



September 14, 2018

Massachusetts Joint Statewide Electric and Gas

Three-Year Energy Efficiency Plan

2019–2021



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2019-2021 MASSACHUSETTS JOINT STATEWIDE THREE-YEAR ELECTRIC & GAS ENERGY EFFICIENCY PLAN

I. EXECUTIVE SUMMARY

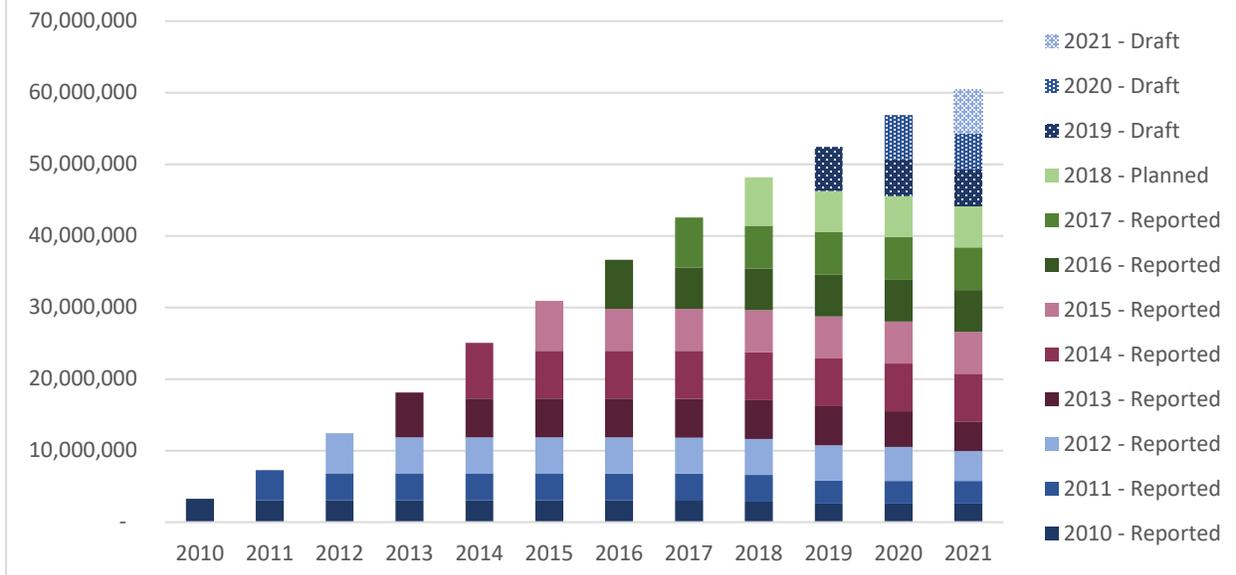
Program Administrators propose a sustained, intense energy efficiency effort in 2019-2021

- ★ The 2019-2021 Three-Year Energy Efficiency Plan builds on the historic success of the energy efficiency programs delivered since the implementation of the Green Communities Act, and represents sustained efforts and creative new ideas to achieve high total energy reductions over the term. This Plan represents a pivot point, where the Program Administrators will embrace a broader, holistic energy system view by providing new tools to help all customers reduce their overall energy bills in addition to system costs by reducing energy usage and lowering demand at peak periods. The Program Administrators propose a statewide three-year investment in energy efficiency programs of **\$2.65 billion** – an investment that saves customers money, helps the environment, and creates and keeps jobs. The gas and electric Program Administrators are proposing an investment of over \$100 million more this Plan compared to the 2016-2018 Three-Year Plan. The plan includes a suite of innovative programs that will continue to weatherize homes, increase the comfort of customers, make businesses more competitive, and drive down total energy bill costs. Overall, the plan sets forth aggressive goals, which translate to:
 - Proposed electric lifetime savings (excluding fuel conversion and active demand reduction) of 33,521,427 MWh for electric Program Administrators.
 - Proposed gas lifetime therm savings (excluding fuel conversion) of 1,063,774,961 therms for gas Program Administrators.
 - Proposed MMBTu savings (excluding CHP and active demand reduction) of 216,936,178.
- ★ In this Plan, the Program Administrators are proposing a suite of measures and strategies that achieve even greater levels of greenhouse gas reductions than in the current 2016-2018 Plan. The 2019-2021 Plan proposes CO₂e reductions of over 2.4 million short tons—over 250,000 short tons more in reductions than in the current 2016-2018 plan.
- ★ The proposed energy savings levels represent an aggressive commitment to reducing overall customer energy usage, while providing at least **\$6.97 billion** in benefits to customers and contributing to the Commonwealth’s economic, environmental, and job creation goals.¹

