turn-in program collects and recycles working refrigerators and stand-alone freezers that are being used as second units from residential customers.

The primary evaluation activities consisted of a participant survey, a process evaluation, and estimation of net program savings impacts derived by applying participant-reported decision behavior about program influence and usage patterns to gross savings estimates from studies conducted in other areas. These gross and net savings estimates were compared to ex ante savings estimates currently used by the PAs. A secondary focus of the evaluation effort included an exploration of the secondary market and disposal market that exists for appliances to provide insight about how the program functions in the overall appliance market.

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

- Residential Energy Star Appliances (Electric)

**Results of the Study and How the Study Determined those Results:** The updated gross and impact estimates derived in this study are based on two methodologies. The first methodology used unit energy consumption ("UEC") estimates from the Association of Home Appliance Manufacturers. The second methodology applied Massachusetts refrigerator characteristics to the DOE-based model utilized by Cadmus in their 2010 evaluation of the California Appliance Recycling Program. Under each of the NMR

methodologies, UECs were adjusted to account for partial use, equipment replacement, and free ridership, values that were derived from the participant survey. While the program targeted secondary units for recycling, three distinct types of units were identified in the study—secondary units that were replaced with another unit, secondary units that were not replaced, and primary units. The study revealed that each type of recycled unit had a different energy savings profile.

Process related conclusions are based on the participant survey, depth interviews with Sponsors and the implementation contractor, and exploration of the secondary market and disposal market for appliances outside of the program.

#### **Recommendations Derived from the Study:**

- *Use updated gross and net impact estimates for the program*—Overall, the net savings estimate for refrigerators is 522 kWh/year and for freezers is 391 kWh/year. The *ex ante* estimates used by the Sponsors are 724 kWh.
- *Weigh the value of removing primary refrigerators*—The Sponsors should consider either reducing the number of primary fridges removed by the program by reinforcing the requirement (e.g., in marketing materials and verification of eligibility) or alternatively, opening up the program to include primary fridges.
- *Consider partnering with major retailers to market and implement the program*. Major retailers could promote the program in their stores to customers who may be making a decision to keep or discard an existing unit. Using retailers would necessitate a shift in targeted appliances for the program—the program would be more likely to pick up primary refrigerators and nearly dead units.
- *Target missed appointments*—Attempt to reschedule appointments with customers who have missed appointments for recycling pickup using post cards, phone calls, and emails. The program already offers Saturday pick-ups and choices for pick-up times based on schedule and geography, but additional effort should be made to give these customers priority for pick-up times that might include Saturdays, early mornings, evenings, next day pick-up, or small, one- to two-hour windows for pick-up times. Messaging with these customers should reinforce their good decision making for initiating the removal and recycling of an appliance through the program.
- *Adjust goals to reflect demographics of the residential customer base for each Sponsor*—Service areas in NSTAR and Western Massachusetts Electric have a large number of apartments and multifamily homes and residents typically do not have areas where they can keep second refrigerators, such as basements or garages. Adjusting the goals of the program to reflect the pool of single family homes may result in more realistic targets for these Sponsors.
- *Educate participants about the program goals*—The program should emphasize that the primary goal of the program is to save energy and reduce demand on the electric grid by removing older, less efficient secondary refrigerators and stand-alone freezers. The program helps customers get rid of the appliances before they might do so on their own. Reductions in energy bills and the participation incentive are additional bonuses for customers.
- *Continue messaging about the ease of removal through the program*—Physical and financial barriers may encourage some consumers to keep their secondary appliances, and marketing the program to residents faced with these barriers might allow the Sponsors to collect additional units that would

not otherwise be removed from the grid.

- *Continue promoting the program through existing channels*—The Sponsors' communications network to customers through bill inserts, notations on bills, newsletters, and emails should continue to be used to promote the program on a continuous basis, or when a quick boost in participation is desired. Promotions through schools and community groups and options for rebate donations to these groups help to promote the program and provide a community service.
- Reinforce the idea of saving energy by not using appliances that are not essential and buying products with the ENERGY STAR label—Tell participants how much energy and money they saved by getting rid of their inefficient model and will continue to save if they do not replace the appliance. If they must replace the appliance, encourage them to consider the more efficient ENERGY STAR labeled units.
- *Sponsors should consider reaching out to Craigslist sellers.* Units offered on Craigslist are likely to be working units. The average listing price on Craigslist was \$230 more than the program's incentive. However, 10% of units were \$50 or less, and 23% percent were \$100 or less, and six postings offered their refrigerator for free. Although those with high-value refrigerators may not be dissuaded from selling them on Craigslist, sellers with low-priced units may prefer the ease and environmental benefits of the program.
- *Let participants know about the environmental benefits they generated*—It should also be emphasized that appliances will be recycled in a way that is less harmful to the environment than other disposal options. They will not be sold, donated to charity, or disposed of in a landfill.

**How the Results of the Study Impact each Identified Program's Savings:** Please see Table II.A.8.

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

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

- The PAs have adopted the net savings estimates.
- The PAs will look into the best approach for handling primary refrigerators in the future.
- The PAs have looked into partnering with retailers in the past but have not had much success with retailers embracing this program as many/most retailers have pick-up/recycling programs of their own in which they charge customers for picking up appliances and, therefore, make a profit. The PAs will continue to investigate whether other retailers are willing to partner with us on this program.
- JACO (the recycling vendor) currently has a missed appointment procedure where they follow up on all missed appointments via multiple phone calls and letters, if necessary. The PAs will work with JACO to see if setting a priority pick-up for these customers is possible.
- Currently, each PA adjusts goals annually after assessing the previous year's results.
- All of the print marketing materials (the primary marketing outlet for this program) refers to "saving energy" and the first sentence of the ad's body copy discusses how an "old refrigerator uses up to four times more electricity than a new one." The PAs will highlight this benefit more often where possible.

- Marketing materials do mention that “We’ll even haul it away for FREE.” There is potential to highlight this benefit more prominently and the PAs will look into that, where possible.
- The PAs will continue to promote the program through existing channels. Some PAs have supplemented their program with additional marketing to help lift participation (NSTAR purchased billboards, transit advertising and sent out a direct mail piece to 50,000 customers. NSTAR & NGRID are also purchasing radio advertising).
- All of the PA’s advertising currently highlights energy savings more than once by having a specific call-out on ads with the savings message in a prominent spot as well as text in the ad that states “...you could save up to \$150 a year on your electricity usage.” The PAs will continue to focus on this energy savings benefit with marketing efforts.
- If reaching out to Craigslist sellers could be justified with a higher volume of units on the site, then it could be considered. It seems that the majority of listings on Craigslist are priced significantly higher than the program’s incentive and this may not be a good use of time and money.
- Environmental benefits are currently highlighted in most of the PAs marketing materials as the ads state, “Plus, recycling that fridge will keep 10 tons of carbon dioxide out of the atmosphere, which means a lot more clean air for our future.” The PAs will continue to focus on this environmental message with marketing efforts.

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

#### CROSS-CUTTING NET-TO-GROSS METHODOLOGY STUDY FOR RESIDENTIAL PROGRAMS – SUGGESTED APPROACHES (FINAL) (STUDY 10)

**Type of Study:** Process

**Objective of the Study:** The primary objective of this methodology study was to develop suggested approaches for consideration by the PAs for estimating net program impacts for the Massachusetts PAs’ residential programs by reviewing the revised methodology report for C&I programs (2010) and adapting the decision framework and methodology guidelines to programs targeted to residential customers. The study team particularly sought to identify residential programs for which market-level approaches to measuring net-to-gross effects, rather than standard self-report methods, might be appropriate and feasible.

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

- Residential New Construction & Major Renovation (Electric and Gas)
- Residential Cooling & Heating Equipment (Electric)
- Multi-Family Retrofit (Electric and Gas)
- MassSave (Electric and Gas)
- Behavior/Feedback Program (Electric and Gas)



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- ENERGY STAR Lighting (Electric)
  - ENERGY STAR Appliances (Electric)
  - Residential Heating and Water Heating (Gas)
  - Weatherization Program (Gas)

**Recommendations Derived from the Study:** The study included suggested methodologies for PAs to consider in future NTG evaluations for the above programs.

**How the Study Came to the Recommended Conclusions:** The evaluation team first conducted a review of the PAs' current residential programs, focusing on program elements most relevant to methodological decisions regarding the estimation of net effects. As part of the program review, the study team reviewed the three-year plans and information collected from the PAs by the NMR team and interviewed PA staff about their residential programs. Based on the program information garnered from the program review, the Net Savings Scoping Paper, and the decision matrix from the C&I report (adapted to the context of the residential programs), the evaluation developed suggested approaches for consideration by the PAs for estimating net-to-gross effects for each residential program.

**Explain Whether or Not the PA Decided to Adopt Recommendations from the Study, and Why:** In general, the Company adopts results from an evaluation study which are supported by the data generated from the study. The Company will incorporate the findings of this study into the planning process for future evaluations of Net-to-Gross ratios for residential programs.

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

## ESTIMATED NET-TO-GROSS (NTG) FACTORS FOR THE MASSACHUSETTS PROGRAM ADMINISTRATORS (PAs) 2010 RESIDENTIAL NEW CONSTRUCTION PROGRAMS, RESIDENTIAL HEHE<sup>7</sup> AND MULTI-FAMILY GAS PROGRAMS, AND C&I GAS PROGRAMS (STUDY 11)

**Type of Study:** Impact

**Objective of the Study:** The object of the study was to assist the Massachusetts PAs in identifying a reasonable estimated NTG factor for the 2010 Residential New Construction programs; C&I programs; Multi-Family Retrofit and Residential High Efficiency Heating and Water Heating programs.

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

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

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7 HEHE is an acronym for the Residential High Efficiency Heating and Water Heating Equipment Program

- Residential Heating and Water Heating (Gas)
- Multi-Family Retrofit (Gas)
- C&I New Construction & Major Renovation (Gas)
- C&I Retrofit (Gas)
- C&I Direct Install (Gas)

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

| Program Type                      | Recommended NTGR                              |
|-----------------------------------|---|
| Residential New Construction      | 1.00  |
| C&I Gas                           |   |
| Custom                            | 0.96  |
| Prescriptive                      | 0.83  |
| Residential HEHE and Multi-family |   |
| Boiler controls—HEHE              | NTGR 1.0 (Residential)                        |
| Boilers—HEHE                      | Spillover: 0.14 (Residential)                 |
| Furnace/ECM furnace—HEHE          | Spillover: 0.19 (Residential)                 |
| Insulation                        | NTGR 0.8 (Multifamily)                        |
| Programmable thermostats          | NTGR 0.88 (Multifamily)<br>0.42 (Residential) |
| Misc water heating equipment      | NTGR 0.63 (Residential)                       |
| Water saving devices              | NTGR 0.77 (Multifamily)                       |
| Windows                           | NTGR 0.8 (Combined MF & Res)                  |

The evaluation contractors (Tetra Tech, NMR, and KEMA) reviewed secondary literature including program impact evaluations, utility filings, and Market Effects studies to develop the above recommendations. Given the short time frame allotted for this work, they focused the search for information on a limited number of readily available sources.

**How the Results of the Study Impact each Identified Program’s Savings:** Please refer to the tables in Sections II.A.2 and II.C.2 for each of the programs listed above.

**Formulas Necessary to Understand the Impact of the Study on the PA’s Programs:** Not Applicable

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

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

**HEHE PROCESS AND IMPACT EVALUATION (STUDY 12)**

**Type of Study:** Process and Impact

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**Objective of the Study:** The objective of the process portion of this study was to assess the effectiveness of marketing efforts, program satisfaction and data tracking. The process evaluation focused on understanding the program: (1) from program implementation and delivery perspectives including program staff, implementation contractors, circuit riders, supply houses, rebate processors, and participating and nonparticipating heating and plumbing contractors; and (2) from end use customer perspectives including program participants and nonparticipants.

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

- Residential Heating and Water Heating (Gas)

**Recommendations Derived From The Study:**

- Drop all current rebates for furnaces, forced hot water boilers, steam boilers, and water heaters
- Assess the feasibility of working to effect a change in the state standards for forced hot water boilers to 90% AFUE
- Consider a new program for early replacement of newer, less efficient boilers
- Continue to nurture relationship with contractors because of the key role they play in customer education and energy-efficient equipment purchase and installation.
  - The program should evaluate the potential savings from offering an installation incentive to contractors for adhering to energy-efficient criteria for equipment sizing, duct testing, and duct sealing.
  - The program should educate contractors and participants on correct usage of ECM furnace fans, and check settings during verification visits.
  - The HEHE program can further increase its value to contractors by helping them grow their businesses through energy-efficient installations. Examples of approaches that would be attractive to them include offering co-op advertising and providing referrals.
  - Make greater efforts to reach out to nonparticipating contractors. Approaches to doing so could include:
    - Facilitating program participation by older contractors. Examples of approaches might be to have exhibits at trade shows that demonstrate installations of high-efficiency systems, and if possible, demonstrate how the installation practices are simply an extension of what techniques they are already familiar with.
    - Increasing the number and frequency of educational offerings.
- Conduct a survey of distributors in HEHE states and elsewhere to get a better estimate of market-level sales by efficiency level, and the possible long-term spillover both within and outside the HEHE states

**How the Study Came To The Recommended Conclusions:**

The recommendations were based on information gathered during the data collection activities for the process evaluation. These included in-depth interviews with program staff, program implementer staff, program contractors, rebate processing contractors, circuit riders, and supply

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houses / big box stores; and telephone surveys of HEHE program participants from the 2007-08 and 2009 program years, oil-to-gas conversion customers including HEHE participants and nonparticipants, general population program nonparticipants, participating and nonparticipating contractors, and contractors attending the Fall 2009 HEHE Annual Conference.

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

In general, the Company adopts results from an evaluation study which are supported by the data generated from the study.

Lower efficiency furnaces (92% without ECMs) and steam boilers were dropped from the program. Incentive levels for other furnaces (92% and 94% with ECM) and water heaters were dropped as a result of this study. The 85% boiler will no longer be offered starting in January 2012.

The Company, as part of GasNetworks, believes influencing federal standards is the priority since the state needs federal approval.

The Company reviewed the savings and costs for an early retirement program for newer (less than 20 year old) boilers and it was determined to not be cost effective.

Due to program budget constraints the Company as part of GasNetworks decided not to offer an incentive to contractors. GasNetworks is exploring conducting ECM training in conjunction with CoolSmart. The Company already helps contractors grow their business through energy efficient installations via co-op advertising and though trainings offered through GasNetworks. The Company feels that utilities should not undertake the role of providing referrals.

The Company, as part of GasNetworks, already has exhibits at trade shows and demonstrates installation practices. The Company usually increases the number of training it offers each year.

The Company plans to conduct the survey of distributors in 2011 as part of the Residential Retrofit research area.

**A copy of the complete study can be found in:** Appendix C, Study 112.

MASSACHUSETTS 2010 RESIDENTIAL RETROFIT AND LOW INCOME EVALUATION – DEEP ENERGY RETROFIT  
(STUDY 13)

**Type of Study:** Process

**Objective of the Study:** The overarching goal of the 2010 Deep Energy Retrofit pilot evaluation was to provide the PAs/implementers with actionable findings and recommendations aimed at increasing customer and contractor participation, as well as refining pilot program's delivery. As the investigations

progressed, effort focused on identifying information to aid in formulating a consensus about the pilot's mission and goals, rather than fine-tuning delivery mechanisms.

