Cape Light Compact JPE

Plan-Year Report on
Energy Efficiency Activities
for 2019

Submitted to the
Massachusetts Department of Public Utilities
and the Massachusetts Department of Energy Resources

May 29, 2020

Cape Light Compact JPE

D.P.U. 20-50

2019 Energy Efficiency Plan-Year Report

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SECTION I
INTRODUCTION AND OVERVIEW

Cape Light Compact JPE Overview

The Cape Light Compact JPE ("Compact" or "CLC") is pleased with the results for the first year ("2019 Plan-Year") of its 2019–2021 Three-Year Energy Efficiency Plan ("2019–2021 Three-Year Plan"), the fourth of such plans envisioned by the Green Communities Act and approved by the Department of Public Utilities ("Department" or "DPU"). The Compact and the other Massachusetts Energy Efficiency Program Administrators ("Program Administrators" or "PAs") diligently implemented their respective plans over the past year, making significant progress toward their three-year goals. The 2019 Plan-Year built on the nationally acclaimed accomplishments of the 2016–2018 Three-Year Plan and previous plans, showing remarkable success with respect to goal attainment and achievement of real benefits for the environment and the economy in the Commonwealth of Massachusetts.

The results of the first year of the 2019–2021 Three-Year Plan, presented in this 2019 annual report ("Plan-Year Report"), indicate that the Compact is on track to reach its three-year goals by the end of 2021. Including actual results from 2019, the Compact achieved 37 percent of its three-year lifetime energy savings goal, achieved 27 percent of its three-year total benefit goal, and spent 31 percent of its planned three-year budget. Based on these results in combination with the 2020 and 2021 planned values, over the three-year term, the Compact expects to achieve:

- robustly cost-effective programs with a benefit-cost ratio ("BCR") of 2.49,
- net benefits of $255 million,
- annual energy savings of 112 gigawatt hours ("GWh"),
- lifetime energy savings of 890 GWh,
- total benefits of $389 million, and
- program costs of $134 million.

Organization of Plan-Year Report

The Compact's 2019 Plan-Year Report[1] is organized as follows:

- Section I provides an overview of the 2019 Plan-Year.
- Section II provides Compact-specific data tables at the core initiative level, including planned, preliminary, and evaluated data, and comparisons across the three different types of data.
- Appendix 1 provides explanations for (a) significant variances at the core initiative level and (b) any non-cost-effective core initiatives over the three-year term, consistent with the D.P.U. 11-120, Phase II, Energy Efficiency Plan-Year Report Template.
- Appendix 2 provides the Compact's evaluated BCR screening tool in Microsoft Excel format.
- Appendix 3 provides the 2019 Report Version of the statewide Technical Reference Manual.
- Appendix 4 provides detail on the year's evaluation efforts, including summaries for each statewide evaluation study and a complete copy of each evaluation study.
- Appendix 5 provides the statewide performance incentive model. Since the Compact is a public entity, it does not collect any performance incentives. As such, this section is not applicable to the Compact.
- Appendix 6 provides a miscellaneous statewide implementation update in addition to Compact-specific renter, income, and language data and a Compact-specific summary of shared costs and consumer advocacy matters.
- Appendix 7 provides the statewide MMBtu study.
- Appendix CLC-1 provides the Compact's town activity reports for the 2019 Plan-Year.
- Appendix CLC-2 provides the Compact's Energy Education Outreach activities for the 2019 Plan-Year.

[1] In previous annual reports, the Compact provided information on its financial reports. The Compact continues to provide its financial reports on its website at: www.capelightcompact.org/reports.

SECTION II
CAPE LIGHT COMPACT JPE DATA TABLES

Energy Efficiency Data Tables

2019 Plan Year Report Overview

Cape Light Compact
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DATA OVERVIEW

The following data tables provide a summary of the Program Administrator's benefits, costs, savings, and cost-effectiveness for 2019 through 2021. The planned values are consistent with each Program Administrator's 2019-2021 Three-Year Plan. The Compact's 2019–2021 Plan referenced in this section excludes the Compact's Cape and Vineyard Electrification Offering ("CVEO"). See Appendix I, Page 1 of this report for more details. The 2019 preliminary and evaluated values are presented here for the first time as part of each Program Administrator's 2019 Plan Year Report.

The data included in these tables is based on other supporting models. The primary supporting models used by the Program Administrators in the preparation of this 2019 Plan Year Report are the Benefit-Cost Screening model and the Performance Incentive model. These exhibits should be referenced when looking for more detailed analyses, such as measure-level savings. High-level summaries for each of these models are provided below.

USING THE DATA TABLES

These Plan Year Report data tables are in a pivot table format with set outputs based on the Department's direction in D.P.U. 11-120, Phase II. Users can manipulate the data by using either the raw data included on the Master Data tab, or the Slicers shown on the Selections tab. The Slicers will update the comparisons between the planned, preliminary, or evaluated results on the Plan Year Summary tables only.

BENEFIT-COST SCREENING MODEL

The Benefit-Cost Screening model provides measure-level savings and benefits. This model uses the avoided cost values from the 2018 Avoided Energy Supply Cost study prepared by Synapse Energy Economics, Inc.

PERFORMANCE INCENTIVE MODEL

The Performance Incentive model filed as part of the Joint Statewide Three-Year Plan provides support for the performance incentive dollars proposed for collection by the Program Administrator. Final performance incentive amounts will be based on the three-year term and will be subject to review and final approval in the three-year term report; the amounts shown in the Plan Year Report are based on the data available to date and will change as additional years of data are included. Note that performance incentives are not applicable to the Cape Light Compact.

EM&V ACTIVITIES

The Evaluation, Monitoring & Verification (EMV) Section of the Joint Statewide Three-Year Plan describes in detail the EM&V activities planned for 2019-2021. The EMV section of each Program Administrator's 2019 Plan Year Report summarizes the evaluation results completed in 2019 and their impact on the 2019 evaluated results. The Technical Reference Library (TRL) has been updated to account for recent evaluation results.

2019 Plan Year Report Data Tables

Template Version: May 27, 2020

PA-Specific Information

2019 Plan Year Report Filing Detail

Distribution Fuel	Electric
Program Administrator	Cape Light Compact
Date of Filing	May 29, 2020
Name of Filing	2019 Plan Year Report

PLAN FILINGS

Reporting Period	Filing Date	DPU Docket #
2019 Plan	February 19, 2019	D.P.U. 18-116
2020 Plan	February 19, 2019	D.P.U. 18-116
2021 Plan	February 19, 2019	D.P.U. 18-116
2019 Preliminary and Evaluated	May 29, 2020	D.P.U. 20-50
2020 Preliminary and Evaluated	TBD	D.P.U. 21-###
2021 Preliminary and Evaluated	TBD	D.P.U. 22-###

RATES FOR ADJUSTMENTS

2020 Nominal Discount Rate	2.33%	
2021 Nominal Discount Rate	2.33%	
Effective Tax Rate	27.32%	PA-specific

PLAN YEARS

Current Plan Year 1	2019
Current Plan Year 2	2020
Current Plan Year 3	2021

GHG EMISSIONS REDUCTION FACTORS (Short Tons)

GHG per:	NOX	SO2	CO2
Electricity (MWh)	0.00016	0.00004	0.49400
Gas (Therm)			0.00585
Oil (MMBTU)			0.08069
Propane (MMBTU)			0.06959
Source:	File named "3-year plan EFs 8-9-18.xlsx"		

Technical Reference Library

TRL Link	https://etrm.anbetrack.com/#/workarea/home?token=6

Selections for Data Displayed in Tables

2019 Plan Year Report

Cape Light Compact

May 29, 2020

Use the options in the boxes below to select the data shown and compared in the Term Report data tables.

Tables with Master Data source

Select comparison Year

Year

- 2019
- 2020
- 2021

Select comparison Reporting Periods

First Comparison	*Second Comparison*
Evaluated	Evaluated
Planned	Planned
Preliminary	Preliminary

Select the PA and corresponding Distribution Company

Program Administrator	*Distribution Company*
Cape Light Compact	Electric
Eversource	Gas
National Grid	(blank)
Statewide Electric	
Unitil	

Tables with Master ADR data source

Select comparison Year

Year

- 2019
- 2020
- 2021

Select comparison Reporting Periods

First Comparison	*Second Comparison*
Planned	Planned

Select the PA and corresponding Distribution Company

Program Administrator	*Distribution Company*
Cape Light Compact	Electric
Eversource	(blank)
National Grid	
Statewide Electric	
Unitil	
(blank)	

Notes

• To select more than one option, press the Control button while clicking on the options.

• If no data is included for a Program Administrator on the MasterData tabs, then the Program Administrator's name and distribution company may not appear in the above boxes. For example, if this a Program Administrator-specific filing, then the other Program Administrators names may not appear in the boxes for selection.

2019 Plan Year Report Variances

Variances Summary

Cape Light Compact
May 29, 2020

Variances Summary				
Program	Total Program Cost Variances	Lifetime Electric Savings (MWh) Variances	Total Benefits (2019$) Variances	Total Resource Benefits (2019$) Variances
A - Residential	**19%**	**69%**	**11%**	**-17%**
A1 - Residential New Buildings	3%	41%	-31%	-26%
A1a - Residential New Homes & Renovations	3%	41%	**-31%**	**-26%**
A2 - Residential Existing Buildings	21%	73%	15%	-16%
A2a - Residential Coordinated Delivery	**44%**	67%	35%	-12%
A2b - Residential Conservation Services (RCS)	6%			
A2c - Residential Retail	-4%	95%	-12%	**-24%**
A2d - Residential Behavior	**-31%**	**-94%**	**-90%**	-4%
A2e - Residential Active Demand Reduction				
A3 - Residential Hard-to-Measure	8%			
B - Income Eligible	**-10%**	**-11%**	**-26%**	**-1%**
B1 - Income Eligible Existing Buildings	-9%	-11%	-26%	-1%
B1a - Income Eligible Coordinated Delivery	-9%	-11%	**-26%**	-1%
B1b - Income Eligible Active Demand Reduction				
B2 - Income Eligible Hard-to-Measure	**-31%**			
C - Commercial & Industrial	**-38%**	**-30%**	**-52%**	**-3%**
C1 - C&I New Buildings	-45%	9%	17%	-3%
C1a - C&I New Buildings & Major Renovations	**-45%**	9%	17%	-3%
C2 - C&I Existing Buildings	-40%	-33%	-55%	-3%
C2a - C&I Existing Building Retrofit	**-40%**	**-39%**	**-59%**	-3%
C2b - C&I New & Replacement Equipment	**-42%**	8%	-3%	-3%
C2c - C&I Active Demand Reduction				
C3 - C&I Hard-to-Measure	3%			
Grand Total	**-3%**	**5%**	**-17%**	**-13%**

Notes

• Significant variances, which require explanation, are defined as:

(1) variances between *planned and actual* core initiative budget of *15 percent or greater;*
(2) variances between *planned and preliminary* core initiative *total lifetime savings* showing a *decrease of 15 percent or greater;*
(3) variances between *planned and preliminary* core initiative *total benefits* showing a *decrease of 15 percent or greater;* and
(4) variances between *preliminary and evaluated* core initiative *total resource benefits* showing a *decrease of 15 percent or greater* .

• Variances are calculated as a percent of the three-year goal, meaning variance are calculated as the percentage difference between the percentage of the Three-Year Plan goals planned to be achieved through the Plan Year Report year compared to the percentage of the Three-Year Plan goals actually achieved through the Plan Year Report year.

• Cells highlighted in the above tables indicate that a variance is significant enough to require explanation. Refer to the Program Administrator's Plan Year Report for explanations of significant variances.

2019 Plan Year Report Variances

Total Program Cost Variances

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Total Program Cost Variances								
Program	Planned				Actual	Planned v. Actual (%)		
	2019	2020	2021	2019-2021	2019	Planned 2019 % Total Plan	Actual 2019 % Total Plan	Planned v Actual (%)
A - Residential	**24,849,635**	**24,097,012**	**23,574,299**	**72,520,946**	**29,571,652**	**34%**	**41%**	**19%**
A1 - Residential New Buildings	925,744	975,692	1,030,425	2,931,861	958,135	32%	33%	3%
A1a - Residential New Homes & Renovations	925,744	975,692	1,030,425	2,931,861	958,135	32%	33%	3%
A2 - Residential Existing Buildings	20,990,223	20,071,681	19,403,931	60,465,835	25,457,914	35%	42%	21%
A2a - Residential Coordinated Delivery	11,165,815	10,966,175	11,219,816	33,351,806	16,089,258	33%	48%	**44%**
A2b - Residential Conservation Services (RCS)	1,914,195	1,921,625	1,937,560	5,773,380	2,031,757	33%	35%	6%
A2c - Residential Retail	7,048,565	6,035,629	5,080,625	18,164,818	6,741,839	39%	37%	-4%
A2d - Residential Behavior	861,648	730,438	678,351	2,270,438	595,059	38%	26%	**-31%**
A2e - Residential Active Demand Reduction	-	417,814	487,579	905,393	-	0%	0%	
A3 - Residential Hard-to-Measure	2,933,668	3,049,639	3,139,942	9,123,250	3,155,604	32%	35%	8%
B - Income Eligible	**4,177,118**	**4,514,047**	**5,000,459**	**13,691,624**	**3,757,783**	**31%**	**27%**	**-10%**
B1 - Income Eligible Existing Buildings	3,952,489	4,285,614	4,766,155	13,004,258	3,602,721	30%	28%	-9%
B1a - Income Eligible Coordinated Delivery	3,952,489	4,285,614	4,766,155	13,004,258	3,602,721	30%	28%	-9%
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-			
B2 - Income Eligible Hard-to-Measure	224,629	228,433	234,304	687,366	155,063	33%	23%	**-31%**
C - Commercial & Industrial	**14,888,929**	**16,628,489**	**17,507,342**	**49,024,760**	**9,219,403**	**30%**	**19%**	**-38%**
C1 - C&I New Buildings	626,369	632,111	642,013	1,900,493	342,308	33%	18%	-45%
C1a - C&I New Buildings & Major Renovations	626,369	632,111	642,013	1,900,493	342,308	33%	18%	**-45%**
C2 - C&I Existing Buildings	13,565,911	15,281,781	16,137,757	44,985,448	8,159,007	30%	18%	-40%
C2a - C&I Existing Building Retrofit	12,165,537	12,631,085	13,070,025	37,866,647	7,353,090	32%	19%	**-40%**
C2b - C&I New & Replacement Equipment	1,400,374	1,433,032	1,255,209	4,088,614	805,917	34%	20%	**-42%**
C2c - C&I Active Demand Reduction	-	1,217,664	1,812,523	3,030,187	-	0%	0%	
C3 - C&I Hard-to-Measure	696,649	714,597	727,572	2,138,818	718,087	33%	34%	3%
Grand Total	**43,915,682**	**45,239,548**	**46,082,099**	**135,237,329**	**42,548,838**	**32%**	**31%**	**-3%**

Notes

Plan year core initiative significant variance explanations are required for: (1) variances between planned and actual core initiative budget of 15 percent or greater.

2019 Plan Year Report Variances

Lifetime Electric Savings (MWh) Variances

Cape Light Compact

May 29, 2020

Lifetime Electric Savings (MWh) Variances								
Program	Planned				Preliminary	Planned v. Preliminary (%)		
	2019	2020	2021	2019-2021	2019	Planned 2019 % Total Plan	Preliminary 2019 % Total Plan	Planned v Preliminary (%)
A - Residential	**110,297**	**88,056**	**66,054**	**264,408**	**186,868**	**42%**	**71%**	**69%**
A1 - Residential New Buildings	13,800	13,850	13,395	41,046	19,499	34%	48%	41%
A1a - Residential New Homes & Renovations	13,800	13,850	13,395	41,046	19,499	34%	48%	41%
A2 - Residential Existing Buildings	96,497	74,206	52,659	223,362	167,369	43%	75%	73%
A2a - Residential Coordinated Delivery	48,931	43,434	45,461	137,825	81,900	36%	59%	67%
A2b - Residential Conservation Services (RCS)	-	-	-	-	-			
A2c - Residential Retail	43,614	24,117	(290)	67,441	85,223	65%	126%	95%
A2d - Residential Behavior	3,952	6,656	7,488	18,096	246	22%	1%	**-94%**
A2e - Residential Active Demand Reduction	-	-	-	-	-			
A3 - Residential Hard-to-Measure	-	-	-	-	-			
B - Income Eligible	**17,535**	**17,603**	**18,144**	**53,282**	**15,652**	**33%**	**29%**	**-11%**
B1 - Income Eligible Existing Buildings	17,535	17,603	18,144	53,282	15,652	33%	29%	-11%
B1a - Income Eligible Coordinated Delivery	17,535	17,603	18,144	53,282	15,652	33%	29%	-11%
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-			
B2 - Income Eligible Hard-to-Measure	-	-	-	-	-			
C - Commercial & Industrial	**195,060**	**202,036**	**196,715**	**593,812**	**136,666**	**33%**	**23%**	**-30%**
C1 - C&I New Buildings	14,033	17,434	18,260	49,727	15,294	28%	31%	9%
C1a - C&I New Buildings & Major Renovations	14,033	17,434	18,260	49,727	15,294	28%	31%	9%
C2 - C&I Existing Buildings	181,027	184,602	178,455	544,085	121,372	33%	22%	-33%
C2a - C&I Existing Building Retrofit	157,637	164,470	160,532	482,639	96,112	33%	20%	**-39%**
C2b - C&I New & Replacement Equipment	23,390	20,133	17,924	61,446	25,261	38%	41%	8%
C2c - C&I Active Demand Reduction	-	-	-	-	-			
C3 - C&I Hard-to-Measure	-	-	-	-	-			
Grand Total	**322,893**	**307,695**	**280,914**	**911,502**	**339,185**	**35%**	**37%**	**5%**

Notes

• Plan year core initiative significant variance explanations are required for: (2) variances between planned and preliminary core initiative total lifetime savings showing a decrease of 15 percent or greater.

• Total lifetime savings are not calculated for active demand reduction (ADR) measures. Correspondingly, a variance for total lifetime savings is not calculated for the ADR core initiatives in each sector.

2019 Plan Year Report Variances

Total Benefits (2019$) Variances

Cape Light Compact

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Total Benefits (2019$) Variances								
Program	Planned				Preliminary	Planned v. Preliminary (%)		
	2019	2020	2021	2019-2021	2019	Planned 2019 % Total Plan	Preliminary 2019 % Total Plan	Planned v Preliminary (%)
A - Residential	**73,921,750**	**69,517,588**	**67,062,991**	**210,502,329**	**81,845,679**	**35%**	**39%**	**11%**
A1 - Residential New Buildings	6,534,859	6,779,002	6,959,008	20,272,869	4,500,953	32%	22%	-31%
A1a - Residential New Homes & Renovations	6,534,859	6,779,002	6,959,008	20,272,869	4,500,953	32%	22%	**-31%**
A2 - Residential Existing Buildings	67,386,891	62,738,586	60,103,983	190,229,460	77,344,726	35%	41%	15%
A2a - Residential Coordinated Delivery	40,120,102	38,373,686	39,062,472	117,556,259	53,996,866	34%	46%	35%
A2b - Residential Conservation Services (RCS)	-	-	-	-	-			
A2c - Residential Retail	26,522,831	22,521,775	18,722,333	67,766,939	23,270,652	39%	34%	-12%
A2d - Residential Behavior	743,958	1,264,581	1,425,325	3,433,865	77,208	22%	2%	**-90%**
A2e - Residential Active Demand Reduction	-	578,543	893,853	1,472,397	-	0%	0%	
A3 - Residential Hard-to-Measure	-	-	-	-	-			
B - Income Eligible	**9,378,213**	**9,809,568**	**10,155,851**	**29,343,632**	**6,976,915**	**32%**	**24%**	**-26%**
B1 - Income Eligible Existing Buildings	9,378,213	9,809,568	10,155,851	29,343,632	6,976,915	32%	24%	-26%
B1a - Income Eligible Coordinated Delivery	9,378,213	9,809,568	10,155,851	29,343,632	6,976,915	32%	24%	**-26%**
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-			
B2 - Income Eligible Hard-to-Measure	-	-	-	-	-			
C - Commercial & Industrial	**54,973,612**	**62,766,069**	**67,059,186**	**184,798,867**	**26,301,870**	**30%**	**14%**	**-52%**
C1 - C&I New Buildings	1,854,264	2,225,554	2,321,632	6,401,450	2,164,523	29%	34%	17%
C1a - C&I New Buildings & Major Renovations	1,854,264	2,225,554	2,321,632	6,401,450	2,164,523	29%	34%	17%
C2 - C&I Existing Buildings	53,119,348	60,540,515	64,737,554	178,397,417	24,137,348	30%	14%	-55%
C2a - C&I Existing Building Retrofit	48,538,291	50,753,049	51,185,761	150,477,101	19,677,159	32%	13%	**-59%**
C2b - C&I New & Replacement Equipment	4,581,057	3,994,141	3,560,265	12,135,463	4,460,189	38%	37%	-3%
C2c - C&I Active Demand Reduction	-	5,793,324	9,991,528	15,784,852	-	0%	0%	
C3 - C&I Hard-to-Measure	-	-	-	-	-			
Grand Total	**138,273,576**	**142,093,224**	**144,278,028**	**424,644,828**	**115,124,464**	**33%**	**27%**	**-17%**

Notes

Plan year core initiative significant variance explanations are required for: (3) variances between planned and preliminary core initiative total benefits showing a decrease of 15 percent or greater.

2019 Plan Year Report Variances

Total Resource Benefits (2019$) Variances

Cape Light Compact

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Total Resource Benefits (2019$) Variances			
Program	2019		
	Preliminary	Evaluated	Preliminary v Evaluated (%)
A - Residential	**71,949,685**	**60,029,064**	**-17%**
A1 - Residential New Buildings	4,255,916	3,160,027	-26%
A1a - Residential New Homes & Renovations	4,255,916	3,160,027	**-26%**
A2 - Residential Existing Buildings	67,693,769	56,869,036	-16%
A2a - Residential Coordinated Delivery	45,663,941	40,019,265	-12%
A2b - Residential Conservation Services (RCS)	-	-	
A2c - Residential Retail	21,952,620	16,775,882	**-24%**
A2d - Residential Behavior	77,208	73,890	-4%
A2e - Residential Active Demand Reduction	-	-	
A3 - Residential Hard-to-Measure	-	-	
B - Income Eligible	**4,609,434**	**4,541,617**	**-1%**
B1 - Income Eligible Existing Buildings	4,609,434	4,541,617	-1%
B1a - Income Eligible Coordinated Delivery	4,609,434	4,541,617	-1%
B1b - Income Eligible Active Demand Reduction	-	-	
B2 - Income Eligible Hard-to-Measure	-	-	
C - Commercial & Industrial	**23,354,633**	**22,643,367**	**-3%**
C1 - C&I New Buildings	2,116,064	2,059,661	-3%
C1a - C&I New Buildings & Major Renovations	2,116,064	2,059,661	-3%
C2 - C&I Existing Buildings	21,238,569	20,583,706	-3%
C2a - C&I Existing Building Retrofit	16,845,558	16,313,758	-3%
C2b - C&I New & Replacement Equipment	4,393,011	4,269,948	-3%
C2c - C&I Active Demand Reduction	-	-	
C3 - C&I Hard-to-Measure	-	-	
Grand Total	**99,913,752**	**87,214,047**	**-13%**

Notes

Plan year core initiative significant variance explanations are required for: (4) variances between preliminary and evaluated core initiative total resource benefits showing a decrease of 15 percent or greater.

Program Administrator Budgets, Plan Year Summary

2019 Planned vs. Evaluated

Cape Light Compact

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2019 Planned Program Administrator Budget										
Program	Program Costs						Performance Incentive	Total Program Administrator Budget	Program Cost per Participant	Resource Benefit per Program Cost
	Program Planning and Administration	Marketing and Advertising	Participant Incentive	Sales, Technical Assistance & Training	Evaluation and Market Research	Total Program Costs				
A - Residential	**1,436,504**	**735,758**	**17,505,513**	**4,515,277**	**656,583**	**24,849,635**	**-**	**24,849,635**	**86**	**2.71**
A1 - Residential New Buildings	48,851	23,523	652,471	200,899	-	925,744	-	925,744	1,859	6.75
A1a - Residential New Homes & Renovations	48,851	23,523	652,471	200,899	-	925,744	-	925,744	1,859	6.75
A2 - Residential Existing Buildings	1,107,651	458,025	15,332,227	4,092,320	-	20,990,223	-	20,990,223	73	2.91
A2a - Residential Coordinated Delivery	589,219	159,042	8,729,232	1,688,323	-	11,165,815	-	11,165,815	3,039	3.10
A2b - Residential Conservation Services (RCS)	101,012	44,969	-	1,768,214	-	1,914,195	-	1,914,195		-
A2c - Residential Retail	371,952	244,787	5,815,495	616,331	-	7,048,565	-	7,048,565	36	3.64
A2d - Residential Behavior	45,469	9,227	787,500	19,452	-	861,648	-	861,648	10	0.86
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-		
A3 - Residential Hard-to-Measure	280,001	254,210	1,520,816	222,058	656,583	2,933,668	-	2,933,668		-
A3a - Residential Statewide Marketing	-	159,797	-	-	-	159,797	-	159,797		-
A3b - Residential Statewide Database	8,193	-	-	-	-	8,193	-	8,193		-
A3c - Residential DOER Assessment	145,089	-	-	-	-	145,089	-	145,089		-
A3d - Residential Sponsorships & Subscriptions	-	-	-	-	-	-	-	-		
A3e - Residential Workforce Development	-	-	-	37,590	-	37,590	-	37,590		-
A3f - Residential Evaluation and Market Research	-	-	-	-	656,583	656,583	-	656,583		-
A3g - Residential EEAC Consultants	40,912	-	-	-	-	40,912	-	40,912		-
A3h - Residential R&D and Demonstration	-	-	134,426	-	-	134,426	-	134,426		-
A3i - Residential HEAT Loan	85,808	19,413	1,386,390	134,468	-	1,626,079	-	1,626,079		-
A3j - Residential Education	-	75,000	-	50,000	-	125,000	-	125,000		-
B - Income Eligible	**258,317**	**91,637**	**3,030,377**	**675,712**	**121,075**	**4,177,118**	**-**	**4,177,118**	**3,094**	**1.29**
B1 - Income Eligible Existing Buildings	198,336	73,064	3,030,377	650,712	-	3,952,489	-	3,952,489	2,928	1.36
B1a - Income Eligible Coordinated Delivery	198,336	73,064	3,030,377	650,712	-	3,952,489	-	3,952,489	2,928	1.36
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-		
B2 - Income Eligible Hard-to-Measure	59,981	18,573	-	25,000	121,075	224,629	-	224,629		-
B2a - Income Eligible Statewide Marketing	-	18,573	-	-	-	18,573	-	18,573		-
B2b - Income Eligible Statewide Database	1,013	-	-	-	-	1,013	-	1,013		-
B2c - Income Eligible DOER Assessment	29,381	-	-	-	-	29,381	-	29,381		-
B2d - Income Eligible Sponsorships & Subscriptions	-	-	-	-	-	-	-	-		
B2e - Income Eligible Workforce Development	-	-	-	25,000	-	25,000	-	25,000		-
B2f - Income Eligible Evaluation and Market Research	-	-	-	-	121,075	121,075	-	121,075		-
B2g - Income Eligible Energy Affordability Network	29,587	-	-	-	-	29,587	-	29,587		-
C - Commercial & Industrial	**1,008,797**	**344,481**	**11,367,305**	**1,676,934**	**491,412**	**14,888,929**	**-**	**14,888,929**	**7,600**	**2.18**
C1 - C&I New Buildings	51,014	7,608	360,650	207,097	-	626,369	-	626,369	12,527	2.90
C1a - C&I New Buildings & Major Renovations	51,014	7,608	360,650	207,097	-	626,369	-	626,369	12,527	2.90
C2 - C&I Existing Buildings	852,661	302,612	10,969,155	1,441,483	-	13,565,911	-	13,565,911	7,106	2.26
C2a - C&I Existing Building Retrofit	766,142	255,339	10,055,054	1,089,002	-	12,165,537	-	12,165,537	16,308	2.14
C2b - C&I New & Replacement Equipment	86,519	47,273	914,101	352,481	-	1,400,374	-	1,400,374	1,204	3.23
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-		
C3 - C&I Hard-to-Measure	105,122	34,261	37,500	28,354	491,412	696,649	-	696,649		-
C3a - C&I Statewide Marketing	-	29,261	-	-	-	29,261	-	29,261		-
C3b - C&I Statewide Database	1,394	-	-	-	-	1,394	-	1,394		-
C3c - C&I DOER Assessment	97,530	-	-	-	-	97,530	-	97,530		-
C3d - C&I Sponsorships & Subscriptions	-	-	-	-	-	-	-	-		
C3e - C&I Workforce Development	-	5,000	-	28,354	-	33,354	-	33,354		-
C3f - C&I Evaluation and Market Research	-	-	-	-	491,412	491,412	-	491,412		-
C3g - C&I EEAC Consultants	6,197	-	-	-	-	6,197	-	6,197		-
C3h - C&I R&D and Demonstration	-	-	37,500	-	-	37,500	-	37,500		-
Grand Total	**2,703,617**	**1,171,876**	**31,903,196**	**6,867,923**	**1,269,070**	**43,915,682**	**-**	**43,915,682**	**150**	**2.39**

Program Administrator Budgets, Plan Year Summary

2019 Planned vs. Evaluated

Cape Light Compact

May 29, 2020

2019 Evaluated Program Administrator Budget										
Program	Program Costs						Performance Incentive	Total Program Administrator Budget	Program Cost per Participant	Resource Benefit per Program Cost
	Program Planning and Administration	Marketing and Advertising	Participant Incentive	Sales, Technical Assistance & Training	Evaluation and Market Research	Total Program Costs				
A - Residential	**1,503,624**	**580,889**	**21,425,751**	**5,573,413**	**487,975**	**29,571,652**	**-**	**29,571,652**	**104**	**2.03**
A1 - Residential New Buildings	53,739	18,586	742,424	143,386	-	958,135	-	958,135	2,618	3.30
A1a - Residential New Homes & Renovations	53,739	18,586	742,424	143,386	-	958,135	-	958,135	2,618	3.30
A2 - Residential Existing Buildings	1,229,555	418,123	18,568,967	5,241,269	-	25,457,914	-	25,457,914	90	2.23
A2a - Residential Coordinated Delivery	648,167	150,970	13,092,573	2,197,548	-	16,089,258	-	16,089,258	1,555	2.49
A2b - Residential Conservation Services (RCS)	122,206	32,754	-	1,876,796	-	2,031,757	-	2,031,757	314	-
A2c - Residential Retail	409,164	224,631	5,467,358	640,686	-	6,741,839	-	6,741,839	25	2.49
A2d - Residential Behavior	50,018	9,768	9,036	526,237	-	595,059	-	595,059	297,529	0.12
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-		
A3 - Residential Hard-to-Measure	220,331	144,180	2,114,359	188,758	487,975	3,155,604	-	3,155,604	1,833	-
A3a - Residential Statewide Marketing	-	92,938	-	-	-	92,938	-	92,938		-
A3b - Residential Statewide Database	1,361	-	-	-	-	1,361	-	1,361		-
A3c - Residential DOER Assessment	124,577	-	-	-	-	124,577	-	124,577		-
A3d - Residential Sponsorships & Subscriptions	-	-	-	-	-	-	-	-		
A3e - Residential Workforce Development	-	-	-	12,663	-	12,663	-	12,663		-
A3f - Residential Evaluation and Market Research	-	-	-	-	487,975	487,975	-	487,975		-
A3g - Residential EEAC Consultants	-	-	-	-	-	-	-	-		
A3h - Residential R&D and Demonstration	-	-	-	-	-	-	-	-		
A3i - Residential HEAT Loan	94,393	18,661	2,114,359	167,267	-	2,394,681	-	2,394,681	1,391	-
A3j - Residential Education	-	32,581	-	8,827	-	41,409	-	41,409		-
B - Income Eligible	**265,884**	**70,574**	**2,739,800**	**594,915**	**86,610**	**3,757,783**	**-**	**3,757,783**	**1,655**	**1.21**
B1 - Income Eligible Existing Buildings	218,940	49,155	2,739,800	594,826	-	3,602,721	-	3,602,721	1,587	1.26
B1a - Income Eligible Coordinated Delivery	218,940	49,155	2,739,800	594,826	-	3,602,721	-	3,602,721	1,587	1.26
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-		
B2 - Income Eligible Hard-to-Measure	46,944	21,420	-	89	86,610	155,063	-	155,063		-
B2a - Income Eligible Statewide Marketing	-	21,420	-	-	-	21,420	-	21,420		-
B2b - Income Eligible Statewide Database	235	-	-	-	-	235	-	235		-
B2c - Income Eligible DOER Assessment	14,927	-	-	-	-	14,927	-	14,927		-
B2d - Income Eligible Sponsorships & Subscriptions	-	-	-	-	-	-	-	-		
B2e - Income Eligible Workforce Development	-	-	-	89	-	89	-	89		-
B2f - Income Eligible Evaluation and Market Research	-	-	-	-	86,610	86,610	-	86,610		-
B2g - Income Eligible Energy Affordability Network	31,782	-	-	-	-	31,782	-	31,782		-
C - Commercial & Industrial	**974,019**	**296,204**	**6,334,595**	**1,049,183**	**565,402**	**9,219,403**	**-**	**9,219,403**	**6,794**	**2.46**
C1 - C&I New Buildings	39,778	7,038	184,531	110,961	-	342,308	-	342,308	12,225	6.02
C1a - C&I New Buildings & Major Renovations	39,778	7,038	184,531	110,961	-	342,308	-	342,308	12,225	6.02
C2 - C&I Existing Buildings	861,624	224,710	6,150,064	922,610	-	8,159,007	-	8,159,007	6,139	2.52
C2a - C&I Existing Building Retrofit	772,693	193,753	5,636,214	750,430	-	7,353,090	-	7,353,090	9,883	2.22
C2b - C&I New & Replacement Equipment	88,931	30,956	513,850	172,180	-	805,917	-	805,917	1,378	5.30
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-		
C3 - C&I Hard-to-Measure	72,617	64,456	-	15,613	565,402	718,087	-	718,087		-
C3a - C&I Statewide Marketing	-	64,373	-	-	-	64,373	-	64,373		-
C3b - C&I Statewide Database	751	-	-	-	-	751	-	751		-
C3c - C&I DOER Assessment	71,866	-	-	-	-	71,866	-	71,866		-
C3d - C&I Sponsorships & Subscriptions	-	-	-	-	-	-	-	-		
C3e - C&I Workforce Development	-	83	-	15,613	-	15,696	-	15,696		-
C3f - C&I Evaluation and Market Research	-	-	-	-	565,402	565,402	-	565,402		-
C3g - C&I EEAC Consultants	-	-	-	-	-	-	-	-		
C3h - C&I R&D and Demonstration	-	-	-	-	-	-	-	-		
Grand Total	**2,743,528**	**947,667**	**30,500,145**	**7,217,511**	**1,139,987**	**42,548,838**	**-**	**42,548,838**	**148**	**2.05**

Program Administrator Budgets, Plan Year Summary

2019 Planned vs. Evaluated

Cape Light Compact

May 29, 2020

2019 Planned v. Evaluated Program Administrator Budget Variances (%)										
Program	Program Costs						Performance Incentive	Total Program Administrator Budget	Program Cost per Participant	Resource Benefit per Program Cost
	Program Planning and Administration	Marketing and Advertising	Participant Incentive	Sales, Technical Assistance & Training	Evaluation and Market Research	Total Program Costs				
A - Residential	**5%**	**-21%**	**22%**	**23%**	**-26%**	**19%**		**19%**	**21%**	**-25%**
A1 - Residential New Buildings	10%	-21%	14%	-29%		3%		3%	41%	-51%
A1a - Residential New Homes & Renovations	10%	-21%	14%	-29%		3%		3%	41%	-51%
A2 - Residential Existing Buildings	11%	-9%	21%	28%		21%		21%	24%	-23%
A2a - Residential Coordinated Delivery	10%	-5%	50%	30%		44%		44%	-49%	-20%
A2b - Residential Conservation Services (RCS)	21%	-27%		6%		6%		6%		
A2c - Residential Retail	10%	-8%	-6%	4%		-4%		-4%	-30%	-32%
A2d - Residential Behavior	10%	6%	-99%	2605%		-31%		-31%	3107624%	-86%
A2e - Residential Active Demand Reduction										
A3 - Residential Hard-to-Measure	-21%	-43%	39%	-15%	-26%	8%		8%		
A3a - Residential Statewide Marketing		-42%				-42%		-42%		
A3b - Residential Statewide Database	-83%					-83%		-83%		
A3c - Residential DOER Assessment	-14%					-14%		-14%		
A3d - Residential Sponsorships & Subscriptions										
A3e - Residential Workforce Development				-66%		-66%		-66%		
A3f - Residential Evaluation and Market Research					-26%	-26%		-26%		
A3g - Residential EEAC Consultants	-100%					-100%		-100%		
A3h - Residential R&D and Demonstration			-100%			-100%		-100%		
A3i - Residential HEAT Loan	10%	-4%	53%	24%		47%		47%		
A3j - Residential Education		-57%		-82%		-67%		-67%		
B - Income Eligible	**3%**	**-23%**	**-10%**	**-12%**	**-28%**	**-10%**		**-10%**	**-46%**	**-6%**
B1 - Income Eligible Existing Buildings	10%	-33%	-10%	-9%		-9%		-9%	-46%	-8%
B1a - Income Eligible Coordinated Delivery	10%	-33%	-10%	-9%		-9%		-9%	-46%	-8%
B1b - Income Eligible Active Demand Reduction										
B2 - Income Eligible Hard-to-Measure	-22%	15%		-100%	-28%	-31%		-31%		
B2a - Income Eligible Statewide Marketing		15%				15%		15%		
B2b - Income Eligible Statewide Database	-77%					-77%		-77%		
B2c - Income Eligible DOER Assessment	-49%					-49%		-49%		
B2d - Income Eligible Sponsorships & Subscriptions										
B2e - Income Eligible Workforce Development				-100%		-100%		-100%		
B2f - Income Eligible Evaluation and Market Research					-28%	-28%		-28%		
B2g - Income Eligible Energy Affordability Network	7%					7%		7%		
C - Commercial & Industrial	**-3%**	**-14%**	**-44%**	**-37%**	**15%**	**-38%**		**-38%**	**-11%**	**13%**
C1 - C&I New Buildings	-22%	-7%	-49%	-46%		-45%		-45%	-2%	107%
C1a - C&I New Buildings & Major Renovations	-22%	-7%	-49%	-46%		-45%		-45%	-2%	107%
C2 - C&I Existing Buildings	1%	-26%	-44%	-36%		-40%		-40%	-14%	12%
C2a - C&I Existing Building Retrofit	1%	-24%	-44%	-31%		-40%		-40%	-39%	4%
C2b - C&I New & Replacement Equipment	3%	-35%	-44%	-51%		-42%		-42%	14%	64%
C2c - C&I Active Demand Reduction										
C3 - C&I Hard-to-Measure	-31%	88%	-100%	-45%	15%	3%		3%		
C3a - C&I Statewide Marketing		120%				120%		120%		
C3b - C&I Statewide Database	-46%					-46%		-46%		
C3c - C&I DOER Assessment	-26%					-26%		-26%		
C3d - C&I Sponsorships & Subscriptions										
C3e - C&I Workforce Development		-98%		-45%		-53%		-53%		
C3f - C&I Evaluation and Market Research					15%	15%		15%		
C3g - C&I EEAC Consultants	-100%					-100%		-100%		
C3h - C&I R&D and Demonstration			-100%			-100%		-100%		
Grand Total	**1%**	**-19%**	**-4%**	**5%**	**-10%**	**-3%**		**-3%**	**-2%**	**-14%**

Notes

• Where not otherwise indicated, budgets for each year are represented in nominal dollars (2019$, 2020$, 2021$).

• Refer to common definitions for allocation of costs.

• The plan year variances provided above are intended to indicate the Program Administrator's performance in the plan year only. The variances used to determine significant variances are provided separately. The variances above and the significant variances use different calculations to determine variances on an annual basis and over the three-year term, respectively.

Program Administrator Budgets, Three-Year Total

2019-2021 Program Administrator Budget

Cape Light Compact

May 29, 2020

2019 Evaluated Program Administrator Budget										
Program	Program Costs						Performance Incentive	Total Program Administrator Budget	Program Cost per Participant	Resource Benefit per Program Cost
	Program Planning and Administration	Marketing and Advertising	Participant Incentive	Sales, Technical Assistance & Training	Evaluation and Market Research	Total Program Costs				
A - Residential	**1,503,624**	**580,889**	**21,425,751**	**5,573,413**	**487,975**	**29,571,652**	**-**	**29,571,652**	**104**	**2.03**
A1 - Residential New Buildings	53,739	18,586	742,424	143,386	-	958,135	-	958,135	2,618	3.30
A1a - Residential New Homes & Renovations	53,739	18,586	742,424	143,386	-	958,135	-	958,135	2,618	3.30
A2 - Residential Existing Buildings	1,229,555	418,123	18,568,967	5,241,269	-	25,457,914	-	25,457,914	90	2.23
A2a - Residential Coordinated Delivery	648,167	150,970	13,092,573	2,197,548	-	16,089,258	-	16,089,258	1,555	2.49
A2b - Residential Conservation Services (RCS)	122,206	32,754	-	1,876,796	-	2,031,757	-	2,031,757	314	-
A2c - Residential Retail	409,164	224,631	5,467,358	640,686	-	6,741,839	-	6,741,839	25	2.49
A2d - Residential Behavior	50,018	9,768	9,036	526,237	-	595,059	-	595,059	297,529	0.12
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-		
A3 - Residential Hard-to-Measure	220,331	144,180	2,114,359	188,758	487,975	3,155,604	-	3,155,604	1,833	-
A3a - Residential Statewide Marketing	-	92,938	-	-	-	92,938	-	92,938		-
A3b - Residential Statewide Database	1,361	-	-	-	-	1,361	-	1,361		-
A3c - Residential DOER Assessment	124,577	-	-	-	-	124,577	-	124,577		-
A3d - Residential Sponsorships & Subscriptions	-	-	-	-	-	-	-	-		
A3e - Residential Workforce Development	-	-	-	12,663	-	12,663	-	12,663		-
A3f - Residential Evaluation and Market Research	-	-	-	-	487,975	487,975	-	487,975		-
A3g - Residential EEAC Consultants	-	-	-	-	-	-	-	-		
A3h - Residential R&D and Demonstration	-	-	-	-	-	-	-	-		
A3i - Residential HEAT Loan	94,393	18,661	2,114,359	167,267	-	2,394,681	-	2,394,681	1,391	-
A3j - Residential Education	-	32,581	-	8,827	-	41,409	-	41,409		-
B - Income Eligible	**265,884**	**70,574**	**2,739,800**	**594,915**	**86,610**	**3,757,783**	**-**	**3,757,783**	**1,655**	**1.21**
B1 - Income Eligible Existing Buildings	218,940	49,155	2,739,800	594,826	-	3,602,721	-	3,602,721	1,587	1.26
B1a - Income Eligible Coordinated Delivery	218,940	49,155	2,739,800	594,826	-	3,602,721	-	3,602,721	1,587	1.26
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-		
B2 - Income Eligible Hard-to-Measure	46,944	21,420	-	89	86,610	155,063	-	155,063		-
B2a - Income Eligible Statewide Marketing	-	21,420	-	-	-	21,420	-	21,420		-
B2b - Income Eligible Statewide Database	235	-	-	-	-	235	-	235		-
B2c - Income Eligible DOER Assessment	14,927	-	-	-	-	14,927	-	14,927		-
B2d - Income Eligible Sponsorships & Subscriptions	-	-	-	-	-	-	-	-		
B2e - Income Eligible Workforce Development	-	-	-	89	-	89	-	89		-
B2f - Income Eligible Evaluation and Market Research	-	-	-	-	86,610	86,610	-	86,610		-
B2g - Income Eligible Energy Affordability Network	31,782	-	-	-	-	31,782	-	31,782		-
C - Commercial & Industrial	**974,019**	**296,204**	**6,334,595**	**1,049,183**	**565,402**	**9,219,403**	**-**	**9,219,403**	**6,794**	**2.46**
C1 - C&I New Buildings	39,778	7,038	184,531	110,961	-	342,308	-	342,308	12,225	6.02
C1a - C&I New Buildings & Major Renovations	39,778	7,038	184,531	110,961	-	342,308	-	342,308	12,225	6.02
C2 - C&I Existing Buildings	861,624	224,710	6,150,064	922,610	-	8,159,007	-	8,159,007	6,139	2.52
C2a - C&I Existing Building Retrofit	772,693	193,753	5,636,214	750,430	-	7,353,090	-	7,353,090	9,883	2.22
C2b - C&I New & Replacement Equipment	88,931	30,956	513,850	172,180	-	805,917	-	805,917	1,378	5.30
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-		
C3 - C&I Hard-to-Measure	72,617	64,456	-	15,613	565,402	718,087	-	718,087		-
C3a - C&I Statewide Marketing	-	64,373	-	-	-	64,373	-	64,373		-
C3b - C&I Statewide Database	751	-	-	-	-	751	-	751		-
C3c - C&I DOER Assessment	71,866	-	-	-	-	71,866	-	71,866		-
C3d - C&I Sponsorships & Subscriptions	-	-	-	-	-	-	-	-		
C3e - C&I Workforce Development	-	83	-	15,613	-	15,696	-	15,696		-
C3f - C&I Evaluation and Market Research	-	-	-	-	565,402	565,402	-	565,402		-
C3g - C&I EEAC Consultants	-	-	-	-	-	-	-	-		
C3h - C&I R&D and Demonstration	-	-	-	-	-	-	-	-		
Grand Total	**2,743,528**	**947,667**	**30,500,145**	**7,217,511**	**1,139,987**	**42,548,838**	**-**	**42,548,838**	**148**	**2.05**

Program Administrator Budgets, Three-Year Total

2019-2021 Program Administrator Budget

Cape Light Compact

May 29, 2020

2020 Planned Program Administrator Budget										
Program	Program Costs						Performance Incentive	Total Program Administrator Budget	Program Cost per Participant	Resource Benefit per Program Cost
	Program Planning and Administration	Marketing and Advertising	Participant Incentive	Sales, Technical Assistance & Training	Evaluation and Market Research	Total Program Costs				
A - Residential	**1,436,066**	**737,359**	**16,407,017**	**4,861,567**	**655,004**	**24,097,012**	**-**	**24,097,012**	**99**	**2.62**
A1 - Residential New Buildings	52,861	25,566	694,050	203,215	-	975,692	-	975,692	1,887	6.64
A1a - Residential New Homes & Renovations	52,861	25,566	694,050	203,215	-	975,692	-	975,692	1,887	6.64
A2 - Residential Existing Buildings	1,094,024	454,630	14,091,739	4,431,288	-	20,071,681	-	20,071,681	83	2.82
A2a - Residential Coordinated Delivery	594,128	157,387	8,409,067	1,805,594	-	10,966,175	-	10,966,175	3,014	3.00
A2b - Residential Conservation Services (RCS)	104,110	46,793	-	1,770,722	-	1,921,625	-	1,921,625		-
A2c - Residential Retail	326,999	230,112	4,872,982	605,535	-	6,035,629	-	6,035,629	37	3.62
A2d - Residential Behavior	39,574	8,485	665,000	17,379	-	730,438	-	730,438	10	1.73
A2e - Residential Active Demand Reduction	29,213	11,853	144,690	232,058	-	417,814	-	417,814		1.38
A3 - Residential Hard-to-Measure	289,180	257,163	1,621,228	227,064	655,004	3,049,639	-	3,049,639		-
A3a - Residential Statewide Marketing	-	159,797	-	-	-	159,797	-	159,797		-
A3b - Residential Statewide Database	8,193	-	-	-	-	8,193	-	8,193		-
A3c - Residential DOER Assessment	145,089	-	-	-	-	145,089	-	145,089		-
A3d - Residential Sponsorships & Subscriptions	-	-	-	-	-	-	-	-		
A3e - Residential Workforce Development	-	-	-	37,590	-	37,590	-	37,590		-
A3f - Residential Evaluation and Market Research	-	-	-	-	655,004	655,004	-	655,004		-
A3g - Residential EEAC Consultants	40,912	-	-	-	-	40,912	-	40,912		-
A3h - Residential R&D and Demonstration	-	-	124,817	-	-	124,817	-	124,817		-
A3i - Residential HEAT Loan	94,987	22,366	1,496,411	139,474	-	1,753,238	-	1,753,238		-
A3j - Residential Education	-	75,000	-	50,000	-	125,000	-	125,000		-
B - Income Eligible	**279,644**	**99,177**	**3,280,186**	**730,161**	**124,880**	**4,514,047**	**-**	**4,514,047**	**3,224**	**1.25**
B1 - Income Eligible Existing Buildings	219,663	80,603	3,280,186	705,161	-	4,285,614	-	4,285,614	3,061	1.32
B1a - Income Eligible Coordinated Delivery	219,663	80,603	3,280,186	705,161	-	4,285,614	-	4,285,614	3,061	1.32
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-		
B2 - Income Eligible Hard-to-Measure	59,981	18,573	-	25,000	124,880	228,433	-	228,433		-
B2a - Income Eligible Statewide Marketing	-	18,573	-	-	-	18,573	-	18,573		-
B2b - Income Eligible Statewide Database	1,013	-	-	-	-	1,013	-	1,013		-
B2c - Income Eligible DOER Assessment	29,381	-	-	-	-	29,381	-	29,381		-
B2d - Income Eligible Sponsorships & Subscriptions	-	-	-	-	-	-	-	-		
B2e - Income Eligible Workforce Development	-	-	-	25,000	-	25,000	-	25,000		-
B2f - Income Eligible Evaluation and Market Research	-	-	-	-	124,880	124,880	-	124,880		-
B2g - Income Eligible Energy Affordability Network	29,587	-	-	-	-	29,587	-	29,587		-
C - Commercial & Industrial	**1,129,025**	**380,401**	**12,736,906**	**1,872,797**	**509,360**	**16,628,489**	**-**	**16,628,489**	**8,314**	**2.41**
C1 - C&I New Buildings	51,576	8,235	360,850	211,451	-	632,111	-	632,111	12,394	3.46
C1a - C&I New Buildings & Major Renovations	51,576	8,235	360,850	211,451	-	632,111	-	632,111	12,394	3.46
C2 - C&I Existing Buildings	972,328	337,905	12,338,556	1,632,992	-	15,281,781	-	15,281,781	7,841	2.48
C2a - C&I Existing Building Retrofit	797,981	273,067	10,426,875	1,133,163	-	12,631,085	-	12,631,085	16,173	2.23
C2b - C&I New & Replacement Equipment	88,947	48,902	925,601	369,582	-	1,433,032	-	1,433,032	1,230	2.75
C2c - C&I Active Demand Reduction	85,400	15,937	986,080	130,247	-	1,217,664	-	1,217,664	405,888	4.76
C3 - C&I Hard-to-Measure	105,122	34,261	37,500	28,354	509,360	714,597	-	714,597		-
C3a - C&I Statewide Marketing	-	29,261	-	-	-	29,261	-	29,261		-
C3b - C&I Statewide Database	1,394	-	-	-	-	1,394	-	1,394		-
C3c - C&I DOER Assessment	97,530	-	-	-	-	97,530	-	97,530		-
C3d - C&I Sponsorships & Subscriptions	-	-	-	-	-	-	-	-		
C3e - C&I Workforce Development	-	5,000	-	28,354	-	33,354	-	33,354		-
C3f - C&I Evaluation and Market Research	-	-	-	-	509,360	509,360	-	509,360		-
C3g - C&I EEAC Consultants	6,197	-	-	-	-	6,197	-	6,197		-
C3h - C&I R&D and Demonstration	-	-	37,500	-	-	37,500	-	37,500		-
Grand Total	**2,844,734**	**1,216,937**	**32,424,108**	**7,464,525**	**1,289,244**	**45,239,548**	**-**	**45,239,548**	**184**	**2.41**

Program Administrator Budgets, Three-Year Total

2019-2021 Program Administrator Budget

Cape Light Compact

May 29, 2020

2021 Planned Program Administrator Budget										
Program	Program Costs						Performance Incentive	Total Program Administrator Budget	Program Cost per Participant	Resource Benefit per Program Cost
	Program Planning and Administration	Marketing and Advertising	Participant Incentive	Sales, Technical Assistance & Training	Evaluation and Market Research	Total Program Costs				
A - Residential	**1,509,802**	**770,291**	**15,610,097**	**5,026,354**	**657,754**	**23,574,299**	**-**	**23,574,299**	**140**	**2.58**
A1 - Residential New Buildings	60,556	27,499	736,455	205,915	-	1,030,425	-	1,030,425	1,922	6.45
A1a - Residential New Homes & Renovations	60,556	27,499	736,455	205,915	-	1,030,425	-	1,030,425	1,922	6.45
A2 - Residential Existing Buildings	1,146,904	481,781	13,186,440	4,588,807	-	19,403,931	-	19,403,931	116	2.79
A2a - Residential Coordinated Delivery	659,364	177,626	8,443,972	1,938,853	-	11,219,816	-	11,219,816	3,067	2.99
A2b - Residential Conservation Services (RCS)	113,866	49,964	-	1,773,730	-	1,937,560	-	1,937,560		-
A2c - Residential Retail	298,577	231,849	3,947,049	603,149	-	5,080,625	-	5,080,625	54	3.60
A2d - Residential Behavior	39,865	8,926	612,500	17,061	-	678,351	-	678,351	10	2.10
A2e - Residential Active Demand Reduction	35,230	13,415	182,919	256,014	-	487,579	-	487,579		1.83
A3 - Residential Hard-to-Measure	302,343	261,011	1,687,202	231,632	657,754	3,139,942	-	3,139,942		-
A3a - Residential Statewide Marketing	-	159,797	-	-	-	159,797	-	159,797		-
A3b - Residential Statewide Database	8,193	-	-	-	-	8,193	-	8,193		-
A3c - Residential DOER Assessment	145,089	-	-	-	-	145,089	-	145,089		-
A3d - Residential Sponsorships & Subscriptions	-	-	-	-	-	-	-	-		
A3e - Residential Workforce Development	-	-	-	37,590	-	37,590	-	37,590		-
A3f - Residential Evaluation and Market Research	-	-	-	-	657,754	657,754	-	657,754		-
A3g - Residential EEAC Consultants	40,912	-	-	-	-	40,912	-	40,912		-
A3h - Residential R&D and Demonstration	-	-	125,322	-	-	125,322	-	125,322		-
A3i - Residential HEAT Loan	108,150	26,214	1,561,881	144,042	-	1,840,287	-	1,840,287		-
A3j - Residential Education	-	75,000	-	50,000	-	125,000	-	125,000		-
B - Income Eligible	**324,765**	**112,245**	**3,626,278**	**806,421**	**130,750**	**5,000,459**	**-**	**5,000,459**	**3,449**	**1.17**
B1 - Income Eligible Existing Buildings	264,784	93,672	3,626,278	781,421	-	4,766,155	-	4,766,155	3,287	1.23
B1a - Income Eligible Coordinated Delivery	264,784	93,672	3,626,278	781,421	-	4,766,155	-	4,766,155	3,287	1.23
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-		
B2 - Income Eligible Hard-to-Measure	59,981	18,573	-	25,000	130,750	234,304	-	234,304		-
B2a - Income Eligible Statewide Marketing	-	18,573	-	-	-	18,573	-	18,573		-
B2b - Income Eligible Statewide Database	1,013	-	-	-	-	1,013	-	1,013		-
B2c - Income Eligible DOER Assessment	29,381	-	-	-	-	29,381	-	29,381		-
B2d - Income Eligible Sponsorships & Subscriptions	-	-	-	-	-	-	-	-		
B2e - Income Eligible Workforce Development	-	-	-	25,000	-	25,000	-	25,000		-
B2f - Income Eligible Evaluation and Market Research	-	-	-	-	130,750	130,750	-	130,750		-
B2g - Income Eligible Energy Affordability Network	29,587	-	-	-	-	29,587	-	29,587		-
C - Commercial & Industrial	**1,248,831**	**417,228**	**13,355,941**	**1,963,007**	**522,335**	**17,507,342**	**-**	**17,507,342**	**8,586**	**2.55**
C1 - C&I New Buildings	54,787	9,321	360,850	217,056	-	642,013	-	642,013	12,346	3.56
C1a - C&I New Buildings & Major Renovations	54,787	9,321	360,850	217,056	-	642,013	-	642,013	12,346	3.56
C2 - C&I Existing Buildings	1,088,922	373,646	12,957,591	1,717,597	-	16,137,757	-	16,137,757	8,122	2.63
C2a - C&I Existing Building Retrofit	877,378	299,388	10,695,285	1,197,974	-	13,070,025	-	13,070,025	16,017	2.21
C2b - C&I New & Replacement Equipment	83,569	48,768	741,081	381,791	-	1,255,209	-	1,255,209	1,075	2.81
C2c - C&I Active Demand Reduction	127,975	25,490	1,521,225	137,832	-	1,812,523	-	1,812,523	604,174	5.51
C3 - C&I Hard-to-Measure	105,122	34,261	37,500	28,354	522,335	727,572	-	727,572		-
C3a - C&I Statewide Marketing	-	29,261	-	-	-	29,261	-	29,261		-
C3b - C&I Statewide Database	1,394	-	-	-	-	1,394	-	1,394		-
C3c - C&I DOER Assessment	97,530	-	-	-	-	97,530	-	97,530		-
C3d - C&I Sponsorships & Subscriptions	-	-	-	-	-	-	-	-		
C3e - C&I Workforce Development	-	5,000	-	28,354	-	33,354	-	33,354		-
C3f - C&I Evaluation and Market Research	-	-	-	-	522,335	522,335	-	522,335		-
C3g - C&I EEAC Consultants	6,197	-	-	-	-	6,197	-	6,197		-
C3h - C&I R&D and Demonstration	-	-	37,500	-	-	37,500	-	37,500		-
Grand Total	**3,083,398**	**1,299,764**	**32,592,316**	**7,795,782**	**1,310,839**	**46,082,099**	**-**	**46,082,099**	**268**	**2.42**

Program Administrator Budgets, Three-Year Total

2019-2021 Program Administrator Budget

Cape Light Compact

May 29, 2020

2019-2021 Program Administrator Budget										
Program	Program Costs						Performance Incentive	Total Program Administrator Budget	Program Cost per Participant	Resource Benefit per Program Cost
	Program Planning and Administration	Marketing and Advertising	Participant Incentive	Sales, Technical Assistance & Training	Evaluation and Market Research	Total Program Costs				
A - Residential	**4,449,492**	**2,088,539**	**53,442,865**	**15,461,334**	**1,800,733**	**77,242,963**	**-**	**77,242,963**	**111**	**2.38**
A1 - Residential New Buildings	167,156	71,651	2,172,929	552,517	-	2,964,252	-	2,964,252	2,089	5.50
A1a - Residential New Homes & Renovations	167,156	71,651	2,172,929	552,517	-	2,964,252	-	2,964,252	2,089	5.50
A2 - Residential Existing Buildings	3,470,482	1,354,533	45,847,146	14,261,363	-	64,933,525	-	64,933,525	94	2.58
A2a - Residential Coordinated Delivery	1,901,659	485,983	29,945,612	5,941,995	-	38,275,249	-	38,275,249	2,170	2.78
A2b - Residential Conservation Services (RCS)	340,183	129,512	-	5,421,248	-	5,890,942	-	5,890,942	911	-
A2c - Residential Retail	1,034,741	686,592	14,287,390	1,849,371	-	17,858,093	-	17,858,093	34	3.19
A2d - Residential Behavior	129,457	27,178	1,286,536	560,677	-	2,003,849	-	2,003,849	14	1.38
A2e - Residential Active Demand Reduction	64,443	25,269	327,609	488,072	-	905,393	-	905,393		1.63
A3 - Residential Hard-to-Measure	811,854	662,355	5,422,789	647,454	1,800,733	9,345,185	-	9,345,185		
A3a - Residential Statewide Marketing	-	412,532	-	-	-	412,532	-	412,532		
A3b - Residential Statewide Database	17,746	-	-	-	-	17,746	-	17,746		
A3c - Residential DOER Assessment	414,755	-	-	-	-	414,755	-	414,755		
A3d - Residential Sponsorships & Subscriptions	-	-	-	-	-	-	-	-		
A3e - Residential Workforce Development	-	-	-	87,843	-	87,843	-	87,843		
A3f - Residential Evaluation and Market Research	-	-	-	-	1,800,733	1,800,733	-	1,800,733		
A3g - Residential EEAC Consultants	81,823	-	-	-	-	81,823	-	81,823		
A3h - Residential R&D and Demonstration	-	-	250,139	-	-	250,139	-	250,139		
A3i - Residential HEAT Loan	297,530	67,241	5,172,651	450,784	-	5,988,205	-	5,988,205		
A3j - Residential Education	-	182,581	-	108,827	-	291,409	-	291,409		
B - Income Eligible	**870,293**	**281,996**	**9,646,264**	**2,131,497**	**342,240**	**13,272,289**	**-**	**13,272,289**	**2,592**	**1.21**
B1 - Income Eligible Existing Buildings	703,388	223,430	9,646,264	2,081,408	-	12,654,489	-	12,654,489	2,472	1.27
B1a - Income Eligible Coordinated Delivery	703,388	223,430	9,646,264	2,081,408	-	12,654,489	-	12,654,489	2,472	1.27
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-		
B2 - Income Eligible Hard-to-Measure	166,905	58,566	-	50,089	342,240	617,800	-	617,800		
B2a - Income Eligible Statewide Marketing	-	58,566	-	-	-	58,566	-	58,566		
B2b - Income Eligible Statewide Database	2,260	-	-	-	-	2,260	-	2,260		
B2c - Income Eligible DOER Assessment	73,689	-	-	-	-	73,689	-	73,689		
B2d - Income Eligible Sponsorships & Subscriptions	-	-	-	-	-	-	-	-		
B2e - Income Eligible Workforce Development	-	-	-	50,089	-	50,089	-	50,089		
B2f - Income Eligible Evaluation and Market Research	-	-	-	-	342,240	342,240	-	342,240		
B2g - Income Eligible Energy Affordability Network	90,956	-	-	-	-	90,956	-	90,956		
C - Commercial & Industrial	**3,351,875**	**1,093,833**	**32,427,442**	**4,884,987**	**1,597,097**	**43,355,234**	**-**	**43,355,234**	**8,035**	**2.48**
C1 - C&I New Buildings	146,141	24,594	906,231	539,467	-	1,616,433	-	1,616,433	12,339	4.04
C1a - C&I New Buildings & Major Renovations	146,141	24,594	906,231	539,467	-	1,616,433	-	1,616,433	12,339	4.04
C2 - C&I Existing Buildings	2,922,874	936,261	31,446,211	4,273,199	-	39,578,545	-	39,578,545	7,517	2.55
C2a - C&I Existing Building Retrofit	2,448,052	766,209	26,758,374	3,081,566	-	33,054,201	-	33,054,201	14,120	2.22
C2b - C&I New & Replacement Equipment	261,447	128,626	2,180,532	923,553	-	3,494,158	-	3,494,158	1,197	3.36
C2c - C&I Active Demand Reduction	213,376	41,427	2,507,305	268,079	-	3,030,187	-	3,030,187	505,031	5.21
C3 - C&I Hard-to-Measure	282,860	132,978	75,000	72,321	1,597,097	2,160,256	-	2,160,256		
C3a - C&I Statewide Marketing	-	122,895	-	-	-	122,895	-	122,895		
C3b - C&I Statewide Database	3,540	-	-	-	-	3,540	-	3,540		
C3c - C&I DOER Assessment	266,926	-	-	-	-	266,926	-	266,926		
C3d - C&I Sponsorships & Subscriptions	-	-	-	-	-	-	-	-		
C3e - C&I Workforce Development	-	10,083	-	72,321	-	82,404	-	82,404		
C3f - C&I Evaluation and Market Research	-	-	-	-	1,597,097	1,597,097	-	1,597,097		
C3g - C&I EEAC Consultants	12,394	-	-	-	-	12,394	-	12,394		
C3h - C&I R&D and Demonstration	-	-	75,000	-	-	75,000	-	75,000		
Grand Total	**8,671,660**	**3,464,368**	**95,516,570**	**22,477,818**	**3,740,070**	**133,870,486**	**-**	**133,870,486**	**190**	**2.30**

Notes

• Where not otherwise indicated, budgets for each year are represented in nominal dollars (2019$, 2020$, 2021$).

• Refer to common definitions for allocation of costs.

Program Savings, Plan Year Summary

2019 Planned vs. Evaluated

Cape Light Compact

May 29, 2020

2019 Planned Net Savings									
Program	# of Participants	Electric						Natural Gas	
		Annual Capacity (kW)		Electric Energy (MWh)		Electric Energy (MMBTU)		(Therms)	
		Summer	Winter	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential	**289,096**	**3,357**	**4,623**	**21,060**	**110,297**	**153,180**	**762,340**	**142,071**	**4,496,539**
A1 - Residential New Buildings	498	123	216	1,064	13,800	7,749	90,836	-	-
A1a - Residential New Homes & Renovations	498	123	216	1,064	13,800	7,749	90,836	-	-
A2 - Residential Existing Buildings	288,598	3,234	4,407	19,996	96,497	145,432	671,503	142,071	4,496,539
A2a - Residential Coordinated Delivery	3,674	921	1,529	7,268	48,931	52,869	330,846	233,891	4,997,098
A2b - Residential Conservation Services (RCS)		-	-	-	-	-	-	-	-
A2c - Residential Retail	194,924	1,781	2,055	8,776	43,614	63,779	311,875	(91,821)	(500,559)
A2d - Residential Behavior	90,000	532	822	3,952	3,952	28,783	28,783	-	-
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	-
B - Income Eligible	**1,350**	**279**	**423**	**2,226**	**17,535**	**16,222**	**120,346**	**-**	**-**
B1 - Income Eligible Existing Buildings	1,350	279	423	2,226	17,535	16,222	120,346	-	-
B1a - Income Eligible Coordinated Delivery	1,350	279	423	2,226	17,535	16,222	120,346	-	-
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	**1,959**	**2,643**	**2,236**	**16,777**	**195,060**	**122,966**	**1,337,932**	**(61,744)**	**(672,910)**
C1 - C&I New Buildings	50	71	61	814	14,033	5,980	94,233	(1,803)	(32,889)
C1a - C&I New Buildings & Major Renovations	50	71	61	814	14,033	5,980	94,233	(1,803)	(32,889)
C2 - C&I Existing Buildings	1,909	2,572	2,175	15,964	181,027	116,986	1,243,699	(59,941)	(640,021)
C2a - C&I Existing Building Retrofit	746	2,069	1,861	13,558	157,637	99,353	1,081,717	(58,501)	(628,017)
C2b - C&I New & Replacement Equipment	1,163	503	313	2,405	23,390	17,633	161,982	(1,439)	(12,003)
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-	-
Grand Total	**292,405**	**6,279**	**7,282**	**40,063**	**322,893**	**292,369**	**2,220,617**	**80,327**	**3,823,629**

2019 Evaluated Net Savings									
Program	# of Participants	Electric						Natural Gas	
		Annual Capacity (kW)		Electric Energy (MWh)		Electric Energy (MMBTU)		(Therms)	
		Summer	Winter	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential	**282,965**	**3,714**	**5,022**	**24,892**	**152,794**	**181,161**	**1,039,504**	**116,076**	**4,612,976**
A1 - Residential New Buildings	366	76	179	1,006	17,639	7,306	114,158	-	-
A1a - Residential New Homes & Renovations	366	76	179	1,006	17,639	7,306	114,158	-	-
A2 - Residential Existing Buildings	282,599	3,639	4,843	23,886	135,156	173,855	925,346	116,076	4,612,976
A2a - Residential Coordinated Delivery	10,344	1,334	2,236	10,560	80,086	76,805	538,516	240,801	4,961,384
A2b - Residential Conservation Services (RCS)	6,468	-	-	-	-	-	-	-	-
A2c - Residential Retail	265,785	2,260	2,562	13,073	54,817	95,203	384,983	(124,725)	(348,408)
A2d - Residential Behavior	2	44	45	253	253	1,846	1,846	-	-
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	-
B - Income Eligible	**2,270**	**299**	**350**	**2,075**	**15,200**	**15,135**	**105,236**	**-**	**-**
B1 - Income Eligible Existing Buildings	2,270	299	350	2,075	15,200	15,135	105,236	-	-
B1a - Income Eligible Coordinated Delivery	2,270	299	350	2,075	15,200	15,135	105,236	-	-
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	**1,357**	**2,152**	**2,019**	**11,669**	**132,875**	**82,659**	**879,506**	**(34,709)**	**(377,839)**
C1 - C&I New Buildings	28	120	48	859	14,917	5,819	93,164	(2,205)	(39,619)
C1a - C&I New Buildings & Major Renovations	28	120	48	859	14,917	5,819	93,164	(2,205)	(39,619)
C2 - C&I Existing Buildings	1,329	2,032	1,971	10,810	117,958	76,840	786,342	(32,504)	(338,221)
C2a - C&I Existing Building Retrofit	744	1,646	1,655	8,378	92,771	59,137	614,278	(30,909)	(324,168)
C2b - C&I New & Replacement Equipment	585	386	316	2,432	25,187	17,703	172,064	(1,595)	(14,053)
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-	-
Grand Total	**286,592**	**6,165**	**7,391**	**38,636**	**300,870**	**278,955**	**2,024,246**	**81,367**	**4,235,137**

Program Savings, Plan Year Summary

2019 Planned vs. Evaluated

Cape Light Compact

May 29, 2020

2019 Planned v. Evaluated Net Savings Variances (%)									
Program	# of Participants	Electric						Natural Gas	
		Annual Capacity (kW)		Electric Energy (MWh)		Electric Energy (MMBTU)		(Therms)	
		Summer	Winter	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential	**-2%**	**11%**	**9%**	**18%**	**39%**	**18%**	**36%**	**-18%**	**3%**
A1 - Residential New Buildings	-27%	-38%	-17%	-5%	28%	-6%	26%		
A1a - Residential New Homes & Renovations	-27%	-38%	-17%	-5%	28%	-6%	26%		
A2 - Residential Existing Buildings	-2%	13%	10%	19%	40%	20%	38%	-18%	3%
A2a - Residential Coordinated Delivery	182%	45%	46%	45%	64%	45%	63%	3%	-1%
A2b - Residential Conservation Services (RCS)									
A2c - Residential Retail	36%	27%	25%	49%	26%	49%	23%	36%	-30%
A2d - Residential Behavior	-100%	-92%	-94%	-94%	-94%	-94%	-94%		
A2e - Residential Active Demand Reduction									
B - Income Eligible	**68%**	**7%**	**-17%**	**-7%**	**-13%**	**-7%**	**-13%**		
B1 - Income Eligible Existing Buildings	68%	7%	-17%	-7%	-13%	-7%	-13%		
B1a - Income Eligible Coordinated Delivery	68%	7%	-17%	-7%	-13%	-7%	-13%		
B1b - Income Eligible Active Demand Reduction									
C - Commercial & Industrial	**-31%**	**-19%**	**-10%**	**-30%**	**-32%**	**-33%**	**-34%**	**-44%**	**-44%**
C1 - C&I New Buildings	-44%	68%	-22%	6%	6%	-3%	-1%	22%	20%
C1a - C&I New Buildings & Major Renovations	-44%	68%	-22%	6%	6%	-3%	-1%	22%	20%
C2 - C&I Existing Buildings	-30%	-21%	-9%	-32%	-35%	-34%	-37%	-46%	-47%
C2a - C&I Existing Building Retrofit	0%	-20%	-11%	-38%	-41%	-40%	-43%	-47%	-48%
C2b - C&I New & Replacement Equipment	-50%	-23%	1%	1%	8%	0%	6%	11%	17%
C2c - C&I Active Demand Reduction									
Grand Total	**-2%**	**-2%**	**2%**	**-4%**	**-7%**	**-5%**	**-9%**	**1%**	**11%**

Notes

• The plan year variances provided above are intended to indicate the Program Administrator's performance in the plan year only. The variances used to determine significant variances are provided separately. The variances above and the significant variances use different calculations to determine variances on an annual basis and over the three-year term, respectively.

• MMBtu savings are calculated consistent with the findings in the Study to Propose a More Refined Method to Account for the Conversion of Electric Savings to MMBtu Savings (see Appendix 7). For more information, see Appendix 6.

Program Savings, Plan Year Summary

2019 Planned vs. Evaluated

Cape Light Compact

May 29, 2020

2019 Planned Net Savings

Program	Deliverable Fuels				Other				Total Savings		Electric Energy, no Fuel	
	Oil (MMBTU)		Propane (MMBTU)		Wood (MMBTU)		Water (Gallons)		MMBTU		Switching or ADR (MWh)	
	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential	**44,980**	**930,079**	**17,285**	**361,703**	**-**	**-**	**2,701,602**	**19,586,572**	**229,652**	**2,503,775**	**23,408**	**151,812**
A1 - Residential New Buildings	18	436	4,637	114,470	-	-	-	-	12,404	205,743	1,064	13,800
A1a - Residential New Homes & Renovations	18	436	4,637	114,470	-	-	-	-	12,404	205,743	1,064	13,800
A2 - Residential Existing Buildings	44,962	929,643	12,647	247,232	-	-	2,701,602	19,586,572	217,248	2,298,033	22,343	138,011
A2a - Residential Coordinated Delivery	26,695	543,580	5,820	109,924	-	-	2,433,883	17,712,542	108,773	1,484,059	7,411	51,460
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	18,267	386,063	6,828	137,308	-	-	267,719	1,874,030	79,692	785,191	10,981	82,600
A2d - Residential Behavior	-	-	-	-	-	-	-	-	28,783	28,783	3,952	3,952
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-
B - Income Eligible	**3,953**	**74,508**	**851**	**14,440**	**-**	**-**	**-**	**-**	**21,026**	**209,293**	**2,226**	**17,535**
B1 - Income Eligible Existing Buildings	3,953	74,508	851	14,440	-	-	-	-	21,026	209,293	2,226	17,535
B1a - Income Eligible Coordinated Delivery	3,953	74,508	851	14,440	-	-	-	-	21,026	209,293	2,226	17,535
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	**(4,776)**	**(54,220)**	**35**	**778**	**-**	**-**	**234,596**	**1,960,762**	**112,050**	**1,217,199**	**16,777**	**195,060**
C1 - C&I New Buildings	(97)	(1,300)	-	-	-	-	3,499	27,994	5,703	89,644	814	14,033
C1a - C&I New Buildings & Major Renovations	(97)	(1,300)	-	-	-	-	3,499	27,994	5,703	89,644	814	14,033
C2 - C&I Existing Buildings	(4,679)	(52,921)	35	778	-	-	231,097	1,932,768	106,348	1,127,555	15,964	181,027
C2a - C&I Existing Building Retrofit	(4,436)	(50,598)	35	778	-	-	216,097	1,794,195	89,102	969,096	13,558	157,637
C2b - C&I New & Replacement Equipment	(244)	(2,323)	-	-	-	-	15,000	138,574	17,246	158,459	2,405	23,390
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-
Grand Total	**44,156**	**950,367**	**18,171**	**376,920**	**-**	**-**	**2,936,198**	**21,547,334**	**362,728**	**3,930,267**	**42,411**	**364,408**

2019 Evaluated Net Savings

Program	Deliverable Fuels				Other				Total Savings		Electric Energy, no Fuel	
	Oil (MMBTU)		Propane (MMBTU)		Wood (MMBTU)		Water (Gallons)		MMBTU		Switching or ADR (MWh)	
	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential	**28,868**	**672,821**	**10,076**	**221,642**	**-**	**-**	**3,876,723**	**27,863,522**	**231,711**	**2,395,264**	**25,642**	**166,199**
A1 - Residential New Buildings	80	1,997	744	20,520	-	-	-	-	8,130	136,675	1,006	17,639
A1a - Residential New Homes & Renovations	80	1,997	744	20,520	-	-	-	-	8,130	136,675	1,006	17,639
A2 - Residential Existing Buildings	28,788	670,824	9,332	201,122	-	-	3,876,723	27,863,522	223,582	2,258,589	24,636	148,560
A2a - Residential Coordinated Delivery	27,292	551,465	5,667	115,659	-	-	3,872,009	27,830,522	133,845	1,701,778	10,678	82,189
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	939	118,803	3,358	85,156	-	-	4,714	33,000	87,028	554,102	13,706	66,118
A2d - Residential Behavior	556	556	307	307	-	-	-	-	2,709	2,709	253	253
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-
B - Income Eligible	**2,460**	**48,005**	**494**	**9,510**	**-**	**-**	**1,328,006**	**15,936,072**	**18,089**	**162,751**	**2,075**	**15,200**
B1 - Income Eligible Existing Buildings	2,460	48,005	494	9,510	-	-	1,328,006	15,936,072	18,089	162,751	2,075	15,200
B1a - Income Eligible Coordinated Delivery	2,460	48,005	494	9,510	-	-	1,328,006	15,936,072	18,089	162,751	2,075	15,200
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	**(2,052)**	**(22,765)**	**53**	**474**	**-**	**-**	**1,413,457**	**11,794,732**	**77,189**	**819,431**	**11,669**	**132,875**
C1 - C&I New Buildings	(179)	(2,670)	-	-	-	-	-	-	5,419	86,531	859	14,917
C1a - C&I New Buildings & Major Renovations	(179)	(2,670)	-	-	-	-	-	-	5,419	86,531	859	14,917
C2 - C&I Existing Buildings	(1,873)	(20,094)	53	474	-	-	1,413,457	11,794,732	71,769	732,900	10,810	117,958
C2a - C&I Existing Building Retrofit	(1,685)	(18,324)	53	474	-	-	1,314,945	10,519,557	54,414	564,011	8,378	92,771
C2b - C&I New & Replacement Equipment	(188)	(1,770)	-	-	-	-	98,512	1,275,175	17,355	168,889	2,432	25,187
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-
Grand Total	**29,275**	**698,061**	**10,623**	**231,626**	**-**	**-**	**6,618,186**	**55,594,326**	**326,989**	**3,377,446**	**39,386**	**314,274**

Program Savings, Plan Year Summary

2019 Planned vs. Evaluated

Cape Light Compact

May 29, 2020

2019 Planned v. Evaluated Net Savings Variances (%)												
Program	Deliverable Fuels				Other				Total Savings MMBTU		Electric Energy, no Fuel Switching or ADR (MWh)	
	Oil (MMBTU)		Propane (MMBTU)		Wood (MMBTU)		Water (Gallons)					
	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential	**-36%**	**-28%**	**-42%**	**-39%**			**43%**	**42%**	**1%**	**-4%**	**10%**	**9%**
A1 - Residential New Buildings	343%	358%	-84%	-82%					-34%	-34%	-5%	28%
A1a - Residential New Homes & Renovations	343%	358%	-84%	-82%					-34%	-34%	-5%	28%
A2 - Residential Existing Buildings	-36%	-28%	-26%	-19%			43%	42%	3%	-2%	10%	8%
A2a - Residential Coordinated Delivery	2%	1%	-3%	5%			59%	57%	23%	15%	44%	60%
A2b - Residential Conservation Services (RCS)												
A2c - Residential Retail	-95%	-69%	-51%	-38%			-98%	-98%	9%	-29%	25%	-20%
A2d - Residential Behavior									-91%	-91%	-94%	-94%
A2e - Residential Active Demand Reduction												
B - Income Eligible	**-38%**	**-36%**	**-42%**	**-34%**					**-14%**	**-22%**	**-7%**	**-13%**
B1 - Income Eligible Existing Buildings	-38%	-36%	-42%	-34%					-14%	-22%	-7%	-13%
B1a - Income Eligible Coordinated Delivery	-38%	-36%	-42%	-34%					-14%	-22%	-7%	-13%
B1b - Income Eligible Active Demand Reduction												
C - Commercial & Industrial	**-57%**	**-58%**	**52%**	**-39%**			**503%**	**502%**	**-31%**	**-33%**	**-30%**	**-32%**
C1 - C&I New Buildings	84%	105%					-100%	-100%	-5%	-3%	6%	6%
C1a - C&I New Buildings & Major Renovations	84%	105%					-100%	-100%	-5%	-3%	6%	6%
C2 - C&I Existing Buildings	-60%	-62%	52%	-39%			512%	510%	-33%	-35%	-32%	-35%
C2a - C&I Existing Building Retrofit	-62%	-64%	52%	-39%			508%	486%	-39%	-42%	-38%	-41%
C2b - C&I New & Replacement Equipment	-23%	-24%					557%	820%	1%	7%	1%	8%
C2c - C&I Active Demand Reduction												
Grand Total	**-34%**	**-27%**	**-42%**	**-39%**			**125%**	**158%**	**-10%**	**-14%**	**-7%**	**-14%**

Notes

• The plan year variances provided above are intended to indicate the Program Administrator's performance in the plan year only. The variances used to determine significant variances are provided separately. The variances above and the significant variances use different calculations to determine variances on an annual basis and over the three-year term, respectively.

• MMBtu savings are calculated consistent with the findings in the Study to Propose a More Refined Method to Account for the Conversion of Electric Savings to MMBtu Savings (see Appendix 7). For more information, see Appendix 6.