¹ The benefit value does not include additional benefits identified by DOER’s study of avoided costs of compliance with the Global Warming Solutions Act. When the additional values are taken into consideration, the Plan is expected to deliver \$7.77 billion in benefits.

Statewide Cumulative MMBTu Savings

(Electric & Gas Programs without CHP & ADR)



The 2019-2021 Plan builds on past success and embraces new challenges and opportunities

- ★ The Program Administrators have a long and unparalleled track record of success in implementing energy efficiency programs. This success has contributed to Massachusetts' nation-leading position in energy efficiency and made the programs a model for the rest of the country. This success has earned the Program Administrators the trust of customers and stakeholders in the Commonwealth. Program Administrators achieve success because of their ability to look forward and analyze technologies and the marketplace, and evolve programs to best serve the energy goals of customers under the mandate and framework of the Green Communities Act.
- ★ The Program Administrators, with the support of the Council, have been able to transform the lighting market and support increased building codes through the successful implementation of the energy efficiency programs. Due to these efforts, the lighting market has been substantially transformed to the point where LED lighting is fast becoming the standard in Massachusetts in many lighting applications. These new standards resulting from the efforts of the Program Administrators and the Commonwealth create enduring economic and environmental benefits for all customers, but the savings associated with standard practice and rising baselines reduce the savings claimable by the Program Administrators.

The proposed 2019-2021 investment will continue to expand the Program Administrators' robust contractor infrastructure

- ★ According to MassCEC's 2017 Clean Energy Industry Report, the energy efficiency, demand management, and clean heating and cooling industries are estimated to support the employment of about 78,000 workers. In this Plan, the Program Administrators expand their commitment to a robust, well-trained contractor infrastructure. To do this, the Program Administrators will modify contractor training to match the evolution of the programs.

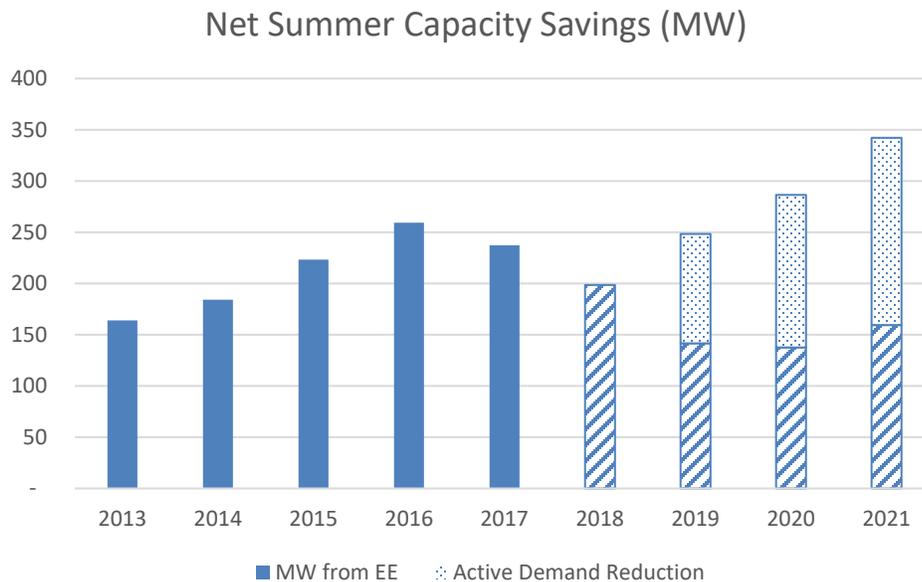
The Plan describes a holistic approach to customer-focused energy efficiency called Energy Optimization.