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

- Deep Energy Retrofit Pilot (Electric & Gas)

**Recommendations Derived from the Study:**

- Restructure and refocus the pilot. The pilot is primarily focused on completing projects. Though pilot performance will clearly fall short of the cost-effective energy saving goals, it is still valuable. The Cadmus team recommends restructuring the pilot as a research effort with a voluntary board and implementation team (both of which could include PA members) and refocusing the research on activities that will lead to a scalable program. Resolving some inherent policy issues and establishing a pathway to lowering costs and overall cost-effectiveness should be a near term focus of the research effort.
- Seek to fill program gaps. Customers, as well as some stakeholders, have identified the need for energy efficiency services that fill the gap between basic PA programs (e.g., Home Energy Assessment) and comprehensive deep retrofits: Two possible solutions are:
- Partial deep retrofits. Identify a DER track that meets the needs of customers who are prepared for a major project but are not willing or able to commit to all the requirements of a comprehensive DER project. This could be accomplished by providing incentives for deep retrofits of one building system at a time, possibly when normal maintenance would take place, such as re-roofing, re-siding, or window replacements. Such partial deep retrofits, with much smaller up-front costs, might attract a larger number of homeowners, and would greatly reduce the size of an incentive provided to any one customer.
- Deep (but not as deep) retrofits. As reported by several PAs and also in the Massachusetts Clean Energy and Climate Plan for 2020, there is need for a middle ground between the level of savings provided by the current relatively low-cost programs and the very high savings achieved at a high cost in the pilot homes. Customer re-roofing and re-siding events present opportunities for additional savings at a relatively low cost.

**How the Study Came to the Recommended Conclusions:**

The process evaluation included interviews with 40 of the approximately 120 participating customers (including in process, completed and drop-out participants), fifteen contractors, and nine stakeholders. Pilot material was reviewed, including marketing material, websites, and project files. Based on the information obtained, the Cadmus team used evaluation experience to offer recommendations aimed at improving program processes where appropriate.

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

It is both evident in this report and in practice that deep energy retrofits are extremely complex projects and require additional research and cost-effectiveness study for it to be a viable initiative as a stand alone program or for its complex measures to be incorporated into existing programs going forward. The Company supports the idea of further research in this area to

better quantify incremental costs of these deeper savings measures and to focus on what can be done to reduce the costs associated with complex efforts such as this. Future study should provide PAs with data on the true incremental costs, as well as quantification of all the program benefits (energy, non-energy, and other resources) associated with these projects.

The Company is fully supportive of filling program gaps by implementing deeper measures within programs. However, the Company believes these measures need to be deemed cost-effective before they can be mainstreamed through programs such as the Home Energy Services program.

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

#### MASSACHUSETTS NEW HOMES WITH ENERGY STAR PROCESS EVALUATION OF THE FOUR TO EIGHT STORY MULTI-FAMILY NEW CONSTRUCTION PILOT INTERIM FINDINGS (STUDY 14)

**Type of Study:** Process

**Objective of the Study:** This report presents preliminary findings from interviews with the two Sponsors of the Pilot, NSTAR and National Grid, the Pilot's chief project manager, and two individuals representing the three projects that completed in 2010. The objective of the interviews was to address several process evaluation issues such as the Pilot's goals and objectives, the process of signing up and completing verification, outreach and the types of projects served, the measures covered, the measures installed, barriers to energy efficient multi-family new construction, and satisfaction. The limited number of completed projects did not allow the report to address particular issues such as free-ridership and providing technical assistance for participants to consider the addition of all applicable measures in their projects.

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

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

**Recommendations Derived from the Study:** There are no recommendations from this study as it is an interim report issued until more projects complete the process.

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

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

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

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THE MASSACHUSETTS NEW HOMES WITH ENERGY STAR PROGRAM MAJOR RENOVATIONS PILOT  
EVALUATION: PRELIMINARY REPORT ON NON-PARTICIPANT INTERVIEWS (STUDY 15)

**Type of Study:** Process

**Objective of the Study:** The purpose of the Major Renovations Pilot Pilot, introduced in 2009, is to address the gap between the Home Energy Assessment Program for existing homes and the Massachusetts New Homes with ENERGY STAR Program. This report presents preliminary findings from interviews with seven homeowners and one builder who had projects eligible to participate in the pilot and considered enrolling in the pilot, but decided not to enroll. The objective of the interviews was to identify how these potential participants learned about the pilot, why they decided not to enroll in the pilot and get their suggestions for how to make participation in the pilot more user-friendly for homeowners.

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

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

**Recommendations Derived from the Study:** There are no recommendations from this report as it is an interim report issued while the PAs wait for more projects to complete.

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

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

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

THE MASSACHUSETTS NEW HOMES WITH ENERGY STAR PROGRAM VERSION 3 PILOT EVALUATION (STUDY  
16)

**Type of Study:** Process

**Objective of the Study:** The focus of this report is on lessons learned from the Massachusetts New Homes with ENERGY STAR Program Version 3 Pilot ("Pilot") and issues the program will face going forward to keep existing builders in the program, as well as recruit new builders, as ENERGY STAR Version 3 requirements take effect. Version 3 Guidelines for ENERGY STAR Homes become effective for all new homes, regardless of permit dates, starting January 1, 2012.

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

- Residential New Construction & Major Renovation (Electric)

- Low-Income Residential New Construction (Electric)

**Recommendations Derived from the Study:**

- Keep training on code changes and Version 3 requirements separate, to the extent possible. Interviewed builders who attended training covering both topics found it confusing.
- Focus builder training on the new Thermal Enclosure Checklist (“TEC”) section 3 and section 5 requirements that are expected to be the most challenging for builders: One example is the TEC section 5 requirement that sheetrock be sealed to the top plate at all attic/wall interfaces using caulk, foam, or equivalent material. HERS raters say builders are trying out different approaches for meeting this requirement. It may require the sheetrock crew to come back a second time, which is costly and impacts the construction schedule. EnergyComplete™ from Owens Corning is a spray on gasket that can be used at the same time the sheet rock is put up, but the cost is high.
- Offer training in a variety of formats and use trainers with hands-on experience: Some builders and HVAC contractors prefer classroom training; others prefer more hands-on field training. They also like the idea of having webinar presentations or videos of training presentations available online to view at their convenience. For all training, interviewees stressed the importance of using trainers who have extensive hands-on experience. Also, encourage HVAC contractors to take advantage of other available training options: Air Conditioning Contractors of America and supply houses offer several training options to help contractors interested in being prepared to meet Version 3 requirements. HVAC contractors could also be encouraged to consider participating in the Cool Smart Program, which offers multiple training courses, including training to offer ENERGY STAR Quality Installations.
- Include HERS raters in any program sponsored HVAC contractor training: The interviewed HVAC contractors and distributor say it would be useful to have a HERS rater at trainings to explain exactly what HVAC contractors are expected to do in a qualifying home, especially if they are going to guarantee in their contract with the builder that the home will meet program requirements.
- Review the timeline for moving to an open HERS rater market: Assess the potential negative impact on Program participation of asking builders to assume the full cost of HERS rater services at the same time that builders interested in meeting Version 3 requirements will likely need more HERS rater support and need to pay more for HVAC contractors able to meet Version 3 requirements. Hitting builders with two cost increases at the same time may negatively impact participation.

**How the Study Came to the Recommended Conclusions:** Recommendations are based on findings from in-depth interviews conducted with 17 builders, 11 HERS raters, 10 HVAC contractors and one HVAC distributor. Interviewees included all six builders who participated in the Pilot and the HERS raters they worked with, as well as two of the HVAC contractors who worked on Pilot homes with ducted HVAC systems.

**Explain Whether or Not the PA Decided to Adopt Recommendations from the Study, and Why:** As this report was recently issued, the recommendations are currently under consideration. Version 3 is the latest version of the EPA ENERGY STAR Homes program, at this time a final decision has not been made as to whether Version 3 will be a requirement of the Massachusetts Residential New Construction program.

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



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## MASSACHUSETTS CROSS-CUTTING BEHAVIORAL PROCESS EVALUATION (STUDY 17)

**Type of Study:** Process and Impact

**Objective of the Study:** This study is the first annual process evaluation of Massachusetts behavioral programs under the three-year Massachusetts Cross-Cutting Program Evaluation plan. The primary objective of the process portion of the evaluation was to provide preliminary insights into the effectiveness of National Grid's OPower program and the actions that residential customers may take to generate energy savings. The secondary objective of this study was to create a framework to evaluate all Massachusetts behavior programs in upcoming evaluations. Specific research objectives of the process portion of the evaluation include:

- Assess program characteristics that may lead to greater savings
- Determine specific actions taken as a result of the Home Energy Report ("HER") – including conservation behaviors and direct measure installations
- Identify other effects from behavioral program efforts (increased awareness of energy efficiency options, changes in attitudes)
- Develop suggestions for improving the programs to increase savings

In addition to the process portion, this study is the first annual impact evaluation of Massachusetts behavioral programs under the three-year Massachusetts Cross-Cutting Program Evaluation plan. The study objective is to examine the National Grid HER program's ability to generate residential electric and gas savings among targeted Massachusetts customer households.

**Programs to which the Results of the Study Apply:** This study applies to two National Grid program efforts:

- OPOWER Electric Program
- OPOWER Gas Program

### **Recommendations Derived from the Study:**

Process: The evaluation identified a number of recommendations in three areas: (1) planning and policy, (2) program implementation, and (3) monitoring and evaluations. Additional analysis supporting the recommendations can be found in "Massachusetts Cross-Cutting Behavioral Program Evaluation Volume I" on pages 5-6 and 41-43.

Recommendations:

1. Planning and Policy
  - The PAs should continue to develop approaches for targeting different household types with different messages through the HER program.
  - The PAs should conduct additional research to determine the effective useful life and

persistence estimates for the HER program.

- The PAs should determine whether the HER and other behavioral programs should aim to channel customers to other rebate and audit programs.
  - If cross-program promotion is desired, two-three months after the delivery of the first report may be the most appropriate time to do so.
2. Program implementation
    - The program should consider developing ways to personalize the experience further by providing customers with more household-specific information.
    - More actively promote the website and increase its prominence on the report.
    - Provide more explicit, positive affirmations to participants on the Home Energy Report.
  3. Monitoring and Evaluation
    - Program savings forecasts should be developed based on ex post or market-specific findings from the implementers or evaluation.
    - Continue to employ empirical methods, such as billing analysis using panel data or treatment/control experimental design, to gauge the impact of the report on energy savings, awareness and attitudes.
    - Continue to incorporate channeling analysis to determine behavioral program impacts.
    - Enhance participant surveys to gather information on actions participants and non-participants have taken to save energy.

**How the Process Study Came to the Recommended Conclusions:** The process evaluation recommendations are based on a number of data collection efforts:

In-depth interviews with PAs:

Telephone surveys with participants and control group members: Telephone survey research was conducted with 501 participant and 501 control group households. The telephone survey was designed to understand differences in energy efficiency and conservation behaviors among participants, compared with control group members, based on participant exposure to the Home Energy Report for approximately one year.

In-home ethnographic research: In-home ethnographic research was conducted with 11 participant households. The in-home ethnographic research was designed to supplement insights gained through survey research, and explored participants' responses to the Home Energy Report, changes in behaviors or intentions in direct response to the report, and suggestions for report content and delivery.

Detailed process evaluation research methods and sampling are described in Sections 4.2 and 4.3 of "Massachusetts Cross-Cutting Behavioral Program Evaluation Volume I." Key findings from these methods are described in Sections 5.1 and 5.2 of "Massachusetts Cross-Cutting Behavioral Program Evaluation Volume I."

Results of the Impact Study and How the Study Determined those Results: OPOWER Electric Program: Electric pilot households averaged 184.1 net annual kWh savings per participant in the first program year, and 1.61% kWh savings from 11,433 kWh per participant expected consumption in the absence of the program. This equates to a total of 4,575 MWh savings across households in the pilot cohort.

OPOWER Gas Program: Gas pilot participants averaged 9.93 net annual therm savings per participant in the first program year, and 0.77% therm savings from 1,286 therms per participant expected consumption in the absence of the program. The billing analysis found that the average reduction in therms was 0.81% and the channeling analysis found that 0.04% of the average reduction was due to incremental savings from other programs. This equates to a total of 248,257 therm savings across all households in the pilot cohort.

Net program savings were determined by conducting billing analysis to estimate annual electric and therm savings. Average annual net savings attributable to the behavioral program were determined using a linear fixed effects regression analysis of customer billing data that included billing data from behavioral program participants (who received the Home Energy Reports), and a matched comparison group of residential customers. The billing analysis approach is described in Section 4.4 of "Massachusetts Cross-Cutting Behavioral Program Evaluation Volume I." For the National Grid gas pilot, a channeling analysis was conducted where net program savings determined by billing analysis were adjusted by factoring out deemed savings values counted in other National Grid programs. The savings values cited here reflect only those program savings directly obtained by the OPower Program, factoring out savings jointly attributable to the OPower program *and* other energy efficiency programs. This adjustment is described in Section 4.5 of "Massachusetts Cross-Cutting Behavioral Program Evaluation Volume I." Percent savings are determined by calculating average annual net program savings as a proportion of energy consumption expected in the absence of the program, described in Section 3.6 of "Massachusetts Cross-Cutting Behavioral Program Evaluation Volume II."

**How the Results of the Study Impact each Identified Program's Savings:** N/A (Unitil)

**Formulas Necessary To Understand The Impact Of The Study On The Program Administrator's Programs:** The TRM for the 2011 Plan contains the algorithms for calculating primary energy impacts for the gas and electric programs:

$$\Delta kWh = (kWh_{BASE})(\%SAVE)$$

$$\Delta MMBtu = (MMBtu_{BASE})(\%SAVE)$$

Where:

|                             |  |
|-----------------------------|--|
| <i>Unit</i>                 | = One participant household                      |
| <i>kWh<sub>BASE</sub></i>   | = Baseline consumption of kWh                    |
| <i>%SAVE</i>                | = Energy savings percent per program participant |
| <i>MMBtu<sub>BASE</sub></i> | = Baseline consumption of MMBtu                  |

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The results of this study are used to update the energy savings percent per participant (%SAVE) that are used to calculate net unit savings ( $\Delta\text{kWh}$  or  $\Delta\text{MMBtu}$ ) for OPOWER electric and gas programs. Calculation of the impact metric %SAVE is described in Section 3.6 of “Massachusetts Cross-Cutting Behavioral Program Evaluation Volume II.” Note that the ex post savings value ( $\Delta\text{MMBtu}$ ) used to calculate percent savings (%SAVE) factors out deemed savings values counted in other National Grid programs, as explained above and in Section 4.5 of “Massachusetts Cross-Cutting Behavioral Program Evaluation Volume I.”

**Explain Whether or Not the PA Decided to Adopt Recommendations from the Study, and Why:** The Company is adopting the recommendations from the study. The OPower program is relatively new, and the recommendations inform ways to enhance the program, increase savings, and continue evaluation best practices.

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

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## LOW-INCOME STUDIES

### FINAL REPORT FOR LOW INCOME PROGRAM – MASSACHUSETTS 2010 RESIDENTIAL RETROFIT AND LOW INCOME EVALUATION (STUDY 18)

**Type of Study:** Process

**Objective of the Study:** For the 2010 process evaluation, the Cadmus team focused on assessing program processes and identifying similarities and differences between the perspectives and assumptions of program staff, implementation staff, and customers regarding program goals, design, and implementation. The Cadmus team also reviewed the process by which program data are collected, managed, and reported, including an assessment of the quality and consistency of the program data across PAs.