Program Savings, Three-Year Total

2019-2021 Net Savings

Cape Light Compact

May 29, 2020

2019 Evaluated Net Savings									
Program	# of Participants	Electric						Natural Gas	
		Annual Capacity (kW)		Electric Energy (MWh)		Electric Energy (MMBTU)		(Therms)	
		Summer	Winter	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential	**282,965**	**3,714**	**5,022**	**24,892**	**152,794**	**181,161**	**1,039,504**	**116,076**	**4,612,976**
A1 - Residential New Buildings	366	76	179	1,006	17,639	7,306	114,158	-	-
A1a - Residential New Homes & Renovations	366	76	179	1,006	17,639	7,306	114,158	-	-
A2 - Residential Existing Buildings	282,599	3,639	4,843	23,886	135,156	173,855	925,346	116,076	4,612,976
A2a - Residential Coordinated Delivery	10,344	1,334	2,236	10,560	80,086	76,805	538,516	240,801	4,961,384
A2b - Residential Conservation Services (RCS)	6,468	-	-	-	-	-	-	-	-
A2c - Residential Retail	265,785	2,260	2,562	13,073	54,817	95,203	384,983	(124,725)	(348,408)
A2d - Residential Behavior	2	44	45	253	253	1,846	1,846	-	-
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	-
B - Income Eligible	**2,270**	**299**	**350**	**2,075**	**15,200**	**15,135**	**105,236**	**-**	**-**
B1 - Income Eligible Existing Buildings	2,270	299	350	2,075	15,200	15,135	105,236	-	-
B1a - Income Eligible Coordinated Delivery	2,270	299	350	2,075	15,200	15,135	105,236	-	-
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	**1,357**	**2,152**	**2,019**	**11,669**	**132,875**	**82,659**	**879,506**	**(34,709)**	**(377,839)**
C1 - C&I New Buildings	28	120	48	859	14,917	5,819	93,164	(2,205)	(39,619)
C1a - C&I New Buildings & Major Renovations	28	120	48	859	14,917	5,819	93,164	(2,205)	(39,619)
C2 - C&I Existing Buildings	1,329	2,032	1,971	10,810	117,958	76,840	786,342	(32,504)	(338,221)
C2a - C&I Existing Building Retrofit	744	1,646	1,655	8,378	92,771	59,137	614,278	(30,909)	(324,168)
C2b - C&I New & Replacement Equipment	585	386	316	2,432	25,187	17,703	172,064	(1,595)	(14,053)
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-	-
Grand Total	**286,592**	**6,165**	**7,391**	**38,636**	**300,870**	**278,955**	**2,024,246**	**81,367**	**4,235,137**

2020 Planned Net Savings									
Program	# of Participants	Electric						Natural Gas	
		Annual Capacity (kW)		Electric Energy (MWh)		Electric Energy (MMBTU)		(Therms)	
		Summer	Winter	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential	**242,609**	**3,005**	**4,263**	**19,500**	**88,056**	**141,836**	**597,259**	**168,202**	**4,653,634**
A1 - Residential New Buildings	517	112	210	1,008	13,850	7,332	89,945	-	-
A1a - Residential New Homes & Renovations	517	112	210	1,008	13,850	7,332	89,945	-	-
A2 - Residential Existing Buildings	242,092	2,892	4,052	18,492	74,206	134,504	507,314	168,202	4,653,634
A2a - Residential Coordinated Delivery	3,638	680	1,186	5,777	43,434	42,013	286,602	232,334	4,973,736
A2b - Residential Conservation Services (RCS)		-	-	-	-	-	-	-	-
A2c - Residential Retail	162,454	1,317	1,482	6,060	24,117	44,013	172,234	(64,132)	(320,102)
A2d - Residential Behavior	76,000	896	1,385	6,656	6,656	48,479	48,479	-	-
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	-
B - Income Eligible	**1,400**	**258**	**405**	**2,143**	**17,603**	**15,616**	**118,829**	**-**	**-**
B1 - Income Eligible Existing Buildings	1,400	258	405	2,143	17,603	15,616	118,829	-	-
B1a - Income Eligible Coordinated Delivery	1,400	258	405	2,143	17,603	15,616	118,829	-	-
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	**2,000**	**2,768**	**2,377**	**17,140**	**202,036**	**125,614**	**1,367,926**	**(62,747)**	**(688,026)**
C1 - C&I New Buildings	51	71	61	985	17,434	7,236	115,742	(2,355)	(43,863)
C1a - C&I New Buildings & Major Renovations	51	71	61	985	17,434	7,236	115,742	(2,355)	(43,863)
C2 - C&I Existing Buildings	1,949	2,696	2,316	16,155	184,602	118,378	1,252,184	(60,393)	(644,163)
C2a - C&I Existing Building Retrofit	781	2,236	2,031	13,963	164,470	102,305	1,113,797	(59,152)	(634,531)
C2b - C&I New & Replacement Equipment	1,165	461	285	2,192	20,133	16,073	138,387	(1,240)	(9,632)
C2c - C&I Active Demand Reduction	3	-	-	-	-	-	-	-	-
Grand Total	**246,009**	**6,030**	**7,045**	**38,783**	**307,695**	**283,067**	**2,084,013**	**105,455**	**3,965,608**

Program Savings, Three-Year Total

2019-2021 Net Savings

Cape Light Compact
May 29, 2020

2021 Planned Net Savings									
Program	# of Participants	Electric						Natural Gas	
		Annual Capacity (kW)		Electric Energy (MWh)		Electric Energy (MMBTU)		(Therms)	
		Summer	Winter	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential	**168,200**	**2,340**	**3,464**	**15,546**	**66,054**	**112,301**	**436,798**	**203,213**	**4,845,655**
A1 - Residential New Buildings	536	99	202	935	13,395	6,754	85,640	-	-
A1a - Residential New Homes & Renovations	536	99	202	935	13,395	6,754	85,640	-	-
A2 - Residential Existing Buildings	167,664	2,241	3,262	14,611	52,659	105,547	351,158	203,213	4,845,655
A2a - Residential Coordinated Delivery	3,658	490	959	4,671	45,461	33,706	294,323	231,181	4,956,447
A2b - Residential Conservation Services (RCS)		-	-	-	-	-	-	-	-
A2c - Residential Retail	94,006	743	744	2,452	(290)	17,634	2,628	(27,968)	(110,793)
A2d - Residential Behavior	70,000	1,008	1,558	7,488	7,488	54,207	54,207	-	-
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	-
B - Income Eligible	**1,450**	**236**	**390**	**2,056**	**18,144**	**14,884**	**120,604**	**-**	**-**
B1 - Income Eligible Existing Buildings	1,450	236	390	2,056	18,144	14,884	120,604	-	-
B1a - Income Eligible Coordinated Delivery	1,450	236	390	2,056	18,144	14,884	120,604	-	-
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	**2,039**	**2,854**	**2,496**	**17,087**	**196,715**	**124,576**	**1,316,050**	**(63,580)**	**(655,101)**
C1 - C&I New Buildings	52	71	61	1,026	18,260	7,505	120,099	(2,471)	(46,191)
C1a - C&I New Buildings & Major Renovations	52	71	61	1,026	18,260	7,505	120,099	(2,471)	(46,191)
C2 - C&I Existing Buildings	1,987	2,783	2,435	16,061	178,455	117,071	1,195,951	(61,109)	(608,910)
C2a - C&I Existing Building Retrofit	816	2,366	2,178	14,082	160,532	102,633	1,074,455	(60,067)	(601,289)
C2b - C&I New & Replacement Equipment	1,168	417	256	1,979	17,924	14,437	121,496	(1,043)	(7,621)
C2c - C&I Active Demand Reduction	3	-	-	-	-	-	-	-	-
Grand Total	**171,689**	**5,430**	**6,350**	**34,689**	**280,914**	**251,761**	**1,873,453**	**139,633**	**4,190,554**

2019-2021 Net Savings									
Program	# of Participants	Electric						Natural Gas	
		Annual Capacity (kW)		Electric Energy (MWh)		Electric Energy (MMBTU)		(Therms)	
		Summer	Winter	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential	**693,774**	**9,059**	**12,749**	**59,938**	**306,905**	**435,298**	**2,073,561**	**487,491**	**14,112,264**
A1 - Residential New Buildings	1,419	287	591	2,949	44,884	21,392	289,743	-	-
A1a - Residential New Homes & Renovations	1,419	287	591	2,949	44,884	21,392	289,743	-	-
A2 - Residential Existing Buildings	692,355	8,772	12,157	56,989	262,021	413,906	1,783,818	487,491	14,112,264
A2a - Residential Coordinated Delivery	17,640	2,504	4,381	21,008	168,980	152,525	1,119,441	704,316	14,891,567
A2b - Residential Conservation Services (RCS)	6,468	-	-	-	-	-	-	-	-
A2c - Residential Retail	522,245	4,321	4,788	21,585	78,644	156,850	559,845	(216,825)	(779,303)
A2d - Residential Behavior	146,002	1,948	2,988	14,397	14,397	104,532	104,532	-	-
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	-
B - Income Eligible	**5,120**	**793**	**1,146**	**6,273**	**50,947**	**45,636**	**344,670**	**-**	**-**
B1 - Income Eligible Existing Buildings	5,120	793	1,146	6,273	50,947	45,636	344,670	-	-
B1a - Income Eligible Coordinated Delivery	5,120	793	1,146	6,273	50,947	45,636	344,670	-	-
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	**5,396**	**7,773**	**6,892**	**45,896**	**531,627**	**332,849**	**3,563,481**	**(161,037)**	**(1,720,966)**
C1 - C&I New Buildings	131	262	170	2,871	50,611	20,559	329,005	(7,031)	(129,673)
C1a - C&I New Buildings & Major Renovations	131	262	170	2,871	50,611	20,559	329,005	(7,031)	(129,673)
C2 - C&I Existing Buildings	5,265	7,511	6,722	43,025	481,016	312,289	3,234,477	(154,006)	(1,591,293)
C2a - C&I Existing Building Retrofit	2,341	6,247	5,864	36,422	417,772	264,076	2,802,530	(150,128)	(1,559,988)
C2b - C&I New & Replacement Equipment	2,918	1,264	857	6,603	63,244	48,213	431,947	(3,878)	(31,306)
C2c - C&I Active Demand Reduction	6	-	-	-	-	-	-	-	-
Grand Total	**704,290**	**17,625**	**20,786**	**112,107**	**889,479**	**813,782**	**5,981,712**	**326,454**	**12,391,298**

Notes

• MMBtu savings are calculated consistent with the findings in the Study to Propose a More Refined Method to Account for the Conversion of Electric Savings to MMBtu Savings (see Appendix 7). For more information, see Appendix 6.

Program Savings, Three-Year Total

2019-2021 Net Savings

Cape Light Compact

May 29, 2020

2019 Evaluated Net Savings												
Program	Deliverable Fuels				Other				Total Savings		Electric Energy, no Fuel	
	Oil (MMBTU)		Propane (MMBTU)		Wood (MMBTU)		Water (Gallons)		MMBTU		Switching or ADR (MWh)	
	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential	**28,868**	**672,821**	**10,076**	**221,642**	**-**	**-**	**3,876,723**	**27,863,522**	**231,711**	**2,395,264**	**25,642**	**166,199**
A1 - Residential New Buildings	80	1,997	744	20,520	-	-	-	-	8,130	136,675	1,006	17,639
A1a - Residential New Homes & Renovations	80	1,997	744	20,520	-	-	-	-	8,130	136,675	1,006	17,639
A2 - Residential Existing Buildings	28,788	670,824	9,332	201,122	-	-	3,876,723	27,863,522	223,582	2,258,589	24,636	148,560
A2a - Residential Coordinated Delivery	27,292	551,465	5,667	115,659	-	-	3,872,009	27,830,522	133,845	1,701,778	10,678	82,189
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	939	118,803	3,358	85,156	-	-	4,714	33,000	87,028	554,102	13,706	66,118
A2d - Residential Behavior	556	556	307	307	-	-	-	-	2,709	2,709	253	253
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-
B - Income Eligible	**2,460**	**48,005**	**494**	**9,510**	**-**	**-**	**1,328,006**	**15,936,072**	**18,089**	**162,751**	**2,075**	**15,200**
B1 - Income Eligible Existing Buildings	2,460	48,005	494	9,510	-	-	1,328,006	15,936,072	18,089	162,751	2,075	15,200
B1a - Income Eligible Coordinated Delivery	2,460	48,005	494	9,510	-	-	1,328,006	15,936,072	18,089	162,751	2,075	15,200
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	**(2,052)**	**(22,765)**	**53**	**474**	**-**	**-**	**1,413,457**	**11,794,732**	**77,189**	**819,431**	**11,669**	**132,875**
C1 - C&I New Buildings	(179)	(2,670)	-	-	-	-	-	-	5,419	86,531	859	14,917
C1a - C&I New Buildings & Major Renovations	(179)	(2,670)	-	-	-	-	-	-	5,419	86,531	859	14,917
C2 - C&I Existing Buildings	(1,873)	(20,094)	53	474	-	-	1,413,457	11,794,732	71,769	732,900	10,810	117,958
C2a - C&I Existing Building Retrofit	(1,685)	(18,324)	53	474	-	-	1,314,945	10,519,557	54,414	564,011	8,378	92,771
C2b - C&I New & Replacement Equipment	(188)	(1,770)	-	-	-	-	98,512	1,275,175	17,355	168,889	2,432	25,187
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-
Grand Total	**29,275**	**698,061**	**10,623**	**231,626**	**-**	**-**	**6,618,186**	**55,594,326**	**326,989**	**3,377,446**	**39,386**	**314,274**

2020 Planned Net Savings												
Program	Deliverable Fuels				Other				Total Savings		Electric Energy, no Fuel	
	Oil (MMBTU)		Propane (MMBTU)		Wood (MMBTU)		Water (Gallons)		MMBTU		Switching or ADR (MWh)	
	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential	**43,708**	**888,726**	**17,163**	**355,139**	**-**	**-**	**2,701,602**	**19,586,572**	**219,527**	**2,306,488**	**21,555**	**124,409**
A1 - Residential New Buildings	19	453	4,820	118,992	-	-	-	-	12,171	209,390	1,008	13,850
A1a - Residential New Homes & Renovations	19	453	4,820	118,992	-	-	-	-	12,171	209,390	1,008	13,850
A2 - Residential Existing Buildings	43,689	888,273	12,343	236,148	-	-	2,701,602	19,586,572	207,356	2,097,099	20,548	110,559
A2a - Residential Coordinated Delivery	25,238	517,736	5,646	106,032	-	-	2,433,883	17,712,542	96,131	1,407,743	5,777	43,434
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	18,451	370,538	6,697	130,116	-	-	267,719	1,874,030	62,747	640,878	8,115	60,469
A2d - Residential Behavior	-	-	-	-	-	-	-	-	48,479	48,479	6,656	6,656
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-
B - Income Eligible	**4,351**	**81,389**	**904**	**15,230**	**-**	**-**	**-**	**-**	**20,871**	**215,447**	**2,143**	**17,603**
B1 - Income Eligible Existing Buildings	4,351	81,389	904	15,230	-	-	-	-	20,871	215,447	2,143	17,603
B1a - Income Eligible Coordinated Delivery	4,351	81,389	904	15,230	-	-	-	-	20,871	215,447	2,143	17,603
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	**(4,760)**	**(53,915)**	**35**	**778**	**-**	**-**	**245,770**	**2,059,439**	**114,614**	**1,245,987**	**17,140**	**202,036**
C1 - C&I New Buildings	(97)	(1,290)	-	-	-	-	5,249	41,991	6,903	110,066	985	17,434
C1a - C&I New Buildings & Major Renovations	(97)	(1,290)	-	-	-	-	5,249	41,991	6,903	110,066	985	17,434
C2 - C&I Existing Buildings	(4,663)	(52,625)	35	778	-	-	240,521	2,017,448	107,711	1,135,921	16,155	184,602
C2a - C&I Existing Building Retrofit	(4,444)	(50,681)	35	778	-	-	218,021	1,809,588	91,981	1,000,441	13,963	164,470
C2b - C&I New & Replacement Equipment	(218)	(1,944)	-	-	-	-	22,500	207,860	15,731	135,480	2,192	20,133
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-
Grand Total	**43,299**	**916,200**	**18,102**	**371,148**	**-**	**-**	**2,947,372**	**21,646,011**	**355,013**	**3,767,922**	**40,838**	**344,048**

Program Savings, Three-Year Total

2019-2021 Net Savings

Cape Light Compact

May 29, 2020

2021 Planned Net Savings

Program	Deliverable Fuels				Other				Total Savings MMBTU		Electric Energy, no Fuel Switching or ADR (MWh)	
	Oil (MMBTU)		Propane (MMBTU)		Wood (MMBTU)		Water (Gallons)					
	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential	**45,686**	**897,031**	**18,291**	**368,676**	**-**	**-**	**2,701,602**	**19,586,572**	**196,599**	**2,187,071**	**17,564**	**101,745**
A1 - Residential New Buildings	20	473	5,036	124,323	-	-	-	-	11,810	210,437	935	13,395
A1a - Residential New Homes & Renovations	20	473	5,036	124,323	-	-	-	-	11,810	210,437	935	13,395
A2 - Residential Existing Buildings	45,666	896,558	13,254	244,353	-	-	2,701,602	19,586,572	184,789	1,976,634	16,629	88,349
A2a - Residential Coordinated Delivery	25,460	521,086	6,072	112,422	-	-	2,433,883	17,712,542	88,356	1,423,476	4,671	45,461
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	20,206	375,471	7,182	131,931	-	-	267,719	1,874,030	42,226	498,951	4,470	35,401
A2d - Residential Behavior	-	-	-	-	-	-	-	-	54,207	54,207	7,488	7,488
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-
B - Income Eligible	**4,512**	**84,607**	**930**	**15,756**	**-**	**-**	**-**	**-**	**20,326**	**220,967**	**2,056**	**18,144**
B1 - Income Eligible Existing Buildings	4,512	84,607	930	15,756	-	-	-	-	20,326	220,967	2,056	18,144
B1a - Income Eligible Coordinated Delivery	4,512	84,607	930	15,756	-	-	-	-	20,326	220,967	2,056	18,144
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	**(4,763)**	**(51,450)**	**35**	**778**	**-**	**-**	**262,875**	**2,205,561**	**113,489**	**1,199,869**	**17,087**	**196,715**
C1 - C&I New Buildings	(115)	(1,648)	-	-	-	-	5,249	41,991	7,143	113,832	1,026	18,260
C1a - C&I New Buildings & Major Renovations	(115)	(1,648)	-	-	-	-	5,249	41,991	7,143	113,832	1,026	18,260
C2 - C&I Existing Buildings	(4,648)	(49,801)	35	778	-	-	257,626	2,163,571	106,347	1,086,037	16,061	178,455
C2a - C&I Existing Building Retrofit	(4,454)	(48,118)	35	778	-	-	227,626	1,886,424	92,207	966,986	14,082	160,532
C2b - C&I New & Replacement Equipment	(194)	(1,683)	-	-	-	-	30,000	277,147	14,140	119,051	1,979	17,924
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-
Grand Total	**45,435**	**930,188**	**19,256**	**385,211**	**-**	**-**	**2,964,476**	**21,792,133**	**330,415**	**3,607,907**	**36,706**	**316,604**

2019-2021 Net Savings

Program	Deliverable Fuels				Other				Total Savings MMBTU		Electric Energy, no Fuel Switching or ADR (MWh)	
	Oil (MMBTU)		Propane (MMBTU)		Wood (MMBTU)		Water (Gallons)					
	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential	**118,261**	**2,458,578**	**45,529**	**945,457**	**-**	**-**	**9,279,926**	**67,036,666**	**647,838**	**6,888,824**	**64,761**	**392,352**
A1 - Residential New Buildings	118	2,923	10,601	263,835	-	-	-	-	32,111	556,502	2,949	44,884
A1a - Residential New Homes & Renovations	118	2,923	10,601	263,835	-	-	-	-	32,111	556,502	2,949	44,884
A2 - Residential Existing Buildings	118,143	2,455,655	34,929	681,622	-	-	9,279,926	67,036,666	615,727	6,332,322	61,812	347,468
A2a - Residential Coordinated Delivery	77,990	1,590,287	17,385	334,112	-	-	8,739,775	63,255,605	318,332	4,532,997	21,125	171,083
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	39,597	864,812	17,237	347,203	-	-	540,152	3,781,061	192,000	1,693,930	26,290	161,988
A2d - Residential Behavior	556	556	307	307	-	-	-	-	105,394	105,394	14,397	14,397
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-
B - Income Eligible	**11,323**	**214,000**	**2,329**	**40,496**	**-**	**-**	**1,328,006**	**15,936,072**	**59,287**	**599,165**	**6,273**	**50,947**
B1 - Income Eligible Existing Buildings	11,323	214,000	2,329	40,496	-	-	1,328,006	15,936,072	59,287	599,165	6,273	50,947
B1a - Income Eligible Coordinated Delivery	11,323	214,000	2,329	40,496	-	-	1,328,006	15,936,072	59,287	599,165	6,273	50,947
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	**(11,575)**	**(128,129)**	**122**	**2,031**	**-**	**-**	**1,922,101**	**16,059,732**	**305,293**	**3,265,286**	**45,896**	**531,627**
C1 - C&I New Buildings	(391)	(5,609)	-	-	-	-	10,498	83,982	19,465	310,429	2,871	50,611
C1a - C&I New Buildings & Major Renovations	(391)	(5,609)	-	-	-	-	10,498	83,982	19,465	310,429	2,871	50,611
C2 - C&I Existing Buildings	(11,184)	(122,521)	122	2,031	-	-	1,911,604	15,975,751	285,827	2,954,858	43,025	481,016
C2a - C&I Existing Building Retrofit	(10,584)	(117,124)	122	2,031	-	-	1,760,591	14,215,568	238,602	2,531,438	36,422	417,772
C2b - C&I New & Replacement Equipment	(600)	(5,397)	-	-	-	-	151,013	1,760,183	47,225	423,420	6,603	63,244
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-
Grand Total	**118,009**	**2,544,449**	**47,981**	**987,984**	**-**	**-**	**12,530,034**	**99,032,471**	**1,012,417**	**10,753,275**	**116,930**	**974,926**

Notes

• MMBtu savings are calculated consistent with the findings in the Study to Propose a More Refined Method to Account for the Conversion of Electric Savings to MMBtu Savings (see Appendix 7). For more information, see Appendix 6.

Demand Response Savings, Plan Year Summary

2019 Planned vs. Evaluated

Cape Light Compact

May 29, 2020

2019 Planned Net Savings										
Program	# of Participants	Electric						Total Savings	
		Annual Capacity (kW)		Electric Energy (MWh)		Electric Energy (MMBTU)		MMBTU	
		Summer	Winter	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential	-	-	-	-	-				
A2 - Residential Existing Buildings	-	-	-	-	-				
A2e - Residential Active Demand Reduction	-	-	-	-	-				
B - Income Eligible	-	-	-	-	-				
B1 - Income Eligible Existing Buildings	-	-	-	-	-				
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-				
C - Commercial & Industrial	-	-	-	-	-				
C2 - C&I Existing Buildings	-	-	-	-	-				
C2c - C&I Active Demand Reduction	-	-	-	-	-				
Grand Total	-	-	-	-	-				

2019 Evaluated Net Savings									
Program	# of Participants	Electric						Total Savings	
		Annual Capacity (kW)		Electric Energy (MWh)		Electric Energy (MMBTU)		MMBTU	
		Summer	Winter	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential									
A2 - Residential Existing Buildings									
A2e - Residential Active Demand Reduction									
B - Income Eligible									
B1 - Income Eligible Existing Buildings									
B1b - Income Eligible Active Demand Reduction									
C - Commercial & Industrial									
C2 - C&I Existing Buildings									
C2c - C&I Active Demand Reduction									
Grand Total									

2019 Planned v. Evaluated Greenhouse Gas Reductions Variances (%)									
Program	# of Participants	Electric						Total Savings	
		Annual Capacity (kW)		Electric Energy (MWh)		Electric Energy (MMBTU)		MMBTU	
		Summer	Winter	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential									
A2 - Residential Existing Buildings									
A2e - Residential Active Demand Reduction									
B - Income Eligible									
B1 - Income Eligible Existing Buildings									
B1b - Income Eligible Active Demand Reduction									
C - Commercial & Industrial									
C2 - C&I Existing Buildings									
C2c - C&I Active Demand Reduction									
Grand Total									

Notes

• The above tables reflect only demand response measures in the active demand reduction core initiatives. These savings cannot be summed across years, so are shown here for each individual year.

• The active demand reduction core initiatives may include other, non-demand response measures such as storage. If applicable, those measures are included in the previous savings tables.

• The Compact did not implement active demand reduction measures in 2019. See D.P.U. 18-116-A, *Order Regarding Implementation of Active Demand Reduction Offerings By Cape Light Compact JPE* (2020).

Demand Response Savings, Three-Year Total

2019-2021 Net Savings

Cape Light Compact
May 29, 2020

2019 Evaluated Net Savings									
Program	# of Participants	Electric						Total Savings	
		Annual Capacity (kW)		Electric Energy (MWh)		Electric Energy (MMBTU)		MMBTU	
		Summer	Winter	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential									
A2 - Residential Existing Buildings									
A2e - Residential Active Demand Reduction									
B - Income Eligible									
B1 - Income Eligible Existing Buildings									
B1b - Income Eligible Active Demand Reduction									
C - Commercial & Industrial									
C2 - C&I Existing Buildings									
C2c - C&I Active Demand Reduction									
Grand Total									

2020 Planned Net Savings									
Program	# of Participants	Electric						Total Savings	
		Annual Capacity (kW)		Electric Energy (MWh)		Electric Energy (MMBTU)		MMBTU	
		Summer	Winter	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential	**1,764**	**1,455**	**120**	**(1)**	**(1)**				
A2 - Residential Existing Buildings	1,764	1,455	120	(1)	(1)				
A2e - Residential Active Demand Reduction	1,764	1,455	120	(1)	(1)				
B - Income Eligible	**-**	**-**	**-**	**-**	**-**				
B1 - Income Eligible Existing Buildings	-	-	-	-	-				
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-				
C - Commercial & Industrial	**40**	**14,563**	**5,125**	**(16)**	**(16)**				
C2 - C&I Existing Buildings	40	14,563	5,125	(16)	(16)				
C2c - C&I Active Demand Reduction	40	14,563	5,125	(16)	(16)				
Grand Total	**1,804**	**16,018**	**5,245**	**(17)**	**(17)**				

2021 Planned Net Savings									
Program	# of Participants	Electric						Total Savings	
		Annual Capacity (kW)		Electric Energy (MWh)		Electric Energy (MMBTU)		MMBTU	
		Summer	Winter	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential	**2,709**	**2,247**	**200**	**(2)**	**(2)**				
A2 - Residential Existing Buildings	2,709	2,247	200	(2)	(2)				
A2e - Residential Active Demand Reduction	2,709	2,247	200	(2)	(2)				
B - Income Eligible	**-**	**-**	**-**	**-**	**-**				
B1 - Income Eligible Existing Buildings	-	-	-	-	-				
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-				
C - Commercial & Industrial	**54**	**25,120**	**7,750**	**(16)**	**(16)**				
C2 - C&I Existing Buildings	54	25,120	7,750	(16)	(16)				
C2c - C&I Active Demand Reduction	54	25,120	7,750	(16)	(16)				
Grand Total	**2,763**	**27,367**	**7,950**	**(17)**	**(17)**				

Notes

• The above tables reflect only demand response measures in the active demand reduction core initiatives. These savings cannot be summed across years, so are shown here for each individual year.
• The active demand reduction core initiatives may include other, non-demand response measures such as storage. If applicable, those measures are included in the previous savings tables.
• The Compact did not implement active demand reduction measures in 2019. The 2020 and 2021 active demand reduction savings in the tables above are consistent with the Compact's November 2019 compliance filing. See D.P.U. 18-116-A, *Order Regarding Implementation of Active Demand Reduction Offerings By Cape Light Compact JPE* (2020).

Program Benefits, Plan Year Summary

2019 Planned vs. Evaluated

Cape Light Compact

May 29, 2020

2019 Planned Benefits

Program	Electric Benefits									
	Capacity						Electric Energy			
	Summer Generation	Capacity DRIPE	Transmission	Distribution	Reliability	Total Capacity Benefits	Electric Energy	Electric Energy DRIPE	Electric Energy Environmental Compliance	Total Electric Energy Benefits
A - Residential	**1,399,836**	**139,868**	**1,806,804**	**3,805,822**	**37,047**	**7,189,378**	**7,099,476**	**2,715,567**	**3,960,292**	**13,775,336**
A1 - Residential New Buildings	84,634	1,575	101,930	214,704	1,610	404,452	902,860	200,901	484,563	1,588,324
A1a - Residential New Homes & Renovations	84,634	1,575	101,930	214,704	1,610	404,452	902,860	200,901	484,563	1,588,324
A2 - Residential Existing Buildings	1,315,203	138,294	1,704,874	3,591,118	35,437	6,784,926	6,196,617	2,514,666	3,475,729	12,187,012
A2a - Residential Coordinated Delivery	402,264	25,512	485,386	1,022,409	9,418	1,944,990	3,168,223	908,349	1,737,467	5,814,039
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	863,299	37,462	1,168,664	2,461,654	23,626	4,554,705	2,796,335	1,523,641	1,594,271	5,914,246
A2d - Residential Behavior	49,640	75,320	50,824	107,055	2,393	285,232	232,058	82,677	143,991	458,726
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	-	-
B - Income Eligible	**133,620**	**8,030**	**169,454**	**356,936**	**3,370**	**671,410**	**1,090,742**	**365,192**	**625,830**	**2,081,764**
B1 - Income Eligible Existing Buildings	133,620	8,030	169,454	356,936	3,370	671,410	1,090,742	365,192	625,830	2,081,764
B1a - Income Eligible Coordinated Delivery	133,620	8,030	169,454	356,936	3,370	671,410	1,090,742	365,192	625,830	2,081,764
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	**2,475,144**	**162,476**	**3,022,217**	**6,365,947**	**50,726**	**12,076,511**	**11,648,798**	**3,977,944**	**6,878,426**	**22,505,168**
C1 - C&I New Buildings	76,847	1,095	92,339	194,501	1,462	366,244	837,134	201,068	487,846	1,526,048
C1a - C&I New Buildings & Major Renovations	76,847	1,095	92,339	194,501	1,462	366,244	837,134	201,068	487,846	1,526,048
C2 - C&I Existing Buildings	2,398,297	161,381	2,929,878	6,171,446	49,265	11,710,267	10,811,664	3,776,876	6,390,580	20,979,120
C2a - C&I Existing Building Retrofit	2,033,111	129,562	2,465,445	5,193,170	40,367	9,861,656	9,423,090	3,249,847	5,562,832	18,235,769
C2b - C&I New & Replacement Equipment	365,186	31,819	464,434	978,276	8,898	1,848,612	1,388,574	527,029	827,748	2,743,351
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-	-	-
Grand Total	**4,008,600**	**310,374**	**4,998,476**	**10,528,705**	**91,144**	**19,937,299**	**19,839,016**	**7,058,703**	**11,464,549**	**38,362,267**

2019 Evaluated Benefits

Program	Electric Benefits									
	Capacity						Electric Energy			
	Summer Generation	Capacity DRIPE	Transmission	Distribution	Reliability	Total Capacity Benefits	Electric Energy	Electric Energy DRIPE	Electric Energy Environmental Compliance	Total Electric Energy Benefits
A - Residential	**1,527,659**	**210,706**	**1,862,046**	**3,922,183**	**37,546**	**7,560,140**	**9,811,859**	**2,976,100**	**5,436,742**	**18,224,702**
A1 - Residential New Buildings	84,669	1,241	92,060	193,913	1,075	372,959	1,167,825	182,293	615,341	1,965,460
A1a - Residential New Homes & Renovations	84,669	1,241	92,060	193,913	1,075	372,959	1,167,825	182,293	615,341	1,965,460
A2 - Residential Existing Buildings	1,442,990	209,465	1,769,986	3,728,269	36,470	7,187,181	8,644,034	2,793,807	4,821,401	16,259,242
A2a - Residential Coordinated Delivery	667,325	37,434	791,832	1,667,901	14,236	3,178,727	5,191,542	1,391,177	2,838,342	9,421,060
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	771,559	165,800	973,950	2,051,512	22,037	3,984,858	3,437,996	1,397,313	1,973,871	6,809,180
A2d - Residential Behavior	4,106	6,231	4,204	8,856	198	23,596	14,495	5,318	9,189	29,002
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	-	-
B - Income Eligible	**149,361**	**8,854**	**190,611**	**401,500**	**3,816**	**754,143**	**933,460**	**340,179**	**542,379**	**1,816,018**
B1 - Income Eligible Existing Buildings	149,361	8,854	190,611	401,500	3,816	754,143	933,460	340,179	542,379	1,816,018
B1a - Income Eligible Coordinated Delivery	149,361	8,854	190,611	401,500	3,816	754,143	933,460	340,179	542,379	1,816,018
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	**1,745,789**	**136,782**	**2,210,210**	**4,655,550**	**40,608**	**8,788,939**	**7,559,080**	**2,634,624**	**4,511,780**	**14,705,484**
C1 - C&I New Buildings	140,371	350	166,199	350,078	2,478	659,476	840,314	192,543	485,060	1,517,917
C1a - C&I New Buildings & Major Renovations	140,371	350	166,199	350,078	2,478	659,476	840,314	192,543	485,060	1,517,917
C2 - C&I Existing Buildings	1,605,418	136,432	2,044,012	4,305,471	38,130	8,129,463	6,718,766	2,442,081	4,026,720	13,187,567
C2a - C&I Existing Building Retrofit	1,322,510	121,770	1,686,809	3,553,066	31,591	6,715,746	5,239,886	1,904,489	3,146,012	10,290,386
C2b - C&I New & Replacement Equipment	282,908	14,662	357,203	752,405	6,539	1,413,716	1,478,881	537,592	880,708	2,897,180
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-	-	-
Grand Total	**3,422,810**	**356,342**	**4,262,868**	**8,979,233**	**81,970**	**17,103,222**	**18,304,400**	**5,950,903**	**10,490,901**	**34,746,204**

Program Benefits, Plan Year Summary

2019 Planned vs. Evaluated

Cape Light Compact

May 29, 2020

2019 Planned v. Evaluated Total Benefits Variances (%)										
Program	Electric Benefits									
	Capacity						Electric Energy			
	Summer Generation	Capacity DRIPE	Transmission	Distribution	Reliability	Total Capacity Benefits	Electric Energy	Electric Energy DRIPE	Electric Energy Environmental Compliance	Total Electric Energy Benefits
A - Residential	**9%**	**51%**	**3%**	**3%**	**1%**	**5%**	**38%**	**10%**	**37%**	**32%**
A1 - Residential New Buildings	0%	-21%	-10%	-10%	-33%	-8%	29%	-9%	27%	24%
A1a - Residential New Homes & Renovations	0%	-21%	-10%	-10%	-33%	-8%	29%	-9%	27%	24%
A2 - Residential Existing Buildings	10%	51%	4%	4%	3%	6%	39%	11%	39%	33%
A2a - Residential Coordinated Delivery	66%	47%	63%	63%	51%	63%	64%	53%	63%	62%
A2b - Residential Conservation Services (RCS)										
A2c - Residential Retail	-11%	343%	-17%	-17%	-7%	-13%	23%	-8%	24%	15%
A2d - Residential Behavior	-92%	-92%	-92%	-92%	-92%	-92%	-94%	-94%	-94%	-94%
A2e - Residential Active Demand Reduction										
B - Income Eligible	**12%**	**10%**	**12%**	**12%**	**13%**	**12%**	**-14%**	**-7%**	**-13%**	**-13%**
B1 - Income Eligible Existing Buildings	12%	10%	12%	12%	13%	12%	-14%	-7%	-13%	-13%
B1a - Income Eligible Coordinated Delivery	12%	10%	12%	12%	13%	12%	-14%	-7%	-13%	-13%
B1b - Income Eligible Active Demand Reduction										
C - Commercial & Industrial	**-29%**	**-16%**	**-27%**	**-27%**	**-20%**	**-27%**	**-35%**	**-34%**	**-34%**	**-35%**
C1 - C&I New Buildings	83%	-68%	80%	80%	70%	80%	0%	-4%	-1%	-1%
C1a - C&I New Buildings & Major Renovations	83%	-68%	80%	80%	70%	80%	0%	-4%	-1%	-1%
C2 - C&I Existing Buildings	-33%	-15%	-30%	-30%	-23%	-31%	-38%	-35%	-37%	-37%
C2a - C&I Existing Building Retrofit	-35%	-6%	-32%	-32%	-22%	-32%	-44%	-41%	-43%	-44%
C2b - C&I New & Replacement Equipment	-23%	-54%	-23%	-23%	-27%	-24%	7%	2%	6%	6%
C2c - C&I Active Demand Reduction										
Grand Total	**-15%**	**15%**	**-15%**	**-15%**	**-10%**	**-14%**	**-8%**	**-16%**	**-8%**	**-9%**

Notes

• Benefits for each year are presented in real dollars (2019$).

• Total Energy Benefits are the sum of electric benefits, natural gas benefits, and other resource benefits.

Program Benefits, Plan Year Summary

2019 Planned vs. Evaluated

Cape Light Compact

May 29, 2020

	2019 Planned Benefits										
	Natural Gas Benefits				Oil Benefits				Propane Benefits		
Program	Natural Gas	Natural Gas DRIPE	Natural Gas Environmental Compliance	Total Natural Gas Benefits	Oil	Oil DRIPE	Oil Environmental Compliance	Total Oil Benefits	Propane	Propane Environmental Compliance	Total Propane Benefits
A - Residential	**4,122,566**	**332,858**	**1,723,652**	**6,179,075**	**21,544,627**	**61,233**	**4,951,612**	**26,557,472**	**11,588,802**	**1,660,420**	**13,249,222**
A1 - Residential New Buildings	-	-	-	-	10,261	32	2,299	12,592	3,719,106	520,846	4,239,952
A1a - Residential New Homes & Renovations	-	-	-	-	10,261	32	2,299	12,592	3,719,106	520,846	4,239,952
A2 - Residential Existing Buildings	4,122,566	332,858	1,723,652	6,179,075	21,534,367	61,201	4,949,313	26,544,880	7,869,696	1,139,574	9,009,269
A2a - Residential Coordinated Delivery	4,566,545	499,595	1,923,940	6,990,080	12,624,435	36,779	2,885,743	15,546,957	3,505,816	505,606	4,011,422
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	(443,979)	(166,737)	(200,288)	(811,004)	8,909,931	24,422	2,063,570	10,997,923	4,363,880	633,967	4,997,847
A2d - Residential Behavior	-	-	-	-	-	-	-	-	-	-	-
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-
B - Income Eligible	**-**	**-**	**-**	**-**	**1,715,099**	**4,819**	**397,782**	**2,117,699**	**455,699**	**66,823**	**522,522**
B1 - Income Eligible Existing Buildings	-	-	-	-	1,715,099	4,819	397,782	2,117,699	455,699	66,823	522,522
B1a - Income Eligible Coordinated Delivery	-	-	-	-	1,715,099	4,819	397,782	2,117,699	455,699	66,823	522,522
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	**(555,311)**	**(129,784)**	**(265,802)**	**(950,897)**	**(981,662)**	**(2,187)**	**(295,244)**	**(1,279,093)**	**25,136**	**3,554**	**28,690**
C1 - C&I New Buildings	(27,469)	(3,850)	(12,770)	(44,089)	(24,018)	(63)	(7,043)	(31,124)	-	-	-
C1a - C&I New Buildings & Major Renovations	(27,469)	(3,850)	(12,770)	(44,089)	(24,018)	(63)	(7,043)	(31,124)	-	-	-
C2 - C&I Existing Buildings	(527,843)	(125,934)	(253,032)	(906,808)	(957,643)	(2,125)	(288,201)	(1,247,969)	25,136	3,554	28,690
C2a - C&I Existing Building Retrofit	(517,918)	(123,176)	(248,277)	(889,371)	(916,246)	(2,029)	(275,529)	(1,193,805)	25,136	3,554	28,690
C2b - C&I New & Replacement Equipment	(9,925)	(2,758)	(4,754)	(17,437)	(41,397)	(95)	(12,672)	(54,164)	-	-	-
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-
Grand Total	**3,567,255**	**203,074**	**1,457,850**	**5,228,178**	**22,278,065**	**63,864**	**5,054,149**	**27,396,079**	**12,069,636**	**1,730,797**	**13,800,433**

	2019 Evaluated Benefits										
	Natural Gas Benefits				Oil Benefits				Propane Benefits		
Program	Natural Gas	Natural Gas DRIPE	Natural Gas Environmental Compliance	Total Natural Gas Benefits	Oil	Oil DRIPE	Oil Environmental Compliance	Total Oil Benefits	Propane	Propane Environmental Compliance	Total Propane Benefits
A - Residential	**4,236,301**	**376,811**	**1,772,649**	**6,385,760**	**15,658,085**	**44,819**	**3,575,580**	**19,278,483**	**7,107,459**	**1,017,835**	**8,125,294**
A1 - Residential New Buildings	-	-	-	-	47,132	149	10,520	57,800	670,780	93,028	763,808
A1a - Residential New Homes & Renovations	-	-	-	-	47,132	149	10,520	57,800	670,780	93,028	763,808
A2 - Residential Existing Buildings	4,236,301	376,811	1,772,649	6,385,760	15,610,953	44,670	3,565,060	19,220,683	6,436,679	924,807	7,361,485
A2a - Residential Coordinated Delivery	4,532,314	511,776	1,912,872	6,956,962	12,801,131	37,212	2,928,069	15,766,412	3,711,936	530,022	4,241,958
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	(296,013)	(134,965)	(140,224)	(571,201)	2,800,635	7,437	633,898	3,441,970	2,717,225	393,311	3,110,536
A2d - Residential Behavior	-	-	-	-	9,188	21	3,093	12,301	7,518	1,473	8,992
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-
B - Income Eligible	**-**	**-**	**-**	**-**	**1,108,472**	**3,173**	**255,962**	**1,367,607**	**302,638**	**43,805**	**346,444**
B1 - Income Eligible Existing Buildings	-	-	-	-	1,108,472	3,173	255,962	1,367,607	302,638	43,805	346,444
B1a - Income Eligible Coordinated Delivery	-	-	-	-	1,108,472	3,173	255,962	1,367,607	302,638	43,805	346,444
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	**(311,735)**	**(72,870)**	**(149,186)**	**(533,791)**	**(400,739)**	**(872)**	**(124,221)**	**(525,831)**	**14,341**	**2,227**	**16,568**
C1 - C&I New Buildings	(33,105)	(4,706)	(15,398)	(53,208)	(49,955)	(144)	(14,426)	(64,525)	-	-	-
C1a - C&I New Buildings & Major Renovations	(33,105)	(4,706)	(15,398)	(53,208)	(49,955)	(144)	(14,426)	(64,525)	-	-	-
C2 - C&I Existing Buildings	(278,630)	(68,164)	(133,789)	(480,583)	(350,783)	(728)	(109,795)	(461,306)	14,341	2,227	16,568
C2a - C&I Existing Building Retrofit	(267,098)	(65,032)	(128,223)	(460,354)	(319,267)	(654)	(100,137)	(420,059)	14,341	2,227	16,568
C2b - C&I New & Replacement Equipment	(11,532)	(3,131)	(5,565)	(20,229)	(31,516)	(74)	(9,657)	(41,248)	-	-	-
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-
Grand Total	**3,924,566**	**303,941**	**1,623,462**	**5,851,969**	**16,365,818**	**47,121**	**3,707,321**	**20,120,259**	**7,424,438**	**1,063,867**	**8,488,305**

Program Benefits, Plan Year Summary

2019 Planned vs. Evaluated

Cape Light Compact

May 29, 2020

	2019 Planned v. Evaluated Total Benefits Variances (%)										
	Natural Gas Benefits				Oil Benefits				Propane Benefits		
Program	Natural Gas	Natural Gas DRIPE	Natural Gas Environmental Compliance	Total Natural Gas Benefits	Oil	Oil DRIPE	Oil Environmental Compliance	Total Oil Benefits	Propane	Propane Environmental Compliance	Total Propane Benefits
A - Residential	**3%**	**13%**	**3%**	**3%**	**-27%**	**-27%**	**-28%**	**-27%**	**-39%**	**-39%**	**-39%**
A1 - Residential New Buildings					359%	365%	358%	359%	-82%	-82%	-82%
A1a - Residential New Homes & Renovations					359%	365%	358%	359%	-82%	-82%	-82%
A2 - Residential Existing Buildings	3%	13%	3%	3%	-28%	-27%	-28%	-28%	-18%	-19%	-18%
A2a - Residential Coordinated Delivery	-1%	2%	-1%	0%	1%	1%	1%	1%	6%	5%	6%
A2b - Residential Conservation Services (RCS)											
A2c - Residential Retail	-33%	-19%	-30%	-30%	-69%	-70%	-69%	-69%	-38%	-38%	-38%
A2d - Residential Behavior											
A2e - Residential Active Demand Reduction											
B - Income Eligible					**-35%**	**-34%**	**-36%**	**-35%**	**-34%**	**-34%**	**-34%**
B1 - Income Eligible Existing Buildings					-35%	-34%	-36%	-35%	-34%	-34%	-34%
B1a - Income Eligible Coordinated Delivery					-35%	-34%	-36%	-35%	-34%	-34%	-34%
B1b - Income Eligible Active Demand Reduction											
C - Commercial & Industrial	**-44%**	**-44%**	**-44%**	**-44%**	**-59%**	**-60%**	**-58%**	**-59%**	**-43%**	**-37%**	**-42%**
C1 - C&I New Buildings	21%	22%	21%	21%	108%	128%	105%	107%			
C1a - C&I New Buildings & Major Renovations	21%	22%	21%	21%	108%	128%	105%	107%			
C2 - C&I Existing Buildings	-47%	-46%	-47%	-47%	-63%	-66%	-62%	-63%	-43%	-37%	-42%
C2a - C&I Existing Building Retrofit	-48%	-47%	-48%	-48%	-65%	-68%	-64%	-65%	-43%	-37%	-42%
C2b - C&I New & Replacement Equipment	16%	14%	17%	16%	-24%	-22%	-24%	-24%			
C2c - C&I Active Demand Reduction											
Grand Total	**10%**	**50%**	**11%**	**12%**	**-27%**	**-26%**	**-27%**	**-27%**	**-38%**	**-39%**	**-38%**

Notes

• Benefits for each year are presented in real dollars (2019$).

• Total Energy Benefits are the sum of electric benefits, natural gas benefits, and other resource benefits.

Program Benefits, Plan Year Summary

2019 Planned vs. Evaluated

Cape Light Compact

May 29, 2020

	2019 Planned Benefits						
Program	Wood	Water	Total Energy Benefits	Total Environmental Compliance Benefits	Non-Energy Impacts	Total TRC Test Benefits	Total Resource Benefits per Participant
A - Residential	**-**	**319,395**	**67,269,878**	**12,295,976**	**6,651,873**	**73,921,750**	**233**
A1 - Residential New Buildings	-	-	6,245,320	1,007,708	289,540	6,534,859	12,541
A1a - Residential New Homes & Renovations	-	-	6,245,320	1,007,708	289,540	6,534,859	12,541
A2 - Residential Existing Buildings	-	319,395	61,024,558	11,288,267	6,362,333	67,386,891	211
A2a - Residential Coordinated Delivery	-	288,778	34,596,266	7,052,756	5,523,836	40,120,102	9,417
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	
A2c - Residential Retail	-	30,617	25,684,334	4,091,520	838,497	26,522,831	132
A2d - Residential Behavior	-	-	743,958	143,991	-	743,958	8
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	
B - Income Eligible	**-**	**-**	**5,393,395**	**1,090,435**	**3,984,818**	**9,378,213**	**3,995**
B1 - Income Eligible Existing Buildings	-	-	5,393,395	1,090,435	3,984,818	9,378,213	3,995
B1a - Income Eligible Coordinated Delivery	-	-	5,393,395	1,090,435	3,984,818	9,378,213	3,995
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	
C - Commercial & Industrial	**-**	**31,915**	**32,412,294**	**6,320,935**	**22,561,318**	**54,973,612**	**16,545**
C1 - C&I New Buildings	-	456	1,817,536	468,033	36,729	1,854,264	36,351
C1a - C&I New Buildings & Major Renovations	-	456	1,817,536	468,033	36,729	1,854,264	36,351
C2 - C&I Existing Buildings	-	31,459	30,594,759	5,852,901	22,524,589	53,119,348	16,027
C2a - C&I Existing Building Retrofit	-	29,207	26,072,145	5,042,580	22,466,145	48,538,291	34,949
C2b - C&I New & Replacement Equipment	-	2,252	4,522,613	810,322	58,444	4,581,057	3,889
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	
Grand Total	**-**	**351,310**	**105,075,567**	**19,707,345**	**33,198,009**	**138,273,576**	**359**

	2019 Evaluated Benefits						
Program	Wood	Water	Total Energy Benefits	Total Environmental Compliance Benefits	Non-Energy Impacts	Total TRC Test Benefits	Total Resource Benefits per Participant
A - Residential	**-**	**454,685**	**60,029,064**	**11,802,805**	**9,895,755**	**69,924,819**	**212**
A1 - Residential New Buildings	-	-	3,160,027	718,889	245,036	3,405,064	8,634
A1a - Residential New Homes & Renovations	-	-	3,160,027	718,889	245,036	3,405,064	8,634
A2 - Residential Existing Buildings	-	454,685	56,869,036	11,083,916	9,650,719	66,519,755	201
A2a - Residential Coordinated Delivery	-	454,146	40,019,265	8,209,305	8,332,688	48,351,952	3,869
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-
A2c - Residential Retail	-	539	16,775,882	2,860,856	1,318,031	18,093,913	63
A2d - Residential Behavior	-	-	73,890	13,755	-	73,890	36,945
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	
B - Income Eligible	**-**	**257,405**	**4,541,617**	**842,146**	**2,344,210**	**6,885,827**	**2,001**
B1 - Income Eligible Existing Buildings	-	257,405	4,541,617	842,146	2,344,210	6,885,827	2,001
B1a - Income Eligible Coordinated Delivery	-	257,405	4,541,617	842,146	2,344,210	6,885,827	2,001
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	
C - Commercial & Industrial	**-**	**191,999**	**22,643,367**	**4,240,600**	**2,859,630**	**25,502,997**	**16,686**
C1 - C&I New Buildings	-	-	2,059,661	455,237	47,727	2,107,388	73,559
C1a - C&I New Buildings & Major Renovations	-	-	2,059,661	455,237	47,727	2,107,388	73,559
C2 - C&I Existing Buildings	-	191,999	20,583,706	3,785,363	2,811,903	23,395,609	15,488
C2a - C&I Existing Building Retrofit	-	171,470	16,313,758	2,919,878	2,727,601	19,041,360	21,927
C2b - C&I New & Replacement Equipment	-	20,529	4,269,948	865,485	84,301	4,354,249	7,299
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	
Grand Total	**-**	**904,088**	**87,214,047**	**16,885,551**	**15,099,595**	**102,313,642**	**304**

Program Benefits, Plan Year Summary

2019 Planned vs. Evaluated

Cape Light Compact

May 29, 2020

	2019 Planned v. Evaluated Total Benefits Variances (%)						
Program	**Wood**	**Water**	**Total Energy Benefits**	**Total Environmental Compliance Benefits**	**Non-Energy Impacts**	**Total TRC Test Benefits**	**Total Resource Benefits per Participant**
A - Residential		**42%**	**-11%**	**-4%**	**49%**	**-5%**	**-9%**
A1 - Residential New Buildings			-49%	-29%	-15%	-48%	-31%
A1a - Residential New Homes & Renovations			-49%	-29%	-15%	-48%	-31%
A2 - Residential Existing Buildings		42%	-7%	-2%	52%	-1%	-5%
A2a - Residential Coordinated Delivery		57%	16%	16%	51%	21%	-59%
A2b - Residential Conservation Services (RCS)							
A2c - Residential Retail		-98%	-35%	-30%	57%	-32%	-52%
A2d - Residential Behavior			-90%	-90%		-90%	446842%
A2e - Residential Active Demand Reduction							
B - Income Eligible			**-16%**	**-23%**	**-41%**	**-27%**	**-50%**
B1 - Income Eligible Existing Buildings			-16%	-23%	-41%	-27%	-50%
B1a - Income Eligible Coordinated Delivery			-16%	-23%	-41%	-27%	-50%
B1b - Income Eligible Active Demand Reduction							
C - Commercial & Industrial		**502%**	**-30%**	**-33%**	**-87%**	**-54%**	**1%**
C1 - C&I New Buildings		-100%	13%	-3%	30%	14%	102%
C1a - C&I New Buildings & Major Renovations		-100%	13%	-3%	30%	14%	102%
C2 - C&I Existing Buildings		510%	-33%	-35%	-88%	-56%	-3%
C2a - C&I Existing Building Retrofit		487%	-37%	-42%	-88%	-61%	-37%
C2b - C&I New & Replacement Equipment		812%	-6%	7%	44%	-5%	88%
C2c - C&I Active Demand Reduction							
Grand Total		**157%**	**-17%**	**-14%**	**-55%**	**-26%**	**-15%**

Notes

• Benefits for each year are presented in real dollars (2019$).

• Total Energy Benefits are the sum of electric benefits, natural gas benefits, and other resource benefits.

Program Benefits, Three-Year Total

2019-2021 Benefits

Cape Light Compact

May 29, 2020

2019 Evaluated Benefits										
Program	Electric Benefits									
	Capacity						Electric Energy			
	Summer Generation	Capacity DRIPE	Transmission	Distribution	Reliability	Total Capacity Benefits	Electric Energy	Electric Energy DRIPE	Electric Energy Environmental Compliance	Total Electric Energy Benefits
A - Residential	**1,527,659**	**210,706**	**1,862,046**	**3,922,183**	**37,546**	**7,560,140**	**9,811,859**	**2,976,100**	**5,436,742**	**18,224,702**
A1 - Residential New Buildings	84,669	1,241	92,060	193,913	1,075	372,959	1,167,825	182,293	615,341	1,965,460
A1a - Residential New Homes & Renovations	84,669	1,241	92,060	193,913	1,075	372,959	1,167,825	182,293	615,341	1,965,460
A2 - Residential Existing Buildings	1,442,990	209,465	1,769,986	3,728,269	36,470	7,187,181	8,644,034	2,793,807	4,821,401	16,259,242
A2a - Residential Coordinated Delivery	667,325	37,434	791,832	1,667,901	14,236	3,178,727	5,191,542	1,391,177	2,838,342	9,421,060
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	771,559	165,800	973,950	2,051,512	22,037	3,984,858	3,437,996	1,397,313	1,973,871	6,809,180
A2d - Residential Behavior	4,106	6,231	4,204	8,856	198	23,596	14,495	5,318	9,189	29,002
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	-	-
B - Income Eligible	**149,361**	**8,854**	**190,611**	**401,500**	**3,816**	**754,143**	**933,460**	**340,179**	**542,379**	**1,816,018**
B1 - Income Eligible Existing Buildings	149,361	8,854	190,611	401,500	3,816	754,143	933,460	340,179	542,379	1,816,018
B1a - Income Eligible Coordinated Delivery	149,361	8,854	190,611	401,500	3,816	754,143	933,460	340,179	542,379	1,816,018
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	**1,745,789**	**136,782**	**2,210,210**	**4,655,550**	**40,608**	**8,788,939**	**7,559,080**	**2,634,624**	**4,511,780**	**14,705,484**
C1 - C&I New Buildings	140,371	350	166,199	350,078	2,478	659,476	840,314	192,543	485,060	1,517,917
C1a - C&I New Buildings & Major Renovations	140,371	350	166,199	350,078	2,478	659,476	840,314	192,543	485,060	1,517,917
C2 - C&I Existing Buildings	1,605,418	136,432	2,044,012	4,305,471	38,130	8,129,463	6,718,766	2,442,081	4,026,720	13,187,567
C2a - C&I Existing Building Retrofit	1,322,510	121,770	1,686,809	3,553,066	31,591	6,715,746	5,239,886	1,904,489	3,146,012	10,290,386
C2b - C&I New & Replacement Equipment	282,908	14,662	357,203	752,405	6,539	1,413,716	1,478,881	537,592	880,708	2,897,180
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-	-	-
Grand Total	**3,422,810**	**356,342**	**4,262,868**	**8,979,233**	**81,970**	**17,103,222**	**18,304,400**	**5,950,903**	**10,490,901**	**34,746,204**

2020 Planned Benefits										
Program	Electric Benefits									
	Capacity						Electric Energy			
	Summer Generation	Capacity DRIPE	Transmission	Distribution	Reliability	Total Capacity Benefits	Electric Energy	Electric Energy DRIPE	Electric Energy Environmental Compliance	Total Electric Energy Benefits
A - Residential	**1,068,013**	**368,639**	**1,542,006**	**3,248,054**	**48,156**	**6,274,868**	**5,804,851**	**1,955,351**	**3,156,490**	**10,916,692**
A1 - Residential New Buildings	80,898	1,392	98,714	207,928	1,503	390,434	921,914	191,856	485,888	1,599,658
A1a - Residential New Homes & Renovations	80,898	1,392	98,714	207,928	1,503	390,434	921,914	191,856	485,888	1,599,658
A2 - Residential Existing Buildings	987,116	367,248	1,443,292	3,040,126	46,653	5,884,435	4,882,937	1,763,495	2,670,602	9,317,035
A2a - Residential Coordinated Delivery	292,507	90,420	356,781	751,518	6,538	1,497,764	2,866,517	644,914	1,535,145	5,046,577
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	619,165	35,901	861,926	1,815,546	17,353	3,349,891	1,592,037	979,104	892,970	3,464,112
A2d - Residential Behavior	61,738	126,860	85,602	180,311	4,031	458,543	424,264	139,251	242,523	806,039
A2e - Residential Active Demand Reduction	13,706	114,067	138,982	292,750	18,731	578,236	119	226	(37)	307
B - Income Eligible	**123,618**	**23,169**	**160,496**	**338,067**	**3,114**	**648,464**	**1,106,868**	**343,132**	**627,513**	**2,077,513**
B1 - Income Eligible Existing Buildings	123,618	23,169	160,496	338,067	3,114	648,464	1,106,868	343,132	627,513	2,077,513
B1a - Income Eligible Coordinated Delivery	123,618	23,169	160,496	338,067	3,114	648,464	1,106,868	343,132	627,513	2,077,513
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	**2,869,252**	**1,313,430**	**4,674,263**	**9,845,788**	**240,529**	**18,943,262**	**12,247,414**	**4,079,084**	**7,116,311**	**23,442,809**
C1 - C&I New Buildings	77,154	1,112	92,457	194,750	1,464	366,936	1,063,604	242,845	605,765	1,912,215
C1a - C&I New Buildings & Major Renovations	77,154	1,112	92,457	194,750	1,464	366,936	1,063,604	242,845	605,765	1,912,215
C2 - C&I Existing Buildings	2,792,098	1,312,318	4,581,806	9,651,039	239,065	18,576,326	11,183,810	3,836,239	6,510,546	21,530,594
C2a - C&I Existing Building Retrofit	2,347,511	133,941	2,789,473	5,875,699	43,731	11,190,356	9,974,111	3,350,058	5,797,694	19,121,864
C2b - C&I New & Replacement Equipment	307,390	36,556	401,106	844,883	7,831	1,597,767	1,207,723	482,421	713,465	2,403,609
C2c - C&I Active Demand Reduction	137,197	1,141,820	1,391,227	2,930,456	187,503	5,788,202	1,975	3,760	(613)	5,122
Grand Total	**4,060,883**	**1,705,237**	**6,376,765**	**13,431,910**	**291,799**	**25,866,594**	**19,159,134**	**6,377,566**	**10,900,315**	**36,437,015**

Program Benefits, Three-Year Total

2019-2021 Benefits

Cape Light Compact

May 29, 2020

2021 Planned Benefits										
Program	Electric Benefits									
	Capacity						Electric Energy			
	Summer Generation	Capacity DRIPE	Transmission	Distribution	Reliability	Total Capacity Benefits	Electric Energy	Electric Energy DRIPE	Electric Energy Environmental Compliance	Total Electric Energy Benefits
A - Residential	**836,922**	**405,762**	**1,255,139**	**2,643,804**	**50,135**	**5,191,763**	**4,459,414**	**1,243,819**	**2,362,483**	**8,065,716**
A1 - Residential New Buildings	75,064	1,746	87,377	184,049	1,249	349,486	907,401	165,856	469,206	1,542,462
A1a - Residential New Homes & Renovations	75,064	1,746	87,377	184,049	1,249	349,486	907,401	165,856	469,206	1,542,462
A2 - Residential Existing Buildings	761,858	404,016	1,167,763	2,459,755	48,885	4,842,277	3,552,013	1,077,963	1,893,277	6,523,253
A2a - Residential Coordinated Delivery	272,124	56,493	323,364	681,129	5,368	1,338,477	3,023,584	623,313	1,604,857	5,251,754
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	412,200	28,618	533,426	1,123,600	10,051	2,107,895	34,980	297,611	15,634	348,225
A2d - Residential Behavior	56,365	142,722	96,306	202,857	4,535	502,786	493,028	156,663	272,848	922,539
A2e - Residential Active Demand Reduction	21,170	176,183	214,666	452,169	28,932	893,119	420	376	(61)	734
B - Income Eligible	**125,518**	**18,845**	**159,239**	**335,419**	**3,002**	**642,023**	**1,143,709**	**345,975**	**646,583**	**2,136,267**
B1 - Income Eligible Existing Buildings	125,518	18,845	159,239	335,419	3,002	642,023	1,143,709	345,975	646,583	2,136,267
B1a - Income Eligible Coordinated Delivery	125,518	18,845	159,239	335,419	3,002	642,023	1,143,709	345,975	646,583	2,136,267
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	**3,195,219**	**2,153,695**	**5,830,048**	**12,280,313**	**377,030**	**23,836,304**	**12,041,885**	**4,041,065**	**6,928,344**	**23,011,294**
C1 - C&I New Buildings	79,171	1,112	92,457	194,750	1,464	368,953	1,132,308	252,940	634,425	2,019,674
C1a - C&I New Buildings & Major Renovations	79,171	1,112	92,457	194,750	1,464	368,953	1,132,308	252,940	634,425	2,019,674
C2 - C&I Existing Buildings	3,116,048	2,152,583	5,737,591	12,085,563	375,566	23,467,350	10,909,577	3,788,124	6,293,919	20,991,620
C2a - C&I Existing Building Retrofit	2,595,082	148,676	2,979,298	6,275,542	45,117	12,043,715	9,824,265	3,362,938	5,659,526	18,846,730
C2b - C&I New & Replacement Equipment	284,311	34,359	358,539	755,220	7,022	1,439,451	1,081,114	421,427	635,006	2,137,547
C2c - C&I Active Demand Reduction	236,654	1,969,548	2,399,754	5,054,801	323,427	9,984,184	4,197	3,760	(613)	7,343
Grand Total	**4,157,658**	**2,578,302**	**7,244,426**	**15,259,536**	**430,167**	**29,670,090**	**17,645,008**	**5,630,858**	**9,937,411**	**33,213,277**

2019-2021 Benefits										
Program	Electric Benefits									
	Capacity						Electric Energy			
	Summer Generation	Capacity DRIPE	Transmission	Distribution	Reliability	Total Capacity Benefits	Electric Energy	Electric Energy DRIPE	Electric Energy Environmental Compliance	Total Electric Energy Benefits
A - Residential	**3,432,595**	**985,107**	**4,659,191**	**9,814,041**	**135,836**	**19,026,771**	**20,076,124**	**6,175,270**	**10,955,715**	**37,207,109**
A1 - Residential New Buildings	240,630	4,379	278,150	585,891	3,827	1,112,878	2,997,140	540,004	1,570,435	5,107,580
A1a - Residential New Homes & Renovations	240,630	4,379	278,150	585,891	3,827	1,112,878	2,997,140	540,004	1,570,435	5,107,580
A2 - Residential Existing Buildings	3,191,964	980,728	4,381,041	9,228,150	132,009	17,913,893	17,078,984	5,635,266	9,385,280	32,099,530
A2a - Residential Coordinated Delivery	1,231,956	184,347	1,471,977	3,100,548	26,141	6,014,969	11,081,643	2,659,404	5,978,344	19,719,391
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	1,802,924	230,319	2,369,302	4,990,658	49,441	9,442,644	5,065,014	2,674,028	2,882,475	10,621,517
A2d - Residential Behavior	122,210	275,813	186,113	392,025	8,764	984,924	931,788	301,232	524,559	1,757,580
A2e - Residential Active Demand Reduction	34,875	290,249	353,648	744,919	47,663	1,471,355	538	602	(98)	1,042
B - Income Eligible	**398,496**	**50,868**	**510,347**	**1,074,986**	**9,933**	**2,044,630**	**3,184,038**	**1,029,285**	**1,816,476**	**6,029,799**
B1 - Income Eligible Existing Buildings	398,496	50,868	510,347	1,074,986	9,933	2,044,630	3,184,038	1,029,285	1,816,476	6,029,799
B1a - Income Eligible Coordinated Delivery	398,496	50,868	510,347	1,074,986	9,933	2,044,630	3,184,038	1,029,285	1,816,476	6,029,799
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	**7,810,260**	**3,603,906**	**12,714,521**	**26,781,651**	**658,167**	**51,568,505**	**31,848,379**	**10,754,772**	**18,556,435**	**61,159,586**
C1 - C&I New Buildings	296,696	2,574	351,113	739,577	5,406	1,395,366	3,036,227	688,328	1,725,251	5,449,806
C1a - C&I New Buildings & Major Renovations	296,696	2,574	351,113	739,577	5,406	1,395,366	3,036,227	688,328	1,725,251	5,449,806
C2 - C&I Existing Buildings	7,513,564	3,601,332	12,363,409	26,042,073	652,761	50,173,139	28,812,152	10,066,444	16,831,184	55,709,781
C2a - C&I Existing Building Retrofit	6,265,104	404,387	7,455,580	15,704,307	120,439	29,949,818	25,038,262	8,617,485	14,603,232	48,258,980
C2b - C&I New & Replacement Equipment	874,609	85,577	1,116,848	2,352,509	21,392	4,450,934	3,767,718	1,441,440	2,229,178	7,438,336
C2c - C&I Active Demand Reduction	373,852	3,111,368	3,790,981	7,985,257	510,929	15,772,387	6,172	7,519	(1,226)	12,465
Grand Total	**11,641,351**	**4,639,881**	**17,884,059**	**37,670,678**	**803,936**	**72,639,906**	**55,108,541**	**17,959,328**	**31,328,626**	**104,396,495**

Notes

• Benefits for each year are presented in real dollars (2019$).

• Total Energy Benefits are the sum of electric benefits, natural gas benefits, and other resource benefits.

Program Benefits, Three-Year Total

2019-2021 Benefits

Cape Light Compact

May 29, 2020

Program	2019 Evaluated Benefits										
	Natural Gas Benefits				Oil Benefits				Propane Benefits		
	Natural Gas	Natural Gas DRIPE	Natural Gas Environmental Compliance	Total Natural Gas Benefits	Oil	Oil DRIPE	Oil Environmental Compliance	Total Oil Benefits	Propane	Propane Environmental Compliance	Total Propane Benefits
A - Residential	**4,236,301**	**376,811**	**1,772,649**	**6,385,760**	**15,658,085**	**44,819**	**3,575,580**	**19,278,483**	**7,107,459**	**1,017,835**	**8,125,294**
A1 - Residential New Buildings	-	-	-	-	47,132	149	10,520	57,800	670,780	93,028	763,808
A1a - Residential New Homes & Renovations	-	-	-	-	47,132	149	10,520	57,800	670,780	93,028	763,808
A2 - Residential Existing Buildings	4,236,301	376,811	1,772,649	6,385,760	15,610,953	44,670	3,565,060	19,220,683	6,436,679	924,807	7,361,485
A2a - Residential Coordinated Delivery	4,532,314	511,776	1,912,872	6,956,962	12,801,131	37,212	2,928,069	15,766,412	3,711,936	530,022	4,241,958
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	(296,013)	(134,965)	(140,224)	(571,201)	2,800,635	7,437	633,898	3,441,970	2,717,225	393,311	3,110,536
A2d - Residential Behavior	-	-	-	-	9,188	21	3,093	12,301	7,518	1,473	8,992
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-
B - Income Eligible	**-**	**-**	**-**	**-**	**1,108,472**	**3,173**	**255,962**	**1,367,607**	**302,638**	**43,805**	**346,444**
B1 - Income Eligible Existing Buildings	-	-	-	-	1,108,472	3,173	255,962	1,367,607	302,638	43,805	346,444
B1a - Income Eligible Coordinated Delivery	-	-	-	-	1,108,472	3,173	255,962	1,367,607	302,638	43,805	346,444
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	**(311,735)**	**(72,870)**	**(149,186)**	**(533,791)**	**(400,739)**	**(872)**	**(124,221)**	**(525,831)**	**14,341**	**2,227**	**16,568**
C1 - C&I New Buildings	(33,105)	(4,706)	(15,398)	(53,208)	(49,955)	(144)	(14,426)	(64,525)	-	-	-
C1a - C&I New Buildings & Major Renovations	(33,105)	(4,706)	(15,398)	(53,208)	(49,955)	(144)	(14,426)	(64,525)	-	-	-
C2 - C&I Existing Buildings	(278,630)	(68,164)	(133,789)	(480,583)	(350,783)	(728)	(109,795)	(461,306)	14,341	2,227	16,568
C2a - C&I Existing Building Retrofit	(267,098)	(65,032)	(128,223)	(460,354)	(319,267)	(654)	(100,137)	(420,059)	14,341	2,227	16,568
C2b - C&I New & Replacement Equipment	(11,532)	(3,131)	(5,565)	(20,229)	(31,516)	(74)	(9,657)	(41,248)	-	-	-
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-
Grand Total	**3,924,566**	**303,941**	**1,623,462**	**5,851,969**	**16,365,818**	**47,121**	**3,707,321**	**20,120,259**	**7,424,438**	**1,063,867**	**8,488,305**

Program	2020 Planned Benefits										
	Natural Gas Benefits				Oil Benefits				Propane Benefits		
	Natural Gas	Natural Gas DRIPE	Natural Gas Environmental Compliance	Total Natural Gas Benefits	Oil	Oil DRIPE	Oil Environmental Compliance	Total Oil Benefits	Propane	Propane Environmental Compliance	Total Propane Benefits
A - Residential	**4,302,391**	**383,995**	**1,786,563**	**6,472,949**	**21,050,939**	**61,875**	**4,731,703**	**25,844,518**	**11,599,904**	**1,630,219**	**13,230,124**
A1 - Residential New Buildings	-	-	-	-	10,880	35	2,389	13,304	3,935,558	541,417	4,476,976
A1a - Residential New Homes & Renovations	-	-	-	-	10,880	35	2,389	13,304	3,935,558	541,417	4,476,976
A2 - Residential Existing Buildings	4,302,391	383,995	1,786,563	6,472,949	21,040,059	61,841	4,729,314	25,831,214	7,664,346	1,088,802	8,753,148
A2a - Residential Coordinated Delivery	4,595,635	496,289	1,914,792	7,006,715	12,305,544	37,027	2,747,358	15,089,929	3,451,529	487,744	3,939,272
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	(293,244)	(112,294)	(128,229)	(533,766)	8,734,515	24,813	1,981,956	10,741,285	4,212,817	601,058	4,813,876
A2d - Residential Behavior	-	-	-	-	-	-	-	-	-	-	-
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-
B - Income Eligible	**-**	**-**	**-**	**-**	**1,919,210**	**5,563**	**434,638**	**2,359,412**	**491,207**	**70,501**	**561,708**
B1 - Income Eligible Existing Buildings	-	-	-	-	1,919,210	5,563	434,638	2,359,412	491,207	70,501	561,708
B1a - Income Eligible Coordinated Delivery	-	-	-	-	1,919,210	5,563	434,638	2,359,412	491,207	70,501	561,708
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	**(580,928)**	**(131,986)**	**(271,698)**	**(984,612)**	**(1,013,256)**	**(2,368)**	**(293,598)**	**(1,309,222)**	**25,611**	**3,554**	**29,165**
C1 - C&I New Buildings	(37,157)	(5,030)	(17,019)	(59,206)	(24,640)	(69)	(6,990)	(31,699)	-	-	-
C1a - C&I New Buildings & Major Renovations	(37,157)	(5,030)	(17,019)	(59,206)	(24,640)	(69)	(6,990)	(31,699)	-	-	-
C2 - C&I Existing Buildings	(543,770)	(126,956)	(254,679)	(925,406)	(988,615)	(2,299)	(286,608)	(1,277,523)	25,611	3,554	29,165
C2a - C&I Existing Building Retrofit	(535,539)	(124,544)	(250,857)	(910,940)	(952,736)	(2,217)	(275,984)	(1,230,938)	25,611	3,554	29,165
C2b - C&I New & Replacement Equipment	(8,231)	(2,412)	(3,822)	(14,465)	(35,879)	(82)	(10,624)	(46,585)	-	-	-
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-
Grand Total	**3,721,463**	**252,009**	**1,514,865**	**5,488,337**	**21,956,894**	**65,070**	**4,872,744**	**26,894,708**	**12,116,723**	**1,704,274**	**13,820,996**

Program Benefits, Three-Year Total

2019-2021 Benefits

Cape Light Compact

May 29, 2020

Program	2021 Planned Benefits										
	Natural Gas Benefits				Oil Benefits				Propane Benefits		
	Natural Gas	Natural Gas DRIPE	Natural Gas Environmental Compliance	Total Natural Gas Benefits	Oil	Oil DRIPE	Oil Environmental Compliance	Total Oil Benefits	Propane	Propane Environmental Compliance	Total Propane Benefits
A - Residential	**4,510,371**	**451,253**	**1,863,537**	**6,825,161**	**21,652,130**	**65,508**	**4,778,192**	**26,495,829**	**12,246,353**	**1,693,029**	**13,939,381**
A1 - Residential New Buildings	-	-	-	-	11,566	38	2,497	14,100	4,177,787	565,678	4,743,465
A1a - Residential New Homes & Renovations	-	-	-	-	11,566	38	2,497	14,100	4,177,787	565,678	4,743,465
A2 - Residential Existing Buildings	4,510,371	451,253	1,863,537	6,825,161	21,640,564	65,470	4,775,695	26,481,729	8,068,566	1,127,350	9,195,917
A2a - Residential Coordinated Delivery	4,613,808	493,842	1,908,022	7,015,672	12,624,714	39,064	2,765,413	15,429,192	3,723,438	517,471	4,240,908
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	(103,437)	(42,589)	(44,485)	(190,511)	9,015,850	26,406	2,010,282	11,052,538	4,345,129	609,880	4,955,008
A2d - Residential Behavior	-	-	-	-	-	-	-	-	-	-	-
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-
B - Income Eligible	**-**	**-**	**-**	**-**	**2,038,652**	**6,120**	**451,783**	**2,496,555**	**518,283**	**72,920**	**591,203**
B1 - Income Eligible Existing Buildings	-	-	-	-	2,038,652	6,120	451,783	2,496,555	518,283	72,920	591,203
B1a - Income Eligible Coordinated Delivery	-	-	-	-	2,038,652	6,120	451,783	2,496,555	518,283	72,920	591,203
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	**(561,004)**	**(133,437)**	**(259,021)**	**(953,462)**	**(994,904)**	**(2,419)**	**(280,500)**	**(1,277,822)**	**26,039**	**3,554**	**29,593**
C1 - C&I New Buildings	(39,489)	(5,279)	(17,920)	(62,688)	(32,607)	(102)	(8,906)	(41,615)	-	-	-
C1a - C&I New Buildings & Major Renovations	(39,489)	(5,279)	(17,920)	(62,688)	(32,607)	(102)	(8,906)	(41,615)	-	-	-
C2 - C&I Existing Buildings	(521,515)	(128,157)	(241,101)	(890,774)	(962,297)	(2,316)	(271,594)	(1,236,207)	26,039	3,554	29,593
C2a - C&I Existing Building Retrofit	(514,815)	(126,240)	(238,077)	(879,133)	(930,075)	(2,245)	(262,395)	(1,194,714)	26,039	3,554	29,593
C2b - C&I New & Replacement Equipment	(6,700)	(1,917)	(3,024)	(11,641)	(32,222)	(72)	(9,199)	(41,493)	-	-	-
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-
Grand Total	**3,949,367**	**317,817**	**1,604,515**	**5,871,699**	**22,695,878**	**69,209**	**4,949,475**	**27,714,562**	**12,790,675**	**1,769,502**	**14,560,177**

Program	2019-2021 Benefits										
	Natural Gas Benefits				Oil Benefits				Propane Benefits		
	Natural Gas	Natural Gas DRIPE	Natural Gas Environmental Compliance	Total Natural Gas Benefits	Oil	Oil DRIPE	Oil Environmental Compliance	Total Oil Benefits	Propane	Propane Environmental Compliance	Total Propane Benefits
A - Residential	**13,049,063**	**1,212,059**	**5,422,748**	**19,683,870**	**58,361,154**	**172,202**	**13,085,475**	**71,618,831**	**30,953,716**	**4,341,083**	**35,294,799**
A1 - Residential New Buildings	-	-	-	-	69,577	221	15,406	85,204	8,784,125	1,200,123	9,984,249
A1a - Residential New Homes & Renovations	-	-	-	-	69,577	221	15,406	85,204	8,784,125	1,200,123	9,984,249
A2 - Residential Existing Buildings	13,049,063	1,212,059	5,422,748	19,683,870	58,291,577	171,981	13,070,069	71,533,627	22,169,591	3,140,959	25,310,550
A2a - Residential Coordinated Delivery	13,741,756	1,501,906	5,735,686	20,979,348	37,731,389	113,304	8,440,840	46,285,533	10,886,902	1,535,237	12,422,139
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	(692,694)	(289,847)	(312,937)	(1,295,478)	20,551,000	58,657	4,626,136	25,235,792	11,275,171	1,604,250	12,879,420
A2d - Residential Behavior	-	-	-	-	9,188	21	3,093	12,301	7,518	1,473	8,992
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-
B - Income Eligible	**-**	**-**	**-**	**-**	**5,066,335**	**14,856**	**1,142,383**	**6,223,574**	**1,312,128**	**187,226**	**1,499,354**
B1 - Income Eligible Existing Buildings	-	-	-	-	5,066,335	14,856	1,142,383	6,223,574	1,312,128	187,226	1,499,354
B1a - Income Eligible Coordinated Delivery	-	-	-	-	5,066,335	14,856	1,142,383	6,223,574	1,312,128	187,226	1,499,354
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	**(1,453,667)**	**(338,292)**	**(679,906)**	**(2,471,865)**	**(2,408,898)**	**(5,659)**	**(698,318)**	**(3,112,875)**	**65,991**	**9,335**	**75,326**
C1 - C&I New Buildings	(109,751)	(15,015)	(50,337)	(175,103)	(107,202)	(315)	(30,322)	(137,839)	-	-	-
C1a - C&I New Buildings & Major Renovations	(109,751)	(15,015)	(50,337)	(175,103)	(107,202)	(315)	(30,322)	(137,839)	-	-	-
C2 - C&I Existing Buildings	(1,343,916)	(323,277)	(629,569)	(2,296,762)	(2,301,696)	(5,344)	(667,997)	(2,975,036)	65,991	9,335	75,326
C2a - C&I Existing Building Retrofit	(1,317,452)	(315,817)	(617,158)	(2,250,427)	(2,202,079)	(5,116)	(638,516)	(2,845,711)	65,991	9,335	75,326
C2b - C&I New & Replacement Equipment	(26,464)	(7,460)	(12,411)	(46,336)	(99,617)	(228)	(29,480)	(129,326)	-	-	-
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-
Grand Total	**11,595,395**	**873,767**	**4,742,843**	**17,212,005**	**61,018,590**	**181,400**	**13,529,540**	**74,729,530**	**32,331,836**	**4,537,643**	**36,869,479**

Notes

• Benefits for each year are presented in real dollars (2019$).

• Total Energy Benefits are the sum of electric benefits, natural gas benefits, and other resource benefits.

Program Benefits, Three-Year Total

2019-2021 Benefits

Cape Light Compact

May 29, 2020

	2019 Evaluated Benefits						
Program	Wood	Water	Total Energy Benefits	Total Environmental Compliance Benefits	Non-Energy Impacts	Total TRC Test Benefits	Total Resource Benefits per Participant
A - Residential	**-**	**454,685**	**60,029,064**	**11,802,805**	**9,895,755**	**69,924,819**	**212**
A1 - Residential New Buildings	-	-	3,160,027	718,889	245,036	3,405,064	8,634
A1a - Residential New Homes & Renovations	-	-	3,160,027	718,889	245,036	3,405,064	8,634
A2 - Residential Existing Buildings	-	454,685	56,869,036	11,083,916	9,650,719	66,519,755	201
A2a - Residential Coordinated Delivery	-	454,146	40,019,265	8,209,305	8,332,688	48,351,952	3,869
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-
A2c - Residential Retail	-	539	16,775,882	2,860,856	1,318,031	18,093,913	63
A2d - Residential Behavior	-	-	73,890	13,755	-	73,890	36,945
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	
B - Income Eligible	**-**	**257,405**	**4,541,617**	**842,146**	**2,344,210**	**6,885,827**	**2,001**
B1 - Income Eligible Existing Buildings	-	257,405	4,541,617	842,146	2,344,210	6,885,827	2,001
B1a - Income Eligible Coordinated Delivery	-	257,405	4,541,617	842,146	2,344,210	6,885,827	2,001
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	
C - Commercial & Industrial	**-**	**191,999**	**22,643,367**	**4,240,600**	**2,859,630**	**25,502,997**	**16,686**
C1 - C&I New Buildings	-	-	2,059,661	455,237	47,727	2,107,388	73,559
C1a - C&I New Buildings & Major Renovations	-	-	2,059,661	455,237	47,727	2,107,388	73,559
C2 - C&I Existing Buildings	-	191,999	20,583,706	3,785,363	2,811,903	23,395,609	15,488
C2a - C&I Existing Building Retrofit	-	171,470	16,313,758	2,919,878	2,727,601	19,041,360	21,927
C2b - C&I New & Replacement Equipment	-	20,529	4,269,948	865,485	84,301	4,354,249	7,299
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	
Grand Total	**-**	**904,088**	**87,214,047**	**16,885,551**	**15,099,595**	**102,313,642**	**304**

	2020 Planned Benefits						
Program	Wood	Water	Total Energy Benefits	Total Environmental Compliance Benefits	Non-Energy Impacts	Total TRC Test Benefits	Total Resource Benefits per Participant
A - Residential	**-**	**319,395**	**63,058,546**	**11,304,976**	**6,459,042**	**69,517,588**	**260**
A1 - Residential New Buildings	-	-	6,480,371	1,029,695	298,632	6,779,002	12,535
A1a - Residential New Homes & Renovations	-	-	6,480,371	1,029,695	298,632	6,779,002	12,535
A2 - Residential Existing Buildings	-	319,395	56,578,175	10,275,281	6,160,411	62,738,586	234
A2a - Residential Coordinated Delivery	-	288,778	32,869,036	6,685,039	5,504,650	38,373,686	9,035
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	
A2c - Residential Retail	-	30,617	21,866,014	3,347,756	655,761	22,521,775	135
A2d - Residential Behavior	-	-	1,264,581	242,523	-	1,264,581	17
A2e - Residential Active Demand Reduction	-	-	578,543	(37)	-	578,543	
B - Income Eligible	**-**	**-**	**5,647,097**	**1,132,652**	**4,162,470**	**9,809,568**	**4,034**
B1 - Income Eligible Existing Buildings	-	-	5,647,097	1,132,652	4,162,470	9,809,568	4,034
B1a - Income Eligible Coordinated Delivery	-	-	5,647,097	1,132,652	4,162,470	9,809,568	4,034
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	
C - Commercial & Industrial	**-**	**33,520**	**40,154,922**	**6,554,569**	**22,611,147**	**62,766,069**	**20,077**
C1 - C&I New Buildings	-	684	2,188,930	581,757	36,624	2,225,554	42,920
C1a - C&I New Buildings & Major Renovations	-	684	2,188,930	581,757	36,624	2,225,554	42,920
C2 - C&I Existing Buildings	-	32,836	37,965,992	5,972,813	22,574,523	60,540,515	19,480
C2a - C&I Existing Building Retrofit	-	29,458	28,228,965	5,274,407	22,524,085	50,753,049	36,145
C2b - C&I New & Replacement Equipment	-	3,378	3,943,703	699,019	50,438	3,994,141	3,385
C2c - C&I Active Demand Reduction	-	-	5,793,324	(613)	-	5,793,324	1,931,108
Grand Total	**-**	**352,915**	**108,860,565**	**18,992,198**	**33,232,659**	**142,093,224**	**443**

Program Benefits, Three-Year Total

2019-2021 Benefits

Cape Light Compact

May 29, 2020

	2021 Planned Benefits						
Program	**Wood**	**Water**	**Total Energy Benefits**	**Total Environmental Compliance Benefits**	**Non-Energy Impacts**	**Total TRC Test Benefits**	**Total Resource Benefits per Participant**
A - Residential	**-**	**319,395**	**60,837,245**	**10,697,240**	**6,225,746**	**67,062,991**	**362**
A1 - Residential New Buildings	-	-	6,649,513	1,037,380	309,495	6,959,008	12,406
A1a - Residential New Homes & Renovations	-	-	6,649,513	1,037,380	309,495	6,959,008	12,406
A2 - Residential Existing Buildings	-	319,395	54,187,732	9,659,860	5,916,251	60,103,983	323
A2a - Residential Coordinated Delivery	-	288,778	33,564,782	6,795,763	5,497,690	39,062,472	9,176
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	
A2c - Residential Retail	-	30,617	18,303,772	2,591,310	418,561	18,722,333	195
A2d - Residential Behavior	-	-	1,425,325	272,848	-	1,425,325	20
A2e - Residential Active Demand Reduction	-	-	893,853	(61)	-	893,853	
B - Income Eligible	**-**	**-**	**5,866,048**	**1,171,286**	**4,289,803**	**10,155,851**	**4,046**
B1 - Income Eligible Existing Buildings	-	-	5,866,048	1,171,286	4,289,803	10,155,851	4,046
B1a - Income Eligible Coordinated Delivery	-	-	5,866,048	1,171,286	4,289,803	10,155,851	4,046
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	
C - Commercial & Industrial	**-**	**35,899**	**44,681,805**	**6,392,377**	**22,377,381**	**67,059,186**	**21,914**
C1 - C&I New Buildings	-	684	2,285,008	607,599	36,624	2,321,632	43,942
C1a - C&I New Buildings & Major Renovations	-	684	2,285,008	607,599	36,624	2,321,632	43,942
C2 - C&I Existing Buildings	-	35,214	42,396,797	5,784,778	22,340,757	64,737,554	21,337
C2a - C&I Existing Building Retrofit	-	30,710	28,876,901	5,162,608	22,308,860	51,185,761	35,388
C2b - C&I New & Replacement Equipment	-	4,504	3,528,368	622,783	31,897	3,560,265	3,021
C2c - C&I Active Demand Reduction	-	-	9,991,528	(613)	-	9,991,528	3,330,509
Grand Total	**-**	**355,294**	**111,385,098**	**18,260,903**	**32,892,929**	**144,278,028**	**649**

	2019-2021 Benefits						
Program	**Wood**	**Water**	**Total Energy Benefits**	**Total Environmental Compliance Benefits**	**Non-Energy Impacts**	**Total TRC Test Benefits**	**Total Resource Benefits per Participant**
A - Residential	**-**	**1,093,474**	**183,924,854**	**33,805,021**	**22,580,543**	**206,505,398**	**265**
A1 - Residential New Buildings	-	-	16,289,910	2,785,964	853,163	17,143,074	11,480
A1a - Residential New Homes & Renovations	-	-	16,289,910	2,785,964	853,163	17,143,074	11,480
A2 - Residential Existing Buildings	-	1,093,474	167,634,944	31,019,057	21,727,380	189,362,324	242
A2a - Residential Coordinated Delivery	-	1,031,702	106,453,082	21,690,106	19,335,027	125,788,110	6,035
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-
A2c - Residential Retail	-	61,773	56,945,668	8,799,923	2,392,353	59,338,021	109
A2d - Residential Behavior	-	-	2,763,797	529,126	-	2,763,797	19
A2e - Residential Active Demand Reduction	-	-	1,472,397	(98)	-	1,472,397	
B - Income Eligible	**-**	**257,405**	**16,054,762**	**3,146,085**	**10,796,483**	**26,851,245**	**3,136**
B1 - Income Eligible Existing Buildings	-	257,405	16,054,762	3,146,085	10,796,483	26,851,245	3,136
B1a - Income Eligible Coordinated Delivery	-	257,405	16,054,762	3,146,085	10,796,483	26,851,245	3,136
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	
C - Commercial & Industrial	**-**	**261,418**	**107,480,094**	**17,187,546**	**47,848,157**	**155,328,252**	**19,918**
C1 - C&I New Buildings	-	1,369	6,533,599	1,644,593	120,975	6,654,574	49,875
C1a - C&I New Buildings & Major Renovations	-	1,369	6,533,599	1,644,593	120,975	6,654,574	49,875
C2 - C&I Existing Buildings	-	260,049	100,946,495	15,542,954	47,727,182	148,673,678	19,173
C2a - C&I Existing Building Retrofit	-	231,639	73,419,624	13,356,893	47,560,546	120,980,170	31,363
C2b - C&I New & Replacement Equipment	-	28,410	11,742,019	2,187,286	166,636	11,908,655	4,024
C2c - C&I Active Demand Reduction	-	-	15,784,852	(1,226)	-	15,784,852	2,630,809
Grand Total	**-**	**1,612,297**	**307,459,711**	**54,138,652**	**81,225,184**	**388,684,894**	**437**

Notes

• Benefits for each year are presented in real dollars (2019$).