- ★ The Program Administrators are re-focusing from primarily seeking to reduce electric and gas energy usage to helping customers reduce total energy use, and helping lower overall customer utility bills. The 2019-2021 Plan will provide a more holistic and integrated approach to helping customers address their energy use and associated costs based on their individual needs and goals. The energy optimization approach builds on the successful integrated gas and electric program delivery, and will include strategies that target customers' overall energy costs, as well as provide broader energy and economic benefits both for participating customers as well as all ratepayers.

The Program Administrators maintain their passion for excellence in program design and serving all customers

- ★ The Program Administrators propose a **bold rethinking of residential program delivery**, designed to better serve customers, provide more opportunities for engagement, more effectively address barriers, and leverage relationships with contractors and market actors.
- ★ The Program Administrators will continue their intense focus, working with the deeply committed team at LEAN, to serve **income eligible customers** with successful energy efficiency programs that provide myriad benefits that extend well beyond lower energy costs.
- ★ The Program Administrators are amplifying efforts to serve all customers, including moderate income customers. Targeted efforts include expanding and simplifying delivery channels to all customers, in order to ensure all customers are being served effectively. The Plan will offer enhanced strategies and community outreach efforts targeting **renters, moderate income customers, and non-English speaking customers**. Highlights of new efforts are:
 - No-cost weatherization for moderate income customers and, to assist renters, 90% incentives for insulation for landlords of all low-rise buildings (three stories and under) who are willing to complete all recommended insulation and air sealing.
 - Proactive engagement with municipalities and communities with historically low participation rates through a partnership model that will provide marketing materials, trainings, and networking check-ins to share program updates and outreach best practices.

- Optimization of the customer journey for non-English speakers 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, and will offer additional translated program materials in the most commonly spoken languages across Massachusetts.
- ★ The Program Administrators will continue their diligent focus to serve **commercial and industrial customers** with successful programs that reach customers through many different pathways and target existing and emerging technologies including lighting with integrated controls, HVAC and controls, and industrial processes including heat recovery.
- ★ The 2019-2021 Plan includes exciting new statewide **Active Demand Reduction Offerings** for residential and commercial and industrial sectors. Customers will earn an incentive for verifiably shedding load in response to events called by Program Administrators. The Program Administrators will offer a technology agnostic approach to encourage innovations and capture all cost-effective demand reductions. In addition, the Program Administrators are excited to offer a specialized performance based incentive option for storage designed to provide enhanced incentives to customers in a manner that is complimentary to other state sponsored storage programs and deliver summer and winter peak demand reductions.



- ★ Development and promotion of the **Passive House** approach for new construction projects.
- ★ The Plan will also target savings to support the Commonwealth’s **winter reliability** efforts and drive down winter electric demand by approximately 400 MW. The PAs will introduce new active demand offerings targeting winter demand. Savings from weatherizing buildings delivered by gas Program Administrators increase year-over-year during the Plan term, which significantly decreases the demand for natural gas during the winter period. The PAs will also introduce a **temperature optimization** approach that will strategically reduce winter energy use by automatically adjusting customer set points on eligible Wi-Fi enabled thermostats.

The Plan fulfills the requirements of the Green Communities Act and provides value for customers

- ★ Each program and core initiative is cost-effective with statewide portfolio benefits of at least **\$6.97 billion**, nearly double the total program costs (inclusive of customer contributions) of **\$3.6 billion**.
- ★ Through statewide collaboration and coordination, the Program Administrators continue to share best practices, leverage collective resources, and use competitive procurement to minimize administrative costs. This results in **almost three-quarters of program budgets being allocated to participant incentives that flow back to customers**.

The Plan materially increases savings and benefits from the April Draft levels.

- ★ In this revised Plan, savings, benefits, greenhouse gas reductions, and production have all materially increased since the April draft, as has the proposed dollar investment in energy efficiency. Benefits have increased by approximately 12%, driven by a 15% increase in lifetime electric savings and a 4% increase in lifetime gas savings, notwithstanding impacts from EM&V results, finalized after the April 30 draft, that materially decreased claimable savings. The revised Plan also has dynamically increased the proposed number of cost-effective air source heat pumps to be installed in 2019-2021.

The revised Plan reflects the unique collaborations that are the hallmark of Massachusetts energy efficiency.