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

- Low-Income 1-4 Family Retrofit (Electric and Gas)
- Low-Income Multifamily Retrofit (Electric and Gas)

**Recommendations Derived from the Study:**

- To address any concerns related to funding and resource management, PAs and lead Community Action Program (“CAP”) agency could increase communication during the goal-setting processes, and track spending throughout implementation.
- The PAs should schedule a meeting or series of meetings in coordination with LEAN for the express purpose of clearly defining standardization and integration objectives for the program. Once the definition of standardization is communicated and agreed upon, strategies should be determined for meeting those objectives over a specified time period. This will ensure all stakeholders work toward commonly agreed upon objectives, and enhance progress toward meeting objectives to be measured.
- The PAs should strongly consider all options for creating a streamlined, independent, third-party QA/QC process that serves the needs of the PA-funded program, while minimizing participant intrusion. Such a process could reduce existing inefficiencies including the potential number of visits to participants’ homes, ensure CAPs do not perform quality control on their own projects, free up CAP auditors’ time to reach more low income customers, and align this program’s QA/QC process with that proposed for the Home Energy Assessment program. This does not necessarily have to be an additional QA/QC process, just a streamlined process that is collaborative in nature.
- The PAs should maintain a data dictionary for all critical program datasets that includes all field definitions, value definitions, and the sources of the data. The data dictionaries should be provided as part of all data requests thereby allowing evaluators (or any other third-party) to decode field names and data values efficiently. The data dictionaries would also ensure internal knowledge of the database is not lost in the event of critical personnel turnover. Once created, draft data dictionaries should be circulated among the low income working group to ensure that all PAs are collecting the same data and using the same naming conventions whenever possible. If such data

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dictionaries do not exist, the Data Management Working Group established as part of the 2011 Residential Retrofit and Low Income evaluation could assist with their creation.

- The PAs should ensure the collection and availability of a minimum set of critical data fields for current and future evaluation work.
- The PAs should consider mandating that a standard set of critical audit data fields be entered into an electronic format and maintained/archived for future internal and external use. The PAs should collaborate with the CAPs and the evaluators to identify valuable audit information not currently maintained electronically.
- The PAs should also explore the potential of having field technicians use electronic hardware (a PDA or laptop) to collect and enter onsite data whenever possible. This approach would minimize manual data entry, reduce program administrative costs, and improve data quality through the institution of unique keys, foreign key constraints, lookup tables, and other database design best practices.
- The PAs should work collaboratively on integration of a common Measure ID system to allow tracking of each installed measure from the participant tracking database to the BCR input sheet and to the TRM. In addition, PAs should develop and maintain standardized ID fields (standardized internally, not across PAs) linking data across programs, customers, contractors, and billing data.
- Through a collaborative process with the PAs and the TRM working group, continue to develop and employ a standardized measure naming convention for all PAs and CAPs. The TRM should be used as a basis to develop standard names and codes. A naming convention would allow for faster and more accurate statewide reporting, improve evaluability, and add transparency to the measure tracking process. The Cadmus team specifically recommends consideration of a four-part measure naming convention that includes varying levels of detail for each program stakeholder: denoting the measure's end-use, group, type, and detail. Examples of several common program measures are provided in the report.

**How the Study Came to the Recommended Conclusions:** The Low Income Program evaluation included PA program manager interviews, CAP agency staff interviews, PA data manager surveys, a data review, and participant interviews. Based on information obtained from these stakeholders, the Cadmus team used its professional judgment and experience evaluating low income programs to offer recommendations aimed at improving program processes where appropriate.

**Explain Whether or Not the PA Decided to Adopt Recommendations from the Study, and Why:** In general, the PAs adopt results from an evaluation study which are supported by the data generated from the study.

The PAs already track spending throughout the implementation. Starting in July 2011, for 2012 goal setting, PAs and LEAN will start discussions about budgets and savings goals in advance of the program year.

The PAs will use the Best Practice Meetings to clearly define standardization and integration objectives for the program and a timeline.

There is already a new QA/QC process being initiated that would minimize the number of visits to customer homes.

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The PAs will explore the potential of having field technicians use electronic hardware to collect and enter onsite data. There is some current use of handheld devices for auditors. Due to the high cost and since some of the audits requiring the auditors to crawl into small spaces, it may not be feasible.

The PAs are working with the evaluation team to ensure in the future we are better able to aggregate and/or compare measure savings where possible.

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

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## C&I STUDIES

### NON-CONTROLS LIGHTING EVALUATION FOR THE MASSACHUSETTS SMALL COMMERCIAL DIRECT INSTALL PROGRAM (STUDY 19)

**Type of Study:** Impact

**Objective of the Study:** Provide independent estimates of annual energy savings and peak demand impacts for a single type of installed measure: the replacement of lighting fixtures without controls.

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

- C&I Small Retrofit (Electric)

**Results of the Study and How the Study Determined those Results:** Logged operating hours and installed measure survey data from 130, 2010 program participant sites throughout Massachusetts during the months of December through February were used to calculate summer and winter coincidence factors for ISO on-peak and seasonal peak performance hours. The data were also used to adjust estimates of energy and demand savings to determine realization rates at the statewide level, by program administrator and for two demand ranges. Information collected on site was compared to that in electronic tracking system files to make documentation, technology and quantity adjustments, as well as incorporating heating and cooling interactive effects.

**How the Results of the Study Impact each Identified Program's Savings:** Please refer to Table II.C.6.

**Formulas Necessary to Understand the Impact of the Study on the PA's Programs:** The results of this study are used to update uncontrolled lighting realization rates for energy ( $RR_E$ ), summer on-peak demand ( $RR_{SP}$ ) and winter on-peak demand ( $RR_{WP}$ ) savings, and the coincidence factor for winter on-peak demand ( $CF_{WP}$ ). Both the Energy Realization Rate and the Coincidence factors incorporate HVAC interactive effects.

The formulas necessary to understand the impacts are described in the TRM.

**If the Results of the Study are Not Adopted, Fully Explain Why:** This study collected operating hour data during winter months. A significant number of sampled sites exhibited seasonal variation in operating hours. PAs elected to not adopt the calculated summer coincidence factors at this time and are planning a follow on summer metering study to capture the seasonal variation.

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



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## MASSACHUSETTS NON-RESIDENTIAL SMALL BUSINESS DIRECT INSTALL PROGRAM: MULTI-TIER STRUCTURE ASSESSMENT 2010 PROCESS EVALUATION (STUDY 20)

**Type of Study:** Process

**Objective of the Study:** The main objective of the Multi-Tier Program Structure Assessment is to document progress towards statewide integration of the C&I Direct Install programs during 2010, and to gauge customer interest in different program design options such as varying incentive levels, zero interest financing, and on-bill financing options. The assessment is also designed to gather information related to program satisfaction and awareness. In particular, the evaluation sought to address the following research questions:

- What kind of program changes has each PA implemented? How is this process going? What are the challenges? How do customers and market actors view these changes?
- How is the integration of electric and gas progressing? What are the challenges? What is being done to overcome them?
- How has the workload of PA program staff and vendors changed as integration and standardization of the Small Business Direct Install program has moved forward?
- What is the level of program awareness and customer satisfaction with the program? What are the barriers to participation and what are the most important factors in participant decision making around participation.

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

- C&I Small Retrofit (Electric and Gas)

**Recommendations Derived from the Study:**

- Use the Direct Install program facility audit as a way to disseminate information about other PA C&I programs. In the process, identify for customers the equipment or systems that may need replacement in the future.

**How the Study Came to the Recommended Conclusions:** The recommendation presented above is based on results from quantitative telephone surveys with participating customers, as well as a review of program materials and in-depth interviews with PA program staff and vendors. In-depth interviews provided the evaluation team with a comprehensive understanding of the audit process while a review of program materials further contributed to knowledge of what the program currently provides onsite. The survey with 2009 and 2010 program participants allowed the team to assess the degree to which participating customers receive information about other PA programs.

**Explain Whether or Not the PA Decided to Adopt Recommendations from the Study, and Why:** PAs began addressing the recommendation from this study in the second half of 2010, following an initial focus on integrating electric and gas measures during the first 8 months. An audit checklist was developed that program vendors use to note the existence and condition of energy consuming equipment

outside the standard prescriptive measures offered. PAs and their vendors are using the information gathered to inform direct install program participants of other C&I programs that can be accessed.

Future evaluation work during 2011 and 2012 should allow examination of the effectiveness of this approach in motivating direct install program participants to undertake additional energy efficiency projects by channeling them to other C&I programs. This may be accomplished through a combination of additional process interviews and mining of data from PA program tracking database systems.

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

## FINAL REPORT HBL MARKET EFFECTS STUDY PROJECT 1A NEW CONSTRUCTION MARKET CHARACTERIZATION (STUDY 21)

**Type of Study:** Market Assessment

**Objective of the Study:** The principal research objectives of the High Bay Lighting Market Effects Study are:

- Estimate the energy savings associated with the changes to a high bay lighting market in Massachusetts.
- Assess the attribution of these changes (i.e., market effects) to the PAs' energy efficiency programs.

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

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

**Recommendations Derived from the Study:** The High Bay Lighting ("HBL") Market Effects Study recommendations are provided in the following table. For a more detailed discussion please refer to the full report.

- Based on the modeled approach and the preponderance of evidence presented in the market effects study, KEMA recommends the electric PAs claim untracked spillover energy savings associated with Massachusetts HBL measures. KEMA recommends the Scenario 2 energy savings estimate of 12.4 GWh per year or 39 percent of 2010 program tracked gross savings. This value is consistent with the untracked spillover estimate of 34 percent of program tracked savings estimated for Wisconsin in the 2010 Wisconsin HBL study.
- Several of the electric PAs are currently claiming low levels of participant and or non-participant

energy savings for HBL measures. Prior to claiming the untracked spillover savings recommended by this report, the PAs must remove participant and or non-participant spillover energy savings for HBL measures already being claimed to avoid double counting.

**How the Study Came to the Recommended Conclusions:** The Large C&I Electric Consultant (“LCIEC”) team estimated untracked spillover, then assessed the attribution of these savings to the PA’s energy efficiency programs based on a comparison of the level of adoption of energy efficient high bay lighting in Massachusetts to a comparison area lacking programs promoting energy efficient high bay lighting.

**The primary analytic steps include:**

- Estimate the volume of high bay lighting installed in Massachusetts and the comparison area.
- Estimate the market share of energy efficient high bay lighting installed in Massachusetts and the comparison area.
- Assess attribution of untracked spillover to the PA’s energy efficiency programs.

**Primary data collected for this study includes:**

- Surveys with: End Users, Lighting Contractors
- In-depth Interviews with: Program Staff, Lighting Distributors, Lighting Manufacturers

Additionally, the study used PA program tracking data, engineering data from various engineering databases, and survey data from a prior study.

**How the Results of the Study Impact each Identified Program’s Savings:** Please refer to the tables in Section II.C.2 for each of the programs described above.

**Formulas Necessary to Understand the Impact of the Study on the PA’s Savings:** Following the recommendations of the study, the PAs have applied the 39 percent spillover factor resulting from this study to all measures associated with high bay lighting, instead of applying any spillover from any other net-to-gross study.

Each PA uses the results of the *2010 Commercial and Industrial Electric Programs Free-ridership and Spillover Study (TetraTech, Study 30)* for the spillover value for all non-high bay lighting savings in 2010. In order to determine the factor for all lighting measures, the following equation is used:

$$SO_{ALL} = \frac{SO_{HBL} \times kWh_{HBL} + SO_{OTH} \times kWh_{OTH}}{kWh_{ALL}}$$

Where:

$SO_{ALL}$  is the final spillover rate for all lighting measures.

$SO_{HBL}$  is the spillover rate of 39 percent resulting from this study for High Bay Lighting measures only.

$kWh_{HBL}$  is the gross annual kWh savings resulting from High Bay Lighting measure installations.

$SO_{OTH}$  is the spillover rate for all other Non-High Bay Lighting Measures and is specific to each program administrator.

$kWh_{OTH}$  is the gross annual kWh savings resulting from all other Non-High Bay Lighting measure installations.

$kWh_{ALL}$  is the total gross annual kWh savings for all Lighting measures.

This calculation is done for both the *C&I New Construction and Major Renovation* and the *C&I Large Retrofit* programs by each program administrator, except Unitil, as the spillover rates used for the Non-High Bay Lighting measures are specific to each administrator. The calculation is also done for *C&I Small Business* program for WMECO and CLC, as these programs included high bay lighting installations and these savings were analyzed as part of this study. None of Unitil's projects in 2010 included High Bay Lighting installations. This calculation is therefore unnecessary for Unitil.

The following table shows this calculation for each PA's programs:

| PA                  | NSTAR      |            | National Grid |            | WMECO     |          |                | CLC     |          |                |
|---------------------|------------|------------|---------------|------------|-----------|----------|----------------|---------|----------|----------------|
|                     | NC         | Retrofit   | NC            | Retrofit   | NC        | Retrofit | Small Business | NC      | Retrofit | Small Business |
| $kWh_{HBL}$         | 765,663    | 4,933,376  | 3,645,109     | 19,438,428 | 534,105   | 55,859   | 1,654,904      | 0       | 59,015   | 76,616         |
| $kWh_{OTH}$         | 13,451,544 | 52,632,615 | 2,723,676     | 45,575,106 | 7,423,917 | 776,427  | 6,822,148      | 154,161 | 386,354  | 3,398,029      |
| $kWh_{ALL}$         | 14,217,207 | 57,565,991 | 6,368,785     | 65,013,534 | 7,958,022 | 832,286  | 8,477,052      | 154,161 | 445,369  | 3,474,645      |
| $SO_{HBL}$          | 39%        | 39%        | 39%           | 39%        | 39%       | 39%      | 39%            | 39%     | 39%      | 39%            |
| $SO_{OTH}$          | 2.40%      | 16.50%     | 16.00%        | 2.50%      | 4.70%     | 0.00%    | 3.70%          | 0.00%   | 0.00%    | 6.40%          |
| $SO_{ALL}$ (Result) | 4.37%      | 18.43%     | 29.16%        | 13.41%     | 7.00%     | 2.62%    | 10.59%         | 0.00%   | 5.17%    | 7.12%          |

**Explain Whether or Not the PA Decided to Adopt Recommendations from the Study, and Why:** The PAs have adopted the results of this study.

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

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## FINAL COMMERCIAL NEW CONSTRUCTION CUSTOMER QUANTITATIVE PROFILE PROJECT 1A NEW CONSTRUCTION MARKET CHARACTERIZATION (STUDY 22)

**Type of Study:** Market Assessment

**Objective of the Study:** The overarching objective of all LCIEC Market Characterization studies is: “To define the attributes of a specific market area in enough detail that the program planners and administrators can use the information for improving program implementation.” The principal research objectives of the Commercial New Construction Customer Quantitative Profile are:

Develop a comprehensive characterization of the large C&I new construction market in Massachusetts, in terms of building type, size, ownership, geographic location, chain or franchise status, and energy use.

Assess how the trends for large C&I projects have changed over the past 15 years.

Characterize the presence of the PAs new construction projects in the market in terms of the number of projects that participated in them and the portion of floor space and energy use they represent in key commercial market segments.

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

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

**Recommendations Derived from the Study:** None.

**How the Study Came to the Recommended Conclusions:** The LCIEC team acquired and analyzed the entire F. W. Dodge Players Database for non-residential construction projects for the State of Massachusetts for the years 1996 through 2009. The Dodge Players database contains retrospective information on C&I construction projects that, according to Dodge, have begun construction. A sample of new construction projects from the Dodge Database were matched with PA billing data and program tracking data to characterize the new construction market and assess program penetration.

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

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

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## SUPPLY CHAIN PROFILE PROJECT 1A NEW CONSTRUCTION MARKET CHARACTERIZATION (STUDY 23)

**Type of Study:** Market Assessment

**Objective of the Study:** The overarching objective of all LCIEC Market Characterization studies is: “To define the attributes of a specific market area in enough detail that the program planners and administrators can use the information for improving program implementation.” The principal research objectives of the New Construction Supply Chain Profile are provided in the following.