• Total Energy Benefits are the sum of electric benefits, natural gas benefits, and other resource benefits.

Cost-Effectiveness, Plan Year Summary

2019 Planned vs. Evaluated

Cape Light Compact

May 29, 2020

2019 Planned Total Resource Cost Test (2019$)							
Program	Benefit-Cost Ratio	Net Benefits	Total TRC Test Benefits	Costs			
				Total Program Costs	Performance Incentive	Participant Costs	Total TRC Test Costs
A - Residential	**2.25**	**41,071,164**	**73,921,750**	**24,849,635**	**-**	**8,000,951**	**32,850,587**
A1 - Residential New Buildings	4.75	5,159,182	6,534,859	925,744	-	449,933	1,375,677
A1a - Residential New Homes & Renovations	4.75	5,159,182	6,534,859	925,744	-	449,933	1,375,677
A2 - Residential Existing Buildings	2.36	38,845,650	67,386,891	20,990,223	-	7,551,018	28,541,241
A2a - Residential Coordinated Delivery	2.69	25,180,138	40,120,102	11,165,815	-	3,774,149	14,939,964
A2b - Residential Conservation Services (RCS)	0.00	(1,914,195)	-	1,914,195	-	-	1,914,195
A2c - Residential Retail	2.45	15,697,398	26,522,831	7,048,565	-	3,776,869	10,825,433
A2d - Residential Behavior	0.86	(117,690)	743,958	861,648	-	-	861,648
A2e - Residential Active Demand Reduction		-	-	-	-	-	-
A3 - Residential Hard-to-Measure	0.00	(2,933,668)	-	2,933,668	-	-	2,933,668
B - Income Eligible	**2.25**	**5,201,095**	**9,378,213**	**4,177,118**	**-**	**-**	**4,177,118**
B1 - Income Eligible Existing Buildings	2.37	5,425,724	9,378,213	3,952,489	-	-	3,952,489
B1a - Income Eligible Coordinated Delivery	2.37	5,425,724	9,378,213	3,952,489	-	-	3,952,489
B1b - Income Eligible Active Demand Reduction		-	-	-	-	-	-
B2 - Income Eligible Hard-to-Measure	0.00	(224,629)	-	224,629	-	-	224,629
C - Commercial & Industrial	**3.41**	**38,873,034**	**54,973,612**	**14,888,929**	**-**	**1,211,650**	**16,100,579**
C1 - C&I New Buildings	2.69	1,164,676	1,854,264	626,369	-	63,220	689,589
C1a - C&I New Buildings & Major Renovations	2.69	1,164,676	1,854,264	626,369	-	63,220	689,589
C2 - C&I Existing Buildings	3.61	38,405,007	53,119,348	13,565,911	-	1,148,430	14,714,341
C2a - C&I Existing Building Retrofit	3.72	35,505,672	48,538,291	12,165,537	-	867,081	13,032,619
C2b - C&I New & Replacement Equipment	2.72	2,899,335	4,581,057	1,400,374	-	281,348	1,681,722
C2c - C&I Active Demand Reduction		-	-	-	-	-	-
C3 - C&I Hard-to-Measure	0.00	(696,649)	-	696,649	-	-	696,649
Grand Total	**2.60**	**85,145,293**	**138,273,576**	**43,915,682**	**-**	**9,212,601**	**53,128,283**

Cost-Effectiveness, Plan Year Summary

2019 Planned vs. Evaluated

Cape Light Compact

May 29, 2020

2019 Evaluated Total Resource Cost Test (2019$)							
Program	Benefit-Cost Ratio	Net Benefits	Total TRC Test Benefits	Costs			
				Total Program Costs	Performance Incentive	Participant Costs	Total TRC Test Costs
A - Residential	**1.90**	**33,107,847**	**69,924,819**	**29,571,652**	**-**	**7,245,320**	**36,816,972**
A1 - Residential New Buildings	2.29	1,917,596	3,405,064	958,135	-	529,332	1,487,467
A1a - Residential New Homes & Renovations	2.29	1,917,596	3,405,064	958,135	-	529,332	1,487,467
A2 - Residential Existing Buildings	2.07	34,345,854	66,519,755	25,457,914	-	6,715,987	32,173,901
A2a - Residential Coordinated Delivery	2.31	27,459,565	48,351,952	16,089,258	-	4,803,128	20,892,387
A2b - Residential Conservation Services (RCS)	0.00	(2,031,757)	-	2,031,757	-	-	2,031,757
A2c - Residential Retail	2.09	9,439,215	18,093,913	6,741,839	-	1,912,859	8,654,698
A2d - Residential Behavior	0.12	(521,169)	73,890	595,059	-	-	595,059
A2e - Residential Active Demand Reduction		-	-	-	-	-	-
A3 - Residential Hard-to-Measure	0.00	(3,155,604)	-	3,155,604	-	-	3,155,604
B - Income Eligible	**1.83**	**3,128,043**	**6,885,827**	**3,757,783**	**-**	**-**	**3,757,783**
B1 - Income Eligible Existing Buildings	1.91	3,283,106	6,885,827	3,602,721	-	-	3,602,721
B1a - Income Eligible Coordinated Delivery	1.91	3,283,106	6,885,827	3,602,721	-	-	3,602,721
B1b - Income Eligible Active Demand Reduction		-	-	-	-	-	-
B2 - Income Eligible Hard-to-Measure	0.00	(155,063)	-	155,063	-	-	155,063
C - Commercial & Industrial	**2.50**	**15,301,346**	**25,502,997**	**9,219,403**	**-**	**982,248**	**10,201,651**
C1 - C&I New Buildings	4.64	1,653,671	2,107,388	342,308	-	111,408	453,716
C1a - C&I New Buildings & Major Renovations	4.64	1,653,671	2,107,388	342,308	-	111,408	453,716
C2 - C&I Existing Buildings	2.59	14,365,762	23,395,609	8,159,007	-	870,839	9,029,847
C2a - C&I Existing Building Retrofit	2.31	10,793,479	19,041,360	7,353,090	-	894,790	8,247,880
C2b - C&I New & Replacement Equipment	5.57	3,572,283	4,354,249	805,917	-	(23,951)	781,966
C2c - C&I Active Demand Reduction		-	-	-	-	-	-
C3 - C&I Hard-to-Measure	0.00	(718,087)	-	718,087	-	-	718,087
Grand Total	**2.01**	**51,537,237**	**102,313,642**	**42,548,838**	**-**	**8,227,567**	**50,776,406**

Cost-Effectiveness, Plan Year Summary

2019 Planned vs. Evaluated

Cape Light Compact

May 29, 2020

2019 Planned v. Evaluated Total Resource Cost Test (2019$) Variances (%)							
Program	Benefit-Cost Ratio	Net Benefits	Total TRC Test Benefits	Costs			
				Total Program Costs	Performance Incentive	Participant Costs	Total TRC Test Costs
A - Residential	**-16%**	**-19%**	**-5%**	**19%**		**-9%**	**12%**
A1 - Residential New Buildings	-52%	-63%	-48%	3%		18%	8%
A1a - Residential New Homes & Renovations	-52%	-63%	-48%	3%		18%	8%
A2 - Residential Existing Buildings	-12%	-12%	-1%	21%		-11%	13%
A2a - Residential Coordinated Delivery	-14%	9%	21%	44%		27%	40%
A2b - Residential Conservation Services (RCS)		6%		6%			6%
A2c - Residential Retail	-15%	-40%	-32%	-4%		-49%	-20%
A2d - Residential Behavior	-86%	343%	-90%	-31%			-31%
A2e - Residential Active Demand Reduction							
A3 - Residential Hard-to-Measure		8%		8%			8%
B - Income Eligible	**-18%**	**-40%**	**-27%**	**-10%**			**-10%**
B1 - Income Eligible Existing Buildings	-19%	-39%	-27%	-9%			-9%
B1a - Income Eligible Coordinated Delivery	-19%	-39%	-27%	-9%			-9%
B1b - Income Eligible Active Demand Reduction							
B2 - Income Eligible Hard-to-Measure		-31%		-31%			-31%
C - Commercial & Industrial	**-27%**	**-61%**	**-54%**	**-38%**		**-19%**	**-37%**
C1 - C&I New Buildings	73%	42%	14%	-45%		76%	-34%
C1a - C&I New Buildings & Major Renovations	73%	42%	14%	-45%		76%	-34%
C2 - C&I Existing Buildings	-28%	-63%	-56%	-40%		-24%	-39%
C2a - C&I Existing Building Retrofit	-38%	-70%	-61%	-40%		3%	-37%
C2b - C&I New & Replacement Equipment	104%	23%	-5%	-42%		-109%	-54%
C2c - C&I Active Demand Reduction							
C3 - C&I Hard-to-Measure		3%		3%			3%
Grand Total	**-23%**	**-39%**	**-26%**	**-3%**		**-11%**	**-4%**

Notes

• Costs and benefits for each year are presented in real dollars (2019$).

• The Total TRC Costs are the sum of the Total Program Costs, Performance Incentives, and Participant Costs.

• The plan year variances provided above are intended to indicate the Program Administrator's performance in the plan year only. The variances used to determine significant variances are provided separately. The variances above and the significant variances use different calculations to determine variances on an annual basis and over the three-year term, respectively.

Cost-Effectiveness, Three-Year Total

2019-2021 Total Resource Cost Test (2019$)

Cape Light Compact

May 29, 2020

2019 Evaluated Total Resource Cost Test (2019$)							
Program	Benefit-Cost Ratio	Net Benefits	Total TRC Test Benefits	Costs			
				Total Program Costs	Performance Incentive	Participant Costs	Total TRC Test Costs
A - Residential	**1.90**	**33,107,847**	**69,924,819**	**29,571,652**	**-**	**7,245,320**	**36,816,972**
A1 - Residential New Buildings	2.29	1,917,596	3,405,064	958,135	-	529,332	1,487,467
A1a - Residential New Homes & Renovations	2.29	1,917,596	3,405,064	958,135	-	529,332	1,487,467
A2 - Residential Existing Buildings	2.07	34,345,854	66,519,755	25,457,914	-	6,715,987	32,173,901
A2a - Residential Coordinated Delivery	2.31	27,459,565	48,351,952	16,089,258	-	4,803,128	20,892,387
A2b - Residential Conservation Services (RCS)	0.00	(2,031,757)	-	2,031,757	-	-	2,031,757
A2c - Residential Retail	2.09	9,439,215	18,093,913	6,741,839	-	1,912,859	8,654,698
A2d - Residential Behavior	0.12	(521,169)	73,890	595,059	-	-	595,059
A2e - Residential Active Demand Reduction		-	-	-	-	-	-
A3 - Residential Hard-to-Measure	0.00	(3,155,604)	-	3,155,604	-	-	3,155,604
B - Income Eligible	**1.83**	**3,128,043**	**6,885,827**	**3,757,783**	**-**	**-**	**3,757,783**
B1 - Income Eligible Existing Buildings	1.91	3,283,106	6,885,827	3,602,721	-	-	3,602,721
B1a - Income Eligible Coordinated Delivery	1.91	3,283,106	6,885,827	3,602,721	-	-	3,602,721
B1b - Income Eligible Active Demand Reduction		-	-	-	-	-	-
B2 - Income Eligible Hard-to-Measure	0.00	(155,063)	-	155,063	-	-	155,063
C - Commercial & Industrial	**2.50**	**15,301,346**	**25,502,997**	**9,219,403**	**-**	**982,248**	**10,201,651**
C1 - C&I New Buildings	4.64	1,653,671	2,107,388	342,308	-	111,408	453,716
C1a - C&I New Buildings & Major Renovations	4.64	1,653,671	2,107,388	342,308	-	111,408	453,716
C2 - C&I Existing Buildings	2.59	14,365,762	23,395,609	8,159,007	-	870,839	9,029,847
C2a - C&I Existing Building Retrofit	2.31	10,793,479	19,041,360	7,353,090	-	894,790	8,247,880
C2b - C&I New & Replacement Equipment	5.57	3,572,283	4,354,249	805,917	-	(23,951)	781,966
C2c - C&I Active Demand Reduction		-	-	-	-	-	-
C3 - C&I Hard-to-Measure	0.00	(718,087)	-	718,087	-	-	718,087
Grand Total	**2.01**	**51,537,237**	**102,313,642**	**42,548,838**	**-**	**8,227,567**	**50,776,406**

Cost-Effectiveness, Three-Year Total

2019-2021 Total Resource Cost Test (2019$)

Cape Light Compact

May 29, 2020

2020 Planned Total Resource Cost Test (2019$)							
Program	Benefit-Cost Ratio	Net Benefits	Total TRC Test Benefits	Costs			
				Total Program Costs	Performance Incentive	Participant Costs	Total TRC Test Costs
A - Residential	**2.27**	**38,826,541**	**69,517,588**	**23,548,336**	**-**	**7,142,712**	**30,691,047**
A1 - Residential New Buildings	4.92	5,402,084	6,779,002	953,476	-	423,442	1,376,918
A1a - Residential New Homes & Renovations	4.92	5,402,084	6,779,002	953,476	-	423,442	1,376,918
A2 - Residential Existing Buildings	2.38	36,404,657	62,738,586	19,614,659	-	6,719,269	26,333,928
A2a - Residential Coordinated Delivery	2.68	24,063,341	38,373,686	10,716,481	-	3,593,864	14,310,345
A2b - Residential Conservation Services (RCS)	0.00	(1,877,870)	-	1,877,870	-	-	1,877,870
A2c - Residential Retail	2.50	13,498,169	22,521,775	5,898,201	-	3,125,405	9,023,606
A2d - Residential Behavior	1.77	550,775	1,264,581	713,807	-	-	713,807
A2e - Residential Active Demand Reduction	1.42	170,243	578,543	408,301	-	-	408,301
A3 - Residential Hard-to-Measure	0.00	(2,980,201)	-	2,980,201	-	-	2,980,201
B - Income Eligible	**2.22**	**5,398,303**	**9,809,568**	**4,411,265**	**-**	**-**	**4,411,265**
B1 - Income Eligible Existing Buildings	2.34	5,621,535	9,809,568	4,188,032	-	-	4,188,032
B1a - Income Eligible Coordinated Delivery	2.34	5,621,535	9,809,568	4,188,032	-	-	4,188,032
B1b - Income Eligible Active Demand Reduction		-	-	-	-	-	-
B2 - Income Eligible Hard-to-Measure	0.00	(223,232)	-	223,232	-	-	223,232
C - Commercial & Industrial	**3.56**	**45,127,792**	**62,766,069**	**16,249,867**	**-**	**1,388,409**	**17,638,276**
C1 - C&I New Buildings	3.28	1,546,106	2,225,554	617,719	-	61,729	679,448
C1a - C&I New Buildings & Major Renovations	3.28	1,546,106	2,225,554	617,719	-	61,729	679,448
C2 - C&I Existing Buildings	3.72	44,280,013	60,540,515	14,933,823	-	1,326,679	16,260,502
C2a - C&I Existing Building Retrofit	3.79	37,349,395	50,753,049	12,343,482	-	1,060,173	13,403,655
C2b - C&I New & Replacement Equipment	2.40	2,327,232	3,994,141	1,400,402	-	266,507	1,666,909
C2c - C&I Active Demand Reduction	4.87	4,603,386	5,793,324	1,189,939	-	-	1,189,939
C3 - C&I Hard-to-Measure	0.00	(698,326)	-	698,326	-	-	698,326
Grand Total	**2.69**	**89,352,636**	**142,093,224**	**44,209,468**	**-**	**8,531,120**	**52,740,588**

Cost-Effectiveness, Three-Year Total

2019-2021 Total Resource Cost Test (2019$)

Cape Light Compact

May 29, 2020

2021 Planned Total Resource Cost Test (2019$)							
Program	Benefit-Cost Ratio	Net Benefits	Total TRC Test Benefits	Costs			
				Total Program Costs	Performance Incentive	Participant Costs	Total TRC Test Costs
A - Residential	**2.28**	**37,603,524**	**67,062,991**	**22,512,972**	**-**	**6,946,495**	**29,459,467**
A1 - Residential New Buildings	5.02	5,573,137	6,959,008	984,035	-	401,836	1,385,871
A1a - Residential New Homes & Renovations	5.02	5,573,137	6,959,008	984,035	-	401,836	1,385,871
A2 - Residential Existing Buildings	2.40	35,028,968	60,103,983	18,530,357	-	6,544,659	25,075,015
A2a - Residential Coordinated Delivery	2.71	24,622,206	39,062,472	10,714,694	-	3,725,572	14,440,266
A2b - Residential Conservation Services (RCS)	0.00	(1,850,330)	-	1,850,330	-	-	1,850,330
A2c - Residential Retail	2.44	11,051,353	18,722,333	4,851,893	-	2,819,087	7,670,980
A2d - Residential Behavior	2.20	777,514	1,425,325	647,812	-	-	647,812
A2e - Residential Active Demand Reduction	1.92	428,226	893,853	465,628	-	-	465,628
A3 - Residential Hard-to-Measure	0.00	(2,998,581)	-	2,998,581	-	-	2,998,581
B - Income Eligible	**2.13**	**5,380,515**	**10,155,851**	**4,775,336**	**-**	**-**	**4,775,336**
B1 - Income Eligible Existing Buildings	2.23	5,604,271	10,155,851	4,551,580	-	-	4,551,580
B1a - Income Eligible Coordinated Delivery	2.23	5,604,271	10,155,851	4,551,580	-	-	4,551,580
B1b - Income Eligible Active Demand Reduction		-	-	-	-	-	-
B2 - Income Eligible Hard-to-Measure	0.00	(223,755)	-	223,755	-	-	223,755
C - Commercial & Industrial	**3.68**	**48,854,526**	**67,059,186**	**16,719,153**	**-**	**1,485,508**	**18,204,660**
C1 - C&I New Buildings	3.45	1,648,199	2,321,632	613,109	-	60,324	673,433
C1a - C&I New Buildings & Major Renovations	3.45	1,648,199	2,321,632	613,109	-	60,324	673,433
C2 - C&I Existing Buildings	3.85	47,901,143	64,737,554	15,411,227	-	1,425,184	16,836,411
C2a - C&I Existing Building Retrofit	3.75	37,533,324	51,185,761	12,481,606	-	1,170,831	13,652,437
C2b - C&I New & Replacement Equipment	2.45	2,107,213	3,560,265	1,198,699	-	254,353	1,453,051
C2c - C&I Active Demand Reduction	5.77	8,260,606	9,991,528	1,730,922	-	-	1,730,922
C3 - C&I Hard-to-Measure	0.00	(694,816)	-	694,816	-	-	694,816
Grand Total	**2.75**	**91,838,565**	**144,278,028**	**44,007,460**	**-**	**8,432,002**	**52,439,463**

Cost-Effectiveness, Three-Year Total

2019-2021 Total Resource Cost Test (2019$)

Cape Light Compact

May 29, 2020

2019-2021 Total Resource Cost Test (2019$)							
Program	Benefit-Cost Ratio	Net Benefits	Total TRC Test Benefits	Costs			
				Total Program Costs	Performance Incentive	Participant Costs	Total TRC Test Costs
A - Residential	**2.13**	**109,537,912**	**206,505,398**	**75,632,960**	**-**	**21,334,526**	**96,967,486**
A1 - Residential New Buildings	4.03	12,892,817	17,143,074	2,895,646	-	1,354,611	4,250,256
A1a - Residential New Homes & Renovations	4.03	12,892,817	17,143,074	2,895,646	-	1,354,611	4,250,256
A2 - Residential Existing Buildings	2.27	105,779,479	189,362,324	63,602,929	-	19,979,915	83,582,845
A2a - Residential Coordinated Delivery	2.53	76,145,112	125,788,110	37,520,434	-	12,122,564	49,642,998
A2b - Residential Conservation Services (RCS)	0.00	(5,759,958)	-	5,759,958	-	-	5,759,958
A2c - Residential Retail	2.34	33,988,737	59,338,021	17,491,932	-	7,857,351	25,349,284
A2d - Residential Behavior	1.41	807,120	2,763,797	1,956,677	-	-	1,956,677
A2e - Residential Active Demand Reduction	1.68	598,468	1,472,397	873,928	-	-	873,928
A3 - Residential Hard-to-Measure	0.00	(9,134,385)	-	9,134,385	-	-	9,134,385
B - Income Eligible	**2.07**	**13,906,862**	**26,851,245**	**12,944,384**	**-**	**-**	**12,944,384**
B1 - Income Eligible Existing Buildings	2.18	14,508,912	26,851,245	12,342,334	-	-	12,342,334
B1a - Income Eligible Coordinated Delivery	2.18	14,508,912	26,851,245	12,342,334	-	-	12,342,334
B1b - Income Eligible Active Demand Reduction		-	-	-	-	-	-
B2 - Income Eligible Hard-to-Measure	0.00	(602,050)	-	602,050	-	-	602,050
C - Commercial & Industrial	**3.37**	**109,283,665**	**155,328,252**	**42,188,423**	**-**	**3,856,164**	**46,044,587**
C1 - C&I New Buildings	3.68	4,847,976	6,654,574	1,573,136	-	233,462	1,806,598
C1a - C&I New Buildings & Major Renovations	3.68	4,847,976	6,654,574	1,573,136	-	233,462	1,806,598
C2 - C&I Existing Buildings	3.53	106,546,918	148,673,678	38,504,057	-	3,622,703	42,126,760
C2a - C&I Existing Building Retrofit	3.43	85,676,198	120,980,170	32,178,178	-	3,125,794	35,303,972
C2b - C&I New & Replacement Equipment	3.05	8,006,729	11,908,655	3,405,018	-	496,909	3,901,927
C2c - C&I Active Demand Reduction	5.40	12,863,991	15,784,852	2,920,861	-	-	2,920,861
C3 - C&I Hard-to-Measure	0.00	(2,111,230)	-	2,111,230	-	-	2,111,230
Grand Total	**2.49**	**232,728,438**	**388,684,894**	**130,765,766**	**-**	**25,190,690**	**155,956,456**

Notes

• Costs and benefits for each year are presented in real dollars (2019$).

• The Total TRC Costs are the sum of the Total Program Costs, Performance Incentives, and Participant Costs.

Core Initiatives, Plan Year Summary

Residential Programs

Cape Light Compact

May 29, 2020

A1 - Residential New Buildings, 2019 Summary

A1a - Residential New Homes & Renovations

Metric	Units	Planned	Preliminary	Evaluated	Plan v Preliminary	Plan v Evaluated	Preliminary v Evaluated
Annual Energy	MWh	1,064	1,048	1,006	-2%	-5%	-4%
Lifetime Energy	MWh	13,800	19,499	17,639	41%	28%	-10%
Annual Natural Gas	Therms	-	-	-			
Lifetime Natural Gas	Therms	-	-	-			
Total Benefits	2019$	6,534,859	4,500,953	3,405,064	-31%	-48%	-24%
Total Program Costs	nominal$	925,744	958,135	958,135	3%	3%	0%
Total Resource Costs	2019$	1,375,677	1,487,467	1,487,467	8%	8%	0%
Benefit Cost Ratio	B/C	4.75	3.03	2.29	-36%	-52%	-24%

A2 - Residential Existing Buildings, 2019 Summary

A2a - Residential Coordinated Delivery

Metric	Units	Planned	Preliminary	Evaluated	Plan v Preliminary	Plan v Evaluated	Preliminary v Evaluated
Annual Energy	MWh	7,268	10,892	10,560	50%	45%	-3%
Lifetime Energy	MWh	48,931	81,900	80,086	67%	64%	-2%
Annual Natural Gas	Therms	233,891	304,262	240,801	30%	3%	-21%
Lifetime Natural Gas	Therms	4,997,098	6,547,912	4,961,384	31%	-1%	-24%
Total Benefits	2019$	40,120,102	53,996,866	48,351,952	35%	21%	-10%
Total Program Costs	nominal$	11,165,815	16,089,258	16,089,258	44%	44%	0%
Total Resource Costs	2019$	14,939,964	20,892,387	20,892,387	40%	40%	0%
Benefit Cost Ratio	B/C	2.69	2.58	2.31	-4%	-14%	-10%

A2c - Residential Retail

Metric	Units	Planned	Preliminary	Evaluated	Plan v Preliminary	Plan v Evaluated	Preliminary v Evaluated
Annual Energy	MWh	8,776	13,164	13,073	50%	49%	-1%
Lifetime Energy	MWh	43,614	85,223	54,817	95%	26%	-36%
Annual Natural Gas	Therms	(91,821)	(120,355)	(124,725)	31%	36%	4%
Lifetime Natural Gas	Therms	(500,559)	(662,037)	(348,408)	32%	-30%	-47%
Total Benefits	2019$	26,522,831	23,270,652	18,093,913	-12%	-32%	-22%
Total Program Costs	nominal$	7,048,565	6,741,839	6,741,839	-4%	-4%	0%
Total Resource Costs	2019$	10,825,433	8,654,698	8,654,698	-20%	-20%	0%
Benefit Cost Ratio	B/C	2.45	2.69	2.09	10%	-15%	-22%

A2d - Residential Behavior

Metric	Units	Planned	Preliminary	Evaluated	Plan v Preliminary	Plan v Evaluated	Preliminary v Evaluated
Annual Energy	MWh	3,952	246	253	-94%	-94%	3%
Lifetime Energy	MWh	3,952	246	253	-94%	-94%	3%
Annual Natural Gas	Therms	-	-	-			
Lifetime Natural Gas	Therms	-	-	-			
Total Benefits	2019$	743,958	77,208	73,890	-90%	-90%	-4%
Total Program Costs	nominal$	861,648	595,059	595,059	-31%	-31%	0%
Total Resource Costs	2019$	861,648	595,059	595,059	-31%	-31%	0%
Benefit Cost Ratio	B/C	0.86	0.13	0.12	-85%	-86%	-4%

A2e - Residential Active Demand Reduction

Metric	Units	Planned	Preliminary	Evaluated	Plan v Preliminary	Plan v Evaluated	Preliminary v Evaluated
Annual Energy	MWh	-	-	-			
Lifetime Energy	MWh	-	-	-			
Annual Natural Gas	Therms	-	-	-			
Lifetime Natural Gas	Therms	-	-	-			
Total Benefits	2019$	-	-	-			
Total Program Costs	nominal$	-	-	-			
Total Resource Costs	2019$	-	-	-			
Benefit Cost Ratio	B/C						

Core Initiatives, Plan Year Summary

Income Eligible Programs

Cape Light Compact

May 29, 2020

B1 - Income Eligible Existing Buildings, 2019 Summary							
B1a - Income Eligible Coordinated Delivery							
Metric	**Units**	**Planned**	**Preliminary**	**Evaluated**	**Plan v Preliminary**	**Plan v Evaluated**	**Preliminary v Evaluated**
Annual Energy	MWh	2,226	2,134	2,075	-4%	-7%	-3%
Lifetime Energy	MWh	17,535	15,652	15,200	-11%	-13%	-3%
Annual Natural Gas	Therms	-	-	-			
Lifetime Natural Gas	Therms	-	-	-			
Total Benefits	2019$	9,378,213	6,976,915	6,885,827	-26%	-27%	-1%
Total Program Costs	nominal$	3,952,489	3,602,721	3,602,721	-9%	-9%	0%
Total Resource Costs	2019$	3,952,489	3,602,721	3,602,721	-9%	-9%	0%
Benefit Cost Ratio	B/C	2.37	1.94	1.91	-18%	-19%	-1%

B1b - Income Eligible Active Demand Reduction							
Metric	**Units**	**Planned**	**Preliminary**	**Evaluated**	**Plan v Preliminary**	**Plan v Evaluated**	**Preliminary v Evaluated**
Annual Energy	MWh	-	-	-			
Lifetime Energy	MWh	-	-	-			
Annual Natural Gas	Therms	-	-	-			
Lifetime Natural Gas	Therms	-	-	-			
Total Benefits	2019$	-	-	-			
Total Program Costs	nominal$	-	-	-			
Total Resource Costs	2019$	-	-	-			
Benefit Cost Ratio	B/C						

Core Initiatives, Plan Year Summary

C&I Programs

Cape Light Compact

May 29, 2020

C1 - C&I New Buildings, 2019 Summary

C1a - C&I New Buildings & Major Renovations

Metric	Units	Planned	Preliminary	Evaluated	Plan v Preliminary	Plan v Evaluated	Preliminary v Evaluated
Annual Energy	MWh	814	885	859	9%	6%	-3%
Lifetime Energy	MWh	14,033	15,294	14,917	9%	6%	-2%
Annual Natural Gas	Therms	(1,803)	(2,241)	(2,205)	24%	22%	-2%
Lifetime Natural Gas	Therms	(32,889)	(40,151)	(39,619)	22%	20%	-1%
Total Benefits	2019$	1,854,264	2,164,523	2,107,388	17%	14%	-3%
Total Program Costs	nominal$	626,369	342,308	342,308	-45%	-45%	0%
Total Resource Costs	2019$	689,589	453,716	453,716	-34%	-34%	0%
Benefit Cost Ratio	B/C	2.69	4.77	4.64	77%	73%	-3%

C2 - C&I Existing Buildings, 2019 Summary

C2a - C&I Existing Building Retrofit

Metric	Units	Planned	Preliminary	Evaluated	Plan v Preliminary	Plan v Evaluated	Preliminary v Evaluated
Annual Energy	MWh	13,558	8,670	8,378	-36%	-38%	-3%
Lifetime Energy	MWh	157,637	96,112	92,771	-39%	-41%	-3%
Annual Natural Gas	Therms	(58,501)	(32,307)	(30,909)	-45%	-47%	-4%
Lifetime Natural Gas	Therms	(628,017)	(338,471)	(324,168)	-46%	-48%	-4%
Total Benefits	2019$	48,538,291	19,677,159	19,041,360	-59%	-61%	-3%
Total Program Costs	nominal$	12,165,537	7,353,090	7,353,090	-40%	-40%	0%
Total Resource Costs	2019$	13,032,619	8,247,880	8,247,880	-37%	-37%	0%
Benefit Cost Ratio	B/C	3.72	2.39	2.31	-36%	-38%	-3%

C2b - C&I New & Replacement Equipment

Metric	Units	Planned	Preliminary	Evaluated	Plan v Preliminary	Plan v Evaluated	Preliminary v Evaluated
Annual Energy	MWh	2,405	2,443	2,432	2%	1%	0%
Lifetime Energy	MWh	23,390	25,261	25,187	8%	8%	0%
Annual Natural Gas	Therms	(1,439)	(1,596)	(1,595)	11%	11%	0%
Lifetime Natural Gas	Therms	(12,003)	(13,439)	(14,053)	12%	17%	5%
Total Benefits	2019$	4,581,057	4,460,189	4,354,249	-3%	-5%	-2%
Total Program Costs	nominal$	1,400,374	805,917	805,917	-42%	-42%	0%
Total Resource Costs	2019$	1,681,722	781,966	781,966	-54%	-54%	0%
Benefit Cost Ratio	B/C	2.72	5.70	5.57	109%	104%	-2%

C2c - C&I Active Demand Reduction

Metric	Units	Planned	Preliminary	Evaluated	Plan v Preliminary	Plan v Evaluated	Preliminary v Evaluated
Annual Energy	MWh	-	-	-			
Lifetime Energy	MWh	-	-	-			
Annual Natural Gas	Therms	-	-	-			
Lifetime Natural Gas	Therms	-	-	-			
Total Benefits	2019$	-	-	-			
Total Program Costs	nominal$	-	-	-			
Total Resource Costs	2019$	-	-	-			
Benefit Cost Ratio	B/C						

Core Initiatives, Three-Year Total

Residential Programs

Cape Light Compact

May 29, 2020

A1 - Residential New Buildings, 2019-2021 Summary					
A1a - Residential New Homes & Renovations					
Metric	**Units**	**2019 Evaluated**	**2020 Planned**	**2021 Planned**	**2019-2021 Total**
Annual Energy	MWh	1,006	1,008	935	2,949
Lifetime Energy	MWh	17,639	13,850	13,395	44,884
Annual Natural Gas	Therms	-	-	-	-
Lifetime Natural Gas	Therms	-	-	-	-
Total Benefits	2019$	3,405,064	6,779,002	6,959,008	17,143,074
Total Program Costs	nominal$	958,135	975,692	1,030,425	2,964,252
Total Resource Costs	2019$	1,487,467	1,409,001	1,451,205	4,347,673
Benefit Cost Ratio	B/C	2.29	4.92	5.02	3.94

A2 - Residential Existing Buildings, 2019-2021 Summary					
A2a - Residential Coordinated Delivery					
Metric	**Units**	**2019 Evaluated**	**2020 Planned**	**2021 Planned**	**2019-2021 Total**
Annual Energy	MWh	10,560	5,777	4,671	21,008
Lifetime Energy	MWh	80,086	43,434	45,461	168,980
Annual Natural Gas	Therms	240,801	232,334	231,181	704,316
Lifetime Natural Gas	Therms	4,961,384	4,973,736	4,956,447	14,891,567
Total Benefits	2019$	48,351,952	38,373,686	39,062,472	125,788,110
Total Program Costs	nominal$	16,089,258	10,966,175	11,219,816	38,275,249
Total Resource Costs	2019$	20,892,387	14,643,776	15,121,022	50,657,184
Benefit Cost Ratio	B/C	2.31	2.68	2.71	2.48

A2c - Residential Retail					
Metric	**Units**	**2019 Evaluated**	**2020 Planned**	**2021 Planned**	**2019-2021 Total**
Annual Energy	MWh	13,073	6,060	2,452	21,585
Lifetime Energy	MWh	54,817	24,117	(290)	78,644
Annual Natural Gas	Therms	(124,725)	(64,132)	(27,968)	(216,825)
Lifetime Natural Gas	Therms	(348,408)	(320,102)	(110,793)	(779,303)
Total Benefits	2019$	18,093,913	22,521,775	18,722,333	59,338,021
Total Program Costs	nominal$	6,741,839	6,035,629	5,080,625	17,858,093
Total Resource Costs	2019$	8,654,698	9,233,856	8,032,612	25,921,166
Benefit Cost Ratio	B/C	2.09	2.50	2.44	2.29

A2d - Residential Behavior					
Metric	**Units**	**2019 Evaluated**	**2020 Planned**	**2021 Planned**	**2019-2021 Total**
Annual Energy	MWh	253	6,656	7,488	14,397
Lifetime Energy	MWh	253	6,656	7,488	14,397
Annual Natural Gas	Therms	-	-	-	-
Lifetime Natural Gas	Therms	-	-	-	-
Total Benefits	2019$	73,890	1,264,581	1,425,325	2,763,797
Total Program Costs	nominal$	595,059	730,438	678,351	2,003,849
Total Resource Costs	2019$	595,059	730,438	678,351	2,003,849
Benefit Cost Ratio	B/C	0.12	1.77	2.20	1.38

A2e - Residential Active Demand Reduction				
Metric	**Units**	**2019 Evaluated**	**2020 Planned**	**2021 Planned**
Annual Energy	MWh		(1)	(2)
Lifetime Energy	MWh		(1)	(2)
Annual Natural Gas	Therms			
Lifetime Natural Gas	Therms			
Total Benefits	2019$	-	578,543	893,853
Total Program Costs	nominal$	-	417,814	487,579
Total Resource Costs	2019$	-	417,814	487,579
Benefit Cost Ratio	B/C		1.42	1.92

Core Initiatives, Three-Year Total

Income Eligible Programs

Cape Light Compact

May 29, 2020

B1 - Income Eligible Existing Buildings, 2019-2021 Summary					
B1a - Income Eligible Coordinated Delivery					
Metric	**Units**	**2019 Evaluated**	**2020 Planned**	**2021 Planned**	**2019-2021 Total**
Annual Energy	MWh	2,075	2,143	2,056	6,273
Lifetime Energy	MWh	15,200	17,603	18,144	50,947
Annual Natural Gas	Therms	-	-	-	-
Lifetime Natural Gas	Therms	-	-	-	-
Total Benefits	2019$	6,885,827	9,809,568	10,155,851	26,851,245
Total Program Costs	nominal$	3,602,721	4,285,614	4,766,155	12,654,489
Total Resource Costs	2019$	3,602,721	4,285,614	4,766,155	12,654,489
Benefit Cost Ratio	B/C	1.91	2.34	2.23	2.12

B1b - Income Eligible Active Demand Reduction				
Metric	**Units**	**2019 Evaluated**	**2020 Planned**	**2021 Planned**
Annual Energy	MWh		-	-
Lifetime Energy	MWh		-	-
Annual Natural Gas	Therms			
Lifetime Natural Gas	Therms			
Total Benefits	2019$	-	-	-
Total Program Costs	nominal$	-	-	-
Total Resource Costs	2019$	-	-	-
Benefit Cost Ratio	B/C			

Core Initiatives, Three-Year Total

C&I Programs

Cape Light Compact

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C1 - C&I New Buildings, 2019-2021 Summary

C1a - C&I New Buildings & Major Renovations

Metric	Units	2019 Evaluated	2020 Planned	2021 Planned	2019-2021 Total
Annual Energy	MWh	859	985	1,026	2,871
Lifetime Energy	MWh	14,917	17,434	18,260	50,611
Annual Natural Gas	Therms	(2,205)	(2,355)	(2,471)	(7,031)
Lifetime Natural Gas	Therms	(39,619)	(43,863)	(46,191)	(129,673)
Total Benefits	2019$	2,107,388	2,225,554	2,321,632	6,654,574
Total Program Costs	nominal$	342,308	632,111	642,013	1,616,433
Total Resource Costs	2019$	453,716	695,279	705,181	1,854,176
Benefit Cost Ratio	B/C	4.64	3.28	3.45	3.59

C2 - C&I Existing Buildings, 2019-2021 Summary

C2a - C&I Existing Building Retrofit

Metric	Units	2019 Evaluated	2020 Planned	2021 Planned	2019-2021 Total
Annual Energy	MWh	8,378	13,963	14,082	36,422
Lifetime Energy	MWh	92,771	164,470	160,532	417,772
Annual Natural Gas	Therms	(30,909)	(59,152)	(60,067)	(150,128)
Lifetime Natural Gas	Therms	(324,168)	(634,531)	(601,289)	(1,559,988)
Total Benefits	2019$	19,041,360	50,753,049	51,185,761	120,980,170
Total Program Costs	nominal$	7,353,090	12,631,085	13,070,025	33,054,201
Total Resource Costs	2019$	8,247,880	13,715,960	14,296,053	36,259,893
Benefit Cost Ratio	B/C	2.31	3.79	3.75	3.34

C2b - C&I New & Replacement Equipment

Metric	Units	2019 Evaluated	2020 Planned	2021 Planned	2019-2021 Total
Annual Energy	MWh	2,432	2,192	1,979	6,603
Lifetime Energy	MWh	25,187	20,133	17,924	63,244
Annual Natural Gas	Therms	(1,595)	(1,240)	(1,043)	(3,878)
Lifetime Natural Gas	Therms	(14,053)	(9,632)	(7,621)	(31,306)
Total Benefits	2019$	4,354,249	3,994,141	3,560,265	11,908,655
Total Program Costs	nominal$	805,917	1,433,032	1,255,209	3,494,158
Total Resource Costs	2019$	781,966	1,705,748	1,521,553	4,009,267
Benefit Cost Ratio	B/C	5.57	2.40	2.45	2.97

C2c - C&I Active Demand Reduction

Metric	Units	2019 Evaluated	2020 Planned	2021 Planned
Annual Energy	MWh		(16)	(16)
Lifetime Energy	MWh		(16)	(16)
Annual Natural Gas	Therms			
Lifetime Natural Gas	Therms			
Total Benefits	2019$	-	5,793,324	9,991,528
Total Program Costs	nominal$	-	1,217,664	1,812,523
Total Resource Costs	2019$	-	1,217,664	1,812,523
Benefit Cost Ratio	B/C		4.87	5.77

Greenhouse Gas Reductions, Plan Year Summary

GHG reductions are provided for information purposes only. They are not included in the TRC test.

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2019 Planned Greenhouse Gas Reductions							
Sector	Adjusted Gross Annual Savings				Annual Emissions Reductions (Short Tons)		
	Electric Energy (MWh)	Natural Gas (Therm)	Oil (MMBTU)	Propane (MMBTU)	NOX	SO2	CO2
A - Residential	36,138	(39,124)	35,699	16,109	5.94	1.53	21,625
B - Income Eligible	2,226	-	3,953	851	0.37	0.09	1,478
C - Commercial & Industrial	18,764	(67,648)	(5,287)	32	3.08	0.80	8,449
Grand Total	**57,128**	**(106,772)**	**34,365**	**16,992**	**9.39**	**2.42**	**31,552**

2019 Evaluated Greenhouse Gas Reductions							
Sector	Adjusted Gross Annual Savings				Annual Emissions Reductions (Short Tons)		
	Electric Energy (MWh)	Natural Gas (Therm)	Oil (MMBTU)	Propane (MMBTU)	NOX	SO2	CO2
A - Residential	43,922	(113,204)	14,554	7,201	7.22	1.86	22,711
B - Income Eligible	2,075	-	2,460	494	0.34	0.09	1,258
C - Commercial & Industrial	13,199	(37,722)	(2,317)	50	2.17	0.56	6,116
Grand Total	**59,196**	**(150,926)**	**14,697**	**7,745**	**9.73**	**2.51**	**30,085**

2019 Planned v. Evaluated Greenhouse Gas Reductions Variances (%)							
Sector	Adjusted Gross Annual Savings				Annual Emissions Reductions (Short Tons)		
	Electric Energy (MWh)	Natural Gas (Therm)	Oil (MMBTU)	Propane (MMBTU)	NOX	SO2	CO2
A - Residential	22%	189%	-59%	-55%	22%	22%	5%
B - Income Eligible	-7%		-38%	-42%	-7%	-7%	-15%
C - Commercial & Industrial	-30%	-44%	-56%	56%	-30%	-30%	-28%
Grand Total	**4%**	**41%**	**-57%**	**-54%**	**4%**	**4%**	**-5%**

Notes

The Program Administrators have worked with the Department of Environmental Protection ("DEP") to properly capture the full impact of energy efficiency measures on GHG emissions. These reductions are calculated using factors prepared by DEP, which are based on adjusted gross annual electric energy, natural gas, oil, and propane savings. For projected emissions reductions in future years for the electric sector, Program Administrators are using values that are consistent with the values used in the Massachusetts Clean Energy and Climate Plan for 2020, as provided by DEP.

Greenhouse Gas Reductions, Three-Year Total

GHG reductions are provided for information purposes only. They are not included in the TRC test.

Cape Light Compact
May 29, 2020

2019 Evaluated Greenhouse Gas Reductions							
Sector	Adjusted Gross Annual Savings				Annual Emissions Reductions (Short Tons)		
	Electric Energy (MWh)	Natural Gas (Therm)	Oil (MMBTU)	Propane (MMBTU)	NOX	SO2	CO2
A - Residential	43,922	(113,204)	14,554	7,201	7.22	1.86	22,711
B - Income Eligible	2,075	-	2,460	494	0.34	0.09	1,258
C - Commercial & Industrial	13,199	(37,722)	(2,317)	50	2.17	0.56	6,116
Grand Total	**59,196**	**(150,926)**	**14,697**	**7,745**	**9.73**	**2.51**	**30,085**

2020 Planned Greenhouse Gas Reductions							
Sector	Adjusted Gross Annual Savings				Annual Emissions Reductions (Short Tons)		
	Electric Energy (MWh)	Natural Gas (Therm)	Oil (MMBTU)	Propane (MMBTU)	NOX	SO2	CO2
A - Residential	33,127	5,701	35,199	16,165	5.45	1.41	20,363
B - Income Eligible	2,143	-	4,351	904	0.35	0.09	1,473
C - Commercial & Industrial	19,385	(68,847)	(5,294)	32	3.19	0.82	8,749
Grand Total	**54,655**	**(63,146)**	**34,256**	**17,101**	**8.98**	**2.32**	**30,584**

2021 Planned Greenhouse Gas Reductions							
Sector	Adjusted Gross Annual Savings				Annual Emissions Reductions (Short Tons)		
	Electric Energy (MWh)	Natural Gas (Therm)	Oil (MMBTU)	Propane (MMBTU)	NOX	SO2	CO2
A - Residential	24,569	94,462	40,372	18,131	4.04	1.04	17,209
B - Income Eligible	2,056	-	4,512	930	0.34	0.09	1,444
C - Commercial & Industrial	19,549	(69,894)	(5,322)	32	3.21	0.83	8,821
Grand Total	**46,173**	**24,567**	**39,562**	**19,093**	**7.59**	**1.96**	**27,474**

2019-2021 Greenhouse Gas Reductions							
Sector	Adjusted Gross Annual Savings				Annual Emissions Reductions (Short Tons)		
	Electric Energy (MWh)	Natural Gas (Therm)	Oil (MMBTU)	Propane (MMBTU)	NOX	SO2	CO2
A - Residential	101,617	(13,042)	90,125	41,497	16.70	4.31	60,283
B - Income Eligible	6,273	-	11,323	2,329	1.03	0.27	4,175
C - Commercial & Industrial	52,133	(176,464)	(12,933)	114	8.57	2.21	23,686
Grand Total	**160,024**	**(189,505)**	**88,515**	**43,940**	**26.30**	**6.79**	**88,143**

Notes
The Program Administrators have worked with the Department of Environmental Protection ("DEP") to properly capture the full impact of energy efficiency measures on GHG emissions. These reductions are calculated using factors prepared by DEP, which are based on adjusted gross annual electric energy, natural gas, oil, and propane savings. For projected emissions reductions in future years for the electric sector, Program Administrators are using values that are consistent with the values used in the Massachusetts Clean Energy and Climate Plan for 2020, as provided by DEP.

Calculated Fields

Formulas used in pivot tables

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Field	Formula
B/C Ratio	='Total Benefits '/'Total Resource Costs (First Yr$)'
Net Benefits	='Total Benefits '-'Total Resource Costs (First Yr$)'
Avg Measure Life	=ROUND('Net Lifetime Electric Energy (MWh) No FS or DR'/'Net Annual Electric Energy (MWh) No FS or DR',0)
PA Budget (First Yr$)	='Total Program Costs (First Yr$)'+'Performance Incentive (First Yr$)'
Summer Cost (TRC Cost First Yr$/Summer kW)	='Total Resource Costs (First Yr$)'/'Net Summer Capacity (kW)'
Energy Cost (TRC Cost First Yr$/Annual MWh)	='Total Program Costs (First Yr$)'/'Net Annual Electric Energy (MWh)'
Natural Gas Costs (PA Cost First Yr$/Annual Therm)	='PA Budget (First Yr$)'/'Net Annual Natural Gas (Therms)'
Summer Cost (PA Cost First Yr$/Summer kW)	='PA Budget (First Yr$)'/'Net Summer Capacity (kW)'
Energy Cost (PA Cost First Yr$/Annual MWh)	='PA Budget (First Yr$)'/'Net Annual Electric Energy (MWh)'
Natural Gas Costs (TRC Cost First Yr$/Annual Therm)	='Total Program Costs (First Yr$)'/'Net Annual Natural Gas (Therms)'
Total Savings Cost (PA Cost First Yr$/Annual MMBTU)	='PA Budget (First Yr$)'/'Total Net Annual Adjusted (MMBTU)'
Total Savings Cost (TRC Cost First Yr$/Annual MMBTU)	='Total Resource Costs (First Yr$)'/'Total Net Annual Adjusted (MMBTU)'
Total PA Budget (Programs + PI + Benefit Burden)	='Total Program Costs'+'Performance Incentive'+'Benefit Burden'
Total Resource Benefits per Participant	='Total Resource Benefits'/Participants
Total PA Budget	='Total Program Costs'+'Performance Incentive'
Program Cost per Participant	='Total Program Costs'/Participants
Resource Benefit per Program Cost	='Total Resource Benefits'/'Total Program Costs'

Notes

• The above calculations are used to prepare the previous data tables.

• This table is provided consistent with the Department's directives in D.P.U. 18-110 through D.P.U. 18-119, at 75 to provide a detailed list of calculated fields used in creating the pivot tables.

APPENDIX 1
SIGNIFICANT CORE INITIATIVE VARIANCES & COST-EFFECTIVENESS

The Compact's 2019–2021 Plan referenced in this section excludes the Compact's Cape and Vineyard Electrification Offering ("CVEO"). On October 31, 2018, the Compact, along with the other Massachusetts Program Administrators, submitted its 2019–2021 Three-Year Plan to the Department for review and approval. As part of its 2019–2021 Three-Year Plan, the Compact first proposed CVEO for Department review. CVEO is the Compact's integrated and comprehensive strategic electrification and energy optimization offering that combines home weatherization from the Compact's historically successful energy efficiency programs with three technologies: (1) cold climate air source heat pumps; (2) battery storage; and (3) solar photovoltaic ("PV") arrays. The Department did not approve CVEO as presented in the 2019–2021 Three-Year Plan, but instead invited the Compact to submit a revised proposal for the Department's review and approval after the Compact received approval from the Energy Efficiency Advisory Council ("EEAC") and addressed the issues raised in the Department's order on the Plan. After following the Department's direction, on May 15, 2020, the Compact submitted a revised CVEO proposal and associated budget for the Department's review.

Please note any projections regarding term goals and cost-effectiveness do not take into account the economic and implementation impacts of COVID-19. The Compact will include a summary of COVID-19 related impacts in the 2020 Plan-Year Report.

Program Administrator-Specific Narrative Explanations for the Compact are as follows.

I. Residential Programs

A. Residential New Buildings

For the Residential New Buildings program, the 2019 actual BCR is 2.29, while the BCR for the three-year term after accounting for actual results from 2019 is 4.03.

1. Residential New Homes & Renovations

a. Significant Variances

For this core initiative, actual total benefits were significantly less than planned.

The variance in total benefits is driven by a change in fuel mix for HVAC measures, which despite yielding 60% more lifetime MWh savings than planned, achieved less than 70% of planned total benefits. This variance is due to the fact that more all-electric homes and fewer propane-heated homes participated than planned. HVAC measures drive overall savings and benefits for this program, comprising 76% of planned savings and 89% of planned benefits. Therefore, changes in HVAC measures yield significant variances for the core initiative overall.

Evaluated total resource benefits were also significantly lower than preliminary total resource benefits. This variance is due to a reduction in attributable energy savings as a result of the 2019 Residential New Construction Baseline and Code Compliance Study (2019 Plan-Year Report D.P.U. 20-50 Appendix 4D, Study 19-27). The evaluation study updated the User Defined Reference Home ("UDRH"), last updated in 2016, based on current common installation practices for non-participating homes. The study found that program homes are significantly more efficient than non-program homes, but the difference between the two is decreasing.

In addition, a decrease in measure lives for lighting measures (derived via consensus process) reduced lifetime MWh savings.

b. Cost-Effectiveness

For the Residential New Homes & Renovations core initiative, the 2019 actual BCR is 2.29, while the BCR for the three-year term after accounting for actual results from 2019 is 4.03.

B. Residential Existing Buildings

For the Residential Existing Buildings program, the 2019 actual BCR is 2.07, while the BCR for the three-year term after accounting for actual results from 2019 is 2.27.

1. Residential Coordinated Delivery

a. Significant Variances

For this core initiative, actual expenditures were significantly higher than planned.

Expenditures in the Residential Coordinated Delivery ("RCD") core initiative were 44% higher than planned. Increased spending was due to higher than planned quantities in every end use. Envelope measures made up the largest portion of the overall RCD incentive budget and saw a 50% increase from planned quantities in 2019. A secondary contributor to this variance was higher than planned spending for both HVAC and lighting measures by approximately 40%. During the 2019 Plan Year, the Compact increased marketing efforts through print and social media targeting the Home Energy Assessments and Air Source Heat Pumps. These successful campaigns drove higher than planned program participation and related costs.

The Compact will continue to monitor expenditures in RCD but at this time does not anticipate any changes to program design or implementation.

b. Cost-Effectiveness

For the Residential Coordinated Delivery core initiative, the 2019 actual BCR is 2.31, while the BCR for the three-year term after accounting for actual results from 2019 is 2.53.

2. Residential Conservation Services

a. Significant Variances

There are no significant variances for this core initiative.

b. Cost-Effectiveness

There are no benefits associated with Residential Conservation Services measures.

3. Residential Retail

a. Significant Variances

For this core initiative, evaluated total resource benefits were significantly less than preliminary total resource benefits. This variance resulted from a reduction to the claimable measure lives for lighting measures. The method that the Program Administrators use to calculate an adjusted measure life for residential lighting measures takes into account both regulatory and market conditions, both of which changed substantially. The Adjusted Measure Lives were derived via a consensus process and the result is measure lives that are much shorter than planned, and a corresponding decrease in benefits.

b. Cost-Effectiveness

For the Residential Retail core initiative, the 2019 actual BCR is 2.09, while the BCR for the three-year term after accounting for actual results from 2019 is 2.34.

4. Residential Behavior

a. Significant Variances

For this core initiative, actual expenditures, lifetime savings, and total benefits were significantly lower than planned.

This is the first time the Compact has offered home energy reports, which is different from the type of measures and services the Compact has offered customers within this core initiative in the past. The Compact launched this offering in the third quarter of 2019 and sent out two sets of reports to customers during the year.

b. Cost-Effectiveness

For the Residential Behavior core initiative, the 2019 actual BCR is 0.12, while the BCR for the three-year term after accounting for actual results from 2019 is 1.41. 2019 is the first year the Compact offered the program. The Compact plans to increase the volume of reports in 2020 and expects this core initiative will provide savings and benefits to customers going forward. The Compact further expects this core initiative will be cost-effective over the three-year term.

5. Residential Active Demand Reduction

The Compact did not implement any active demand reduction measures in 2019, consistent with the 2019–2021 Three-Year Plan. Therefore, there are no significant variances in 2019 for this core initiative, nor are there cost-effectiveness results to report.

II. Income Eligible Programs

The 2019 actual low-income expenditures were 10% lower than the 2019 planned low-income budget. Despite lower-than-expected spending in the low-income sector for 2019, the Compact continues to spend a significant amount of its budget on low-income customers. The Compact's low-income budget for the full three-year term is expected to be 10% of the three-year total budget, including actual expenditures for 2019 and the budget planned for 2020 and 2021. Therefore, the Compact continues to meet the statutory requirement that spending on low-income programs represents at least 10% of the total amount expended on electric energy efficiency programs.

A. Income Eligible Existing Buildings

For the Income Eligible Existing Buildings program, the 2019 actual BCR is 1.83, while the BCR for the three-year term after accounting for actual results from 2019 is 2.07.

1. Income Eligible Coordinated Delivery

a. Significant Variances

For this core initiative, actual total benefits were significantly less than planned.

The primary driver of this variance was the change in measure mix from plan. The Compact installed just over half of the planned quantities for both HVAC and envelope measures, but more refrigerators and clothes washers than expected. Because HVAC and envelope measures typically have longer measure lives than other measure types, the change in measure mix disproportionately impacted total benefits. In addition to the decrease in HVAC and envelope measures, the Compact also saw lower than expected lighting installations due to lack of opportunities.

The primary driver of reduced HVAC measure quantities for this program was the postponement of a large multi-family heat pump project. A conversion to air-source heat pumps requires greater attention and maintenance than some public housing sites are able to comfortably absorb, despite installation and equipment costs being covered by energy efficiency programs and substantial training being provided to maintenance staff and residents. The Compact remains committed to offering education along with the program offering for future prospective sites.

Unfortunately, as indicated in prior term reports, opportunities for envelope measures either exist or they do not. Once a home or building is retrofitted, those measures have long lives, and the building does not need upgrades again for quite some time. The Compact will continue to work to identify and serve any weatherization opportunities available.

The Compact still expects to attain its three-year savings goals in this core initiative.

b. Cost-Effectiveness

For the Income Eligible Coordinated Delivery core initiative, the 2019 actual BCR is 1.91, while the BCR for the three-year term after accounting for actual results from 2019 is 2.18.

2. Income Eligible Active Demand Response

The Compact did not implement any active demand reduction measures in 2019, consistent with the 2019–2021 Three-Year Plan. Therefore, there are no significant variances in 2019 for this core initiative, nor are there cost-effectiveness results to report.

III. Commercial Programs

A. C&I New Buildings

For the Commercial & Industrial ("C&I") New Buildings program, the 2019 actual BCR is 4.64, while the BCR for the three-year term after accounting for actual results from 2019 is 3.68.

1. C&I New Buildings & Major Renovations

a. Significant Variances

For this core initiative, actual expenditures were significantly lower than planned.

The primary driver for the decrease in spending compared to planned budget is measure mix. The Compact installed more lighting measures as compared to other more expensive measures, such as HVAC. Despite spending less than anticipated, the Compact was able to exceed its expected lifetime electric savings and total benefits goals.

The nature of new construction is highly variable, and program measure mix relies upon construction choices, which are often outside of the Compact's control. While the Compact spent less on incentives than expected in 2019, there are several projects in the planning stage that could impact the remainder of the Three-Year Plan. It should be noted that it is not yet known what impact COVID-19 will have on the construction market.

b. Cost-Effectiveness

For the C&I New Buildings & Major Renovations core initiative, the 2019 actual BCR is 4.64, while the BCR for the three-year term after accounting for actual results from 2019 is 3.68.

B. C&I Existing Buildings

For the C&I Existing Buildings program, the 2019 actual BCR is 2.59, while the BCR for the three-year term after accounting for actual results from 2019 is 3.53.

1. C&I Existing Building Retrofit

a. Significant Variances

For this core initiative, actual expenditures, lifetime savings, and total benefits were significantly lower than planned.

The variances in C&I Existing Building Retrofit were due mainly to less than expected participation throughout the initiative. The reduction in total spending and lifetime savings mirrored the lower participation numbers. Total benefits were affected by both measure mix and less than expected participation.

More specifically, the biggest decrease from planned lifetime electric savings came from a shift in schedule for several large projects in 2019. The Compact expects these projects will remain in the pipeline for 2020 and 2021, but impacts from COVID-19 on the viability of scheduled projects in 2020 and later are not yet known.

The benefit variance largely mirrors the reduction in spending and lifetime electric savings. Additionally, the Compact anticipated participation from electrically heated multi-family buildings, where envelope measures were expected to add associated benefits. There were fewer opportunities here than originally expected, which increased the variance for benefits more than for expenditures or lifetime savings.

Further, benefits were lower than planned due to a planning error for envelope measures in the C&I multi-family sub-initiative. Non-energy benefits were inadvertently determined on a per-quantity basis (e.g., square feet of insulation) rather than the number of participants. This use of incorrect quantities resulted in planned benefits for these measures that were several orders of magnitude greater than they should have been. This issue has been corrected in the preliminary and evaluated models; accordingly, both quantities and total benefits decreased significantly from planned.

b. Cost-Effectiveness

For the C&I Existing Building Retrofit core initiative, the 2019 actual BCR is 2.31, while the BCR for the three-year term after accounting for actual results from 2019 is 3.43.

2. C&I New & Replacement Equipment

a. Significant Variances

For this core initiative, actual expenditures were significantly lower than planned.

The Compact underspent the budget because of the measure mix in New & Replacement Equipment. Measures implemented through the upstream pathway dominated the participation in this core initiative. Specifically, upstream lighting measures were oversubscribed as compared to the plan, while measures installed through applications were undersubscribed. Most commercial customers have fewer technical opportunities to reduce electric load than a residential customer, and the upstream pathway is streamlined to reduce the need for paperwork.

As a result of this increased interest in the upstream pathway, there is a lower cost to achieve the savings and benefits goals. Therefore, the Compact exceeded the lifetime electric savings goal and was very close to the benefits goals while underspending the total budget.

Because the incentives are market-based, the measure mix is highly dependent upon customer demand. At this time, the Compact is not changing the program design.

b. Cost-Effectiveness

For the C&I New & Replacement Equipment core initiative, the 2019 actual BCR is 5.57, while the BCR for the three-year term after accounting for actual results from 2019 is 3.05

3. C&I Active Demand Response

The Compact did not implement any active demand reduction measures in 2019, consistent with the 2019–2021 Three-Year Plan. Therefore, there are no significant variances in 2019 for this core initiative, nor are there cost-effectiveness results to report.

APPENDIX 2
BENEFIT-COST RATIO SCREENING TOOL

Please see the Microsoft Excel workbook accompanying this report for the benefit-cost ratio screening tool.

APPENDIX 3
STATEWIDE TECHNICAL REFERENCE MANUAL
2019 REPORT VERSION

Please see Statewide Appendix 3: Technical Reference Manual – 2019 Report Version, filed under separate cover. The electronic version, the Technical Reference Library, is available at: http://www.masssavedata.com/Public/TechnicalReferenceLibrary.

APPENDIX 4

Statewide Evaluation Studies Summary

A. Table of Evaluation Studies

STUDY NAME	STUDY LOCATION AND NUMBER	FUEL	EM&V CONTRACTOR
Residential Studies			
Residential Lighting Turn-in/Exchange	Appendix 4D, Study 19-1	Electric	NMR Group, Inc.
Delta Watt Update	Appendix 4D, Study 19-2	Electric	NMR Group, Inc.
Lighting Sales Data Analysis	Appendix 4D, Study 19-3	Electric	NMR Group, Inc.
Lighting Hours of Use Update	Appendix 4D, Study 19-4	Electric	NMR Group, Inc.
Residential New Construction Passive House Assessment	Appendix 4D, Study 19-5	Electric and Gas	NMR Group, Inc.
Renovations and Additions Market Characterization and Potential Savings	Appendix 4D, Study 19-6	Electric and Gas	NMR Group, Inc.
Residential New Construction Incremental Cost Update	Appendix 4D, Study 19-7	Electric and Gas	NMR Group, Inc.
2018-2019 Winter Thermostat Optimization	Appendix 4D, Study 19-8	Electric and Gas	Navigant Consulting, Inc.
2019 Massachusetts Summer Thermostat Optimization	Appendix 4D, Study 19-9	Electric	Navigant Consulting, Inc.
HES Realization Rate Assessment	Appendix 4D, Study 19-10	Electric and Gas	Navigant Consulting, Inc.
RCD Logic Model Development	Appendix 4D, Study 19-11	Electric and Gas	Navigant Consulting, Inc
Residential Energy Optimization Model Update	Appendix 4D, Study 19-12	Electric and Gas	Navigant Consulting, Inc.
Residential Nonparticipant Market Characterization and Barriers	Appendix 4D, Study 19-13	Electric and Gas	Navigant Consulting, Inc.
Residential Baseline Phase 4 Comprehensive Report	Appendix 4D, Study 19-14	Electric and Gas	Navigant Consulting, Inc.
Commercial & Industrial Studies			
Gross Impact Framework - Decision Guide	Appendix 4D, Study 19-15	Electric and Gas	DNV GL
C&I Measure Life	Appendix 4D, Study 19-16	Electric	DNV GL
Impact Evaluation of PY 2017 Small Business Initiative Non-Lighting Measures	Appendix 4D, Study 19-17	Electric	DNV GL

STUDY NAME	STUDY LOCATION AND NUMBER	FUEL	EM&V CONTRACTOR
C&I Energy Optimization Study Task 3 Methodology Memo	Appendix 4D, Study 19-18	Electric	Navigant Consulting, Inc.
Impact Evaluation of PY2017 Custom Gas Installations	Appendix 4D, Study 19-19	Gas	DNV GL
Impact Evaluation of PY2017-2018 Custom Electric Installations	Appendix 4D, Study 19-20	Electric	DNV GL
C&I Early Replacement Study - Interview Findings Memo	Appendix 4D, Study 19-21	Gas	Cadeo
New Construction Energy Use Intensity Baseline	Appendix 4D, Study 19-22	Electric and Gas	DNV GL
Indoor Cannabis Lighting ISP Prior to 935 CMR 500	Appendix 4D, Study 19-23	Electric	DNV GL
2019 C&I Lighting Inventory & Market Model Update	Appendix 4D, Study 19-24	Electric	DNV GL
Special & Cross Sector Studies			
Analysis of Residential HVAC Sales Data from HARDI Distributors	Appendix 4D, Study 19-25	Electric and Gas	NMR Group, Inc.
Evidence for Market Effects from Support for Mini-split Heat Pump Integrated Controls	Appendix 4D, Study 19-26	Electric and Gas	NMR Group, Inc.
Residential New Construction Baseline/Compliance	Appendix 4D, Study 19-27	Electric and Gas	NMR Group, Inc.
C&I NEI Update Scoping Study	Appendix 4D, Study 19-28	Electric and Gas	NMR Group, Inc.
Immediate and Follow-up Surveys for the Cross-Cutting Code Compliance Support Initiative	Appendix 4D, Study 19-29	Electric and Gas	NMR Group, Inc.
C&I New Construction Market Effects/Spillover	Appendix 4D, Study 19-30	Electric and Gas	NMR Group, Inc.
Commercial and Industrial Small Business Nonparticipant Customer Profile Study	Appendix 4D, Study 19-31	Electric and Gas	NMR Group, Inc.
Massachusetts Statewide Residential and Commercial 2019 Awareness Survey	Appendix 4D, Study 19-32	Electric and Gas	NMR Group, Inc.
2019 Residential Wi-Fi Thermostat Direct Load Control Offering Evaluation	Appendix 4D, Study 19-33	Electric	Navigant Consulting, Inc.
Cross-State C&I Demand Response Program Summer 2019 Evaluation Report	Appendix 4D, Study 19-34	Electric	Energy & Resource Solutions
Daily Dispatch Battery Project Evaluation	Appendix 4D, Study 19-35	Electric	Energy & Resource Solutions
2019 Residential Energy Storage Demand Response Demonstration Evaluation - Summer Season	Appendix 4D, Study 19-36	Electric	Navigant Consulting, Inc.
2019 Small and Medium Business Wi-Fi Thermostat Direct Load Control Demonstration Evaluation	Appendix 4D, Study 19-37	Electric	Navigant Consulting, Inc.

STUDY NAME	STUDY LOCATION AND NUMBER	FUEL	EM&V CONTRACTOR
2019 Consolidated Demand Demonstration Project Evaluation Report	Appendix 4D, Study 19-38	Electric	Energy & Resource Solutions
Residential Nonparticipant Customer Profile Study	Appendix 4D, Study 19-39	Electric and Gas	DNV GL
C&I Customer Profile Study Dashboard User Guide	Appendix 4D, Study 19-40	Electric and Gas	DNV GL

APPENDIX 4

Statewide Evaluation Studies Summary

B. Summary of the Studies with the Most Significant Effects

The Massachusetts Program Administrators completed 40 evaluation studies for the 2019 Energy Efficiency Plan-Year Report. The studies that produced the most significant results in 2019 were the:

1. Residential Non-Participant Studies (Residential Nonparticipant Customer Profile Study and Residential Nonparticipant Market Characterization and Barriers Study)
2. 2019 C&I Lighting Inventory & Market Model Update
3. Impact Evaluations of C&I Custom Installations (Impact Evaluation of PY2017 Custom Gas Installations and Impact Evaluation of PY2017-2018 Custom Electric Installations)
4. Renovations and Additions Market Characterization and Potential Savings Study
5. Cross-State C&I Demand Response Program Summer 2019 Evaluation Report

1. Residential Non-Participant Studies

These studies were designed to characterize residential nonparticipants of Mass Save programs and investigate barriers to participation. As part of the 2019-2021 Energy Efficiency Plan, PAs agreed to conduct tailored evaluations in 2019 that address participation levels and potential unaddressed barriers for residential customers in certain groups of interest, including renters, moderate income customers, and customers with limited English proficiency. These studies fulfill that commitment and identify ways in which program designs may be refined to make efficiency programs more accessible to all customers.

Residential Nonparticipant Customer Profile Study

The purpose of this study was to assess the relationship between rates of customer participation in Mass Save residential programs between 2013-2017 and certain customer characteristics, including income levels, home ownership status, and English language. The study analysed existing data, including demographic data from the U.S. Census American Community Survey ("ACS"), program tracking data which identifies program participants between 2013 and 2017, and Tax Assessor data which identifies multifamily properties and year of home construction. The study also considered additional data on income and language from Experian (available only for Eversource). The study identified four different metrics of participation: Location participation, Consumption-weighted location participation, Account participation, and Savings/consumption.

The researchers conducted two levels of analysis, at the Census block-group level and at the individual customer level. The block-group analysis included correlations and ordinary least squares regression models. Dependent variables for these models were location participation rate

and the ratio of savings to consumption (savings/consumption); independent variables were proportions of households in block groups with certain characteristics such as moderate income. The independent variables were based on ACS data. The individual level analyses were parallel to the block group-level analyses but used individual-level data. The dependent variables for these models were account participation and savings/consumption. Independent variables were individual-level variables reflecting demographic characteristics drawn either from Tax Assessor data or Experian.

The study found that moderate-income households, renter households, and limited English-speaking households participated at a lower rate than other populations in 2013-2017. However, there is evidence that the PAs have had some success in getting low-income and multifamily locations to participate, based on an analysis of participation measured as the ratio of 2013-2017 savings to consumption (depth of savings). In particular, 2013-2017 savings/consumption metric is positively correlated with the concentration of low-income customers and customers living in multifamily buildings at the block group level. Additional analysis revealed that savings from the low-income multifamily programs account for these positive correlations.

The study also found that populations of interest tend to cluster together geographically. For example, populations of renters, moderate-income customers, and customers with limited English proficiency are geographically clustered in urban areas. In addition, the study found that analysis conducted at the level of individual customers is largely consistent with analysis conducted at the level of Census block groups. Therefore, it is valid to focus on Census tracts as the unit of analysis.

The study provides tools that may be helpful to target program offerings, such as maps that show concentrations of populations of interest and bivariate maps that show areas with low past participation overlaid with high concentrations of certain populations of interest. A copy of the complete study can be found in Appendix 4D, Study 19-40.

Residential Nonparticipant Market Characterization and Barriers Study

The purpose of this study was to collect primary data to characterize residential nonparticipants and provide insight into market barriers for renters, moderate income customers, and customers with limited English proficiency. The study relied on a combination of data collection activities with a focus on gathering data and perspectives from non-participants. These activities included over 1,600 surveys via multi-mode web, telephone, mail, and door-to-door approaches, as well as qualitative research including intercept, door-to-door, and in-depth telephone interviews. In addition to customers, the study also included perspectives from Massachusetts Program Administrators and community organizations that service the groups of interest. The research coordinated closely with the Residential Nonparticipant Customer Profile Study completed by DNV-GL.

The study found that non-participants tend to have different characteristics than participants. For example, non-participants are more likely than participants to live in rental units. Among those surveyed, 30% of renters participated compared to 40% of homeowners. Non-participants are also

more likely to have no more than a high school education and to have low-to-moderate incomes. Non-participants are generally harder to reach than participants for the purpose of survey research, even when efforts were made to make surveys available through multiple modes and in multiple languages, and even when incentives are offered for participation.

Researchers found that many barriers prevent customers from participating in Mass Save programs. Non-participants often expressed lack of trust in government and their landlords and have a fear of scams. These customers also prioritized their time and resources on needs that they considered more fundamental to living (e.g., food and shelter). Many non-participants needed more information on Mass Save offerings, participation processes, and a better understanding of how the program would benefit them. These customers perceived energy efficiency as irrelevant or not applicable to them. In addition, some customers believed Mass Save is government-funded, which deterred participation.

The evaluation study identified several program design and implementation opportunities, such as engaging trusted community organizations, reinforcing that denial in any assistance program does not mean lack of eligibility for Mass Save, and providing personal and step-by-step guidance through program process, particularly for those who speak a language other than English. A copy of the complete study can be found in Appendix 4D, Study 19-14.

2. 2019 C&I Lighting Inventory & Market Model Update

The primary goal of the 2019 Lighting Inventory and Market Model Update study was to produce adjusted measure lives ("AMLs") for major commercial and industrial ("C&I") lighting applications using lighting market data collected to improve the Lighting Market Model (the Model). As part of updating the Model, the study analyzed market trends in C&I lighting, including saturation (the percentage of fixtures of different types installed across the C&I sector) and market share (the percentage of sales of different lighting types in the C&I sector).

The research conducted during this study to support the Model and AML updates focused on three main C&I lighting applications: ambient linear, high & low bay, and building exterior & outdoor lighting. This study also presents AMLs for traditional screw-based lighting categories (a-line, downlight/track, and decorative lighting). This study did not research this equipment and instead presents AMLs based on market share forecasts from the April 2019 version of the Model.

The evaluation team used a variety of methods to research C&I lighting market indicators which were used to refine the Model's saturation and market share forecasts and the resulting AML calculations. Methods included onsite lighting inventories, distributor and manufacturer interviews, ER/ROF customer surveys, reviewing program tracking data, reviewing secondary data sources, and comparing model results to national and regional forecasts.

The study found that AMLs for ambient linear LED lighting ranged from 10.98 to 11.39 years for 2019. AMLs for high/low bay LED lighting ranged from 13.02 to 13.25 years for 2019. AMLs for exterior/outdoor LED lighting ranged from 10.10 to 10.45 years in 2019. AMLs for screw-

based LED lighting ranged from 4.07 to 4.99 years in 2019. AML values decreased for all lighting types between 2019-2021.

The study concluded that the LED C&I Market is continuing to advance, and it will become increasingly difficult to fund opportunities for program savings. With regard to ambient linear lighting, the study found that TLEDs and LED integrated fixtures continue to replace fluorescent technologies at a rapid pace, with LED integrated fixtures growing at a faster rate than TLEDs as a result of PA program support. It appears that many LEDs are replacing T8s. With regard to high/low bay lighting, the dominant technology type is linear, so the largest opportunity in this market is for TLEDs and LED integrated fixtures to continue to replace the T8s and the T12s that continue to persist in the market. With regard to building exterior/outdoor lighting, there is considerable diversity of products within this submarket, but opportunities to replace metal halide and high-pressure sodium lamps remain. A copy of the complete study can be found in Appendix 4D, Study 19-25.

3. Impact Evaluations of C&I Custom Installations

These studies were conducted to verify the savings generated through C&I custom electric and gas installations, which account for approximately 15% of planned lifetime electric savings and 7% of planned lifetime gas savings. Impact studies for C&I custom installations are conducted on a rolling basis, with updates to the sample of facilities evaluated each year. Impact evaluations produce realization rates, which are used to calibrate savings estimates. In addition, these evaluations produce recommendations for program improvements, including opportunities to bring estimated savings more in line with evaluated savings.

Impact Evaluation of 2017-2018 Custom Electric Installations

The objective of this impact evaluation is to provide verification or re-estimation of electric energy and demand savings estimates for a sample of custom lighting and non-lighting electric projects through site-specific inspection, monitoring, and analysis.

The study approach involved selecting a representative sample of large C&I custom electric projects from 2017 and 2018. Evaluators then conducted comprehensive data collection at each sample site to support an independent analysis of achieved gross electric savings realization rates. The site level evaluation results were aggregated using the final adjusted case weights. The sample for the 2017-18 impact evaluation was generated with the intention of pooling the annual evaluation results with the prior 2016 results to produce a rolling updated result.

The results of this study are realization rates for custom lighting and non-lighting electric energy efficiency measures. Realization rates were determined at the statewide level as well as separately for Cape Light Compact, Eversource, and National Grid. Statewide, two-year pooled realization rates for gross annual MWh savings were 100% ±7.2% for custom lighting, and 71% ±8.7% for custom non-lighting measures. Realization rates are reported at a 90% confidence level. Realization rates for both lighting and non-lighting measures improved from the prior year analysis. Statewide, the improvements in realization rates between the two-year pooled results

and 2016 for gross annual MWh are + 6.5% for custom lighting and + 6.0% for custom non-lighting. A copy of the complete study can be found in Appendix 4D, Study 19-21.

Impact Evaluation of 2017 Custom Gas Installations

The primary objective of this impact evaluation was to verify and re-estimate the energy savings for a sample of statistically selected 2017 custom gas projects through site-specific inspection, monitoring, and analysis.

The study approach was consisted of desk reviews, on-site visits, and metering of a randomly selected sample of projects at participating facilities. The sample for the 2017 impact evaluation was generated with the intention of pooling the annual evaluation results with the prior 2016 results to produce a rolling updated result.

The study produced statewide realization rates, as well as specific realization rates for Columbia Gas, Eversource, and National Grid. The statewide realization rate for the two -year pooled sample (2016 and 2017) was 85% ±6.5% at an 80% confidence level. This realization rate represented an improvement compared to the prior year analysis. The study results increase the 2017 reported gross savings for statewide by 3%, for Columbia Gas by 4%, for Eversource by 3%, and for National Grid by 3%. A copy of the complete study can be found in Appendix 4D, Study 19-20.

4. Renovations and Additions Market Characterization and Potential Savings Study

The purpose of this study was to understand the state and size of the market for single-family (one-unit attached and detached) renovations and additions in Massachusetts and to inform the design of the PAs' current additions and renovations offering that operates within the Residential New Homes and Renovations Initiative. In particular, the study sought to: (1) measure the market size by developing an estimate of the number projects occurring in a given year; (2) identify the typical scope associated with these renovations and addition projects; and (3) assess the gross technical potential savings associated with program-eligible projects.

To conduct the research, evaluators reviewed building department websites for the 351 municipalities in Massachusetts. The researchers also conducted a web survey of general contractors to estimate the number of projects completed without permit, in-depth interviews with HVAC contractors, in-person focus groups with contractors, and web surveys of homeowners.

The study found that there are approximately 130,000 single-family renovations and additions projects per year in Massachusetts. Of these projects, approximately 43% included at least 500 sq. ft. of floor area, which would make them eligible for program participation. Walls, lighting, and windows are the most commonly affected measures. Contractors indicated that when renovation projects are permitted (which is true for the vast majority of major projects), insulating exposed cavities is a typical practice. When heating systems are part of project scopes, they are often replaced, rather than repaired. Heat pumps commonly replace combustion heating systems. The technical potential savings with the single-family renovations and additions market are substantial. The potential savings for the renovations and additions program is more than four times the electric

savings and nearly three times the gas savings claimed by the 2018 Residential New Construction Initiative. The potential savings are equivalent to 64% and 63% of electric and gas savings, respectively, claimed by the Home Energy Services program.

The study recommended that the PAs adopt a baseline similar to the Industry Standard Practice ("ISP") baseline that was used in this study's potential modeling assessment starting in 2020.

The findings from this study provide insight into how residential renovations and additions projects affect energy usage and the potential energy savings that may be realized from these projects. This information may inform the design of the PAs' current additions and renovations offering that operates within the Residential New Homes and Renovations Initiative. A copy of the complete study can be found in Appendix 4D, Study 19-7.

5. Cross-State C&I Demand Response Program Summer 2019 Evaluation Report

The purpose of this study was to measure the average demand reduction achieved by two active demand reduction ("ADR") initiatives – C&I interruptible and C&I targeted storage – which were offered for the first time at full scale in 2019. In addition, the study assessed customer experience, barriers to implementation, and PA and vendor success in delivering these two initiatives. The evaluation also examined the overlap between the PA ADR initiatives and the ISO-NE Forward Capacity Market ("FCM") and provided input on other opportunities for peak demand management.

The evaluation approach varied depending on the ADR initiative. For C&I interruptible participants, the impact evaluation was based on account-level analysis of interval data of all available participants. First the reported results were validated. After validation, the counterfactual (i.e., baseline behavior, or the hypothetical behavior of customers absent the initiative) was characterized using five different approaches including the settlement approach used by the initiative, three alternative settlement-type methods, and a weather-based regression analysis. For C&I targeted storage participants, impact was measured based on battery system-level charge and discharge data. For both ADR initiatives, the process evaluation was based on review of initiative materials and in-depth phone interviews with PA program managers, ISO-NE Price Responsive Demand program managers, and curtailment service providers ("CSPs"). In addition, the evaluators conducted an online and phone survey of participating customers.

The study found that National Grid, Eversource, and Unitil collectively enrolled 206 Massachusetts customers in the C&I interruptible ADR initiative, and that together these customers reduced their load by an average of 75 MW during demand reduction events. The ratio between reported MW reduction and evaluated MW reduction was 81%; the difference between these two figures was largely due to differences in baseline adjustment approaches and calculation methodologies. The study also found that Eversource enrolled two targeted battery storage systems in the initiative, for an average of 0.3 MW reduction during demand reduction events. The realization rates for the targeted dispatch systems was 1.01, because the reported MW reduction was slightly lower than the evaluated MW reduction.

The study recommended a series of program adjustments based on the findings of this study. These include, for example, accelerating the incentive payment process with centralized program tracking and management systems, reminding and educating the CSPs of the shutdown allowance requirement and reporting rule, and formally standardizing all rules related to data quality, baseline calculation methods, and aggregation. A copy of the complete study can be found in Appendix 4D, Study 19-34.

APPENDIX 4

Statewide Evaluation Studies Summary

C. Evaluation Study Summaries

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Study 19-1: Residential Lighting Turn-in/Exchange Study

Type of Study: Impact Evaluation

Net-to-Gross Evaluation

Evaluation Conducted by: NMR Group

Date Evaluation Completed: 3/22/2020

Study Objective and Summary of Results:

The Program Administrators ("Pas") introduced a Residential Lighting Turn-In/Exchange Program (the program) in April 2019. This program is designed to facilitate customer exchange of inefficient bulbs or fixtures for new light emitting diode ("LEDs") bulbs. Recent studies have found that, while customers are inclined to replace inefficient bulbs with LEDs, most of those bulbs are still replaced upon failure rather than replaced early. Incandescent bulbs made up the plurality (45%) of stored bulbs in Massachusetts homes in 2019 and some of these inefficient bulbs do get installed. The program objective would be to accelerate adoption of LEDs by reducing the large stockpiles of stored inefficient bulbs or to encourage customers to change out inefficient bulbs before failure.