- ★ The Program Administrators greatly appreciate the efforts of DOER, the Attorney General, Council members, LEAN, and other stakeholders. Assembling a statewide plan for an endeavor as expansive as the 2019-2021 Plan is a challenging and rewarding process that benefits greatly from thoughtful and positive engagement by stakeholders. Engagement occurs through multiple avenues ranging from public comments to workshops to deep dives between DOER experts, the consultants, and the PA Management Committees. With so many perspectives and priorities on how to best pursue cost-effective energy efficiency and demand reduction, the Program Administrators recognize that differing views legitimately exist, but believe that through the extensive collaboration during Plan development process the overall end product – and results for the Commonwealth and customers – is ultimately improved.

This aggressive draft Plan reflects the Program Administrators' commitment to a robust and dynamic investment in energy efficiency and continued leadership during 2019-2021.

II. OVERVIEW

A. Introduction

Bay State Gas Company d/b/a Columbia Gas of Massachusetts (“CMA”), The Berkshire Gas Company (“Berkshire”), Boston Gas Company, Colonial Gas Company, Massachusetts Electric Company and Nantucket Electric Company, each d/b/a National Grid (“National Grid”),² Fitchburg Gas and Electric Light Company d/b/a Unitil (“Unitil”), Liberty Utilities (New England Natural Gas Company) Corp. d/b/a Liberty Utilities (“Liberty”), Cape Light Compact JPE (“Compact” or “CLC”),³ and NSTAR Electric Company and NSTAR Gas Company, each d/b/a Eversource Energy (“Eversource”) (collectively, “Program Administrators” or “PAs”) developed and prepared this 2019-2021 Energy Efficiency Plan (“2019-2021 Plan” or “Plan”) pursuant to the mandates of An Act Relative to Green Communities, Acts of 2008, c. 169, codified at G.L. c. 25 §§ 19, 21-22, amended by An Act Relative to Competitively Priced Electricity in the Commonwealth, Acts of 2012, c. 209, and by An Act to Advance Clean Energy, Acts of 2018, c. 227⁴ (“Green Communities Act” or “GCA”).

The 2019-2021 Plan includes multiple parts that, taken together as an integrated whole, describe the Program Administrators’ strategy for acquiring cost-effective energy efficiency and demand reduction resources through a sustained effort while considering short term customer bill impacts. The provisions of the entire Plan must be considered as a whole to fully appreciate and understand both the Program Administrators’ energy efficiency programs and their strategy for satisfying the mandates of the GCA over the next three years. While detailed, an energy efficiency investment plan under the GCA (“Three-Year Plan”) is a strategic plan, not an implementation guide. This strategic plan approach provides the Program Administrators with the flexibility necessary respond to meet changing circumstances in order to deliver on their Plan goals and comply with the GCA.

The tremendous success of energy efficiency programs in Massachusetts is directly related to the collaboration amongst the Program Administrators in developing and delivering integrated programs and services, as well as the robust stakeholder and customer engagement process. Engagement through the Energy Efficiency Advisory Council (“Council”), as well as informal outreach and engagement, have contributed to this success. Program Administrators have also engaged with customers and organizations, researched and analyzed evaluations and best practices, and participated in collaborative discussions with key stakeholders including the Council, its consultants, Department of Energy Resources (“DOER”), the Office of the Attorney General (the “Attorney General”), and the Low-Income Energy Affordability Network (“LEAN”). The

² Pursuant to D.P.U. 15-79, National Grid offers energy efficiency services to Blackstone Gas Company customers.

³ The Cape Light Compact is the only publicly funded, municipal aggregator (as defined by G.L. c. 164, § 134) energy efficiency program administrator in Massachusetts. Since it is a public entity consisting of twenty-one towns and one county, it does not participate in performance incentives or collect lost-based revenues. As such, any discussion of these topics contained in the Three-Year Plan does not pertain to the Compact and general references to Program Administrators in these topic narratives do not include the Compact.

⁴ Acts of 2018, c. 227 was signed on August 9, 2018 and is effective November 7, 2018 (the Act does not include an emergency preamble).