Principal Research Objectives:

- Characterize the design, engineering, and construction management firms involved with recent large commercial construction projects in Massachusetts.
- Characterize the design and specification practices with regard to energy efficiency.
- Assess changes in design and specification practices as a result of contact with the program.
- Assess awareness and participation in new construction programs offered by the PA’s.

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

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

**Recommendations Derived from the Study:** The New Construction Supply Chain Profile recommendations are provided in the following table. For a more detailed discussion please refer to the full report.

Recommendation Summaries

- Consider alternative incentive approaches such as tiered incentives for higher levels of efficiency. Consider expanding financial or technical assistance offerings for life cycle cost analysis to demonstrate the longer term value of accepting higher first costs.
- Improve the value of technical assistance offerings by being consistently engaged with project design teams. The impact of the utility intervention is not fully realized because information about incentives and alternative technologies choice is not delivered on time to design teams. Modeling firms need to quickly upgrade models and turnaround results to customers.
- Assist architects and engineers in understanding appropriate high performance building envelope design strategies for the Massachusetts climate. We suggest a two pronged approach to advance high performance envelope design: 1) Convene a working group consisting of stakeholders to study the challenges associated with high performance building envelope design, and 2) based on input from the working group, commission a study of advanced building envelope designs beyond what is required by code and provide examples of appropriate, high performance designs for Massachusetts.
- Continue to build upon educational seminars, similar to Advanced Building seminars, to provide education and programmatic support on integrated design and whole building performance.

- Streamline the application process by reducing the amount of paperwork that is required for participation.
- Establish contacts within the top 25 architects, design engineers and construction management firms.

**How The Study Came To The Recommended Conclusions:** The New Construction Supply Chain Profile included the follow research activities:

- Examination of the F. W. Dodge Players Database for non-residential construction projects in Massachusetts.
- In-depth Interviews with:
  - 31 architects,
  - 11 design engineers, and
  - 9 construction engineers.

**Explain Why Or Why Not The Program Administrator Decided To Adopt Recommendations From The Study:**

The program administrators accept the results of the study and are considering all recommendations at this time. The recommendations resulting from this study are based on solely on interviews with market actors in the commercial new construction market and therefore do not necessarily provide an objective view of the programs.

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

## FINAL REPORT PROJECT 1B CHAIN & FRANCHISE MARKET CHARACTERIZATION (STUDY 24)

**Type of Study:** Market Assessment

**Objective of the Study:** The overarching objective of all LCIEC Market Characterization studies is: “To define the attributes of a specific market area in enough detail that the program planners and administrators can use the information for improving program implementation.” The principal research objectives of the Chain & Franchise (“C&F”) Market Characterization are:

- Characterize the C&F market in Massachusetts, including estimates of size and key segments (big box, retail, restaurant, etc).
- Identify the key decision-maker at C&F customers and the major barriers to the adoption of energy efficiency measures
- Understand the decision-making process, in particular free-ridership, regarding energy efficiency at C&F businesses in Massachusetts and in comparable non-program states.
- Assess the current level of program participation and methods to increase participation.

- Identify the opportunities for increased energy efficiency through on-site inventories of building shell characteristics, end use technologies, and missed opportunities.

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

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

**Recommendations Derived from the Study:** There are no recommendations for program changes resulting from the study.

**How the Study Came to the Recommended Conclusions:** This project included the follow research activities:

- Literature Review of existing C&F studies.
- Re-analysis of interview data from past NSTAR C&I program impact evaluations in order to investigate potential differences in free-ridership and spillover rates of C&F and non-C&F participants.
- A Customer Quantitative Profile of the C&F Market. This analysis characterizes the size and composition of the population of Massachusetts' C&F customers.
- In-depth Interviews with:
  - PA National Account Managers
  - C&F company managers.

**Explain Whether or Not the PA Decided to Adopt Recommendations from the Study, and Why:** There are no recommendations for program changes resulting from the study.

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

## IMPACT EVALUATION OF 2009 CUSTOM HVAC INSTALLATIONS (STUDY 25)

**Type of Study:** Impact

**Objective of the Study:** The objective of this impact evaluation is to provide verification or re-estimation of electric energy and demand savings estimates for 29 Custom HVAC projects through site-specific inspection, monitoring, and analysis. The results of this study are the final realization rates for Custom HVAC energy efficiency measures.

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

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



- C&I Large Retrofit (Electric)

**Results of the Study and How the Study Determined those Results:** The final Custom HVAC realization rates are calculated using statistical weightings of the results of the (29) studied Custom HVAC applications. This calculation is explained in detail in Section 3 of the “Impact Evaluation of 2009 Custom HVAC Installations” report.

The final Custom HVAC realization rates (“RRs”) are calculated individually for National Grid and NSTAR, and at the statewide level. Site level RRs are determined through site inspection, data collection and engineering analysis. Analysis methods include spreadsheet and building simulation modeling.

**How the Results of the Study Impact each Identified Program’s Savings:** Please refer to the tables in Section II.C.2 for each of the programs listed above.

**Formulas Necessary to Understand the Impact of the Study on the PA’s Programs:** The results of this study are used to update the realization rates for energy (RRE), summer on-peak demand (RRSP), and winter on-peak demand (RRWP) savings for the “HVAC” end-use within Custom Measures.

The formulas necessary to understand the impacts are described in the TRM.

**If the Results of the Study are Not Adopted, Fully Explain Why:** All results have been adopted by the PAs

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

## FINAL REPORT PROJECT 1C COMBINED HEAT & POWER MARKET CHARACTERIZATION (STUDY 26)

**Type of Study:** Market Assessment

**Objective of the Study:** The overarching objective of all LCIEC Market Characterization studies is: “To define the attributes of a specific market area in enough detail that the program planners and administrators can use the information for improving program implementation.” The principal research objectives of the Combined Heat & Power (“CHP”) Market Characterization are:

- Characterize the CHP market including key players and market segments.
- Understand the decision making processes used by potential CHP customers including reasons customers elect to install CHP, selection of specific types or configurations of CHP, and the factors most influencing decisions to purchase CHP systems.
- Identify the current mix of CHP technologies including the CHP systems types deployed, installed and operating costs of the technologies, and identify anticipated changes in the CHP market or improvements in the technologies.
- Identify barriers impacting entry for customers including the key factors that dissuade potential customers from evaluating CHP technologies or have led customers who evaluated CHP technologies to decide not to install it.

- Estimate CHP opportunities by key market segments and provide PAs with a list of customers likely suitable for CHP.

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

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

**Recommendations Derived from the Study:** The CHP Market Characterization's six short-term recommendations are provided in the following table. For a more detailed discussion please refer to the full report.

- Determine realistically achievable targets. Energy-saving goals of the Program are tied to the time it takes to sell, install and commission CHP systems. The PAs can help insure the Program achieves these goals by taking into account the project development timeframes and establishing a "pipeline" approach that associates the different market segments to the anticipated timeframes.
- Outreach to large sites. The PAs should identify and reach out to high-value large sites using the Account Executive ("AE") teams from the different utilities.
- Focused outreach for under 300 kW. For sites 60 – 300 kW, the PAs should work with partners to promote the incentive program. The PAs role with these customers is to build the credibility of CHP technology and act as the role of energy advisor by providing customers with an integrated solution of energy efficiency measures including CHP systems.
- Training Using Webinars. The evaluation team understands that planning for webinar training sessions is currently underway via the PA Implementers' CHP Working Group. The evaluation team supports this endeavor and recommends training session in several areas.
- Program Stability-Coordination. The program should consider increased coordination with other CHP initiatives (i.e. Alternative Energy Portfolio Standards requirements) to leverage overlapping requirements for cost-effective execution of both programs. Specific areas of consideration include the development of consistent metering approaches.
- Partners to collaborate. The program should consider collaborations with existing groups such as trade groups, vendor associations, and customer groups with the goal of leveraging existing mass marketing efforts.

**How the Study Came to the Recommended Conclusions:** The CHP Market Characterization included the follow research activities:

- Literature Review of existing major CHP support programs in the U.S.
- In-depth Interviews with:
  - CHP Program staff,
  - 10 CHP vendors,
  - 10 current users of CHP, and
  - 10 potential users of CHP.

- Quantitative Market Assessment based on gas billing data. This task identified high-value CHP opportunities, in terms of number of customers, business types, and equipment size category in the service territories served by the PAs.

**Explain Whether or Not the PA Decided to Adopt Recommendations from the Study, and Why:** The PAs have accepted the results of the study and are considering all recommendations for adoption.

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

## PROJECT 6B COMPREHENSIVE DESIGN APPROACH PROCESS EVALUATION (STUDY 27)

**Type of Study:** Process

**Objective of the Study:** This process evaluation had two research objectives. The first was to examine whether the Comprehensive Design Approach (“CDA”) tracks that are being delivered by National Grid, Western Massachusetts Electric Company (“WMECo”) and NSTAR are meeting their primary goals. These primary goals are to: 1) maximize energy and demand reduction in new construction projects; and 2) influence energy efficiency best practices in the commercial design sector.

CDA is a track within the custom C&I New Construction and Major Renovation programs offered by these PAs. It is an integrated approach that is ideally initiated at the beginning of the building design stage in order to ensure that cost-effective energy efficiency opportunities are incorporated such that energy use reduction of twenty percent or more is achieved relative to the requirements of state building code. The CDA track also offers financial incentives that are usually larger than those offered by prescriptive or the traditional custom new construction programs.

The second research objective was to conduct a comparative study of the Advanced Buildings (“AB”) track. This study compares the AB tracks delivered by the Massachusetts PAs to those delivered in Maine and Vermont. The AB track is similar to CDA but it targets smaller buildings within the commercial new construction market and aims to simplify and expedite the participation process by using standardized incentive and savings assumptions. In order for customers to receive monetary incentives through the AB track, they must incorporate a series of thirteen Core Performance requirements into their building designs.

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

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

**Recommendations Derived from the Study:** The following are two different sets of recommendations, one for the CDA track and one for the AB track.

Recommendation Summaries for CDA Track

1. Reduce the costs associated with the energy modeling study required for the CDA or alter the payment arrangement so that it is less burdensome on the customer upfront. Although technical study costs are split between the PA and the customer, it is still an upfront cost that is incurred by the customer that would not necessarily be faced if a non-comprehensive program track were used. A possible solution would be for the PA to initially absorb the cost of the study, and then deduct the amount from the final incentive offer. This would relieve the customer of the burden of facing an upfront cost to participating in CDA.
2. Use a variety of marketing methods to inform customers of the CDA track, including printed materials and communication via AEs. In the process, make sure to inform customers of the relative benefits of CDA over competing approaches that may be simpler to use, but result in smaller long term energy savings and offer lower incentives. These marketing methods are needed to address key barriers to using the CDA track include a lack of customer awareness about the CDA track and competition with alternative energy efficiency programs that may be simpler or faster to use.
3. Since AEs are usually the first to hear about new construction projects, the Sponsors should ensure that they are well informed about the CDA track so that they can explain the program requirements and benefits to customers when they are first in contact about a potentially qualifying project. AEs are in a unique position to guide customers with appropriate projects towards the use of the CDA track since they interact most directly with potential participants in the C&I sector.
4. Incorporate the tracking of project leads into a database so that program staff and AEs can learn about potentially qualifying CDA track projects in time for this approach to be used. AEs do look to new construction databases such as Reed Connect and Dodge, but a centralized repository of information does not exist. This type of database would assist AEs in the identification and monitoring of potential CDA participants and would potentially increase participation in this track.
5. By focusing on educating potential design team members about the CDA through workshops and “lunch and learn” events, in addition to informing customers via AEs, PAs are more likely to have their customers learn of CDA track benefits. According to the new construction PA program managers, customers usually hear about the CDA from AEs. Doing more outreach to the design community could increase the pool of CDA projects.
6. The PAs should increase their distribution of marketing materials to its customers and potential design team members to more effectively market the CDA track. It would be worthwhile to invest in the development of CDA-specific brochures to mail out to potential participants, architects, and engineers so they are aware of the track prior to developing building plans.
7. Create a database, or annual report, of past program participants to document all information about their CDA project. This will allow AEs to actively follow up with these participants on a regular basis to make sure that they do not miss an opportunity to use the CDA track for future projects. If a database is created, it can also be used to track inquiries made by customers about new construction program approaches so that these customers can be actively marketed to as well.
8. Divide the rebate payment up into milestone payments over the course of the project. This recommendation was based on feedback from participants who said it would be beneficial to receive more of the incentive payments upfront, as they could be used to help finance construction costs and would be especially useful given the current state of the economy.
9. Rather than assuming the CDA will provide the largest incentives to customers, the PAs should evaluate the total incentives customers would be eligible to receive under each of the approaches. During interviews with CDA non-participants, the evaluation team did find two cases where incentives were actually larger under the alternative program tracks (e.g., AB track and a combination of the prescriptive and custom tracks) than they were under CDA.

10. Target CDA marketing towards the market segments that have historically used and benefited from the CDA as a way to increase participation in this track. Certain market sectors -- such as schools, universities, hospitals, supermarkets, and biotech/pharmaceutical companies -- participate in the CDA track more than others. Brochures describing projects specific to these sectors could be created and distributed to potential participants as a way to show how customers in the same lines of business benefited from addressing energy efficiency in a comprehensive manner.
11. Designate a project champion to ensure clear communications among the various projects involved in a CDA project. This would be especially useful during the construction phases to minimize the chance that contractors would make an unwarranted equipment substitution.
12. Streamline the processes related to the implementation and delivery of the CDA track. The CDA processes were acknowledged to have improved over time, yet there were multiple observations indicating that they still need to be further streamlined. A key complaint was the time required to get the PA's review and approval for a design plan and application. Some projects did not participate because necessary approvals could not be obtained in time to meet the project schedule.
13. PAs should offer more diverse applications of systems and technology opportunities through the CDA track. Fuel switching and the inclusion of renewable fuels were recommended applications. This provides customers with a variety of implementation possibilities and ensures incentives are not limited to a certain set of technologies.
14. Improve CDA tracking systems: The process evaluation had a number of recommendations for improving the CDA data tracking systems including storing electronic copies of project documentation, making CDA reporting more specific, allowing more accessible tracking of measure-level information, expanding the scope of data tracking, addressing the need for data-entry support, and incorporating the tracking of project leads.