To support the development of this new program, the PAs and the Energy Efficiency Advisory Council ("EEAC") consultants requested that NMR Group, Inc. ("NMR"), facilitate a process to (1) come to a consensus agreement on considerations for impact factors related to the program including Net-to-Gross Ratios ("NTGR), Delta Watt, Adjusted Measure Life ("AML"), Lifetime In-Service Rate ("ISR"), and Hours of Use ("HOU"), and (2) establish deemed savings values for the program.

A consensus process yielded the following impact factors:

Program Year	**2019**	**2020**	**2021**
Net-to-Gross Ratio[1] (NTGR)	62%	55%	46%
Delta Watt[2]	46.4	46.4	46.4
Adjusted Measure Life (AML)	3	2	2
Lifetime In-Service Rate (ISR)	91%	89%	88%
Hours-of-Use per Day[3] (HOU)	2.7	2.7	2.7

[1] Assumes upstream program continues through 2021

[2] Based on combined incandescent and halogen – excluding CFLs.

[3] Value may change due to results of a pending study.

Core Initiatives or End Uses to which the Results of the Study Apply:

- Residential
- Residential Retail
- Lighting
- Electric Only

Evaluation Recommendations:

No formal recommendations were made in this evaluation.

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

N/A (no formal recommendations were made in this evaluation)

How the Study Affects Program Results and Its Significance:

The PAs will use the consensus-derived impact factors to guide program planning and filings, unless/until other studies are completed to update the impact factors.

Overview of Study Method:

NMR reviewed existing data sources, developed draft impact factors, and updated deemed savings values. For this study, NMR was interested in providing data to help inform the establishment of prospective impact factor values for LEDs that will be distributed as part of the program (Net-to-Gross Ratios ("NTGRs"), Delta Watts, Lifetime In-Service Rate ("ISR"), and Adjusted Measure Life ("AML")). Given the consensus basis for the project, NMR sought to develop a method that allowed both the PAs and EEAC consultants to provide input into developing these estimates. To this end, NMR prepared a memo outlining the proposed impact factors and then held a call with the PAs and EEAC consultants to discuss the proposed values and build consensus around which values to use in the program. The group was able to come to consensus during this call. After the call, NMR revised the final impact factor values based on the feedback from the PAs and EEAC consultants.

Application of Results: Retrospectively and Prospectively

A copy of the complete study can be found in Appendix 4D, Study 19-1.

Study 19-2: Delta Watt Update

Type of Study: Impact Evaluation

Evaluation Conducted by: NMR Group

Date Evaluation Completed: 3/26/2020

Study Objective and Summary of Results:

This evaluation was developed for the Program Administrators to update some of the inputs used to calculate LED delta watts in the Lighting Market Adoption Models ("MAMs"). Replicating an approach first applied in E-Delta Watt Update, for this current study, the PAs and EEAC consultants agreed to update equivalent wattage and sales weights based on 2019 program tracking data, which ties the delta watts directly to program sales. However, they also agreed to retain the estimated future market share values from the 2017 MAMs. The decision to keep the same future market share estimates reflected the continued market uncertainty related to federal standards, which existed when the estimates were developed in 2017 and remains in place now. The study also updated delta watts for linear fixtures sold through the program in 2019, based on planning assumptions reported in TED Product Impact Factor Estimation.

The study objectives included the following:

- Update the sales weights and wattage bins
- Update the following 2017 Annual Report MAMs:
    - Standard (GSL) model – update
    - Reflector model – update
    - Other Specialty model – update
- Update the delta watts for linear fixtures

Key findings in this study include:

Updating the wattage by bulb type and sales share based on actual 2019 screw-based LED sales, resulted in decreased delta watts for Reflector and Specialty and increased delta watts for GSLs. The changes in first-year delta watts are summarized in the table below, with the number representing the years between 2019 and 2025 in which delta watts changed in the direction shown:

	GSL	**Reflector**	**Specialty**
Gross delta watts	Increased	Decreased	Decreased
Net delta watts	Increased	Decreased	Decreased

The delta watts for linear fixtures increased from 17.9 to 19.2 based on the mix of products sold through the program in 2019.

Core Initiatives or End Uses to which the Results of the Study Apply:

- Residential
- Residential Retail
- Existing Building Retrofit
- Lighting
- Electric Only

Evaluation Recommendations:

No formal recommendations were made in this evaluation.

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

N/A (no formal recommendations were made in this evaluation)

How the Study Affects Program Results and Its Significance:

The increase in delta watts for GSLs increases first-year program savings. The decrease in delta watts for Reflectors and Specialties reduces first-year program savings.

Overview of Study Method:

NMR reviewed and cleaned the January through October 2019 sales data obtained from EFI via TRC. In total, the data contained sales records for 10,811,487 LEDs. After cleaning, NMR grouped LEDs into three types: General Service (GSL) (63%), reflector (23%), and specialty (14%). As the EFI data do not include equivalent incandescent wattage, after categorizing LEDs by type, NMR leveraged web scraping and shelf stocking data from Massachusetts and Rhode Island to look up manufacturer-specified equivalent incandescent wattage. A statistical model provided predictions of halogen reflector and specialty equivalents, as the variety of bulbs among these shapes do not lend themselves to simple rules of thumb about wattage equivalence. The resulting equivalent incandescent wattages across all bulb shapes and technologies were used to assign LEDs to the appropriate 2017 MAM equivalent wattage bins. After binning LEDs, we updated sales weights, which are equivalent to the proportions of 2019 program-supported bulbs in each wattage bin.

NMR also estimated delta watts for tubular (linear) LEDs. The tracking data indicated that the program only sold linear fixtures between January through October of 2019. During this time period the 350,925 fixtures collectively contained 536,086 lamps, which NMR binned by length (24”, 36”, 48” 96”). Using the planning assumptions reported in RLPNC 18-7 for binned delta watts for T8 linear lamps with a ballast bypass (the most comparable to the linear fixtures sold through the program), NMR produced sales weighted estimates of delta watts for 2019.

Application of Results: Retrospectively

A copy of the complete study can be found in Appendix 4D, Study 19-2.

Study 19-3: Lighting Sales Data Analysis

Type of Study: Market Characterization or Assessment Evaluation

Evaluation Conducted by: NMR Group

Date Evaluation Completed: 10/24/2019

Study Objective and Summary of Results:

For this study, NMR analyzed third-party light bulb sales data (LightTracker) obtained on behalf of the Program Administrators ("PAs") from the Consortium for Retail Energy Efficiency Data ("CREED"). It compares market conditions in Massachusetts to the nation, other states with upstream lighting programs, and states without upstream lighting programs. The objectives of this study were:

- Examine current market share, bulb sales, and bulb shipments in Massachusetts, states with upstream programs, states without upstream lighting programs, and the entire nation.
- Provide breakdowns of market share by bulb type (i.e., light emitting diodes ("LEDs"), compact fluorescent lamps ("CFLs"), halogens, and incandescents), shape (A-line, reflector, globe, and candelabra), and ENERGY STAR® status, when data quality allow.
- Explore trends in bulb market share from 2009 to 2018 and NEMA reported quarterly bulb shipment share from 2011 to the most recent quarter available, including a comparison and assessment of NEMA's revised methodology.
- Compare average prices of LEDs to halogens in the bulb price analysis.
- Assess market share in very low (<310) and very high lumen bins (>3,300), which roughly coincide with ranges that will remain exempt if Phase II of the EISA goes into effect.

Key findings in this study include:

- The sales data analysis suggests that the Massachusetts Residential Lighting Core Initiative still matters and has positive impacts on the residential lighting market, but market transformation is progressing in Massachusetts and across the nation. The sales data analysis suggests that the Program continued to increase the adoption of energy-efficient bulbs in 2018. However, non-program areas experienced a more rapid increase in LED sales market share compared to Massachusetts and states with upstream lighting programs more generally.
- Efficient lamp (LEDs and CFLs) market share in Massachusetts was slightly higher (57%) compared to the nation, but the same as in 2017. LED market share broke 50% in Massachusetts, the United States, and all program states. Massachusetts saw its LED market share increase from 49% in 2017 to 53% in 2018, while the national LED market share increased from 35% to 51% across the same period.

- Massachusetts customers purchased a higher proportion of LEDs within each bulb shape compared to the nation and non-program areas, but reflector and A-line market shares across all areas considered showed strong progress towards transformation. The LightTracker data suggest that LEDs made up 78% of reflector, 54% of A-line, 51% of globe, and 34% of candelabra bulbs in Massachusetts. However, reflector LED market share was at 73% and A-line 48% in non-program areas, which are not much lower than those of Massachusetts.
- A greater portion of LED bulbs sold in Massachusetts in 2018 were ENERGY STAR qualified compared to the non-program comparison areas. Nearly four out of five LEDs (77%) sold in Massachusetts in discount, dollar, drug, grocery, mass merchandise, and some membership stores qualified for the ENERGY STAR label. Non-program states had only a 60% ENERGY STAR market share.
- Residential lighting program spending is associated with higher LED market share, but natural market adoption of LEDs progressed the most in non-program areas between 2017 and 2018. The rate of increase in market share between 2017 and 2018 was higher in non-program states than in all states with moderate or aggressive program activity.
- In Massachusetts, LEDs garnered the majority of the A-line bulbs market in the 60-watt equivalent range (750 to 1,049 lumens), while incandescents dominated lumen bins that were exempted from EISA per the original legislation. While they were a majority (64%) in the 750 to 1,049 lumen bin in Massachusetts (this bin accounts for nearly one-half of all A-line bulb sales), LEDs still had significant growth potential in all other lumen bins. Halogens had the largest market share in four of the five lumen bins currently subject to EISA.
- LED prices were higher than halogens in all regions examined – but prices for efficient bulbs were lowest in Massachusetts. Massachusetts had the lowest average LED prices ($2.56 compared to $2.59 or higher in other areas) despite having a higher proportion of ENERGY STAR LEDs than the comparison areas. The substantial program incentives in Massachusetts certainly help explain the lower average.

Core Initiatives or End Uses to which the Results of the Study Apply:

- Residential
- Residential Retail
- Lighting
- Electric Only

Evaluation Recommendations:

No formal recommendations were made in this evaluation.

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

N/A (no formal recommendations were made in this evaluation)

How the Study Affects Program Results and Its Significance:

The Study provided valuable context as the PAs continue to monitor the residential lighting market and the impact of the Residential Lighting Initiative. The results suggest that, in 2018, the Residential Lighting Initiative contributed to increased market share and lower shelf prices of ENERGY STAR LEDs, but the impact of the program on the market as a whole appears to be dwindling as the market naturally progresses towards LEDs.

Overview of Study Method:

Using lighting bulb sales data compiled by CREED as part of the LightTracker Initiative (2009 to 2018), shipment data (2011-2018) from NEMA, and program activity data, NMR employed a series of descriptive analysis tasks. The CREED data were generated from point-of-sale (POS) sales data (from grocery, drug, dollar, discount, mass merchandiser, and selected club stores), and National Consumer Panel state sales data (from home improvement, hardware, online, and selected club stores).

Application of Results: Retrospectively and Prospectively

A copy of the complete study can be found in Appendix 4D, Study 19-3.

Study 19-4: Residential Lighting Hours-of-Use

Type of Study: Impact Evaluation

Evaluation Conducted by: NMR Group

DNV GL

Date Evaluation Completed: 3/31/2020

Study Objective and Summary of Results:

The purpose of this study was to explore the relationship between saturation and HOU and, based on that, help the PAs and EEAC Consultants agree on updated HOU estimates for program supported LEDs for the 2019, 2020, and 2021 program periods.

The study provides the following key findings:

- HOU distribution was right skewed and bounded between zero and 24 hours of use per day. While the validity of ordinary least squares (OLS) regression does not hinge on the normality of the underlying distribution, significant departures from a normal distribution can yield estimates and inferences that lack the typically assumed characteristics of OLS regression. Therefore, a transformation was performed on the 2014 HOU data to find a transformation which would allow the HOU distribution to more closely approximate normality.
- Updated model found smaller difference between efficient and inefficient HOU. The 2014 Northeast HOU study provided a point estimate for inefficient lamps (2.3) that was 23% lower than efficient lamps (3.0). Using the model created as part of this study and the 2018 saturation values, the difference was smaller with a 10% difference in HOU between inefficient (2.58) and efficient (2.86).
- Saturation and demographic factors significant in model. Room type, education, tenure, the total number of sockets, and efficient lamp saturation variables for each room type were all found to be significant in the model and were used in the final model.
- Changes in saturation by room type decreased HOU. When the revised model was applied to the most recent lighting inventory data, estimated efficient HOU decreased relative to original lighting data included in the 2014 study. This was driven by relative changes in and the inventory of efficient lamps across room types. The number of efficient lamps in rooms with lower HOU is higher in the 2018 saturation data compared to the data used for the 2014 study.
- HOU appears to increase as energy efficient saturation by room type increases. Models prepared as part of this study to explore the relationship between HOU and saturation revealed a positive and significant relationship between saturation and HOU. This relationship persisted across a variety of models and variable combinations. This finding

is counterintuitive and runs counter to a previous study conducted in California, and it highlights the complexity of the relationship between HOU and individual behavior. Possible explanations include customers with higher overall HOU tending to purchase more energy efficient lamps, and snapback behavior with customers increasing the use of lamps as saturation increases and the cost to operate lamps decreases. With no strong or compelling reasoning behind this phenomenon, care must be taken when drawing any conclusions. Additional work needs to be performed to develop a more complete understanding of the relationship.

- Inefficient lamps comprised a greater proportion of rarely used lamps (less than 0.5 daily HOU). Overall, 20% of lamps were used for less than 30 minutes a day, based on weighted metering data (pre-modeled). Efficient lamps accounted for 45% of the low-use lamps, which was lower than their portion of the entire sample of metered lamp (52%). Not surprisingly, closets had the highest proportion of low-use lamps (66%), and kitchens and the home's exterior tied for the lowest proportion of low-use lamps (10%). Inefficient lamps accounted for the majority of low-use lamps in all room types except kitchens and basements.
- Efficient lamps account for a sizeable portion of replaced lamps. Based on lamp replacement behavior observed as part of the 2018-19 Market Assessment Study, 43% of replaced medium screw-base lamps were efficient (33% CFLs and 10% LEDs) and 57% were inefficient (46% incandescent and 11%).[1]
- Consensus process considered both inefficient and efficient HOU, adjusted for saturation rates in the 2018 to 2019 Lighting Market Assessment. At a meeting led by the DNV GL team, the PAs and EEAC Consultants agreed to the use of the rounded inefficient HOU (2.6) for direct install and turn-in programs and combined efficient and inefficient HOU (2.7 – unadjusted for cross-sector sales and 3.0 after adjusting for cross-sector sales) for upstream programs for the full 2019 to 2021 program cycle.

Core Initiatives or End Uses to which the Results of the Study Apply:

- Residential
- Residenital Coordinated Delivery & Residential Retail
- Lighting
- Electric Only

Evaluation Recommendations:

The following recommendations were made by the evaluators conducting this study.

[1] Excludes empty sockets, linear fluorescents, and pin-based lamps.

Recommendation 1: The PAs and EEAC Consultants should apply the consensus-derived HOU for the 2019 to 2021 program cycle.

Rationale: The re-analysis of the original 2014 metering data considered additional factors and relied on modeling approach more appropriate to the distribution of HOU. The PAs and EEAC Consultants carefully considered the results and reached consensus on recommended values.

The table below provides the recommended HOU impact factor updates by measure and initiative. For context, the table also includes the assumed values from the 2019-2021 plan and the percentage change in HOU.

Hours-of-use impact factors (planned and updated)

Measure	Delivery Method	Initiatives	Year	Residential Daily HOU****		
				2019 -21 TRM	Updated Value	% Change (decrease)
LED Lamp – General Service Lamp	Direct Install	RES_NH, RCD, & IECD**	2019 2020 2021	2.7	**2.6**	(3.7%)
LED Lamp – Reflector	Direct Install	RES_NH, RCD, & IECD**	2019 2020 2021	2.7	**2.6**	(3.7%)
LED Lamp – Specialty	Direct Install	RES_NH, RCD, & IECD**	2019 2020 2021	2.7	**2.6**	(3.7%)
LED Lamp – General Service Lamp	Upstream	RES_RETAIL	2019 2020 2021	3.2 3.1 3.0	**3.0**	(6.3%) (3.2%) 0
LED Lamp - Reflector	Upstream	RES_RETAIL	2019 2020 2021	3.2 3.1 3.0	**3.0**	(6.3%) (3.2%) 0
LED Lamp - Specialty	Upstream	RES_RETAIL	2019 2020 2021	3.2 3.1 3.0	**3.0**	(6.3%) (3.2%) 0
LED Lamp – General Service Lamp	Turn in	RES_RETAIL***	2019 2020 2021	2.7	**2.6**	(3.7%)
LED Lamp - Reflector	Turn in	RES_ RETAIL	2019 2020 2021	2.7	**2.6**	(3.7%)
LED Lamp - Specialty	Turn in	RES_ RETAIL	2019 2020 2021	2.7	**2.6**	(3.7%)

*Source: https://www.masssavedata.com/Public/TechnicalReferenceLibrary.

**Single-family only for RES NH&R = Residential New Homes & Renovations; RCD = Residential Coordinated Delivery (excluding High Rise measures), IECD = Income Eligible Coordinated Delivery, RES_RETAIL = Residential Retail

***The turn-in program was not included in the three-year plan and was new to the portfolio for 2019. The turn-in program was using the HOU for direct install as a placeholder awaiting results from this study.

****Residential Retail hours have been adjusted for assumed cross-sector sales of 7% with 7 HOU per bulb. Without this adjustment planned values were 2.9, 2.8, and 2.7 for 2019, 2020, and 2021, respectively. The revised value was 2.7 for all three years.

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

The PAs are considering all recommendations for adoption at this time. The PAs have not formally adopted or rejected any recommendations that require changes to program design and operations.

How the Study Affects Program Results and Its Significance:

The findings from the study decrease the hours of use that are used to derive claimable savings for the 2019-2021 term for LED lighting measures supported as part of the Residential Retail, Residential Coordinated Delivery (RCD), Income Eligible Coordinated Delivery (IECD), and Residential New Homes and Renovations (NH&R) programs. For RCD, IECD, and NH&R, HOU decreased by 3.7% in all 3 years. For Residential Retail, HOU decreased by 6.3% for 2019, by 3.2% for 2020, and are unaffected for 2021.

Overview of Study Method:

Evaluators identified and assembled existing data sources, transformed data to provide approximately normal data, fit a regression model to the transformed data, and applied the new model to recent inventory data. Evaluators then facilitated a consensus process during which the PAs and EEAC Consultants arrived at agreement on what HOU to use moving forward.

The study relied on data from the 2014 Northeast HOU Study and more recent lighting saturation data collected as part of the 2018-19 Residential Lighting Market Assessment. The 2014 HOU study estimated HOU as a function of lamp, application, and household characteristics. The model constructed for this study has been applied in the original study and subsequent analysis to estimate program lamp average HOU using onsite inventory data from the 2014 HOU study and the 2018-19 Market Assessment.

Application of Results: Retrospectively and Prospectively

A copy of the complete study can be found in Appendix 4D, Study 19-4.

Study 19-5: Residential New Construction Passive House Assessment

Type of Study: Market Characterization or Assessment Evaluation

Evaluation Conducted by: NMR Group

Date Evaluation Completed: 1/6/2020

Study Objective and Summary of Results:

The purpose of this study was to assist in the design of a new Passive House offering within the Residential New Construction Program by understanding the extent to which various energy modeling tools can handle the inputs and detail associated with Passive House, as well as the opportunities, barriers, incremental costs, and incentive issues associated with a new Passive House offering. The study provided preliminary energy savings from Passive House models for three types of buildings:

- Multifamily high-rise—multifamily buildings four stories or greater in size, or any multifamily buildings with a central HVAC system
- Multifamily low-rise
- Single family

The study provides the following key findings:

- Passive House provides substantial savings over the current Residential New Construction Program for all housing types.
- Incremental cost estimates, covering both construction costs and certification costs, ranged from 2% to 15% over homes built to code for single family and multifamily low-rise buildings.
- Most market actors interviewed for the study suggested an incentive amount between $4,000 and $5,000 per unit. Most respondents recommended this level for high-rise multifamily buildings; they also believe that single-family buildings may require additional incentives to overcome perceived increases in incremental costs.

Core Initiatives or End Uses to which the Results of the Study Apply:

- Residential
- New Homes & Renovations
- Envelope & All End Uses
- Electric & Gas

Evaluation Recommendations:

The following recommendations were made by the evaluators conducting this study.

Recommendation 1: The Passive House offering should use one modeling tool per project to assess savings; projects pursuing PHIUS certification should use WUFI Passive models, while projects pursuing PHI certification should use PHPP models.

Recommendation 2: Monitor the energy performance of early program participants as this proof of performance may help recruit additional builders and developers into the programs.

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

The PAs are considering all recommendations for adoption at this time. The PAs have not formally adopted or rejected any recommendations that require changes to program design and operations.

How the Study Affects Program Results and Its Significance:

The findings from this study provide insight into probable energy savings, modeling, incremental costs, and incentive issues associated with a new Passive House offering within the Residential New Construction Program. This information may inform the design, marketing, and administration of such an offering.

Overview of Study Method:

NMR modeled five high-rise multifamily Passive House projects that had met pre-certification or final certification requirements using three tools: WUFI Passive, PHPP, and the ICF multifamily modeling tool. Two low-rise multifamily and five single family projects were modeled using REM/Rate and Ekotrope. NMR also reviewed 62 high-rise multifamily participant projects from 2018 to understand the energy consumption of the proposed and baseline conditions from recent high-rise multifamily participant projects. The study included 25 in-depth interviews of architects, builders, industry experts, owners or occupants, and developers.

Application of Results: Prospectively

A copy of the complete study can be found in Appendix 4D, Study 19-5.

Study 19-6: Renovations & Additions Market Characterization & Potential Savings

Type of Study: Market Characterization or Assessment Evaluation

Evaluation Conducted by: NMR Group

Date Evaluation Completed: 3/27/2020

Study Objective and Summary of Results:

The purpose of this study was to understand the state and size of the market for single-family (one-unit attached and detached) renovations and additions in Massachusetts and to inform the design of the Program Administrators' current additions and renovations offering that operates within the Residential New Homes and Renovations Initiative. The study had three goals:

- Measure market size by developing an estimate of the number projects occurring in a given year.
- Identify the typical scope associated with these projects.
- Assess the gross technical potential savings associated with program-eligible projects.

The study provides the following key findings:

- There are approximately 130,000 single-family renovations and additions projects per year. The study estimated approximately 55,500 projects affect at least 500 sq. ft. of floor area, which would make them eligible for program participation.
- Walls, lighting, and windows are the most commonly affected measures. Contractors indicated that when renovation projects are permitted (97% of major projects), insulating exposed cavities is a typical practice.
- When heating systems are part of project scopes, they are often replaced, rather than repaired. Heat pumps commonly replace combustion heating systems.
- The technical potential savings with the single-family renovations and additions market are substantial, representing 445% of the electric savings and 270% of the gas evaluated net savings claimed by the 2018 RNC initiative, and 64% and 63% of electric and gas savings, respectively, claimed by the HES program.

Core Initiatives or End Uses to which the Results of the Study Apply:

- Residential
- New Homes & Renovations
- Envelope & All End Uses
- Electric & Gas

Evaluation Recommendations:

The following recommendations were made by the evaluators conducting this study.

> **Recommendation 1:** The PAs should adopt a baseline similar to the Industry Standard Practice ("ISP") baseline that was used in this study's potential modeling assessment starting in 2020.

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

The PAs plan to adopt the recommendations.

How the Study Affects Program Results and Its Significance:

The findings from this study provide insight into how residential renovations and additions projects affect energy usage and the potential energy savings that may be realized from these projects. This information may inform the design of the PAs' current additions and renovations offering that operates within the Residential New Homes and Renovations Initiative. Further, this study identifies areas for further evaluation research and should help PAs and the EEAC determine if such work is justified.

Overview of Study Method:

NMR reviewed building department websites for the 351 municipalities in Massachusetts. Fifty-six had online databases that included permit records with project descriptions; permit counts for the municipalities without online databases were estimated using regression models. NMR conducted a web survey of 77 general contractors to estimate the number of projects completed without permits. The study also included in-depth interviews with ten HVAC contractors, five in-person contractor focus groups, and 207 homeowner web surveys.

Application of Results: Prospectively

A copy of the complete study can be found in Appendix 4D, Study 19-6.

Study 19-7: Residential New Construction Incremental Cost Update

Type of Study: Market Characterization or Assessment Evaluation

Evaluation Conducted by: NMR Group

Date Evaluation Completed: 3/27/2020

Study Objective and Summary of Results:

The purpose of this study was to provide an updated estimate of the incremental costs associated with participating in the Massachusetts low-rise Residential New Construction ("RNC") program. The original study was finalized in July of 2018. This study applies to single-family homes and low-rise (three stories or less) multifamily housing units. Incremental costs were calculated on a per square foot of conditioned floor area ("CFA") basis to move from baseline construction practices to construction practices commonly found in recent RNC program projects.

The study provides the following key findings:

- Incremental costs range from $0.83 to $1.23 per square foot of CFA across all housing types, depending on the methodology used. The average is an incremental cost of $1.03 per square foot of CFA.
- The incremental costs for all home types have decreased from the original incremental cost study. Non-program home performance has increased for nearly all measures since the original study at a faster rate than program homes. This yields lower incremental costs to participate, given that it takes limited labor and materials to achieve program performance relative to a rising baseline.

Core Initiatives or End Uses to which the Results of the Study Apply:

- Residential
- New Homes & Renovations
- Envelope & All End Uses
- Electric & Gas

Evaluation Recommendations:

The following recommendations were made by the evaluators conducting this study.

Recommendation 1: The PAs should apply the overall average incremental cost of $1.03 per CFA for the low-rise RNC program. If the PAs' cost-effectiveness testing requires the incremental costs to be broken out by home type, the average incremental cost per CFA by home type should be applied.

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

The PAs plan to adopt the recommendations.

How the Study Affects Program Results and Its Significance:

The findings from this study provide insight into the incremental costs currently faced by builders or owners who decide to participate in the RNC Program. This information may inform the incentives offered to participants.

Overview of Study Method:

NMR had used estimated measure-level incremental costs associated with participating in the RNC program based on pricing quotes provided by Massachusetts contractors in the original study. In this study, NMR developed new incremental cost estimates that assessed costs for recently-built program homes against the most recent non-program baseline, to provide a more up-to-date estimate of the incremental costs associated with program participation using two approaches.

The first approach relied on the contractor estimates of incremental costs that were provided as a part of the original study and adjusted them to reflect the improvements to various measures found in the most recent non-program baseline. The second approach relied on cost data from the National Renewable Energy Laboratory's ("NREL") National Residential Efficiency Measures Database ("NREMD"), which were, again, applied to the most recent non-program baseline.

Application of Results: Retrospectively and Prospectively

A copy of the complete study can be found in Appendix 4D, Study 19-7.

Study 19-8: 2018-2019 Winter Temperature Optimization Evaluation

Type of Study: Impact Evaluation

Evaluation Conducted by: Guidehouse

Date Evaluation Completed: 2/28/2020

Study Objective and Summary of Results:

The purpose of this study was to assess the technical feasibility of the winter thermostat optimization program (called Seasonal Savings, hereafter SS) deployed in Cape Light Compact ("CLC"), Eversource ("ES"), and National Grid ("NGrid") service territories in winter 2018-2019, and to estimate associated energy and demand savings and calculate realization rates.

The study provides the following key findings:

- Over half of thermostats in the ITT group opted into the program — 53%.
- The heating setpoint schedules for the treated thermostats were adjusted downward during the program period — 0.73°F.
- The largest setpoint adjustments took place during the middle of the night, when customers were likely to asleep — 1.50°F. This is different than the 2018 summer SS program which saw the largest adjustments during the middle of the weekdays.
- The average energy savings per treated thermostat between January 14, 2019 and April 30, 2019 were 13.6 therms and 10.7 kWh.
- The program yielded average energy savings of 4.1% of fuel heating load and 5.1% of electric heating load between January 14, 2019 and April 30, 2019.
- The program yielded no statistically significant peak demand savings between January 14, 2019 and January 31, 2019
- The program achieved energy savings between January 14, 2019 and April 30, 2019 of 68,684 MMBtu and 559 MWh.
- Compared to vendor reported savings, the program achieved 98% of Natural Gas heating fuel savings, 98% of Natural Gas heating electric savings, 99% for Non-Natural Gas heating fuel savings, and 104% for Non-Natural Gas heating electric savings

Core Initiatives or End Uses to which the Results of the Study Apply:

- Residential
- New Buildings & Major Renovations
- Behavior & HVAC
- Electric & Gas

Evaluation Recommendations:

The following recommendations were made by the evaluators conducting this study.

Recommendation 1: For the current 2018-2019 winter season, the Massachusetts PA should use a realization rate of:

- 97% for Natural Gas heating fuel savings
- 98% for Natural Gas heating electric savings
- 98% for Non-Natural Gas (Oil and Propane) heating fuel savings
- 100% for Non-Natural Gas (Electric, Oil, and Propane) heating electric savings

These realization rates can be applied to the vendor reported estimates of total savings or per thermostat savings.

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

The PAs have adopted the recommendation as part of the 2019 annual report.

How the Study Affects Program Results and Its Significance:

The study found average energy savings of approximately 13.6 therms and 10.7 kWh per treated thermostat in winter 2018-2019 validating the technical feasibility of the thermostat optimization program.

All Massachusetts PAs will deploy the SS program during winter 2019-2020 to better inform a PA-specific savings value or realization rate for inclusion in the Technical Reference Manual.

Overview of Study Method:

The study relied on thermostat telemetry data and thermostat-level participation data. A total of 139,626 thermostats (22,343 in National Grid's electric service territory, 61,691 in National Grid's electric service territory, 21,476 in ES's electric service territory, 29,571 in ES's gas service territory, and 4,545 in CLC's service territory) were included in the study (4% of the 139,626 thermostats in the PAs combined service territories were excluded from the analysis due to data quality).

1. An exploratory analysis of the data was performed to:
    - Analyse setpoint schedules and thermostat heating runtime during the pre-period, tune-up period, and post tune-up period to assess whether the impact of temperature optimization was evident in the data.
    - Compare data across several groups, including ITT versus control and treated versus untreated versus control.

- Conduct a time differentiated analysis by comparing differences between weekdays/weekends, and the hour-of-the-day.
- Compare actual setpoints to scheduled setpoints.

2. A regression-based modeling approach was used to estimate energy savings and demand impacts over the cooling season. The SS program uses a randomized encouragement design ("RED") in which all customers in a PA's service territory with a Nest thermostat were randomly assigned into one of two groups. These two groups are the intent to treat ("ITT") group, where participants are randomly assigned to receive the program offering, and the control group, where participants are randomly assigned to *not* receive the program offering.[2]

   All qualified customers were provided the program offering on the thermostat itself and through Nest's mobile app. Some portion of ITT customers chose to opt in and enrolled into the program, while others did not. The group of customers that opted in is referred to as the treated group. Thermostats that were part of the ITT group but either did not qualify or did not opt in are referred to as the untreated group.

   SS savings are evaluated by comparing the ITT group (both treated and untreated thermostats) to the control group using a linear fixed effects (or difference-in-differences) regression model to estimate energy and demand savings. The estimate of savings is then scaled by the program opt-in rate to calculate savings per treated thermostat.

   Due to the design of the program, targeted thermostats could not be linked directly to customers and their billing data. Therefore, the study relied exclusively on thermostat telemetry data to estimate impacts after converting thermostat runtime to energy consumption. Based on a combination of geographic location, self-reported heating types, and thermostat wiring, each Nest thermostat was assigned a heating fuel and equipment type. To develop conversion factors for each heating and equipment type, Guidehouse leveraged various data sources to obtain accurate estimates of average capacity and operating efficiency, including previous potential studies, the RES 1 Baseline Load Shape Study, past DOE regulatory analyses and the Massachusetts Technical Reference Manual.

   The study estimated statewide electric and fuel energy savings and electric demand savings for natural gas and combined non-natural gas heating fuel types. Energy savings were estimated for the following periods: winter, effective winter, winter on-peak (electric-only), winter off-peak (electric-only), tune-up, and post tune-up[3]; demand savings were

[2] For each PA, 70% of thermostats were randomly assigned to the ITT group while the remaining 30% were assigned to the control group.

[3] Winter – all hours December 1 through April 30 while SS program is active; Effective Winter – all hours December 1 through April 30, assuming the SS program were active the entire period; Winter On-Peak – weekdays, non-holidays from 7 AM to 11 PM, October 1 through May 30 while SS program is active; Winter Off-Peak – all hours not on-peak; Tune-Up – all hours January 14 through February 13; Post Tune-Up – all hours February 14 through April 30

estimated for the winter on-peak period[4], as well as an adjusted winter period which assumes zero demand savings prior to program launch. The study developed realization rates for fuel and electric energy savings for natural gas and combined non-natural gas heating types.

Application of Results: Retrospectively and Prospectively

A copy of the complete study can be found in Appendix 4D, Study 19-8.

[4] Winter Demand – weekdays, non-holidays from 5 PM to 7 PM, December 1 through January 31 while the SS program is active; Adjusted Winter Demand - weekdays, non-holidays from 5 PM to 7 PM, December 1 through January 31 assuming zero savings prior to program launch

Study 19-9: 2019 Summer Thermostat Optimization Evaluation

Type of Study: Impact Evaluation

Evaluation Conducted by: Navigant Consulting

Date Evaluation Completed: 3/26/2020

Study Objective and Summary of Results:

The purpose of this study was to estimate energy and demand savings and calculate realization rates for the summer thermostat optimization program (called Seasonal Savings, hereafter SS) deployed in Cape Light Compact ("CLC"), Eversource ("ES"), and National Grid ("NGrid") service territories in summer 2019. A secondary objective was to assess the persistence of program as this is the third summer it ran for NGrid and the second summer for CLC.

The study provides the following key findings:

- 40% of ITT thermostats and 56% of qualified ITT thermostats enrolled in the program.
- Enrollment and qualifications rates are lower for CLC than NGrid and ES (~30% compared to ~40%), likely due to different home usage and cooling needs on the Cape.
- Enrollment rates have been steady across years for NGrid (~40%) and CLC (~30%). Customers are more likely than not to maintain their most recent treatment status from one year to the next.
- Clear evidence of persistence exists in early summer 2019 in scheduled setpoints for the NGrid ITT devices from one year to the next. This is especially true for those treated for multiple years of the three-year study period: 1.25°F for three years treated and 0.25°F for two years treated.
- There is also evidence of persistence in actual setpoints and runtime for the devices opting in for three years over the three-year study period: 0.75°F in actual setpoints and approximately 3 minutes less runtime. However, based on the entire pre-period no evidence of persistence exists in actual setpoints and runtime for those treated two years of the three-year study period.
- The time differentiated setpoint analyses and the runtime both suggest that the devices treated three years over the three-year study period are manually overriding their thermostat setpoints on the hottest days of the summer. This suggests that these customers may be reaching the limits of what is comfortable in their homes on these very hot days.
- The average energy savings per treated thermostat was 19.7 kWh (3% of electric cooling load) between July 18 and September 30, 2019.
- The average demand savings per treated thermostat was 46 W (7% of electric cooling load) between July 18 and September 30, 2019.

- The program achieved 669 MWh of total energy savings (495 on-peak and 174 off-peak) and 1.3 MW of total demand savings between July 18 and September 30, 2019.
- Compared to vendor-reported savings, the program achieved 99% of electric energy savings.
- The demand-to-energy (W to kWh) factor was 2, the on-peak savings percentage was 74%, and the off-peak savings percentage was 26%.

Core Initiatives or End Uses to which the Results of the Study Apply:

- Residential
- Residential Behavior
- Behavior & HVAC
- Electric Only

Evaluation Recommendations:

The following recommendations were made by the evaluators conducting this study.

Recommendation 1: The PAs should claim the electric energy and demand savings listed in the following table.

PA	Measure Life	No. of Participating Thermostats (Google)†	Total Energy (kWh) Savings‡	On-Peak Energy (kWh) Savings§	Off-Peak Energy (kWh) Savings††	Total Demand (kW) Savings‡‡
CLC	1	2,052	40,424	29,914	10,510	81
ES	1	19,802	390,099	288,674	101,426	780
NGrid	1	12,087	238,114	176,204	61,910	476
Statewide	**1**	**33,941**	**668,638**	**494,792**	**173,846**	**1,337**

Recommendation 2: For 2019 and future years when an evaluation is not conducted, Navigant recommends the PAs claim energy savings based on a realization rate of 99%.

- PAs should claim energy savings using the following formula:

  Claimable total energy (kWh) savings by PA = Google's statewide weighted average per treated thermostat energy savings (kWh) * Google's treated thermostat count by PA * 99% (realization rate)

Recommendation 3: For 2019 and future years, Navigant recommends the PAs claim on-peak and off-peak energy savings based on an on-peak savings percentage of 74% and off-peak savings of 26%.

- PAs should claim on-peak and off-peak savings using the following formulas:

  Claimable on-peak energy (kWh) savings by PA = Claimable total energy (kWh) savings by PA * 74% (on-peak savings percentage)

  Claimable off-peak energy (kWh) savings by PA = Claimable total energy (kWh) savings by PA - Claimable on-peak energy (kWh) savings by PA

Recommendation 4: For 2019 and future years, Navigant recommends the PAs claim demand savings based on a realization rate of 99% and a demand-to-energy (W to kWh) factor of 2.

- PAs should claim demand savings using the following formula:

  Claimable demand (kW) savings by PA = (Google's statewide weighted average per treated thermostat energy savings (kWh) * Google's treated thermostat count by PA * 99% (realization rate) * 2 (demand-to-energy factor)) / 1,000

Recommendation 5: The realization rate should be reassessed within 3-5 years or if new vendors join the program, Google changes its method of estimating savings, the groups are re-randomized in future deployments, or the PAs want to reduce the size of past control groups.

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

The PAs have adopted recommendations 1 through 4. The PAs are considering recommendation 5 at this time. The PAs have not formally adopted or rejected any recommendations that require future evaluation studies.

How the Study Affects Program Results and Its Significance:

The study found average energy savings of approximately 19.7 kWh and average demand savings of 46 W per treated thermostat in summer 2019. This led to a statewide realization rate of 99%. The PAs can use the realization rate found in this study for the next 3-5 years if the program design remains the same.[5] As the vendor will no longer provide the data needed to estimate hourly values, the study also calculated an on-peak savings percentage of 74%, an off-peak savings percentage of 26%, and a demand-to-energy (W to kWh) factor of 2 for use in future years.

Overview of Study Method:

The study relied on thermostat telemetry data and thermostat-level participation data. A total of 108,903 thermostats (40,617 in NGrid's service territory, 8,831 in CLC's service territory, 59,455 in ES's electric service territory) were included in the study (3% of the 108,903 thermostats in the PAs combined service territories were excluded from the analysis due to data quality).

[5] In terms of program vendor, vendor savings estimation method, and ITT and control group assignments of existing thermostats.

1. An exploratory analysis of the data was performed to:
   a) Assess program eligibility and opt-in rates, providing insight into customer acceptance of the thermostat optimization solution;
   b) Assess opt-in rates over time for CLC and NGrid, the PAs in the program for multiple years;
   c) Analyze setpoint (scheduled and actual) and runtime changes from 2017 to 2019 for NGrid (the PA in the program the longest); and
   d) Compare time differentiated actual and scheduled setpoints by hour-of-the-day on weekdays and weekends across all cohorts
2. A regression-based modeling approach was used to estimate energy savings and demand impacts over the cooling season. The SS program uses a randomized encouragement design ("RED") in which all customers in a PA's service territory with a Google Nest thermostat were randomly assigned into one of two groups. These two groups are the intent to treat ("ITT") group, where participants are randomly assigned to receive the program offering, and the control group, where participants are randomly assigned to *not* receive the program offering.[6]

   All qualified customers were provided the program offering on the thermostat itself and through a mobile app. Some portion of ITT customers chose to opt in and enrolled into the program, while others did not. The group of customers that opted in is referred to as the treated group. Thermostats that were part of the ITT group but either did not qualify or did not opt in are referred to as the untreated group.

   SS savings are evaluated by comparing the ITT group (both treated and untreated thermostats) to the control group using a linear fixed effects (or difference-in-differences) regression model to estimate energy and demand savings. The estimate of savings is then scaled by the program opt-in rate to calculate savings per treated thermostat.

   Due to the design of the program, targeted thermostats could not be linked directly to customers and their billing data. Therefore, the study relied exclusively on thermostat telemetry data to estimate impacts after converting thermostat runtime to power. The thermostat runtime to power conversion was based on an analysis of metering data from Phase 2 of the 2017 Massachusetts Baseline Study (n=92) and assumptions regarding average size (3.0 tons) and efficiency (10.7 Energy Efficiency Ratio) of air conditioners based on a field study (n=52) of DR program participants conducted in October 2017.

   The study estimated energy and demand savings for each PA cohort (2017, 2018, and 2019 NGrid; 2018 and 2019 CLC, All ES[7]) separately and aggregated to the statewide level.

[6] For each PA, in 2019, 80% of thermostats were randomly assigned to the ITT group while the remaining 20% were assigned to the control group. In 2017 and 2018, 70% of thermostats were randomly assigned to the ITT group and 30% to the control group.

[7] The ES cohort formally launched in 2019 but is referred to as All because approximately 20% of the devices in this cohort were in the program in 2017 and/or 2018 and assigned to NGrid.

Energy savings were estimated for the following periods: summer, summer on peak, and summer off peak;[8] demand savings were estimated for the summer on-peak period. The study developed realization rates for energy (summer) and factors to be applied to calculate savings for summer on-peak energy, summer off-peak energy, and demand (summer on-peak).

Application of Results: Retrospectively

A copy of the complete study can be found in Appendix 4D, Study 19-9.

[8] Summer – all hours June 1 through September 30 while SS program is active; Summer On-Peak – weekdays, non-holidays from 7 AM to 11 PM, June 1 through September 30 while SS program is active; Summer Off-Peak – all hours not on-peak; Tune-Up – all hours July 2 through July 29; Post Tune-Up – all hours July 30 through September 30.

Study 19-10: Home Energy Services Realization Rate Assessment

Type of Study: Process Evaluation

Evaluation Conducted by: Guidehouse

Cadeo Group

Date Evaluation Completed: 3/19/2020

Study Objective and Summary of Results:

The goal of RES 39 was to better understand potential causes for the disparity between ex ante and ex post weatherization savings apparent in the last two evaluations and to recommend specific actions that the PAs and/or Lead Vendors (LVs) can take that could minimize the difference in future evaluations. The study sought answers to the following two key research questions:

1. Why are the evaluation realization rates not closer to 1.0?
2. What changes would improve vendor savings estimates?

The evaluation team offered the following key findings:

- Independent of impact evaluation regression models, a direct comparison of modeled and actual consumption reveals that both whole-home simulation models over predict total consumption and/or savings.
- Both whole-home simulations less accurately estimated the consumption of older homes, which typically receive more insulation than newer homes.
- All three LVs use robust models that rely on MA-specific data. There does not appear to be meaningful differences in how Energy Specialists (ESs) or Home Performance Contractors (HPCs) use these tools in the field; most shared a similar data collection and modeling approach and reported they infrequently change model default values.
- ESs and HPCs do not typically utilize customer-specific billing data when modeling a participant's home and estimating weatherization savings. However, assessors typically have access to participant's usage information (i.e., the participant shares a copy of their bill). In these instances, some assessors will use the bill to do a "sanity check" on the model's estimated savings.
- Rebound effect is not a meaningful contributor to the realization rate disparity observed in the previous two HES impact evaluations

Core Initiatives or End Uses to which the Results of the Study Apply:

- Residential
- Residenital Coordinated Delivery
- Envelope & HVAC
- Electric & Gas

Evaluation Recommendations:

The following recommendations were made by the evaluators conducting this study.

Recommendation 1: Integrate Participant Consumption Data

Our model reviews and LV interviews determined that none of the HES LVs currently use a participant's pre-program energy consumption data to model their potential weatherization savings in a formal or systematic way. Not using participant-specific consumption data means the weatherization savings modeled for each participant are disconnected from that participant's actual energy usage. Our team believes this fundamental disconnect is likely a significant contributor to observed disparity in historical weatherization realization rates.

Since improving realization rates requires the HES LV models to accurately characterize energy consumption pre- and post-intervention, we recommend that PAs and LVs work together to formally integrate participant's actual historical energy consumption into the weatherization modeling process. We recognize that PAs and LVs have different legacy data management infrastructures and policies and, as such, also recognize the importance of providing each PA and LV with room for operationalizing this consideration.

Ideally, the LVs can load participant's consumption data into their models in an automated way prior to each assessment. This would prevent assessors from relying on participants to share a copy of their bill or from manually retrieving consumption data. However, if automated integration of consumption data into the modeling software is not technically possible—or requires significant time to implement—the PAs and LVs should take simpler, near-term steps toward integrating participant's consumption history. As an example, PAs could ensure that assessors have access to participant's consumption records and require them to review that information prior to the assessment.

Recommendation 2: Formalize Sanity Checks

Our assessor interviews also determined that some assessors perform an informal "sanity check" to confirm that their modeled total consumption and savings values are reasonable using a copy of the participant's bill. However, this practice is assessor-specific and only occurs when a participant proactively provides a copy of their bill or can provide one upon request.

Consistent with the concept of better leveraging participant-specific consumption data to improve model accuracy, we recommend formalizing these sanity checks. There is variation in the capabilities of PA billing systems and LVs modeling systems, thus the sanity check could happen through either an automated or manual process. As an example, it may be possible to add an automated alert to the modeling software itself notifies the assessor if modeled consumption is beyond +/-10% of the home's actual consumption or the modeled weatherization savings exceed 35% of a participant's actual pre-program consumption. (Our team has offered placeholder values for these alert thresholds, but we suggest the PAs and LVs work together to select the appropriate values.) Alternatively, an example of a manual sanity check is a program requirement for the assessor to confirm that the model's consumption and/or savings fall within the designated range before the LV software produces a final assessment (and, if it does not, document

Whether implemented using an automated or manual approach, the formalization of these sanity checks will require all assessors to adopt this best practice and mitigate outlier savings estimates.

Recommendation 3: Revisit Existing R-value Assumptions

Our team found meaningful differences between modeled and actual consumption for Eversource and National Grid participants across all types of insulation, particularly in older homes that received multiple types of insulation. (Our team was unable to complete a similar analysis for the other PAs.) Through the team's literature review and an interview with a building simulation industry expert, the team found anecdotal evidence that under-characterizing the R-value of the uninsulated building shell (especially in older homes) can be a source of overestimation of heating system energy use. Our team attempted to assess the default R-values associated with air films and the non-insulation portions of the building shell in each model (including wall assemblies, e.g. sheathing, siding, drywall), but we did not have access to this specific information. This and other background assumptions and/or engineering calculations were unavailable behind the model's user interface. For this reason, we recommend the LVs closely review all default R-value assumptions and consider using, at a minimum, a default of R-3 to reflect the thermal properties of a completely uninsulated wall.

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

The PAs are considering all recommendations for adoption at this time. The PAs have not formally adopted or rejected any recommendations that require changes to program design and operations.

How the Study Affects Program Results and Its Significance:

This study does not directly adjust savings estimated for 2019 or 2020 but instead provides recommendations for improving program estimates based on Lead Vendor modeling techniques.

Overview of Study Method:

To understand how these factors are impacting realization rates and answer the two overarching research questions above, the evaluation team undertook the following four, complementary tasks.

- **Task 1. Engineering Review of LV Modeling Software.** Our team began the study by reviewing the modeling tools used by HES LVs. The review included an independent assessment of the model itself (i.e., reviewing model inputs, data sources, and model functionality), as well as in-depth interviews with each LV's modeling teams. We used the interview to build upon our initial review and identify any potential systemic causes of savings overestimation. Given the technical nature of the discussion, the team summarized its discussion and confirmed the key takeaways with the interviewee following each interview. Our contact with the LV modeling teams did not end with these interviews; our team exchanged e-mails and phone calls throughout the study.
- **Task 2. Interviews with Assessors.** Following our interviews with the LV modeling teams, we interviewed 20 Energy Specialists (n=14) and HPCs (n=6) that, collectively, estimate weatherization savings using every LV tool. The interviews complemented the top-down perspective offered by the LV modeling teams and provided our team with insight into how assessors use the tools "in the field" (i.e., the inputs they update and ones they do not).
- **Task 3. Survey Participants.** Rebound effect (i.e., participants changing their behavior after weatherizing their home in a way that diminishes savings) is another potential contributor to the observed disparity between ex ante and ex post savings estimates. To assess the extent to which recent HES participants took actions that produce a rebound effect, our team surveyed 321 HES participants that weatherized their home in 2018. These surveys, completed online, includes participants from all seven PAs and focused on behavioral changes to participant's heating and cooling practices following weatherization.
- **Task 4. Compare Modeled Consumption and Billing Data.** To understand how participant's LV modeled consumption compared to their actual consumption (i.e., PA billing data), our team analyzed LV and PA data for over 3,000 2017 HES participants. Our team compared each participant's actual pre- 2016 and post- 2018 HES annual consumption with modeled annual estimates provided by the HES LVs. In addition to looking at overall trends, our team also investigated whether the relationship between actual and modeled consumption differed for specific participant and/or building types (e.g., home size, type, and size, as well the type of insulation the participant installed and their heating fuel).

Application of Results: Prospectively

A copy of the complete study can be found in Appendix 4D, Study 19-10.

Study 19-11: Residential Coordinated Delivery Logic Model Creation

Type of Study: Process Evaluation

Evaluation Conducted by: Guidehouse Cadeo Group

Date Evaluation Completed: 3/17/2020

Study Objective and Summary of Results:

The objective of this study was to create a logic model for the Program Administrator's new Residential Coordinated Delivery ("RCD") initiative. Specifically, the logic model sought to document answers to the following key questions about RCD evolution out of the Home Energy Services ("HES") initiative:

1. What are the barriers, activities, outputs and outcomes associated with the new RCD initiative?
2. What initiative, market, and customer information do the PAs and their implementation teams need to collect to inform ongoing internal and periodic external (third party) evaluations of RCD's effectiveness?

To provide greater context for the RCD logic model, the study also included the creation of a participation pathway diagram. The diagram depicts the core steps in most residential customers' participation in RCD.

The key result, or, more accurately output, of this study was the creation of the RCD logic model and participation pathway diagram. Both diagrams were provided in the study's final memo.

Core Initiatives or End Uses to which the Results of the Study Apply:

- Residential
- Residenital Coordinated Delivery
- Electric & Gas

Evaluation Recommendations:

No formal recommendations were made in this evaluation.

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

N/A (no formal recommendations were made in this evaluation)

How the Study Affects Program Results and Its Significance:

The study does not directly affect savings estimated for 2019 or other program years. This study provides a logic model diagram for the statewide RCD program, serving existing residential buildings throughout Massachusetts under the Mass Save brand. The logic model diagram provides a graphical representation of the activities, outputs, and outcomes expected from successful execution of RCD. The accompanying tables and explanatory text in the memo provide additional detail for reviewers and provide examples for how the PAs could potentially measure RCD's progress toward these outputs and outcomes over time. The memo also includes a supplementary participation path diagram that depicts, at a high-level, how participants move through RCD delivery process.

Overview of Study Method:

This project was designed to support the work of the Program Administrators by documenting progress toward the transition to RCD and developing an agreed-upon vision for the program through graphical representations of both process and objectives. To achieve these objectives the team sought to:

- Obtain information on progress to-date implementing changes towards achieving the goals of RCD
- Develop a logic model diagram that reviewers and program stakeholders agree represents the aspirational objectives of RCD
- Identify a set of outputs and near-term outcomes that could potentially signal progress on achieving the overarching RCD objectives
- Develop a participation path diagram that reflects the expected intake, screening, and triage steps expected to funnel customers into the most appropriate service path

The logic and participation path diagrams provide different types of information and perspectives regarding a program. A logic model provides a map of a program's hypothesis: if the program does x, y will happen. A participation path diagram maps the steps a customer follows to access and benefit from a program's services. Together, these two complementary diagrams are expected to document the changes underway for RCD and enable internal and external assessments of RCD's progress as measured by progress indicators. In the tables provided in the memo, the team provides a set of suggested preliminary indicators that should be reviewed and tested prior to adopting them.

Application of Results: Prospectively

A copy of the complete study can be found in Appendix 4D, Study 19-11.

Study 19-12: Energy Optimization Measures and Assumptions Update

Type of Study: Market Characterization or Assessment Evaluation

Evaluation Conducted by: Guidehouse

Date Evaluation Completed: 3/2/2020

Study Objective and Summary of Results:

This study updated the previously developed Energy Optimization Model ("EOM") for residential energy optimization measures in Massachusetts. The evaluation team initially developed the EOM in October 2018 to estimate the costs and benefits associated with a variety of energy efficiency measures that use electric heat pumps and natural gas heating equipment to displace the consumption of delivered fuels. The PAs have used this model to develop prescribed savings values used for energy efficiency measures that involve fuel switching.

The study included updates to the model, including revised input values, new installation parameters, and new measures covering ground-source heat pumps ("GSHPs"). In addition, the study implemented further improvements in the model as part of the C&I Energy Optimization Study conducted for the Massachusetts commercial PAs.

Core Initiatives or End Uses to which the Results of the Study Apply:

- Residential
- Residenital Coordinated Delivery
- HVAC & Hot Water
- Electric & Gas

The PAs have used this model to develop prescribed savings values used for energy efficiency measures that involve fuel switching.

Evaluation Recommendations:

No formal recommendations were made in this evaluation.

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

N/A (no formal recommendations were made in this evaluation)

How the Study Affects Program Results and Its Significance:

The findings of this study help inform an update of the Residential Coordinated Delivery rebate offerings. The study provides information that will help PAs make informed decisions about the

replacement scenarios for which rebates are offered, and the rebate amounts that are offered. This study updated a spreadsheet tool that PAs may use to evaluate the costs and savings available from different user-input operating assumptions, including different equipment capacities, balance points, and cooling and heating loads.

Overview of Study Method:

The goal of this study was to update the existing EOM with more recent data sources and to implement additional features of interest to the PAs and EEAC consultants. The original EOM was developed in 2018 and allowed users to estimate the savings, costs, peak demand, and lifetimes for a focused group of energy optimization measures for space heating and water heating end uses.

The evaluation team used the following publicly available data sources throughout the analyses conducted for the EOM update:

- Massachusetts Technical Reference Manual (TRM), 2019-2021 Plan Version
- Residential Evaluation Studies Conducted on Behalf of the EEAC
- Northeast Energy Efficiency Partnerships (NEEP) Cold Climate Air-Source Heat Pump
- ISO-NE Electricity Generation Fuel Mix
- Massachusetts Clean Energy Center (MassCEC) GSHP Rebate Data

Application of Results: Retrospectively and Prospectively

A copy of the complete study can be found in Appendix 4D, Study 19-12.

Study 19-13: Residential Nonparticipant Market Characterization & Barriers Study

Type of Study: Market Characterization or Assessment Evaluation

Evaluation Conducted by: Illume Advising

Cadeo Group

Guidehouse

Date Evaluation Completed: 2/27/2020

Study Objective and Summary of Results:

The purpose of this study was to characterize residential nonparticipants and provide insight into market barriers for three key customer segments of interest: renters, limited English speakers, and low-to-moderate income customers.

The study provides the following key findings

- Nonparticipants are more likely than participants to:
  - Live in rental units. Specifically, among those surveyed, 30% of renters participated compared to 40% of homeowners.
  - Only have a high school education or no secondary school degree
  - Be low-to-moderate income households
  - Report lower awareness of Mass Save
  - Be harder to reach, even with greater effort and financial incentives
- Participation barriers identified by the research indicate that nonparticipants:
  - Often expressed lack of trust in government and their landlords, and have a fear of scams
  - Prioritized their time and resources on needs that they considered more fundamental to living (e.g., food and shelter)
  - Needed more information or understanding of Mass Save offerings, participation processes, and benefits
  - Perceived energy efficiency as irrelevant or not applicable to them
  - Believed Mass Save is government-funded, deterring participation
- Program design and implementation opportunities included:
  - Engaging trusted community organizations

- Shifting focus from raising awareness to increasing understanding of Mass Save benefits and linking program services to everyday needs and value to customers.
- Countering the perception that participating takes a lot of time
- Conveying that Mass Save is available to all PA customers
- Designing a multi-faceted, multi-modal outreach strategy that meets the needs of target customer groups
- Messaging to impress the relevance of programs and services to customers, accounting for their unique circumstances
- Reinforcing that denial in any assistance program does not mean lack of eligibility for Mass Save
- Providing personal and step-by-step guidance through program process, particularly for those who speak a language other than English
- Reinforcing cross-program promotion between assistance programs and Mass Save
- Designing and/or implementing programs that directly overcome the barriers identified in this research

Core Initiatives or End Uses to which the Results of the Study Apply:

- Residential & Income-Eligible

Evaluation Recommendations:

No formal recommendations were made in this evaluation.

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

N/A (no formal recommendations were made in this evaluation)

How the Study Affects Program Results and Its Significance:

This research provided insight into program outreach and design opportunities. It characterized nonparticipants, and challenges of and challenges to reaching nonparticipants, as evidenced through the research.

Overview of Study Method:

The study relied on a combination of primary data collection activities. These activities included over 1,600 surveys via multi-mode web, telephone, mail, and door-to-door approaches, as well as qualitative research including intercept, door-to-door, and in-depth telephone interviews. In addition to customers, the study also included perspectives from Massachusetts Program Administrators and community organizations that service the groups of interest. The research

coordinated closely with the Residential Nonparticipant Customer Profile Study completed by DNV GL.

Application of Results: Prospectively

A copy of the complete study can be found in Appendix 4D, Study 19-13.

Study 19-14: Residential Baseline Phase 4 Comprehensive Report

Type of Study: Impact Evaluation

Evaluation Conducted by: Guidehouse

Date Evaluation Completed: 3/31/2020

Study Objective and Summary of Results:

The primary goal of the Residential Baseline Study was to collect data on saturation, characterization, consumption, peak demand, and key explanatory variables for all major electric and gas appliances, mechanical equipment, and electronics in Massachusetts homes. This data provides the foundation for updating the Massachusetts TRM, informing future energy efficiency and demand response potential studies, and designing programs. The secondary goal of this study is to support other research that the PAs are undertaking—such as energy efficiency potential studies and market effects research—by providing comprehensive data for the sampled customers.

The study provides the following key findings:

- The saturations of cooling end uses are increasing, potentially driven by hot temperatures in recent summer seasons.
- Emerging technologies such as EVs, solar PV systems, and heat pump water heaters are increasing in saturation.
- Gas end uses have increased in saturation from 2018 to 2019, while oil end uses have remained constant.
- While HVAC is the most seasonally variable end use category, refrigerators, water heaters, dehumidifiers, and pool pumps all contribute seasonal variation.
- Statewide electricity consumption from certain high consumption, low saturation end uses like ductless heat pumps and central AC increased in 2019 as compared to 2018. This consumption could increase dramatically with increased adoption over time.
- Cooling is responsible for half of summer peak demand.
- Refrigerators, dehumidifiers, clothes dryers, TVs and their peripherals, and pool pumps also contribute to the summer peak demand in Massachusetts.
- The higher temperatures in Massachusetts in summer 2018 resulted in higher average consumption for all cooling end uses.
- The relative contribution of end uses to overall peak demand varies depending on the year.
- The top contributors to summer peak demand across all homes in Massachusetts are central ACs and room ACs.

- Lighting and other unmetered loads contributed most to Massachusetts' winter peak demand. These end uses include lighting and various small plug loads. On winter peak days, HVAC loads are large but relatively flat. Miscellaneous loads are driven by primary and secondary TVs and peripherals.
- When the major end uses are disaggregated further, no single HVAC end use dominates winter peak demand. Hardwired electric heat, plug-in electric heat, boiler distribution, furnace fans, and mini-split heat pumps all contribute about the same to winter peak, adding up to HVAC as a whole presenting significant savings opportunities. Savings opportunities may also exist for clothes dryers and water heaters.
- If saturation of ductless heat pumps continues to rise, they could quickly become the single most important driver of winter peak aside from lighting.
- The average natural gas demand is approximately 70% larger on the peak day than the typical winter day. Hourly residential natural gas demand peaks in the morning hours between 5 a.m. and 9 a.m. with a secondary peak between 3 p.m. and 9 p.m. The morning peak is approximately 25% larger than the evening peak.
- Approximately 10 kW of electric demand would be added per home during the morning peak on the winter peak day for each home that converts from all existing gas end uses to electric resistance heat and hot water.

Core Initiatives or End Uses to which the Results of the Study Apply:

- Residential
- Residenital Coordinated Delivery
- Envelope & HVAC
- Electric & Gas

Evaluation Recommendations:

No formal recommendations were made in this evaluation.

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

N/A (no formal recommendations were made in this evaluation)

How the Study Affects Program Results and Its Significance:

The PAs are reviewing considerations from this comprehensive report and will appropriately incorporate the results into all residential initiatives.

Overview of Study Method:

Guidehouse conducted a large multiyear residential baseline saturation and load shape study using data collected via online survey, onsite validation, and long-term metering. Through this research, the Guidehouse team provided the Massachusetts PAs and Energy EEAC consultants more granular data about the energy consumption of residential buildings and their occupants. The PAs and EEAC also want to learn more about relevant opportunities for reducing overall energy consumption and consumption during peak periods/hours. This report reflects all study findings to date, including all survey and metered data collected from January 2017 through winter 2019-2020.

Application of Results: Retrospectively and Prospectively

A copy of the complete study can be found in Appendix 4D, Study 19-14.

Study 19-15: Gross Impact Framework – Decision Guide

Type of Study: Impact Evaluation

Evaluation Conducted by: DNV GL

Energy and Resource Solutions (ERS)

Date Evaluation Completed: 3/18/2020

Study Objective and Summary of Results:

The purpose of this study was to document and summarize decisions related to key processes and issues that the DNV GL team has addressed since the implementation of the Gross Impact Evaluation Framework ("Framework") adopted in February 2017. The current focus is on documenting specific custom electric and gas impact evaluation methods developed to date; some of the principles discussed here also apply more broadly to the MA CIEC portfolio. In addition, the memo documents specific emerging issues for which decisions have not yet been reached.

The study provides the following key findings:

- **Gas Precision Targets.** Columbia, Eversource, and National Grid have PA-specific targets, while Berkshire, Liberty, and Unitil do not currently have specific sampling targets and rely on statewide results.
    - Statewide: ±10% relative precision (RP) at the 80% confidence level (CL)
    - PA-specific: ±20% RP at the 80% confidence level
    - Precision targets are for the full three-year rolling sample
- **Electric Precision Targets.** Cape Light Compact, National Grid, and Eversource have PA-specific targets, while Unitil does not currently have a specific sampling target and relies on statewide results.
    - Statewide overall: energy ±10% RP @ 90%
    - Statewide lighting/non-lighting: energy ±10% RP @ 90%
    - PA-specific overall: energy ±15% RP @ 90%
    - PA-specific lighting/non-lighting: ±15% RP @ 90%
    - Precision targets are for the full three-year rolling sample
- **Pooled Sampling Approach.** Custom studies are designed using rolling samples to achieve statewide and PA-specific precision targets over a three-year period. The combined three-year realization rate is a weighted average of separate realization rates, weighted by tracked savings in each year.

- **Choosing between PA or Statewide Results.** The preference is to use PA-specific results when they are reliable, even if they are similar. Current agreement is when sample size is > 10 and the PA-precision targets noted above are met.
- **Prioritization for Custom Sites.** Establish a scheme for prioritizing custom electric sites based on sample characteristics and with the purpose of minimizing and avoiding bias in the sample in case not all site reports are finalized in time for the PAs' annual filing deadline.
- **Outlier Review.** Calculate the mean (m) and standard deviation (SD) of the relative residuals (u), then look for values that are more than t standard deviations from the mean. That is, we test for: |uj -m| > t SD, where t is the t-statistic we want to use as a criterion for extreme.
- **Gross realization Rate Reweighting for Cases with an Evaluated Baseline equal to Installed Equipment.** Retain the case in the GRR calculation but multiply savings by the case implicit net-to-gross Rate (NTGR).
- **Prospective Evaluation Results.** Systematic updates to engineering assumptions or tracking adjustments that are implemented may result in gross savings differences that make it inappropriate to apply a retrospective realization rate. In these cases, evaluators should prepare prospective realization rates that account for systematic changes and therefore do not double count for adjustments.

Core Initiatives or End Uses to which the Results of the Study Apply:

- Commercial & Industrial
- All Initiatives
- All End Uses
- Electric & Gas

While the memo focuses on documenting specific custom electric and gas impact evaluation methods developed to date, some of the principles also apply more broadly to the C&I portfolio.

Evaluation Recommendations:

No formal recommendations were made in this evaluation.

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

N/A (no formal recommendations were made in this evaluation)

How the Study Affects Program Results and Its Significance:

The study findings do not directly affect the savings estimated for 2019 and projected for 2020. The study results help serve as a framework to help refine and document the approach used to

determine which Massachusetts C&I impact evaluation studies to undertake, at what level of rigor, and when. The results will be used to update impact evaluation methodologies in the face of changing needs of programs, the PAs, and the role of evaluation in responding to those needs.

Overview of Study Method:

This study did not include any primary research and instead compiled decisions, emerging issues, and supporting documentation from existing sources. Sources included working group discussions, memos, study plans, and reports.

Application of Results: Retrospectively and Prospectively

A copy of the complete study can be found in Appendix 4D, Study 19-15.

Study 19-16: C&I Measure Life Study

Type of Study: Impact Evaluation

Evaluation Conducted by: DNV GL

Date Evaluation Completed: 3/31/2020

Study Objective and Summary of Results:

The purpose of this study was to inform Effective Useful Lives ("EULs") and Remaining Useful Lives ("RULs") for key C&I energy efficiency measures, including lighting, HVAC, custom projects, and gas heating equipment.

The study provides the following key findings:

- Lighting
    - **Product quality concerns.** Two representatives claimed that DLC quality specifications, which most rebate programs require, are not tough enough and have only set a floor above which there are many variations in product quality.
    - **Manufacturer defined measure lives.** Almost all the manufacturers base their measure life estimates on how long their LED products take to depreciate to 70% of their original lumen level. Tests have shown that some LED lighting components can fail catastrophically long before this 70% lumen depreciation level is reached, but it has been difficult for the industry to devise an alternate measure life definition based on failure rates.
    - **Manufacturer testing procedures.** All but one of the manufacturer representatives said they use the Illuminating Engineering Society's (IES) LM-80 testing protocols. LM-80 is a method for measuring the lumen maintenance of LED packages, arrays, and modules (i.e., the LED light source) at various temperatures.
- Commercial Heating
    - **Contractor estimated early replacement rates.** The average estimate of the contractors for early replacement of commercial boilers was 21% and their average estimate for the early replacement of commercial furnaces was 20%.
    - **Contractors amenable to photo-based verification**. The team asked the contractors if they were interested in a program that would pay them to email in pictures of the manufacturer nameplates of the commercial HVAC equipment they removed, along with brief descriptions of the equipment's condition. Two thirds of the contractors said they would participate in such a program, with another 20% saying that their participation would depend on program requirements. When asked about the minimum amount the program could pay them per emailed nameplate photo to get them to participate, the average incentive estimate was $36.

- **Contractor defined EUL.** Contractors defined EUL based on a mix of factors including age, cost to repair, safety concerns, and reduced performance.

- Custom Projects
  - **Custom screening tool (CST) uses correct measure life assumptions with few exceptions.** The evaluation team determined that the CST lifetime savings calculations correctly followed the Framework guidance for dual baseline lifetime savings at the measure and project (all measure) level. The combination of program and measure type led to the correct measure event type. However, the CST classified add-on measures as a single baseline only, while the Baseline Framework requires dual baseline treatment for add-on measures with an EUL that exceeds 2/3 the RUL of the host equipment.
  - **Inconsistency in EULs used by the CST, the eTRM, and the TRM.** When the team compared the EUL estimates being used by the CST, the eTRM, and the TRM for selected measures, they found some inconsistencies. Similar inconsistencies were found for the AMLs. For example, the CST EUL is less than the eTRM for chillers, while greater for furnaces.
  - **Flexibility of CST EUL assignment option may lead to mis-assignments.** Users of the CST are typically offered a choice of two or more EULs for a given measure. This flexibility is necessary given the range of measures that could be included within a measure category in the CST. However, this flexibility means that CST users who are not carefully consulting the 2019-2021 MA electronic Technical Reference Manual (eTRM) could assign the wrong EUL to a given measure. There is a similar risk that AMLs would be mis-assigned.
  - **Gap exists in evaluation of second period baselines and out-year factors (OYF).** While the custom impact evaluation teams are focusing more attention on individual implementer measure life assumptions and how they align with TRM and eTRM sources, an evaluation gap exists for second period baselines since current impact evaluations do not include that task. Since the determination of the second period baseline is a derivative of baseline research, determining the second period baseline and the OYF could logically fall under the scope of future measure baseline research and maintained in the Baseline Repository.

- Unitary HVAC, add-on, and O&M measures
  - **Revised EUL values slightly higher than those produced previously under Project 73 Track D.** The revised analysis, which used a new cooling installation index and updated imputations for unitary HVAC equipment with missing manufacture dates, gives an EUL of 8.6 years. Estimates using the cooling installation index with the prior study's alternative imputation method give an EUL of 9.8 years. These EULs are slightly higher than those from the Project 73 Track D analysis which were mostly in the 6-8-year range. However, the updated estimates are still lower than the current TRM EUL (12 years).

- **It is difficult to apply EUL or RUL estimates based on project tracking data and documentation.** While adjusting EUL or RUL based on site-specific condition should, in theory, produce more accurate EUL estimates for add-on measures, project tracking data and documentation often do not provide enough data. Interviews are needed to collect the EUL and RUL estimates for the host and add-on equipment.
- **Deemed values most frequently used methods for assigning EULs to add-on and Operations and Maintenance (O&M) measures.** Over 80% of the TRMs the team reviewed used deemed values for add-on and O&M EULs. For the add-on measures there was a narrower range of deemed EUL values across TRMs for the same types of equipment. In contrast, the deemed EUL values for the O&M measures had more variation across TRMs for the same equipment types.
- **Deemed value EULs for add-on and O&M measures may be overstating the actual lifetimes of these measures.** A 2017 DNV GL study which applied an interview-based method for determining measure lives for add-on measures and O&M measures in 30 C&I sites found an average ex post EUL of 9.1 years compared to a ex ante EUL of 16.6 years. The most common reason for the reduction in the EULs was that the remaining useful life of the host equipment was shorter than the ex-ante EULs of the add-on equipment and it was unlikely the add-on equipment would be reused on another piece of host equipment. Over two-thirds of the states which used deemed EULs for add-on and O&M measures derived these measures from the same four studies. Not only were these sources dated (most were 10-15 years old), but most of the EULs in them were derived from even older secondary sources rather than primary research such as persistence studies.

Core Initiatives or End Uses to which the Results of the Study Apply:

- Commercial & Industrial
- All Initiatives
- Custom & HVAC & Lighting & Other
- Electric & Gas

Evaluation Recommendations:

The following recommendations were made by the evaluators conducting this study.

Recommendation 1: Keep the EUL for commercial unitary HVAC equipment at 12 years. When the EUL for commercial unitary HVAC equipment was reduced from 15 to 12 years in 2018 in response to the EUL analysis conducted under Project 73 Track D, the reduction was conditional on improvements in the EUL analysis method that were to be conducted in 2019. The revised EUL analysis conducted under Project MA19C02-B-EUL did estimate EULs that were slightly higher (9-10 years) than those estimated under Project 73 Track D (6-8 years).

However, the updated estimates are still lower than the current TRM EUL of 12 years. The improved EUL estimation method still has some limitations as discussed in the detailed findings of this report. For this reason, the evaluation team is not advocating it be reduced below 12 years. However, the team believes that the 9-10-year EULs that emerged from the improved 2019 analysis also suggest that this EUL should not revert to the 15-year estimate that was used prior to 2018.

Recommendation 2: Keep the EUL for commercial furnaces at 18 years. The HVAC contractors estimated the average age of the commercial furnaces they removed which still had some useful life remaining to be 17 years. They estimated the average age of the commercial furnaces they removed which were at or near failure to be 19 years. Since the 19-year average is close to the current EUL in the TRM of 18 years, the evaluation team recommends that this EUL remain unchanged.

Recommendation 3: Change the assumed ER rate for commercial boilers from 0% to 20% and for commercial furnaces from 0% to 15%. As noted, this study found an ER rate of 21% for commercial boilers and 20% for commercial furnaces. Another recent Massachusetts study which involved interviews with both HVAC contractors and end users found an ER rate of 18% for commercial boilers and 11% for commercial furnaces. Since two different evaluation studies have come out with similar results that are well above the default assumption of 0%, the team recommends that the PAs should change this ER rate to 20% for commercial boilers and 15% for commercial furnaces, which is the average of the ER rates from the two studies.

Recommendation 4: The impact evaluation team should continue reviewing site-specific EUL assumptions. The impact evaluation team should continue to provide meaningful feedback regarding EUL assumptions observed at individual sites and communicate those findings through the Monthly BAG meetings with stakeholders and in the final evaluation report.

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

The PAs are considering all recommendations for adoption at this time. The PAs have not formally adopted or rejected any recommendations that require changes to program design and operations.

How the Study Affects Program Results and Its Significance:

If the PAs adopt the recommended Early Replacement ("ER") rates of 20% for commercial boilers and 15% for commercial furnaces, it should increase the savings for these measures. This is because ER measures require the use of a dual baseline, and during the first period (Remaining Useful Life – RUL) of the dual baseline the baseline is the efficiency of the existing equipment. This allows for greater savings than would be the case for Replace on Failure ("ROF") measures where the baseline is not the energy efficiency of the existing equipment but is based on the efficiency of the equipment that would have been installed under Industry Standard Practices ("ISPs").

As the PAs increase consistency between EULs and AMLs they are using in the CST, the eTRM, and the TRM, lifetime savings estimates will shift on a measure-by-measure basis.

The recommendation to keep the EUL for unitary HVAC equipment at 12 years will impact savings because currently while the eTRM is using the recommended 12 years, the CST and the TRM are still using the old (pre-2018) value of 15 years.

Overview of Study Method:

Overall study methods included in-depth interviews, surveys, review of tools, cross-checks of assumptions, literature reviews, and TRM reviews. The methods for each specific end-use are briefly summarized here.

> **Lighting.** For lighting, the primary source of data was 11 in-depth interviews with lighting manufacturers who accounted for about two-thirds (64%) of 2018-2019 C&I Upstream Initiative sales. In addition, the team completed a literature review of LED testing methods.
>
> **HVAC.** For HVAC, the team completed interviews with a sample of 15 HVAC contractors who participated in the C&I Upstream HVAC Initiative in 2018.
>
> **Custom Projects.** The assessment of EUL for custom projects included three primary data collection activities: interviews with PA staff and evaluators, review of the custom screening tool, and cross-check of assumptions.
>
> **Unitary HVAC Equipment.** For unitary HVAC equipment, the team updated EUL estimates by updating the prior (P73-D) analysis with revised inputs.
>
> **Add-on and O&M Measures.** For add-on and O&M measures, the team reviewed over 20 TRMs as well as recent measure life studies commissioned by PAs and other stakeholders that focused on the measure lives of add-on or O&M measures.

Application of Results: Retrospectively and Prospectively

A copy of the complete study can be found in Appendix 4D, Study 19-16.

Study 19-17: Impact Evaluation of PY2017 Small Business Initiative Non-Lighting Measures

Type of Study: Impact Evaluation

Evaluation Conducted by: DNV GL

DMI

Date Evaluation Completed: 3/20/2020

Study Objective and Summary of Results:

The purpose of this study was to provide annual energy kWh savings and realization rates, summer and winter peak kW realization rates, and lifetime kWh realization rates for HVAC and refrigeration measures installed through the small business program in the 2017 program year. Additional objectives include providing the primary drivers of the annual energy savings, establishing the proper baselines for lifetime savings (including dual baselines), and providing recommendations on how to apply study results.

The study provides the following key findings:

- At the program level, the tracking estimates of annual energy impacts were observed to be reasonably accurate with realization rates of near 90% for both refrigeration and HVAC measures.
- Among the HVAC sample, the performance of franchise sites and non-franchise sites were very different from one another, resulting in two sets of factors: one for combined refrigeration and non-franchise HVAC results and one for overall refrigeration and HVAC results. These results are provided below.

Impact Result Summary

	Energy (kWh)	Summer (kW)	Winter (kW)
Combined Refrigeration and HVAC			
Tracked savings	7,376,462	612	551
Statewide evaluated savings	6,979,214	774	779
Realization rate	94.6%	126.5%	141.5%
Relative precision	±20.6%†	33.9%*	37.0%*
Combined Refrigeration and non-franchise HVAC			
Tracked savings	5,480,531	612	551
Statewide evaluated savings	5,751,339	576	647
Realization rate	104.9%	94.1%	117.4%
Relative precision	19.1%†	28.1%*	31.7%*

† provided at the 90% confidence interval * Provided at the 80% confidence interval

- Summer and winter peak kW savings are not being fully populated in tracking estimates of small business projects, as evidenced by instances of either blank or zero savings in these categories among the samples examined.
- Lifetime savings are similarly not tracked regularly, though we found reasonably accurate use of lifetime values when present.
- The 2015 NEEP Commercial Refrigeration Loadshape Report contains the conclusion that EC motors use 61% less power than shaded-pole motors, on average, compared to the MA TRM value of 65%. The MA TRM cites a 2007 study to support the 65% reduction. The NEEP study is the more recent study and is based on a larger sample size of pre/post measurements, so the 61% reduction appears to be a better value to represent average power reductions for this measure type.

Core Initiatives or End Uses to which the Results of the Study Apply:

- Commercial & Industrial
- Existing Building Retrofit
- HVAC & Refrigeration
- Electric Only

Evaluation Recommendations:

The following recommendations were made by the evaluators conducting this study.

Recommendation 1: Use the retrospective and prospective realization rates as provided in the table below with two important notes:

1. Application of the prospective energy savings realization rates are dependent on implementation of the recommended calculation change in the MA TRM regarding a new adjustment factor that reflects shaded pole motor power when only EC motor power is measured (recommended below).
2. Due to missing tracking summer peak kW and winter peak kW estimates in both the HVAC and refrigeration samples influencing the realization rate around these results, we do not recommend a prospective realization rate for these items. The concern is that such realization rates will not be appropriate for application when summer and winter values are fully populated.

Factor	Retrospective	Prospective
Combined refrigeration and HVAC applied when franchise served in Turnkey (Eversource, Unitil)		
Energy Realization rate (kWh)	94.6%	94.8%
Summer peak kW Realization Rate	126.5%	N/A
Winter peak kW Realization Rate	141.5%	N/A
Combined refrigeration and non-franchise HVAC applied when franchise not served in Turnkey (National Grid, Cape Light Compact)		
Energy Realization rate (kWh)	104.9%	105.2%
Summer peak kW Realization Rate	94.1%	N/A
Winter peak kW Realization Rate	117.4%	N/A

Recommendation 2: Revise the MA TRM to accommodate a demand reduction factor of 61% in its calculation when replacing shaded pole motors with ECM motors.

Recommendation 3: Work with program vendors to ensure that summer and winter peak demand estimates are fully populated in the tracking system when appropriate.

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

The PAs plan to adopt and/or are considering some of the recommendations, as described below.

The PAs are adopting Recommendation 1 and all other Recommendations are under consideration at this time.

How the Study Affects Program Results and Its Significance:

The study results decrease the PY2017 small business HVAC and refrigeration annual energy savings by 5.4% for Eversource and Unitil and increase small business HVAC and refrigeration annual energy savings by 4.9% for National Grid and Cape Light Compact.

Overview of Study Method:

DNV GL conducted full metering and verification at 16 HVAC and 14 refrigeration sites. Metered data were used by engineers to develop energy and peak demand impacts. Data collection was compliant with ISO NE MMVDR standards and analysis with IPMVP protocols. Metering was timed to occur depending on measure type and season of operation. Metering was performed between June and December of 2019.

Application of Results: Retrospectively and Prospectively

A copy of the complete study can be found in Appendix 4D, Study 19-17.

Study 19-18: C&I Energy Optimization Study Task 3 Methodology Memo

Type of Study: Impact Evaluation

Evaluation Conducted by: Cadeo Group

Navigant Consulting

Date Evaluation Completed: 1/31/2020

Study Objective and Summary of Results:

The purpose of this study was to develop a spreadsheet model that characterizes and estimates the savings, costs, and lifetimes for a set of Commercial & Industrial ("C&I") energy optimization measures that use fuel switching to reduce customers' total energy usage across multiple fuel types.

The results of this study will be used to develop a C&I Energy Optimization program targeted at commercial customers in smaller commercial buildings that operate their own heating system (i.e., are not part of a larger centralized system). Specifically, the PAs are considering offering tailored incentives for electric heat pump systems that replace (or displace) existing oil space heating equipment. To facilitate the calculation of savings for C&I energy optimization measures, the study expanded the Energy Optimization Model (developed for the Residential offering in October 2018) to estimate savings for different sizes and types of C&I buildings up to 10,000 sq.ft. in size.

The Energy Optimization Model spreadsheet describes the energy consumption and demand savings, the energy cost savings, and the incremental installation costs for each of the fuel switching measures analyzed in this study. The outputs of the model vary depending on the replacement scenario (early replacement, partial displacement, or replace on failure) and the size and type of building selected. An example output table, describing the savings for small office buildings in a Partial Displacement scenario, is provided below.

	Partial Displacement							
	Measure ID	MEAS34	MEAS42	MEAS45	MEAS39	MEAS36	MEAS44	MEAS46
	Baseline Name	Ducted AC+Oil Furnace	Oil Furnace	Room AC+Oil Furnace	Ducted AC+Oil Boiler	Non-Ducted AC+Oil Boiler	Oil Boiler	Room AC +Oil Boiler
	Replacement Name	Central HP+Oil Furnace	Central HP+Oil Furnace	Central HP+Oil Furnace	Central HP+Oil Boiler	DMSHP +Oil Boiler	DMSHP +Oil Boiler	DMSHP +Oil Boiler
High Measure Level	Energy Cost Savings (USD/yr)	-65	-245	70	9	91	-78	238
	Oil Annual Consumption	54	54	54	57	57	57	57
	Electric Annual	-5,062	-6,195	-4,213	-4,838	-4,328	-5,386	-3,403
	Annual Energy Savings on	37	33	40	41	42	39	46
	Carbon Emissions	2.1	1.6	2.5	2.4	2.6	2.2	3.1

Core Initiatives or End Uses to which the Results of the Study Apply:

- Commercial & Industrial
- Existing Building Retrofit
- HVAC
- Electric Only

Evaluation Recommendations:

No formal recommendations were made in this evaluation.

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

N/A (no formal recommendations were made in this evaluation)

How the Study Affects Program Results and Its Significance:

This study produced a spreadsheet tool that the PAs are using to assess the potential costs and savings for various energy optimization scenarios and measures based on user-defined inputs such as building type, size, cooling load, and heating load. It will help inform and prioritize the PAs' plans for deploying these measures under a C&I Energy Optimization program offering.

Overview of Study Method:

This study involved modeling oil-to-electric fuel conversions in small commercial buildings, based on research of heating loads and equipment configurations. The team gathered heat load and equipment information by conducting a customer survey and referencing the 2016 Massachusetts C&I Market Characterization Study and the U.S. EIA's Commercial Buildings Energy Consumption Survey ("CBECS").