Program Administrators coordinate closely with LEAN in serving income eligible customers and appreciate LEAN's continued commitment to the Commonwealth's most vulnerable residents.

B. Sustaining Excellence in 2019-2021

The energy marketplace is evolving quickly, and the Massachusetts Program Administrators have been at the center, driving the changing landscape of energy efficiency. The Program Administrators' nation-leading and collaborative efforts have accelerated market transformation, and contributed to lower demand, lower energy prices, and a more efficient energy system. Sustaining very high claimable savings goals becomes increasingly difficult in each subsequent year as markets become saturated, "easy" savings no longer exist, and rising baselines continue to reduce claimable savings opportunities. Over the next three years, the Program Administrators will need to find ways to mine savings from more difficult, costly, and challenging projects and market segments. To maintain the robust levels of energy efficiency investments, the Program Administrators will undertake a paradigm shift focused on positioning the Program Administrators as energy advisors to empower customers to make educated decisions about their energy use and **ensuring that energy efficiency remains consumers' first choice**. Opportunities for efficiency still exist, and in the 2019-2021 Plan the Program Administrators continue to innovate and raise the bar for energy efficiency programs, despite increased challenges.

The 2019-2021 Plan sets an ambitious agenda to build on the success of prior plans through a more holistic and integrated effort. The Program Administrators have defined a new approach: Energy Optimization. This approach includes a combination of energy efficiency, active and passive demand reduction, and holistic approaches targeted at reducing customers' overall energy use, particularly for space and water heating. This holistic approach aligns with the recent revisions to the GCA and focuses on the customers' individual energy needs and goals, such as customers' desires for cleaner and less expensive energy, in order to provide significant energy and economic benefits to customers and the Commonwealth. The Program Administrators are seeking to engage customers and provide effective combinations of education and incentives to drive efficiency and optimize energy use.

The 2019-2021 Three-Year Plan introduces several new strategies and redesigned programs:

Residential and Income Eligible

- *Program Realignment*: designed to target customer-specific opportunities and provide multiple engagement paths for customers
- *Enhanced Customer and Ally Support*: structuring initiatives to provide enhanced support for customers and relationships with trade allies, tailoring energy savings packages for direct delivery to customers, and leveraging in-home assessments to provide deeper education and more facilitated options to support adoption of major measures
- *Moderate Income*: simplifying communications and providing seamless, uncomplicated pathways to mitigate structural barriers in order to serve all customers, including addressing the needs of moderate income customers, as well as providing no-cost weatherization for moderate income customers

- *Renters*: developed tailored pathways to access energy efficiency services and address barriers to participation. To further assist renters, the Program Administrators are offering 90% incentives for insulation for landlords of all low-rise buildings (three stories and under) who are willing to complete all recommended insulation and air sealing
- *Active Demand Reduction*: a new bring-your-own device active demand reduction initiative that allows residential and income eligible customers to expand the use of controllable efficiency equipment that can provide demand reduction during peak hours
- *Storage Performance*: a new specialized storage performance offering will provide enhanced incentives to customers to dispatch energy storage during daily peak hours in the summer and winter months
- *New Partnerships with Communities*: proactive engagement with municipalities and communities with historically low participation rates through a partnership model that will provide marketing materials, trainings, and networking check-ins to share program updates and outreach best practices
- *Pay for Savings*: fully optimized incentive structure that rewards builders for savings based on energy modeling in the New Homes & Renovations initiative
- *Passive House*: offering training, technical support, and incentives for evolved design approach that focuses on super-efficient shell or building envelope design and optimized energy systems
- *Market Rate and Income Eligible*: better alignment of market rate and income eligible programs to support increased awareness and drive customer participation, and align auditor and contractor protocols, program measures, and service delivery
- *Income Eligible Workforce*: developing training and retention strategies to ensure a knowledgeable workforce to continue on-the-ground success in income eligible programs