#### Recommendation Summaries for AB Track

1. Foster personal relationships with design teams and customers: An effective implementation plan leverages the strong awareness among the design community to expand awareness at the customer level. A vital component of this strategy is an established rapport between the design community and specific individuals at the program office. The evaluation team recommends the intimate approach used by Efficiency Maine in which they assign 1-2 persons to a given project. This allows the program staff to develop personal relationships with program participants and encourages more proactive communications.
2. Take advantage of green marketing opportunities: An effective implementation plan takes advantage of the favorable environment of "green building." Efficiency Vermont, for example, supports the construction of Advanced Buildings with press releases, letters of recognition and NBI certification plaques. These elements of green advertising are particularly attractive to institutional customers, such as universities, who place significant value upon their public image. In Massachusetts, however, none of these green marketing strategies were observed among the implementation activities.
3. Emphasize importance of long-term savings: While there is no remedy for the downturn in new construction, it is possible to mitigate the budgetary concerns of customers. A successful program design may benefit from shifting the emphasis from incentives to long-term savings.
4. Maintain interest with follow-up communications: It is important for program staff to take a proactive approach in maintaining customer and design team interest. Program staff can't afford to wait for the owner or design firm to call when the critical steps are being made. Staff has to stay on

- 
- top of the project and do its own duty to ensure that the owners and design team are staying on track.
5. **Improve lead tracking:** A cohesive system of documenting and monitoring the status of program leads is important to the success of program implementation. For example, Efficiency Maine employs Efficiency Reporting & Tracking, an online database, to track project leads, contact and status descriptors. Among the PAs program staff did not use such a method of tracking prospective customers. In the case of National Grid and NSTAR, information such as customers contacted, outreach efforts, and lead status are not linked to their respective tracking system, InDemand or eTrack. According to program managers, the progress and status of project leads is documented in a spreadsheet, which is typically not shared among various levels of staff.
  6. **Minimize customer burden:** One of the greatest deterrents to program participation has been apprehension regarding the application process. Therefore an effective implementation strategy should make it well known to customers and design firms that staff will be available to assist in filling out application forms and understanding program requirements. The Efficiency Maine staff said they made ease-of-use a selling point for potential customers.
  7. **Take advantage of American Institute of Architects (“AIA”) continuing education requirements:** An excellent method of engaging the design community is to take advantage of the AIA continuing education requirements. In order to attract design firms, some implementers offer Advanced Buildings seminars paired with continuing education courses valid for credit towards the continuing education requirement. Under the current MassSave platform, attendees may earn four AIA Learning Units but are required to pay \$199 per session. PAs should consider waiving this fee in order to increase participation among harder-to-reach firms.
  8. **Anticipate advancements in code and standard practice:** The National Building Institute (“NBI”) – which develops rules for the AB track -- has not been diligent in maintaining AB requirements that exceed building code to a satisfactory degree. The PAs have been active in pushing NBI to keep their product ahead of the model codes. The PA should continue to push NBI to maintain program requirements well ahead of recent code developments and standard building practices.
  9. **Present the AB track as a learning opportunity for design firms:** One interviewee suggested that the architects and engineers who work on AB projects are not necessarily of the same caliber as those who work on CDA projects. The program can advertise the expertise brought by experienced program staff as a means of attracting design teams to working with the program.
  10. **Discuss ideas with design team before presenting them to the customer:** The actions of program staff have shown that it is best to work out any suggestions or changes to the design plan prior to engaging the customer in significant decisions regarding energy efficiency measures. Such consideration is useful in maintaining the support and cooperation of the involved design firms.
  11. **Maintain “soft cap” on building size:** Program staff has been receptive towards accommodating a wide range of buildings types, regardless of whether or not the building exceeds stipulated size guidelines. The AB track is offered as an option even for those building greater than 100,000 square feet so that customers are never reluctantly pushed towards the CDA track as the result of size requirements. It is the responsibility of NBI to issue some guiding principles regarding how such offers or exceptions should be framed.
  12. **Investigate “box” retail stores as a potential customer segment:** It is recommended that NBI examine the designs of various large retailers with respect to code requirements to identify any buildings that are performing below their potential efficiency. If certain big box stores are not using an efficient building design, program staff should investigate the contributing factors and explore opportunities for program participation. Program implementers can exploit these inefficient

building designs and possibly tap into a new customer segment.

13. Consider the benefits of a common platform: Under the MassSave initiative, the PAs have already taken the first steps in creating such a platform. It is unlikely, however, that various implementers will come to a consensus because there are obvious difficulties in making uniform the AB platform. While it is assumed that the MassSave platform is working with the PAs to attain uniformity in implementation, design and marketing, the evaluation team feels that this objective is worth restating in the specific context of program branding.

**How the Study came to the Recommended Conclusions:** Both the CDA and AB process evaluations relied primarily on in-depth interviews for their program findings. These evaluations completed 58 in-depth interviews with:

- Participating and non-participating customers;
- Participating design teams;
- PA C&I new construction program managers and staff;
- PA AEs;
- PA technical staff;
- Technical assistance consultants; and
- AB program managers and staff in Massachusetts, Maine, and Vermont and other AB program actors.

The evaluations also reviewed 24 new construction projects for a case study analysis. Finally the evaluators also reviewed program tracking databases, program marketing materials, and other program documents.

**Explain Whether or Not the PA Decided to Adopt Recommendations from the Study, and Why:** All recommendations are being considered for adoption at this time. The PAs have not formally adopted or rejected any recommendations that require changes program design and operations.

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

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## IMPACT EVALUATION OF 2008 AND 2009 CUSTOM CDA INSTALLATIONS (STUDY 28)

**Type of Study:** Impact

**Objective of the Study:** The objective of this impact evaluation is to provide verification or re-estimation of electric energy and demand savings estimates for five Custom CDA projects through site-specific inspection, monitoring, and analysis. The results of this study are the final realization rates for Custom Comprehensive energy efficiency measures.

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

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

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

The final realization rates are calculated using statistical weightings of the results of the five studied Custom CDA applications. This calculation is explained in detail in Section 3 of the “Impact Evaluation of 2008 and 2009 Custom CDA Installations” report.

Site level RRs are determined through site inspection, data collection and engineering analysis. Analysis methods included building simulation modeling.

**How the Results of the Study Impact each Identified Program’s Savings:** Please refer to the tables in Section II.C.2 for each of the programs listed above

**Formulas Necessary to Understand the Impact of the Study on the PA’s Programs:** The results of this study are used to update the realization rates for energy (RRE), summer on-peak demand (RRSP), and winter on-peak demand (RRWP) savings for the “Comprehensive” end-use within Custom Measures.

The formulas necessary to understand the impacts are described in the TRM.

**If the Results of the Study are Not Adopted, Fully Explain Why:** All results have been adopted by the PAs.

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

## PROJECT 7 GENERAL PROCESS EVALUATION FINAL REPORT (STUDY 29)

**Type of Study:** Process

**Objective of the Study:** The objective of this process evaluation was to look at ways to improve the design and delivery of Massachusetts C&I energy efficiency programs that would be applicable to multiple



programs. Issues that the PAs and the EEAC were particularly interested in included how to increase program participation levels, how to obtain deeper energy savings from energy efficiency projects, how to improve the integration of electric and gas energy efficiency programs, and how to increase the general uniformity of program delivery across the state.

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

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

**Recommendations Derived from the Study:**

- Increase AE and technical advisor staffing levels: Interviewees with nearly all the PAs cited the need for additional staff to help achieve the expanded program savings goals. Adding AEs will allow more face-to-face meetings with customers, which should yield more projects. Adding technical staff will speed up the project technical analysis process (which was too slow according to some interviewees) and will help make up for the lack of technical knowledge among some AEs.
- Increase program incentive levels and limits: Many interviewees recommended increasing incentives in order to recruit more projects and achieve deeper savings. Raising the limit on the cumulative incentive allowed per project would help C&I customers overcome barriers to participation related to lack of capital. Raising the maximum \$/unit (kWh or therms) will encourage customers to install longer-payback measures which are critical to achieving the expanded program savings goals.
- Offer turnkey financing: Nearly all program staff and AEs cited the lack of capital as the primary barrier preventing customers from moving forward with projects. A turnkey financing program to provide financing for eligible efficiency projects would help C&I customers overcome the important lack-of-capital barrier. In 2011 the PAs are preparing to launch several prescriptive load products for C&I customers that would buy down the interest rate to 0%.
- Improve the design of marketing materials: The AEs recommended that program marketing materials be easier to understand and make greater use of case studies and testimonials.
- Organize AEs by industry sector: At least for the larger PAs, it may be more productive to organize all AEs by industry sector (e.g., vs. by geography). If AEs are only responsible for understanding a few select industries, this should improve their level of technical and business knowledge for those industries.
- Tie AE performance to program energy savings: PAs should consider tying AE bonuses to the level of savings achieved by the projects completed by their customers. Although some PAs currently do consider energy efficiency programs in AE performance assessments, it is not tied to a specific energy savings goal. Only one third of the AEs reported that the current performance structure clearly motivates them.
- Systematize the process for making requests for technical assistance: A common complaint among AEs was that technical staff members did not reply promptly to their requests for technical assistance. AEs suggested establishing a central email inbox that technical staff can access and respond to questions. It would also be useful to develop clear guidelines for responding to most technical requests within a certain timeframe so that AEs can notify their customers when to expect a response.
- Help large C&I customers establish long-term commitments to energy efficiency: At least one PA is

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developing multi-year non-binding commitments with the corporate management of their large C&I customers to establish specific energy-saving goals. An efficiency plan should lead to longer-term consistent budgeting for energy projects and draw the attention of higher-level management.

**How the Study Came to the Recommended Conclusions:** These conclusions and recommendations are primarily based on 28 in-depth interviews with C&I program staff, AEs, and utility technical staff. These interviews were conducted in September and October 2010 and included representatives from seven different PAs.

**Explain Why Or Why Not The Program Administrator Decided To Adopt Recommendations From The Study:** The PAs have reviewed the recommendations resulting from this study. As stated in recommendation three, the PAs are now offering financing mechanisms to help address our customer's capital constraints. All other recommendations are being considered for adoption by the PAs at this time.

**A copy of the complete study can be found in:** Appendix C, Study 29.

## 2010 COMMERCIAL AND INDUSTRIAL ELECTRIC PROGRAMS FREE-RIDERSHIP AND SPILLOVER STUDY (STUDY 30)

**Type of Study:** Impact

**Objective of the Study:** The primary objective of the 2010 program year free-ridership and spillover study was to quantifying the net impacts of the commercial and industrial electric energy efficiency programs by estimating the extent of program free-ridership, early participant "like" and "unlike" spillover, and non-participant "like" spillover.

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

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

**Results of the Study and How the Study Determined those Results:** The study produced free-ridership, participant spillover and non-participant spillover rates for each PA by end use. The methodology used for this year's study follows the standardized methodology developed in 2010 and 2011 for the Massachusetts PAs for use in situations where end-users are able to report on program impacts via self-report methods. This study used telephone surveys with samples of 2010 program participants in each of the PAs' C&I electric programs and with design professionals and equipment vendors involved in these 2010 installations.

**How the Results of the Study Impact each Identified Program's Savings:** Please refer to the tables in Section II.C.2 for each of the programs listed above.

**Formulas Necessary to Understand the Impact of the Study on the PA's Programs:** The results of this study are used to calculate the net savings associated with programs listed above. The formulas necessary to understand the impacts are described in the TRM.

**If the Results of the Study are Not Adopted, Fully Explain Why:** Not Applicable.

**A copy of the complete study can be found in:** Appendix C, Study 30.

## C&I LIGHTING MEASURE LIFE AND PERSISTENCE PROJECT (STUDY 31)

**Type of Study:** Impact

**Objective of the Study:** To determine measure lives of five categories of lighting measures installed over a ten year period from 199 to 2009 using statistical analysis techniques.

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

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

**Results of the Study and How the Study Determined those Results:** This study determined the measure life of each of five categories of C&I lighting by estimating their mean retention times, defined as the time at which half the units of the measure installed during a program year are not retained. Data for the survival analysis was collected during on site visits to 224 projects in New England and New York. Estimates from the survival analysis were also compared with research of secondary sources. Measure lives for each category were also estimated for two other strata of interest, self-reported operating hours and building type. All results are presented with a two-tailed error range at the 80% confidence interval.

**How the Results of the Study Impact each Identified Program's Savings:** Please refer to the tables in Section II.C.2 for each of the programs listed above.

**Formulas Necessary to Understand the Impact of the Study on the PA's Programs:** The results of this study were compared with existing values used by program administrators. Existing values come from a 2005 Massachusetts study, updated in 2007 for the State Program Working Group, a group of New England electric energy efficiency program administrators and state regulators. Measure lives developed from these two studies were based on secondary research of manufacturer literature and surveys of energy efficiency programs in other states.

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**If the Results of the Study are Not Adopted, Fully Explain Why:** The Massachusetts PAs have not yet determined how to apply the results of this study going forward. Application of the results requires consensus on the types of measures in each category that will be affected, differences between new construction versus retrofit installations and necessary changes to tracking system databases.

**A copy of the complete study can be found in:** Appendix C, Study 31.

## C&I LIGHTING LOADSHAPE (STUDY 32)

**Type of Study:** Impact

**Objective of the Study:** A regional study conducted by the Northeast Energy Efficiency Partnership's EM&V Forum building upon a 2007 study done for the New England State Program Working Group to develop Commercial and Industrial lighting loadshapes and coincidence factors.

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

- C&I New Construction (Electric)
- C&I Large Retrofit (Electric)
- C&I Small Retrofit (Electric)

**Results of the Study and How the Study Determined those Results:** Through the use of data from lighting logger studies conducted by various Program Administrators in New England and New York since 2000 that covered 775 projects and utilized 3,780 loggers, Summer and Winter Coincidence factors for Commercial and Industrial lighting were derived.

**How the Results of the Study Impact each Identified Program's Savings:** Please refer to the tables in Section II.C.2 for each of the programs listed above.

**Formulas Necessary to Understand the Impact of the Study on the PA's Programs:** The results of this study are used to update the coincidence factors for summer on-peak demand ( $CF_{SP}$ ), and winter on-peak demand ( $CF_{WP}$ ) savings for non-controlled lighting measures for the Large C&I New Construction and Retrofit programs, and the summer on-peak demand ( $CF_{SP}$ ) for the Small C&I Retrofit programs. The Coincidence factors incorporate HVAC interactive effects.

The results of this study were presented for three weather zones; NE-Mass Weather (representing NEMA and SEMA Load zones), NE-North Weather (representing New Hampshire and Maine), and NE-South Coastal (representing Rhode Island and Connecticut). The Massachusetts PAs used the results from the NE-Mass Weather zone and NE-North Weather zone (this zone was used as the best representation of western Massachusetts weather). The results across these two weather zones were exactly the same to two significant digits.

The formulas necessary to understand the impacts are described in the TRM.

**If the Results of the Study are Not Adopted, Fully Explain Why:** A separate study conducted in 2010 by the Non-Residential Small Retrofit research area determined winter on-peak ( $CF_{WP}$ ) coincidence factors for the Small C&I Retrofit program. Results from that study, where metering was conducted during the on-peak winter months, have been adopted instead of the values produced by this study.

**A copy of the complete study can be found in:** Appendix C, Study 32.

## C&I UNITARY HVAC LOADSHAPE PROJECT FINAL REPORT (STUDY 33)

**Type of Study:** Impact

**Objective of the Study:** The primary goal of this project was to develop weather normalized 8,760 (representing every hour of the year) cooling end-use load shapes representative of hourly savings for the target population of efficient unitary HVAC equipment promoted by efficiency programs in New England, New York and mid-Atlantic regions.

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

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

Results of the Study and How the Study Determined those Results The results of the study are hourly weather normalized load shape profiles for different weather regions in the northeast. These profiles are then used to calculate the Equivalent Full Load Hours for the equipment and the coincidence factors for the ISO New England summer peak periods.

Results were determined through four to five months of direct on site energy metering at 511 individual units from May through October 2010. Metering data and weather for the period was then processed to develop an hourly annual load shape normalized to a typical meteorological year.

**How the Results of the Study Impact each Identified Program's Savings:** Please refer to the tables in Section II.C.2 for each of the programs listed above.

**Formulas Necessary to Understand the Impact of the Study on the PA's Programs:** The formulas necessary to understand the impacts are described in the TRM. Gross energy and demand savings use the following four formulas.