Our team leveraged the residential Energy Optimization Model developed by the MA Residential PAs in Oct 2018. We added measures to the model to estimate savings and costs of oil-to-electric fuel switching for C&I customers with buildings smaller than 10,000 sq.ft. We also added analysis oil-to-gas and electric resistance-to-heat pumps. The table below summarizes the C&I measures analyzed in the updated Energy Optimization Model.

Baseline Equipment Type	**Replacement Equipment Type, by Replacement Scenario**	
	Partial Displacement	**Early Replacement or Replace on Failure**
Oil Furnace (no A/C)	Central HP + Oil Furnace	Central HP
Oil Furnace + Room A/C	Central HP + Oil Furnace	*(not modeled)*
Oil Furnace + Ducted A/C	Central HP + Oil Furnace	Central HP
Oil Boiler (no A/C)	DMSHP + Oil Boiler	DMSHP
Oil Boiler + Room A/C	DMSHP + Oil Boiler	*(not modeled)*
Oil Boiler + Ductless A/C	DMSHP + Oil Boiler	DMSHP
Oil Boiler + Ducted A/C	Central HP + Oil Boiler	*(not modeled)*
Oil Boiler	*(not modeled)*	Natural Gas Boiler
Oil Furnace	*(not modeled)*	Natural Gas Furnace
Electric Baseboard	*(not modeled)*	DMSHP
Non-Ducted A/C + Electric Baseboard	*(not modeled)*	DMSHP
Room A/C + Electric Baseboard	*(not modeled)*	DMSHP

For each of the measures listed above, our model estimates the energy consumption, demand, and costs at the baseline level and the measure level. These values are calculated using generalized assumptions about the capacity, efficiency, and performance of the baseline and measure-level equipment. The model then calculates the savings associated with each measure as the difference between the baseline level and the measure level.

The results from the Energy Optimization Model may be used for savings evaluation where site-specific calculations and measurements are not economical.

Application of Results: Prospectively

A copy of the complete study can be found in Appendix 4D, Study 19-18.

Study 19-19: Impact Evaluation of PY2017 Custom Gas Installations

Type of Study: Impact Evaluation

Evaluation Conducted by: DNV GL

Energy and Resource Solutions (ERS)

Date Evaluation Completed: 3/16/2020

Study Objective and Summary of Results:

The primary objective of this impact evaluation was to verify and re-estimate the energy savings for a sample of statistically selected PY2017 custom gas projects through site-specific inspection, monitoring, and analysis.

The study provides the following key findings:

- **PY2017 Performance.** The program continues to generate significant natural gas savings. The statewide PY2017 participation consisted of 630 distinct accounts, with adjusted gross savings of over 8 million therms annually. Until PY2016, the impact evaluation cycles were not conducted every year; they were determined by stakeholders based on an assessment of program stability.
- **Implementation of the Baseline Framework.** Since the rollout of the Baseline Framework, both the PAs and evaluators have been working to implement a more rigorous review of baselines and to prepare for the application of dual baseline methods in the 2019 program implementation.

  The Team commends the PAs for their selection of baselines for lost opportunity measures. We anticipate that the deployment of the Baseline Repository will help maintain this exemplary practice.

  Starting with PY2019, program gross lifetime savings could be modestly reduced by around 1% for dual baseline methods and by around 4% for adjustments to effective useful lives ("EULs") for both retrofit and lost opportunity measures to better reflect TRM-recommended EULs.
- **Future Evaluation.** Starting with the evaluation of PY2017, results from current and previous cycles will be rolled in to calculate a gross RR. The error ratio has been improving over time, with the exception of steam trap measures. The improved error ratio allows for smaller sample sizes for future impact evaluations.

Combined PA results and statewide summary

Results	Columbia Gas	Eversource	National Grid	Statewide
Two-year pooled RR	84%±11.7%	75%±14.5%	91%±8.6%	85%±6.5%
PY2017 RR	91% ±27%	77% ±16%	94% ±15%	87% ±10%
PY2016 RR	80% ±6%	72% ±25%	88% ±9%	82% ±9%

Core Initiatives or End Uses to which the Results of the Study Apply:

- Commercial & Industrial
- Custom
- Gas Only

Evaluation Recommendations:

The following recommendations were made by the evaluators conducting this study.

Recommendation 1: Use appropriate realization rates. The Team recommends that Columbia Gas, Eversource, and National Grid use their individual pooled RRs. Berkshire Gas, Liberty Gas, and Unitil should use the statewide pooled RR. The Team recommends using these RRs for planning and program reporting, starting with PY2019 and continuing to subsequent years until a new impact evaluation study is conducted and those results are rolled in.

Recommendation 2: Use protocol to determine error ratio. The Team has recommended a protocol for determining error ratios for future custom gas studies, as follows:

1. Average the actual and assumed error ratio from the previous impact evaluation for steam traps and non-steam-trap projects.
2. Round up to the nearest 0.05.
3. Establish a hard floor of 0.25.

The protocol incorporates the historical error ratio, which is embodied in the assumed error ratio, and the actual error ratio of the most recent study. Rounding the value up helps ensure that the target is met or exceeded.

Recommendation 3: Use current sampling methodology. The Team recommends using the current sample design method, as follows:

1. Plan for 20% for a three-year pooled relative precision at 80% confidence interval for Columbia Gas, Eversource, and National Grid results calculated for each program year.
2. Plan for 10% for a three-year pooled relative precision at 80% confidence interval for statewide results calculated for each program year.

3. The stakeholders will decide if for the next cycles, steam trap projects will be treated separately in the sample design.

Recommendation 4: Research methods for measures impacting steam traps and heat load. During the PY2017 evaluation, methodological questions were raised about steam traps and best practices for incorporating boiler efficiency into measures impacting the heating load (like steam traps and insulation). Steam traps constitute a large share of custom program savings and had a poorer realization rate in this evaluation. This raises the issue of whether steam trap measures should be treated as a separate segment within the custom program or even evaluated separately entirely. In addition, a statewide calculator is used to estimate steam trap savings. In 2016, this tool was vetted and calibrated using participant billing data. Potentially, the steam trap calculator could benefit from another round of calibration incorporating additional sites from recent evaluations. Measures such as insulation and steam traps reduce the heating load served by a boiler. Converting the heat load reduction from these measures to natural gas savings requires a boiler efficiency.

The Team recommends conducting a two-phase approach to resolving these issues. The purpose of the first phase is to use readily available data, best practices research, and interviews of knowledgeable staff to produce a clear problem statement and to conduct a high-level assessment of the potential value of additional research and the scope of that research. Phase two will execute the approved research recommended by the first phase.

Recommendation 5: Use lifetime impacts methods. The PAs have done a commendable job adopting correct ISP baselines. Stakeholders regularly referencing the new Baseline Repository should be helpful in continuing this practice. Application of dual baselines requires new lifetime savings calculation methods and includes closer scrutiny of EULs for both retrofit and lost opportunity measures. The Team recommends the following:

1. PAs adopt the recommendation made in the "Memorandum on Dual Baseline Calculation Practices and Assumptions, November 27, 2019" to maximize the accuracy of lifetime savings.
2. Starting with subsequent impact studies, evaluate lifetime savings impacts and calculate an adjustment factor to be applied to tracking lifetime savings. This factor should be applied to PY2020 tracking savings reported in the 2020 Plan Year Report in the spring of 2021.
3. Expand the in-progress PY2018 Custom Gas workplan to include the scope to provide the technical support and facilitation for implementing the lifetime savings adjustment.

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

The PAs plan to adopt and/or are considering some of the recommendations, as described below.

The PAs have adopted Recommendation 1 and are considering all other Recommendations at this time.

How the Study Affects Program Results and Its Significance:

The study results increase the PY2017 reported gross savings for statewide by 3%, for Columbia Gas by 4%, for Eversource by 3%, and for National Grid by 3%.

Overview of Study Method:

The study approach was consistent with the procedures and protocols developed during the previous round of custom gas impact evaluation conducted for PY2016. The impact evaluation consisted of desk reviews, on-site visits, and metering of a randomly selected sample of projects at participating facilities.

The sample for the PY2017 impact evaluation was generated with the intention of pooling the annual evaluation results with the prior PY2016 results to produce a rolling updated result.[9] This allowed the sampling precision to meet the targets at the statewide level, as well as at the PA level for Columbia Gas, Eversource, and National Grid. The RRs will be updated each year as part of this custom gas evaluation framework. PY2016, PY2017, and PY2018 results will be pooled and applied to PY2020 savings in the 2021 term year report. In subsequent years, the realization rate will reflect pooling of the three most recent impact results.

PY2016 and PY2017 combined expected precision at 80% confidence interval

Program Administrator	PY2017 Sample(n)	PY2016 Actual RP	PY2017 Estimated RP	Overall Estimated RP
Berkshire Gas	1	N/A	N/A	N/A
Columbia Gas	6	17%	34%	17%
Eversource	14	23%	20%	15%
Liberty	1	N/A	N/A	N/A
National Grid	8	15%	27%	15%
Unitil	1	N/A	N/A	N/A
Statewide	**31**	**10%**	**16%**	**9%**

N/A = Not applicable

To support the findings of the study, the study was conducted using the following data sources:

- PY2017 tracking data provided by all six PAs that offer the program
- PY2016 tracking data
- PY2016 impact evaluation results

[9] This study is the second custom gas study completed under the impact evaluation framework. The intention is to eventually maintain a rolling three-year pooling of results so that when the fourth year is completed, the first year (PY2016) will be removed entirely.

- Project files, which typically include the following: applications, BCR screenings, invoices, technical assistance studies, applicant savings calculations, and post-installation reports
- On-site observations and data collection including inspection and verifications of equipment, nameplate data, staff interviews, vendor interviews, spot measurements of various parameters including kW, and combustion efficiency
- Metered and/or energy management system ("EMS") trend data from each of the 31 sites that participated in the study

The study results included the gross RRs (and associated precision levels) calculated using the results from PY2017 and PY2016. PY2016 impact evaluation results have been presented in the "Impact Evaluation of 2016 Custom Gas Installations" report issued in March 2019.

Application of Results: Retrospectively and Prospectively

A copy of the complete study can be found in Appendix 4D, Study 19-19.

Study 19-20: Impact Evaluation of PY2017-2018 Custom Electric Installations

Type of Study: Impact Evaluation

Evaluation Conducted by: DNV GL

Energy and Resource Solutions (ERS)

NMR Group

Second Law Engineers (DMI)

Date Evaluation Completed: 3/26/2020

Study Objective and Summary of Results:

The objective of this impact evaluation is to provide verification or re-estimation of electric energy and demand savings estimates for a sample of custom lighting and non-lighting electric projects through site-specific inspection, monitoring, and analysis.

The results of this study are realization rates for custom lighting and non-lighting electric energy efficiency measures. Realization rates were determined at the statewide level as well as separately for Cape Light Compact, Eversource, and National Grid.

This Interim Results Memo is intended to lock in evaluation results for Custom Lighting and Custom Non-Lighting for the 2019 plan year report (PYR). In order to meet the PA-requested interim deadline for this memo, the sites were systematically prioritized and 83 of the total 93 sampled sites were included in this memo. Results for the remaining 10 sites not included in the Interim Results Memo will be included in the final report in April 2020 and are intended to be part of the rolling evaluation data set going forward.

The study provides the following key findings:

Custom Lighting		Statewide (n=23)*	Cape Light Compact (n=4)	Eversource (n=9)	National Grid (n=8)
Gross Annual MWh Savings - Realization Rates @ 90% Confidence	Two-year pooled RR	100% @ ±7.2%	93% @ ±4.2%	103.2% @ ±9.8%	96.4% @ ±10.5%
	PY2017/18 RR	107.3% @ ±13.7%	91.6% @ ±1.5%	116.8% @ ±15.8%	90.7% @ ±23.5%
	PY2016 RR	93.9% @ ±6.7%	93.9% @ ±6.7%	88.3% @ ±10.9%	99.8% @ ±9.1%
Gross Summer On-Peak kW Savings - Realization Rates @ 80% Confidence	Two-year pooled RR	93% @ ±9.8%	94.2% @ ±5.8%	85.1% @ ±16%	101.9% @ ±12%
	PY2017/18 RR	98.8% @ ±16.4%	99.3% @ ±3.5%	99.7% @ ±21.8%	96.2% @ ±28.5%
	PY2016 RR	88.4% @ ±11.7%	88.4% @ ±11.7%	67.1% @ ±23.4%	104% @ ±12.7%
Gross Winter On-Peak kW Savings - Realization Rates @ 80% Confidence	Two-year pooled RR	82.7% @ ±9.6%	78.1% @ ±5%	78.8% @ ±15.4%	93.1% @ ±11.7%
	PY2017/18 RR	82.5% @ ±18.1%	73.8% @ ±5.4%	78.5% @ ±26.8%	105% @ ±25.4%
	PY2016 RR	82.9% @ ±8.8%	82.9% @ ±8.8%	79.2% @ ±14.9%	85.2% @ ±9.8%
* The statewide results include two Unitil samples					

Custom Non-Lighting		Statewide (n=58)*	Cape Light Compact (n=16)	Eversource (n=21)	National Grid (n=19)
Gross Annual MWh Savings - Realization Rates @ 90% Confidence	Two-year pooled RR	71% @ ±8.7%	77.5% @ ±3.7%	73% @ ±10.8%	67.9% @ ±14.3%
	PY2017/18 RR	75.4% @ ±15.5%	84.6% @ ±1.9%	79.3% @ ±19.2%	72.5% @ ±27%
	PY2016 RR	67% @ ±8.7%	67% @ ±8.7%	67.1% @ ±10.9%	64.2% @ ±14.4%
Gross Summer On-Peak kW Savings - Realization Rates @ 80% Confidence	Two-year pooled RR	79.7% @ ±9.3%	76.1% @ ±5.3%	83.1% @ ±13.2%	77.5% @ ±12.3%
	PY2017/18 RR	92.4% @ ±14.6%	79.1% @ ±5.3%	104.6% @ ±21.8%	87.2% @ ±19.2%
	PY2016 RR	69.8% @ ±11.9%	69.8% @ ±11.9%	67.6% @ ±16.4%	69.5% @ ±15.8%
Gross Winter On-Peak kW Savings - Realization Rates @ 80% Confidence	Two-year pooled RR	73.5% @ ±14.1%	60.9% @ ±5.2%	85.4% @ ±19%	64.3% @ ±18.5%
	PY2017/18 RR	96.7% @ ±31.2%	63.4% @ ±2%	137% @ ±43.1%	61.9% @ ±40.7%
	PY2016 RR	58% @ ±10.9%	58% @ ±10.9%	52% @ ±14.4%	66% @ ±12.9%
* The statewide results include four Unitil samples and exclude two National Grid franchise samples					

Core Initiatives or End Uses to which the Results of the Study Apply:

- Commercial & Industrial
- Custom
- Electric Only

Evaluation Recommendations:

The following recommendations were made by the evaluators conducting this study.

Recommendation 1: The realization rates from this study should be applied retrospectively to custom lighting and non-lighting projects installed in 2019.

1. Cape Light Compact, Eversource, and National Grid should use their own two-year pooled PA specific realization rates for lighting and non-lighting projects, respectively.

2. Unitil should use the statewide two-year pooled realization rates for lighting and non-lighting projects, respectively.

Recommendation 2: A concurrent ISP study on lighting in indoor cannabis growing facilities determined the ISP baseline at the time of these projects was 1,000 watt high pressure sodium lamps with electronic ballasts. However, the Cannabis Control Commission (CCC) has set new regulations which establish a maximum allowable lighting power density that all growers will have to meet going forward, which is expected to impact all lighting projects done at these facilities. It is recommended that the PAs adopt the cannabis ISP once it is made available in early 2020. The full custom electric study report will adapt this recommendation following the finalization of the cannabis ISP study.

Recommendation 3: The evaluation team recognizes that the PAs have been making improvements to how they approach making baseline decisions. Similar to the PY2016 custom electric study, this study also recommends the PAs provide more supporting information on baseline selection in the project documentation. Given the impact that baseline changes had in this study, particularly for non-lighting projects, the program should document how the measure event type and baseline selection decision was made. The evaluation team also recognizes that the PAs and EEAC have developed a policy for performing ex-ante reviews by the evaluators. This process should help support the PAs with their baseline decision making process.

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

The PAs plan to adopt and/or are considering some of the recommendations, as described below.

The PAs have adopted Recommendation 1 and are considering Recommendations 2 and 3.

How the Study Affects Program Results and Its Significance:

This is the second rolling evaluation of full custom electric installations covering both lighting and all other custom electric end-uses, excluding CDA and CHP. Overall, the statewide realization rates have improved as compared to the results from the study covering PY2016. Statewide, the improvements in realization rates between the two-year pooled results and PY2016 for gross annual MWh are:

- Custom Lighting: + 6.5%
- Custom Non-Lighting: + 6.0%

Overview of Study Method:

- Examined the 2017 and 2018 large C&I custom electric population to determine summer dependent and non-summer dependent projects for sampling purposes. 2017 summer dependent sites and 2018 non-summer dependent and 2018 census strata (largest) sites were included in the sample design.
- Designed an efficient sampling plan for the selection of custom lighting and non-lighting projects to achieve the agreed relative precision targets using the error ratios determined in the previous custom electric evaluations. The primary sample design for this study was expected to achieve a statewide lighting and non-lighting electric energy savings realization rate results with ±10% relative precision at the 90% confidence interval when combined with PY2016 results. Cape Light Compact, National Grid, and Eversource lighting and non-lighting electric energy savings precision targets were each set at ±15% for each PA at the 90% confidence interval.
- Reviewed the TA studies, model files, and calculations used to develop the tracking savings for each sampled participant to develop site specific M&V plans.
- Performed comprehensive data collection, including metering and trend data, at each sample site to support an independent analysis of achieved gross electric energy savings realization rates.
- Established baselines for each sampled project based on the materials reviewed and additional data collected.
- Documented the evaluation activities completed in comprehensive site-specific M&V reports.
- The site level evaluation results were aggregated using the final adjusted case weights. The PA realization rates were calculated and then applied to each PA's total tracking savings to determine their total evaluated savings. The statewide realization rate is the ratio of the total evaluated savings to the total tracking savings, each of which is calculated by summing across the PAs.

A**pplication of Results:** Retrospectively and Prospectively

A copy of the complete study can be found in Appendix 4D, Study 19-20.

Study 19-21: C&I Early Replacement Study – Interview Findings Memo

Type of Study: Market Characterization or Assessment Evaluation

Evaluation Conducted by: Cadeo Group Navigant Consulting

Date Evaluation Completed: 2/4/2020

Study Objective and Summary of Results:

The primary goal of the study was to determine the proportion of C&I natural gas furnace, boiler, and water heater installations associated with the three following baseline event types: early replacement ("ER"), replace on failure ("ROF"), and new construction ("NC"). Information about these proportions would allow PAs to update the existing assumptions related to the frequency of early replacement for these three C&I natural gas measures and, if desired, tailor incentive amounts and reported savings for specific C&I gas equipment and baseline event types.

Based on 172 interviews with recent C&I participants that collectively installed 1,078 program units, the study determined following early replacement rates for each measure and/or measure type:

Measure	Type	ER	ROF/NC
Boilers	All	13%	87%
Furnaces	All	6%	94%
Water Heaters	Volume/Indirect	24%	76%
	Storage/Tankless	1%	99%

Core Initiatives or End Uses to which the Results of the Study Apply:

- Commercial & Industrial
- C&I New & Replacement Equipment
- HVAC & Hot Water
- Gas Only

Evaluation Recommendations:

The following recommendations were made by the evaluators conducting this study.

- **Recommendation 1:** Based on the team's analysis of the interview results, we recommended the PAs use the values shown in the table above if they decide to account for early replacement rates when developing incentives or reporting savings for these three C&I measures.

Please note that the team recommends two rates for water heaters, depending on the water heater type. Aggregating the results across water heater types helps offset the potential effects of sampling error (i.e., the chance that sampled units do not accurately represent the program overall) and increases the reliability of the results.

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

The PAs are considering all recommendations for adoption at this time. The PAs have not formally adopted or rejected any recommendations that require changes to program design and operations.

How the Study Affects Program Results and Its Significance:

The effect of the recommendations is expected to increase annual savings for relevant units as ER baselines would be blended with traditional, ROF baseline assumptions. However, evaluation stakeholders will need to discuss exactly how to fold these recommendations into program assumptions.

Overview of Study Method:

To determine the proportion of PA-incented units associated with each event type, our team completed 172 short interviews with recent C&I gas equipment program participants.

The table below summarizes the number of completed interviews by measure and, since some participants installed more than one measure and/or were associated with more than one project, the total number of program units represented by those interviews. The table also denotes the year that interview respondents participated in the program, as well as the source of program data that our team used to develop the interview call list.

Measure	Interviews	Units	Units/Interview	Program Data
Boilers	75	86	1.1	2017 (via PAs' C&I Data Management team)
Furnaces	14	18	1.3	
Water Heaters	83	974	11.7	2018 and Q1 2019 (via PAs' upstream program implementer)
Total	**172**	**1,078**	**6.3**	

Prior to launching the interviews, our team collaborated with the PAs and Energy Efficiency Advisory Council consultants to apply the PAs' existing C&I Baseline Framework methodology to the three measures of interest and to develop an algorithm to associate each interviewee's collective responses with a specific event type.

Application of Results: Prospectively

A copy of the complete study can be found in Appendix 4D, Study 19-21.

Study 19-22: New Construction Energy Use Intensity Baseline

Type of Study: Market Characterization or Assessment Evaluation

Evaluation Conducted by: DNV GL

Date Evaluation Completed: 2/10/2020

Study Objective and Summary of Results:

The purpose of this study was to assess whether the MA Data Warehouse maintained by DNV GL could be used to:

- Estimate energy use intensity ("EU"I) baselines for various building types participating in the PAs' new construction initiatives
- Identify supplemental information that may be needed to support the creation of EUI baselines

The study provides the following key findings:

- DNV GL was able to generate average EUI estimates for most building-use size categories using square footage from tax data and building level energy consumption from the PAs; however, the estimates for some categories were extremely variable or represented very few buildings.
- Building-use size categories with less variable EUI estimates that might be used to develop baselines included large (>50,000 sq ft) education, outpatient healthcare, office, multifamily, food sales, lodging, and warehouse and storage. The study found that the PAs should consider collecting additional information for these categories to refine the EUI estimates.
- Development of EUI estimates using tax and consumption data is complicated by four issues:
    - There is sometimes not a direct relationship between tax parcel square footage and account consumption. This is especially prevalent for large campuses that fall on a single tax parcel (e.g. some universities, healthcare, manufacturing). If it is not possible to associate the correct consumption with the correct square footage, it is not possible to calculate an accurate EUI.
    - The land-use types in the tax data are occasionally too broad to develop accurate EUIs without additional information. For example, primary care physicians and medical imaging centers would both fall under "medical office buildings" but would have vastly different EUI estimates.
    - For buildings in Massachusetts with net-metered on-site generation, it is not possible to calculate an accurate EUI using consumption data, since it is not

possible to know the full extent of a building's consumption without additional information.

- For buildings in Massachusetts using an energy source not provided by the PAs (propane, fuel oil, steam, etc.), it is not possible to calculate an accurate EUI, since we have no information regarding a large part of the building's consumption.

Core Initiatives or End Uses to which the Results of the Study Apply:

- Commercial & Industrial
- New Buildings & Major Renovations
- All End Uses
- Electric & Gas

Evaluation Recommendations:

No formal recommendations were made in this evaluation.

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

N/A (no formal recommendations were made in this evaluation)

How the Study Affects Program Results and Its Significance:

This study does not affect program results. It served as an informational research effort to determine whether the PAs could develop EUI baselines for use by their C&I new construction initiatives using information from state tax records and the PAs' customer consumption data. Specifically, the PAs wished to develop EUI baselines to calculate savings resulting from their new Deep Energy Savings and Whole Building Modeled pathways, under which incentives are based on achieving low EUIs. Based on one of the study findings that the PAs should consider collecting additional information for certain building-use size categories to refine estimates, there will likely be a follow-on study in 2020 to collect that information.

Overview of Study Method:

DNV GL used square footage and land use information from the MA L3 tax database and Boston tax database, along with consumption information from the MA PAs, to develop average EUI estimates for new construction buildings by dividing total building consumption by total building square footage. To allow comparison of the results with other data sources, we cross walked the land use types in the tax data to CBECS building classes. To make our estimates as applicable as possible to new construction buildings, we limited our analysis of buildings in the tax data to those built beginning in 2010.

Application of Results: Prospectively

A copy of the complete study can be found in Appendix 4D, Study 19-22.

Study 19-23: Indoor Cannabis Lighting ISP Prior to 935 CMR 500

Type of Study: Impact Evaluation

Evaluation Conducted by: DNV GL

Energy and Resource Solutions (ERS)

Date Evaluation Completed: 3/5/2020

Study Objective and Summary of Results:

The primary objective of the Cannabis ISP study is to define industry standard practice ("ISP") for indoor cannabis cultivation in Massachusetts. This memo considers only retrospective horticultural lighting ISP for cannabis facilities. The full report, to be completed in 2020, will consider prospective ISP as well as systems beyond lighting. The full study considers processes and equipment related to the cultivation and preparation of medical and adult-use cannabis including horticultural lighting, cultivation area HVAC, and extraction process equipment.

The study provides the following key findings:

- ISP is greatly impacted by lighting power density limitations enacted by the Massachusetts Cannabis Control Commission (CCC) that went into effect in November 2016. Therefore, the study looked at ISP prior to November 2016. Pre-November 2016 ISP findings are presented in the table below. Post-November 2016 ISP will be addressed in the full report.

ISP conclusions for horticultural lighting prior to 2016 CCC regulations

Stage	Industry Standard Practice
Flower/bloom	1,000-watt double-ended HPS, with electronic ballast
Vegetative	1,000-watt single-ended metal halide
Clone/seedling	4LT5HO fluorescent
Mother	1,000-watt single-ended metal halide

Core Initiatives or End Uses to which the Results of the Study Apply:

- Commercial & Industrial
- All Initiatives
- Lighting
- Electric Only

Evaluation Recommendations:

The following recommendations were made by the evaluators conducting this study.

Recommendation 1: The PAs should adopt electronic ballasts for double-ended high pressure sodium fixtures as ISP for retrospective lighting applications in cannabis facilities. The Team recommends an ISP of electronic ballasts for double-ended high pressure sodium fixtures.

Recommendation 2: Ensure baseline and proposed designs produce equivalent PPFD. The Team recommends that applicants model the baseline and proposed lighting designs to ensure equivalent photosynthetic photon flux density ("PPFD"). Academic studies on non-cannabis crops have shown a strong (nearly 1-to-1) relationship between intensity of PAR light and photosynthesis.[10] Since PAR is a major factor in photosynthesis and plant growth, it is important to ensure that comparisons between lighting technologies or designs produce equivalent PAR delivered to the canopy. PAR at the canopy is expressed as photosynthetic photon flux density (PPFD, µmol/m2/s) and is the appropriate metric for comparing lighting designs in terms of equivalent light intensity. While numerous factors influence plant growth, including the different spectrum output of various lighting technologies, establishing equivalent PPFD for baseline and proposed systems currently provides the best method for ensuring equivalency of light intensity delivered to the plants.

A comparison of different horticultural lighting designs requires modeling to ensure equal PPFD at the canopy, considering the lighting technology and its unique light distribution, fixture spacing, mounting height, and the canopy footprint.

Recommendation 3: Adopt horticultural lighting technology ISPs provided by this study. The Team recommends using the fixture technologies provided in the table above as ISP for projects prior to November 2016 for the various phases of growth.

Recommendation 4: Adopt a consistent methodology for calculating horticultural lighting impacts based on ISP. For retrospective projects prior to CCC regulation, adopt the following methodology for calculating horticultural lighting impacts.

- Identify the phase of cultivation and select the appropriate baseline technology per the table above.
- Identify the project's target PPFD for that phase of growth. This value will differ based on the cultivator's preference for lighting design.
- Model the base-case, using the technology identified in the table above, and the proposed case to validate PPFD equivalency of the two designs. Most LED vendors and many service providers can generate this modeling. Modeling can be performed or validated with AGi32 lighting analysis software.
- Calculate the connected wattage of the PPFD-equivalent base-case and proposed designs. The difference in wattage is the demand reduction.

[10] Bugbee, *Effects of Radiation Quality, Intensity, and Duration on Photosynthesis and Growth,* International Lighting in Controlled Environments Workshop.

- Calculate the annual lighting energy impacts based on fixture run hours, a value specific to each phase and project and referred to as the photoperiod. The flower phase photoperiod is 12 hours. The vegetative, mother, and clone photoperiods are either 18 or 24 hours, depending on cultivator preference.
- Calculate the interactive HVAC impacts of the proposed lighting design.

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

The PAs are considering all recommendations for adoption at this time. The PAs have not formally adopted or rejected any recommendations that require changes to program design and operations.

How the Study Affects Program Results and Its Significance:

The study results reduce savings for two PY2019 custom electric sites that included cannabis cultivation related projects based on new baselines for lighting.

Overview of Study Method:

Data sources on this project include expert interviews from cannabis professionals with experience working in Massachusetts facilities. These fall into two groups, cultivators and service providers. Service providers consist of all supporting vendor and consulting professionals that assist in the design and construction of a cannabis facility.

In addition to the interviews, the Team made use of the Resource Innovation Institute ("RII") Cannabis PowerScore database, a national self-reported database on cannabis facility equipment, energy use, and production to assess national ISP for lighting technologies. Secondary research was also performed as part of the study.

Application of Results: Retrospectively

A copy of the complete study can be found in Appendix 4D, Study 19-23.

Study 19-24: 2019 C&I Lighting Inventory & Market Model Update

Type of Study: Market Characterization or Assessment Evaluation

Evaluation Conducted by: DNV GL

NMR Group

Date Evaluation Completed: 4/6/2020

Study Objective and Summary of Results:

The primary goal of the 2019 Lighting Inventory and Market Model Update study was to produce adjusted measure lives ("AMLs") for major commercial and industrial ("C&I") lighting applications using lighting market data collected to improve the Lighting Market Model (the Model). The research conducted during this study to support the Model and AML updates focused on three main C&I lighting applications: ambient linear, high & low bay, and building exterior & outdoor lighting. This study also presents AMLs for traditional screw-based categories (a-line, downlight/track, and decorative lighting). DNV GL did not research this equipment on this study and thus presents AMLs based on market share forecasts from the April 2019 version of the Model. The final recommended AMLs are listed in the table below.

Recommended AMLs

Application	Equipment Type	2019	2020	2021
Ambient Linear	TLED	10.98	10.68	10.53
Ambient Linear	LED Fixture	11.39	11.13	10.99
High/Low Bay	TLED	13.22	12.96	12.81
High/Low Bay	LED Fixture	13.25	12.99	12.84
High/Low Bay	LED Lamp	13.02	12.73	12.56
Exterior/Outdoor	TLED	10.45	10.32	10.12
Exterior/Outdoor	LED Fixture	10.50	10.37	10.18
Exterior/Outdoor	LED Lamp	10.10	9.96	9.74
Screw-Based	A-Line	4.99	4.82	4.69
Screw-Based	Downlight/Track	5.89	5.88	5.86
Screw-Based	Decorative	4.07	3.99	3.78

In addition to AMLs, the study provides the following key findings on the state of the C&I lighting market:

- Ambient Linear: TLEDs and LED integrated fixtures continue to replace fluorescent technologies at a rapid pace, with LED integrated fixtures growing at a faster rate than TLEDs as a result of PA program support. It appears that many LEDs are replacing T8s.

- High/Low Bay: the dominant technology type in high/low bay lighting is linear, so the largest opportunity in this market is for TLEDs and LED integrated fixtures to continue to replace the T8s and the T12s that continue to persist in the market.
- Building Exterior/Outdoor: there is a lot of diversity of products within this submarket, but opportunities to replace metal halide and high-pressure sodium lamps remain.

Core Initiatives or End Uses to which the Results of the Study Apply:

- Commercial & Industrial
- All Initiatives
- Lighting
- Electric Only

Evaluation Recommendations:

The following recommendations were made by the evaluators conducting this study.

> **Recommendation 1:** We recommend the PAs adopt the PY2019 retrospective AMLs for all ER and ROF measures reflected in the table above for upstream, prescriptive, and custom lighting program installations.
>
> **Recommendation 2:** We recommend the PAs examine the AML assumptions as they apply to the ROF component of the calculations. Currently, the current AML calculations for ambient linear, high/low bay, and building exterior/outdoor use the same EUL for ROF in LED and non-LED technologies based on the lighting systems values in the Massachusetts electronic Technical Reference Manual.

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

The PAs plan to adopt and/or are considering some of the recommendations, as described below.

The PAs are adopting Recommendation 1 and considering Recommendation 2.

How the Study Affects Program Results and Its Significance:

Gross lifetime savings for the Program Administrators C&I lighting programs are assessed as a product of the first-year annualized savings and the AML. Since early replacement ("ER") measures are subject to dual baseline savings methods, the AML is used to account for both replace-on-failure ("ROF") and ER. For ROF, the lifetime savings are equal to the product of first-year savings and the effective useful life ("EUL"), whereas the lifetime savings for ER are equal to the sum of the first- and second-period lifetime savings. Using an AML instead of the EUL will reduce the gross lifetime savings for all upstream and downstream prescriptive and custom lighting measures.

Overview of Study Method:

To support the AML updates, the DNV GL team used a variety of methods to research C&I lighting market indicators which were used to refine the Model's saturation and market share forecasts and the resulting AML calculations. Methods included:

On-Site Lighting Inventories (n=107)	Distributor and Manufacturer Interviews (n=30)	ER/ROF Customer CATI Surveys (n=511)	Additional Research
•Estimated the stock of installed fixtures by application and equipment type in 2019 •Compared current saturation estimates to 2015 and 2018 saturation estimates	•Estimated market share by application and equipment type in 2019, 2021, and 2023 •Created a counterfactual for the Model scenarios by asking about sales with continued program support versus program support ending after 2018	•Asked a series of questions to inform an algorithm which assigned lighting projects and replacements to New Construction, ER, and ROF event types •Included updated ROF fraction in AML calculation	•Aggregated program tracking sales data to compare Model results to gross and net program sales •Reviewed secondary data sources to validate or qualify Model input assumptions •Compared Model results to national and regional forecasts

Application of Results: Retrospectively and Prospectively

A copy of the complete study can be found in Appendix 4D, Study 19-24.

Study 19-25: Analysis of Residential HVAC Sales Data from HARDI Distributors

Type of Study: Market Characterization or Assessment Evaluation

Evaluation Conducted by: NMR Group

Date Evaluation Completed: 11/15/2019

Study Objective and Summary of Results:

The purpose of this study was to purchase and analyze HARDI residential HVAC sales data on behalf of the PAs to assess the market share represented by Mass Save programs from 2013 to 2018, the potential for using these data to quantify market effects, and how the HARDI market size estimates compared to estimates collected from distributors via the 2018 Residential HVAC Efficient Market Share Estimates study. The HARDI data are derived from sales invoices from HVAC distributors that are members of Heating, Air-conditioning, & Refrigeration Distributors International ("HARDI"). The data span from 2013 into 2019 for central air conditioners ("CAC"), air source heat pumps ("ASHP"), gas and oil furnaces, and boilers.

The study provides the following key findings:

- Sales of most equipment types increased modestly from 2013 to 2018, with only central ASHP sales staying flat.
- More than half of annual CAC sales from 2013 to 2018 were 13 SEER, the least efficient units allowed by federal standards. In contrast, nearly 60% of annual gas furnace sales were high efficiency (95 AFUE or better). The mini-split ASHP market grew over this period and has increasingly shifted toward higher-efficiency models; the least efficient models (below 15 SEER) all but disappeared from the market in 2015 as federal standards increased.
- From 2014 through the first half of 2017, the PA programs incentivized about 10% of all gas furnaces, central ASHP, and CAC systems sold in Massachusetts, just over 25% of gas boilers, and over 75% of all mini-split ASHP systems.
- The HARDI data appear to be useful for market effects quantification via cross-sectional analysis using direct comparison or modeling approaches. Should the PAs choose to use the HARDI data to quantify market effects in future, it would be best to first explore the viability of modeling, and if modeling proves to be a viable approach, to undertake both direct comparison and modeling to triangulate the market effects.
- There is a role for both primary data collection from HVAC distributors like that conducted for the study and for HARDI data. HARDI time series data provide estimates of market share by efficiency from a large and stable group of distributors and can serve the backbone of market effects studies, while TXC52-style data collection efforts are useful for triangulating estimates of market size and obtaining market insights to inform market effects and other studies.

- The HARDI data include only the cooling performance of ASHP systems, not their heating performance. The study team developed regression models to estimate heating performance based on the cooling specifications included in the HARDI data.
- There is no reason the PAs to purchase additional custom reports from D+R to meet PA evaluation needs.

Core Initiatives or End Uses to which the Results of the Study Apply:

- Residential
- All Program Paths
- HVAC
- Electric & Gas

Evaluation Recommendations:

No formal recommendations were made in this evaluation.

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

N/A (no formal recommendations were made in this evaluation)

How the Study Affects Program Results and Its Significance:

The study has no quantitative recommendations or findings from the research conducted but did explore the residential HVAC market by equipment efficiency and capacity in Massachusetts and comparison states. The study found that the data may support market effects quantification which opens the possibility of future studies to quantify savings from PA programs' indirect effects on the Massachusetts markets for residential CAC equipment, ASHPs, and gas and oil furnaces. The data can also be used to estimate the market share represented by interview and survey respondents for other HVAC studies, and so determine the extent to which a given sample of respondents reflects the broader market.

Overview of Study Method:

The study team conducted a high-level review of how D+R compiles HARDI data from its distributor partners and scales up the results to represent the market and compiled and compared 2014-2017 program records with HARDI sales to estimate the PAs' market share (i.e., the percentage of units sold that received incentives from PA programs).

As HARDI data do not include ASHP heating capacity or efficiency values, which are necessary to assign the data into program bins, the study team approximated these missing values. To estimate the heating performance of those systems, the team used the Air-Conditioning, Heating, and Refrigeration Institute ("AHRI") product specification data to investigate the correlation

between cooling performance and heating performance for ASHP systems and applied those correlations to the cooling-only data included in the HARDI dataset. After testing multiple modeling approaches, the NMR team generated average HSPF values based on cooling capacity and SEER for nearly 800,000 heat pump systems from the AHRI directory and ran regressions on the results.

Application of Results: Prospectively

A copy of the complete study can be found in Appendix 4D Study 19-25.

Study 19-26: Market Effects from Ductless Mini-Split Heat Pump Integrated Controls

Type of Study: Market Effects Evaluation

Evaluation Conducted by: NMR Group

DNV GL

Date Evaluation Completed: 3/31/2020

Study Objective and Summary of Results:

The objective of this study was to assess whether the PAs' support of Ductless Mini-Split Heat Pump ("DMSHP") integrated controls has made a substantial, lasting impact on the market for these integrated controls and for cold-climate DMSHPs. The study provides a qualitative assessment of the degree of market effects.

The study provides the following key findings:

- The research confirms the underlying program theory that a major barrier to more widespread adoption and use of cold-climate DMSHPs for heating is the lack of an easy way for customers to optimize using DMSHPs efficiently in combination with fossil fuel heating equipment. The research also validates the program logic.
- The integrated controls market in Massachusetts is at the beginning of the early adopters stage of the innovation adoption curve. The target market is Massachusetts homes heated with delivered fuels that could conceivably use DMSHPs for heating and benefit from an integrated control. A rough estimate of the rate of adoption of DMSHPs with integrated controls in 2019 by the target market is 0.4%.
- There are substantial opportunities for progress in this market. A rough estimate of the remaining number of Massachusetts homes in the target market as of January 2020 is about 338,000.
- The evaluation team calculated a preliminary estimate of 2019 Massachusetts market share of DMSHPs sold in conjunction with integrated controls of 13%. The quarterly data suggest that market share increased from 0% in Q1 to 34% in Q4. The estimate should be recalculated with final rebate data when these data become available.
- The PAs were partly responsible for accelerating the development of the market for DMSHP integrated controls in Massachusetts—but not for establishing it, as the market is still in the process of being established. The PAs' share of responsibility for raising manufacturer awareness of DMSHP integrated controls is at least one-third. The PAs' share of responsibility for motivating manufacturers to offer these products is at least one-half.
- The research suggests that there could be savings from market effects due to the PAs' early activities helping to accelerate the market for integrated controls and the PAs' ongoing program support for this product. These market effects could be quantified through a

market-focused approach to measuring NTG using the supply-side market actor self-reported counterfactual analysis method and the steps described in the report.

Core Initiatives or End Uses to which the Results of the Study Apply:

- Residential & Commercial & Industrial (the primary focus is on Residential)
- Existing Building Retrofit
- HVAC
- Electric & Gas
- Energy Optimization

Evaluation Recommendations:

No formal recommendations were made in this evaluation.

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

N/A (no formal recommendations were made in this evaluation)

How the Study Affects Program Results and Its Significance:

This study's findings offer evidence that the PAs' support of integrated controls for DMSHPs may result in—or have already resulted in—market effects that are large enough to warrant measuring. The study laid out a plan for quantifying market effects in future and identified additional market effects indicators.

Overview of Study Method:

The evaluation team used the evaluation approach of historical tracing to assess the validity of the predefined theory of how and why the initiative should work, or the program logic. The sources of data for historical tracing included structured in-depth interviews with program administrator staff and implementation staff (2); market actors (19); and selected energy-efficiency organizations (5). The research also relied on the implementation contractor's documentation of outreach activities with market actors, 2018 US Census data, the PAs' 2019 Key Progress Indicator data, 2019 Massachusetts residential HVAC sales data (HARDI data) from D+R International, and various evaluation reports.

Application of Results: Prospectively

A copy of the complete study can be found in Appendix 4D, Study 19-26.

Study 19-27: Residential New Construction Baseline/Compliance Study

Type of Study: Market Characterization or Assessment Evaluation

Evaluation Conducted by: NMR Group

Date Evaluation Completed: 4/1/2020

Study Objective and Summary of Results:

The primary objective of this study was to update the User-Defined Reference Home ("UDRH") used by the Residential New Construction Program ("RNC") in Massachusetts. The program determines a home's efficiency over a baseline by comparing an energy model of the home to an energy model of a baseline home or UDRH. Other objectives included identifying statewide baseline efficiencies for measures included in the UDRH; assessing code compliance and measure-level efficiency of program and non-program homes under the base code (2015 International Energy Conservation Code ("IECC")) and stretch code that were current at the time of the study; and identifying which measures could provide the largest savings opportunities for the low-rise RNC program and Codes and Standards Compliance Support ("CSCS") moving forward. The 2015 IECC base code and the 2015 stretch code both went into effect on January 1, 2017. This is the first study to assess the efficiency of homes built under these new codes.

The study provides the following key findings:

- New non-program homes are about 14% more efficient than homes built in 2015, when the last baseline study was conducted. Non-program homes built under the new stretch code are about 11% more efficient than those built under the old stretch code.
- Program homes are about 7% more efficient than non-program homes, but the difference in efficiency between program and non-program homes is decreasing.
- The program comprised 70% of the single-family new construction market in 2019.
- Including program homes, the average overall code compliance for base code towns has increased from 86% to 94% since 2015. During this time, the average for stretch code towns stayed relatively constant, at 96% in 2015 and 98% in 2019.
- Efficient builders are changing their practices to address building energy consumption more holistically. The share of homes with insulated basements has increased from 29% to 40% since 2015. The share of homes with sealed attics has increased from 10% to 39% over that same time.
- Homes increasingly use heat pumps as a primary source of heating, cooling, and water heating. Compared to the previous evaluation, the share of homes with heat pumps as their primary equipment type increased from 2% in 2015 to 14% in 2019 for heating, from 5% to 16% for cooling, and from 11% to 17% for water heating.

- The use of spray foam as insulation increased since the previous evaluation, especially in vaulted ceilings (from 14% in 2015 to 60% in 2019), walls (from 8% to 31%), and foundation walls (from 30% to 40%).

Core Initiatives or End Uses to which the Results of the Study Apply:

- Residential
- New Homes & Renovations
- Envelope & All End Uses
- Electric & Gas

Evaluation Recommendations:

The following recommendations were made by the evaluators conducting this study.

> **Recommendation 1:** The RNC program should adopt the UDRH inputs as the baseline values for modeling energy savings for low-rise RNC projects in Massachusetts. This study finds that market transformation effects created by past RNC efforts have created a situation where the savings gap between program homes and non-program homes has shrunk considerably in the three years since the previous baseline evaluation. Specifically, the updated UDRH represents a significant improvement in home energy intensity compared with the current UDRH. Based on a sample of 2018-2019 program projects, the average home participating in the program was 25% less energy intensive than the current UDRH home, but only 7% less energy intensive than the updated UDRH. This dramatic shift warrants comprehensive consideration by program implementors of how the new baseline will affect participation, claimable savings, and program cost-effectiveness. It will be critical for program implementors to consider whether any changes to program design are necessary to enable the program's continued pursuit of all cost-effective energy efficiency.

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

The PAs plan to adopt the recommendations.

How the Study Affects Program Results and Its Significance:

The updated UDRH from this study which will be used to determine a program home's incremental efficiency by comparing an energy model of the program home to an energy model of a baseline home. The study may also be used to develop key inputs and background information to inform future net-to-gross, passive design, and incremental cost evaluations for the RNC program and CSCS.

Overview of Study Method:

NMR conducted 100 on-site energy inspections of single-family, non-program homes built between 2017 and 2019 in Massachusetts. The inspections included full Home Energy Rating System ("HERS") ratings. The study sample included 51 homes built under the 2015 IECC base code and 49 homes built under the stretch code. NMR created full energy models in both REM/Rate and Ekotrope for each home. The program adopted Ekotrope as its modeling software in 2017. Prior to this, HERS raters and the program used REM/rate for modeling. NMR used the REM/rate models to compare the results from this study to previous studies, and the Ekotrope models to compare the sample to program homes.

Application of Results: Retrospectively and Prospectively

A copy of the complete study can be found in Appendix 4D, Study 19-27.

Study 19-28: C&I NEI Update Scoping Study

Type of Study: Impact Evaluation

Evaluation Conducted by: NMR Group

DNV GL

Three Cubed

Date Evaluation Completed: 3/31/2020

Study Objective and Summary of Results:

The objectives of this study were to identify NEIs currently claimed by the PAs for C&I Retrofit and New Construction measures that require updates; identify C&I measures and initiatives that lack NEIs; identify gaps in previous C&I NEI research for Massachusetts; determine the most appropriate and cost-effective methods for developing or updating estimates of the NEIs identified ; and provide prioritized considerations for future research to quantify and monetize NEI values.

The study provides the following key findings:

The NEI gap analysis found that:

- More than half (57%) of the C&I electric measures in the 2019 BCR have NEI values assigned.
- While all NEI values could be considered outdated due to their use of 2010 program tracking data for application to 2019-2020 measures, lighting and HVAC end uses are most significantly outdated because both the LED and ductless mini-split heat pump markets have changed drastically since 2010.

Interviews with PA implementation staff and EEAC consultants yielded the following insights:

- Interview respondents expressed a desire for NEI research to reduce uncertainty around NEIs used in cost-effectiveness testing.
- Interview respondents look to NEIs to help them present more comprehensive solutions to customers by clearly demonstrating the value of program participation.
- Interview respondents seek NEIs for specific measures, projects, and programs. They want more clarity regarding how and when to apply NEIs.
- Interview respondents desire broader NEI coverage across current and proposed measures.
- Interview respondents desire additional types of NEIs, including those resulting from changes to facility costs or revenues, health- and safety-related NEIs, education-sector NEIs, and durability, comfort, productivity, and resiliency NEIs.

The literature review identified a variety of potential C&I NEIs related to health and safety:

- LED lighting potentially reduces worker injuries, supports productivity impacts, and reduces depressive symptoms among workers.
- HVAC potentially decreases costs from OSHA compliance (by avoiding non-compliance fees) and reduces missed days at work from poor indoor air quality (IAQ) and hearing loss due to lower ambient noise levels.
- Pipe insulation potentially reduces burns.
- Primary data collection is required to measure all these NEIs.
- Primary data should be collected through surveys of management and workers/occupants of C&I buildings.

Three studies, together, could quantify all the NEI needs identified by this research. These are (1) an O&M Cost savings study, (2) a Non-O&M NEIs study, and (3) a health and safety NEIs study. All three would address NEIs among both large C&I and small C&I participants. The study approaches and data sources, and the algorithms for the health and safety NEIs, are described in detail.

Core Initiatives or End Uses to which the Results of the Study Apply:

- Commercial & Industrial
- New Buildings & Major Renovations & Existing Building Retrofit & C&I New & Replacement Equipment
- All End Uses
- Electric & Gas

Evaluation Recommendations:

No formal recommendations were made in this evaluation.

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

N/A (no formal recommendations were made in this evaluation)

How the Study Affects Program Results and Its Significance:

Previous NEI research performed for the PAs, such as the 2018 NEI Framework Study, found gaps in NEIs for C&I program offerings, did not adequately address C&I health and safety NEIs, and did not address a class of NEIs that can be considered "secondary impacts," such as improved economic viability of businesses and jobs. The results of this study offer a clear path forward for conducting research that would reduce the uncertainty around C&I NEIs used in cost-effectiveness

testing, quantify previously unmeasured C&I NEIs, and enable program staff to clearly demonstrate to customers the full value of program participation.

Overview of Study Method:

This research is based on an NEI gap analysis, interviews with PA staff, and a literature review of potential health and safety NEIs from three common energy upgrades in the C&I sector (LED lighting, HVAC, and pipe insulation). The gap analysis involved reviewing the PAs' current C&I programs, initiatives, and measures and the PAs' 2019 electric and gas benefit cost ratio models to identify measures for which there is either no NEI value or for which the NEI value is aging or outdated. The Team conducted seven interviews with 21 respondents. Twenty respondents were PA implementation and evaluation staff and one respondent represented the EEAC Consultants. For the literature review of health and safety NEIs, the team identified and examined peer-reviewed manuscripts, publicly available databases, and other secondary sources.

Application of Results: Prospectively

A copy of the complete study can be found in Appendix 4D, Study 19-28.

Study 19-29: Codes and Standards Compliance and Support Initiative Residential and Commercial Immediate and Follow-up Surveys

Type of Study: Process Evaluation

Evaluation Conducted by: NMR Group

The Cadmus Group

Date Evaluation Completed: 3/10/2020

Study Objective and Summary of Results:

The objective of this study was to assess the quality and effectiveness of the trainings offered by the Codes and Standards Compliance and Support Initiative (CSCS) in 2019 and how well they are meeting the needs of code officials, builders, and other market actors to enable enhanced compliance with the current energy codes.

The study provides the following key findings:

- Classroom training attendees continued to provide positive feedback on the quality of the trainings including quality of presentation slides, quality of handouts, presenter's skills, and handling of participant questions. On a scale of 1 to 6, where 1 is poor and 6 is excellent, all areas received mean ratings of 5 or above.
- Classroom training attendees found most of the subjects covered to be useful to their work with at least two-thirds giving the most often covered subjects ratings or 5 or 6.
- Most classroom and web training attendees who responded to follow-up surveys four months after the trainings reported making some changes to their work as a result of these events. Eighty-three percent of municipal building code employees and 62% of building professionals reported making such changes after attending residential trainings. Changes were reported by 85% of municipal building code employees and 54% of building professionals who attended commercial trainings.
- Most classroom and web training attendees who responded to follow-up surveys also report sharing what they have learned with others. Eighty-seven percent of municipal building code employees and 79% of building professionals who attended residential trainings had shared some of the information from the trainings with other parties, most often homeowners, contractors, and colleagues. Eighty-nine percent of municipal building code employees and 68% of building professionals who attended commercial trainings had shared information.

Core Initiatives or End Uses to which the Results of the Study Apply:

- Residential & Commercial & Industrial
- New Homes & Renovations
- Envelope & All End Uses
- Electric & Gas

Evaluation Recommendations:

No formal recommendations were made in this evaluation.

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

N/A (no formal recommendations were made in this evaluation)

How the Study Affects Program Results and Its Significance:

Previous findings from similar studies have been used to help assess net-to-gross savings for the Residential New Construction Program, and the findings from this study may be used in a similar fashion in the future for various Mass Save new construction programs. The study also helps inform the design of the CSCS classroom and webinar trainings by providing insights about the effectiveness of the trainings and actionable feedback from attendees.

Overview of Study Method:

The study used data gathered via two sets of surveys. The first set of surveys was given to classroom training attendees at the end of each training. In 2019, 458 classroom training attendees—286 residential and 172 commercial—out of a total of 1047 filled out these paper surveys. This represents an overall response rate of 44% (41% for residential surveys and 50% for commercial surveys).

Approximately four months after attending a classroom or webinar training, attendees received the second set of surveys as a link. This web-based survey explored if, and how, attendees were using what they had learned. The web surveys replaced telephone interviews that had been conducted in past years, and for the first time included attendees of webinar trainings. In 2019, 154 trainees—86 residential and 68 commercial—out of a total of 729 filled out the second set of surveys. This represents an overall response rate of 21% (20% for residential surveys and 22% for commercial surveys).

Application of Results: Retrospectively and Prospectively

A copy of the complete study can be found in Appendix 4D, Study 19-29.

Study 19-30: C&I New Construction Program Planning & Market Effects/Spillover

Type of Study: Process Evaluation

Evaluation Conducted by: NMR Group

EMI Consulting

Date Evaluation Completed: 3/31/2020

Study Objective and Summary of Results:

The objectives of this study were to facilitate the redesign of the C&I New Buildings and Major Renovations initiative and to help the PAs prepare to measure and claim market effects and spillover from the redesigned initiative.

The study provides the following key findings:

- Best design and implementation practices for C&I new construction programs.
- A proposed redesign of the C&I New Construction program that emphasizes low EUIs, technical assistance, early engagement, incentives based on actual energy consumption, and bonus incentives. The redesigned program consists of four paths with differing objectives, activities, incentive structures, and targeted project types. The first two paths focus on optimized design and low EUIs, and the second two paths follow a more traditional measure-based incentive structure.
- A program theory and logic model (PTLM) and indicators for measuring expected outcomes from the redesigned initiative over the short term (1-3 years), medium term (4-6 years), and long term (7-10 years).
- Suggestions for when to measure baselines for the indicators and how to measure each indicator.

Core Initiatives or End Uses to which the Results of the Study Apply:

- Commercial & Industrial
- New Buildings & Major Renovations
- Process
- Electric & Gas

Evaluation Recommendations:

The following recommendations were made by the evaluators conducting this study.

Recommendation 1: The program should field surveys with market actors and conduct additional research as soon as possible to establish market baselines for the indicators.

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

The PAs plan to adopt the recommendations.

How the Study Affects Program Results and Its Significance:

The study has facilitated a fundamental redesign of program that preserves traditional measure-level incentive options so as not to create barriers to participation while also shifting the program's focus to reducing observed energy consumption. The study lays a foundation to reimagine program energy savings in terms of both observed changes in EUIs of participating buildings and optimization of building design that can create market effects, enhancing program performance. With input from program staff and stakeholders the study identified market effects indicators and proposed ways to measure them. Measuring these indicators early in the life of the redesigned initiative and periodically afterwards will help ensure that PAs can capture the information needed to attribute to the initiative market effects quantified in the future.

Overview of Study Method:

The evaluation team led four design charrettes; conducted a review of C&I new construction programs design and implementation best practices; conducted in-depth interviews with implementation staff and ten other entities, including participating market actors, implementers in other jurisdictions, and industry experts; and led two focus groups with program participants.

Application of Results: Prospectively

A copy of the complete study can be found in Appendix 4D, Study 19-30.

Study 19-31: C&I Small Business Non-Participant Customer Profile Study

Type of Study: Market Characterization or Assessment Evaluation

Evaluation Conducted by: DNV GL

Date Evaluation Completed: 4/15/2020

Study Objective and Summary of Results:

This purpose of this study was to better understand small business participation and identify which small business segments have relatively low participation and savings rates.

This study's two objectives were to:

1. Compare performance metrics (participation and savings rates) of small business customers to those of other C&I customers (as analyzed in the 2017 C&I Customer Profile Study).
2. Identify differences in performance metrics across sub- segments of the C&I small business population. Sub-segments included business size (micro, small, and non-small), seasonal businesses, and industry (educational services, hospitals, etc.).

The study provides the following key findings:

- Microbusinesses have consistent patterns of lower population savings and account participation rates than small and non-small businesses.
- While microbusiness participation rates are relatively low at the account level, viewing participation at the location level reveals that over half of gas microbusiness locations have been served over the analysis period.
- Extracting microbusinesses from the small business population shows that the small business group and large business group obtain comparable population savings achieved.
- Upstream lighting initiatives have driven a substantial increase in the number of microbusiness participants over the analysis period, but other initiatives, especially turnkey, provided deeper savings for participants and for the population as a whole.
- Breaking out microbusiness by industry segment shows that across PAs, some industries perform better than others.
- While seasonal microbusinesses have lower participation rates than non-seasonal microbusinesses, they have higher population savings achieved.

Core Initiatives or End Uses to which the Results of the Study Apply:

- Commercial & Industrial
- All Initiatives
- All End Uses
- Electric & Gas

Evaluation Recommendations:

The following recommendations were made by the evaluators conducting this study.

> **Recommendation 1:** DNV GL recommends that all PAs consistently provide BCR IDs in their tracking data. Having these IDs in the data will allow for a direct link to the PAs' BCR models, which will provide a consistent framework across all PAs and customers for end use classifications, program and core initiative classifications, savings calculations, incentives, etc. This will allow these classifications to be consistently defined across all PAs and the information to be available for analysis.[11] Some PAs are already doing this, and when they do, it provides more useful data for program tracking, resulting in fewer end uses classified as "Unknown."

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

Some PAs have adopted this recommendation and others are considering the recommendation for adoption at this time.

How the Study Affects Program Results and Its Significance:

The study found that over the analysis period, microbusinesses had consistent patterns of lower population savings and participation rates than larger small and non-small businesses and may hold opportunities for the PAs to achieve more savings. The PAs are using these findings to explore the unique needs of microbusinesses, the most effective delivery pathways and marketing practices for this group, and potential barriers to participation.

Overview of Study Method:

DNV GL used PA provided C&I billing and tracking data from 2012-2017 to develop an analysis focused on comparing participation patterns for micro-, small and non-small businesses. Business size was determined by consumption breakpoints (kWh for electric and therms for gas). DNV GL analyzed seven business subsegments and three program activity categories using three performance metrics: participation rate, population savings achieved, and participant savings

[11] For example, BCR ID G16C1b26 is Indirect Water Heater under the C&I Initial Purchase and End of Useful life core initiative, saving 190 therms per unit (according to 2017 BCR models). Anytime this ID is in the PAs' tracking data, we will have this consistent information about the ID.

achieved. To define business size, DNV GL first underwent a data cleaning process to remove tracking accounts that did not link to the billing data. DNV GL also removed accounts with zero consumption, negative consumption, or savings greater than consumption. For participating New Construction accounts, most of which do not have sufficient consumption in the billing data to generate a useful performance metric, a consumption proxy was used. The cleaned data was then analyzed at the appropriate level for the different analysis metrics in the report.

Application of Results: Retrospectively

A copy of the complete study can be found in Appendix 4D, Study 19-31.

Study 19-32: Statewide Residential and Commercial 2019 Awareness Survey

Type of Study: Market Characterization or Assessment Evaluation

Evaluation Conducted by: Illume Advising

Date Evaluation Completed: 3/30/2020

Study Objective and Summary of Results:

The goals of this current study were to:

- Continue the longitudinal assessment of key awareness metrics, such as overall awareness and Mass Save brand familiarity;
- Assess whether changes in awareness are due to Mass Save campaign changes;
- Measure customer awareness of specific energy efficiency programs;
- Explore the relationship between customers' brand and program awareness, their intention to make behavior changes, and actual behavior changes and participation in energy efficiency programs;
- Explore customers' understanding of Mass Save sponsorship; and
- Continue to gather feedback on the Mass Save website, which was redesigned in 2017.

Key findings included the following:

- Finding 1. Brand awareness holds steady and there was a marked increase in awareness among Latino residential customers.
- Finding 2. Website awareness is leveling off, but engagement with the website is increasing.
- Finding 3. Marketing outreach effectively reaches customers in a variety of ways and contributes to message clarity and customer favorability.
- Finding 4. There was a downward shift in residential customers reporting that Mass Save promotes energy efficiency, and an upward shift in those reporting that their utilities or energy efficiency service providers promote energy efficiency, from last year to this year.
- Finding 5. Familiarity with the Mass Save brand corresponds with higher awareness of energy efficiency programs and program participation.

Core Initiatives or End Uses to which the Results of the Study Apply:

- All Sectors
- All Initiatives
- All End Uses
- Electric & Gas

Evaluation Recommendations:

No formal recommendations were made in this evaluation.

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

N/A (no formal recommendations were made in this evaluation)

How the Study Affects Program Results and Its Significance:

This study has implications for planning and marketing the Mass Save brand, but no specific implications for program savings.

Overview of Study Method:

Primary data collection included a general population survey of residential and small business customers. In total, we surveyed 609 residential and 308 business customers.

Application of Results: Prospectively

A copy of the complete study can be found in Appendix 4D, Study 19-32.

Study 19-33: 2019 Residential Wi-Fi Thermostat Direct Load Control Offering Evaluation

Type of Study: Impact Evaluation

Evaluation Conducted by: Navigant Consulting

Date Evaluation Completed: 4/1/2020

Study Objective and Summary of Results:

This evaluation's objectives included verifying that the 2019 residential Wi-Fi thermostat direct load control ("DLC") solution successfully enables demand reductions (and if so, by how much) and assessing the customer experience and acceptance of the solution. These objectives were achievable through the investigation of several research questions relating to (1) Customer Experience, (2) DR Impacts, and (3) Program Design and Implementation. Where appropriate, these research questions were explored by PA (i.e., Eversource MA and CT, National Grid MA, and Unitil MA). The evaluation also sought to compare select metrics for this National Grid offering across 2016 to 2019.

The study provides the following key findings:

Customer Experience Research Findings

- **Overall, 96% of thermostats that enrolled since September 30, 2018 remained enrolled through the end of the evaluated 2019 DR season.** The rate of sustained enrollment for thermostats enrolled after September 30, 2018 was 97%, 94%, and 99% for Eversource, National Grid, and Unitil, respectively.
- **The annualized rate at which thermostats leave the ConnectedSolutions offering ("annualized attrition") ranges from 5 to 11% per year.** For National Grid, annual attrition ranges from 6% to 10% depending on the period of enrollment, reflecting National Grid's device management plan. For Eversource, attrition ranges from 10 to 14%, depending on the period of enrollment. However, for both Eversource and National Grid, implementation vendor transitions impact the ability to fully analyze the extent to which thermostats have left the programs over time. For Unitil, annualized attrition is 5%.
- **Across all PAs and cohorts, more than 85% of survey respondents reported that they are likely or very likely to participate again in the future.** Respondents were generally satisfied with event characteristics in 2019, including the number, length, and timing of events.
- **Bill savings is a perceived offering benefit.** Bill savings is the most commonly cited motivation for participating, including among returning National Grid customers. Although this offering achieved energy savings in 2019, the primary goal of the offering is to achieve peak demand reductions. As a result, any given participant may or may not experience bill savings by participating in the offering. The perception that participation

will lead to bill savings may be a consequence of co-marketing the offering with Wi-Fi thermostat rebates.

- **55% of respondents were satisfied with the mode of notification received.** Overall, approximately 73% of survey respondents reported receiving event notification, and 75% of these respondents received their preferred mode of notification.
- **About 20% of respondents would like more flexibility in terms of how they are notified of events.** 25% of respondents *who reported receiving event notifications* would like to receive a different mode of event notification than what they received in 2019. Of these, a majority would like notifications by email.
- **Overall 17% of respondents reported not receiving event notifications and 10% were unsure whether or not they received event notifications.** 80% of Unitil and Eversource respondents reported receiving advance notifications for events while only about 62% of National Grid new participant respondents and 70% of National Grid returning participant respondents reported receiving advance notifications. The remaining participants either reported receiving no event notification or they were unsure whether or not they received notifications. Eversource and Unitil elected to send event notification emails to participants with device types that allowed this. National Grid elected not to send advance notification emails. For device types where email notification was an option the PAs could select, participants that received event notifications *only* through the thermostat provider's app had lower rates of event notification recall than those who also received an email. For respondents who reported not receiving any event notification, a majority would like to receive email notification, at a minimum.
- **Approximately two-thirds of participants reported noticing temperature changes during events but only 40% reported ever opting out**. Most of those who reported having opted out stated that they did so only sometimes (30-40%) or rarely (50-65%). When looking at thermostat telemetry data, the percentage of devices that opted out at least once over the course of the season, and the frequency with which they opted out, is somewhat higher than what survey respondents reported (see section 4.2).[12,13] Notably, 16% of National Grid returning participants reported not knowing if they ever opted-out of an event. Relatedly, over 40% of survey respondents indicated they did not recall pre-cooling happening prior to events. In open-ended feedback, three respondents noted that it was too easy to override events inadvertently.
- **Approximately 10% of survey respondents are interested in seeing changes to or the ability to customize offering design parameters.** Some survey respondents would like to see changes to or to be able to specify their preferences related to: pre-cooling temperature adjustment and/or duration (26), event duration and/or timing (16), event setpoint

[12] The thermostat usage assessment (section 4.2) shows that 45% of Eversource devices, 54% of National Grid devices, and 43% of Unitil devices opted-out for at least one event during the 2019 season.

[13] The thermostat usage assessment shows that 47% and 45% of participants who opted of at least one event during the summer, for Eversource and National respectively, opted out of over half of events (see Section 4.2).

maximum (3). Three survey respondents would like to be able to opt back into the event after opting-out.

Thermostat Usage Assessment Findings

- **2019 full participation rates exceeded 50% on average and across the season.** Eversource MA and CT had the highest full participation at 60%, followed by Unitil MA at 56% and National Grid MA at 52%. The primary reason for devices not fully participating in events was not being in cooling mode.
- **A significant number of devices were never in cooling mode for any event.** Over 60% of system off/heat mode issues for Eversource MA and CT, National Grid MA, and Unitil MA stem from devices that were in system off/heat mode for the entire season.
- **Connectivity was a small issue overall during events for Eversource MA and CT, National Grid MA, and Unitil MA.** A large portion of connectivity issues stem from devices that were disconnected for the entire season.
- **Participants exhibited no evidence of event participation fatigue (increased opt-out rates) due to back-to-back events or a higher event dispatch frequency.** Devices in the experimental design groups participated at similar rates regardless of the number of events for which they were dispatched.

Impact Analysis Findings

- **Eversource and National Grid had very similar average treatment effects for the 2019 season, 0.60 kW and 0.59 kW per thermostat, respectively.** Unitil's average treatment effect was lower, 0.38 kW per thermostat, which uses the savings adjustment factor and EnergyHub's estimates of load shed**.**
- **As a percent of baseline usage, average demand savings were 58% and 59% for Eversource and National Grid, respectively.** For National Grid, this reduction in cooling load is slightly higher than 2018 (likely due to the higher temperature setback during events), but consistent with the previous two implementation seasons.
- **Fully participating devices have average event savings across the 2019 season that are over 35% higher than the average across all dispatched participants.** Impacts for full participants show the technical potential of the offering. As opt-outs and other forms of non-participation are reduced, average and total event impacts should increase.
- **National Grid's average demand savings per event in 2019 was 0.59 kW, a decrease from the average savings found in 2018 (0.71 kW).** The lower savings likely stem from the later event times and the fewer number of event days exceeding 90°F in 2019 compared to 2018, which resulted in a lower baseline cooling load.

Core Initiatives or End Uses to which the Results of the Study Apply:

- Residential
- Residential Behavior
- HVAC
- Electric Only
- Wi-Fi Thermostat-Based Direct Load Control

Evaluation Recommendations:

The following recommendations were made by the evaluators conducting this study.

Recommendation 1: Unenroll thermostats from the offering that frequently opt out of events, do not have connectivity, and/or are consistently in a non-cooling mode. This will lower the costs of the Direct Load Control Offering and increase average savings per thermostat. In parallel, ensure that the enrollment tracking system allows for the tracking of unenrollment reasons related to the opt outs, connectivity and AC system mode behavior.

Recommendation 2: Include the count of all residential and non-residential devices and participants enrolled as of August 31 in the Massachusetts ADR BCR model. For 2019, the count of thermostats is 8,020, 11,503, and 70 for Eversource MA, National Grid MA, and Unitil, respectively. The count of participants is 5,158, 7,814, and 45 for Eversource MA, National Grid MA, and Unitil, respectively.

Recommendation 3: Calculate ex-post savings by applying the savings adjustment factor to vendor-reported savings. Use ex-post savings for claiming savings in 2019 and in future years. For the event period, the savings adjustment factor is an equation based on average outdoor temperature: -3.06 + (0.05 x Avg Temp °F). For pre-cooling and recovery hours, the savings adjustment factors are constants, 0.72 and 0.68, respectively.

The adjustment factor can apply when the ISO-NE or PJM baseline is used, pre-cooling and event duration conditions are met, the assumed AC nameplate capacity continues to be 3.5 kW in the EnergyHub portal, and the average outdoor temperature is 75 degrees F or higher. When these conditions are not met, the savings adjustment factor does not apply.

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

The PAs have adopted Recommendations 2 and 3. The PAs are still considering Recommendation 1 at this time. The PAs have not formally adopted or rejected any recommendations that require changes to program design and operations.

How the Study Affects Program Results and Its Significance:

Navigant developed a savings adjustment factor to be applied to vendor-reported savings estimates by comparing the hourly evaluated impacts for National Grid in 2018 and 2019 and Eversource in 2019 to the hourly impacts estimated by the implementer, EnergyHub, where the average outdoor temperature was greater than 75 degrees. Looking at event hours, Navigant found that the comparison had a positive correlation, indicating that EnergyHub was overestimating impacts for lower event temperatures and underestimating impacts for higher event temperatures. Due to the correlation observed, Navigant recommends an adjustment factor equation where the adjustment factor is a function of hourly temperature.

Navigant also compared the evaluated pre-cooling impacts to EnergyHub's impacts. There was no strong correlation between outdoor air temperature and the resulting adjustment factor. For the pre-cooling hours, Navigant recommends a single average value.

Navigant compared the evaluated post-event recovery impacts to EnergyHub's impacts. Similar to the pre-cooling hours, there was no strong correlation between outdoor air temperature and the resulting adjustment factor. For the post-event recovery hours (the 3 hours following the event period), Navigant also recommends a single average value.

Navigant recommends that all the PAs apply the savings adjustment factors in the table below to Energy Hub-reported savings to generate *ex post* savings values for the purposes of claiming savings in 2019 and in future years.

Demand Savings Adjustment Factors

Period	Conditions	Hourly Load Adjustment Factor
Pre-cooling	Average Temperature ≥ 75°F 30 to 90 Minute Duration ISO-NE or PJM Baseline	0.72
Event	Average Temperature ≥ 75°F 3-Hour Duration ISO-NE or PJM Baseline	-3.06 + (0.05 x Average Temperature °F)
Recovery	Average Temperature ≥ 75°F ISO-NE or PJM Baseline	0.68

Overview of Study Method:

This evaluation assessed demand and energy savings for the 2019 offering and focused on the development of a savings adjustment factor for use by the PAs in future years. The evaluation also assessed the customer experience with the offering. The key elements of the study method include the following:

Participant Survey: Navigant developed, fielded, and analyzed the results of an online survey of 316 participants at the end of the DR season.

Analysis of Enrollment Data: Navigant analyzed offering enrollment data to calculate attrition rates for those enrolled in 2019 (all PAs) and prior to 2019 (for National Grid and Eversource CT).

Thermostat Usage Assessment: The team analyzed thermostat telemetry data and thermostat-level participation data to assess participation status (including opt-out and connectivity rates) during events and throughout the DR season.

Experimental Design: Navigant randomized devices into one of three groups (A, B, C). Once implemented, either the A group or B group was withheld from the event dispatch to serve as the control group, while the C group was always dispatched. For events prior to the experimental design implementation, Navigant employed within-subject approach using non-event days to estimate impacts.

Data Management: Prior to conducting its analysis, Navigant performed a QA/QC of the 15-minute thermostat telemetry for 20,737 participants. The review included screening for gaps in the data, logic errors, and confirming the experimental design group assignment. The team also reviewed the National Weather Service hourly temperature data to confirm that the relevant Massachusetts and Connecticut weather stations were not missing hourly data on days of interest and had reasonable temperature and humidity readings across weather stations.

Runtime to Energy: The team relied on thermostat telemetry data, converting thermostat runtime into power based on data from the 2017 MA residential baseline study and 2017 National Grid MA DR field study.

Regression Analysis: For National Grid and Eversource, the evaluation measured demand and energy impacts during pre-cooling, event, and recovery hours using regression analysis with the experimental design and a within-subject approach. The team did not measure impacts for Unitil using regression analysis due to low program enrollment.

Savings Adjustment Factor: Navigant developed a savings adjustment factor to apply to vendor-reported savings to calculate *ex post* savings that would be claimed by the PAs, including savings to be claimed in 2019 and in future years.[14] The savings adjustment factor was informed by (1) analysis of evaluation results in 2018 and 2019 for National Grid and Eversource, and (2) developing an understanding of EnergyHub's approach to calculating savings.

Application of Results: Retrospectively and Prospectively

A copy of the complete study can be found in Appendix 4D, Study 19-33.

[14] For the Massachusetts PAs, *ex post* savings values will be the input to the Massachusetts Demand Reduction Benefit Cost Ratio model via the DR Impact Factor Calculator tool developed by Synapse Energy Economics.

Study 19-34: Cross-State C&I Active Demand Reduction Initiative Summer 2019

Type of Study: Impact Evaluation and Process Evaluation

Evaluation Conducted by: Energy and Resource Solutions (ERS)

DNV GL

Date Evaluation Completed: 4/15/2020 (revised draft)

Study Objective and Summary of Results:

The purpose of this study was to measure the average demand reduction achieved by two active demand reduction ("ADR") initiatives — C&I interruptible and C&I targeted storage — and to assess customer experience, barriers to implementation, and PA and vendor success in delivering these two offers. The evaluation also examined the overlap between the PA ADR initiatives and the ISO-NE Forward Capacity Market ("FCM") and provided input on other opportunities for peak demand management.

The research covers ADR initiatives offered by Eversource, National Grid, and Unitil in Massachusetts, Connecticut, and New Hampshire. This summary focuses solely on Massachusetts.

C&I Interruptible Impact.

The C&I interruptible initiative enrolled 206 Massachusetts customers with 517 accounts using 7 different curtailment service providers (CSPs). The impact evaluation measures average demand reduction during specified events and during the annual peak installed capacity (ICAP) hour. Table 1 shows the Summer 2019 initiative demand reduction goals, reported and evaluated results by PA as well as reported demand reduction and participation. Eversource results are based on three called event days, one of which covered the ICAP hour. National Grid and Unitil called a single event on July 30th, the ICAP day.

The evaluation team recommends using a symmetrically adjusted baseline to estimate the 2019 summer event period load reduction (see Evaluated – Symmetric in the tables below). This estimate adjusted for the likelihood of unreported shutdowns is the evaluators' best estimate of expected load reduction by these resources for future years (see Evaluated – Forecast in the tables below).

In Table 1, the "unadjusted" baseline is the average demand during event hours on 10 non-holiday weekdays that precede the event day. "Symmetric" adjusts the prior baseline up or down to account for the fact that the event day weather or customer behavior may cause the starting point for load reduction to differ from preceding days, such as the event day being much hotter than preceding days. "Asymmetric" is the same as symmetric except that the adjustment is not made if the baseline adjustment would cause load to decrease. "Forecast" is the same as symmetric except that it adds a factor to account for likely customer shutdowns on random future summer weekdays. The "regression" baseline doesn't use the 10-day criteria. Instead it uses the full month in which the

event occurs to estimate likely load as a function of outside temperature and time. "Validation" refers to the evaluators replicating the program's reported (asymmetric) baseline calculations.

Table 1. Average Demand Reduction During Event Period and ICAP Hour

Result	**Eversource MA**		**National Grid MA**		**Unitil MA**		**Total MA**	
	Event (MW)	**ICAP Hour (MW)**	**Event (MW)**	**ICAP Hour (MW)**	**Event (MW)**	**ICAP Hour (MW)**	**Event (MW)**	**ICAP Hour (MW)**
Goal	30.0		62.0		0.9		92.9	
Enrolled Capacity	37.2	36.7	93.1	93.1	0.95	0.95	131.3	130.8
Reported - Asymmetric	22.3	N/A	71.4	N/A	0.85	N/A	94.5	N/A
Evaluated - Validation	21.5	N/A	71.6	N/A	0.84	N/A	94.0	N/A
Evaluated - Unadjusted	6.6	7.4	42.5	36.1	0.59	0.60	49.6	44.1
Evaluated - Asymmetric	19.9	21.8	70.0	63.2	0.84	0.86	90.3	85.8
Evaluated - Symmetric	**17.4**	**20.6**	**58.5**	**52.2**	**0.78**	**0.79**	**76.7**	**73.5**
Evaluated - Forecast	**16.5**	**19.4**	**57.3**	**51.3**	**0.78**	**0.79**	**74.6**	**71.4**
Evaluated - Regression	12.7	15.4	48.8	42.5	0.67	0.69	62.2	58.6
Accounts	*161*	*151*	*357*	*357*	*3*	*3*		

Table 2 shows four key performance ratios that quantify the initiative's performance:

(1) The **enrollment ratio** shows the percentage of the enrolled capacity that was reported as load reduction, which is meaningful for planning and sales purposes (the value is not expected to be near 100%);

(2) The **asymmetric ratio** shows the effect that differences in calculation rules have on the reductions by comparing the evaluated and reported asymmetric reductions;

(3) The **retrospective realization rate** shows how the choice of baseline adjustment and calculation methodologies impacts the load reduction estimates. This rate is what evaluators believe to be most representative of reported to evaluated performance; and

(4) The **prospective realization rate** is the same as (3) except that it also adjusts for unreported shutdowns to provide insight into likelihood of availability of the resources on a future unknown event day.

Table 2. Key Performance Ratios

PA and State	Enrollment Ratio	Asymmetric Ratio	Retrospective Realization Rate	Prospective Realization Rate
	Reported Asymmetric / Enrolled Capacity	Evaluated Asymmetric / Reported Asymmetric	Evaluated Symmetric / Reported Asymmetric	Evaluated Forecast / Reported Asymmetric
Eversource MA	59.8%	89.4%	78.3%	74.2%
National Grid MA	76.7%	97.4%	81.9%	80.2%
Unitil MA	89.8%	98.8%	90.8%	90.8%
MA – All 3 PAs	72.0%	95.5%	81.1%	78.9%

Targeted Battery Storage Impact

Eversource enrolled two targeted battery storage systems in the initiative during summer 2019 season. One of the two battery storage systems included daily dispatch as well as targeted dispatch in response to demand response calls. For that battery storage system evaluators measured targeted response as the demand reduction beyond their known daily goal. Results are in Table 3.

Table 3. Targeted Dispatch Results for Battery Systems

	Site 1 (1,500 kW, 3,000 kWh, with 500 kW daily DR goal)		Site 2 (1,300 kW, 5,600 kWh)	
	Utility Weekday Event Average Reduction (kW)	ISO-NE ICAP Hour Reduction (kW)	Utility Weekday Event Average Reduction (kW)	ISO-NE ICAP Hour Reduction (kW)
Committed	400	N/A	N/A	N/A
Reported	283	800	1,033	1,290
Evaluated	295	800	1,033	1,290

The targeted battery realization rate for the two systems together is 1.01.

The ratio of charging to discharging energy was 0.67 for site 1 and unable to be evaluated but reported as 0.90 for site 2.

Process Evaluation Results

Customers reported general satisfaction with all aspects of the two DR initiatives except for the event payments. Key challenges in administration varied by utility company.

- **Eversource:** Challenges were material, but largely attributed to it being the first year of the initiative: (1) There were administrative challenges due to having different systems for application submittals, sending notifications, and event monitoring, and variations across states. Use of a single distributed energy resource management system (DERMS) platform will reduce this challenge. (2) Annual incentive payments were late relative to customer expectations, although the PA stated that the customers were notified of more accurate timeline estimates. The DERMS platform also is expected to improve payment processing. (3) The Terms and Conditions (T&C) on the customer application changed during the first sales season, resulting in multiple versions of the application with different T&Cs being in circulation and CSPs re-negotiating T&Cs and program rules well into the summer.
- **National Grid:** While 2019 was the first year of the full-scale ADR initiative, National Grid has had a predecessor program for two years. Their challenges largely center on burdens of expansion. As with Eversource, payment processing is challenging, but for different reasons. Delays were described as being predominantly due to new procurement requirements. Recruitment is National Grid's second challenge. A significant percentage of the PA's largest commercial and industrial customers had already signed-up for the program prior to 2019. More sales effort was required in 2019 to achieve the same amount of MW reduction that had been reached in prior years. The PA anticipates this need for increased promotion to continue.
- **Unitil:** Unitil had three enrolled participants and few challenges in Massachusetts. Participants were mainly recruited by one CSP for the summer 2019 season. To meet their summer 2020 demand reduction targets, Unitil staff are considering several changes to their promotional efforts including developing content on their website and working with an additional CSP.

Other/Integrated Findings and Results

- **Shutdown Days:** Customers are failing to report shutdown days to the PAs even though the initiative rules include a shutdown day allowance, which could have a negative impact on customer payments if they fell within their baseline period and went unreported, and also interferes with evaluation analysis.
- **Pre-Cooling, Gaming, and Snapback:** None of the load shapes point toward pre-event activity (pre-cooling, load shifting, or gaming) and snapback would be non-existent with any of the shapes adjusted to event-day load levels.
- **ISO Overlap:** Scenarios in which PA DR Initiative events and ISO-NE scarcity conditions overlap or are called coincidently are rare, as scarcity conditions occur because of a supply constraint (at the transmission level) while utility DR events are typically called in response to expected peak demand conditions on the distribution grid. The PAs reached out to ISO-NE to coordinate during the initiative development, however, at the time it was determined that the PA initiatives were too small to warrant collaboration. The magnitude of reductions through the initiatives is expected to keep growing. ISO-NE staff is concerned that participation in utility DR events could result in eroding the ISO-NE baseline calculation and same-day adjustment for performance, or vice versa, and that the ISO could over-

designate reserves if Demand Response Resources that participate in utility DR programs do not revise their Forward Capacity Market bids. The utility rules ease customer overlap concerns regarding utility payment but do not address those of the ISO. Interviewed ISO staff indicated a willingness to discuss overlap concerns and solutions with the PAs.

Core Initiatives or End Uses to which the Results of the Study Apply:

- Commercial & Industrial
- C&I Active Demand Reduction
- Active Demand Reductions
- Electric Only

Evaluation Recommendations:

The following recommendations were made by the evaluators conducting this study.

Recommendation 1: Continue to seek solutions to accelerate the incentive payment process with centralized program tracking and management systems and by allowing CSPs to access their online day-after data and daily performance summaries.

Recommendation 2: Remind and educate the CSPs of the shutdown allowance requirement and reporting rule. The PAs could ask for pre-planned shutdown information during the application/enrollment process.

Recommendation 3: Adapt the shutdown rule to account for unexpected facility shutdown events, such as by reducing the advance notification requirement from seven days to 24 hours in advance of the shutdown.

Recommendation 4: Formally standardize all rules related to data quality, baseline calculation methods, and aggregation.

Recommendation 5: Establish data quality rules with clear outcomes for poor quality and/or insufficient data.

Recommendation 6: Use the retrospective realization rate to determine past season performance.

Recommendation 7: Use the prospective realization rate to estimate future load reduction.

Recommendation 8: In the short-term, representatives from ISO-NE, the PAs, and, if feasible, the CSPs should come together at a Demand Resources Working Group (DRWG) meeting and brainstorm mutually beneficial design solutions that would minimize the impact of one entity on the other.

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

The PAs are considering all recommendations for adoption at this time. The PAs have not formally adopted or rejected any recommendations that require changes to program design and operations.