Commercial and Industrial

- *Active Demand Reduction*: offering an innovative technology-agnostic curtailment initiative allowing customers to work with experts to develop facility-tailored curtailment strategies and receive incentives for verifiable load shedding during peak periods
- *Storage Performance*: specialized storage performance offerings will provide enhanced incentives to customers to dispatch energy storage to either shave peak demand or during daily peak hours in the summer and winter months
- *Enhanced Technical Assistance and Design Support*: advanced, integrated design path that fosters collaboration among owners, designers, and Program Administrators to incorporate high performance characteristics into the earliest design schemes and optimize performance
- *Whole Building Project Approaches*: testing new approaches to engage with design teams early to encourage designers and customers to set energy use intensity targets that can lead to more zero net energy or Passive House criteria projects
- *Operations and Maintenance Savings*: providing simplified and expedited paths for implementing common low-cost/no-cost measures or actions through a prescriptive

incentive as a means to help capture and achieve consistent, verifiable operations and maintenance savings

- *Advanced Systems Training*: including new training offers for advanced lighting controls to ensure that contractors have the expertise to optimize the specifications and installation of energy efficiency equipment combined with system controls
- *Franchised Businesses*: offering customized and specialized industrial engineering services for franchised businesses

Fundamentally, the 2019-2021 Plan will provide customers with the tools and knowledge to save energy and lower bills, improve the comfort of homes and businesses, and increase business productivity.

C. **Core Ways to Measure Success for 2019-2021**

In the 2019-2021 Plan, the Program Administrators are expanding their scope of services in order to provide energy efficiency and demand reduction benefits to customers in a more holistic manner. This innovative, comprehensive energy efficiency service can be examined through a multi-prong approach that shows the overall impact and success of the Program Administrators.

Several measures and strategies in the 2019-2021 Plan reduce energy use from one fuel source but may increase use of another fuel. For example, efficient lighting measures produce less heat waste than traditional lighting, and therefore result in an increase in heating fuel usage to replace the heat previously produced by inefficient lighting. New active demand reduction strategies may shift energy consumption from one time period to another, producing peak savings but not necessarily overall energy savings. Additionally, pre-cooling of air conditioning for a demand event may result in higher kWh consumption, but can provide significant peak demand savings and benefits that are important to both customers and the Commonwealth. Also, storage technologies may have efficiency losses during use, resulting in lower peak kW but higher kWh consumption. Further, the recently amended statute encourages strategic electrification, which may reduce the use of oil or propane but increase the use of electricity and increase peak demand.

As the Program Administrators transition to a more holistic approach of reducing and optimizing overall energy use, the Program Administrators recognize the need to provide key data points to measure success of the Plan and provide comparable metrics to prior Plans for stakeholders to understand the impact of the programs. Accordingly, the Program Administrators will provide the following key data sets quarterly:

- Net lifetime all-fuel savings (MMBTu) (excluding MMBTus associated with combined heat and power, and active demand reduction efforts) to transparently illustrate the net effect of all fuel savings efforts (electric, gas, oil, and propane), as well as the impact of fuel conversions that result in overall lower energy use.

- Demand savings (kW) (excluding fuel conversions) for electric Program Administrators, which provides total peak demand savings from passive and active⁵ demand reduction measures and strategies.⁶
- Net lifetime electric savings (MWh) (excluding fuel conversions and active demand reduction efforts) for electric Program Administrators, which provides total electric savings for measures designed to reduce total electric use. Excluding new initiatives that may increase kWh but provide significant overall energy and demand reduction benefits provides a comparable metric to the electric savings metric used in prior terms.
- Net lifetime gas savings (therms) (excluding fuel conversions) for gas Program Administrators, which provides total gas savings for measures designed to reduce total gas use. Excluding new initiatives that may increase therms but provide significant overall energy benefits provides a comparable metric to the gas savings metric used in prior terms.

While the above data points will serve as the primary metrics for planning and measuring success in this Plan, the Program Administrators will continue to transparently report all savings metrics that are currently reported, including any and all positive and negative annual and lifetime kWh, therms, MMBTu of oil, MMBTu of propane, and gallons of water. The Program Administrators will continue to report benefits and calculate cost-effectiveness consistent with the Department's Energy Efficiency Guidelines.⁷

In setting forth goals and budgets in this Plan, the Program Administrators have carefully considered new program structures and strategies, lessons learned from past three-year plans, changing baselines, new technologies, market opportunities, individual territory characteristics, PA-specific potential studies, and the desire to foster a sustainable energy efficiency infrastructure in the Commonwealth. The Program Administrators will pursue available cost-effective energy efficiency and demand reduction, with consideration of reasonable short-term customer bill impacts, consistent with Department precedent, and will seek to maximize benefits to the Commonwealth and its residents. Specifically, the Program Administrators have sought to minimize bill impacts by proposing only the necessary levels of funding required to achieve the aggressive mandates of the GCA. An overview of the statewide savings (presented as discussed above), benefits, and budgets described further in this Plan are set forth below.