For units with cooling capacities less than 65 kBtu/h (for National Grid):

$$\Delta kWh = (kBtu / h) \left( \frac{1}{SEER_{BASE}} - \frac{1}{SEER_{EE}} \right) (EFLH_{Cool})$$

$$\Delta kW = (kBtu / h) \left( \frac{1}{SEER_{BASE}} - \frac{1}{SEER_{EE}} \right)$$

For units with cooling capacities equal to or greater than 65 kBtu/h (all PA's):

$$\Delta kWh = (kBtu/h) \left( \frac{1}{EER_{BASE}} - \frac{1}{EER_{EE}} \right) (EFLH_{cool})$$

$$\Delta kW = (kBtu/h) \left( \frac{1}{EER_{BASE}} - \frac{1}{EER_{EE}} \right)$$

**If the Results of the Study are Not Adopted, Fully Explain Why:** All results of the study have been adopted by the PAs as follows:

Cape Light Compact - This study represents the best available information regarding installations in the Cape Light Compact's territory for this end use. The Cape Light Compact has used the results of the study to create realization rates on energy and demand for the measures studied. These realization rates will apply to results for the 2010 and 2011 program years. For program years starting in 2012, the equivalent full load hours and coincidence factors determined through this study will be used to calculate gross savings for installations in the Cape Light Compact's service territory.

To calculate gross energy savings in 2010, Cape Light Compact used an equivalent full load hours of 777 for all installations. The results of this study are equivalent full load hour estimations encompassing all installations in the three load zones within Massachusetts. Cape Light Compact exists entirely within the SEMA load zone and therefore used only the results from this zone to calculate all realization rates. This calculation is shown in the following table.

| Load Zone                  | Cape Light Compact Load Zone Weight | NEEP Result EFLH | NEEP Result ISO-NE On-Peak Summer Coincidence Factor (1-5PM, WDNH, Jun-Aug) |
|----------------------------|-------------------------------------|------------------|---|
| SEMA                       | 1.0000                              | 1,172            | 0.448   |
| NEMA                       | 0.0000                              | 1,172            | 0.448   |
| WCMA                       | 0.0000                              | 719              | 0.332   |
| Cape Light Compact Results |                                     | 1,172            | 0.448   |
| Gross Estimate             |                                     | 777              | 0.820   |
| Realization Rate           |                                     | 150.08%          | 54.63%  |

Net Savings for each installation, before Freeridership and Spillover adjustment, is therefore calculated as:

$$\Delta kWh = (kBtu/h)(\Delta kW)(777)(150.08\%)$$

$$\Delta kW_{Summer} = (kBtu/h)(\Delta kW)(0.820)(54.63\%)$$

See the TRM for further discussion of this measure and details on the equations used.

National Grid - This study represents the best available information regarding installations in National Grid's territory for this end use. National Grid has used the results of the study to create realization rates on energy and demand for the measures studied. These realization rates will apply to results for the 2010 and 2011 program years. For program years starting in 2012, the equivalent full load hours and coincidence factors determined through this study will be used to calculate gross savings for installations in National Grid's service territory.

To calculate gross energy savings in 2010, National Grid used an equivalent full load hours of 777 for all installations. The results of this study are equivalent full load hour estimations encompassing all installations in the three load zones within Massachusetts. National Grid has chosen to use its load zone peak demands to consolidate the three zones into one National Grid specific value. This calculation was also done for the summer coincidence factor. This calculation is shown in the following table.

| Load Zone             | National Grid Load Zone Weight | NEEP Result EFLH | NEEP Result ISO-NE On-Peak Summer Coincidence Factor (1-5PM, WDNH, Jun-Aug) |
|-----------------------|--------------------------------|------------------|---|
| SEMA                  | 0.3234                         | 1,172            | 0.448   |
| NEMA                  | 0.2378                         | 1,172            | 0.448   |
| WCMA                  | 0.4388                         | 719              | 0.332   |
| National Grid Results |                                | 973              | 0.397   |
| Gross Estimate        |                                | 777              | 0.441   |
| Realization Rate      |                                | 125.23%          | 89.94%  |

Net Savings for each installation, before Freeridership and Spillover adjustment, is therefore calculated as.

$$\Delta kWh = (kBtu/h)(\Delta kW)(777)(125.23\%)$$

$$\Delta kW_{Summer} = (kBtu/h)(\Delta kW)(0.441)(89.9\%)$$

See the TRM for further discussion of this measure and details on the equations used.

NSTAR - This study represents the best available information regarding installations in NSTAR's territory for this end use. NSTAR has used the results of the study to create realization rates on energy and demand for the measures studied. These realization rates will be applied to results for the 2010 program year. For program year 2011 and beyond, the equivalent full load hours and coincidence factors determined through this study will be used to calculate gross savings for installations in NSTAR's service territory.

To calculate gross energy savings in 2010, NSTAR used several equivalent full load hour values, depending on the type of installation. The results of this study are equivalent full load hour

estimations encompassing all installations in the three load zones within Massachusetts. NSTAR's service territory is contained within the NEMA and SEMA load zones. The realization rate developed for 2010, as indicated in the table below, is based on an analysis of all unitary HVAC measures in the company's tracking system.

| Load Zone        | NSTAR Load Zone Weight | NEEP Result EFLH | NEEP Result ISO-NE On-Peak Summer Coincidence Factor (1-5PM, WDNH, Jun-Aug) |
|------------------|------------------------|------------------|---|
| SEMA             | 1                      | 1,172            | 0.448   |
| NEMA             | 1                      | 1,172            | 0.448   |
| WCMA             | 0                      | 719              | 0.332   |
| NSTAR Results    |                        | 1172             | 0.448   |
| Gross Estimate   |                        | xxxx             | 0.82  |
| Realization Rate |                        | yy%              | 54.6%   |

Net Savings for each installation, before Freeridership and Spillover adjustment, is therefore calculated as.

$$\Delta kWh = (kBtu / h)(\Delta kW)(xxxx)(yyyy\%)$$

$$\Delta kW Summer = (kBtu / h)(\Delta kW)(0.82)(54.6\%)$$

See the TRM for further discussion of this measure and details on the equations used.

**A copy of the complete study can be found in:** Appendix C, Study 33.

## CROSS CUTTING C&I FREE-RIDERSHIP AND SPILLOVER METHODOLOGY STUDY FINAL REPORT (STUDY 34)

**Type of Study:** Process

**Objective of the Study:** Programs to which the Results of the Study Apply: The focus of this study was on the general methods for estimating what would have happened absent C&I programs in Massachusetts. The net program effect is the observed effect, less the estimate of what would have happened absent the program. The objectives of this study were to develop a standardized methodology for situations where C&I end-users are able to report on program impacts via self-report methods, and to provide a decision framework and guidelines for when the standardized self-report methodology is appropriate and when other methods need to be used (e.g., upstream programs).

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

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



- C&I Small Retrofit (Electric)
- C&I Retrofit (Gas)
- C&I Direct Install (Gas)

**Recommendations derived from the study:** There were no recommendations derived from this study, rather, the study suggested methodologies for PAs to consider in future NTG evaluations.

**Explain Why Or Why Not The Program Administrator Decided To Adopt Recommendations From The Study:** In general, the Company adopts results from an evaluation study which are supported by the data generated from the study. The Company will incorporate the findings of this study into the planning process for future evaluations of Net-to-Gross ratios for Commercial & Industrial programs.

**A copy of the complete study can be found in:** Appendix C, Study 34.

## PRESCRIPTIVE CONDENSING BOILER IMPACT EVALUATION PROJECT 5 PRESCRIPTIVE GAS (STUDY 35)

**Type of Study:** Impact

**Objective of the Study:** The objective of this impact evaluation was to develop annual gas savings impacts for all five size categories of prescriptive condensing boilers installed through the C&I gas programs.

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

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

**Results of the Study and How the Study Determined those Results:** The study produced impact estimates for condensing boilers in all size categories. The results were also presented as realization rates to apply to prescribed savings provided in the 2011 Program Year TRM.

The results were developed using telephone and on-site sample interview results to update estimates of site-level savings. The updated results were combined in a ratio estimator framework to produce estimates of realization rates and impacts.

**How the Results of the Study Impact each Identified Program's Savings:** Please refer to the tables in Section II.C.2 of the Gas Energy Efficiency Annual Reports for each of the programs listed above.

**Formulas Necessary to Understand the Impact of the Study on the PA's Programs:** The report provides realization rates and updated unit level savings estimates for:

- Condensing boiler <= 300 mbh
- Condensing boiler 301-499 mbh

- Condensing boiler 500-999 mbh
- Condensing boiler 1000-1700 mbh
- Condensing boiler 1701+ mbh

The formulas necessary to understand the impacts are described in the TRM.

**If the Results of the Study are Not Adopted, Fully Explain Why:** All results have been adopted by the Program Administrators.

**A copy of the complete study can be found in:** Appendix C, Study 35.

## SPECIAL AND CROSS SECTOR STUDIES

### INDUSTRY PRACTICES AND POLICIES ON ENERGY EFFICIENCY PROGRAM REBATE/INCENTIVES (STUDY 36)

**Type of Study:** Process

**Objective of the Study:** Tetra Tech and the Energy Center of Wisconsin (ECW) (“the research team”) conducted a high-level scoping study of statewide energy efficiency program incentive and rebate levels to help inform the policy debate for statewide programs in Massachusetts and to support fourth quarter 2010 programmatic planning.

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

- ENERGY STAR Lighting (Electric)
- Residential Cooling and Heating Program (Electric)
- Residential Heating and Water Heating (Gas)
- Residential Weatherization (Gas)
- C&I Large Retrofit (Electric)
- C&I Small Retrofit (Electric)
- C&I Retrofit (Gas)
- C&I Direct Install (Gas)

**Recommendations derived from the study:** The study presented key findings without specific recommendations. The key findings indicated that residential incentives and rebates in Massachusetts were not consistently higher or lower than those in the other states programs. Those incentives that were not in the mid-range when compared to other industry programs included:

- Residential gas furnace incentives in Massachusetts are among the higher incentives offered and are currently under review. Massachusetts also ranked the highest for hot water boiler rebates.

- Massachusetts weatherization incentives fall in the upper half of offerings, but these are complex programs and difficult to compare.
- Massachusetts commercial rebates examined for lighting were on the low end of lighting rebates offered in other states.
- The Massachusetts small business incentive at 70 percent of installed cost of existing building projects is higher than two other state programs and higher than the cap on custom incentives for large commercial projects.
- Massachusetts rebates appear to be at the high end of offerings in other states for hot-air furnaces.

**Explain Why Or Why Not The Program Administrator Decided To Adopt Recommendations From The Study:** Not Applicable

**A copy of the complete study can be found in:** Appendix C, Study 36.

## COMMUNITY BASED PARTNERSHIP INTERIM PROCESS EVALUATION (STUDY 37)

**Type of Study:** Process

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

As the evaluation of community-based partnerships is still ongoing, the *Interim Process Evaluation* provides an overview of each effort's structure and performance against the goals and presents findings from the research activities already conducted with a goal of providing early feedback and identifying areas for program improvement early on. The report also presents comparative analysis of community-based efforts under evaluation with the goal of developing best practices for design and implementation of such efforts.

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

- Renew Boston (Electric and Gas)
- Western Mass Saves Challenge (Electric)
- New Bedford Community Mobilization Initiative (Electric and Gas)

**Recommendations Derived from the Study:**

Overarching Findings

1. Articulate program design to reflect the target market – when planning and designing a community outreach effort, it is important to lay out what each partnership is intending to accomplish, why such an effort is needed for a specific population, and how they fit into existing programs. This will help ensure that the target audience and barriers are

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clearly documented, and the most effective interventions are selected.

2. Draw on the strengths of local and existing resources and ensure that the community group efforts align with partnership goals – while there is no right or wrong model for structuring a community engagement network, it is important to consider the existing infrastructure and the amount of resources required to engage the network when planning and designing a community-based effort. A full analysis of the financial and local resources may also enhance these efforts. In addition, program leaders or organizers should focus local organizations on their strengths and, where relevant, consider the sustainability of the effort if this is a desired outcome.
3. Understand the unique nature of the target market – community-based efforts could benefit from bringing together local knowledge on the front end and revisiting the existing program designs to ensure that they are anticipating unique characteristics in the population to the extent that they can prior to fielding the effort. This would include looking beyond the assumed cultural barriers to understand what other logistical or technical barriers may present a challenge to program implementation in the specific market (and finding resources to overcome these challenges). Pre-screening communities and their barriers will be useful to this effort.
4. Tracking information to help improve efforts and demonstrate success – tracking core performance metrics is integral to the success of any effort. Effective tracking is essential to measuring milestones and progress, as well as energy impacts of community-based efforts. When designing and implementing community-based efforts, stakeholders should carefully consider which performance metrics to track, and develop mechanisms to track them, while balancing this effort with resource constraints.

**How the Study Came to the Recommended Conclusions:** The findings presented in the study were developed through analysis of program materials and tracking databases, in-depth interviews with the PA staff, and in-depth interviews with program stakeholders and community groups. As part of the research, the evaluation team has also conducted a literature review of community-based programs implemented across the United States, and developed both partnership-specific logic models and an overarching theory of change for community-based partnerships. Additional primary research will be conducted in 2011.

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

**A copy of the complete study can be found in:** Appendix C, Study 37.

PA SPECIFIC

Unitil did not conduct any Company-specific evaluations during 2010.

FUTURE STUDIES

Table III.B summarizes the studies expected to be included in next year’s Annual Report.<sup>8</sup>

Table III.B:

| Evaluation Studies in Next Annual Report   |  |  |
|--|--|--|
| Studies  | Docket & Exhibit Approving Planned Evaluation Studies  | Expected to be Implemented as Approved? (yes/no) |
| Residential Studies  | Docket D.P.U. 09-127<br>2010–2012 Massachusetts Joint Statewide Three-Year Gas Energy Efficiency Plan October 29, 2009, Sec II.H and pending D.P.U. 10-150 (Unitil’s 2011 MTM) |  |
| Market Study for Hard-to-Reach Lighting market   |  | Yes  |
| Impact Study for Specialty Lighting  |  | Yes  |
| Impact study on CFL measure life   |  | Yes  |
| Evaluation of Smart Powerstrips  |  | Yes  |
| Market study on changes in consumer electronics  |  | Yes  |
| Market assessment to identify additional areas for residential energy efficiency savings |  | Yes  |
| Process study to streamline appliance rebate programs                                    |  | Yes  |
| Follow-up Evaluation of Appliance Recycling program                                      |  | Yes  |
| Net-to-Gross study for selected appliance rebates  |  | Yes  |
| Baseline Study/Impact Study of Mass Save program   |  | Yes  |
| Process and Impact evaluation of Multifamily Program                                     |  | Yes  |

<sup>8</sup> See D.P.U. 09-116 through D.P.U. 09-120, at 132; D.P.U. 09-121 through D.P.U. 09-128, at 122.