How the Study Affects Program Results and Its Significance:

The results reduce overall reported impact by 18.9% for the C&I interruptible offering and increase the reported impact by 1% for the targeted battery offering. Evaluators recommend use of a different metric for reporting demand reduction for C&I interruptible in the future.

Overview of Study Method:

For battery participants, impact was measured based on battery system-level charge and discharge data. For C&I interruptible participants, the impact evaluation was based on account-level analysis of interval data of all available participants. First the reported results were validated. After validation, the counterfactual (i.e., baseline behavior, or the hypothetical behavior of customers absent the initiative) was characterized using five different approaches including the settlement approach used by the initiative, three alternative settlement-type methods, and a weather-based regression analysis.

The process evaluation was based on review of initiative materials and in-depth phone interviews with PA program managers, ISO-NE Price Responsive Demand program managers, and CSPs, and a mixed-mode (online and phone) participant of a sample of 61 customers to meet the target of 10% relative precision at 90% confidence.

Application of Results: Retrospectively and Prospectively

A copy of the complete study can be found in Appendix 4D, Study 19-34.

Study 19-35: Eversource Daily Dispatch Battery Project Evaluation Report

Type of Study: Impact Evaluation and Process Evaluation

Evaluation Conducted by: Energy and Resource Solutions (ERS)

DNV GL

Date Evaluation Completed: 2/3/2020

Study Objective and Summary of Results:

This study evaluated the performance of the commercial and industrial daily dispatch battery demonstration project. The project included three battery installations in Massachusetts which were dispatched during summer weekday afternoons to reduce customer electric load at the time of the regional system peak. All three participants are Eversource customers. The overall evaluation of the daily dispatch battery project has spanned two years, covering the performance in the summers of 2018 and 2019 and the 2018/2019 winter season. This evaluation report summarizes the findings from the 2019 summer season.

The evaluation scope included both impact and process evaluations, including measuring how much load reduction each battery installation delivered and describing customer recruitment, delivery, and satisfaction.

The results of this three-site study affirm several of the hypotheses regarding the value of batteries as demand management devices. The findings from this study also point to the fact that installation and optimization of controls take longer and have more potential obstacles than typically accounted for. Once the battery systems are installed, operational, and optimized, they are reliable, predictable, and easy to measure. Straightforward and defensible data produced by the vendors' battery systems was available and demonstrated the batteries' exact impact on facility load. Occasional anomalous errant data occurred no more frequently than with other equipment logging or utility-grade premise-level interval metering systems.

The evaluation resulted in the following key findings:

- The installation and "shakedown" period required to refine operation is long and complex.
- Once functional, seasonal average performance is good. Daily dispatch systems are almost meeting their committed levels. The three battery systems' committed average load reduction during the daily dispatch period was 1,070 kW. Evaluated average load reduction during the dispatch periods was 972 kW, 91% of the commitment. The evaluated average daily dispatch reductions were found to be 4% higher than the reported reductions for one site. Evaluators did not receive reported average daily dispatch reductions for the remaining two sites.

- Daily dispatch battery systems can escalate load reduction during the annual regional system peak hour (also known as the installed capacity, or ICAP hour). The ISO-NE ICAP hour occurred on July 30th, 2019 from 5 to 6 p.m. The two battery systems that were installed and operational at this time had committed 695 kW as their average daily dispatch load reduction. During the ICAP hour they concentrated the battery discharge and markedly increased their performance, discharging energy at a rate of 1,090 kW, a 56% boost.
- Controls optimization of batteries is critical in facilities with other distributed energy resources such as combined heat and power systems.
- Customers are satisfied with their vendors and are optimistic about future performance.

Core Initiatives or End Uses to which the Results of the Study Apply:

- Commercial & Industrial
- Existing Building Retrofits
- Active Demand Reductions
- Electric Only

Evaluation Recommendations:

The following recommendations were made by the evaluators conducting this study.

1. The vendor should clearly define DR objectives for each customer and educate customers regarding realistic financial expectations for their systems.
2. Require more gradual recharging of the batteries.

In addition, to aid future evaluation the evaluators recommend**:**

1. Collect additional contextual information to help the evaluation team characterize daily dispatch battery operation.
2. Have vendors communicate site control objectives to Eversource and evaluators.
3. Eversource should carefully design future demonstration projects to prioritize different DR objectives at each demonstration project site.

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

The PAs are considering all recommendations for adoption at this time. The PAs have not formally adopted or rejected any recommendations that require changes to program design and operations.

How the Study Affects Program Results and Its Significance:

The results in this evaluation report provides the data necessary to test cost effectiveness of daily dispatch batteries and inform the design of full-scale programs. Performance was consistent and reliable once the systems were installed and operational.

Overview of Study Method:

Impact was measured based on battery system-level charge and discharge data.

The process evaluation was based on review of marketing materials and in-depth phone interviews with the PA program manager, vendor project manager, and pre- and post-installation surveys of participants.

Application of Results: The quantitative results should be applied retrospectively.

A copy of the complete study can be found in Appendix 4D, Study 19-35.

Study 19-36: 2019 Residential Energy Storage Demand Response Demonstration Evaluation – Summer Season

Type of Study: Pilot Evaluation and Demonstration Projects

Evaluation Conducted by: Navigant Consulting

Date Evaluation Completed: 2/10/2020

Study Objective and Summary of Results:

The purpose of this study was to assess the technical feasibility, customer acceptance, and scalability of using residential energy storage systems (battery) to reduce peak demand for National Grid and to flatten the solar output curve for Unitil as part of their broader active demand response initiatives. This study confirmed this feasibility; however, it has not looked at whether that control will be cost-effective for the electric system, program administrators, and/or customers. National Grid provided a performance incentive to customers in exchange for control of their existing battery as part of a "Bring Your Own Battery" demonstration, while Unitil provided each participant with a battery at no cost to them. Between July and September of 2019, National Grid called 27 events for 50 participating customers[15] and between August 1 and September 30 Unitil called 61 events for 4 participating customers.

The study provides the following key findings for National Grid:

- Access to backup power is a primary motivation for purchasing a battery system.
- Survey respondents reported extremely low opt-out rates, with 94% reporting they never opted out of an event.
- Ninety-seven percent of respondents would recommend the program to other National Grid customers, and 97% are likely or very likely to continue with the program should it be offered in the future.
- Events called by National Grid during the summer season saved 139 kW per event on average, including 126 kW during the 2019 ISO-NE Peak Hour.
- Battery devices that successfully participated in 2-hour events saved an average of 5.5 kW per unit.
- On average, called events had 64% of the expected maximum impact given the maximum expected discharge of the batteries operational at the time of the event. This is affected by some batteries opting out of events and also by lower relative performance by some devices, especially DC coupled batteries.
- 50 devices participated in at least one event this season.

[15] Number of Massachusetts customers that participated in at least one event as of August 31.

- Consecutive event days appeared to have a negligible effect on impacts this season. Weather had a larger effect on devices not being fully charged in time for the next event. The small effects that could be seen were instead caused by weather conditions that prevented some devices from fully charging in time for the next event.
- Successfully participating devices dispatched at a constant rate for the length of the event. This includes DC coupled batteries.
- The conventions (e.g., sign, time zone) associated with the telemetry data varied across manufacturers. Navigant made informed corrections to align the telemetry data for all devices into a single convention.

The study provides the following key findings for Unitil:

- Access to backup power is a primary motivation for participation.
- Participants displayed limited understanding of the program's design, such as when events are called, the existence of a battery reserve, and the degree of control they have over their batteries.
- Half of the current participants report they are unlikely to remain enrolled.
- According to the battery installer, many participants expressed safety concerns, in part due to several highly publicized battery fires in the last several years.
- Combining battery storage with solar PV achieved a flattened output profile during portions of events.
- The combined solar PV plus battery storage performed better during the 1 p.m. to 5 p.m. events than the 3 p.m. to 7 p.m. events, due to greater solar PV output during the earlier period.
- The site with a smaller solar PV array facing south did not perform as well as sites with larger solar PV arrays facing southeast.
- The average output from the battery storage during the four-hour events was 1.3 kW and 5.2 kWh.

Core Initiatives or End Uses to which the Results of the Study Apply:

- Residential
- Residential Behavior
- HVAC
- Electric Only
- Summer Battery Storage

Evaluation Recommendations:

The following recommendations were made by the evaluators conducting this study.

Recommendation 1: Ensure customers are aware National Grid knows backup is important to them. Two manufacturers include the existence of a battery reserve in their marketing materials, and one offers the option, but National Grid does not make this clear in the marketing materials. Create a consistent battery reserve level and publicize both the battery reserve and the restriction of events prior to storms. This will help alleviate customer concern about batteries being depleted when they are being relied upon to provide power in an emergency

Recommendation 2: National Grid to encourage EnergyHub to work with manufacturers and/or integrators to align all details of the telemetry data so the data fields are consistent.

Recommendation 3: Unitil to discuss with the battery manufacturer why the battery charging stopped at 1 p.m. for events that occurred from 3 p.m. to 7 p.m.

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

The PAs are considering all recommendations for adoption at this time. The PAs have not formally adopted or rejected any recommendations that require changes to program design and operations.

How the Study Affects Program Results and Its Significance:

For participant motivations and lessons learned, the study found that backup power is a primary motivation for customer participation. This should be reflected clearly in marketing materials for any future program. In addition, the program design should be communicated clearly to participants, such as how often the battery will be called upon and whether there is a battery reserve requirement.

Regarding energy storage system performance, the study found that most batteries successfully performed in the majority of called events. This implies that daily dispatch is a viable option for consistent peak reduction or load shifting throughout the summer. National Grid should further explore the factors that negatively affected fleet performance, including underperformance of devices (especially DC coupled batteries) and opt outs. Unitil should continue to work with the battery manufacturer to improve the flattening of the solar output, and should consider different approaches to increase event success, such as reducing the duration of events.

Overview of Study Method:

The study relied on several methods:

1. An online survey was administered to National Grid customers participating in the demonstration. The surveys were administered via the Qualtrics platform from October 10

through October 20, 2019. Navigant obtained 41 completes out of a population of 65 participants[16] for a response rate of 63%.

2. Phone interviews were conducted with all four of the Unitil participants enrolled in the demonstration and with a representative from Unitil's energy storage system installer.
3. Impact analysis was performed using whole-home, solar PV, and energy storage system telemetry data along with event participation data. Interval data was collected for all participating devices during the summer season. This was used to calculate the energy storage system dispatch during each called event and to assess the shape of the combined solar and battery output.

Application of Results: Retrospectively and Prospectively

A copy of the complete study can be found in Appendix 4D, Study 19-36.

[16] Survey population was the subset of devices confirmed as installed in either Massachusetts or Rhode Island that were accepted into the program prior to August 6, 2019 to ensure participants had sufficient experience with the program.

Study 19-37: 2019 Small and Medium Business Wi-Fi Thermostat Direct Load Control Demonstration Evaluation

Type of Study: Process Evaluation

Evaluation Conducted by: Navigant Consulting

Date Evaluation Completed: 3/30/2020

Study Objective and Summary of Results:

This evaluation assessed the experiences and program acceptance of participants in the 2019 small and medium business Wi-Fi thermostat direct load control demonstration to understand whether current design and implementation are suitable for this customer segment and whether participants will continue to participate going forward. The scalability of the demonstration was also assessed through general SMB customer population (non-participant) research aimed at understanding the size of the SMB population with Wi-Fi thermostats connected to cooling as well as willingness to participate in a cooling DR program. The initial evaluation scope of work included assessment of impacts and event participation for the SMB customer segment. However, ultimately, DR impacts and event participation were not evaluated in 2019 due to low enrollment by non-residential customers.

The study provides the following key findings:

Comfort and operational impacts to customers were limited in 2019. A majority of respondents recalled fewer than the actual number of events that occurred in 2019. Only four respondents felt less comfortable than usual during events. Ten of eleven respondents who were in the air-conditioned space during at least one event reported that the events had no impact on business operations. Only two respondents reported having ever opted out of events and did so infrequently.

All post-season survey respondents are very satisfied with their ConnectedSolutions experience. Survey respondents did not encounter any challenges during the enrollment process and were generally satisfied with event notification, and the length, timing, and frequency of events in 2019. All 13 post-season survey respondents are likely to continue with the program in future years.

There are fewer than 20 confirmed SMB participants within the ConnectedSolutions program of over 9,000 customers.[17] Through the post-enrollment and post-season survey efforts, Navigant confirmed there are 19 ConnectedSolutions participants with non-residential accounts enrolled; 11 only have non-residential accounts enrolled while eight have both non-residential and residential accounts enrolled in the program.

Bill savings is a perceived benefit of program participation. Nine of 15 SMB survey respondents believe program participation will lead to bill savings. This perception is one

[17] Including residential customers in Massachusetts and Connecticut.

of the biggest motivators for program participation among survey respondents. Although direct load control Wi-Fi thermostat programs can achieve energy savings on a program-level, the primary goal of the program is to achieve peak demand reductions. As a result, any given participant may or may not experience bill savings.

Penetration of Wi-Fi thermostats is low among SMB customers. Around 60% have cooling connected to some kind of thermostat(s). However, only 9% have a Wi-Fi thermostat.

An estimated 5,700 (4%) SMB customer-locations have 13,000 ACs connected to Wi-Fi thermostats and are open to participating in a DR program. 4% of the SMB population has an AC connected to a smart thermostat and is open to participating in cooling DR. Customers with Wi-Fi thermostats have an average of 2.3 AC units connected to thermostats.

Considerably more SMB customers are willing to participate in ConnectedSolutions but do not have the required technology. Apart from those with Wi-Fi thermostats, the remaining population of willing DR participants with (non-smart) thermostats represents an additional potential of approximately 33,000 (26%) customer-locations and 58,000 ACs (if conversion from non-Wi-Fi thermostats to Wi-Fi thermostats happens).

Many customers with Wi-Fi thermostats are unaware of ConnectedSolutions. Of survey respondents with Wi-Fi thermostats (24), only three were aware of the ConnectedSolutions program, indicating most respondents had not viewed or received marketing emails.

SMB customers are conscious energy users. A majority of SMB customers (80%) with thermostats connected to cooling are concerned about managing their energy use; 91% try to operate in ways that reduce energy all or some of the time. Those who report concern for managing energy use are more likely to participate in an AC load management program.

Customers with annual energy use between 8 MWh and 200 MWh are more likely to have cooling connected to thermostats and are more likely to have Wi-Fi thermostats than smaller and larger energy users.

Healthcare, institution, and retail customers are more likely to have cooling connected to thermostats than other business types. Healthcare customers are more willing to participate in DR than other segments.

Past energy efficiency program participation is not an indicator for willingness to participate in DR.

Core Initiatives or End Uses to which the Results of the Study Apply:

- Commercial & Industrial
- New Homes & Renovations
- HVAC
- Electric Only
- Small and Medium Business; Wi-Fi Thermostat-Based Direct Load Control

Evaluation Recommendations:

The following recommendations were made by the evaluators conducting this study.

Recommendation 1: Without taking additional steps to target Wi-Fi thermostat and DR program marketing specifically to the SMB customer population, an explicit Wi-Fi thermostat based non-residential demonstration/offering should not be a priority.

If growth of an explicit non-residential offering is desired, the following recommendation applies:

Recommendation 2: In DLC program marketing, emphasize the customer maintains control during events to alleviate concerns raised by some survey respondents in the General Population survey.

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

The PAs are considering all recommendations for adoption at this time. The PAs have not formally adopted or rejected any recommendations that require changes to program design and operations.

How the Study Affects Program Results and Its Significance:

The study finds that, without taking additional steps to target Wi-Fi thermostat and DR program marketing specifically to the SMB customer population, an explicit Wi-Fi thermostat based non-residential demonstration/offering should not be a priority.

Overview of Study Method:

Participant Enrollment Survey: To inform future program marketing efforts and potential adjustments to the enrollment process, the evaluation team developed, fielded, and analyzed online surveys of customers following enrollment in the program. The survey was used to gain insights into the effectiveness of program marketing and explore any challenges encountered by customers during the enrollment process.

Participant Post-Season Survey: The team also developed, fielded, and analyzed online surveys of participants at the end of the DR season to solicit feedback regarding actions taken during DR

events, customer acceptance of the technology and program offering, and likelihood to participate in the future.

SMB General Population Survey: To assess level of openness to participating in cooling DR as well as barriers to participation in a Wi-Fi thermostat-based program among the general population of nonparticipating SMB customers, the team conducted a survey of a representative sample of nonparticipating SMB customers (based on annual energy usage) using Eversource customer data. Using survey fielding and response results, Navigant conducted a segmentation analysis to develop rough estimates for potential program scalability. The analysis provides insight into the types and attributes of interested customers.

Application of Results: Prospectively

A copy of the complete study can be found in Appendix 4D, Study 19-37.

Study 19-38: Eversource Consolidated Year 2 Demand Demonstration Project Evaluation Report

Type of Study: Impact Evaluation and Process Evaluation

Evaluation Conducted by: Energy and Resource Solutions (ERS)

DNV GL

Date Evaluation Completed: 4/15/2020

Study Objective and Summary of Results:

This study evaluated six medium and large commercial/industrial demand demonstration projects. These demonstration projects were designed to test a variety of different technologies and dispatch approaches to reduce peak demand. Eversource contracted with vendors to test performance and market acceptance of different solutions. The vendors are using a variety of technologies (BMS controls, batteries, thermal energy storage, manual curtailment), controlling for different objectives (e.g. reducing annual system peak loads and customer monthly peak loads), and using different recruitment and financial strategies to enroll customers. The evaluation effort has spanned two years, covering the performance of the demonstration project in summers of 2018 and 2019 and the 2018/2019 winter season.

The evaluation scope includes both impact—measuring how much load reduction each vendor delivers—and process related elements including documenting customer recruitment, delivery, and satisfaction.

The evaluation resulted in the following key findings:

- **System peak hour reduction:** The evaluated demand reduction at the annual system peak hour (ICAP) (July 30, 2019, from 5- 6 p.m.) was 8,685 kW. The manual curtailment demonstration represented 91% of the system peak demand reduction and 38% of participating customers.

Evaluated	System Peak Reduction (kW)	Number of Customers
Manual Curtailment	7,914	16
Targeted Battery	108	2
BMS Controls 1	0	7
BMS Controls 2	0	1
Thermal Storage 1	86	8
Thermal Storage 2	**577**	**8**
Total	**8,685**	**42**

- **Event Performance:**
    - The evaluated impacts for the targeted battery and manual curtailment demonstrations met vendor reported impacts.
    - The software BMS control solutions did not provide a verifiable reduction of customer monthly peak loads and did not successfully reduce summer system peak loads. Both BMS control solutions appear to have opportunities for optimization that might reduce customer or system peak demand, and this demand reduction could be verified through a combination of engineering and load analysis in future seasons.
    - Thermal Storage 1 was successful in offsetting the rooftop unit ("RTU") cooling load during the dispatch window; however, a majority of the RTUs selected for control were oversized and underutilized, resulting in low demand reduction. While this does not reflect a lack of potential for this technology to reduce peak demand, it does mean DR for demonstration participants was lower than committed. This vendor did not revise predicted demand reductions based on actual summer performance.
    - Thermal Storage 2 was reliable and successful in shedding load during the dispatch window. The lower-than-reported demand reductions are entirely due to differences in the calculation methodology between the vendor and the evaluators. Vendor 2 used actual load data but used a calculation methodology that systematically overstated reductions.
- **Winter event performance:** The 2018-2019 winter season did not have any events triggered as intended (by locational marginal prices for electricity exceeding a preset threshold), so a winter test event was conducted for the manual curtailment and targeted battery solutions. Both solutions performed as expected during the test event.
- **Customer monthly peak impacts:** Some of the demonstration projects (targeted batteries, BMS Controls, and one of the thermal storage solutions) sought to reduce customer monthly peak loads. Vendor estimates of customer billed monthly peak demand impacts for targeted batteries and BMS Controls 1 have shortcomings that prevent them from accurately estimating these impacts. Thermal Storage 2 reduced customer billed monthly peak demand by 252.6 kW across all 8 customers.
- **Net energy impacts:** Some of the demonstration projects (one of the thermal storage solutions and targeted batteries) were expected to have either a positive or negative impact on overall energy used. Thermal Storage 2 resulted in energy savings of 126,420 kWh during the 2019 summer season. Targeted batteries resulted in a net energy increase of 2,520 kWh during the 2019 summer season at an average efficiency of 66.1%.
- **Recruiting.** A mix of recruiting approaches were employed for these projects, ranging from almost entirely vendor-driven to almost entirely account executive (AE)-driven. AE involvement was beneficial but not consistently available due to competing responsibilities, such as other programs and customer support during winter storms.

- **Customer Satisfaction:** Overall, customers participating with manual curtailment, targeted batteries, and thermal storage solutions were satisfied with the projects. The BMS Controls customers rated their project satisfaction at 3 out of 5, indicating that while they were not dissatisfied with the projects, there is room for improvement.
- **Storage technology education:** The energy storage (thermal and battery) market is nascent in Massachusetts and requires significant customer education. For thermal storage projects in particular, it was valuable to have a demonstration facility to show other customers.
- **Customer screening process:** The initial customer screening process was too lenient for the Thermal Storage solutions and BMS Controls solutions, leading to failed applications at the time of installation for the thermal storage vendors and to longer-than-anticipated installation processes for the BMS controls vendors.

Core Initiatives or End Uses to which the Results of the Study Apply:

- Commercial & Industrial
- Existing Building Retrofits
- Active Demand Reductions
- Electric Only

Evaluation Recommendations:

The following recommendations were made by the evaluators conducting this study.

1. Provide feedback to vendors with calculation shortcomings identified in these studies that would improve their demand reduction calculation methodologies for future projects.
2. Collect sufficient data to ensure project feasibility early in the participation process.
3. M&V plans should be vetted during project development to ensure that the performance metrics are quantifiable.
4. Require quantifiable and clear goals and performance metrics, and standardize reporting of DR strategies and delivered performance.
5. Either require that out-of-state vendors of nascent technologies have a local marketing representative or plan on longer ramp-up times.
6. Involve evaluators during DR feasibility testing to minimize customer touch points.

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

The PAs are considering all recommendations for adoption at this time. The PAs have not formally adopted or rejected any recommendations that require changes to program design and operations.

How the Study Affects Program Results and Its Significance:

The results in this consolidated report and the technology-specific evaluation reports provide the data necessary to enable cost effectiveness testing, facilitate continued demonstration project improvements, and inform the design of full-scale programs. Performance has varied by demonstration, including some where it could not be fully quantified.

Overview of Study Method:

For battery participants, impact was measured based on battery system-level charge and discharge data. For manual curtailment and BMS Controls 1 participants, the impact evaluation was based on account-level analysis of interval data of all available participants. Impacts were calculated against settlement baselines (e.g. ISO-NE adjusted "10-of-10") and regression baselines, depending on vendor goals. BMS Controls 2 did not have any significant claimed or evaluated demand reductions.

For both thermal storage solutions, impact evaluation was based on equipment-level power data and engineering calculations.

The process evaluation was based on review of marketing materials and in-depth phone interviews with PA program managers, vendor project managers, and pre- and post-installation surveys of participants.

Application of Results: The quantitative results should be applied retrospectively. A prospective realization rate is provided for manual curtailment.

A copy of the complete study can be found in Appendix D, Study 19-38.

Study 19-39: Residential Nonparticipant Customer Profile Study

Type of Study: Market Characterization or Assessment Evaluation

Evaluation Conducted by: DNV GL

Date Evaluation Completed: 2/28/2020

Study Objective and Summary of Results:

The purpose of the Residential Nonparticipant Customer Profile Study is to assess the relationship between rates of customer participation in Mass Save residential programs and certain customer characteristics, including income levels, home ownership status, and English language proficiency, as described in the October 19, 2018 term sheet.[18] The specific study objectives are to:

1. Quantify recent (2013-2017) levels of participation in PA programs for renters, moderate-income customers, and non-English-speaking customers
2. Quantify how various customer characteristics are associated with participation in Mass Save residential programs
3. Compare analytical results at the Census block group level and at the individual customer level to address the possibility of ecological fallacy[19] when using block group-level variables
4. Establish a baseline level of participation that can be used to assess the effectiveness of PA efforts to increase outreach to non-participants

The study provides the following key findings:

- Location participation rates for 2013-2017 are negatively associated with the percentage of moderate-income households, renter households, and limited English-speaking households.
- An analysis of participation measured as the ratio of 2013-2017 savings to consumption provides evidence that the PAs have had some success in getting low-income and multifamily locations to participate. In particular, 2013-2017 savings/consumption metric is positively correlated with the concentration of low-income customers and customers living in multifamily buildings at the block group level. Additional analysis revealed that savings from the low-income multifamily programs account for these positive correlations.
- Location participation for 2013-2017 is negatively correlated with the following characteristics: concentrations of low income and homes built before 1950. Location

[18] http://ma-eeac.org/wordpress/wp-content/uploads/Term-Sheet-10-19-18-Final.pdf

[19] Ecological fallacy occurs when one makes conclusions about an individual based on group-level variables.

participation for 2013-2017 positively correlated with average or higher income and post-1950 construction.

- Most of the variables investigated are correlated with each other, especially in the Census block group data.
- Populations of renters, moderate-income customers, and customers with limited English proficiency are geographically clustered in urban areas.
- Limited English speakers are more likely to rent, and renters are less likely to participate.
- The effects of the examined variables on participation are similar in both electric and gas markets.
- Analysis conducted at the level of individual customers is largely consistent with analysis conducted at the level of Census block groups.
- The study provides tools that may be helpful to target program offerings, including maps that show concentrations of populations of interest and bivariate maps that show areas with low past participation overlaid with high concentrations of certain populations of interest. The study also provides a metric that identifies towns with relatively low historic participation and high concentration of populations of interest; this metric was provided to help assess municipal applications to the Mass Save Municipal and Community Partnership Strategy.

Core Initiatives or End Uses to which the Results of the Study Apply:

- Residential & Income-Eligible
- All Initiatives
- All End Uses
- Electric & Gas
- Excludes savings from upstream, behavioral and delivered fuel projects.

Evaluation Recommendations:

The following recommendations were made by the evaluators conducting this study.

Recommendation 1: Continue working closely with the Low-Income Energy Affordability Network (LEAN) to incorporate their extensive data resources into this analysis.

Recommendation 2: Future analyses of the types of questions examined in this study should utilize more readily accessible Census block-group-level data from the American Community Survey (ACS). Future analyses should remain aware of the strengths and limitations of each way of measuring participation, and carefully choose which definition to use in each analysis based on the conceptual question being asked.

Recommendation 3: All PAs tracking participation at the individual unit level would increase the accuracy of evaluation results for multifamily buildings. For implementers, knowing at a finer granularity what they did in a building would help identify opportunities to revisit buildings that participated in the past.

Recommendation 4: The PAs should continue to share program successes and setbacks with each other so that electric and gas implementers continue to learn from each other's experiences.

Recommendation 5: The PAs should use the metric provided for the Mass Save Municipal and Community Partnership Strategy as the baseline for assessing the effectiveness of future PA efforts to address the term sheet populations. In general, examine multiyear trends rather than focusing on singular years.

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

The PAs are considering all recommendations for adoption at this time. The PAs have not formally adopted or rejected any recommendations that require changes to program design and operations.

How the Study Affects Program Results and Its Significance:

This study provides insights and tools to help programs identify which groups of residential customers have historically participated in Mass Save at lower rates to assist in future program targeting. In addition, the study provides a foundational analysis of participation patterns that informed subsequent research that explored barriers to participation for residential customers with historically lower participation rates.

Overview of Study Method:

DNV GL conducted the following tasks:

1. **Define participation.** The analysis identified four different metrics of participation: Location participation, Consumption-weighted location participation, Account participation, and Savings/consumption.
2. **Prepare data.** These analyses utilized three different data sets to analyse patterns of participation: block group data, individual-level data, and enhanced individual-level data.

   The block group data combined program participation records with ACS variables covering additional income categories, construction date, heating fuel type, and urban/rural status.

   The study also prepared a list of program participants and non-participants from 2013 – 2017. The evaluation team developed a methodology to identify which customers were likely renters based on the number of calculated renter flag.
3. **Conduct block group-level analyses.** These analyses included correlations and ordinary least squares ("OLS") regression models. Dependent variables for these models were location participation rate and the ratio of savings to consumption (savings/consumption);

independent variables were proportions of households in block groups with certain characteristics such as moderate income. The independent variables were based on ACS data.

4. **Conduct individual-level analyses.** These analyses were parallel to the block group-level analyses but used individual-level data. The dependent variables for these models were account participation and savings/consumption. Independent variables were individual-level variables reflecting demographic characteristics available statewide through sources such as the Tax Assessor data (multifamily, year of construction) and additional data on income and language from Experian (available only for Eversource).

The analysis conducted in this study contains similar analyses to that in the 2013-2017 Residential Customer Profile Study report. When discrepancies were found, the evaluators conducted extra analysis to resolve the differences.

Application of Results: Prospectively

A copy of the complete study can be found in Appendix 4D, Study 19-39.

Study 19-40: C&I Customer Profile Study Dashboard Project

Type of Study: Market Characterization or Assessment Evaluation

Evaluation Conducted by: DNV GL

Date Evaluation Completed: 12/20/2019

Study Objective and Summary of Results:

The annual Customer Profile Studies provide analysis summaries of the energy efficiency program tracking and billed usage data for all gas and electric customers served by the Massachusetts Program Administrators (PAs) to characterize the Massachusetts energy efficiency market. Over the years, the traditional "paper" Customer Profile Study reports have expanded in scope and length to include hundreds of report pages, along with volumes of supplemental Excel Workbooks of charts, tables, and geographic outputs.

The purpose of this study was to transition C&I Customer Profile Study ("CCPS") reporting from the MS Word and MS Excel format to a web-based platform with dashboard functionality hosted on DNV GL's Veracity data platform. The dashboard presents data visualizations and data extracts previously available via the CCPS reports in a transparent and easy-to-use format while maintaining existing customer confidentiality rules. This project increased data accessibility and shortened the time frame between DNV GL's receipt of PA data and public availability of summary reports.

The C&I Customer Profile Study Dashboard is now publicly available via the Mass Save Data website.[20] There is also an interactive version of the C&I Customer Profile Study Dashboard User Guide available via the dashboard.

Core Initiatives or End Uses to which the Results of the Study Apply:

- Commercial & Industrial
- All Initiatives
- All End Uses
- Electric & Gas

Evaluation Recommendations:

No formal recommendations were made in this evaluation.

[20] https://www.masssavedata.com/Public/CICustomerProfileDashboard

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

N/A (no formal recommendations were made in this evaluation)

How the Study Affects Program Results and Its Significance:

The dashboard facilitates accessibility of statewide C&I participation, savings and usage data allowing interested stakeholders to:

- Accurately quantify and report on trends and time series evolution in the Massachusetts C&I customer population and program participation; and
- Provide access to summary data and enable exporting to Excel.

The platform also allows the PAs to evaluate how their standardized data compares to other PAs' standardized data, and compares to the state as a whole, while always maintaining PAs' customer and IT system confidentiality.

Overview of Study Method:

DNV GL worked closely with the PAs and EEAC Consultants to develop a user-friendly web-based dashboard tool that provides users with access to the data prepared for the 2017 Commercial & Industrial Customer Profile Study (2017 CCPS). The dashboards allow users to:

- View data by category (e.g., fuel, end use, industry segment, etc.);
- Filter data on selected variables (e.g., program year, city, upstream sales, etc.);
- View data at increasingly granular levels (e.g., broad end use to specific end use to measure); and
- Export data from any screen to an Excel file.

The primary steps in the development included:

1. Transfer and verifying of historical data (2011-2017) to new data warehouse to facilitate connection of PAs' data to the dashboard.
2. Development of semantic model to program most of the analytics in the existing CCPS.
3. Development of dashboard front-end to present data visualizations and data extracts currently available via paper reports.
4. Comparison of the results in the dashboard to those in the final 2017 CCPS as part of the quality control review.

Throughout the development process PA and EEAC stakeholders were provided secure access to the Veracity application and provided feedback on the layout, functionality, and implementation of new ideas. DNV GL provided updated versions of the dashboard and facilitated stakeholder review as part of the on-going agile process.

Additionally, DNV GL developed a user guide to accompany the C&I Customer Profile Dashboard. The user guide had two main objectives:

1. Provide users who are new to Power BI with a primer on how to use the basic functionality.
2. Show users how to navigate and locate information on the MA C&I Customer Profile dashboard.

Application of Results: Prospectively

A copy of the complete study can be found in Appendix 4D, Study 19-40.

APPENDIX 4

Statewide Evaluation Studies Summary

D. Evaluation Studies

Please see Statewide Appendix 4D: Evaluation Studies, filed under separate cover.

APPENDIX 5
PERFORMANCE INCENTIVES

The purpose of this section is to provide detailed supporting documentation on performance incentives that each Program Administrator proposes to collect. The Compact is a municipal aggregator and public entity that does not collect any performance incentives. As such, this section is not applicable to the Compact.

APPENDIX 6
2019 MISCELLANEOUS IMPLEMENTATION UPDATE

A. Minimizing Administrative Costs

Prior to the 2019-2021 Three-Year Energy Efficiency Plan, the Program Administrators worked with a third-party vendor to study best practices for minimizing administrative costs. The Best Practices for Minimizing Program Planning and Administrative Costs ("PP&A") for the Massachusetts Utilities and Energy Efficiency Services Providers report was finalized on October 25, 2018 ("PP&A Report") and was provided to the Department. The PP&A Report: (1) identified best practices, both in Massachusetts and nationwide, for tracking and assessing administrative costs; (2) identified potential benchmarks, metrics, and/or indicators for measuring administrative costs; and (3) provided specific recommendations, as appropriate, for reducing administrative costs. To continue to minimize administrative costs, the PP&A Report made the following overall recommendations: (1) Continue to Focus on Ways to Improve Consistency in Accounting Practices; (2) Formalize and Seek to Streamline Further the Reporting and Data Request Process; (3) Follow Cost Accounting Best Practices in Allocation, Tracking and Control; (4) Seek New Ways to Minimize the Regulatory / Collaboration / Facilitation/ Reporting and Ad hoc Requests Burden Without Compromising Goal Obtainment; and (5) Implement an Annual Process to Stress-Test Status Quo Processes and Spending. Consistent with the Department's directives in the 2019-2021 Plan Order, below is a summary of how the Program Administrator's adopted recommendations from the Report.

The Program Administrators have reviewed accounting practices and have determined that they are consistent. PAs allocate costs based on budgets, assigning the same percentage of an allocated cost to an initiative as the percentage of the sector or portfolio budget (as appropriate) planned for that initiative. The manner of allocation is the same among PAs, even though the actual percentages necessarily differ based on the spending needs for each initiative in each service area.

The PAs have sought to formalize and streamline data reporting requests in 2019-2021 through the Key Performance Indicators ("KPIs") and other data points described in the Term Sheet. As set forth in the Term Sheet, the PAs agreed to provide up to six KPIs quarterly in the quarterly reports. This practice is intended to create regular, known reporting obligations and reduce ad hoc requests. PAs continue to receive requests regularly from many parties, including at the management committees and EEAC meetings, which can increase administrative costs. As the study recommends, PAs look to find ways to balance what is essential and valuable from what is excessive and/or non-critical. PAs are working to raise awareness with all parties that every data request, meeting, committee, and point of contact results in additional administrative costs. PAs will continue to work with stakeholders on finding the right balance of providing information, utilizing existing information, and understanding the purpose of a data request in order to seek to minimize administrative costs where possible.

In order to use best practices for cost allocation, tracking, and control, PAs have an internal working group to review costs. PAs regularly communicate to ensure that costs are allocated in accordance with a common methodology and are allocated consistently. PAs maintain spreadsheets documenting cost allocation decisions. Each PA has specific employees dedicated to reviewing costs. PAs have not sought to establish targets for cost reduction, as spending is related to program implementation, but are continuing to review costs (e.g., sponsorships and subscriptions) to ensure that they provide a direct energy efficiency benefit, and to collaborate to reduce costs (e.g., statewide vendor procurement).

While PAs continuously review spending and possible efficiencies, the study recommends an annual stress test. The PAs review spending at the time of the Term Report/Plan-Year Report. The PAs performed a detailed review of 2016-2018 costs in connection with the preparation of the 2016-2018 Term Reports, and have reviewed spending again in detail in connection with this 2019 Plan-Year Report. As discussed above, one of the largest unforeseeable drivers of administrative costs continues to be Council requests for additional data tracking, information, and reporting. As shown by comparing the 2015 and 2020 EEAC's Priorities, the amount of information requested by the Council has increased exponentially in the last few years. The 2015 Council Priorities was a one page document that highlighted five specific items for the Council to undertake. The 2020 Council Priorities, however, are four pages and contain dozens of new data and information requests to be included in quarterly reports. The Program Administrators have provided comments to the Council regarding the significant administrative costs associated with the requests. DOER and the Program Administrators continue to discuss these issues and how to prioritize these types of requests. Additionally, PAs continuously work on reviewing committees, program design efficiencies, and third-party administrative costs through management committees and other groups.

B. MMBtu Study Update

In the 2019-2021 Three-Year Plans Order, the Department requested that the Program Administrators refine the method used to calculate the all fuels MMBtu savings metric. Specifically, the Department found that (1) electricity used on-site, but generated offsite, contains embedded energy with heat values from a mix of fuels that generate the electricity; however, the Program Administrators failed to consider this embedded energy during the unit conversion; and (2) the energy savings for combined heat and power plants inappropriately mixed heat values with GHG emission rates. 2019-2021 Three-Year Plans Order, at 156-157. The Department directed the Program Administrators to further study and propose a more refined method to account for the conversion of electric savings to MMBtu savings. Id.

Consistent with the Department's directives, the Program Administrators completed a study to identify an appropriate methodology to calculate energy savings. The study is enclosed as Appendix 7. The MMBtu savings included in this report are calculated consistent with the findings in the study. The study includes emission factors and conversion factors. The conversion factors have been included in each Program Administrator's benefit-cost models (Appendix 2). The

Program Administrators continue to use the emission factors provided by the Department of Environmental Protection consistent with the Plan.

All Program Administrators will continue providing MMBtu savings using this study for 2019-2021 term reporting. As technologies, areas of emphasis, and delivery models evolve for energy efficiency plans, the PAs will continue to ensure they provide appropriate, meaningful measurements of success for programs in future plans.

C. Participation Barrier Update

In the 2019–2021 Three-Year Plans Order, the Department requested that the Program Administrators provide an update on the implementation of Plan enhancements that are designed to address residential and C&I sector barriers. The 2019-2021 Plan is a comprehensive plan designed to encourage participation and deliver cost-effective services. Since participation is voluntary, all elements of the programs are designed to remove barriers and attract participation among those who have not adopted energy efficient measures and behaviors. Below is an update on select enhancements.

Residential Coordinated Delivery

The Program Administrators' 2019-2021 Residential Plan builds on our history of successful innovation. The program design represents a realignment of the residential portfolio. This realignment, along with multiple enhancements and innovations, is intended to meet the challenge posed by the decline of residential lighting savings by increasing participation across all customer segments, driving broader penetration of energy efficiency and demand reduction to new participants, and securing deeper savings from existing program participants. The new Residential Coordinated Delivery initiative represents one of the significant enhancements in the 2019-2021 that improves customer experience and participation.

Residential Coordinated Delivery facilitates comprehensive weatherization and home energy efficiency upgrades in existing homes in order to reduce whole-home energy consumption. The initiative provides access to the information, technical support services, and implementation contractors who can assist customers from the identification of cost-effective energy efficiency opportunities through final implementation of energy-efficient measures. The Residential Coordinated Delivery initiative is fuel blind, providing incentives and services to customers regardless of their primary heating fuel.

The goal of this initiative is to deliver a seamless experience and maximum energy savings to every customer, regardless of unit type or ownership structure. By focusing the delivery of services on building science, opportunity, customer choice, and what each customer has the authority to implement, the new design aims to put customers in control of their energy future and reduce the number of customer confusion points along the way. Focusing on clear, uncomplicated participation pathways will result in a more equitable distribution of benefits by making it easier for all customers to engage in our programs

Since approval of the 2019-2021 Plan, the Program Administrators have been working diligently towards the enhancements outlined in the Plan. While some of these changes are relatively straightforward and can be implemented quickly, others are more challenging, requiring changes that affect all components of program delivery, including database structure, vendor contracts, processes, and customer messaging. Some of the most sensitive work that the PAs are tackling include how to best shift from promoting the in-person home energy assessment as the best first step for all customers to focusing on connecting customers to the next best action based on their specific needs and context. Of course, the Program Administrators must continue to work towards the filed ambitious goals while making some of the above changes. This adds to the challenges, as PAs must ensure they continue to operate the programs, minimize disruption and uncertainty for the network of contractors that PAs rely on to help deliver savings, and maintain confidence and engagement with customers, all while planning for and implementing change. As such, during 2019, the Program Administrators implemented several incremental changes, including new rebates, energy savings packages, and tweaks to program roles and testing hypotheses, while preparing for larger changes in 2020.

A key step in implementation of the Plan is coordination between the PAs and vendors directly responsible for delivering services to customers. In May 2019, the PAs convened a two-day meeting including lead vendors and PA staff from all market rate residential programs to further progress towards implementing Plan enhancements. A key focus was the reduction of administrative, customer-facing barriers between programs. Achieving this requires greater coordination between different PA staff and vendors. For example, discussions at the meeting included how to ensure that customers are directed either to the Renovations and Additions or Residential Coordinated Delivery paths, and, more importantly, how a customer might benefit from both paths in certain circumstances.

The PAs have also devoted substantial time and resources to modifications to program delivery for customers in multi-family properties. Serving customers on these properties is inherently more complex. The PAs and their vendors continue to advance plans for improving service to multi-family properties, with an eye towards aligning services to the opportunities in a building and the preferences and decision-making authority of the customers. The PAs have worked with their vendors to map out paths for customers based on these and other characteristics. Some steps the PAs have taken to improve multi-family services include granting greater access to more building types to more vendors, providing energy savings packages, and modifying intake and engagement approaches.

During the first quarter of 2019, the Program Administrators introduced a new savings opportunity for customers who participate in online energy assessments. Through this offer, customers, who may not be good candidates for an in-home energy assessment, are able to receive a no-cost tailored package of energy saving measures, including LED bulbs, thermostats, smart strips, and water saving devices. The first phase was focused on customers using the online assessment. The PAs are monitoring this offering to determine whether refinements to this approach to designing and delivering packages as necessary. Also, the PAs are developing a process to enable Lead

Vendors and Home Performance Contractors to order energy savings packages on behalf of customers contacting them who are not good candidates for an in-home assessment.

The Program Administrators also continue to make progress on the customer intake process. The PAs engaged with and received recommendations from a consultant working specifically in the design and implementation of world-class interactive voice response systems. As discussed above, a key challenge and goal of the Plan is to better use data to determine whether an in-person visit is the most appropriate next step for customers looking for services. While this is a complex issue for single-family buildings, the complexity increases significantly when looking at larger buildings and facilities. The PAs and vendors are looking at how to use data, sensible program rules and processes, and good customer communication to address this challenge.

As part of modifying the in-take process, the PAs delved more deeply into how changes to the program would affect marketing messaging and the content of program materials. For instance, many of the design changes being made focus on customer opportunity, authority, and interest, and the traditional in-person home energy assessment may not be the best first step for all customers. As a result, it is critical to ensure that marketing materials indicate that there are program on-ramps outside of an in-person home energy assessment. Previously, program collateral made sharp distinctions between the Home Energy Services and Multi-family core initiatives in customer-facing collateral. Now, program materials will reflect the Residential Coordinated Delivery program design and delivery that is based on opportunity, and not the former 1-4 vs. 5+ unit building distinction.

The Program Administrators presented additional details on planned changes to the Residential Coordinated Delivery initiative during the September 18, 2019 EEAC meeting.

C&I Enhancements

Equipment and Systems Performance Optimization

In the 2019-2021 Plan, the Program Administrators committed to several strategic program enhancements including providing customers with expanded paths to HVAC Optimization, particularly Retro-commissioning ("RCx") and Operations and Maintenance ("O&M") opportunities. Consistent with this commitment, the Program Administrators have completed a broad redesign of this statewide offering, which is now known as Equipment and Systems Performance Optimization ("ESPO"). The Program Administrators performed a deep review of historic utilization of the pay-for-performance model in relation to RCx as well as completed extensive research on best practices and comparable programs that exist throughout the country. ESPO features greater optionality for customers based on both size and scope of energy savings opportunity, customer-specific resource needs and customer preference for engagement. ESPO has four pathways available to customers, shown below.

A particularly innovative component of the ESPO offering is the Low Cost Tuning Measures pathway, the goal of which is to provide a simplified approach to non-capital intensive measures that are common, are relatively easy to calculate savings from and reasonably easy to implement, and which can therefore be captured through a prescriptive-like approach. That is, a customer can pick from a predefined list of measures, provide a handful of site-specific inputs and receive an incentive that is transparent and tied to the actions the customer chooses to take. This measure list both simplifies and educates customers on savings opportunities that can be considered "no brainers" from an energy efficiency professional's perspective. The Program Administrators are attempting to disseminate and have the customer benefit from accumulated institutional knowledge. Additionally, statewide custom express tools have been created for each measure to ease the administrative burden related to program engagement, hopefully improving the customer experience. The PAs have continued to focus considerable resources on furthering the adoption of high efficiency lighting and HVAC equipment and associated controls, including making available training and education opportunities. Other ESPO highlights include improved pre-implementation resource offerings and revised incentive levels.

Strategic Energy Management

National Grid is leading the statewide implementation of the Continuous Energy Improvement (also known as Strategic Energy Management or "SEM") demonstration effort with Cascade Energy. Cascade has recruited a mixed cohort of wastewater and industrial sites from a targeted list based on electric and gas consumption, participation in energy efficiency programs, staff bandwidth, and corporate commitment, particularly those with industrial and process loads.

The cohort kicked off in the spring of 2019 with initial workshops focused on establishing energy teams and identifying strategies for saving energy. Over the summer, the participants convened internal energy teams and Cascade staff conducted site visits. Additionally, Cascade facilitated "treasure hunts" in which they and facility staff, as well as other cohort participants, conducted walk-throughs of sites and identified instances where energy waste is occurring, either from old,

outdated, or poorly-functioning equipment, or through operational practices. They also began gathering data and building regression models to identify the factors within the facility that drive energy consumption. Another workshop on tracking energy savings was held in October and during the third and fourth quarters, the sites continued to identify and log energy saving interventions and participated in frequent coaching calls with Cascade staff. The initiative will continue into 2020 and the expectation is that savings will be claimed in late spring or early summer.

Kitchen Measures

During 2019, the Program Administrators began using the Food Service Technology Center ("FSTC") methodology as the basis for their upstream point of sale food service offerings and associated savings assumptions. This switch from ENERGY STAR to FSTC, guided by support from the PAs' internal engineering and evaluation teams, provides several improvements and benefits including:

1. The FSTC methodology utilizes standard test methods from the American Society of Testing and Materials ("ASTM") to provide unbiased third-party energy efficiency test results for commercial food service equipment.
2. FSTC is the primary data source for ENERGY STAR. They have also contracted with the state of California for several years to create commercial food service technical work papers and update commercial foodservice qualified products lists.
3. FSTC updates the equipment specifications used for baseline and measure efficiency more frequently than Energy Star. FSTC typically updates their qualified product list ("QPL") monthly while ENERGY STAR does not have a regular update schedule for their QPLs and some of their equipment specifications have not been updated in years.
4. FSTC utilizes measure specific savings assumptions that more accurately reflect the high efficiency equipment installed through energy efficiency programs.
5. FSTC baseline assumptions more accurately reflect the baseline equipment available on the market.

Additionally, the Program Administrators added several refrigeration and freezer measures to their portfolio of commercial food service offerings, providing more tailored measures to meet customers' needs.

Advanced Lighting and Controls Trainings

With the considerable advancement of lighting technology and controls in recent years, additional opportunities beyond daylight harvesting and occupancy controls are now available to provide even greater efficiency of LED lighting systems. During the 2019-2021, advanced lighting controls are an area of focus. Specifically, the Program Administrators have undertaken a number of education and training approaches, in collaboration with manufacturers, distributors, lighting designers, and installers/contractors to promote proper specification, installation and operation of

modern lighting systems to maximize energy savings. Influencing these early design decisions can fundamentally shape the energy costs of a building for its entire lifecycle. For many participants, the greatest value of the New Buildings and Major Renovations initiative is the access to expert, unbiased technical assistance provided by Program Administrators and the network of technical experts that is made available through the program.

The Program Administrators have hosted several training sessions on Advanced Lighting Controls for both union and non-union installers, designers, and engineers. The PAs have also been working with Design Lights Consortium and others developing online training for those unable to attend in-person trainings. The Program Administrators have been proactive about standardizing, streamlining the requirements and promoting training for customers, designers, engineers and building operators to complement the installation of these advanced systems. The trainings support optimizing and right-sizing of systems and provide critical tools for maximizing realized savings through understanding of proper system operation and management. These trainings will also help influence the types of operator behavior change required to ensure buildings operate as designed once completed and occupied.

Renters, Moderate Income, and Limited English Proficient Customers

The Program Administrators continue to evaluate opportunities to serve all customers more effectively. As discussed above, the Program Administrators recognize that customers have different opportunities, needs, priorities, and barriers. Expecting the same services through the same pathways for all customers is not realistic, nor does it recognize the diversity amongst the customers (even among customers in similar sub-segments). In-home coordinated delivery works best for some customers but not all. Some customers may be better served through upstream, retail rebates, online or other service pathways (even if they are not aware of their participation). In order to pursue all cost effective energy efficiency, the Program Administrators' 2019-2021 Plan is designed to provide multiple pathways that meet an individual customer's needs.

The Program Administrators continue to study participation rates of different customer segments and barriers to participation. Recent non-participant studies have found that between 2013 and 2017, renters, moderate income, and limited English-speaking households participated in certain Mass Save® programs at lower rates than other households. The differences in participation were largest between renters and homeowners. A survey of customers found that 30% of renters had participated in Mass Save programs, compared to 40% of homeowners. These studies, as well as prior studies, identify several barriers to participation. A significant finding of the studies is that non-participants are harder to reach, even when evaluators made substantial efforts to engage non-participants using financial incentives, multiple methods of outreach (e.g., web, phone, mail, door to door), and multiple languages. Specific barriers to participation include: lack of trust in government and landlords; fear of scams; other priorities such as meeting fundamental needs for food and shelter; perception that energy efficiency is not relevant or applicable to them; belief that Mass Save is a government program which deters participation; and need more information about how programs would benefit them. Several of the enhancements in the 2019-2021 seek to address these barriers, in particular the residential program redesign discussed above. The Program

Administrators are continuing to review the studies' findings and will continue to look at opportunities to address barriers to participation.

As noted above, in 2019, the Program Administrators have adopted several enhancements, in addition to significant program realignments, to provide pathways for all customers. Below is a summary of those enhancements for renters, moderate income, and limited English proficient customers.

For renters, the Program Administrators worked with vendors to realize changes proposed in the Plan. In-person renter visits that do not lead to larger measures can be a burden to renters, and, for some, staying at home for an assessment may not be a viable option. The introduction of customized energy packages has enabled the PAs to reach renters in a new way, addressing opportunities that renters do have control over (such as lighting and water saving measures), while working with the appropriate party to pursue larger opportunities in the building that renters may not have the authority to pursue major measures. The decision to encourage customized energy packages is informed by data pertaining to past program participation, building type, and the customer's preference. For example, a renter in a large apartment building that has already benefited from improvements to common-area measures may be a good candidate for an energy savings package, while a renter in a smaller, older building that is likely to have a weatherization opportunity is likely a better candidate for an in-home visit. Additionally, the PA efforts discussed above in regard to serving larger buildings is of critical importance to serving renters. The PAs are committed to recruiting landlords to participate in program offerings, and are expanding tiered incentives to encourage participation by more units within a building, which is likely to benefit renters. During the fourth quarter of 2019, the PAs discussed co-hosting sessions with landlord groups within Massachusetts to gather feedback from landlords about additional modifications the PAs may consider to better serve landlords and renters. The PAs and vendors have also revisited the customer journey for renters to take advantage of this new opportunity to serve them and in the context of other changes, such as changes in the types of buildings that Home Performance Contractors are allowed to serve.

Based on an evaluation of the moderate income market, in the 2019-2021 Plan the Program Administrators modified their approach to encouraging moderate income customer participation. The study found that "time and availability, perception of their need for energy efficiency, and the need for more information are the greatest barriers to participation in the Moderate Income offering."[2] To address these barriers and serve all customers, including moderate income customers, the Program Administrators focused the residential program redesign on simplifying communications and providing seamless, uncomplicated pathways to mitigate structural barriers. The program also began providing no-cost weatherization for moderate income customers. The

[2] 2018 Moderate Income Market Characterization Survey, Finding 7, at 7 http://ma-eeac.org/wordpress/wp-content/uploads/Moderate-Income-Market-Characterization-Report-Final-16Mar2018.pdf.

PAs also continue to look for ways to ensure that moderate income customers are aware of and can take advantage of the no-cost insulation for which they are eligible.

During 2019, the Program Administrators promoted the moderate income offerings in emails to all energy assessment recipients, and improved income screening documents, as well as examining the income verification processes and considering new partners that may be interacting with moderate income customers who may benefit from the moderate income weatherization incentive and can assist those customers in moving forward with income verification and energy efficiency. Additionally, the Program Administrators, vendors and LEAN continue to meet to ensure coordination between market rate and income eligible programs as planned changes on the market rate side are rolled out. Because customers can fluctuate between income eligible and moderate income status, and because moderate income customers may be co-located in buildings occupied predominantly by income eligible customers, this coordination is critical to serving both income eligible and market rate customers. Further, the PAs and LEAN have begun to implement a mixed-income protocol (a streamlined process for serving buildings with more than 0% and less than 50% income-eligible customers) and are looking at ways to continue to improve this process and expand its use.

Following the completion of the moderate income demonstration (commenced during the 2016-2018 term), LEAN raised a concern about the ability of moderate income households to afford new heating systems. The PAs and LEAN have discussed two continued challenges with increasing incentives for heating equipment for moderate income customers: (1) market rate programs (which serve moderate income customers) do not have multiple funding sources for heating system replacements like the income-eligible programs do, and (2) total resource costs for heating system replacements do not equal what a customer would pay out of pocket for the replacement of a system, limiting the level of incentive that the PAs could provide. The PAs and LEAN will continue to discuss how best to address some of these challenges.

For limited English proficient customers, the Program Administrators have sought to optimize the customer journey for customers by providing more consistent language services via the Mass Save phone line and in follow-up communications for those customers who communicated that English is not a primary language. The Program Administrators have translated the Mass Save website into the most common languages spoken across the Commonwealth, including English, Spanish and Portuguese. Further improvements will expand the statewide Mass Save phone line to five different language options (English, Spanish, Portuguese, Russian, and Mandarin). Income-eligible flyers are translated into English, Spanish, Portuguese, Cape Verdean Creole, Chinese (traditional and simplified), Haitian Creole, Vietnamese, Russian, Arabic, Khmer, Turkish, Hindi, Urdu, and Somali.

The Program Administrators also worked with outside vendors to benchmark current services to limited English proficient households and to see how best practices across various industries could inform improvements. While appropriate language services are available to customers in most interactions, the Program Administrators are looking for ways to provide greater consistency and fluidity as non-English speaking customers transition between different vendors and aspects of the

programs. One key question the PAs are seeking to understand is the extent to which language serves as primarily a communication barrier (i.e., customers don't participate because they don't have the language support needed to navigate available programs) or a trust barrier (i.e., customers don't participate because they perceive that programs are only intended for English-speakers and are not responsive to their own needs). The Program Administrators are reviewing the findings to identify ways to improve service to limited English proficient customers.

Municipal and Community Partnership Strategy

During 2019, the Program Administrators began implementing the proposed Municipal and Community Partnership strategy, as outlined in the Plan. The PAs engaged with a number of stakeholders to develop an implementation plan, including over 40 municipalities and stakeholder organizations, the Metropolitan Area Planning Council ("MAPC"), the Massachusetts Association of Regional Planning Agencies ("MARPA"), MassCEC, and the EEAC consultants. After a competitive application process in November 2019, the PAs selected seven municipalities to participate in the 2020 Municipal Partnership based on the quality of their applications and action plans for their communities to reach hard to reach customers. The seven municipalities selected include: Chelsea, Framingham, Lancaster, Lawrence, Methuen, New Bedford, and Pittsfield. The PAs held a kick-off event on December 10, 2019 that was attended by all of the municipalities, their volunteer teams, LEAN, and the PAs. At the kick-off event the participants learned more about the structure of RCD, Small Business Turnkey, and Income Eligible programs, reviewed the goals of the Municipal Partnership, reviewed roles and expectations, and discussed marketing and outreach strategies. The PAs held one-on-one meetings with each municipality and will host monthly conference calls for the participants during 2020.

Non-Profit Partnership Strategy

During 2019, the Program Administrators began collaborating with PowerOptions consistent with the Order for the 2019-2021 Plan to examine opportunities to enhance outreach to non-profit customers. The PAs and PowerOptions have discussed the overlaps of customers, services, and segments and identified areas of collaboration. The PAs and PowerOptions jointly identified two discrete sub-segments of the expansive nonprofit segment that we can target together for a tailored marketing approach that complements existing efforts. The PAs and PowerOptions have been jointly developing specific marketing messages and held additional discussions regarding a tailored marketing approach that complements existing efforts. Marketing materials and process mechanics are still being finalized.

D. Additional Data Requests

Below is a table showing additional data related to renters, income level, and language.

Renters

Reporting Category	Number of Renters/Units
Residential Coordinated Delivery	254
Innovation - Tailored Energy Savings Packages	-
Income Eligible Coordinated Delivery	1,202
Total	**1,456**

Reporting Category	Number of Rental Units	Number of C&I Accounts
C&I, Residential End Use	58	3

Income Level (Renters Only)

Income Designation	Number of Renters/Units
Market Rate	247
Moderate Income Qualified and Received Weatherization*	6
Income Eligible	1,202
Total	**1,455**

*The moderate income participants include customers who voluntarily income qualified and are served through the market rate program.

Mass Save Language Data (All PAs)

Language	Mass Save Hotline Language Selection	MassSave.com Page Views
English	137,156	5,154,923
Mandarin	158	
Portuguese	313	9,603
Russian	212	
Spanish	2,900	44,195
Total	**140,739**	**5,208,721**

E. Residential Conservation Services Scorecards Update

During 2019, the Program Administrators worked closely with vendors and DOER to determine a pathway to integrate Home Energy Scorecards into home energy assessments. Home energy scorecards are intended to be an educational component of the home energy assessments, with no

requirement for disclosure as part of a real estate transaction, as emphasized by DOER in its Reply Brief in the 2019-2021 Plan.

In Q1 2019, the parties began working with the Department of Energy ("DOE"), to discuss using the Department of Energy's Home Energy Score as the methodology underlying the scorecards. DOE has a number of requirements, associated with specific data fields to collect, quality control, and training requirements, which the PAs, vendors, DOER, and DOE discussed extensively. The PAs used the outcomes of these discussions to work with vendors to estimate costs for implementing the scorecards, including software set up and maintenance, training, incremental quality control, incremental time at the home energy assessment, providing updated scores after upgrades are made, and other requirements. Initial estimates would have added considerable expense to RCS budgets, very likely triggering the need for a mid-term modification. For this reason, the PAs and DOER began discussing alternative approaches that might be able to achieve the same goals with lower costs. The Program Administrators also reviewed studies on similar scorecard programs in other states, including Connecticut. Ultimately, DOER did not approve of the alternative approaches proposed by the Program Administrators. A primary concern was DOER's desire for a uniform scorecard methodology across the state, including in municipal light plant territories.

After further discussions with DOER, the PAs and DOER have agreed to a staggered roll out of scorecards using DOE's Home Energy Score. Currently, the Program Administrators anticipate that some PAs will be able to rollout scorecards before others, allowing them to share lessons learned that might help mitigate costs and other implementation challenges encountered by the initial adopters. The Program Administrators are still working on details of and budgets for this rollout, including customer communications and reporting, and will continue to work with DOER moving forward. Exact timing of this rollout is dependent upon software updates, which are being implemented by the same vendors making changes for improvements to RCD. Subject to the capacity of these vendors, the PAs anticipate that at least some PAs will be able to start delivering scorecards in late 2020. At this time, the Program Administrators do not anticipate that the increase in the RCS budget will be greater than 20 percent of the planned 2019-2021 RCS budget.

F. Daily Dispatch Demonstration Projects Update

1. Introduction

During the 2016-2018 term, the Program Administrators explored creative new approaches to cost-effective demand reduction. As part of these efforts, the Program Administrators implemented multiple demonstration projects.[3] Based on the lessons learned through these efforts and demonstration projects, the Program Administrators proposed several new statewide active

[3] Certain Eversource and Until demonstration projects approved in D.P.U. 16-178 and D.P.U. 16-184, respectively, continued during 2019.

demand reduction offerings in the 2019–2021 Massachusetts Joint Statewide Three-Year Electric and Gas Energy Efficiency Plan ("Plan").

On January 29, 2019, the Department approved the Plan, including the statewide Active Demand Reduction core initiatives with the exception of the daily dispatch offering. 2019-2021 Three-Year Plans Order, D.P.U. 18-110 through D.P.U. 18-119, at 43.[4] The Department found that the daily dispatch offering was an untested form of dispatch and it was not appropriate to use ratepayer funds to support wide-scale deployment at that time. Id. at 31-32. The Department, however, stated that the Program Administrators may submit a compliance filing to the Department requesting approval to implement a wide-scale daily dispatch offering after completing demonstration projects testing the proposed dispatch strategy. Id. at 32-33. The Department authorized the electric Program Administrators to use a portion of the budget allocated to the daily dispatch pay-for-performance offerings to design demonstration offerings to test the strategy. Id. at 32.

Eversource and National Grid each implemented daily dispatch demonstration projects during 2019. In addition, Eversource and Unitil continued to implement their active demand reduction demonstration projects, which included daily dispatch strategies, approved in D.P.U. 16-178 and D.P.U. 16-184, respectively. Based in part on the results of these demonstrations, the electric Program Administrators each submitted a compliance filing on March 16, 2020 seeking Department approval to implement the statewide pay-for-performance daily dispatch offerings. See D.P.U. 20-33 through D.P.U. 20-36.

Consistent with the Department's directives in the 2019–2021 Three-Year Plans Order, at 33, below is an update on the daily dispatch demonstrations.

2. Update On Daily Dispatch Demonstration Projects

National Grid – Residential Daily Dispatch Demonstration (D.P.U. 18-118)

National Grid implemented a residential daily dispatch pay-for-performance demonstration which enrolled customers with installed energy storage systems. Eligible customers own or lease storage systems located behind the meter, likely coupled with solar PV. Events were called most non-

[4] In its 2019-2021 Three-Year Plans Order at 138-139, the Department also determined that it was premature to consider the Compact's proposed active demand reduction offerings (including the statewide offerings and any Compact-specific enhancements), until a final agreement with NSTAR Electric Company was in place to ensure that any active demand reduction offering would not adversely impact the reliability of the local distribution system. The Compact and NSTAR Electric Company have entered into an agreement regarding the implementation of active demand reduction offerings in the Compact's service territory, and the Department has approved the Compact's non-daily dispatch active demand reduction offerings and budgets. See D.P.U. 18-116-A.

weekend days between July 1, 2019 and September 30, 2019,[5] between the hours of 2:00 p.m. and 7:00 p.m. Events lasted a maximum of three hours and were called based on forecasted daily system peak. National Grid would trigger customer participation by sending a signal through a competitively procured Demand Response Management System, which is also used for the residential direct load control, targeted dispatch approach. Customers retained the ability to opt-out and control their own systems or designate a reserve state of charge in the event of a power outage. Incentives were paid based on performed average kW reduction over the summer.

Due to the capped demonstration project budget and based on the experience in developing the direct load control using communicating thermostat offering, National Grid focused on recruiting energy storage systems from integrators with the greatest installed market penetration and that were able to be integrated through the competitively procured dispatch platform. Enrollments continued throughout the summer. National Grid had roughly 50 full participants for the whole summer participating in its summer daily dispatch events and nearly 80 enrolled as of August 31st. National Grid reported that its demonstration project provided $44,823 in performance-based incentives and achieved an average of 0.199 MWs in demand reduction. On average, 63% of devices enrolled on a given event day successfully performed in the event. However, by the last event called for the summer on August 22nd, over 93% of devices enrolled successfully participated due to technical improvements in the automated dispatch. In line with the Program Administrators' experience with thermostats, opt out rates were extremely low (94% of customers never opted out of an event), residential energy storage systems availability to participate may be intermittent. In addition to customer opt outs, devices may not perform successfully due to loss of connectivity to receive signals, lack of full charge before an event, have inverter losses, or lack of telemetry data verifying performance. The PAs also experienced many of these performance issues in their implementation of targeted dispatch strategies for direct load control.

The evaluation ultimately found that the consecutive event days, which is the hallmark of daily dispatch, had a negligible effect on performance. This differs from the demand reduction degradation expected in the Direct Load Control offering due to participants' unwillingness to forgo cooling on consecutive hot days. Further, successfully participating devices dispatch at a constant rate for the length of the event. Finally, National Grid found that the daily dispatch strategy had a high customer acceptance rate, 97% of participating customers are likely or very likely continue participating in the offer.

Unitil – Residential Storage Demonstration (D.P.U. 16-184)

Unitil also implemented a residential storage daily dispatch demonstration approved in D.P.U. 16-184. Through its demonstration, Unitil paid for the installation of energy storage systems for four residential customers that had solar PV systems. Events were called mostly on non-weekend

[5] National Grid also called events on certain weekend days during heat waves, in order to maximize the benefit to ratepayers during these peak demand periods.

days between July 1, 2019 and September 30, 2019, between the hours of 1:00 p.m. and 7:00 p.m. Events lasted a maximum of four hours and were called based on forecasted daily system peak. The evaluation found that the energy storage systems were successful at balancing solar PV output for the first two hours of an event but less effective in the fourth hour of the event.

Residential customers in both the National Grid and Unitil demonstration projects indicated that the primary reason the customer wanted the energy storage system was for backup power. The evaluators recommend that the Program Administrators work with customers to ensure that there is a known reserve for customer backup generation needs, while also providing substantial storage capacity for dispatch through the daily dispatch offering.

Eversource – C&I Storage (D.P.U. 16-178) and Daily Dispatch (D.P.U. 18-119 Demonstrations

Eversource implemented a C&I daily dispatch pay-for-performance demonstration in conjunction with its storage demonstration approved in D.P.U. 16-178.[6] Due to the capped budget for the demonstration project and the much larger size of C&I storage systems, a total of three customers participated in the demonstration offerings. Eligible customers had storage systems located behind the meter. Two storage systems (one installed through the D.P.U. 16-178 demonstration and one enrolled in the pay-for-performance demonstration) were dispatched daily on non-holiday weekdays[7] between July 1, 2019 and September 30, 2019, between the hours of 2:00 p.m. and 7:00 p.m. Events lasted a maximum of three hours and were called based on forecasted daily system peak. The third storage system (part of the D.P.U. 16-178 demonstration) was not installed until the fall of 2019 and was dispatched daily on a test basis for four hours for four weeks.

Eversource paid for the installation of the two storage systems that participated under the D.P.U. 16-178 demonstration, and therefore these systems were not eligible for pay-for-performance incentives. The remaining project was paid a performance incentive at the rate of $200 per kW. Eversource reported that its demonstration project provided $82,075 in incentives[8][7] and achieved an evaluated average of 0.972 MWs in demand reduction (0.409 MWs from pay-for-performance and 0.563 MWs from D.P.U. 16-178 demonstrations).

The evaluation found that once the energy systems were installed and operational, the average performance was good and the customers consistently met their committed dispatch levels (91% of the commitment). There were limited implementation challenges caused by defective hardware, some software glitches and programming errors, and problems in communications with vendor

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[6] Eversource's demonstration projects approved in D.P.U. 16-178 also included thermal storage, software and controls for building energy management, and direct load control projects.

[7] Similar to National Grid, Eversource also called events on certain weekend days during heat waves, in order to maximize the benefit to ratepayers during these peak demand periods.

[8] The incentives were only paid to projects participating under the pay-for-performance demonstration approved in D.P.U. 18-119.

servers, as well as unforeseen interactions between the energy storage and existing on-site generation. Each of these issues were resolved and ultimately did not significantly impact the overall performance of the energy storage systems through the daily dispatch strategy.

G. [Compact Only] Summary of Shared Costs and Consumer Advocacy Matters

In D.P.U. 18-116, the Department placed new reporting requirements on the Compact for costs: (1) shared between its energy efficiency and operating budget, and (2) related to consumer advocacy matters. D.P.U. 18-116, at 142–143.

1. Shared Costs Allocation Method

Background on Shared Costs Allocation Method and Allocation Factor Method

In its 2019–2021 Plan and consistent with historical practice, the Compact allocated shared costs between its operating budget and energy efficiency program by the relative budget of each program or using alternate allocation methods set by the Compact's Governing Board. The Compact's Governing Board reviews these allocations annually, and the Compact reflects any changes to allocation factors based on the Governing Board's review in its EES filing and its annual operating budget (D.P.U. 18-116, at 141). After review during the 2019–2021 Plan, the Department found these methods to allocate shared costs reasonable and approved them for the 2019–2021 Plan term (D.P.U. 18-116, at 142).

The Compact maintains that the *shared cost allocation method* is the Governing Board's annual review of shared costs. For each shared cost, the Governing Board determines the *allocation factor method*; i.e., how the shared cost will be split between the energy efficiency and operating budgets. Depending on the allocation factor method chosen by the Board, the resulting *allocation factors* could change from planning to reporting, and/or from year-to-year to reflect the most up-to-date information. In addition, the Governing Board could adjust a shared cost's allocation factor method during its annual review of shared costs to better reflect how resources are used between the two programs.

For example, the Board previously determined that the allocation factor method for Compact staff salaries is based on the time that each employee spends on either energy efficiency or operating activities. The Compact then estimated for the energy efficiency plan the amount of time each employee would spend on energy efficiency activities, which resulted in a certain weighted average allocation factor used in the plan. For reporting purposes, the Compact updated the allocation factors based on each employee's actual time spent on each activity. The allocation factors differ between planning and reporting and will differ across years based on staff time, but

the allocation factor methodology as well as the overall shared cost allocation methodology remain the same across planning and reporting and from year-to-year.[9]

This process is consistent with information the Compact presented to the Department in D.P.U. 18-116, both in the Compact's response to DPU-Compact 3-1 and during the Compact's oral testimony (Tr. Vol. 3 at 334-35). In that proceeding, the Compact stated that the estimated allocations are set annually and are reviewed by the Compact's Board and that if changes occur to the allocation factors, they would be reflected in the next EES filing.

The Compact and its Governing Board have adopted the methodology described above to ensure customers only pay for the costs that are relevant to them. *Cf. Plymouth Water Company*, D.P.U. 14-120 at 53-43 (August 31, 2015) (the Department approved a process of charges for direct payroll and associated overheads of payroll taxes, 401K contributions, medical and dental coverage and other benefits converted to hourly overhead rates representing actual costs that are charged based on the particular employee's billing rate and time spent on the activity, finding that the associated expenses are for activities that: (1) specifically benefit Plymouth Water; (2) are made at a competitive and reasonable price; and (3) are allocated to Plymouth Water in a cost-effective and nondiscriminatory manner).

Shared Cost Allocation Factor Methods in 2019

In early 2019, after consideration of the Department's directives in D.P.U. 18-116, the Compact's Governing Board undertook a specific and special review of shared costs and shared cost allocation factor methods. The Compact Board voted on the following allocation factor methods to assign shared costs to the Compact's energy efficiency and operating budgets:[10]

- Staff salaries, including employee benefits, pension, and other post-employment benefit ("OPEB") liabilities are allocated based on the ratio between: (a) time spent working on energy efficiency matters, including consumer advocacy matters related to energy efficiency as determined by the Board; and (b) time spent on all other matters (municipal aggregation program). Payroll services, custodial, utilities, office space, software licenses and internet fees are allocated based on staff's salary allocations.[11]

[9] See also the Compact's response to information request DPU 1-11 in D.P.U. 19-136.

[10] The Board vote approving these allocation factor methods is included in the minutes of the April 2019 Board meeting available online at https://www.capelightcompact.org/aboutus/ board-meeting-information/.

[11] This approach is consistent with the Compact's response to information request DPU-Compact 3-1 in D.P.U. 18-116, where the Compact states "Staff time is allocated based on the estimated amount of time spent on each program. This estimated allocation is set annually."

- Auditor, treasury services and financial software costs are allocated to the energy efficiency budget, including consumer advocacy related to energy efficiency, and the operating budget based on the percentage that each respective budget represents of total costs.[12]
- All insurance expenses associated with Compact staff are allocated based on the salary allocation described above. Board member public official's liability insurance expenses are allocated 50 percent to the energy efficiency budget and 50 percent to the operating budget.[13]

Consistent with the Department's approval to use the allocations approved by the Compact's Governing Board, the Compact began applying the new allocation factor methods and resulting factors to 2019 costs after the Board's vote in April 2019. The Compact intends to continue using these allocation factor methods for sharing costs between its energy efficiency and operating budgets for the remaining years of the Compact's 2019–2021 Three-Year Plan term, unless and until the Governing Board's review determines otherwise.

In D.P.U. 19-136, the Compact's 2020 Energy Efficiency Surcharge ("EES") filing, the Compact applied the allocation factor methods approved by the Governing Board to its 2019 actual and 2020 projected shared costs. In that proceeding, the Department determined that it did not have a sufficient record to determine whether the Compact's allocation methods were reasonable, and directed the Compact to calculate its 2020 EES in a manner consistent with the shared cost allocation factors identified in its three-year plan. D.P.U. 19-136, at 5-6. It is the Compact's understanding that the Department approved the allocation methodology described above in its review of the 2019–2021 Plan. As such, for 2019 actual costs, the Compact allocated shared costs consistent with the allocation method identified in its three-year plan.

2. 2019 Shared Costs

For shared costs, in its plan year reports, the Department now requires the Compact to provide a comparison of planned allocations versus actual spent dollars and an explanation of any variance greater than 10% (D.P.U. 18-116, at 142).

The following two tables provide, for each shared cost in 2019, (1) the allocation factor methodology, (2) the resulting allocation factors used for planning and reporting, and (3) the planned and actual allocated costs in dollars.

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[12] This approach is consistent with the Compact's response to information request DPU-Compact 3-1 in D.P.U. 18-116, where the Compact states that the "allocation reflects the level of financial activity between the two programs."

[13] This approach is consistent with the Compact's response to information request DPU-Compact 3-1 in D.P.U. 18-116, where the Compact states that the "allocation reflects a policy decision of the Compact Governing Board."

Shared Cost	2019-2021 Allocation Factor Methodology	Allocation Factors			
		2019-2020 Plan		2019 PYR	
		Efficiency	*Operating*	*Efficiency*	*Operating*
Legal, Consumer Advocacy	Case-specific, based on Board Consumer Advocacy Allocation Worksheet	n/a	n/a	70%	30%
Salary	Time spent on energy efficiency or operating activities	94%	6%	97%	3%
Software licenses	Same as salary (weighted average across staff based on time)	94%	6%	97%	3%
Payroll services	Same as salary (weighted average across staff based on time)	94%	6%	97%	3%
Internet	Same as salary (weighted average across staff based on time)	75%	25%	97%	3%
Rent	Same as salary (weighted average across staff based on time)	75%	25%	97%	3%
Custodial	Same as salary (weighted average across staff based on time)	75%	25%	97%	3%
Other Utilities	Same as salary (weighted average across staff based on time)	75%	25%	97%	3%
Auditor	Percentage each respective budget represents	90%	10%	98%	2%
Treasury services	Percentage each respective budget represents	90%	10%	98%	2%
Financial software	Percentage each respective budget represents	90%	10%	98%	2%
Insurance	Persons insured	75%	25%	69%	31%
TOTAL					

Shared Cost	2019 Allocated Costs					
	2019-2020 Plan		2019 PYR		Change (%)	
	Efficiency	*Operating*	*Efficiency*	*Operating*	*Efficiency*	*Operating*
Legal, Consumer Advocacy	$ -	$ -	$ 22,934	$ 9,829		
Salary	$ 2,136,810	$ 143,155	$ 2,337,724	$ 80,917	9%	-43%
Software licenses	$ -	$ -	$ 6,141	$ 213		
Payroll services	$ -	$ -	$ 2,381	$ 82		
Internet	$ 8,500	$ 2,833	$ 18,441	$ 638	117%	-77%
Rent	$ 67,500	$ 22,500	$ 87,030	$ 2,970	29%	-87%
Custodial	$ 30,515	$ 10,172	$ 16,736	$ 579	-45%	-94%
Other Utilities	$ 75,750	$ 25,250	$ 27,226	$ 930	-64%	-96%
Auditor	$ 20,000	$ 2,222	$ 97,875	$ 1,693	389%	-24%
Treasury services	$ 12,000	$ 1,333	$ 102,691	$ 1,776	756%	33%
Financial software	$ 1,000	$ 111	$ 70,755	$ 1,224	6975%	1001%
Insurance	$ 12,000	$ 4,000	$ 36,310	$ 16,268	203%	307%
TOTAL	**$ 2,364,075**	**$ 211,576**	**$ 2,826,242**	**$ 117,119**	**20%**	**-45%**

As indicated in the above table, actual energy efficiency costs (in dollars) varied from planned by more than 10%. Below, the Compact provides an explanation for such variances. The Compact uses the best available information at the time of planning to estimate costs. This includes historical information as well as the Compact's best estimate of projected costs. Actual costs reflect total incurred costs, and these sometimes vary from the estimated values.

- *Legal, Consumer Advocacy*. The Compact did not plan at this level of detail in its 2019–2021 Three-Year Plan. See the following section for a discussion on consumer advocacy costs.
- *Salary*. The expenditures for salary reflect the actual time Compact staff spent working on energy efficiency programs. Staff who work on energy efficiency and non-energy efficiency programs track and record their time on a daily basis, charging each program budget based on actual hours worked.

- *Software Licenses*. The expenditures for software licenses allocated to energy efficiency in 2019 is not a new cost. Software license fees were previously embedded in the Compact's database budget. Effective in 2019, the Compact began tracking software licenses separately from the database to more efficiently track shared costs (the database is specific to energy efficiency programs and is not a shared cost).
- *Payroll Services*. Payroll expenditures are directly related to staff time spent on energy efficiency and non-energy efficiency programs. Prior to the 2019–2021 Plan, energy efficiency payroll costs were allocated to the Compact's operating budget. This practice changed as a result of the April 2019 Compact Board vote to accurately track staff time spent on energy efficiency programs and to allocate shared costs based on this practice.
- *Internet*. When the Compact developed its 2019–2021 budget in 2018, it relied on 2017 actual expenditures to estimate future costs. In 2017, the Compact spent approximately $7,300 within energy efficiency on internet services. Anticipating higher costs going forward, the Compact budgeted $8,500 per year in the 2019–2021 plan. In 2018, the Compact expended approximately $11,000 on internet services, and in 2019 spent approximately $18,000.
- *Rent*. Rent costs are allocated based on the percentage of time Compact staff spend working on energy efficiency programs. The increase in costs for rent is directly proportional to the increase in staff time spent on energy efficiency programs in 2019 as compared to the planned time that was estimated to be spent on energy efficiency programs.
- *Custodial*. Custodial services are required to support Compact staff. Custodial costs are allocated based on the percentage of time Compact staff spent working on energy efficiency programs. The Compact's annual custodial costs decreased from the Plan numbers due to revisions in the scope of services provided.
- *Other Utilities*. Utility services are required to support Compact staff. Utility costs are allocated based on the percentage of time Compact staff spent working on energy efficiency programs. The Compact's estimated Plan costs were higher than the actual costs due to changes in the scope of plans (e.g., phone) and services provided.
- *Auditor*. Over the 2016–2018 term, the Compact's audit fees were about $20,000 in 2016, $30,000 in 2017, and $20,000 in 2018. In 2019, the Compact's audit fees were about $94,000. The 2019 costs are higher than previous years because 2019 costs included additional costs for the 2017 and 2018 audits. The cost of the Compact's audits has increased since 2016 and 2017 because the Compact is no longer sharing audit costs with Barnstable County. As an independent entity, the Compact has seen an increase in audit fees. The energy efficiency program will only be billed for the actual cost of the audit, which will be reconciled in future EES.
- *Treasury Service*s. The increase in costs for treasury services for 2019 is a result of the Compact Comptroller's unanticipated retirement due to health reasons. The Compact brought in a consultant to assist in the transition until a new Comptroller could be hired. The consultant was tasked with reviewing the Compact's accounts and records to ensure they were accurate before a new Comptroller was hired. This was a one-time cost increase due to unexpected staff adjustments.

- *Financial Software*. To improve coordination and reporting requirements for energy efficiency vendors, the Compact switched its financial software system in 2019. As a result, the cost of the financial system increased to approximately $71,000 in 2019. The new financial software system will soon be enhanced to enable vendor invoices to be uploaded into the energy efficiency database and financial software system simultaneously, rather than needing to enter the same invoice twice into two different systems. An added benefit will be the ability of Compact staff to view in real time the status of customer rebates, vendor payments, and sector budgets.
- *Insurance*. The Compact is insured by Massachusetts Interlocal Insurance Association. Insurance costs reflect coverage for the following items: general liability, workers compensation, cyber liability, property and equipment, auto, and public officials liability. The Compact procured its insurance coverage competitively. Insurance premiums are determined each year by the Compact's insurance company and the revised budget reflects the updated estimated insurance costs. The energy efficiency program will only be billed for the actual insurance costs, which will be reconciled in future EES filings.

3. Consumer Advocacy Costs related to Energy Efficiency

Where the Compact classifies any consumer advocacy costs as energy efficiency-related, the Department now requires that the Compact be prepared to demonstrate, at the time final cost recovery is sought, that such activities have a direct energy efficiency-related benefit. Accordingly, in each Plan Year report, the Compact is now required to identify any consumer advocacy costs that were charged to its energy efficiency budget and provide an explanation supporting the direct energy efficiency-related benefit of such activities (D.P.U. 18-116, at 143).

In response to the Department's requirement in D.P.U. 18-116 that the Compact report on its consumer advocacy activities, the Compact's Governing Board created a consumer advocacy cost allocation worksheet, to be filled out for all consumer advocacy matters. The worksheet details the energy efficiency and non-energy efficiency activities associated with the matter and contains an initial estimate of the percentage allocation of costs for the matter between the Compact's energy efficiency and operating budgets. The Compact's Governing Board will review the worksheet for a consumer advocacy proceeding annually to determine if there is any change in the energy efficiency and non-energy efficiency issues for the proceeding that would require a new percentage allocation of costs between the energy efficiency and operating budgets.

It is important to note that the Compact's involvement in consumer advocacy matters related to energy efficiency often overlaps with its direct energy efficiency program administration activities: It is not always possible for the Compact to expressly isolate one cost from the other. Therefore, the costs identified herein as consumer advocacy costs are conservative (i.e., potentially on the high side of estimates), as they may include amounts spent directly on energy efficiency planning and program design in addition to consumer advocacy matters. In addition, Compact staff do not track their time at this level of granularity and so cannot identify actual hours spent on "consumer advocacy." The Compact's Administrator and its Senior Power Supply Planner may have spent

time during 2019 communicating with counsel on matters that arose in the dockets identified below as well as reviewing any of the Compact's pleadings and comments in those dockets. No other Compact staff spent time on consumer advocacy matters.

In 2019, the Compact's energy efficiency consumer advocacy costs were for services associated with two dockets where the Compact's work was continuing from previous years: (1) D.P.U. 15-122, Petition of Eversource Energy ("Eversource") for Approval of its Grid Modernization Plan ("GMP"); and (2) D.P.U. 18-50, Petition of Eversource Energy for Review of Proposed Performance Based Ratemaking Mechanism Performance Metrics. Set forth below for both proceedings are a description of the services performed in 2019, as well as the direct energy efficiency benefits for each.

The costs related to each proceeding are as follows:

Proceeding	**2019 Costs**	**Notes**
D.P.U. 15-122	$22,934	The Compact's legal costs were allocated 70% to the energy efficiency budget and 30% to the operating budget based on the scope of the energy efficiency and non-energy efficiency issues in the proceeding. This is documented in the consumer advocacy allocation worksheet for D.P.U. 15-122, attached as Attachment A.
D.P.U. 18-50	$6,894	The Compact's legal costs associated with participation in this proceeding are allocated to its energy efficiency budget because its participation was directly related to the statewide implementation of electric energy efficiency plans and the Compact's energy efficiency program planning. This is documented in the consumer advocacy allocation worksheet for D.P.U. 18-50, attached as Attachment B.

In D.P.U. 19-136, the Compact's 2020 EES filing, the Compact allocated the costs associated with participation in D.P.U. 15-122 as explained above. The Department could not find that the legal and advocacy costs were properly allocated to energy efficiency and indicated it would continue an investigation into whether the costs are eligible for recovery through the EES. The Department has not yet advanced that investigation. The Compact awaits notice of additional procedure in that ongoing investigation to resolve the appropriateness of cost recovery for the direct energy efficiency related aspects of its participation in D.P.U. 15-122 through the EES.

A. D.P.U. 15-122: Petition of Eversource Energy for Approval of its Grid Modernization Plan

The Compact petitioned to intervene as a full party in D.P.U. 15-122 and the Department granted the Compact's petition. The Compact demonstrated it was substantially and specifically affected by the proceeding both as a consumer advocate for its consumers and as an energy efficiency and demand response program administrator because of potential impacts and precedents from the proceeding that may be set on its energy efficiency and other programs. See *NSTAR Electric Company*, D.P.U. 15-122, Petition to Intervene of the Cape Light Compact (March 30, 2016). The Compact had various concerns regarding Eversource's GMP, including that: (1) Eversource declined to propose opt-out advanced metering in its GMP despite Department technology requirements; (2) Eversource did not make time-varying rates a default option for all consumers; (3) the GMP did not provide an opportunity for competitive suppliers to develop a variety of time-varying rate products and for manufacturers to develop new technologies to help customers to manage their electricity costs; (4) Eversource required consumers to pay significant additional costs in order to get real-time access to data; (5) the GMP required anyone wishing to have a smart meter to enroll in Eversource's basic service power supply; and (6) whether the GMP properly accounted for distributed generation, including the technological capacity needed to accommodate more distributed generation.

Grid modernization issues have been an important energy efficiency concern to the Compact for years. Eversource is the distribution company in the Compact's service territory, and Eversource's implementation and evaluation of its grid modernization plan has and will continue to affect Compact energy efficiency and demand response programs. The Compact participated in Eversource's grid modernization proceedings to ensure its understanding of the GMPs and the potential impacts on Compact energy efficiency offerings. The Compact's unique status as the only municipal aggregator that is also a Program Administrator of energy efficiency complicates its implementation of its ideal demand response offerings. Absent participation in the proceeding, the Compact has no ability to choose or even influence the infrastructure technologies or investments of Eversource that would support the Compact's demand response efforts as a Program Administrator.

As detailed below, the Compact's 2019 consumer advocacy efforts in D.P.U. 15-122 provided the following direct energy efficiency benefits: (1) grid modernization performance metrics; (2) grid modernization annual report templates; and (3) a joint letter appealing to the Department to commence a customer-facing deployment investigation as directed in the Department's D.P.U. 15-122 order.

Performance Metrics

In 2019, the Compact issued discovery related to battery storage and location-specific baseline review in Eversource's proposed performance metrics for grid modernization and attended the Technical Session on Eversource's performance metrics, including an update on its two storage projects. The Compact subsequently reviewed Eversource's revised performance metrics. The

Compact also submitted comments and monitored discovery on Eversource's proposed energy storage performance metrics. As a result of the comments by the Compact and Eversource respectively, Eversource and the Compact conducted a meeting in September 2019 to discuss energy storage. In October 2019, the Compact participated in a Technical Session on Eversource battery storage demonstration project metrics. The Compact's participation in the performance metrics compliance phase led to direct energy efficiency benefits in the following ways.

CO2 Emissions Reduction Standard. Eversource's approved grid modernization performance metrics were revised to include the CO2 emissions reduction standard that the Compact had advocated for in this proceeding, resulting in a direct energy efficiency benefit. The Compact asked for application of the same industry standard CO_2 emission factors and methods for Grid Modernization Performance Metrics as is used in reporting CO_2 emission reductions under the Statewide Three-Year 2019–2021 Energy Efficiency Plan. This issue was important to the Compact to ensure consistency in the reporting of CO_2 emission reductions, in part so that accurate comparisons in and evaluations of reductions can be made in the Commonwealth.

Energy Storage. There have been various direct energy efficiency benefits with respect to the energy storage metrics, despite the Department not having yet finalized the storage aspect of the performance metrics. The Compact participated in the proceeding because the utility projects were designed to educate Eversource and third-party stakeholders on various aspects of battery storage projects. In its comments on Eversource's proposed energy storage performance metrics, the Compact was concerned that the metrics for Eversource's energy storage projects would not accomplish the project's intended purposes from D.P.U. 17-05 (Petition of Eversource Energy for Approval of General Increases in Base Distribution Rates for Electric Service and Approval of a Performance Based Ratemaking Mechanism). The intended purposes were to enable energy storage on a broader scale in Eversource's service territory to help meet much wider climate change goals and the Commonwealth's energy storage target by educating Eversource and third-party storage market participants on all areas of storage, including deployment, interconnection, and dispatch. The Compact's involvement allowed it to learn useful information about battery storage projects and to ensure that the Department and Eversource considered these broader goals in finalizing the metrics. That involvement included filing comments on its concerns related to the energy storage metrics and meeting with Eversource on September 24, 2019 to clarify aspects of the energy storage metrics and energy storage more generally as a result of Eversource's reply comments (dated May 31, 2019) which extended the invitation to meet.

Investment Deployment Selection. The Compact was interested in Eversource's deployment criteria on certain grid-facing investments (Volt VAR optimization ("VVO") and distributed management system) to ensure that areas on Cape Cod and Martha's Vineyard could be considered for selection. Advancements on the Cape and Vineyard in such technology would bring obvious benefits to the Compact's customers. As noted by Eversource, the objective of its VVO program is "to maximize the benefit of VVO technology in terms of energy conservation, peak demand reduction, and integration of solar generation in a limited geographic region with diverse characteristics in order to demonstrate the potential costs and benefits of further deployment of

VVO across the Company's service territory." See D.P.U. 15-122, Exhibit CLC-1-3 (January 3, 2019). And the objective of its DMS program is "to maximize the benefits of DMS technology in terms of improved situational awareness, operational efficiency, and reliability in a limited geographic region with diverse characteristics intended to demonstrate the potential costs and benefits of further deployment of DMS across the Company's service territory." (Ibid.) Both programs offer benefits aligned with Compact's energy efficiency goals and thus these efforts provided a direct energy efficiency benefit.

Distributed Generation Tracking and Reporting. The Compact initially raised concerns about distributed generation reporting in relation to performance metrics, although they were ultimately successfully resolved in the consideration of the annual reports templates. The Compact was able to secure confirmation that the metrics would include location-specific information (town name and substation number for distributed generation facilities). See below for further discussion on this direct energy efficiency benefit.

Grid Modernization Annual Report Template

The Compact reviewed the Department's memorandum regarding a template for the utilities' grid modernization annual reports, filed comments on the template, and participated in the Department's Technical Session on the proposed annual report template. The Compact also reviewed the Department's order approving the proposed grid modernization annual report templates.

The Compact's participation on this issue provided a direct energy efficiency benefit by ensuring that each year the grid modernization annual reports will provide more useful and meaningful information to the Compact. Through its participation, the Compact sought to:

- ensure that the annual report would clearly report peak demand reduction related to grid modernization. This is consistent with the Compact's work in D.P.U. 18-50, where it also requested that peak demand reduction be reported separately for different investments (e.g., grid modernization, performance-based ratemaking ("PBR"), energy efficiency).
- support the added ability of stakeholders to sort and filter the annual reports which functionality would be helpful to stakeholders each year in evaluating the information.
- ensure that the annual reports would track and report on distributed generation by feeder, in particular in terms of (1) specific location information, i.e., town and substation, (2) a breakdown of the distributed generation information by type of facility (e.g., PV, fuel cell), and (3) a breakdown of the distributed generation information by whether it is customer-owned or company-owned.

The final item was of particular concern to the Compact because this reporting relates directly to the Compact's planning and design of demand reduction programs in its service territory and the targeted energy efficiency and demand reduction implementation implied by the Department's coordination directive in D.P.U. 14-03. In that proceeding, the Department directed the Compact and Eversource to explore geo-targeting initiatives in an effort to delay infrastructure investment.

See Petition of NSTAR Electric Company for an Exemption to the Zoning of the Town of Mashpee, D.P.U. 14-03, Order at 20 (April 13, 2015). Based on that order, the Compact was actively engaged in exploring the targeted delivery of energy efficiency and demand response initiatives for the purpose of reducing demand, matters which fall within the scope of grid modernization. In response to this directive and as part of its energy efficiency program planning, the Compact is continuously analyzing geo-targeting of energy efficiency measures, renewable energy, and energy storage as a means to delay potential infrastructure investment to support the increasing load and system constraints on the Cape and Vineyard. The provision of the particular information requested by the Compact in the annual report compliance proceeding will assist the Compact in those efforts, resulting in a direct energy efficiency benefit.

Joint Letter on Customer-Facing Proceeding

In 2019 the Compact jointly filed a request with other stakeholders that the Department open its investigation into the deployment of customer-facing grid modernization investment. The letter noted that the Department's Order approved some grid-facing investments proposed by the distribution companies but left a gap in the advancement of grid modernization in the Commonwealth by deferring consideration of customer-facing investments.

In submitting the joint letter to the Department, the Compact and other stakeholders asked the Department to commence in a timely way its investigation into customer-facing grid modernization investments. Although the Department has not yet commenced the investigation, the letter remains posted in the docket in D.P.U. 15-122, and hopefully will help serve as a catalyst to get the investigation underway. It is important for the Department to understand the potential impact of targeted deployment to the Compact's energy efficiency programs.

The Compact has for years recognized the benefits that advanced metering could provide to its energy efficiency programs. Customer-facing grid modernization investments, including advanced metering and time-varying rates, reviewed as part of D.P.U. 15-122, could have benefited the Compact's demand response initiatives by providing access to more granular curtailment/participation data and an inherent participation incentive (by enabling time-varying rates) if deployed on an opt-out basis. The Compact advocated for such investment in prior years in the underlying grid modernization proceeding.

The Compact is limited in what it can offer its customers until advanced metering is deployed in Eversource's territory. The Compact noted in its petition for intervention in D.P.U. 15-122 that its three-year plan filing in D.P.U. 15-166 had proposed to begin establishing a platform for the "connected home" and to install The Energy Detective ("TED") devices on up to 600 residential and small commercial electric meters through the Compact's Home Energy Assessment and Business Energy Assessment initiatives. See Cape Light Compact, D.P.U. 15-166, Compact Initial Filing, Exhibit Compact-11 at 1 (October 30, 2015). The TED devices would allow electric customers to access their electric usage on a real-time basis through a Compact-customized application on their mobile device or computer, but the devices would not provide the range of benefits of advanced meters. The Compact's ability at that point (and today) to fully implement a

demand response program was (and is) limited by the lack of advanced metering and time-varying rates.

Accordingly, the Compact and other stakeholders found it necessary to urge the Department to commence the new investigation as soon as possible. Undertaking this effort provided a direct energy efficiency benefit for the Compact.

B. D.P.U. 18-50: Petition of Eversource Energy for Review of Proposed Performance-Based Ratemaking Mechanism Performance Metrics

D.P.U. 18-50 is a proceeding initiated by the Department as a compliance phase of Eversource's 2017 distribution rate case (D.P.U. 17-05), focused on Eversource's PBR metrics. The Compact's participation in D.P.U. 18-50 in 2019 was limited. The staggered briefing schedule had concluded at the end of 2018. However, the Compact filed a motion to strike a portion of Eversource's reply brief or, in the alternative, to issue a supplemental briefing schedule on January 7, 2019, that resulted in almost all of the 2019 costs. The residual work related to a brief review of related filings and preparation of a consumer advocacy worksheet.

This work supported the Compact's 2018 participation in this case that was directly related to energy efficiency matters. Eversource's annual PBR metrics filings will be a useful tool for the Compact to the extent the information provided is tracked and reported in certain ways. This proceeding raised various concerns related to the potential for overlap between Eversource's statewide administration of energy efficiency and Eversource's peak demand reduction metrics calculations. In addition, the Compact identified other potential concerns relating to the Compact's role as a Program Administrator in Eversource's distribution territory, including how Eversource would count energy efficiency-related demand reductions for programs where the Compact is also involved. Based on these issues, the Compact participated in this docket to obtain further information on various aspects of that overlap, as well as to clarify that there would be no adverse effects on the Compact's energy efficiency program, to safeguard the integrity of energy efficiency tracking and reporting and incentive programs, and to ensure that the tracking and reporting in the PBR metrics would be clear, transparent, and meaningful.

In particular, the Compact's participation in this proceeding was focused on clarifying for the record:

(1) how and whether Eversource's Performance-based Ratemaking Metrics Compliance Filing contained energy efficiency megawatt reductions and/or measures that were already included in Eversource's 2016–2018 Three-Year Energy Efficiency Plan and other issues related to the overlap between statewide administration of energy efficiency and Eversource's peak demand reduction metrics calculations: and

(2) how and whether Eversource would discuss with the Compact the potential for targeted and/or incremental energy efficiency in advance of determining that a transmission or distribution project

is needed in Eversource's Cape Cod service territory as was expressly encouraged by the Department in D.P.U. 14-03.

The relief requested by the Compact in its briefs demonstrates the energy efficiency focus of the Compact in this proceeding, and included: (1) to require Eversource to track and report peak demand reductions according to investment source for the peak demand reduction metric; (2) to base any future incentive/penalty mechanism solely on reductions related to the PBR mechanism and not related to other investment sources; and (3) to confirm that Eversource may not count peak demand reductions or other energy efficiency measures toward its targets unless Eversource itself paid for that energy efficiency programming for both the peak demand reduction and climate adaptation metrics.

Accordingly, the Compact's participation in D.P.U. 18-50 resulted in direct energy efficiency-related benefits, including:

- obtaining information from Eversource during discovery on the overlap between the statewide administration of energy efficiency and Eversource's peak demand reduction metrics calculations;
- encouraging Eversource to undertake with the Compact discussions related to the Department's directives in D.P.U. 14-03 on the potential for targeted and/or incremental energy efficiency ahead of determining that a distribution or transmission project is needed in the Compact's service territory;
- obtaining information from Eversource during discovery on how Eversource would count energy efficiency-related demand reductions for programs where the Compact is also involved;
- clarifying during discovery how Eversource would count megawatt reductions or other activity toward its Peak Demand Reduction Metrics and Climate Change Adaptation Metrics to the extent that another program administrator's energy efficiency funds were expended;
- clarifying during the hearings certain energy efficiency-related issues (e.g., street lighting) and how peak demand reduction will be tracked and reported by Eversource; and
- advocating through its brief issues of concern to the Compact's energy efficiency program (see relief requested above).

While the Department has not yet issued an order in the docket, the Compact believes that its participation advanced the Department's directives in D.P.U. 14-03, safeguarded aspects of the Compact's energy efficiency program (e.g., Eversource agreed its demand reduction reporting would not include reductions paid for by the Compact's energy efficiency programs), led to better understanding of how Eversource should track and report demand reductions across several investments (e.g., energy efficiency, grid modernization, PBR), and clarified issues resulting from the Compact's role as a Program Administrator in Eversource's territory as well as the overlap between Eversource's statewide administration of energy efficiency and Eversource's peak demand reduction metrics calculations.

Consumer Advocacy Allocation Worksheet

Parties involved:
The parties to this proceeding included the Cape Light Compact, Eversource Energy, Attorney General's Office, Department of Energy Resources, National Grid, Acadia Center, Conservation Law Foundation, EFCA/Sun Run, NRG, Low Income Network, and Mass Energy.

Description of the Matter or Proceeding:
The Department of Public Utilities investigated the proposed Grid Modernization Plan filed by Eversource Energy. This investigation was held in furtherance of the Department's responsibilities under the Green Communities Act, St. 2008, c. 169 ("Green Communities Act") (to support the development of energy efficiency, demand response, distributed generation, and renewable resources), the Global Warming Solutions Act, St. 2008, c. 298 ("Global Warming Solutions Act") (emissions reduction targets), and its responsibilities to ensure reliable electric distribution service. See Order 12-76-B at 8-9. The Order issued on May 10, 2018, and approved $220 million in grid-facing investments and upgrades in the electric grid over the following three years. Those investments will improve integration of renewable energy, energy storage and electric vehicles and enhance reliability, including power outage frequency and storm restoration. The investments will also automate processes to improve grid control and promote a self-healing grid. The Order issued after an adjudicatory proceeding; follow-up compliance proceedings remain pending (e.g., metrics).

Docket Number (if any):
D.P.U. 15-122

1. Does this proceeding raise issues that may impact the Compact's administration of its three-year energy efficiency plan? If yes, please explain.
   Yes, this proceeding could have adversely affected the Compact's energy efficiency program through customer-facing investments, including advanced metering and time-varying rates, proposed by Eversource that were ultimately rejected by the Department. The Department committed to investigate targeted advanced metering, which could allow the Compact to offer enhanced energy efficiency measures. The Compact will monitor Eversource's deployment of two energy storage projects and its electric vehicle program. Hopefully, Eversource will learn from its energy storage deployments and become more comfortable with integrating storage on its grid. Eversource's grid modernization investments are also intended to improve renewable energy deployment.

2. Does this proceeding raise issues regarding the general administration of energy efficiency in Massachusetts? Are other Program Administrators parties or otherwise intervening? Other stakeholders? If yes, please explain.
Yes. Eversource Energy (a PA) filed the proposed GMP that resulted in this proceeding. National Grid (also a PA) participated as a limited party. Various energy efficiency topics are considered in this proceeding, including renewable energy integration, advanced metering, energy storage, and electric vehicles.

3. Does this proceeding raise issues regarding the Compact's administration of active demand response programs/initiatives/measures? If yes, please explain.
Yes, the proceeding raises various active demand response issues for the Compact. Based on arguments made by the Compact and other parties, the Department in its Order ended up rejecting all of Eversource's proposed customer-facing investments. The deployment of advanced metering infrastructure (which would enable time-varying rates) was a central issue considered by the Department. Eversource's advanced metering proposal would have significantly harmed active demand response by the Compact, since the Compact's customers could not have access to the meters. Eversource's proposal also offered no access to data for competitive suppliers, including the Compact, meaning that those parties could not effectively participate in the development of a demand response marketplace.

4. Does this proceeding raise issues regarding the general administration of active demand response in Massachusetts? Are other program administrators parties or otherwise intervening? Other stakeholders? If yes, please explain.
Yes, this proceeding directly impacts Eversource's administration of active demand response since it examined its proposed GMP. National Grid is also a limited party since this proceeding could impact D.P.U. 15-120, where National Grid's own GMP was investigated simultaneously by the Department. Advanced metering and other active demand response issues were a central focus in this proceeding.

5. Does this proceeding concern the efficient utilization of energy in Massachusetts? Are other Program Administrators parties or otherwise intervening? Other stakeholders? If yes, please explain.
Yes, grid modernization by nature concerns the efficient utilization of energy in Massachusetts. A key outcome sought by the Department was a more efficient grid. As noted above, Eversource and National Grid were parties to the proceeding.

6. Describe the direct energy efficiency benefit resulting from the Compact's participation in this proceeding.

Some of the grid modernization investments to be made by Eversource will improve renewable energy integration, reliability and outage response for the Compact's customers. The Department in its Order noted that "Through our preauthorization of the grid-facing investments here, we have taken the significant steps towards developing a robust distributed energy market in Massachusetts." However, perhaps the most significant benefits may result from what the Department rejected in its Order, including Eversource's opt-in advanced metering proposal which would not have included any Compact customers. With that rejection, the Department will now undertake a new investigation to examine targeted deployment of advanced metering and – significantly – will examine the role of municipal aggregation and the competitive markets generally in advanced metering. There is the potential through this investigation for a much more beneficial outcome for the Compact's energy efficiency program.

7. Is the described benefit quantifiable? If yes, please explain and provide any supporting documentation.
   No. While the investment that Eversource will undertake into grid modernization will be valued at $220 million for three years, there is no way to value the benefits received from the parts of Eversource's proposal that were rejected by the Department in its Order. In particular, Eversource's advanced metering proposal would have resulted in significant harm to the Compact and its customers.

8. Will the Compact's participation assist its planning for future energy efficiency plans and/or programs?
   Yes. The Department in its Order directed that a future investigation be opened to consider targeted deployment of advanced metering. This proceeding is of great interest to the Compact, which could be an ideal selection for such targeted deployment. The Department's interest in energy storage with Eversource undertaking two demonstration projects is also useful. It is important for the Compact to understand what grid modernization investments Eversource will undertake as well.

9. Is the Compact's participation in this proceeding a reasonable use of energy efficiency ratepayer funds? Please explain.
   Yes, it was necessary for the Compact to participate given the direct impact the outcome would have on the Compact and its customers. Eversource's proposed plan would have ensured advanced metering only for its own Basic Service customers, and would not have allowed the Compact to offer enhanced energy efficiency. The Compact's argument sought to ensure consistent opportunities across energy efficiency service territories.

10. Does this proceeding involve other non-energy efficiency issues? If yes, please explain.

Yes, the proceeding also implicated power supply concerns, including Eversource's proposal requiring Compact customers to return to Basic Service to receive advanced metering under the grid modernization plan and other harms to the competitive markets (e.g., no access to usage data to develop innovative demand response market products).

11. What is the initial estimate of the percentage allocation between energy efficiency and non-energy efficiency issues, as set forth in this worksheet?
The estimate is 70% energy efficiency and 30% non-energy efficiency.

12. Discuss any other factors as may be appropriate.
It was important for the Compact to be involved in this proceeding as Eversource's grid modernization efforts will be ongoing for years to come. This proceeding set the stage for its jumping off point and could have been detrimental to the Compact and its customers.

13. **To be completed at the conclusion of the proceeding/matter or every 12 months, which ever comes first,** a summary of the actual total costs associated with the Compact's participation and costs recovered through energy efficiency ratepayer funds and operating funds. A brief narrative should accompany any readjustment to the percentage allocation explaining the basis for the reallocation.
While the Order issued on May 10, 2018, there are ongoing compliance proceedings.

Please attach:

1. Initial Petition
2. Notice of Proceeding
3. Compact's Petition to Intervene
4. Agreements with Expert Consultants, if any

Consumer Advocacy Allocation Worksheet

Parties involved:
The parties to this proceeding included the Cape Light Compact, Eversource Energy, Attorney General's Office, Department of Energy Resources, National Grid, Acadia Center, and New England Clean Energy Council.

Description of the Matter or Proceeding:
In the rate case order (Phase I) of the Department of Public Utilities ("DPU" or the "Department") in D.P.U. 17-05, Eversource was directed to make a compliance filing with metrics for its performance-based ratemaking mechanism in three areas: (1) improvements to customer satisfaction and engagement; (2) reductions in system peak demand from current levels; and (3) strategic planning for climate adaptation. Phase I Order at 407. On March 1, 2018, Eversource filed its Compliance Filing, including its proposals for the three metrics categories and a climate adaptation plan. The Compact participated in discovery and filed briefs in this docket. An order is pending from the DPU.

Docket Number (if any): D.P.U. 18-50

1. Does this proceeding raise issues that may impact the Compact's administration of its three-year energy efficiency plan? If yes, please explain.
   Yes, this proceeding could have adversely affected the Compact's energy efficiency program through Eversource's design of its metrics program. Specifically, the Compact requested the following express conditions be added to the Department's Order in order to protect the Compact's EE program and EE generally:

   (A) requiring the Company to track and report peak demand reductions according to investment source for the peak demand reduction metric;

   (B) directing the Company to base any future incentive/penalty mechanism solely on reductions related to the PBRM and not related to other investment sources;

   (C) confirming that the Company may not count peak demand reductions or other energy efficiency measures toward its targets unless Eversource itself funded that energy efficiency programming for both the peak demand reduction and climate adaptation metrics;

   (D) requiring Eversource to redo its evaluation of at-risk substations for the climate adaptation metric to include local resources;

   (E) directing Eversource to proactively promote LED light conversion for nonpublic customers under the S-1 rate tariff; and

(F) ordering that there be a comprehensive review, including stakeholder participation, of Eversource's annual report for the first five-year term of the PBRM.

2. Does this proceeding raise issues regarding the general administration of energy efficiency in Massachusetts? Are other Program Administrators parties or otherwise intervening? Other stakeholders? If yes, please explain.
Yes. Eversource Energy (a PA) filed the proposed metrics that resulted in this proceeding. National Grid (also a PA) intervened. Metrics involving a PBR Plan could impact other distribution utilities and thus PAs. See issues raised above.

3. Does this proceeding raise issues regarding the Compact's administration of active demand response programs/initiatives/measures? If yes, please explain.
The proceeding impacts the Compact's EE program generally and also raises LED conversion specifically.

4. Does this proceeding raise issues regarding the general administration of active demand response in Massachusetts? Are other program administrators parties or otherwise intervening? Other stakeholders? If yes, please explain.
Yes, see above regarding LED conversion.

5. Does this proceeding concern the efficient utilization of energy in Massachusetts? Are other Program Administrators parties or otherwise intervening? Other stakeholders? If yes, please explain.
Yes. PBR by nature concerns the efficient utilization of energy in Massachusetts since it is a program designed to separate kWh from sales. As noted above, Eversource and National Grid are parties to the proceeding.

6. Describe the direct energy efficiency benefit resulting from the Compact's participation in this proceeding.
The Compact is concerned in this proceeding about the tracking and reporting of Eversource's peak demand reductions related to EE and grid modernization. It is important that Eversource be required to separately track its progress, in part to ensure that any future incentives do not allow for double dipping by Eversource. Through its participation here, the Compact is protecting its own EE program and also EE generally.

7. Is the described benefit quantifiable? If yes, please explain and provide any supporting documentation.
No, while the issues are of significant concern to the Compact, there is no way to value the benefits received from the Compact's advocacy.

8. Will the Compact's participation assist its planning for future energy efficiency plans and/or programs?
   It may. Depending how the DPU rules in this case, the Compact will need to ensure that EE is tracked separately and that no double dipping of incentives occurs, among other concerns discussed in #1 above.

9. Is the Compact's participation in this proceeding a reasonable use of energy efficiency ratepayer funds? Please explain.
   Yes, it was necessary for the Compact to participate to protect its EE program and EE generally and also given the direct impact the outcome would have on the Compact and its customers. For example, it is important that tracking and reporting be done in a transparent manner and that incentives only be allowed once.

10. Does this proceeding involve other non-energy efficiency issues? If yes, please explain.
    No, the Compact's participation is driven by EE issues.

11. What is the initial estimate of the percentage allocation between energy efficiency and non-energy efficiency issues, as set forth in this worksheet?
    The estimate is 100% energy efficiency.

12. Discuss any other factors as may be appropriate.
    It was important for the Compact to be involved in this proceeding as Eversource's PBR metric efforts will be ongoing for years to come. Because the PBR mechanism and these metrics are new, this proceeding sets the stage for its jumping off point and could have be detrimental to the Compact and its customers.

13. **To be completed at the conclusion of the proceeding/matter or every 12 months, which ever comes first,** a summary of the actual total costs associated with the Compact's participation and costs recovered through energy efficiency ratepayer funds and operating funds. A brief narrative should accompany any readjustment to the percentage allocation explaining the basis for the reallocation.
    The DPU has not yet issued an Order.

Please attach:

1. Initial Petition
2. Notice of Proceeding
3. Compact's Petition to Intervene
4. Agreements with Expert Consultants, if any

APPENDIX 7
STUDY TO PROPOSE A MORE REFINED METHOD TO ACCOUNT FOR THE CONVERSION OF ELECTRIC SAVINGS TO MMBTU SAVINGS

NAVIGANT
A Guidehouse Company

Study to Propose a More Refined Method to Account for the Conversion of Electric Savings to MMBtu Savings

Final Report

Prepared for:

The Electric and Gas Program Administrators of Massachusetts

Submitted by:
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Reference No.: 212040
March 23, 2020

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Appendix A. Detailed Total Generation Mix Forecast A-1

Appendix B. Detailed Marginal Generation Mix Forecast B-1

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EXECUTIVE SUMMARY

The Massachusetts Program Administrators (PAs) that sponsor Mass Save are required by the state to provide energy efficiency services to their customers, and they have annual energy efficiency goals. In the course of measuring progress towards those goals, the PAs calculate the total energy savings across all fuels and the greenhouse gas reductions that result from individual energy efficiency measures. The purpose of this study is to refine the method used by the PAs to convert site savings of electricity (in kWh) into source fuel savings (in MMBtu) and to estimate the emissions reductions (of NOx, SOx, and CO_2) that result from electric consumption savings.

For this study, our team used a market modeling approach to forecast the average generation mix, the marginal generation mix, and the typical heat rates and emission rates of different generation plants in the ISO New England region. We forecast these values for the 2020-2040 period using Navigant's proprietary Portfolio Optimization Model (POM) and PROMOD, a commercially available software model. We extrapolated these results to estimate values for the period from 2041-2050, reflecting Massachusetts' policy goal that 80% of electricity generation come from clean energy sources by the year 2050. Then, we compared the results from our market model forecast to observations from different data sources to verify that our forecasting tools are properly calibrated to current market conditions.

Using the market model results and extrapolations for the last decade of the analysis, we calculated heat rate and emissions factors for four costing periods (summer and winter, on- and off-peak) on an annual basis for the period 2020-2050. These factors enable the PAs to calculate the source fuel savings (in MMBtu) and the emissions reductions (in tons of NOx, SOx, and CO_2) for individual energy efficiency measures, based on the PAs' estimates of electricity savings (in MWh). We calculated two separate sets of factors using an average heat rate approach and a marginal heat rate approach. These factors are presented in Table 1 and Table 2 of this report, and our calculations that support these factors are detailed in the spreadsheet submitted with this report. We recommend that the PAs use factors calculated with an average heat rate approach, since (compared to marginal heat rate forecasts) average heat rate forecasts have less associated uncertainty and volatility and are less sensitive to fuel prices and individual plant activity.

Our team updated the Benefit-Cost Ratio (BCR) model to include the MMBtu and emissions factors developed in this study. Prior to this study, the BCR model calculations used static conversion factors to estimate source energy savings and emissions reductions based on electric consumption savings. Our team updated the BCR model to calculate MMBtu and emissions factors specific to each measure, accounting for the measure life and load shape of individual measures. A version of the BCR model that includes these recommended changes is attached to this report.

Updating the BCR model's MMBtu and emissions factors with the results of this study will not affect the benefit-cost ratios calculated for individual measures, since net MMBtu savings and greenhouse gas reductions are not included in the calculation of the B/C ratio. The new MMBtu/MWh factors are higher than the factors used in the 2019-2021 plan version of the model, because the new factors account for the efficiency of fuel-fired generating plants. As a result, the new MMBtu factors will lead to a relative increase in the net annual energy savings and the net lifetime energy savings calculated for each measure in the BCR model. The emissions factors calculated in this study are lower than the factors used in the 2019-2021 plan version of the model, since the factors in this study account for the future shift toward zero emissions power sources (such as wind, solar, and hydropower). The new factors will lead to a relative decrease in the GHG reductions calculated for each measure in the BCR model.

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1. INTRODUCTION

The Massachusetts Program Administrators (PAs) requested that the Navigant Consulting, Inc., n/k/a Guidehouse Inc. (Navigant) develop a methodology to estimate the source energy consumption and emissions reductions (NOx, SOx, and CO_2) associated with electricity consumption in Massachusetts. The purpose of this study is to refine the method used by the PAs to convert site savings of electricity (in kWh) into source fuel savings (in MMBtu) and to estimate emissions reductions resulting from electric consumption savings. This report describes the methodology and results of our analysis.

The source energy usage and emissions from electric generation at any given time depend on the mix of plants that generate electricity and their relative contributions to the electric supply. Electric customers in Massachusetts are served by ISO New England (ISO NE). In the ISO NE region, electricity is generated from combustion of fuels (natural gas, coal, oil), hydroelectricity, nuclear power, and various renewable sources. The mix of electric generation sources supplying the ISO NE electric grid varies throughout the year, depending on the availability and cost of different sources. Additionally, the electric generation mix will change over time, as older generation plants are retired and newer plants are brought online.

Our team used electricity market modeling tools to forecast the annual average mix of generation fuels and the mix of generation fuels used at the margin to generate electricity for Massachusetts customers for the period from 2020 through 2050 in four costing periods, defined as follows:[1]

- **Winter on-peak** is October through May, weekdays from 7am to 11pm;
- **Winter off-peak** is October through May, weekdays from 11pm to 7am, plus weekends and holidays;
- **Summer on-peak** is June through September, weekdays from 7am to 11pm; and
- **Summer off-peak** is June through September, weekdays from 11pm to 7am, plus weekends and holidays.

The following section describes the methodology used in this study.

[1] These costing period were recommended by the PAs, to align with the costing periods used in Synapse (2018) "Avoided Energy Supply Components in New England: 2018 Report." p.66

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2. METHODOLOGY

This section describes the market modeling approach that our team used to forecast the average generation mix, the marginal generation mix, and the typical heat rates and emission rates of different generation plants serving the ISO NE region. This section also provides a discussion and comparison of two separate approaches to developing the MMBtu and emissions factors: one approach using average heat rates and one approach using marginal heat rates. The section concludes with a discussion regarding the assumed heat rates of non-combustion renewable power generators and a description of suggested updates to the BCR model.

2.1 Market Modeling

At a high level, our approach consisted of the following steps:

1. We used the most recent Navigant Reference Case, which is the company's independent view of plant additions, retirements, and operations over time in the ISO NE power system. The Reference Case is developed using a suite of market modeling tools, including Navigant's proprietary Portfolio Optimization Model (POM) and PROMOD, a commercially available software model.[2]
    a. POM is used to model the change in electric generation capacity from different types of generating plants through the year 2040.
    b. PROMOD is used to develop wholesale energy market prices and plant performance forecasts through 2040.
2. We extrapolated the market model results to estimate the fuel mix from 2041-2050, reflecting Massachusetts' policy goal of sourcing 80% of electric generation from clean energy sources by 2050.
3. We compared the results from the PROMOD forecast to current observations from different data sources to ensure the market modeling tools are properly calibrated to current market conditions.
    a. We compared dispatch fuel mix and daily generation mix data from ISO New England[3] to the generation mix forecast by the market modeling tools.
    b. We compared heat rates of different generation technologies reported in generator's NERC filings to the heat rates forecast by the market modeling tools.

The following sub-sections describe these steps in more detail.

[2] Navigant's Reference Case is used by market participants including developers, IPPs, investors, utilities, and regulatory bodies to understand trends in wholesale power markets. Our team provided the ISO-NE market report for Navigant's Fall 2019 Reference Case to the PAs.
[3] ISO-NE publishes data on the regional electricity generation mix for its service region, at: https://www.iso-ne.com/isoexpress/web/reports/operations/-/tree/gen-fuel-mix

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2.1.1 Electric Market Simulation

Navigant forecasted the electric generation mix using a combination of two tools: our proprietary Portfolio Optimization Model (POM) and the commercially available PROMOD software. POM is a linear optimization model used for capacity expansion. POM simulates economic investment decisions and power plant dispatch on a zonal basis subject to capital costs, reserve margin planning requirements, renewable portfolio standards (RPS), fuel costs, fixed and variable operations and maintenance costs, emissions allowance costs, and zonal transmission interface limits. This model incorporates the same generation base, demand forecasts, fuel prices, other operating costs, and plant parameters that are utilized throughout the market simulation modeling process. The model simultaneously performs least-cost optimization of the electric power system expansion and dispatch in multi-decade time horizons. The generation expansion results from POM are used in the fundamental energy price forecast.

Navigant used PROMOD to develop its wholesale energy market price and plant performance forecasts. PROMOD is a detailed energy production cost model that simulates hourly chronological operation of generation and transmission resources on a nodal basis in wholesale electric markets. PROMOD dispatches generating resources to match hourly electricity demand, dispatching the least expensive generation first. The choice of generation is determined by the generator's total variable cost given operating constraints such as ramp rates (for fossil resources) or water availability (for hydraulic resources), and transmission constraints. The total variable cost of the marginally dispatched unit in each hour sets the hourly market clearing price. We have provided further details on our market modeling approach to the PAs in the form of an ISO NE market report.

2.1.2 Extrapolation through 2050

In its current configuration, the PROMOD tool only forecasts electric market activity through 2040. However, for this study, the PA technical leads requested that source energy and emissions factors be provided through the year 2050, since the PAs offer several energy efficiency measures with lifetimes that extend past 2040. To estimate the generation fuel mix for the period 2041-2050, the team referenced the requirements of the Clean Energy Standard (CES) promulgated by the Massachusetts Department of Environmental Protection (DEP). The CES sets a minimum percentage of electricity sales that utilities and competitive retail suppliers must procure from clean energy sources. The minimum percentage begins at 16% in 2018 and increases 2% annually to 80% in 2050.[4]

Our forecast assumes the following generation sources count towards the CES: nuclear, hydroelectric, wind, solar, and other renewable sources. In 2040, the ending year of the PROMOD forecast, we project that generation from these sources will sum to 71.8% of total electricity generation. Therefore, generation from clean energy sources will need to increase over the 2041-2050 period to meet the minimum CES requirement of 80% in 2050. We estimated that total electric generation will steadily increase in the 2041-2050 period following the same linear trend forecasted for the preceding ten-year period, 2031-2040. We assume that generation from nuclear and hydroelectric sources will remain constant in the 2041-2050 period at the same levels projected for the preceding ten years, and that the required increase in clean energy generation will result from increased generation from solar, wind, and other renewable sources. To model this increased generation, we assume that solar, wind, and other renewable generation will

[4] Summaries of Massachusetts' Renewable and Alternative Energy Portfolio Standard programs, including the CES, are available online at: https://www.mass.gov/service-details/program-summaries

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increase proportionally from 2041 to 2050 such that they meet the 80% CES requirement in 2050, and that generation from natural gas and other non-CES sources will decrease proportionally through 2050.

To estimate the annual heat generation (in MMBtus), we assumed heat rates forecast for each plant type in 2040 will remain constant for the years 2041 through 2050. Combining these heat rates with the extrapolated generation fuel mix, we calculated the total heat output by plant type for 2041 through 2050.

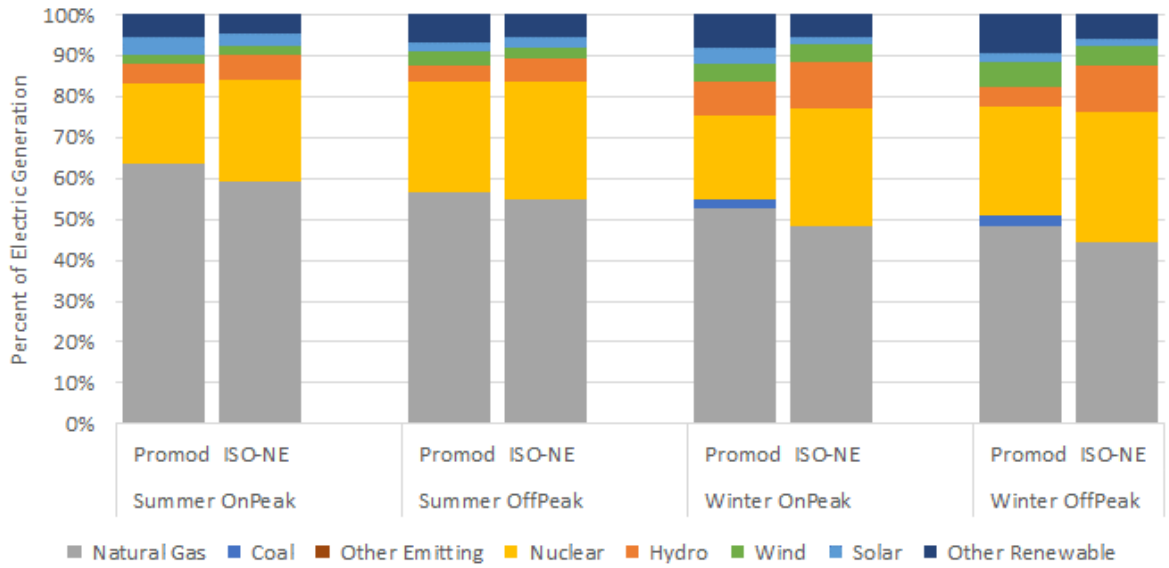
2.1.3 Model Validation

To verify that the POM and PROMOD tools are calibrated to represent the regional electricity market, we compared the models' output to available historical data regarding the generation mix and the heat rates by generator technology.

ISO New England provides data on hourly dispatch rates by fuel type and the daily generation fuel mix for the period 2015-2019. We gathered this data and processed it to determine the average generation fuel mix during the four costing periods for the 2015-2019 period. Since ISO New England has not yet published data for 2020, we used trends observed for the 2015-2019 period to estimate the generation fuel mix for the costing periods in 2020. We compared the 2020 generation mix predicted by our market modeling described above to the projected ISO New England 2020 generation mix, and we found the results to be closely aligned, as illustrated in Figure 1. Our current analysis focuses on the total shares from emitting sources (coal, natural gas, oil) versus non-emitting sources (nuclear, hydro, renewables).

The comparison in Figure 1 provides additional context for the market modeling results, and we are confident that our market modeling represents a sound electric generation mix forecast for electric supply in Massachusetts. Nevertheless, Navigant recommends that the PAs continue to monitor ISO NE actual generation data and periodically update the supply volumes as conditions warrant.

Figure 1. Generation Mix without Imports: Comparison of PROMOD Market Model and ISO New England Dispatch Fuel Mix, 2020



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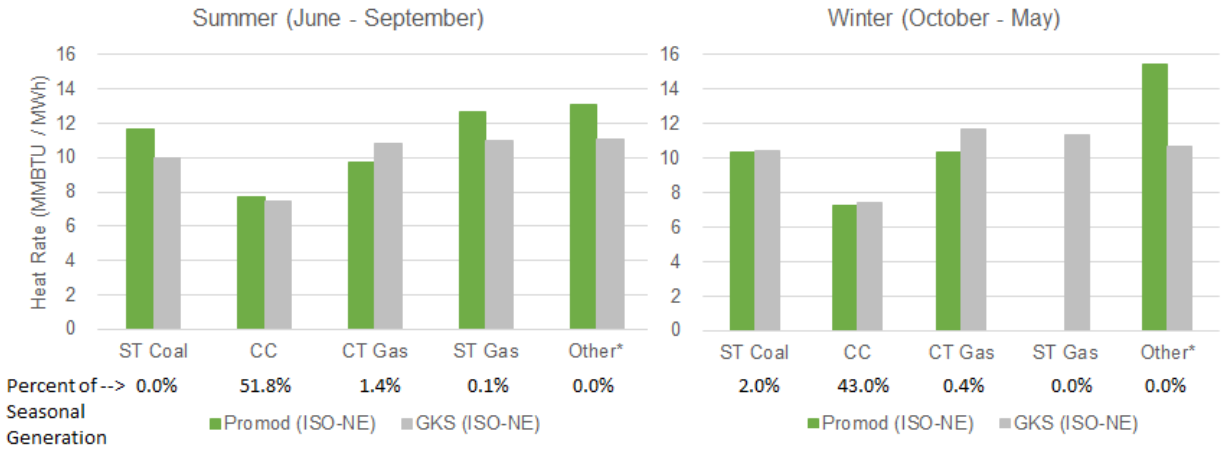
We also compared the heat rates from the market model's output to data from specific ISO NE generating units that Navigant tracks through our GKS Fossil benchmarking service. GKS Fossil calculates heat rates using data that utilities report in monthly intervals to the North American Electric Reliability Corporation's (NERC) Generating Availability Data System (GADS). GKS Fossil currently has data through June 2019, and we calculated a weighted average of seasonal heat rates by plant type (weighted by total plant generation) for the most recent data submitted by each of the 65 generating units that we track in ISO NE. We compared the market models' MMBtu consumption forecast for 2020 to the GKS weighted average heat rate calculations, and we found the results to be comparable. Figure 2 shows that the natural gas combined cycle (CC) plant type comprises the vast majority of combustion-based generation, and that PROMOD's heat rate estimates for combined cycle plants deviate by less than 2% from the heat rates observed in GKS. This comparison provides additional context for the market modeling results, and we are confident they accurately represent the typical heat rates of plants that supply electricity to Massachusetts.

Figure 2. Comparison of PROMOD Market Modeling Outputs (2020) and GKS Fossil Heat Rates (2019) for Combustion Plants



** The "Other" category in GKS Fossil contains oil-fired steam turbine plants and oil-fired simple-cycle combustion turbine plants (including fuel oil, diesel, jet fuel and kerosene). The distribution of "other" plant technologies in GKS Fossil may not align exactly with the distribution of plant technologies in PROMOD. This could explain why there is a larger gap between the GKS and PROMOD heat rate estimates in the winter months, when some plants operate less efficiently due to increased cycling.*

2.2 Average Heat Rates and Marginal Heat Rates

A guiding principle of Massachusetts' energy efficiency programs is that these programs operate on the margin. Consistent with that, the PAs requested that this study produce MMBtu and emissions factors that represent the heat rates and emissions plants operating at the margin in each of the four costing periods.

There is some uncertainty as to how to define the marginal plant. In theory, a marginal approach considers the heat rate and emissions of the single generating plant that is on the margin in each time period so that the last kW generated can be compared with the marginal customer energy efficiency, electrification, or other demand-side resource. However, it is not clear how to define the marginal demand

side resource. Is it any measure being considered in the BCR model, where that measure on the margin has virtually no effect on avoided costs or which plant is the last unit called by ISO-NE? Or is there a "set" of demand-side measures on the margin from Massachusetts—and the rest of New England—that comprises enough of a share that the system is materially affected along with the so-called marginal plant? If so, is the average heat rate and emissions a better estimate for planning purposes?

In the course of our analysis, we observed that the marginal heat rate analysis is more sensitive to individual plant outcomes than the average heat rate approach is. The Results section of this report describes these observations in more detail and weighs the benefits and drawbacks of each approach. In this report, we provide the PAs with separate sets of outputs that result from modeling using the marginal heat rate approach and the average heat rate approach. We also incorporate both sets of outputs in the BCR model to allow the PAs to consider both approaches, and the differences that result, in their analyses.

2.2.1 Average Heat Rate Approach

The results of the market modeling described above include the following values for each costing period for each year from 2020 through 2050: total electric generation (in MWh), total heat output (in MMBtu), and total emissions outputs from electric generation (in tons of NOx, SOx, and CO_2). To calculate MMBtu factors using an average heat rate approach, our team divided the total heat output by the total electric generation for each period. To calculate emissions factors using an average heat rate approach, our team divided the total emissions output for each greenhouse gas (NOx, SOx, and CO_2) by the total electric generation for each period.

2.2.2 Marginal Heat Rate Approach

In addition to average heat rates, Navigant determined approximate marginal heat rates for each costing period based on its estimation of which plant technology (nuclear, renewable, etc.) is at the margin in each hour of the 20-year PROMOD forecast.

To determine the marginal technology type for every hour, Navigant used its standard assumptions from PROMOD of heat rates by technology type, together with forecasted fuel prices and emissions prices from the Reference Case and assumptions about variable operations and maintenance (O&M) costs. Our team used these assumptions to back-calculate energy prices by marginal technology and compared these prices to actual forecasted energy prices to identify the marginal technology type for each hour of our forecast.

We then aggregated all hours by costing period to arrive at a forecast of the proportion of time in each costing period that each technology type is at the margin. We used these proportions to weight the heat rates and emissions rate of individual plant types when we calculated the overall marginal heat rates and emissions rates for each costing period.[5]

[5] Our forecasts of marginal plant selection are unable to differentiate between marginal hours served by hydroelectric plants and marginal hours served by nuclear plants. To address this, we forecast the number of marginal hours served by either nuclear or hydroelectric plants and assumed those hours would be evenly (i.e., 50/50) split between nuclear and hydroelectric plants.

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2.3 Heat Rate Assumptions for Non-Combustion Renewables

2.3.1 Heat Rates for Hydroelectric, Solar, and Wind Sources

This study developed summary MMBtu/MWh factors based on typical heat rates of various electric generator types. It is straightforward to estimate the heat rates for combustion-based sources such as natural gas-fired power plants. A combustion plant's heat rate is equal to the thermal efficiency of the plant's conversion of fuel into electricity. However, the estimation of heat rates for non-combustion renewable sources (such as wind, solar, and hydroelectric plants) is less straightforward. There are several conventions for estimating heat rates of non-combustion renewables, and different approaches may serve different analytic, policy, or statistical needs.

The U.S. Energy Information Administration (EIA) describes several approaches for calculating non-combustible heat rates in Appendix E of their January 2017 Monthly Energy Review:[6]

- The **captured energy approach** reflects the primary energy captured for economic use and does not include losses. This approach uses a simple 3,412 Btu/kWh conversion factor.
- The **incident energy approach** measures the gross energy that first strikes an energy conversion device. In other words, it measures the energy in the water, wind, or sunlight and accounts for conversion efficiency of the turbines or photovoltaic panels.
- The **fossil fuel equivalency approach** represents the energy that would have been consumed if electricity had been generated by fossil fuels.

The California Energy Commission uses a different approach, reporting heat rates for California plants as fuel consumed at each plant divided by each plant's energy output.[7] The CEC reports heat rates of zero MMBtu/MWh for hydroelectric, geothermal, solar photovoltaic, and wind power plants, because these plants do not consume fuel.

Our team reviewed ISO NE documentation on heat rates and could not determine what heat rates ISO NE uses for non-combustible renewable sources.

We understand that the PAs intend to use the MMBtu/MWH factors from this study to account for heat that was generated by consuming non-renewable sources. The Massachusetts Department of Public Utilities (DPU) order that prompted this study stated the following:

> "Electricity used on-site, but generated offsite, contains embedded energy with heat values from a mix of fuels that generate the electricity; however, the Program Administrators failed to consider this embedded energy during the unit conversion."[8]

[6] U.S. Energy Information Administration (2017). "January 2017 Monthly Energy Review." Available at: http://large.stanford.edu/courses/2017/ph241/sheu1/docs/eia-0035-1-2017.pdf
[7] California Energy Commission. "Heat Rates." Available at: https://ww2.energy.ca.gov/almanac/electricity_data/web_qfer/Heat_Rates_cms.php
[8] Massachusetts Department of Public Utilities (2019). "D.P.U. 18-110 through D.P.U. 18-119." p.156-157. Available at: https://fileservice.eea.comacloud.net/FileService.Api/file/FileRoom/10317061

Non-combustion renewable sources do not consume fuel nor produce emissions, so they do not contain embedded energy beyond the energy that is delivered for site consumption. Therefore, we recommend that the PAs follow guidance from the EIA, which states:

> "Users who need renewable primary energy in terms of final energy consumed should multiply the annual generation (in kWh) for the wind, solar, hydro, or geothermal resource of interest by 3,412 Btu/kWh to obtain an estimate of primary energy consumption for renewables."[9]

The analysis conducted in this study therefore assumes a heat rate of 3.41 MMBtu/MWh for wind, solar photovoltaic, and hydroelectric sources.[10]

2.3.2 Heat Rates for Nuclear Sources

Nuclear generating sources do not generate power from fuel combustion, nor do they produce GHG emissions. They do, however, produce heat as they consume uranium fuel. In this study, we assume a typical heat rate of 10.46 MMBtu/MWh to estimate the embedded energy in the electricity generated from nuclear sources. This is consistent with the average operating heat rate that the EIA reports for nuclear plants.[11]

2.4 Benefit Cost Ratio (BCR) Model Updates

2.4.1 Calculations Prior to Update

Prior to this study, the BCR model's calculations used static conversion factors to estimate source energy savings and emissions reductions based on electric consumption savings. The BCR Model ***Lookups*** tab contains a MMBtu factor in range D35:F35 (equal to 3.412 MMBtu/MWh) and emissions factors in range D29:F31 (equal to 0.00016 tons NOx/MWh, 0.00004 tons SOx/MWh, and 0.49400 tons CO_2/MWh).

The MMBtu/MWh factor is referenced in columns R-U of the calculation tabs of the model (tabs ***EECalcsYr1***, ***EECalcsYr2***, and ***EECalcsYr3***), which calculate the following:

- Column R: Adj Gross Annual Energy (MMBTU)
- Column S: Adj Gross Lifetime Energy (MMBTU)
- Column T: Net Annual Energy (MMBTU)
- Column U: Net Lifetime Energy (MMBTU)

Each of these columns calculates MMBtu savings by multiplying the universal named variable "MWhtoMMBTU" (from the ***Lookups*** tab) by the MWh savings values calculated in columns N-Q of the calculation tabs.

[9] U.S. EIA (2019). "Average Fossil Fuel Heat Rates for Electricity Generation." Available at: https://www.eia.gov/outlooks/aeo/heat_rates.php

[10] Note that we assume non-zero heat rates for combustion-based renewable energy sources, such as landfill gas, refuse, and biomass, since these sources consume fuel and have embedded energy beyond the energy that is delivered for site consumption.

[11] U.S. EIA (2019). "Average Operating Heat Rate for Selected Energy Sources." Available at: https://www.eia.gov/electricity/annual/html/epa_08_01.html

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The greenhouse gas reductions for each measure are calculated in columns EF-EH of the calculation tabs, which reference the static emissions factors from the ***Lookups*** tab and calculate the following:

- Column EF: Annual NOx (Short Tons)
- Column EG: Annual SO_2 (Short Tons)
- Column EH: Annual CO_2 (Short Tons)

The annual NOx and SOx reduction values are calculated by multiplying the "Adj Gross Annual MWh" (column N) by static values for GHG_Elec_NOX and GHG_Elec_SO2, respectively. The annual CO_2 reduction value is calculated as a sum of CO_2 reductions due to electric savings ("Adj Gross Annual MWh" multiplied by the factor GHG_Elec_CO2) and CO_2 reductions due to site savings of natural gas, oil, and propane.

The current approach in the BCR model uses the same MMBtu and emissions factors for all measures, even though individual measures have different load shapes and different values for measure life. The following sections describe how the BCR model may be changed to incorporate the findings of this study and to account for different measure lifetimes and load shapes.

2.4.2 New Tables of Annual and Lifetime Factors for MMBtu and Emissions

The analysis in this study developed average and marginal heat rate and emissions factors for each of the four costing periods, for each year from 2020-2050. These values are contained in range T8:BB42 of a new ***SourceFactors*** tab added to the BCR spreadsheet. In cell A5 of the ***SourceFactors*** tab, users can specify whether they want the analysis to use an average heat rate approach or a marginal heat rate approach. Users may also choose to use the original MMBtu and emissions factors used in the 2019-2021 plan version of the BCR model.[12] The user input in cell A5 determines which set of heat rate and emissions factors is selected and used in the BCR model. In both the AVERAGE table and the MARGINAL table, the MMBtu and emissions factors change over time since the proportion of different fuels in the electric generation mix is forecast to evolve over time.

Energy efficiency measures with measure life longer than one year should use MMBtu and emissions factors that account for changes in the generation fuel mix over the lifetime of the measure. The ***SourceFactors*** tab contains tables that calculate average lifetime MMBtu and emissions factors for measures in program years 1, 2, and 3, with measure life ranging from 1 to 25 years. The average lifetime factors are calculated separately in the ***SourceFactors*** tab for program year 1 (range A45:R77), program year 2 (range A79:R110), and program year 3 (range A112:R142). These lifetime factors are calculated as an unweighted average of factors from the program year through the end of the measure life. For example, the lifetime MMBtu factor for a 2020 measure with 20-year life is calculated as the average MMBtu factor over the period 2020-2039.

These lifetime average factors are then referenced by the calculations for individual measures, as described in the following section. The tables of average lifetime factors in the ***SourceFactors*** tab are divided into named ranges to make any equation references to these tables easier to comprehend and quality check. For example, the ***SourceFactors*** range C43:F74 is assigned the name "Tbl_MMBtu_MWh_Yr1," indicating that it is a table of MMBtu/MWh factors for use with Year 1 measures.

[12] If users choose to model the ORIGINAL values, the model uses the following values for all years: a heat rate of 3.412 MMBtu/MWh and emissions factors of 0.00016 tons NOx/MWh, 0.00004 tons SOx/MWh, and 0.49400 tons CO2/MWh.

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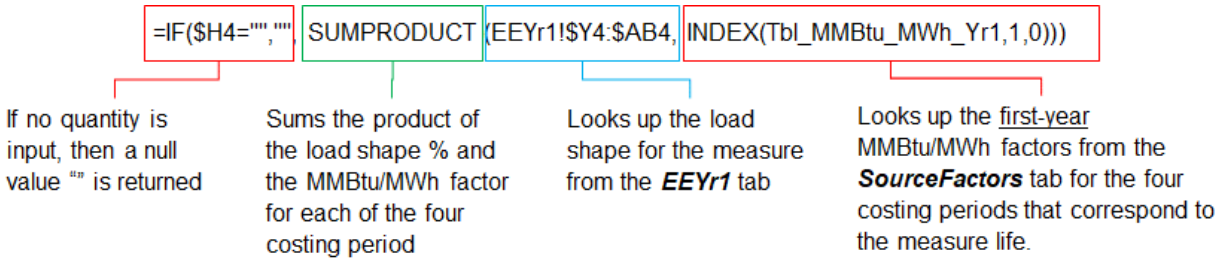
2.4.3 Incorporating MMBtu and Emissions Factors in BC Calculations

As noted above, individual measures have different load shapes and different values for measure life. The MMBtu and emissions factors used for each measure should reflect the measure's load shape and measure life. The team suggests adding five columns to each calculation tab (tabs ***EECalcsYr1***, ***EECalcsYr2***, and ***EECalcsYr3***) to calculate the first-year MMBtu factor, the lifetime average MMBtu factor, and the lifetime average emissions factors unique to each measure. In the edited BCR model submitted with this report, the team has added these five columns to each calculation tab and indicated the new columns using a yellow fill color.

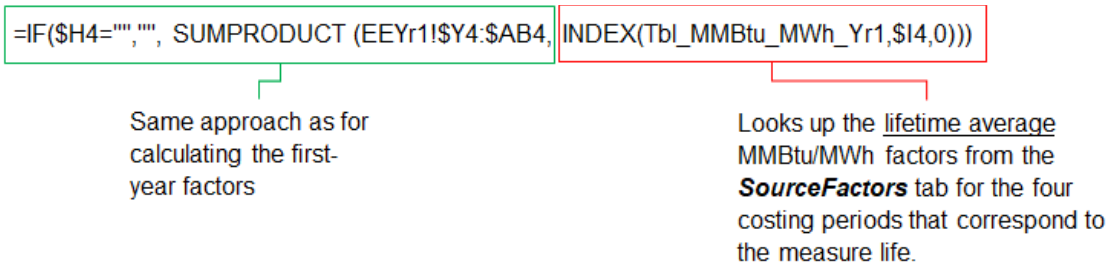
The new column R calculates a first-year MMBtu/MWh factor for each measure, using a formula that (1) looks up the load shape for the measure from the corresponding ***EEYr1***, ***EEYr2***, or ***EEYr3*** tab, (2) looks up the MMBtu factors for the first year of the measure life, and (3) calculates the first-year annual factor as the summed product of (1) and (2). The suggested formula to calculate first-year annual MMBtu/MWh is detailed in Figure 4.

Figure 3. Excel Formula for Calculating the First-Year Annual MMBtu/MWh Factor



The new column S calculates a lifetime average MMBtu/MWh factor for each measure, and the new columns EH, EI, and EJ calculate lifetime average factors for tons of NOx/MWh, tons of SOx/MWh, and tons of CO_2/MWh. The formulas in these columns all use a similar syntax. In each of the new lifetime average columns, the formula (1) looks up the load shape for the measure from the corresponding ***EEYr1***, ***EEYr2***, or ***EEYr3*** tab, (2) looks up the lifetime average MMBtu or emission factor corresponding with the measure life, and (3) calculates the average annual factor as the summed product of (1) and (2). The suggested formula to calculate average annual MMBtu/MWh is detailed in Figure 4.

Figure 4. Excel Formula for Calculating the Lifetime Average Annual MMBtu/MWh Factor



In each of the BCR calculation tabs, the formulas that previously referred to static MMBtu and emissions factors have been updated to refer to the five new factor columns, as described below:

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- References to the static MWHtoMMBTU variable from annual energy savings calculations have been updated to refer to column R. This applies to columns T and V, which calculate Adjusted Gross Annual Electric Energy and Net Annual Electric Energy.
- References to the static MWHtoMMBTU variable from lifetime energy calculations have been updated to refer to column S. This applies to columns U and W, which calculate Adjusted Gross Lifetime Energy and Net Lifetime Energy.
- References to the static GHG_Elec_NOX variable have been updated to refer to column EH. This applies to column EK, which calculates Annual NOX (Short Tons).
- References to the static GHG_Elec_SO2 variable have been updated to refer to column EI. This applies to column EL, which calculates Annual SOx (Short Tons).
- References to the static GHG_Elec_CO2 variable have been updated to refer to column EJ. This applies to column EM, which calculates Annual CO_2 (Short Tons).

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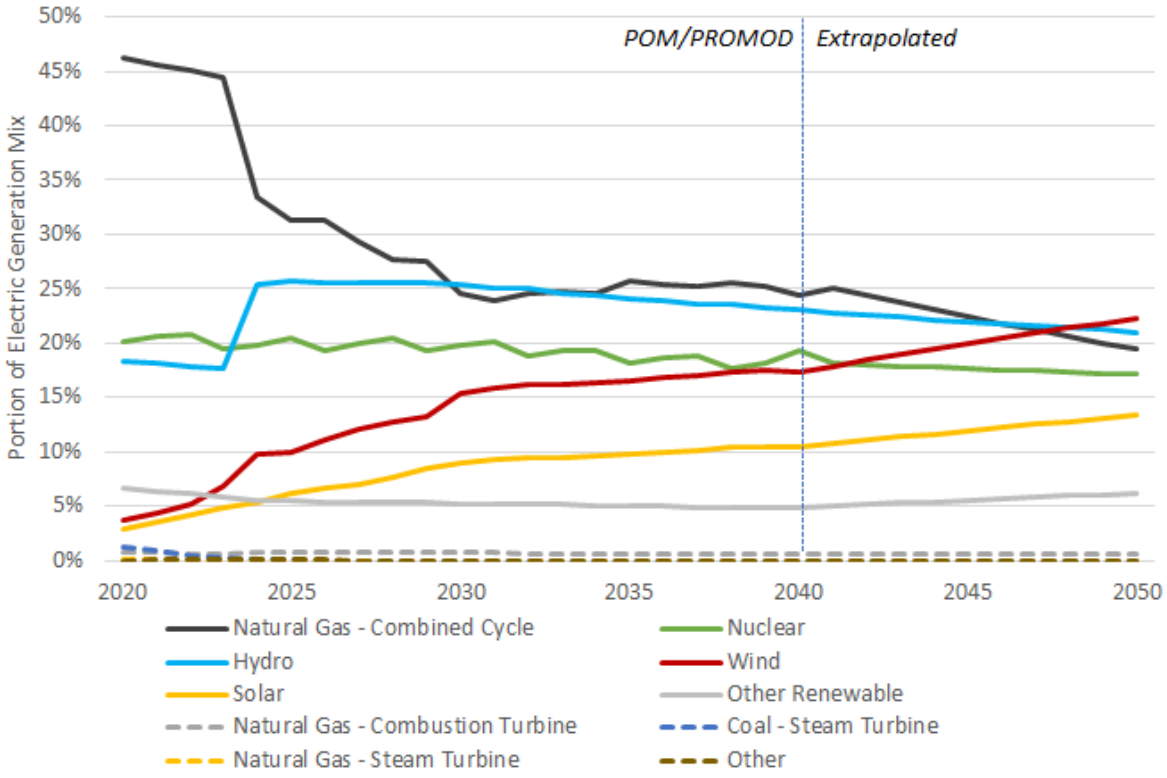
3. RESULTS

3.1 Forecast of Electric Generation Mix

The results of our forecast of the annual electricity generation mix are illustrated in Figure 5, which shows the portion of annual electric generation contributed by each fuel. The total generation mix shown here is used in the analysis to calculate the average heat rate and average emissions values. Appendix A provides detailed tables showing the annual generation mix by costing period at five-year intervals.

Figure 5. Forecast of Total Generation Fuel Mix for ISO New England, 2020-2050



3.2 Forecast of Marginal Generation by Plant Type

The marginal generation analysis forecasts the portion of the time that each plant type is designated as the marginal electric generator in each of the four costing periods from 2020-2050. The results of this analysis are illustrated in Figure 6. The marginal generation mix shown here is used in the analysis to calculate the marginal heat rate and marginal emissions values for each costing period. Appendix B provides detailed tables showing the marginal generation mix by costing period at five-year intervals.

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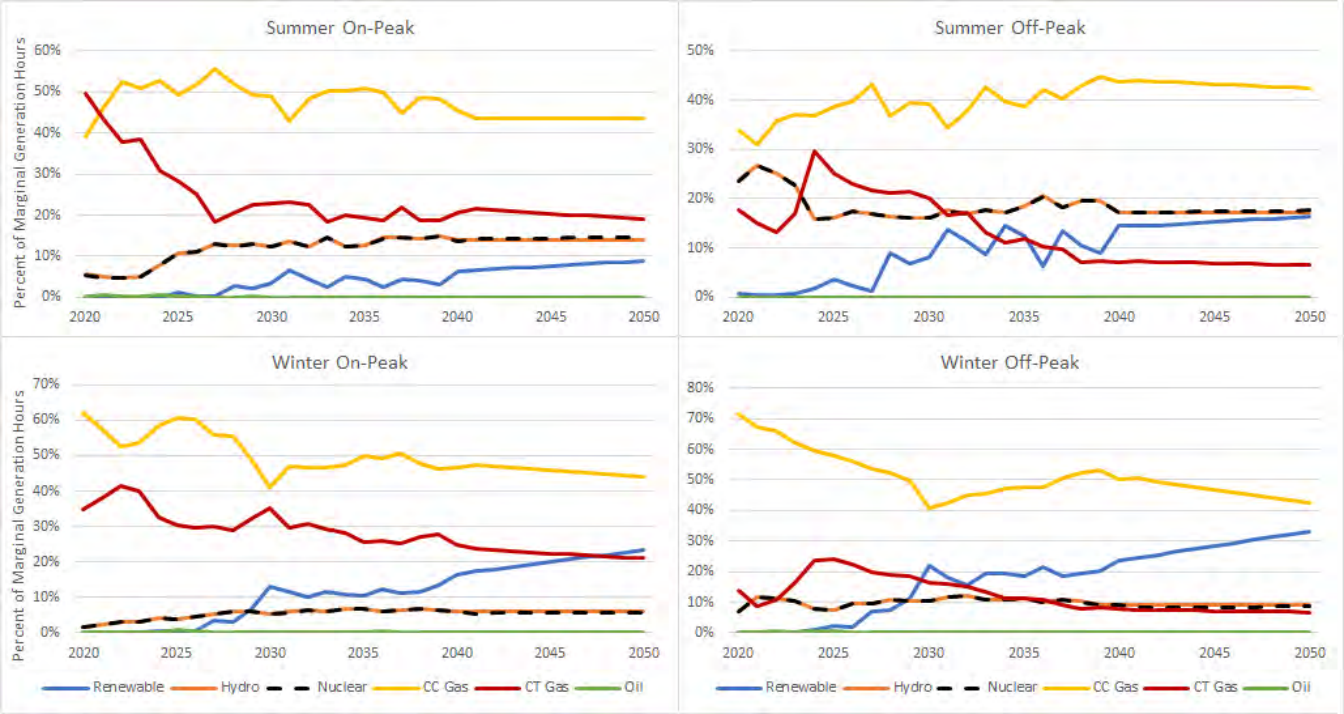
Figure 6. Forecast of Marginal Generation Fuel Mix for ISO New England in Four Costing Periods, 2020-2050



Our team offers the following notes on these forecasts:

- The summer off-peak and winter off-peak charts show that the share of off-peak marginal hours met by natural gas combustion turbines increases sharply in 2024. This is likely the result of a combination of factors (including anticipated plant closures) that in 2024 combine in a way that favors marginal production from natural gas combustion turbine plants.
- As noted previously, our methodology for forecasting shares of marginal generation does not distinguish between generation from nuclear and hydroelectric plants. To address this, we forecast the number of marginal hours served by either nuclear or hydroelectric plants and assumed those hours would be evenly (i.e., 50/50) split between nuclear and hydroelectric plants. As a result, our forecasts for nuclear and hydroelectric shares of marginal generation are identical, and their lines overlap in the Figure 6 charts.
- Our team forecast marginal generation for the period 2020-2040 using energy price forecasts from PROMOD. We extrapolated our forecast to cover the period 2041-2050 on the assumption that the electric generation mix gradually shifts to meet the clean energy requirements of the Massachusetts CES. This extrapolation yields upward trends in the renewable share of marginal generation, downward trends in the fossil fuel share of marginal generation, and nearly constant shares for nuclear and hydroelectric generation for the 2041-2050 period.

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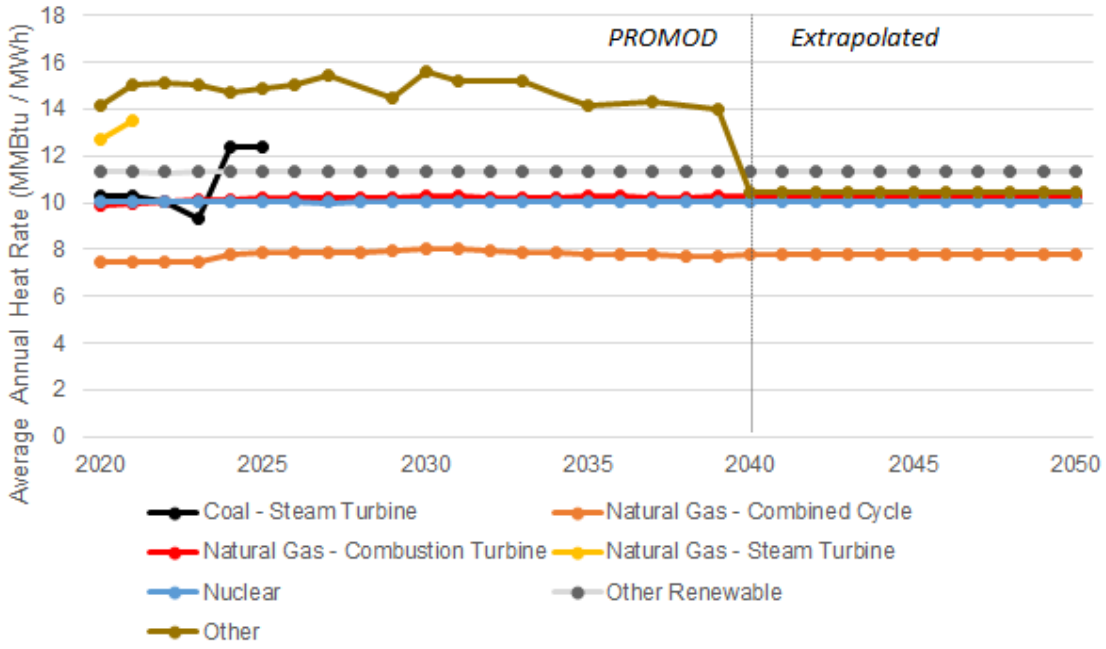
3.3 Forecast of Heat Rates by Plant Type

The analysis produced an annual forecast of the typical heat rate by plant type in the four costing periods, for the years 2020-2050. Figure 7 summarizes the forecast of typical heat rates by plant type. Year-on-year fluctuations in the heat rate forecasts are driven by forecasts of plant retirements and plant construction. For instance, the average heat rate of the "Other" category will decline in 2039-2040 due to the closure of a less-efficient oil-fired generation plant. Conversely, there is an increase in the average heat rate for coal plants due to the expected closure in 2023 of a plant with higher-than-average efficiency. The total capacity in the "Coal – Steam Turbine" category is very small, and the average heat rate in the coal-fired category is driven by just a small number of units. The heat rates presented here are combined with the generation mix forecasts to estimate the average and marginal heat rates over time, described in the following section.

Figure 7. Typical Heat Rate by Generation Type, in MMBtu/MWh, 2020-2050



3.4 Results from Marginal Heat Rate and Average Heat Rate Approaches

As described in Section 2.2, this report provides the PAs with separate sets of outputs: one set derived using the marginal heat rate approach and a separate set derived using an average heat rate approach. Figure 8 compares the average and marginal heat rates for the four costing periods over the period 2020-2050, showing average heat rates with solid lines and marginal heat rates with hollow lines.

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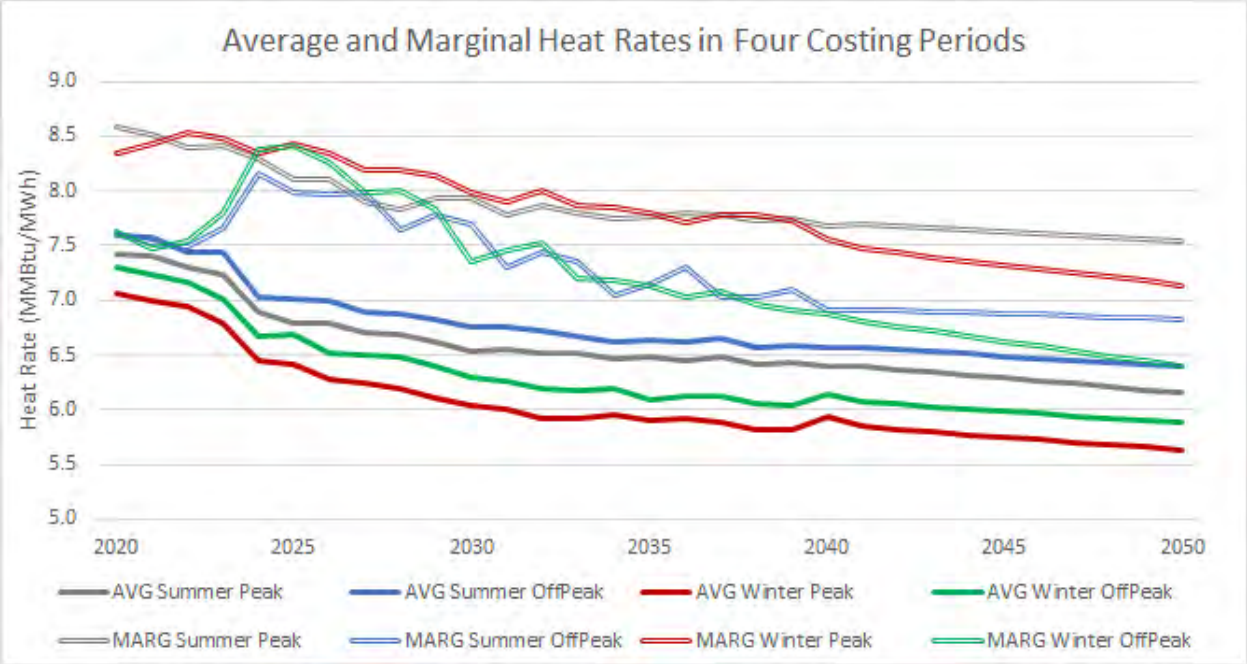
Figure 8. Average and Marginal Heat Rates by Costing Period, in MMBtu/MWh, 2020-2050



Our team offers the following observations on these forecasts:

- Fossil fuel generators have a higher share of marginal generation than total generation. Conversely, renewable generators have a lower share of marginal generation than total generation. As a result, marginal heat rates are forecast to be higher than average heat rates throughout the 2020-2050 period. Using marginal heat rates as a benefit-cost model input will result in a lower calculated “total MMBtu savings” for fuel switching measures (compared to savings calculated using average heat rates).
- There is a general downward trend in the average and marginal heat rates for all periods. This is due to the steady increase in renewable generation as a percent of total generation and a steady increase in the amount of time that renewable generators operate at the margin.
- The forecast suggests that the average heat rates will drop sharply in 2024 due to an increase in hydroelectric generation from the Northeast Energy Connect coming online and delivering hydro power to the ISO NE grid.
- In that same period, 2023-2024, the marginal heat rates in the off-peak periods increase sharply. This is due to an increase in the share of marginal hours for gas combustion turbine plants, likely resulting from a combination of factors (including anticipated plant closures). The forecast indicates that natural gas combustion turbine plants would increase their share of off-peak marginal production starting in 2024. This will lead to a higher marginal heat rate, since combustion turbine plants have a higher heat rate (~10.2 MMBtu/MWh) than combined cycle plants (~7.7 MMBtu/MWh).
- Beyond the PROMOD forecast period ending in 2040, average and marginal heat rates are forecasted to decline over the 2041-2050 period as the renewable share of the electric generation mix increases to comply the requirements of the Massachusetts Clean Energy Standard.

This study provides complete sets of MMBtu/MWh and emissions factors calculated using the average generation mix and the marginal generation mix. The PAs need to select one set of factors to use in their benefit-cost calculations. Factors calculated using the marginal generation mix are better aligned with the assumptions in other energy efficiency calculations. For example, the MA Department of Environmental Protection (DEP) uses a marginal approach to calculate the emissions rates, and the Avoided Energy Supply Costs (AESC) study uses a marginal approach to calculate avoided costs. However, as illustrated above, marginal heat rate analyses can be sensitive to different factors such as the retirement of individual plants. Fluctuations in fuel prices can also influence the selection of different plant types for marginal generation. Fuel markets are somewhat predictable in the near-term, but long-term forecasts of fuel prices are typically less accurate.

Factors calculated using the average generation mix (as opposed to the marginal generation mix) are less sensitive to fuel prices and individual plant closures. Our team expects that heat rate and emission rate forecasts based on average heat rates would provide better accuracy with less sensitivity and uncertainty. We therefore recommend that the PAs conduct benefit-cost calculations using MMBtu and emissions factors based on average heat rates.

3.5 Tables of MMBtu, NOx, SOx, and CO2 per MWh for 2020-2050

The tables in this section show the MMBtu and emissions factors developed using an average heat rate approach and a marginal heat rate approach. These tables are included in the updated BCR model attached to this report. In the updated BCR model, users may select which set of factors (average or marginal) to use in the BCR model, or users may choose to use the static values included in the 2019-2021 plan version of the BCR model.