Table III.B:

| Evaluation Studies in Next Annual Report  |   |  |
|---|---|--|
| Studies   | Docket & Exhibit Approving Planned Evaluation Studies   | Expected to be Implemented as Approved? (yes/no) |
| Phase II: Baseline Study/Code Compliance Assessment                             | Docket D.P.U. 09-127<br>2010–2012 Massachusetts Joint Statewide Three-Year Gas Energy Efficiency Plan<br>October 29, 2009, Sec II.H and pending D.P.U. 10-150 (Unitil’s 2011 MTM) | Yes  |
| Phase II: Analysis of Code Upgrade Program Impacts                              |   | Yes  |
| Phase II: Analysis of Code Compliance Enhancement Impacts                       |   | Yes  |
| Major Renovation Pilot  |   | Yes  |
| Homebuyer Survey  |   | Yes  |
| Assessment of New Technologies  |   | Yes  |
| Builder Focus Groups  |   | Yes  |
| Residential Potential Study work  |   | Yes  |
| Low-Income Studies  |   |  |
| Baseline Study/Impact Study of Low Income program                               |   | Yes  |
| Commercial & Industrial Studies   |   |  |
| Integrated Program Process Evaluation   |   | Yes  |
| Lighting Billing Analysis Evaluation  |   | Yes  |
| Market Assessment   |   | Yes  |
| Net-to-Gross Study  |   | Yes  |
| Phase II: Non-Residential New Construction Market Assessment Study              |   | Yes  |
| Custom Electric Measures Impact Evaluations (Lighting, Process, Compressed Air) |   | Yes  |
| Prescriptive Gas Measures Impact Evaluation                                     |   | Yes  |
| Custom Gas Measures Impact Evaluation   |   | Yes  |
| Prescriptive Measure Impact Evaluation (Lighting, VSDs)                         |   | Yes  |
| CHP Impact Evaluation   |   | Yes  |
| Phase II: Behavioral Pilots   |   | Yes  |
| Phase II: Community Based Pilots  |   | Yes  |
| Phase II: Umbrella Marketing  | Yes   |  |

Table III.B:

| Evaluation Studies in Next Annual Report  |  |  |
|---|--|--|
| Studies                                   | Docket & Exhibit Approving Planned Evaluation Studies  | Expected to be Implemented as Approved? (yes/no) |
| C&I Net-to-Gross Study                    | Docket D.P.U. 09-127   | Yes  |
| Non-Energy Impacts 2011 - C&I: non-Custom | 2010–2012 Massachusetts Joint Statewide Three-Year Gas Energy Efficiency Plan October 29, 2009, Sec II.H and pending D.P.U. 10-150 (Unitil's 2011 MTM) | Yes  |

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## IV. STATUTORY BUDGET REQUIREMENTS

### A. INTRODUCTION

The Green Communities Act requires that energy efficiency programs minimize administrative costs, utilize competitive procurement processes, and spend a certain amount on low-income programs. G.L. c. 25 §§ 19(a)-(c).

For each sector, Tables IV.A through IV.C summarize and compare planned and actual program planning and administration (“PP&A”) costs, outsourced activities, and budget allocation, respectively.

### B. MINIMIZATION OF ADMINISTRATIVE COSTS

The most significant factor in the Company’s approach to controlling administrative costs is its active participation in the statewide planning process. While this participation requires a significant dedication of resources, the benefits of collaborative planning, the adoption of consistent programs and processes and the coordination of program design, EM&V studies, and regulatory proceedings outweigh the cost of participation and brings immense benefits to the Company’s customers. The extent and benefits of the statewide planning process were reflected in the Statewide Three-Year Electric/Gas Plans which created the over-arching framework for the Company’s individual Three-Year Plan filing. This included a significant commitment to competitive procurement and program integration, as well as other design features described in detail in both the Statewide and Company-specific Plans.

A second factor in the Company’s efforts to control administrative costs is its coordination of energy efficiency program delivery, where appropriate, with other customer service activities such as customer acquisition, key account management and trade ally relationships. For example, a key account manager may be in contact with a business customer to discuss electric or gas service or metering issues – at the same time they will seek to recruit the customer into the Company’s energy efficiency programs, and will then serve as a key point of contact through the process. Through this sharing of staff resources, the Company is able to control the costs of delivering energy efficiency services to its customers.

The Company continues to be committed to managing its energy efficiency programs in the most cost-effective manner possible. This includes careful attention to controlling administrative costs. All of the Program Administrators recognize that high quality, effective administration at the lowest possible cost is essential to the delivery of quality programs and achievement of maximum benefits and savings to customers.

Sector PP&A Cost Variance: Table IV.A provides a variance analysis between planned and actual PP&A spending by sector. Reasons for increases in spending of greater than ten percent at the sector level are as follows:

- Residential: The higher than expected internal and third party PP&A costs are primarily due to the extraordinary regulatory and legal efforts required during the year to ensure compliance with the 2008 Green Communities Act.



- Low-Income: The higher than expected internal and third party PP&A costs are primarily due to the extraordinary regulatory and legal efforts required during the year to ensure compliance with the 2008 Green Communities Act.
- Commercial & Industrial: The higher than expected internal and third party PP&A costs are primarily due to the extraordinary regulatory and legal efforts required during the year to ensure compliance with the 2008 Green Communities Act.

Table IV.A

| Program Planning and Administration Costs        |            |                          |            |                          |                                 |                          |
|--|------------|--------------------------|------------|--------------------------|---------------------------------|--------------------------|
| Customer Sector / Program                        | Planned    |                          | Actual     |                          | % Change from Planned to Actual |                          |
|  | Value (\$) | % of Total Program Costs | Value (\$) | % of Total Program Costs | Value                           | % of Total Program Costs |
| <b>Residential</b>                               |            |                          |            |                          |                                 |                          |
| Residential New Construction & Major Renovations | \$ 3,229   | 12.8%                    | \$ 15,455  | 56.1%                    | \$ 12,226                       | 43.3%                    |
| Residential Heating and Water Heating            | \$ 12,237  | 14.2%                    | \$ 41,911  | 25.6%                    | \$ 29,675                       | 11.4%                    |
| MassSAVE   | \$ 4,902   | 70.0%                    | \$ -       | 0.0%                     | \$ (4,902)                      | -70.0%                   |
| Weatherization Program                           | \$ 9,857   | 17.8%                    | \$ 33,693  | 39.1%                    | \$ 23,836                       | 21.2%                    |
| Multifamily Retrofit                             | \$ -       | 0.0%                     | \$ -       | 0.0%                     | \$ -                            | 0.0%                     |
| O Power  | \$ -       | 0.0%                     | \$ -       | 0.0%                     | \$ -                            | 0.0%                     |
| Deep Energy Retrofit                             | \$ 881     | 17.0%                    | \$ -       | 0.0%                     | \$ (881)                        | -17.0%                   |
| Res Building Practices and Demonstration Program | \$ -       | 0.0%                     | \$ -       | 0.0%                     | \$ -                            | 0.0%                     |
| Energy Analysis: Internet Audit Program          | \$ -       | 0.0%                     | \$ -       | 0.0%                     | \$ -                            | 0.0%                     |
| Community Based Pilots                           | \$ -       | 0.0%                     | \$ -       | 0.0%                     | \$ -                            | 0.0%                     |
| Workforce Development                            | \$ -       | 0.0%                     | \$ -       | 0.0%                     | \$ -                            | 0.0%                     |
| Statewide Marketing & Education                  | \$ -       | 0.0%                     | \$ -       | 0.0%                     | \$ -                            | 0.0%                     |
| EEAC Consultants                                 | \$ -       | 0.0%                     | \$ -       | 0.0%                     | \$ -                            | 0.0%                     |
| DOER Assessment                                  | \$ -       | 0.0%                     | \$ -       | 0.0%                     | \$ -                            | 0.0%                     |
| Residential Total                                | \$ 31,104  | 16.8%                    | \$ 91,059  | 32.5%                    | \$ 59,956                       | 15.8%                    |
| <b>Low-Income</b>                                |            |                          |            |                          |                                 |                          |
| Low-Income Single Family Retrofit                | \$ 19,989  | 15.8%                    | \$ 58,653  | 32.5%                    | \$ 38,664                       | 16.7%                    |
| Low-Income Multi Family Retrofit                 | \$ -       | 0.0%                     | \$ -       | 0.0%                     | \$ -                            | 0.0%                     |
| Statewide Marketing & Education                  | \$ -       | 0.0%                     | \$ -       | 0.0%                     | \$ -                            | 0.0%                     |
| Low-Income Energy Affordability Network Funding  | \$ 2,478   | 100.0%                   | \$ 2,478   | 100.0%                   | \$ -                            | 0.0%                     |
| DOER Assessment                                  | \$ -       | 0.0%                     | \$ -       | 0.0%                     | \$ -                            | 0.0%                     |
| Low-Income Total                                 | \$ 22,468  | 17.3%                    | \$ 61,131  | 33.3%                    | \$ 38,663                       | 16.0%                    |
| <b>Commercial &amp; Industrial</b>               |            |                          |            |                          |                                 |                          |
| C&I New Construction & Major Renovation          | \$ 7,986   | 15.5%                    | \$ 20,739  | 30.8%                    | \$ 12,754                       | 15.3%                    |
| C&I Retrofit                                     | \$ 14,040  | 8.7%                     | \$ 83,706  | 31.0%                    | \$ 69,666                       | 22.3%                    |
| C&I Direct Install                               | \$ 1,870   | 14.0%                    | \$ 5,211   | 29.4%                    | \$ 3,341                        | 15.4%                    |
| Workforce Development                            | \$ -       | 0.0%                     | \$ -       | 0.0%                     | \$ -                            | 0.0%                     |
| Business Energy Analyzer                         | \$ -       | 0.0%                     | \$ -       | 0.0%                     | \$ -                            | 0.0%                     |
| Deep Energy Retrofit                             | \$ -       | 0.0%                     | \$ -       | 0.0%                     | \$ -                            | 0.0%                     |
| Statewide Marketing & Education                  | \$ -       | 0.0%                     | \$ -       | 0.0%                     | \$ -                            | 0.0%                     |
| EEAC Consultants                                 | \$ -       | 0.0%                     | \$ -       | 0.0%                     | \$ -                            | 0.0%                     |
| DOER Assessment                                  | \$ -       | 0.0%                     | \$ -       | 0.0%                     | \$ -                            | 0.0%                     |
| Commercial & Industrial Total                    | \$ 23,895  | 10.0%                    | \$ 109,656 | 30.7%                    | \$ 85,761                       | 20.7%                    |
| Grand Total                                      | \$ 77,467  | 14.0%                    | \$ 261,847 | 31.9%                    | \$ 184,380                      | 17.9%                    |

### C. COMPETITIVE PROCUREMENT

Table IV.B provides a variance analysis between the 2010 planned and actual competitively procured and total outsourced spending by sector.

As shown below, there were no significant variances (+/-20%) in Competitively Procured or Total Outsourced spending. The variances in In-House activities are due to higher than expected PP&A costs as well as internal costs (labor and expenses) associated with statewide marketing activities.

Table IV.B

| Customer Sector                     | Outsourced and Competitively Procured Services |                       |                       |                       |           |                       |           |                       |                  |
|-------------------------------------|--|-----------------------|-----------------------|-----------------------|-----------|-----------------------|-----------|-----------------------|------------------|
|                                     | In-House Activities                            |                       | Outsourced Activities |                       |           |                       |           |                       | Total Activities |
|                                     | (\$)   | % of Total Activities | (\$)                  | % of Total Outsourced | (\$)      | % of Total Outsourced | (\$)      | % of Total Activities | (\$)             |
| <b>Residential</b>                  |  |                       |                       |                       |           |                       |           |                       |                  |
| Planned                             | \$ 46,428                                      | 25%                   | \$ 34,845             | 100%                  | \$ -      | 0.0%                  | \$ 34,845 | 18.8%                 | \$ 185,691       |
| Actual                              | \$ 140,335                                     | 50%                   | \$ 23,273             | 100%                  | \$ -      | 0.0%                  | \$ 23,273 | 8.3%                  | \$ 279,985       |
| % Difference from Planned to Actual |  | 25%                   |                       | 0%                    |           | 0.0%                  |           | -10.5%                |                  |
| <b>Low-Income</b>                   |  |                       |                       |                       |           |                       |           |                       |                  |
| Planned [Note 1]                    | \$ 32,480                                      | 25%                   | \$ -                  | 0%                    | \$ 29,366 | 100.0%                | \$ 29,366 | 22.6%                 | \$ 129,898       |
| Actual                              | \$ 75,599                                      | 41%                   | \$ -                  | 0%                    | \$ 7,333  | 100.0%                | \$ 7,333  | 4.0%                  | \$ 183,768       |
| % Difference from Planned to Actual |  | 16%                   |                       | 0%                    |           | 0%                    |           | -18.6%                |                  |
| <b>Commercial &amp; Industrial</b>  |  |                       |                       |                       |           |                       |           |                       |                  |
| Planned                             | \$ 38,311                                      | 16%                   | \$ 24,261             | 100%                  | \$ -      | 0.0%                  | \$ 24,261 | 10.2%                 | \$ 238,550       |
| Actual                              | \$ 161,004                                     | 45%                   | \$ 16,130             | 100%                  | \$ -      | 0.0%                  | \$ 16,130 | 4.5%                  | \$ 356,901       |
| % Difference from Planned to Actual |  | 29%                   |                       | 0%                    |           | 0%                    |           | -5.7%                 |                  |
| <b>Total</b>                        |  |                       |                       |                       |           |                       |           |                       |                  |
| Planned                             | \$ 117,219                                     | 21%                   | \$ 59,105             | 67%                   | \$ 29,366 | 33.2%                 | \$ 88,472 | 16.0%                 | \$ 554,139       |
| Actual                              | \$ 376,938                                     | 46%                   | \$ 39,404             | 84%                   | \$ 7,333  | 15.7%                 | \$ 46,736 | 5.7%                  | \$ 820,654       |
| % Difference from Planned to Actual |  | 25%                   |                       | 18%                   |           | -18%                  |           | -10.3%                |                  |

## D. LOW INCOME SPENDING

Table IV.C summarizes the planned and actual budget allocation by sector. As shown, the Company's planned low-income budget and actual spending for 2010 exceeded the statutory minimum of twenty percent of the amount expended for electric energy efficiency programs.

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                       | \$ 185,691          | 33.5%                    | \$ 279,985          | 34.1%                    | \$ 94,294                       | 0.6%                     |
| Low-Income                        | \$ 129,898          | 23.4%                    | \$ 183,768          | 22.4%                    | \$ 53,870                       | -1.0%                    |
| Commercial & Industrial           | \$ 238,550          | 43.0%                    | \$ 356,901          | 43.5%                    | \$ 118,352                      | 0.4%                     |
| Total                             | \$ 554,139          | 100.0%                   | \$ 820,654          | 100.0%                   | \$ 266,515                      | 0.0%                     |

## V. PERFORMANCE INCENTIVES

Table V below summarizes the Company's 2010 performance incentives.

**Table V.**

| <b>Performance Incentives Summary</b> |           |           |           |                  |
|---------------------------------------|-----------|-----------|-----------|------------------|
| Incentive Components                  | Threshold | Design    | Exemplary | Actual Incentive |
| Savings Mechanism                     | \$ 17,224 | \$ 22,965 | \$ 28,706 | \$ 7,487         |
| Value Mechanism                       | \$ 13,553 | \$ 18,070 | \$ 22,588 | \$ 5,327         |
| Performance Metrics                   | \$ 459    | \$ 612    | \$ 765    | \$ 38,865        |
| Total Incentive (before-tax)          | \$ 31,235 | \$ 41,647 | \$ 52,059 | \$ 51,679        |
| Total Incentive (after-tax)           | \$ 19,357 | \$ 25,809 | \$ 32,261 | \$ 32,025        |

|                              |        |
|------------------------------|--------|
| Effective Tax Rate - 7/2011: | 38.03% |
|------------------------------|--------|

For each performance incentive component, the Company is providing information to support its determination of actual performance incentives for which it seeks recovery in Appendix D.

## VI. AUDITS

There have been no audits of the Company gas energy efficiency activities conducted during the last five years (2006-2010). An internal audit, conducted by the Company's Internal Audit/Control Department is under way to review 2010 program activities for both gas and electric programs.

## Volume 2

### APPENDICES

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## APPENDIX A: GLOSSARY OF DEFINED TERMS

### A1. TYPES OF COSTS IN EACH BUDGET CATEGORY

The categories described below are generally consistent among all Program Administrators, with the exception of the categorization of employee salaries and related expenses. This difference is due to different historical practices and differing staff sizes and staff assignments, as well as internal tracking mechanisms. The Company has accounted for employee labor and related expenses in the PP&A, Marketing-Advertising, Sales, Technical Assistance & Training, and Evaluation & Market Research categories, depending on the employee's responsibility.