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Table 1. MMBtu and Emissions Factors from Average Heat Rates

Factor	Average Heat Rate (MMBtu/MWh)				NOx (short tons / MWh)				SOx (short tons / MWh)				CO_2 (short tons / MWh)			
Season	Summer		Winter		Summer		Winter		Summer		Winter		Summer		Winter	
Peak	On	Off	On	Off	On	Off	On	Off	On	Off	On	Off	On	Off	On	Off
2020	7.423	7.589	7.058	7.304	7.37E-05	7.59E-05	9.38E-05	1.08E-04	3.87E-07	9.19E-08	2.43E-05	2.94E-05	0.302	0.277	0.275	0.270
2021	7.411	7.568	7.002	7.240	7.06E-05	7.35E-05	8.61E-05	9.75E-05	4.39E-07	3.93E-08	1.87E-05	2.03E-05	0.295	0.269	0.264	0.257
2022	7.299	7.447	6.941	7.171	6.92E-05	7.37E-05	8.10E-05	9.02E-05	4.85E-07	9.32E-09	1.01E-05	1.05E-05	0.291	0.266	0.251	0.241
2023	7.242	7.433	6.784	7.013	6.76E-05	7.34E-05	7.68E-05	8.35E-05	3.16E-07	7.45E-09	5.61E-06	4.61E-06	0.281	0.256	0.249	0.239
2024	6.893	7.036	6.451	6.669	6.55E-05	7.00E-05	6.57E-05	7.13E-05	9.31E-07	9.60E-08	2.94E-06	2.57E-06	0.251	0.224	0.196	0.180
2025	6.797	7.019	6.416	6.686	6.37E-05	7.03E-05	6.43E-05	7.02E-05	9.44E-07	2.79E-07	2.62E-06	2.39E-06	0.239	0.220	0.184	0.175
2026	6.787	6.994	6.274	6.520	6.12E-05	6.80E-05	6.26E-05	6.88E-05	4.54E-07	1.11E-08	1.19E-07	1.06E-07	0.230	0.209	0.185	0.178
2027	6.699	6.896	6.246	6.497	5.99E-05	6.85E-05	6.00E-05	6.59E-05	7.40E-08	1.40E-08	3.52E-08	2.48E-08	0.224	0.203	0.172	0.165
2028	6.688	6.873	6.199	6.491	5.88E-05	6.76E-05	5.96E-05	6.63E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.220	0.195	0.163	0.160
2029	6.616	6.833	6.111	6.402	5.94E-05	6.86E-05	5.93E-05	6.56E-05	1.73E-07	7.88E-08	0.00E+00	0.00E+00	0.217	0.197	0.164	0.160
2030	6.536	6.759	6.034	6.290	5.79E-05	6.74E-05	5.78E-05	6.33E-05	6.53E-08	2.57E-08	0.00E+00	0.00E+00	0.211	0.193	0.149	0.140
2031	6.545	6.752	6.011	6.254	5.68E-05	6.59E-05	5.69E-05	6.30E-05	9.21E-08	3.04E-08	0.00E+00	0.00E+00	0.205	0.186	0.144	0.139
2032	6.517	6.722	5.922	6.194	5.65E-05	6.58E-05	5.71E-05	6.29E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.204	0.183	0.148	0.145
2033	6.516	6.676	5.924	6.169	5.65E-05	6.53E-05	5.57E-05	6.15E-05	8.17E-09	3.34E-09	0.00E+00	0.00E+00	0.204	0.182	0.144	0.142
2034	6.462	6.625	5.950	6.193	5.66E-05	6.51E-05	5.54E-05	6.03E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.209	0.192	0.138	0.136
2035	6.488	6.643	5.897	6.087	5.51E-05	6.36E-05	5.56E-05	6.10E-05	8.78E-08	1.00E-07	0.00E+00	0.00E+00	0.206	0.188	0.149	0.145
2036	6.442	6.614	5.912	6.126	5.57E-05	6.38E-05	5.51E-05	6.00E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.208	0.195	0.143	0.137
2037	6.475	6.648	5.888	6.125	5.55E-05	6.33E-05	5.35E-05	5.92E-05	1.18E-07	1.64E-07	0.00E+00	0.00E+00	0.206	0.190	0.139	0.140
2038	6.422	6.565	5.817	6.051	5.51E-05	6.25E-05	5.45E-05	6.00E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.207	0.191	0.142	0.142
2039	6.428	6.586	5.824	6.044	5.35E-05	6.10E-05	5.44E-05	5.99E-05	5.86E-08	8.10E-08	0.00E+00	0.00E+00	0.203	0.188	0.139	0.140
2040	6.394	6.562	5.931	6.133	5.31E-05	6.05E-05	5.42E-05	5.85E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.205	0.192	0.134	0.131
2041	6.399	6.569	5.846	6.078	5.45E-05	6.25E-05	5.51E-05	6.06E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.205	0.191	0.139	0.139
2042	6.372	6.549	5.821	6.055	5.54E-05	6.38E-05	5.60E-05	6.18E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.202	0.190	0.138	0.138
2043	6.343	6.529	5.796	6.030	5.63E-05	6.51E-05	5.70E-05	6.29E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.200	0.188	0.136	0.136
2044	6.317	6.509	5.772	6.008	5.71E-05	6.64E-05	5.79E-05	6.40E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.197	0.186	0.135	0.135
2045	6.288	6.489	5.747	5.984	5.80E-05	6.77E-05	5.88E-05	6.51E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.194	0.184	0.133	0.134
2046	6.262	6.470	5.724	5.962	5.88E-05	6.90E-05	5.97E-05	6.62E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.192	0.182	0.131	0.133
2047	6.237	6.452	5.702	5.941	5.97E-05	7.02E-05	6.05E-05	6.72E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.190	0.181	0.130	0.132
2048	6.211	6.433	5.680	5.920	6.05E-05	7.14E-05	6.14E-05	6.82E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.187	0.179	0.129	0.131
2049	6.184	6.414	5.657	5.899	6.13E-05	7.27E-05	6.22E-05	6.92E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.185	0.177	0.127	0.129
2050	6.159	6.396	5.636	5.879	6.21E-05	7.39E-05	6.30E-05	7.02E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.182	0.176	0.126	0.128

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Table 2. MMBtu and Emissions Factors from Marginal Heat Rates

Factor	Average Heat Rate (MMBtu/MWh)				NOx (short tons / MWh)				SOx (short tons / MWh)				CO2 (short tons / MWh)			
Season	Summer		Winter		Summer		Winter		Summer		Winter		Summer		Winter	
Peak	On	Off	On	Off	On	Off	On	Off	On	Off	On	Off	On	Off	On	Off
2020	8.577	7.609	8.340	7.621	9.95E-05	3.71E-05	7.21E-05	4.61E-05	7.2E-06	0.0E+00	5.5E-07	1.4E-06	0.464	0.259	0.480	0.395
2021	8.577	7.609	8.340	7.621	9.95E-05	3.71E-05	7.21E-05	4.61E-05	7.2E-06	0.0E+00	5.5E-07	1.4E-06	0.464	0.259	0.480	0.395
2022	8.519	7.523	8.433	7.477	9.49E-05	3.21E-05	7.84E-05	4.12E-05	1.0E-05	0.0E+00	4.0E-06	7.6E-06	0.466	0.231	0.480	0.350
2023	8.395	7.488	8.524	7.534	8.74E-05	3.39E-05	8.35E-05	4.71E-05	7.6E-06	0.0E+00	4.1E-06	8.1E-06	0.459	0.240	0.479	0.355
2024	8.418	7.665	8.476	7.792	8.72E-05	3.99E-05	8.15E-05	5.38E-05	8.7E-06	0.0E+00	1.1E-06	6.1E-06	0.457	0.271	0.474	0.378
2025	8.290	8.154	8.346	8.379	8.01E-05	6.48E-05	7.41E-05	7.12E-05	1.2E-05	0.0E+00	4.7E-06	1.2E-05	0.428	0.352	0.459	0.433
2026	8.103	7.978	8.427	8.410	6.79E-05	5.55E-05	8.35E-05	7.35E-05	2.9E-06	0.0E+00	1.8E-05	9.0E-06	0.392	0.335	0.467	0.434
2027	8.101	7.973	8.346	8.258	6.75E-05	5.29E-05	7.41E-05	6.35E-05	7.1E-06	0.0E+00	7.3E-06	2.4E-06	0.390	0.327	0.456	0.408
2028	7.896	7.982	8.198	7.989	5.28E-05	5.18E-05	6.89E-05	5.55E-05	0.0E+00	0.0E+00	4.8E-06	8.9E-07	0.363	0.334	0.435	0.380
2029	7.838	7.638	8.186	8.002	5.47E-05	4.93E-05	6.47E-05	5.53E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.358	0.301	0.428	0.373
2030	7.941	7.776	8.132	7.838	5.79E-05	5.08E-05	6.83E-05	5.38E-05	2.6E-06	0.0E+00	0.0E+00	0.0E+00	0.361	0.317	0.418	0.358
2031	7.940	7.698	7.980	7.359	5.73E-05	4.97E-05	7.21E-05	4.64E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.365	0.309	0.404	0.308
2032	7.786	7.308	7.899	7.464	5.41E-05	4.09E-05	6.55E-05	4.56E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.338	0.264	0.396	0.311
2033	7.871	7.437	8.007	7.532	5.51E-05	4.39E-05	6.53E-05	4.44E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.357	0.282	0.402	0.317
2034	7.801	7.353	7.860	7.193	4.95E-05	3.77E-05	6.20E-05	4.05E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.340	0.275	0.392	0.299
2035	7.755	7.050	7.857	7.183	5.20E-05	3.32E-05	5.99E-05	3.93E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.349	0.250	0.388	0.298
2036	7.760	7.142	7.798	7.132	5.04E-05	3.31E-05	5.74E-05	3.86E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.348	0.249	0.384	0.294
2037	7.795	7.295	7.714	7.030	4.97E-05	3.31E-05	5.87E-05	3.86E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.341	0.254	0.381	0.293
2038	7.775	7.027	7.784	7.075	5.22E-05	3.09E-05	5.67E-05	3.65E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.335	0.242	0.385	0.293
2039	7.724	7.024	7.784	6.967	4.99E-05	2.86E-05	5.85E-05	3.45E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.334	0.237	0.382	0.290
2040	7.738	7.103	7.736	6.917	4.96E-05	2.92E-05	5.97E-05	3.59E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.332	0.246	0.380	0.295
2041	7.685	6.907	7.556	6.868	5.12E-05	2.88E-05	5.58E-05	3.49E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.331	0.241	0.365	0.285
2042	7.696	6.915	7.467	6.807	5.15E-05	2.89E-05	5.43E-05	3.44E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.328	0.242	0.361	0.284
2043	7.680	6.910	7.431	6.761	5.10E-05	2.87E-05	5.37E-05	3.39E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.327	0.241	0.357	0.279
2044	7.663	6.899	7.394	6.716	5.06E-05	2.85E-05	5.31E-05	3.33E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.325	0.240	0.354	0.275
2045	7.647	6.889	7.358	6.670	5.02E-05	2.83E-05	5.25E-05	3.28E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.323	0.239	0.350	0.270
2046	7.630	6.878	7.321	6.624	4.98E-05	2.81E-05	5.19E-05	3.23E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.321	0.237	0.347	0.265
2047	7.614	6.868	7.285	6.579	4.94E-05	2.79E-05	5.13E-05	3.17E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.320	0.236	0.343	0.260
2048	7.597	6.857	7.248	6.533	4.89E-05	2.77E-05	5.07E-05	3.12E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.318	0.235	0.339	0.256
2049	7.581	6.847	7.212	6.487	4.85E-05	2.75E-05	5.01E-05	3.06E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.316	0.233	0.336	0.251
2050	7.564	6.836	7.175	6.441	4.81E-05	2.73E-05	4.96E-05	3.01E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.315	0.232	0.332	0.246

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3.6 Impacts of Updated Factors

This section describes how replacing the static MMBtu and emissions factors in the BCR model with the factors calculated in this study will impact the results of the B/C model.

Section 2.4.1 describes the static MMBtu and emissions factors that are currently used in the BCR model. Table 3 compares these current BCR factors to a selection of factor values derived in this study using the average heat rate approach and the marginal heat rate approach. As illustrated, the average and marginal heat rates calculated in this study decline over time and are higher than the static heat rate value currently used in the BCR model. The CO_2 emissions factors calculated in this study decline over time and are lower than the current assumption in the BCR model.

Table 3. Comparison of Select MMBtu and Emissions Factors to Current BCR Factors, Summer Peak Period

Year	Heat Rate (MMBtu/MWh)			NOx Emissions Factor (1,000 tons NOx/MWh)			CO_2 Emissions Factor (1,000 tons NOx/MWh)		
	2019 BCR Factors	Average Method	Marginal Method	2019 BCR Factors	Average Method	Marginal Method	2019 BCR Factors	Average Method	Marginal Method
2020	3.412	7.423	8.577	0.160	0.074	0.100	0.494	0.302	0.464
2030	3.412	6.536	7.940	0.160	0.058	0.057	0.494	0.211	0.365
2040	3.412	6.394	7.685	0.160	0.053	0.051	0.494	0.205	0.331
2050	3.412	6.159	7.548	0.160	0.062	0.048	0.494	0.182	0.313

Updating the BCR model's MMBtu and emissions factors with the results of this study will not affect the benefit-cost ratios calculated for individual measures, since net MMBtu savings and greenhouse gas reductions are not included in the calculation of the B/C ratio. The new MMBtu factors will lead to an increase in the net annual energy savings and the net lifetime savings calculated in the BCR model. Table 4 illustrates the magnitude of this increase for a handful of measures included in the BCR model.

Table 4. Comparison of Net Lifetime and Net Annual Energy Savings for Selected Measures

Measure Description	Net Annual Energy Savings (MMBtu)			Net Lifetime Energy Savings (MMBTU)		
	2019 BCR Factors	Average Heat Rate Approach	Percent Change	2019 BCR Factors	Average Heat Rate Approach	Percent Change
Insulation, Electric (Single Family)	1,893	3,994	+111%	47,329	87,964	+86%
Insulation, Oil (Single Family)	1,661	3,566	+115%	41,525	79,495	+91%
Heat Pump SEER 18.0 HSPF 9.6, Replacing Existing EUL Heat Pump	975	2,074	+113%	14,627	28,505	+95%
Central Ducted Heat Pump Fully Displacing Existing Furnace, Oil	-213	-457	+115%	-3,407	-6,707	+97%
Water Heater, Heat Pump, <55 gallon, Energy Star	3,337	7,103	+113%	43,380	85,660	+97%

3.7 Limitations of This Analysis

As with any analysis involving forecasting, the results of this study depend on assumptions about the future. Our team has developed forecasts of generating capacity and the total and marginal mixes of generating fuels using the most current information available as of March 2020. Below, we identify several assumptions that could limit the precision of our estimate.

- **Nuclear plant lifetimes** – Our forecast assumes that nuclear generating capacity in the ISO NE region stays constant throughout the forecast period of 2020-2050. In other words, we assume that the nuclear plants supplying the ISO NE region today are not retired or decommissioned prior to 2050. Our analysis uses a heat rate of 10.08 MMBtu/MWh for nuclear generators, and in 2050 we forecast that about 35% of the heat output for power generation will come from nuclear plants. If one or more nuclear plants were to retire prior to 2050, the retired capacity would likely be replaced by another clean energy source (such as wind, solar, or other renewables) such that Massachusetts meets its target of 80% clean energy generation by 2050. If nuclear capacity is retired and replaced with non-combustion renewables, then our forecast in this report would overestimate average heat rates forecast in the later years of the analysis period.
- **New hydroelectric capacity** – The New England Clean Energy Connect is a proposed project to install a transmission line to deliver hydroelectric power from Canada to the ISO NE region. The project was scheduled to be complete in 2022, but it has encountered resistance and its completion will likely be delayed. Our forecast assumes that the project will finish with a two-year delay and that the hydroelectric capacity will be available to the New England grid beginning in 2024. If the project is delayed for more than two years or is cancelled altogether, then our forecast in this report would show an underestimate of average heat rates for any period that the transmission line is not complete after 2024.
- **Marginal plant selection** – As described in Section 2.2.2 of this report, we identified the marginal generating plant in each time period using forecast fuel prices and emissions prices from the Reference Case and assumptions about variable O&M costs. Power markets could develop in ways we have not foreseen, or new rules could impose emissions costs we have not anticipated. Such changes would impact the precision of our marginal plant forecasts, and we suggest that the PAs revisit this analysis on a regular basis to maintain up-to-date forecasts.

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APPENDIX A. DETAILED TOTAL GENERATION MIX FORECAST

This analysis produced an annual forecast of the total generation by plant type in the four costing periods, for the years 2020-2050. Full results are provided in the spreadsheet enclosed with this memo. The enclosed spreadsheet also provides the POM-generated forecast of electric capacity through 2040. The tables below summarize the generation fuel mix by plant type on 5-year increments.

Table 5. Summer On-Peak, Percent of Total Generation by Plant Type, 2020-2050

Generation Type	2020	2025	2030	2035	2040	2045	2050
Coal - Steam Turbine	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Natural Gas - Combined Cycle	54.5	42.5	36.7	36.1	36.2	32.6	28.9
Natural Gas - Combustion Turbine	1.9	1.2	0.8	0.9	1.1	1.0	0.9
Natural Gas - Steam Turbine	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Other (e.g., oil-fired)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nuclear	17.5	16.8	16.6	16.8	15.5	15.5	15.3
Hydro	15.2	21.3	21.0	20.1	19.2	18.5	18.1
Wind	2.1	5.5	7.9	8.2	8.7	10.3	11.8
Solar	3.9	8.5	12.7	14.0	15.4	17.5	19.9
Other Renewable (e.g., landfill gas, refuse, wood)	4.8	4.3	4.3	4.0	3.8	4.5	5.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 6. Summer Off-Peak, Percent of Total Generation by Plant Type, 2020-2050

Generation Type	2020	2025	2030	2035	2040	2045	2050
Coal - Steam Turbine	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Natural Gas - Combined Cycle	48.4	35.3	29.7	30.6	32.4	29.0	25.7
Natural Gas - Combustion Turbine	0.7	0.8	0.7	0.4	0.4	0.4	0.4
Natural Gas - Steam Turbine	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other (e.g., oil-fired)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nuclear	23.6	22.2	22.2	21.8	20.2	20.2	19.9
Hydro	16.3	24.2	24.0	22.4	21.3	20.9	20.3
Wind	3.1	7.8	11.8	12.9	13.6	15.6	17.7
Solar	1.9	4.0	6.1	6.6	7.1	8.1	9.2
Other Renewable (e.g., landfill gas, refuse, wood)	6.0	5.6	5.6	5.2	4.9	5.9	6.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

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Table 7. Winter On-Peak, Percent of Total Generation by Plant Type, 2020-2050

Generation Type	2020	2025	2030	2035	2040	2045	2050
Coal - Steam Turbine	1.9	0.0	0.0	0.0	0.0	0.0	0.0
Natural Gas - Combined Cycle	45.2	29.5	22.0	22.6	19.6	18.4	15.8
Natural Gas - Combustion Turbine	0.3	0.4	0.6	0.5	0.6	0.5	0.4
Natural Gas - Steam Turbine	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other (e.g., oil-fired)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nuclear	17.9	19.2	18.1	16.2	18.7	16.2	15.5
Hydro	20.4	27.2	26.7	25.4	24.5	23.0	21.8
Wind	3.8	10.1	15.8	17.4	18.2	21.0	23.3
Solar	3.7	8.0	11.6	12.9	13.5	15.5	17.1
Other Renewable (e.g., landfill gas, refuse, wood)	6.8	5.5	5.1	4.9	4.9	5.4	6.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 8. Winter Off-Peak, Percent of Total Generation by Plant Type, 2020-2050

Generation Type	2020	2025	2030	2035	2040	2045	2050
Coal - Steam Turbine	2.3	0.0	0.0	0.0	0.0	0.0	0.0
Natural Gas - Combined Cycle	40.5	24.0	16.8	19.9	17.5	16.8	14.5
Natural Gas - Combustion Turbine	0.5	1.0	0.8	0.6	0.5	0.4	0.4
Natural Gas - Steam Turbine	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other (e.g., oil-fired)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nuclear	22.5	23.5	22.3	19.2	22.0	19.3	18.6
Hydro	19.4	28.0	27.5	26.2	24.9	23.6	22.4
Wind	5.1	13.6	21.7	23.0	24.0	27.0	29.9
Solar	1.7	3.6	5.0	5.6	5.8	6.7	7.4
Other Renewable (e.g., landfill gas, refuse, wood)	8.2	6.2	5.9	5.6	5.4	6.1	6.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 9. Annual Total, Percent of Total Generation by Plant Type, 2020-2050

Generation Type	2020	2025	2030	2035	2040	2045	2050
Coal - Steam Turbine	1.3	0.0	0.0	0.0	0.0	0.0	0.0
Natural Gas - Combined Cycle	46.2	31.4	24.6	25.8	24.3	22.4	19.5
Natural Gas - Combustion Turbine	0.8	0.8	0.7	0.6	0.6	0.6	0.5
Natural Gas - Steam Turbine	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other (e.g., oil-fired)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nuclear	20.1	20.5	19.8	18.2	19.3	17.7	17.1
Hydro	18.4	25.8	25.4	24.1	23.1	22.0	21.0
Wind	3.7	9.9	15.4	16.6	17.4	19.9	22.3
Solar	2.8	6.1	8.9	9.8	10.4	11.9	13.4
Other Renewable (e.g., landfill gas, refuse, wood)	6.7	5.5	5.3	5.0	4.8	5.6	6.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

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APPENDIX B. DETAILED MARGINAL GENERATION MIX FORECAST

The analysis produced an annual forecast of the marginal generation by plant type in the four costing periods, for the years 2020-2050. Full results are provided in the spreadsheet enclosed with this memo. The tables below summarize the marginal generation fuel mix by plant type on 5-year increments.

Table 10. Summer On-Peak, Percent of Marginal Generation Hours by Plant Type, 2020-2050

Generation Type	2020	2025	2030	2035	2040	2045	2050
Renewables	0.0	1.1	3.4	4.5	6.3	7.6	8.9
Hydroelectric	5.5	10.6	12.3	12.7	13.8	14.0	14.0
Nuclear	5.5	10.6	12.2	12.7	13.8	14.4	14.6
Natural Gas - Combined Cycle	39.1	49.3	49.1	50.8	45.4	43.6	43.4
Natural Gas - Combustion Turbine	49.6	28.2	23.0	19.3	20.6	20.4	19.1
Oil	0.3	0.1	0.0	0.0	0.1	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 11. Summer Off-Peak, Percent of Marginal Generation Hours by Plant Type, 2020-2050

Generation Type	2020	2025	2030	2035	2040	2045	2050
Renewables	0.8	3.7	8.2	12.3	14.5	15.3	16.4
Hydroelectric	23.7	16.2	16.2	18.5	17.3	17.1	17.1
Nuclear	23.7	16.2	16.1	18.5	17.2	17.4	17.6
Natural Gas - Combined Cycle	33.9	38.8	39.3	38.8	43.8	43.3	42.4
Natural Gas - Combustion Turbine	17.8	25.2	20.2	11.9	7.2	6.9	6.5
Oil	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 12. Winter On-Peak, Percent of Marginal Generation Hours by Plant Type, 2020-2050

Generation Type	2020	2025	2030	2035	2040	2045	2050
Renewables	0.0	0.3	13.0	10.6	16.4	20.1	23.4
Hydroelectric	1.5	4.0	5.2	6.9	6.0	6.0	6.0
Nuclear	1.5	4.0	5.2	6.9	6.0	5.5	5.6
Natural Gas - Combined Cycle	62.0	60.5	41.0	49.9	46.5	45.9	43.9
Natural Gas - Combustion Turbine	34.9	30.2	35.4	25.7	25.0	22.4	21.0
Oil	0.0	1.0	0.2	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

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Table 13. Winter Off-Peak, Percent of Marginal Generation Hours by Plant Type, 2020-2050

Generation Type	2020	2025	2030	2035	2040	2045	2050
Renewables	0.3	2.2	22.0	18.7	23.8	28.5	33.3
Hydroelectric	7.0	7.5	10.3	11.2	9.1	9.1	9.1
Nuclear	7.0	7.5	10.3	11.1	9.1	8.4	8.6
Natural Gas - Combined Cycle	71.7	57.9	40.9	47.6	50.2	46.9	42.4
Natural Gas - Combustion Turbine	13.9	24.3	16.5	11.4	7.9	7.2	6.7
Oil	0.1	0.5	0.0	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 14. Annual Total, Percent of Marginal Generation Hours by Plant Type, 2020-2050

Generation Type	2020	2025	2030	2035	2040	2045	2050
Renewables	0.3	1.8	12.7	12.2	16.2	19.5	22.8
Hydroelectric	8.8	9.1	10.6	11.9	11.0	11.0	11.0
Nuclear	8.8	9.1	10.5	11.9	11.0	10.5	10.6
Natural Gas - Combined Cycle	54.3	52.7	42.2	46.9	46.8	44.9	42.4
Natural Gas - Combustion Turbine	27.7	26.9	23.8	17.0	15.0	14.1	13.2
Oil	0.1	0.5	0.1	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

APPENDIX CLC-1
CAPE LIGHT COMPACT JPE
TOWN ACTIVITY REPORTS

The following are the 2019 Town Activity Reports for the Compact.

Energy Efficiency Program Activity by Town

Town Name: All
Program Period: 2019
Current Dates: 12/1/2019 - 12/31/2019
Cumulative Dates: 1/1/2019 - 12/31/2019

	Current Period			Cumulative Period				
Program Initiative	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Budget**	**Actual % of Budget**
A1a - Residential New Homes & Renovations	96,801.17	$54,981.01	37	1,579,704.23	$738,173.00	364	$0.00	0.00%
A2a - Residential Coordinated Delivery	4,196,192.80	$4,851,434.33	3,972	12,405,182.78	$14,880,577.26	10,321	$10,337,499.37	143.95%
A2b - Residential Conservation Services (RCS)	0.00	$675,412.88	2,744	0.00	$1,804,269.60	6,467	$1,749,470.60	103.13%
A2c - Residential Retail	4,546,510.10	$636,665.77	662	33,068,296.40	$5,509,817.15	6,620	$0.00	0.00%
A2d - Residential Behavior	16,997.73	$2,874.00	1	16,997.73	$2,874.00	1	$0.00	0.00%
A2e - Residential Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A3i - Residential HEAT Loan	0.00	$209,271.08	535	0.00	$2,201,373.23	1,722	$0.00	0.00%
Res Subtotal	**8,856,501.80**	**$6,430,639.07**	**7,951.00**	**47,070,181.14**	**$25,137,084.24**	**25,495**	**$12,086,969.97**	
Res % of Total	**76.37%**	**81.28%**	**91.97%**	**73.80%**	**71.92%**	**87.59%**	**60.41%**	
B1a - Income Eligible Coordinated Delivery	187,300.43	$308,880.73	464	2,140,590.43	$3,242,778.10	2,245	$3,666,452.40	88.44%
B1b - Income Eligible Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
IE Subtotal	**187,300.43**	**$308,880.73**	**464.00**	**2,140,590.43**	**$3,242,778.10**	**2,245**	**$3,666,452.40**	
IE % of Total	**1.62%**	**3.90%**	**5.37%**	**3.36%**	**9.28%**	**7.71%**	**18.32%**	
C1a - C&I New Buildings & Major Renovations	33,890.71	$1,145.22	2	652,092.16	$88,648.32	12	$0.00	0.00%
C1a - C&I New Buildings & Major Renovations – Municipal	167,154.00	$78,817.50	3	337,692.00	$164,690.51	16	$0.00	0.00%
C2a - C&I Existing Building Retrofit	995,629.95	$400,244.47	85	6,679,379.33	$3,170,009.46	619	$4,254,911.10	74.50%
C2a - C&I Existing Building Retrofit - Municipal	687,645.99	$608,335.13	15	2,819,247.26	$2,619,894.25	136	$0.00	0.00%
C2b - C&I New & Replacement Equipment	668,107.79	$83,366.59	125	4,079,892.40	$529,539.64	585	$0.00	0.00%
C2c - C&I Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C&I Subtotal	**2,552,428.44**	**$1,171,908.91**	**230.00**	**14,568,303.15**	**$6,572,782.18**	**1,368**	**$4,254,911.10**	
C&I % of Total	**22.01%**	**14.81%**	**2.66%**	**22.84%**	**18.80%**	**4.70%**	**21.27%**	
Total	**11,596,230.67**	**$7,911,428.71**	**8,645**	**63,779,074.72**	**$34,952,644.52**	**29,108**	**$20,008,333.47**	

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Energy Efficiency Program Activity by Town

Town Name: AQUINNAH
Program Period: 2019
Current Dates: 12/1/2019 - 12/31/2019
Cumulative Dates: 1/1/2019 - 12/31/2019

	Current Period			Cumulative Period				
Program Initiative	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Budget**	**Actual % of Budget**
A1a - Residential New Homes & Renovations	0.00	$0.00	0	18,362.24	$7,746.62	1	$0.00	0.00%
A2a - Residential Coordinated Delivery	7,485.40	$10,394.25	6	25,106.00	$19,351.96	12	$13,438.75	144.00%
A2b - Residential Conservation Services (RCS)	0.00	$1,105.00	5	0.00	$3,945.00	12	$2,274.31	173.46%
A2c - Residential Retail	-43.00	$804.25	1	7,000.50	$4,230.00	3	$0.00	0.00%
A2d - Residential Behavior	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A2e - Residential Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A3i - Residential HEAT Loan	0.00	$35.00	1	0.00	$2,057.77	3	$0.00	0.00%
Res Subtotal	**7,442.40**	**$12,338.50**	**13.00**	**50,468.74**	**$37,331.35**	**31**	**$15,713.06**	
Res % of Total	**100.00%**	**100.00%**	**100.00%**	**98.51%**	**92.47%**	**81.58%**	**60.41%**	
B1a - Income Eligible Coordinated Delivery	0.00	$0.00	0	0.00	$0.00	0	$4,766.39	0.00%
B1b - Income Eligible Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
IE Subtotal	**0.00**	**$0.00**	**0.00**	**0.00**	**$0.00**	**0**	**$4,766.39**	
IE % of Total	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**18.32%**	
C1a - C&I New Buildings & Major Renovations	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C1a - C&I New Buildings & Major Renovations – Municipal	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C2a - C&I Existing Building Retrofit	0.00	$0.00	0	0.00	$0.00	0	$5,531.38	0.00%
C2a - C&I Existing Building Retrofit - Municipal	0.00	$0.00	0	0.00	$3,000.00	6	$0.00	0.00%
C2b - C&I New & Replacement Equipment	0.00	$0.00	0	765.12	$42.00	1	$0.00	0.00%
C2c - C&I Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C&I Subtotal	**0.00**	**$0.00**	**0.00**	**765.12**	**$3,042.00**	**7**	**$5,531.38**	
C&I % of Total	**0.00%**	**0.00%**	**0.00%**	**1.49%**	**7.53%**	**18.42%**	**21.27%**	
Total	**7,442.40**	**$12,338.50**	**13**	**51,233.86**	**$40,373.35**	**38**	**$26,010.83**	

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Energy Efficiency Program Activity by Town

Town Name: BARNSTABLE
Program Period: 2019
Current Dates: 12/1/2019 - 12/31/2019
Cumulative Dates: 1/1/2019 - 12/31/2019

	Current Period			Cumulative Period				
Program Initiative	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Budget**	**Actual % of Budget**
A1a - Residential New Homes & Renovations	14,086.00	$3,777.12	4	373,955.27	$133,583.79	37	$0.00	0.00%
A2a - Residential Coordinated Delivery	679,351.50	$738,929.60	679	2,040,452.51	$2,211,524.34	1,782	$2,010,643.63	109.99%
A2b - Residential Conservation Services (RCS)	0.00	$90,986.49	378	0.00	$253,825.96	912	$340,272.03	74.60%
A2c - Residential Retail	1,035,017.90	$87,775.48	67	8,093,754.50	$840,422.32	947	$0.00	0.00%
A2d - Residential Behavior	16,997.73	$2,874.00	1	16,997.73	$2,874.00	1	$0.00	0.00%
A2e - Residential Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A3i - Residential HEAT Loan	0.00	$24,923.53	89	0.00	$413,810.97	380	$0.00	0.00%
Res Subtotal	**1,745,453.13**	**$949,266.22**	**1,218.00**	**10,525,160.01**	**$3,856,041.38**	**4,059**	**$2,350,915.66**	
Res % of Total	**66.82%**	**64.08%**	**89.43%**	**71.83%**	**66.48%**	**84.62%**	**60.41%**	
B1a - Income Eligible Coordinated Delivery	21,625.50	$59,777.30	92	390,792.16	$476,669.69	454	$713,124.99	66.84%
B1b - Income Eligible Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
IE Subtotal	**21,625.50**	**$59,777.30**	**92.00**	**390,792.16**	**$476,669.69**	**454**	**$713,124.99**	
IE % of Total	**0.83%**	**4.04%**	**6.75%**	**2.67%**	**8.22%**	**9.46%**	**18.32%**	
C1a - C&I New Buildings & Major Renovations	33,890.71	$637.72	1	539,251.16	$28,066.82	5	$0.00	0.00%
C1a - C&I New Buildings & Major Renovations – Municipal	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C2a - C&I Existing Building Retrofit	181,718.66	$61,674.66	13	1,879,755.76	$861,471.97	145	$827,580.21	104.10%
C2a - C&I Existing Building Retrofit - Municipal	478,931.00	$390,820.00	8	571,426.44	$472,709.91	17	$0.00	0.00%
C2b - C&I New & Replacement Equipment	150,732.39	$19,152.43	30	745,953.46	$105,556.06	117	$0.00	0.00%
C2c - C&I Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C&I Subtotal	**845,272.76**	**$472,284.81**	**52.00**	**3,736,386.81**	**$1,467,804.76**	**284**	**$827,580.21**	
C&I % of Total	**32.36%**	**31.88%**	**3.82%**	**25.50%**	**25.30%**	**5.92%**	**21.27%**	
Total	**2,612,351.39**	**$1,481,328.33**	**1,362**	**14,652,338.98**	**$5,800,515.83**	**4,797**	**$3,891,620.86**	

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Energy Efficiency Program Activity by Town

Town Name: BOURNE
Program Period: 2019
Current Dates: 12/1/2019 - 12/31/2019
Cumulative Dates: 1/1/2019 - 12/31/2019

	Current Period			Cumulative Period				
Program Initiative	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Budget**	**Actual % of Budget**
A1a - Residential New Homes & Renovations	380.05	$159.81	2	101,064.88	$71,313.13	56	$0.00	0.00%
A2a - Residential Coordinated Delivery	245,561.20	$234,218.72	235	1,031,731.67	$888,644.54	629	$878,687.45	101.13%
A2b - Residential Conservation Services (RCS)	0.00	$34,700.00	144	0.00	$90,520.00	335	$148,705.00	60.87%
A2c - Residential Retail	480,052.30	$53,124.54	46	2,852,918.00	$387,593.92	415	$0.00	0.00%
A2d - Residential Behavior	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A2e - Residential Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A3i - Residential HEAT Loan	0.00	$10,171.14	29	0.00	$97,015.80	76	$0.00	0.00%
Res Subtotal	**725,993.55**	**$332,374.21**	**456.00**	**3,985,714.56**	**$1,535,087.39**	**1,511**	**$1,027,392.45**	
Res % of Total	**72.97%**	**67.41%**	**90.30%**	**65.00%**	**51.31%**	**80.89%**	**60.41%**	
B1a - Income Eligible Coordinated Delivery	15,322.40	$42,361.10	31	324,341.35	$392,663.86	265	$311,648.45	126.00%
B1b - Income Eligible Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
IE Subtotal	**15,322.40**	**$42,361.10**	**31.00**	**324,341.35**	**$392,663.86**	**265**	**$311,648.45**	
IE % of Total	**1.54%**	**8.59%**	**6.14%**	**5.29%**	**13.12%**	**14.19%**	**18.32%**	
C1a - C&I New Buildings & Major Renovations	0.00	$0.00	0	0.00	$3,055.50	1	$0.00	0.00%
C1a - C&I New Buildings & Major Renovations – Municipal	167,154.00	$78,672.50	2	167,154.00	$89,452.76	4	$0.00	0.00%
C2a - C&I Existing Building Retrofit	44,284.04	$29,466.31	4	588,688.99	$294,029.15	42	$361,667.44	81.30%
C2a - C&I Existing Building Retrofit - Municipal	-3,676.00	$5,070.90	1	592,961.12	$623,250.38	4	$0.00	0.00%
C2b - C&I New & Replacement Equipment	45,879.59	$5,090.00	11	472,836.47	$54,348.92	41	$0.00	0.00%
C2c - C&I Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C&I Subtotal	**253,641.63**	**$118,299.71**	**18.00**	**1,821,640.57**	**$1,064,136.71**	**92**	**$361,667.44**	
C&I % of Total	**25.49%**	**23.99%**	**3.56%**	**29.71%**	**35.57%**	**4.93%**	**21.27%**	
Total	**994,957.58**	**$493,035.02**	**505**	**6,131,696.48**	**$2,991,887.96**	**1,868**	**$1,700,708.34**	

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Energy Efficiency Program Activity by Town

Town Name: BREWSTER
Program Period: 2019
Current Dates: 12/1/2019 - 12/31/2019
Cumulative Dates: 1/1/2019 - 12/31/2019

	Current Period			Cumulative Period				
Program Initiative	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Budget**	**Actual % of Budget**
A1a - Residential New Homes & Renovations	2,224.57	$1,032.81	2	55,034.33	$21,700.46	20	$0.00	0.00%
A2a - Residential Coordinated Delivery	203,388.70	$231,323.84	175	778,223.30	$772,086.69	547	$437,276.22	176.57%
A2b - Residential Conservation Services (RCS)	0.00	$38,592.98	144	0.00	$95,955.64	333	$74,002.61	129.67%
A2c - Residential Retail	197,067.00	$40,873.55	39	1,505,691.20	$344,398.09	400	$0.00	0.00%
A2d - Residential Behavior	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A2e - Residential Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A3i - Residential HEAT Loan	0.00	$10,486.08	28	0.00	$107,089.88	78	$0.00	0.00%
Res Subtotal	**402,680.27**	**$322,309.26**	**388.00**	**2,338,948.83**	**$1,341,230.76**	**1,378**	**$511,278.83**	
Res % of Total	**73.94%**	**82.28%**	**88.58%**	**88.67%**	**85.62%**	**92.98%**	**60.41%**	
B1a - Income Eligible Coordinated Delivery	63,018.22	$57,427.19	39	112,683.02	$152,848.05	67	$155,090.94	98.55%
B1b - Income Eligible Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
IE Subtotal	**63,018.22**	**$57,427.19**	**39.00**	**112,683.02**	**$152,848.05**	**67**	**$155,090.94**	
IE % of Total	**11.57%**	**14.66%**	**8.90%**	**4.27%**	**9.76%**	**4.52%**	**18.32%**	
C1a - C&I New Buildings & Major Renovations	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C1a - C&I New Buildings & Major Renovations – Municipal	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C2a - C&I Existing Building Retrofit	0.00	$1,725.00	4	100,665.55	$55,458.29	17	$179,982.74	30.81%
C2a - C&I Existing Building Retrofit - Municipal	0.00	$0.00	0	0.00	$5,480.00	9	$0.00	0.00%
C2b - C&I New & Replacement Equipment	78,869.58	$10,269.00	7	85,552.48	$11,440.00	11	$0.00	0.00%
C2c - C&I Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C&I Subtotal	**78,869.58**	**$11,994.00**	**11.00**	**186,218.03**	**$72,378.29**	**37**	**$179,982.74**	
C&I % of Total	**14.48%**	**3.06%**	**2.51%**	**7.06%**	**4.62%**	**2.50%**	**21.27%**	
Total	**544,568.07**	**$391,730.45**	**438**	**2,637,849.88**	**$1,566,457.10**	**1,482**	**$846,352.51**	

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Energy Efficiency Program Activity by Town

Town Name: CHATHAM
Program Period: 2019
Current Dates: 12/1/2019 - 12/31/2019
Cumulative Dates: 1/1/2019 - 12/31/2019

	Current Period			Cumulative Period				
Program Initiative	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Budget**	**Actual % of Budget**
A1a - Residential New Homes & Renovations	4,010.73	$589.39	1	53,391.01	$23,599.20	8	$0.00	0.00%
A2a - Residential Coordinated Delivery	187,260.50	$245,589.90	131	470,253.00	$568,475.26	325	$272,909.98	208.30%
A2b - Residential Conservation Services (RCS)	0.00	$25,471.49	98	0.00	$61,584.15	206	$46,186.02	133.34%
A2c - Residential Retail	71,192.30	$10,867.94	17	694,737.50	$137,406.55	211	$0.00	0.00%
A2d - Residential Behavior	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A2e - Residential Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A3i - Residential HEAT Loan	0.00	$6,487.08	10	0.00	$62,939.86	45	$0.00	0.00%
Res Subtotal	**262,463.53**	**$289,005.80**	**257.00**	**1,218,381.51**	**$854,005.02**	**795**	**$319,096.01**	
Res % of Total	**73.94%**	**78.42%**	**88.62%**	**78.40%**	**77.33%**	**87.36%**	**60.41%**	
B1a - Income Eligible Coordinated Delivery	8,501.30	$30,104.98	18	34,000.10	$55,386.98	60	$96,794.34	57.22%
B1b - Income Eligible Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
IE Subtotal	**8,501.30**	**$30,104.98**	**18.00**	**34,000.10**	**$55,386.98**	**60**	**$96,794.34**	
IE % of Total	**2.40%**	**8.17%**	**6.21%**	**2.19%**	**5.02%**	**6.59%**	**18.32%**	
C1a - C&I New Buildings & Major Renovations	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C1a - C&I New Buildings & Major Renovations – Municipal	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C2a - C&I Existing Building Retrofit	81,666.48	$48,333.54	13	152,791.53	$85,880.73	23	$112,329.65	76.45%
C2a - C&I Existing Building Retrofit - Municipal	0.00	$0.00	0	108,664.92	$103,733.55	21	$0.00	0.00%
C2b - C&I New & Replacement Equipment	2,318.27	$1,114.08	2	40,249.95	$5,307.75	11	$0.00	0.00%
C2c - C&I Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C&I Subtotal	**83,984.75**	**$49,447.62**	**15.00**	**301,706.40**	**$194,922.03**	**55**	**$112,329.65**	
C&I % of Total	**23.66%**	**13.42%**	**5.17%**	**19.41%**	**17.65%**	**6.04%**	**21.27%**	
Total	**354,949.58**	**$368,558.40**	**290**	**1,554,088.00**	**$1,104,314.03**	**910**	**$528,220.00**	

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Energy Efficiency Program Activity by Town

Town Name: CHILMARK
Program Period: 2019
Current Dates: 12/1/2019 - 12/31/2019
Cumulative Dates: 1/1/2019 - 12/31/2019

	Current Period			Cumulative Period				
Program Initiative	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Budget**	**Actual % of Budget**
A1a - Residential New Homes & Renovations	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A2a - Residential Coordinated Delivery	10,176.80	$23,359.26	10	59,301.80	$44,762.03	34	$38,248.75	117.03%
A2b - Residential Conservation Services (RCS)	0.00	$2,300.00	10	0.00	$8,435.00	30	$6,473.04	130.31%
A2c - Residential Retail	178.00	$153.50	2	-9,091.30	$34,168.50	27	$0.00	0.00%
A2d - Residential Behavior	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A2e - Residential Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A3i - Residential HEAT Loan	0.00	$0.00	0	0.00	$35.00	1	$0.00	0.00%
Res Subtotal	**10,354.80**	**$25,812.76**	**22.00**	**50,210.50**	**$87,400.53**	**92**	**$44,721.79**	
Res % of Total	**100.00%**	**96.27%**	**91.67%**	**68.84%**	**88.64%**	**85.19%**	**60.41%**	
B1a - Income Eligible Coordinated Delivery	0.00	$0.00	0	1,391.20	$469.22	1	$13,565.87	3.46%
B1b - Income Eligible Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
IE Subtotal	**0.00**	**$0.00**	**0.00**	**1,391.20**	**$469.22**	**1**	**$13,565.87**	
IE % of Total	**0.00%**	**0.00%**	**0.00%**	**1.91%**	**0.48%**	**0.93%**	**18.32%**	
C1a - C&I New Buildings & Major Renovations	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C1a - C&I New Buildings & Major Renovations – Municipal	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C2a - C&I Existing Building Retrofit	0.00	$0.00	0	1,737.00	$200.00	1	$15,743.17	1.27%
C2a - C&I Existing Building Retrofit - Municipal	0.00	$1,000.00	2	0.00	$8,000.00	10	$0.00	0.00%
C2b - C&I New & Replacement Equipment	0.00	$0.00	0	19,602.82	$2,528.00	4	$0.00	0.00%
C2c - C&I Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C&I Subtotal	**0.00**	**$1,000.00**	**2.00**	**21,339.82**	**$10,728.00**	**15**	**$15,743.17**	
C&I % of Total	**0.00%**	**3.73%**	**8.33%**	**29.26%**	**10.88%**	**13.89%**	**21.27%**	
Total	**10,354.80**	**$26,812.76**	**24**	**72,941.52**	**$98,597.75**	**108**	**$74,030.83**	

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Energy Efficiency Program Activity by Town

Town Name: DENNIS
Program Period: 2019
Current Dates: 12/1/2019 - 12/31/2019
Cumulative Dates: 1/1/2019 - 12/31/2019

	Current Period			Cumulative Period				
Program Initiative	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Budget**	**Actual % of Budget**
A1a - Residential New Homes & Renovations	14,493.35	$9,167.63	2	71,222.16	$36,105.71	17	$0.00	0.00%
A2a - Residential Coordinated Delivery	359,899.60	$440,283.20	340	1,020,616.10	$1,311,330.80	902	$631,621.21	207.61%
A2b - Residential Conservation Services (RCS)	0.00	$59,277.66	246	0.00	$158,933.94	568	$106,892.65	148.69%
A2c - Residential Retail	265,777.70	$68,620.25	58	2,622,516.90	$522,880.62	611	$0.00	0.00%
A2d - Residential Behavior	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A2e - Residential Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A3i - Residential HEAT Loan	0.00	$27,217.12	52	0.00	$244,415.45	182	$0.00	0.00%
Res Subtotal	**640,170.65**	**$604,565.86**	**698.00**	**3,714,355.16**	**$2,273,666.52**	**2,280**	**$738,513.87**	
Res % of Total	**88.08%**	**98.07%**	**97.76%**	**83.42%**	**86.84%**	**92.16%**	**60.41%**	
B1a - Income Eligible Coordinated Delivery	1,624.60	$2,931.82	5	105,946.70	$164,668.27	98	$224,020.24	73.51%
B1b - Income Eligible Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
IE Subtotal	**1,624.60**	**$2,931.82**	**5.00**	**105,946.70**	**$164,668.27**	**98**	**$224,020.24**	
IE % of Total	**0.22%**	**0.48%**	**0.70%**	**2.38%**	**6.29%**	**3.96%**	**18.32%**	
C1a - C&I New Buildings & Major Renovations	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C1a - C&I New Buildings & Major Renovations – Municipal	0.00	$145.00	1	0.00	$4,858.75	2	$0.00	0.00%
C2a - C&I Existing Building Retrofit	75,265.12	$7,116.00	5	234,745.67	$112,587.84	47	$259,975.07	43.31%
C2a - C&I Existing Building Retrofit - Municipal	0.00	$700.00	1	0.00	$10,400.00	18	$0.00	0.00%
C2b - C&I New & Replacement Equipment	9,728.96	$1,009.00	4	397,758.18	$52,092.40	29	$0.00	0.00%
C2c - C&I Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C&I Subtotal	**84,994.08**	**$8,970.00**	**11.00**	**632,503.85**	**$179,938.99**	**96**	**$259,975.07**	
C&I % of Total	**11.69%**	**1.46%**	**1.54%**	**14.20%**	**6.87%**	**3.88%**	**21.27%**	
Total	**726,789.33**	**$616,467.68**	**714**	**4,452,805.71**	**$2,618,273.78**	**2,474**	**$1,222,509.18**	

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Energy Efficiency Program Activity by Town

Town Name: EASTHAM
Program Period: 2019
Current Dates: 12/1/2019 - 12/31/2019
Cumulative Dates: 1/1/2019 - 12/31/2019

	Current Period			Cumulative Period				
Program Initiative	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Budget**	**Actual % of Budget**
A1a - Residential New Homes & Renovations	0.00	$0.00	0	13,769.07	$9,297.27	4	$0.00	0.00%
A2a - Residential Coordinated Delivery	160,292.50	$212,475.41	146	435,135.70	$567,853.34	346	$220,188.74	257.89%
A2b - Residential Conservation Services (RCS)	0.00	$32,512.66	135	0.00	$81,981.49	294	$37,263.72	220.00%
A2c - Residential Retail	92,648.80	$16,043.65	26	524,651.00	$130,254.40	273	$0.00	0.00%
A2d - Residential Behavior	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A2e - Residential Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A3i - Residential HEAT Loan	0.00	$9,379.29	16	0.00	$79,413.60	45	$0.00	0.00%
Res Subtotal	**252,941.30**	**$270,411.01**	**323.00**	**973,555.77**	**$868,800.10**	**962**	**$257,452.46**	
Res % of Total	**75.38%**	**93.09%**	**97.58%**	**83.73%**	**86.28%**	**95.15%**	**60.41%**	
B1a - Income Eligible Coordinated Delivery	2,217.10	$4,001.97	2	32,729.60	$81,403.80	27	$78,095.44	104.24%
B1b - Income Eligible Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
IE Subtotal	**2,217.10**	**$4,001.97**	**2.00**	**32,729.60**	**$81,403.80**	**27**	**$78,095.44**	
IE % of Total	**0.66%**	**1.38%**	**0.60%**	**2.82%**	**8.08%**	**2.67%**	**18.32%**	
C1a - C&I New Buildings & Major Renovations	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C1a - C&I New Buildings & Major Renovations – Municipal	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C2a - C&I Existing Building Retrofit	15,934.44	$12,397.19	5	51,779.82	$30,820.80	17	$90,629.61	34.01%
C2a - C&I Existing Building Retrofit - Municipal	0.00	$0.00	0	37,726.42	$21,699.10	3	$0.00	0.00%
C2b - C&I New & Replacement Equipment	64,466.32	$3,675.00	1	66,874.06	$4,275.00	2	$0.00	0.00%
C2c - C&I Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C&I Subtotal	**80,400.76**	**$16,072.19**	**6.00**	**156,380.29**	**$56,794.90**	**22**	**$90,629.61**	
C&I % of Total	**23.96%**	**5.53%**	**1.81%**	**13.45%**	**5.64%**	**2.18%**	**21.27%**	
Total	**335,559.16**	**$290,485.17**	**331**	**1,162,665.66**	**$1,006,998.80**	**1,011**	**$426,177.50**	

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Energy Efficiency Program Activity by Town

Town Name: EDGARTOWN
Program Period: 2019
Current Dates: 12/1/2019 - 12/31/2019
Cumulative Dates: 1/1/2019 - 12/31/2019

	Current Period			Cumulative Period				
Program Initiative	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Budget**	**Actual % of Budget**
A1a - Residential New Homes & Renovations	12,418.37	$6,622.40	1	26,568.72	$13,991.04	3	$0.00	0.00%
A2a - Residential Coordinated Delivery	157,393.00	$182,844.54	92	281,899.90	$381,269.68	166	$181,939.99	209.56%
A2b - Residential Conservation Services (RCS)	0.00	$20,995.00	82	0.00	$46,910.00	165	$30,790.68	152.35%
A2c - Residential Retail	25,293.00	$11,609.94	20	120,964.10	$125,865.41	111	$0.00	0.00%
A2d - Residential Behavior	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A2e - Residential Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A3i - Residential HEAT Loan	0.00	$3,943.32	4	0.00	$35,047.32	21	$0.00	0.00%
Res Subtotal	**195,104.37**	**$226,015.20**	**199.00**	**429,432.72**	**$603,083.45**	**466**	**$212,730.67**	
Res % of Total	**96.74%**	**99.29%**	**96.14%**	**54.17%**	**87.00%**	**89.10%**	**60.41%**	
B1a - Income Eligible Coordinated Delivery	2,462.40	$905.34	2	15,521.80	$32,664.87	11	$64,529.56	50.62%
B1b - Income Eligible Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
IE Subtotal	**2,462.40**	**$905.34**	**2.00**	**15,521.80**	**$32,664.87**	**11**	**$64,529.56**	
IE % of Total	**1.22%**	**0.40%**	**0.97%**	**1.96%**	**4.71%**	**2.10%**	**18.32%**	
C1a - C&I New Buildings & Major Renovations	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C1a - C&I New Buildings & Major Renovations – Municipal	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C2a - C&I Existing Building Retrofit	1,019.00	$375.00	2	44,162.10	$26,253.80	8	$74,886.44	35.06%
C2a - C&I Existing Building Retrofit - Municipal	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C2b - C&I New & Replacement Equipment	3,093.19	$340.00	4	303,568.09	$31,163.04	38	$0.00	0.00%
C2c - C&I Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C&I Subtotal	**4,112.19**	**$715.00**	**6.00**	**347,730.19**	**$57,416.84**	**46**	**$74,886.44**	
C&I % of Total	**2.04%**	**0.31%**	**2.90%**	**43.87%**	**8.28%**	**8.80%**	**21.27%**	
Total	**201,678.96**	**$227,635.54**	**207**	**792,684.71**	**$693,165.16**	**523**	**$352,146.67**	

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Energy Efficiency Program Activity by Town

Town Name: FALMOUTH
Program Period: 2019
Current Dates: 12/1/2019 - 12/31/2019
Cumulative Dates: 1/1/2019 - 12/31/2019

	Current Period			Cumulative Period				
Program Initiative	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Budget**	**Actual % of Budget**
A1a - Residential New Homes & Renovations	22,198.72	$7,679.84	6	145,117.98	$46,035.48	53	$0.00	0.00%
A2a - Residential Coordinated Delivery	649,712.30	$595,356.17	598	1,612,946.90	$1,819,023.62	1,430	$1,402,798.66	129.67%
A2b - Residential Conservation Services (RCS)	0.00	$84,513.83	361	0.00	$226,131.81	835	$237,403.16	95.25%
A2c - Residential Retail	914,642.60	$105,834.18	100	5,686,215.00	$803,632.05	931	$0.00	0.00%
A2d - Residential Behavior	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A2e - Residential Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A3i - Residential HEAT Loan	0.00	$16,793.33	68	0.00	$225,695.15	187	$0.00	0.00%
Res Subtotal	**1,586,553.62**	**$810,177.35**	**1,133.00**	**7,444,279.88**	**$3,120,518.11**	**3,436**	**$1,640,201.82**	
Res % of Total	**74.27%**	**80.05%**	**92.26%**	**74.21%**	**70.11%**	**90.42%**	**60.41%**	
B1a - Income Eligible Coordinated Delivery	25,160.44	$39,229.80	59	173,724.63	$341,744.20	180	$497,537.59	68.69%
B1b - Income Eligible Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
IE Subtotal	**25,160.44**	**$39,229.80**	**59.00**	**173,724.63**	**$341,744.20**	**180**	**$497,537.59**	
IE % of Total	**1.18%**	**3.88%**	**4.80%**	**1.73%**	**7.68%**	**4.74%**	**18.32%**	
C1a - C&I New Buildings & Major Renovations	0.00	$0.00	0	112,841.00	$47,785.50	3	$0.00	0.00%
C1a - C&I New Buildings & Major Renovations – Municipal	0.00	$0.00	0	0.00	$2,288.75	1	$0.00	0.00%
C2a - C&I Existing Building Retrofit	428,661.35	$145,190.67	17	1,192,294.31	$536,543.62	83	$577,391.44	92.93%
C2a - C&I Existing Building Retrofit - Municipal	0.00	$0.00	0	483,975.86	$310,956.21	11	$0.00	0.00%
C2b - C&I New & Replacement Equipment	95,817.49	$17,487.00	19	624,585.17	$91,306.87	86	$0.00	0.00%
C2c - C&I Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C&I Subtotal	**524,478.84**	**$162,677.67**	**36.00**	**2,413,696.34**	**$988,880.95**	**184**	**$577,391.44**	
C&I % of Total	**24.55%**	**16.07%**	**2.93%**	**24.06%**	**22.22%**	**4.84%**	**21.27%**	
Total	**2,136,192.90**	**$1,012,084.82**	**1,228**	**10,031,700.84**	**$4,451,143.26**	**3,800**	**$2,715,130.85**	

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Energy Efficiency Program Activity by Town

Town Name: HARWICH
Program Period: 2019
Current Dates: 12/1/2019 - 12/31/2019
Cumulative Dates: 1/1/2019 - 12/31/2019

	Current Period			Cumulative Period				
Program Initiative	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Budget**	**Actual % of Budget**
A1a - Residential New Homes & Renovations	1,634.12	$1,862.50	2	41,230.42	$28,363.57	12	$0.00	0.00%
A2a - Residential Coordinated Delivery	199,066.70	$222,275.78	211	629,412.10	$867,377.15	586	$544,786.22	159.21%
A2b - Residential Conservation Services (RCS)	0.00	$38,504.47	147	0.00	$116,674.26	401	$92,197.10	126.55%
A2c - Residential Retail	76,531.30	$13,723.72	37	466,214.70	$157,811.18	395	$0.00	0.00%
A2d - Residential Behavior	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A2e - Residential Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A3i - Residential HEAT Loan	0.00	$16,824.15	40	0.00	$143,855.77	102	$0.00	0.00%
Res Subtotal	**277,232.12**	**$293,190.62**	**437.00**	**1,136,857.22**	**$1,314,081.93**	**1,496**	**$636,983.32**	
Res % of Total	**55.59%**	**57.99%**	**95.41%**	**60.85%**	**66.67%**	**92.46%**	**60.41%**	
B1a - Income Eligible Coordinated Delivery	7,232.80	$11,628.94	10	84,569.00	$109,623.06	70	$193,222.04	56.73%
B1b - Income Eligible Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
IE Subtotal	**7,232.80**	**$11,628.94**	**10.00**	**84,569.00**	**$109,623.06**	**70**	**$193,222.04**	
IE % of Total	**1.45%**	**2.30%**	**2.18%**	**4.53%**	**5.56%**	**4.33%**	**18.32%**	
C1a - C&I New Buildings & Major Renovations	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C1a - C&I New Buildings & Major Renovations – Municipal	0.00	$0.00	0	0.00	$3,331.00	1	$0.00	0.00%
C2a - C&I Existing Building Retrofit	3,287.44	$2,062.07	3	133,097.13	$59,983.46	28	$224,233.81	26.75%
C2a - C&I Existing Building Retrofit - Municipal	198,989.29	$197,419.12	2	493,321.93	$480,632.03	6	$0.00	0.00%
C2b - C&I New & Replacement Equipment	12,006.17	$1,266.08	6	20,530.91	$3,516.78	17	$0.00	0.00%
C2c - C&I Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C&I Subtotal	**214,282.90**	**$200,747.27**	**11.00**	**646,949.97**	**$547,463.27**	**52**	**$224,233.81**	
C&I % of Total	**42.96%**	**39.71%**	**2.40%**	**34.63%**	**27.77%**	**3.21%**	**21.27%**	
Total	**498,747.82**	**$505,566.83**	**458**	**1,868,376.19**	**$1,971,168.26**	**1,618**	**$1,054,439.17**	

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Energy Efficiency Program Activity by Town

Town Name: MASHPEE
Program Period: 2019
Current Dates: 12/1/2019 - 12/31/2019
Cumulative Dates: 1/1/2019 - 12/31/2019

	Current Period			Cumulative Period				
Program Initiative	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Budget**	**Actual % of Budget**
A1a - Residential New Homes & Renovations	7,844.95	$3,405.39	5	179,762.43	$47,126.93	52	$0.00	0.00%
A2a - Residential Coordinated Delivery	277,192.40	$212,934.48	203	828,369.00	$590,818.31	669	$623,351.21	94.78%
A2b - Residential Conservation Services (RCS)	0.00	$27,903.83	111	0.00	$74,983.30	274	$105,493.08	71.08%
A2c - Residential Retail	209,995.30	$22,962.10	34	1,039,882.30	$151,627.92	360	$0.00	0.00%
A2d - Residential Behavior	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A2e - Residential Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A3i - Residential HEAT Loan	0.00	$16,328.75	45	0.00	$153,073.60	118	$0.00	0.00%
Res Subtotal	**495,032.65**	**$283,534.55**	**398.00**	**2,048,013.73**	**$1,017,630.06**	**1,473**	**$728,844.29**	
Res % of Total	**84.27%**	**87.00%**	**95.67%**	**71.05%**	**64.47%**	**83.31%**	**60.41%**	
B1a - Income Eligible Coordinated Delivery	3,038.90	$3,631.10	7	132,437.60	$162,762.72	222	$221,087.08	73.62%
B1b - Income Eligible Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
IE Subtotal	**3,038.90**	**$3,631.10**	**7.00**	**132,437.60**	**$162,762.72**	**222**	**$221,087.08**	
IE % of Total	**0.52%**	**1.11%**	**1.68%**	**4.59%**	**10.31%**	**12.56%**	**18.32%**	
C1a - C&I New Buildings & Major Renovations	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C1a - C&I New Buildings & Major Renovations – Municipal	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C2a - C&I Existing Building Retrofit	48,675.75	$31,450.44	4	356,952.96	$211,714.22	34	$256,571.14	82.52%
C2a - C&I Existing Building Retrofit - Municipal	0.00	$0.00	0	146,057.03	$158,832.51	5	$0.00	0.00%
C2b - C&I New & Replacement Equipment	40,719.67	$7,289.00	7	199,158.78	$27,593.85	34	$0.00	0.00%
C2c - C&I Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C&I Subtotal	**89,395.43**	**$38,739.44**	**11.00**	**702,168.78**	**$398,140.58**	**73**	**$256,571.14**	
C&I % of Total	**15.22%**	**11.89%**	**2.64%**	**24.36%**	**25.22%**	**4.13%**	**21.27%**	
Total	**587,466.98**	**$325,905.09**	**416**	**2,882,620.11**	**$1,578,533.36**	**1,768**	**$1,206,502.51**	

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Energy Efficiency Program Activity by Town

Town Name: OAK BLUFFS
Program Period: 2019
Current Dates: 12/1/2019 - 12/31/2019
Cumulative Dates: 1/1/2019 - 12/31/2019

	Current Period			Cumulative Period				
Program Initiative	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Budget**	**Actual % of Budget**
A1a - Residential New Homes & Renovations	0.00	$0.00	0	37,406.76	$19,964.47	6	$0.00	0.00%
A2a - Residential Coordinated Delivery	88,640.00	$75,262.52	76	231,752.80	$285,389.29	174	$201,581.24	141.58%
A2b - Residential Conservation Services (RCS)	0.00	$18,800.00	71	0.00	$46,315.00	172	$34,114.68	135.76%
A2c - Residential Retail	2,819.80	$14,688.04	16	57,843.40	$78,320.41	78	$0.00	0.00%
A2d - Residential Behavior	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A2e - Residential Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A3i - Residential HEAT Loan	0.00	$3,625.18	6	0.00	$15,469.57	15	$0.00	0.00%
Res Subtotal	**91,459.80**	**$112,375.74**	**169.00**	**327,002.96**	**$445,458.74**	**445**	**$235,695.91**	
Res % of Total	**72.63%**	**95.36%**	**95.48%**	**55.14%**	**79.74%**	**89.90%**	**60.41%**	
B1a - Income Eligible Coordinated Delivery	1,642.50	$1,569.72	2	16,227.10	$23,312.62	10	$71,495.82	32.61%
B1b - Income Eligible Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
IE Subtotal	**1,642.50**	**$1,569.72**	**2.00**	**16,227.10**	**$23,312.62**	**10**	**$71,495.82**	
IE % of Total	**1.30%**	**1.33%**	**1.13%**	**2.74%**	**4.17%**	**2.02%**	**18.32%**	
C1a - C&I New Buildings & Major Renovations	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C1a - C&I New Buildings & Major Renovations – Municipal	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C2a - C&I Existing Building Retrofit	4,759.14	$1,458.95	2	121,441.36	$57,870.09	16	$82,970.77	69.75%
C2a - C&I Existing Building Retrofit - Municipal	0.00	$0.00	0	0.00	$5,360.00	8	$0.00	0.00%
C2b - C&I New & Replacement Equipment	28,057.03	$2,440.00	4	128,395.53	$26,614.08	16	$0.00	0.00%
C2c - C&I Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C&I Subtotal	**32,816.17**	**$3,898.95**	**6.00**	**249,836.89**	**$89,844.17**	**40**	**$82,970.77**	
C&I % of Total	**26.06%**	**3.31%**	**3.39%**	**42.13%**	**16.08%**	**8.08%**	**21.27%**	
Total	**125,918.47**	**$117,844.41**	**177**	**593,066.95**	**$558,615.53**	**495**	**$390,162.50**	

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Energy Efficiency Program Activity by Town

Town Name: ORLEANS
Program Period: 2019
Current Dates: 12/1/2019 - 12/31/2019
Cumulative Dates: 1/1/2019 - 12/31/2019

	Current Period			Cumulative Period				
Program Initiative	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Budget**	**Actual % of Budget**
A1a - Residential New Homes & Renovations	0.00	$0.00	0	12,218.34	$10,637.54	4	$0.00	0.00%
A2a - Residential Coordinated Delivery	136,690.20	$201,917.70	117	414,483.00	$610,729.96	286	$261,538.73	233.51%
A2b - Residential Conservation Services (RCS)	0.00	$27,063.83	102	0.00	$67,806.49	240	$44,261.61	153.19%
A2c - Residential Retail	152,118.00	$25,182.36	25	854,340.30	$230,446.90	237	$0.00	0.00%
A2d - Residential Behavior	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A2e - Residential Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A3i - Residential HEAT Loan	0.00	$11,112.97	5	0.00	$72,471.42	31	$0.00	0.00%
Res Subtotal	**288,808.20**	**$265,276.86**	**249.00**	**1,281,041.64**	**$992,092.31**	**798**	**$305,800.34**	
Res % of Total	**91.88%**	**91.67%**	**95.40%**	**62.76%**	**67.59%**	**90.48%**	**60.41%**	
B1a - Income Eligible Coordinated Delivery	1,870.70	$1,657.12	4	27,497.10	$32,717.43	28	$92,761.25	35.27%
B1b - Income Eligible Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
IE Subtotal	**1,870.70**	**$1,657.12**	**4.00**	**27,497.10**	**$32,717.43**	**28**	**$92,761.25**	
IE % of Total	**0.60%**	**0.57%**	**1.53%**	**1.35%**	**2.23%**	**3.17%**	**18.32%**	
C1a - C&I New Buildings & Major Renovations	0.00	$0.00	0	0.00	$1,225.50	1	$0.00	0.00%
C1a - C&I New Buildings & Major Renovations – Municipal	0.00	$0.00	0	0.00	$2,130.00	2	$0.00	0.00%
C2a - C&I Existing Building Retrofit	10,240.46	$9,111.60	7	328,461.17	$112,471.55	29	$107,649.25	104.48%
C2a - C&I Existing Building Retrofit - Municipal	13,401.70	$13,325.11	1	307,863.61	$319,362.30	8	$0.00	0.00%
C2b - C&I New & Replacement Equipment	0.00	$0.00	0	96,323.26	$7,712.01	16	$0.00	0.00%
C2c - C&I Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C&I Subtotal	**23,642.16**	**$22,436.71**	**8.00**	**732,648.04**	**$442,901.36**	**56**	**$107,649.25**	
C&I % of Total	**7.52%**	**7.75%**	**3.07%**	**35.89%**	**30.18%**	**6.35%**	**21.27%**	
Total	**314,321.06**	**$289,370.69**	**261**	**2,041,186.78**	**$1,467,711.10**	**882**	**$506,210.84**	

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Energy Efficiency Program Activity by Town

Town Name: PROVNCTOWN
Program Period: 2019
Current Dates: 12/1/2019 - 12/31/2019
Cumulative Dates: 1/1/2019 - 12/31/2019

	Current Period			Cumulative Period				
Program Initiative	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Budget**	**Actual % of Budget**
A1a - Residential New Homes & Renovations	8,176.12	$9,077.29	4	147,358.35	$89,950.87	27	$0.00	0.00%
A2a - Residential Coordinated Delivery	38,734.60	$74,045.17	65	282,386.00	$551,755.00	155	$131,286.24	420.27%
A2b - Residential Conservation Services (RCS)	0.00	$9,253.83	42	0.00	$27,148.83	101	$22,218.28	122.19%
A2c - Residential Retail	81,622.60	$14,304.41	13	638,855.10	$175,888.74	164	$0.00	0.00%
A2d - Residential Behavior	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A2e - Residential Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A3i - Residential HEAT Loan	0.00	$140.00	4	0.00	$4,095.39	9	$0.00	0.00%
Res Subtotal	**128,533.32**	**$106,820.70**	**128.00**	**1,068,599.45**	**$848,838.83**	**456**	**$153,504.52**	
Res % of Total	**96.50%**	**94.85%**	**94.81%**	**77.91%**	**63.43%**	**65.52%**	**60.41%**	
B1a - Income Eligible Coordinated Delivery	4,656.80	$5,802.77	7	155,400.34	$407,080.21	191	$46,563.95	874.24%
B1b - Income Eligible Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
IE Subtotal	**4,656.80**	**$5,802.77**	**7.00**	**155,400.34**	**$407,080.21**	**191**	**$46,563.95**	
IE % of Total	**3.50%**	**5.15%**	**5.19%**	**11.33%**	**30.42%**	**27.44%**	**18.32%**	
C1a - C&I New Buildings & Major Renovations	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C1a - C&I New Buildings & Major Renovations – Municipal	0.00	$0.00	0	0.00	$3,414.25	1	$0.00	0.00%
C2a - C&I Existing Building Retrofit	0.00	$0.00	0	44,382.14	$36,466.80	14	$54,037.37	67.48%
C2a - C&I Existing Building Retrofit - Municipal	0.00	$0.00	0	14,014.19	$31,185.04	4	$0.00	0.00%
C2b - C&I New & Replacement Equipment	0.00	$0.00	0	89,172.65	$11,347.00	30	$0.00	0.00%
C2c - C&I Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C&I Subtotal	**0.00**	**$0.00**	**0.00**	**147,568.98**	**$82,413.09**	**49**	**$54,037.37**	
C&I % of Total	**0.00%**	**0.00%**	**0.00%**	**10.76%**	**6.16%**	**7.04%**	**21.27%**	
Total	**133,190.12**	**$112,623.47**	**135**	**1,371,568.77**	**$1,338,332.13**	**696**	**$254,105.84**	

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Energy Efficiency Program Activity by Town

Town Name: SANDWICH
Program Period: 2019
Current Dates: 12/1/2019 - 12/31/2019
Cumulative Dates: 1/1/2019 - 12/31/2019

	Current Period			Cumulative Period				
Program Initiative	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Budget**	**Actual % of Budget**
A1a - Residential New Homes & Renovations	6,182.30	$1,229.92	2	61,046.52	$29,183.11	14	$0.00	0.00%
A2a - Residential Coordinated Delivery	306,038.80	$323,160.01	296	749,528.30	$931,399.57	695	$920,037.44	101.23%
A2b - Residential Conservation Services (RCS)	0.00	$49,957.66	208	0.00	$124,741.81	460	$155,702.88	80.12%
A2c - Residential Retail	384,415.80	$30,291.39	54	1,443,069.40	$282,172.25	453	$0.00	0.00%
A2d - Residential Behavior	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A2e - Residential Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A3i - Residential HEAT Loan	0.00	$25,004.56	48	0.00	$219,172.90	157	$0.00	0.00%
Res Subtotal	**696,636.90**	**$429,643.54**	**608.00**	**2,253,644.22**	**$1,586,669.64**	**1,779**	**$1,075,740.33**	
Res % of Total	**94.95%**	**97.48%**	**98.06%**	**68.53%**	**76.87%**	**90.40%**	**60.41%**	
B1a - Income Eligible Coordinated Delivery	2,425.00	$3,556.00	6	140,088.01	$165,950.30	124	$326,314.26	50.86%
B1b - Income Eligible Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
IE Subtotal	**2,425.00**	**$3,556.00**	**6.00**	**140,088.01**	**$165,950.30**	**124**	**$326,314.26**	
IE % of Total	**0.33%**	**0.81%**	**0.97%**	**4.26%**	**8.04%**	**6.30%**	**18.32%**	
C1a - C&I New Buildings & Major Renovations	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C1a - C&I New Buildings & Major Renovations – Municipal	0.00	$0.00	0	170,538.00	$56,743.00	4	$0.00	0.00%
C2a - C&I Existing Building Retrofit	15,062.42	$5,433.83	3	394,760.56	$186,272.81	33	$378,687.09	49.19%
C2a - C&I Existing Building Retrofit - Municipal	0.00	$0.00	0	37,020.83	$35,783.80	2	$0.00	0.00%
C2b - C&I New & Replacement Equipment	19,546.38	$2,118.00	3	292,467.30	$32,580.34	26	$0.00	0.00%
C2c - C&I Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C&I Subtotal	**34,608.80**	**$7,551.83**	**6.00**	**894,786.69**	**$311,379.95**	**65**	**$378,687.09**	
C&I % of Total	**4.72%**	**1.71%**	**0.97%**	**27.21%**	**15.09%**	**3.30%**	**21.27%**	
Total	**733,670.71**	**$440,751.37**	**620**	**3,288,518.92**	**$2,063,999.89**	**1,968**	**$1,780,741.68**	

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Energy Efficiency Program Activity by Town

Town Name: TISBURY
Program Period: 2019
Current Dates: 12/1/2019 - 12/31/2019
Cumulative Dates: 1/1/2019 - 12/31/2019

	Current Period			Cumulative Period				
Program Initiative	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Budget**	**Actual % of Budget**
A1a - Residential New Homes & Renovations	295.59	$3,698.91	2	44,292.88	$34,307.04	12	$0.00	0.00%
A2a - Residential Coordinated Delivery	49,178.20	$94,219.57	53	116,234.60	$233,766.72	115	$175,737.49	133.02%
A2b - Residential Conservation Services (RCS)	0.00	$12,455.00	48	0.00	$31,915.00	113	$29,741.00	107.31%
A2c - Residential Retail	60,993.00	$24,061.48	11	1,307,627.40	$187,318.96	70	$0.00	0.00%
A2d - Residential Behavior	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A2e - Residential Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A3i - Residential HEAT Loan	0.00	$105.00	3	0.00	$14,669.89	11	$0.00	0.00%
Res Subtotal	**110,466.79**	**$134,539.96**	**117.00**	**1,468,154.88**	**$501,977.61**	**321**	**$205,478.49**	
Res % of Total	**90.99%**	**99.09%**	**96.69%**	**87.14%**	**69.22%**	**90.42%**	**60.41%**	
B1a - Income Eligible Coordinated Delivery	0.00	$0.00	0	46,522.80	$147,380.43	8	$62,329.69	236.45%
B1b - Income Eligible Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
IE Subtotal	**0.00**	**$0.00**	**0.00**	**46,522.80**	**$147,380.43**	**8**	**$62,329.69**	
IE % of Total	**0.00%**	**0.00%**	**0.00%**	**2.76%**	**20.32%**	**2.25%**	**18.32%**	
C1a - C&I New Buildings & Major Renovations	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C1a - C&I New Buildings & Major Renovations – Municipal	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C2a - C&I Existing Building Retrofit	0.00	$0.00	0	130,884.45	$70,389.72	7	$72,333.49	97.31%
C2a - C&I Existing Building Retrofit - Municipal	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C2b - C&I New & Replacement Equipment	10,937.93	$1,230.00	4	39,207.39	$5,461.51	19	$0.00	0.00%
C2c - C&I Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C&I Subtotal	**10,937.93**	**$1,230.00**	**4.00**	**170,091.84**	**$75,851.23**	**26**	**$72,333.49**	
C&I % of Total	**9.01%**	**0.91%**	**3.31%**	**10.10%**	**10.46%**	**7.32%**	**21.27%**	
Total	**121,404.72**	**$135,769.96**	**121**	**1,684,769.52**	**$725,209.27**	**355**	**$340,141.67**	

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Energy Efficiency Program Activity by Town

Town Name: TRURO
Program Period: 2019
Current Dates: 12/1/2019 - 12/31/2019
Cumulative Dates: 1/1/2019 - 12/31/2019

	Current Period			Cumulative Period				
Program Initiative	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Budget**	**Actual % of Budget**
A1a - Residential New Homes & Renovations	2,856.29	$6,446.67	3	63,859.00	$41,082.62	14	$0.00	0.00%
A2a - Residential Coordinated Delivery	55,596.10	$96,849.23	57	198,515.50	$232,961.69	139	$88,902.49	262.04%
A2b - Residential Conservation Services (RCS)	0.00	$14,560.00	60	0.00	$35,115.00	130	$15,045.45	233.39%
A2c - Residential Retail	8,380.30	$5,079.90	12	55,928.20	$50,797.13	108	$0.00	0.00%
A2d - Residential Behavior	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A2e - Residential Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A3i - Residential HEAT Loan	0.00	$3,131.47	10	0.00	$18,766.88	17	$0.00	0.00%
Res Subtotal	**66,832.69**	**$126,067.27**	**142.00**	**318,302.70**	**$378,723.32**	**408**	**$103,947.94**	
Res % of Total	**48.18%**	**94.41%**	**97.93%**	**66.05%**	**86.13%**	**90.87%**	**60.41%**	
B1a - Income Eligible Coordinated Delivery	0.00	$0.00	0	21,986.70	$26,548.80	25	$31,531.49	84.20%
B1b - Income Eligible Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
IE Subtotal	**0.00**	**$0.00**	**0.00**	**21,986.70**	**$26,548.80**	**25**	**$31,531.49**	
IE % of Total	**0.00%**	**0.00%**	**0.00%**	**4.56%**	**6.04%**	**5.57%**	**18.32%**	
C1a - C&I New Buildings & Major Renovations	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C1a - C&I New Buildings & Major Renovations – Municipal	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C2a - C&I Existing Building Retrofit	0.00	$0.00	0	22,145.32	$9,599.60	4	$36,592.24	26.23%
C2a - C&I Existing Building Retrofit - Municipal	0.00	$0.00	0	13,536.00	$14,251.00	1	$0.00	0.00%
C2b - C&I New & Replacement Equipment	71,886.73	$7,468.00	3	105,921.05	$10,612.00	11	$0.00	0.00%
C2c - C&I Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C&I Subtotal	**71,886.73**	**$7,468.00**	**3.00**	**141,602.37**	**$34,462.60**	**16**	**$36,592.24**	
C&I % of Total	**51.82%**	**5.59%**	**2.07%**	**29.38%**	**7.84%**	**3.56%**	**21.27%**	
Total	**138,719.42**	**$133,535.27**	**145**	**481,891.77**	**$439,734.72**	**449**	**$172,071.67**	

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Energy Efficiency Program Activity by Town

Town Name: WELLFLEET
Program Period: 2019
Current Dates: 12/1/2019 - 12/31/2019
Cumulative Dates: 1/1/2019 - 12/31/2019

	Current Period			Cumulative Period				
Program Initiative	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Budget**	**Actual % of Budget**
A1a - Residential New Homes & Renovations	0.00	$0.00	0	3,020.15	$12,486.41	3	$0.00	0.00%
A2a - Residential Coordinated Delivery	79,124.50	$129,734.88	77	219,220.30	$334,091.59	197	$121,982.49	273.88%
A2b - Residential Conservation Services (RCS)	0.00	$20,010.00	85	0.00	$49,431.49	190	$20,643.75	239.45%
A2c - Residential Retail	15,543.10	$13,592.70	20	138,586.70	$84,920.60	165	$0.00	0.00%
A2d - Residential Behavior	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A2e - Residential Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A3i - Residential HEAT Loan	0.00	$315.00	9	0.00	$11,960.78	18	$0.00	0.00%
Res Subtotal	**94,667.60**	**$163,652.58**	**191.00**	**360,827.15**	**$492,890.87**	**573**	**$142,626.25**	
Res % of Total	**92.72%**	**97.28%**	**96.46%**	**71.08%**	**78.98%**	**89.81%**	**60.41%**	
B1a - Income Eligible Coordinated Delivery	4,010.30	$3,795.44	4	43,742.66	$82,538.15	45	$43,264.14	190.78%
B1b - Income Eligible Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
IE Subtotal	**4,010.30**	**$3,795.44**	**4.00**	**43,742.66**	**$82,538.15**	**45**	**$43,264.14**	
IE % of Total	**3.93%**	**2.26%**	**2.02%**	**8.62%**	**13.23%**	**7.05%**	**18.32%**	
C1a - C&I New Buildings & Major Renovations	0.00	$507.50	1	0.00	$8,515.00	2	$0.00	0.00%
C1a - C&I New Buildings & Major Renovations – Municipal	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C2a - C&I Existing Building Retrofit	0.00	$0.00	0	62,563.73	$35,088.78	8	$50,207.95	69.89%
C2a - C&I Existing Building Retrofit - Municipal	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C2b - C&I New & Replacement Equipment	3,420.18	$276.00	2	40,485.81	$5,017.00	10	$0.00	0.00%
C2c - C&I Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C&I Subtotal	**3,420.18**	**$783.50**	**3.00**	**103,049.54**	**$48,620.78**	**20**	**$50,207.95**	
C&I % of Total	**3.35%**	**0.47%**	**1.52%**	**20.30%**	**7.79%**	**3.13%**	**21.27%**	
Total	**102,098.08**	**$168,231.52**	**198**	**507,619.35**	**$624,049.80**	**638**	**$236,098.33**	

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Energy Efficiency Program Activity by Town

Town Name: WEST TISBURY
Program Period: 2019
Current Dates: 12/1/2019 - 12/31/2019
Cumulative Dates: 1/1/2019 - 12/31/2019

	Current Period			Cumulative Period				
Program Initiative	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Budget**	**Actual % of Budget**
A1a - Residential New Homes & Renovations	0.00	$0.00	0	37,633.36	$29,064.41	11	$0.00	0.00%
A2a - Residential Coordinated Delivery	55,412.20	$103,700.36	53	144,306.60	$245,095.93	105	$121,982.49	200.93%
A2b - Residential Conservation Services (RCS)	0.00	$12,990.00	50	0.00	$29,240.00	102	$20,643.75	141.64%
A2c - Residential Retail	3,950.00	$5,939.75	6	17,127.10	$69,426.37	69	$0.00	0.00%
A2d - Residential Behavior	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A2e - Residential Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A3i - Residential HEAT Loan	0.00	$2,589.36	8	0.00	$12,398.95	14	$0.00	0.00%
Res Subtotal	**59,362.20**	**$125,219.47**	**117.00**	**199,067.06**	**$385,225.66**	**301**	**$142,626.25**	
Res % of Total	**100.00%**	**100.00%**	**100.00%**	**72.88%**	**89.93%**	**94.65%**	**60.41%**	
B1a - Income Eligible Coordinated Delivery	0.00	$0.00	0	7,316.90	$14,201.14	7	$43,264.14	32.82%
B1b - Income Eligible Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
IE Subtotal	**0.00**	**$0.00**	**0.00**	**7,316.90**	**$14,201.14**	**7**	**$43,264.14**	
IE % of Total	**0.00%**	**0.00%**	**0.00%**	**2.68%**	**3.32%**	**2.20%**	**18.32%**	
C1a - C&I New Buildings & Major Renovations	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C1a - C&I New Buildings & Major Renovations – Municipal	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C2a - C&I Existing Building Retrofit	0.00	$0.00	0	47,936.05	$20,421.84	2	$50,207.95	40.67%
C2a - C&I Existing Building Retrofit - Municipal	0.00	$0.00	0	4,241.74	$6,178.81	2	$0.00	0.00%
C2b - C&I New & Replacement Equipment	0.00	$0.00	0	14,568.06	$2,351.50	6	$0.00	0.00%
C2c - C&I Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C&I Subtotal	**0.00**	**$0.00**	**0.00**	**66,745.85**	**$28,952.15**	**10**	**$50,207.95**	
C&I % of Total	**0.00%**	**0.00%**	**0.00%**	**24.44%**	**6.76%**	**3.14%**	**21.27%**	
Total	**59,362.20**	**$125,219.47**	**117**	**273,129.81**	**$428,378.95**	**318**	**$236,098.33**	

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Energy Efficiency Program Activity by Town

Town Name: YARMOUTH
Program Period: 2019
Current Dates: 12/1/2019 - 12/31/2019
Cumulative Dates: 1/1/2019 - 12/31/2019

	Current Period			Cumulative Period				
Program Initiative	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Annual kWh Savings**	**Actual Expenditures**	**Participants**	**Budget**	**Actual % of Budget**
A1a - Residential New Homes & Renovations	0.00	$231.33	1	93,390.38	$32,633.33	10	$0.00	0.00%
A2a - Residential Coordinated Delivery	249,997.60	$402,559.74	352	835,307.70	$1,412,869.79	1,027	$1,058,559.94	133.47%
A2b - Residential Conservation Services (RCS)	0.00	$53,459.15	217	0.00	$172,675.43	594	$179,145.79	96.39%
A2c - Residential Retail	468,314.30	$71,132.64	58	4,949,464.40	$710,234.83	592	$0.00	0.00%
A2d - Residential Behavior	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A2e - Residential Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
A3i - Residential HEAT Loan	0.00	$20,658.75	60	0.00	$267,917.28	212	$0.00	0.00%
Res Subtotal	**718,311.90**	**$548,041.61**	**688.00**	**5,878,162.48**	**$2,596,330.66**	**2,435**	**$1,237,705.72**	
Res % of Total	**83.87%**	**86.15%**	**77.74%**	**81.12%**	**76.70%**	**83.68%**	**60.41%**	
B1a - Income Eligible Coordinated Delivery	22,491.47	$40,500.14	176	273,671.66	$372,144.30	352	$375,444.73	99.12%
B1b - Income Eligible Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
IE Subtotal	**22,491.47**	**$40,500.14**	**176.00**	**273,671.66**	**$372,144.30**	**352**	**$375,444.73**	
IE % of Total	**2.63%**	**6.37%**	**19.89%**	**3.78%**	**10.99%**	**12.10%**	**18.32%**	
C1a - C&I New Buildings & Major Renovations	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C1a - C&I New Buildings & Major Renovations – Municipal	0.00	$0.00	0	0.00	$2,472.00	1	$0.00	0.00%
C2a - C&I Existing Building Retrofit	85,055.64	$44,449.21	3	790,133.73	$366,484.39	61	$435,702.90	84.11%
C2a - C&I Existing Building Retrofit - Municipal	0.00	$0.00	0	8,437.18	$9,079.61	1	$0.00	0.00%
C2b - C&I New & Replacement Equipment	30,627.90	$3,143.00	18	295,915.87	$38,673.53	60	$0.00	0.00%
C2c - C&I Active Demand Reduction	0.00	$0.00	0	0.00	$0.00	0	$0.00	0.00%
C&I Subtotal	**115,683.54**	**$47,592.21**	**21.00**	**1,094,486.78**	**$416,709.53**	**123**	**$435,702.90**	
C&I % of Total	**13.51%**	**7.48%**	**2.37%**	**15.10%**	**12.31%**	**4.23%**	**21.27%**	
Total	**856,486.91**	**$636,133.96**	**885**	**7,246,320.91**	**$3,385,184.49**	**2,910**	**$2,048,853.35**	

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APPENDIX CLC-2
CAPE LIGHT COMPACT JPE
ENERGY EDUCATION OUTREACH ACTIVITIES

The Compact is committed to energy education outreach within its community and continues to be a regionally and nationally recognized leader in the design and implementation of its energy education programs. As a municipal aggregator with a unique service territory, the Compact supports the community's efforts to develop a deeper and broader knowledge of energy efficiency technology and practices, moving towards an energy-literate society.

Highlights from 2019 include:

- The Compact participated in energy education-based presentations and all-school Energy Carnivals, through which students learn the basic lessons of energy efficiency, energy forms, and energy sources in a first-hand, fun, and engaging way.
- The Compact reached teachers in its service territory through the National Energy Education Development ("NEED") Teacher Workshops, hosted at the Compact Offices in February 2019.
- The Compact participated in Cape Cod and Martha's Vineyard science education festivals, demonstrating the science of energy, building energy efficiency, and renewable energy resources.

The Compact's greatest successes continue with the "kids as teachers" model, where students are trained, conduct studies, and present information on energy efficiency, renewable energy, and related topics to younger students and community members. Many schools have fully adopted energy education into their yearly schedule of classroom activities, as evidenced by their repeated requests for energy education programs from the Compact. As a result, the Compact and the schools it works with continue to reach teachers, students, and families every year.

The Compact continues to use updated and innovative energy education materials from local and national energy education-based resources. Using a model for science-based facts and local science, technology, engineering, and math ("STEM") initiatives, the Compact designs and uses curriculum materials that align with Massachusetts' standards for science and technology, allowing teachers to introduce lesson plans discussing energy efficiency, innovation, and conservation.

A full list of Energy Education Activities provided by Cape Light Compact during 2019 is detailed below:

- January 27: Climate Café with Martha's Vineyard Regional High School
- January 30: Quashnet Elementary School Energy Carnival
- February 1: Zero Waste Night @ West Tisbury School
- February 28: NEED Teacher Training
- May 10: Sandwich STEM Day
- June 4: Monomoy Middle School Energy Carnival
- July 8-9: Advanced Studies and Leadership Program @ Mass Maritime Academy
- October 21: Mattacheese Middle School Energy Carnival