The Company and the other electric and gas Program Administrators have worked together to develop consistent cost categories to the extent that they are efficient and appropriate for each Program Administrator, and the Program Administrators will continue to strive for consistency in this area.

Costs that cannot be assigned directly to a program are allocated among relevant programs on an appropriate basis and tracked accordingly.

**Planning and Administration** include costs associated with developing program plans, including market transformation plans, research and development (excluding R&D assigned to Evaluation & Market Research), and day-to-day program administration, including labor, benefits, expenses, materials, supplies, and overhead costs, and any regulatory costs associated with energy efficiency activities. Also includes costs for energy efficiency services contracted to non-affiliated companies such as outside consultants used to prepare plans, screen programs, improve databases, and perform legal services.

**Marketing/Advertising** includes costs to advertise, through television, radio, billboards, brochures, telemarketing, web-sites, and mailings, the existence and availability of energy efficiency programs or technologies, and to induce customers or trade allies to participate in energy efficiency programs.

**Customer Incentives** are funds paid by the reporting Program Administrator to customers or trade allies as rebates or in other forms.

**Sales, Technical Assistance & Training** are administration, sales technical assistance and training costs to motivate (1) customers to install energy efficiency products and services, (2) retailers to stock energy efficiency products, (3) trade professionals to offer energy efficiency services, (4) manufactures to make energy efficiency products; and (5) vendor services and supplies that demonstrate benefits of energy efficiency.

**Evaluation and Market Research** include costs associated with evaluation activities, including costs related to cost-effectiveness evaluation, market research (e.g., baseline studies, market assessments, surveys), impact and process evaluation reports, tracking and reporting program inputs and outputs, funding studies, and other costs clearly associated with evaluating the program.

**Performance Incentives** are funds earned by a Program Administrator based on its performance in implementing its Energy Efficiency Programs. For 2010, Unitil's gas performance incentives are based on the Energy Efficiency Advisory Council Resolution approved on October 13, 2009, which outlined Statewide Savings Targets and

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Performance Incentives for Gas. As such, the Company used the “Pre-eval” 08-50 tables for purposes of calculating Performance Incentives. These 08-50 tables correspond to the preliminary year-end results listed by program and by sector in the narrative tables.



A2. GLOSSARY OF TERMS AND ABBREVIATIONS

|                          |  |
|--------------------------|--|
| Annual kWh Reduction     | Expected net annual energy savings after all impact factors have been taken into consideration.  |
| AAP                      | Accelerated Application Process  |
| AMP                      | Appliance Management Program   |
| BBRS                     | Board of Building Regulations and Standards  |
| CAP                      | Community Action Program   |
| CEE                      | Consortium for Energy Efficiency   |
| CFL                      | Compact Fluorescent Lamps  |
| Coincident Peak Demand   | Demand for electricity at the time of the Company's peak demand.   |
| Customer Incentive       | Direct rebates to customers, upstream incentives paid to retailers and wholesalers, and rebates paid to vendors to reduce participant costs (see description of participant costs).  |
| Delta Watts              | The difference in the watts between pre-existing or baseline lighting equipment and energy efficient lighting equipment.   |
| Demand                   | The amount of electric energy used by a customer or piece of equipment at a specific time, expressed in kilowatts.   |
| Demand Adjustment Factor | This factor is a combination of one or more evaluation impact parameters applied to gross demand savings in the calculation of net demand savings.   |
| Diversity                | That characteristic of a variety of electric loads whereby individual maximum demands usually occur at different times.  |
| Diversity Factor         | Percent of savings available at the time of the Company's peak demand.   |
| DOE                      | Department of Energy   |
| DOER                     | Massachusetts Department of Energy Resources   |
| D&R                      | D&R International, the contractor to DOE and EPA that monitors sales of ENERGY STAR <sup>®</sup> appliances.   |
| DRIFE                    | Demand Response Induced Price Effect – the impact of efficiency and demand response programs on market prices. It is based on the economic theory that programs will reduce energy quantities in the future, resulting in lower prices for electric energy and capacity markets. |
| DSM                      | Demand Side Management   |
| D.T.E.                   | Massachusetts Department of Telecommunications and Energy  |
| D.P.U.                   | Massachusetts Department of Public Utilities   |

|                               |   |
|-------------------------------|---|
| EFLH                          | Equivalent Full Load Hours  |
| Energy Adjustment Factor      | A factor made up of one or more evaluation impact parameters applied to gross kWh savings in the calculation of net kWh savings.  |
| EPA                           | Environmental Protection Agency   |
| EPACT                         | Energy Policy Act   |
| ENERGY STAR®                  | Brand name for the voluntary energy efficiency labeling initiative sponsored by the U.S. Environmental Protection Agency and Department of Energy.  |
| Evaluation                    | Monies allocated for performing evaluation studies of projects, markets, etc., and the internal labor and expenses for staff that work within this category.  |
| Free Riders                   | Customers who participate in an energy efficiency program but would have installed the same measure(s) on their own if the program had not been available.  |
| Free-Ridership Rate           | The percent of savings attributable to Free Riders.   |
| FCM                           | Forward Capacity Market – ISO NE forecasts demand for the next three years and then conducts auctions, where both generation and demand resources may participate, to purchase sufficient capacity for reliable system operation at competitive prices. |
| Gross kW                      | Expected demand reduction based on a comparison of standard or replaced equipment, and equipment installed through an energy efficiency program.  |
| Gross kWh                     | Expected kWh reduction based on a comparison of standard or replaced equipment, and equipment installed through an energy efficiency program.   |
| GSHP                          | Ground Source Heat Pump   |
| GWh                           | Gigawatt-hour – a measure of electricity usage over time equal to 1,000 megawatt-hours or 1,000,000 kilowatt-hours.   |
| HEM                           | Home Energy Management  |
| Hours of Use                  | The estimated number of hours per year that a measure operates.   |
| Hours of Use Realization Rate | Ratio of actual metered hours of use data to estimated hours of use data.   |
| Hp                            | Horsepower  |
| HVAC                          | Heating Ventilation and Air Conditioning  |
| Impact Factor                 | Generic term for persistence, realization rates, in-service rates, non-coincident connected demand factors, etc., developed during the evaluation of energy efficiency programs and used to calculate net savings.                                      |

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|---------------------------|---|
| ISO NE                    | Independent System Operator New England   |
| ISOS                      | Industrial Systems Optimization Service   |
| JMC                       | The Joint Management Committee of utility and non-utility parties that manages the ENERGY STAR <sup>®</sup> Homes Program.  |
| kWh                       | Kilowatt-hour – The basic unit of electric energy usage over time. One kWh is equal to one kW of power supplied to a circuit for a period of one hour.  |
| kW                        | Kilowatt-A measure of electric demand - 1000 watts.   |
| kW- Years                 | See: Lifetime kW  |
| Lifetime                  | The expected length of time, in years, that an installed measure will be in service and producing savings.  |
| Lifetime kW               | The expected demand savings over the lifetime of an installed measure, calculated by multiplying the annual peak kW reduction associated with a measure by the expected lifetime of that measure. It is expressed in units of kW-years. |
| Lifetime MWh              | The expected energy savings over the lifetime of an installed measure, calculated by multiplying the annual MWh reduction associated with a measure by the expected lifetime of that measure.   |
| LIHEAP                    | Low-income Heating Assistance Program   |
| Lost Base Revenue (LBR)   | For companies not operating under decoupled rate structure, these costs account for revenues not collected by the Company's distribution business as a result of the energy efficiency undertaken during the program year.              |
| Marketing                 | Internal marketing and advertising costs, including labor and expenses for staff. External media costs for television, radio, billboards, brochures, telemarketing, web-sites, and mailings, as well as marketing association fees.     |
| Maximum Annual kW Savings | Peak annual demand savings of a measure. At the program level, this equals the sum of the annual peak demand savings across all measures.   |
| Measure                   | Specific technology or practice that produces energy and/or demand savings for which the Company provides financial incentives.   |
| MOU                       | Memorandum of Understanding   |
| MPER                      | Multi-Year Program Evaluation and Market Progress Reporting, or Market Progress and Evaluation Report, developed for various residential programs.  |
| MW                        | Megawatt – a measure of electric demand equal to 1,000 kilowatts.   |
| MWh                       | Megawatt-hour – a measure of energy use over time equal to 1,000 kilowatt-hours.  |
| NATE                      | North American Technician Excellence Program  |

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| NEEP   | Northeast Energy Efficiency Partnerships  |
| NUP  | Non-utility parties, who participate in some program planning activities.   |
| Net to Gross Ratio                           | A factor representing net program savings divided by gross program savings that is applied to gross program impacts to convert them into net program load impacts.  |
| O&M  | Operation and Maintenance   |
| Off-Peak energy kWh                          | The kWh reduction that occurs during the Company's off-peak hours for energy (Monday-Friday, 9 p.m. to 8 a.m. and all day on weekends and holidays).  |
| On-Peak Energy kWh                           | The kWh reduction that occurs during the Company's on-peak hours for energy (Monday-Friday, 8 a.m. to 9 p.m., except holidays).   |
| Participant Cost                             | Is the total cost of a project or measure less the customer incentive   |
| Performance Incentive (PI)                   | Compensation for the Company's successful execution of the energy efficiency programs during the program year as determined by Massachusetts Department of Public Utilities.  |
| Persistence Rate                             | Percentage of first year energy or demand savings expected to persist over the life of the installed energy efficiency equipment; developed by conducting surveys of installed equipment several years after installation to determine presence and operational capability of the equipment.                  |
| PMR  | Performance Measurement Report  |
| PRISM  | Princeton scorekeeping Method- tool that analyzes DSM savings for large samples of buildings or homes.  |
| Program Planning & Administration (PP&A)     | Day to day administration of programs including: employee labor, benefits, expenses, materials, supplies, taxes, overhead, and internal administrative and general expenses. Also included are external expenses such as consultant fees, legal activities, and external administrative and general expenses. |
| RCS  | Residential Conservation Services. Formerly Energy Conservation Service or ECS.   |
| Sales Technical Assistance & Training (STAT) | Internal labor and expenses for field personnel delivering programs, vendor administration fees, vendor sales costs (rebate processing fees, contractor installation fees), technical assessment study costs paid to vendors for engineering studies of potential energy efficiency projects.                 |
| SBS  | Small Business Services program, formerly known as Small Commercial and Industrial Program.   |
| Seasonal (Winter/Summer) kW                  | The net demand reduction during either the Winter or Summer seasons.  |

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| Spillover      | Additional energy efficient equipment installed by customers that was influenced by the Company's sponsored program, but without direct financial or technical assistance from the program. Spillover is separated into <u>Participant</u> and <u>Non-participant</u> factors. Non-participating customers may be influenced by product availability, publicity, education and other factors that are affected by the program. |
| Spillover Rate | Estimate of energy savings attributable to spillover effects expressed as a percent of savings installed by participants through an energy efficiency program.   |
| VSD            | Variable Speed Drive   |
| WAP            | Weatherization Assistance Program  |
| Watt           | The basic electrical unit of power.  |

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## APPENDIX B: COST-EFFECTIVENESS SUPPORTING TABLES AND DOCUMENTATION

### B1. D.P.U. 08-50 TABLES

Please see the attached tables. An electronic version of these tables is included on CD-Rom in Microsoft Excel format.

### B2. SCREENING TOOL

Please see CD-Rom, with the screening tool in Microsoft Excel format.

### B3. TECHNICAL REFERENCE MANUAL

The Annual Report template approved by the Department requires Program Administrators to provide the reported version of the TRM, as well as a summary of any changes between the planned and reported versions of the TRM and the impact of these changes on the relevant energy efficiency programs. See Order Adopting Energy Efficiency Annual Report Template, D.P.U. 08-50-C at 5, 20 (May 5, 2011). However, 2011 is the first year in which plan and report versions of a TRM will be available. See the Massachusetts Technical Reference Manual for Estimating Savings from Energy Efficiency Measures, 2011 Program Year – Plan Version, October 2010, Revised March 3, 2011 at Page 8. Therefore, 2011 is the first year that a summary of changes document will be available in the TRM format.

The Company recognizes that implicit in D.P.U. 08-50-C is the understanding that the Annual Report template is intended to serve as the model for all future annual reports and that any content that is not applicable to a given program year will be noted as such. Since there is no plan and report version of the TRM for 2010, the Company notes that it cannot populate this section of the report with a plan and report version of the TRM.

However, in recognition of the needs of the Department and other stakeholders for transparency and given time and resource requirements, the Company is providing a spreadsheet showing the cells that changed in the evaluated BCR model as compared to the preliminary BCR model due to: 1) impact evaluation studies; and 2) the use of actual results instead of plan estimates. The Company notes that the format of this document is different than the likely format of the summary of changes document that will be filed in 2011, which will more closely align with the plan and report TRM formats.

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## APPENDIX C: PROGRAM AND PILOT PROGRAM EM&V STUDIES

Please see VOLUME 3 (Evaluation Studies)

## APPENDIX D: PERFORMANCE INCENTIVES SUPPORTING DOCUMENTATION

### D1. CALCULATION OF PERFORMANCE INCENTIVES

Tables D1 through D3 provide a summary of the Company's 2010 Earned Performance Incentive.

### D2. METRICS DOCUMENTATION

Metrics documentation is provided in Appendix D2.



**APPENDIX E: OTHER SUPPORTING DOCUMENTATION**

**E1. COMPETITIVE PROCUREMENT**

A summary of the statewide competitive procurement activities is provided below. Abridged<sup>9</sup> copies of the Requests for Proposals (RFPs) are attached as Appendix E2.

| TOPIC  | WINNER OF BID                          | NUMBER OF VENDORS RECEIVING RFP | NUMBER OF RESPONSES |
|--|--|---------------------------------|---------------------|
| Statewide Outreach, Education, and Marketing                 | Cadmus Group, Inc.                     | 21                              | 12                  |
| Statewide QA/QC for Residential Programs                     | Competitive Resources, Inc.            | 28                              | 6                   |
| Large Commercial & Industrial Evaluations                    | KEMA, Inc.                             | 67                              | 4                   |
| Residential New Construction (Energy Star Homes) Evaluations | NMR Group, Inc.                        | 67                              | 1                   |
| Non-Residential Small Retrofit Area Evaluations              | Cadmus Group, Inc.                     | 73                              | 5                   |
| Residential Retail Product Evaluations                       | NMR Group, Inc.                        | 84                              | 2                   |
| Residential Retrofit & Low Income Area Evaluations           | Cadmus Group, Inc.                     | 73                              | 5                   |
| Multi-Family Market Integrator                               | RISE Engineering                       | 15                              | 8                   |
| Special and Cross-Cutting Multi-Evaluation Tasks             | Tetra Tech MA, Inc. & Opinion Dynamics |                                 |                     |

**E2. AUDIT DOCUMENTATION**

There have been no audits of the Company gas energy efficiency activities conducted during the last five years (2006-2010).

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<sup>9</sup> Complete copies of the RFPs are being provided to the Secretary of the Department of Public Utilities.

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## APPENDIX F: LOST BASE REVENUE INFORMATION

Table F1 summarizes the determination of Lost Base Revenue (“LBR”) actually collected by the Company during 2010. Savings were equal to the cumulative net savings as of December 31, 2008 – the last year for which the Company had received Department approval of its savings during the reporting period<sup>10</sup>.

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10 The Company received approval for its 2009 Gas Annual Report on May 23, 2011. The true-up adjustment to LBR will be made in 2011.