⁵ Passive demand reduction includes measures that provide kWh reductions and summer and winter demand kW savings, which have cumulative benefits. Active demand reduction includes measures and strategies that primarily provide kW savings (but may increase kWh) and are dispatched over specific periods of time through automation, programming, or control.

⁶ Through the measure and core initiative reporting, stakeholders will be able to view active and passive demand measures separately. This will provide transparency into all demand measures (passive and active) so stakeholders will have insight into the impact of each demand measure/approach.

⁷ The current Guidelines were established in Investigation by the Department of Public Utilities on its Own Motion into Updating its Energy Efficiency Guidelines, D.P.U. 11-120-A, Phase II (2013).

	<u>2019</u>	<u>2020</u>	<u>2021</u>	<u>2019-2021</u>
Net Lifetime All Fuel (MMBTu excluding CHP and ADR)	71,435,177	72,423,717	73,077,284	216,936,178
Peak Demand Reduction (kW) (excluding fuel conversions)	246,610	283,173	339,589	613,795
Net lifetime electric savings (MWh) (excluding fuel conversions and ADR)	10,011,896	9,705,776	13,803,754	33,521,427
Net lifetime gas savings (therms) (excluding fuel conversions)	351,255,460	353,683,011	358,836,490	1,063,774,961
Total Statewide Budget (\$)	914,760,859	928,157,861	958,737,202	2,801,655,923
Benefits (\$)	2,173,722,005	2,217,475,064	2,577,170,859	6,968,367,928

D. Continuing Innovation Under the Green Communities Act

The initial passage of the GCA transformed energy efficiency efforts in Massachusetts, and the GCA continues to lead Massachusetts on a path of innovation. The enactment of the GCA expanded energy efficiency mandates by requiring the Program Administrators to develop three-year energy efficiency plans that will “provide for the acquisition of all available energy efficiency and demand reduction resources that are cost effective or less expensive than supply.” G.L. c. 25, § 21. To date, the GCA’s framework and statewide collaborative approach has produced unprecedented results. The Program Administrators are able to embrace new strategies and adopt emerging technologies in order to continuously pursue new cost-effective opportunities and meet the goals of the Commonwealth, including supporting greenhouse gas emission reduction goals.

The recently updated GCA maintains the same scope and objective to pursue all available cost-effective energy efficiency and demand reduction resources, but clarifies the opportunities to deliver holistic energy efficiency services. For example, the updated GCA clarifies that electric Program Administrators may deliver non-electric energy efficiency services, which is a feature that has been included in prior electric Program Administrators’ residential and multi-family programs. See 2016-2018 Three-Year Plans Order at 104-105. The updated GCA also specifically discusses the ability of the Program Administrators to pursue active demand reduction strategies, including energy storage, which the Program Administrators already have been exploring under approved demonstration offerings during the 2016-2018 term and now are part of the Program Administrators’ overall demand reduction strategy.⁸ In addition to clarifying activities already undertaken by the Program Administrators, the updated GCA provides that the Program Administrators may pursue holistic ways to reduce overall energy use through strategic electrification (that result in cost-effective reductions in greenhouse gas emissions and minimize ratepayer costs) and conversions to renewable energy sources or other clean energy technologies. These specific strategies are included in the Plan and further the Program Administrators’ overall

⁸ The new law also requires that energy storage supported under the energy efficiency programs provide sustainable peak load reductions. Acts of 2018, c. 227, § 20.

energy optimization approach, which focuses on working with customers to provide holistic education on ways to reduce and optimize overall energy use.

In delivering energy efficiency programs under the GCA, the Program Administrators have achieved over \$20 billion in total benefits (significantly greater than the cost of delivering them). Using the strategies set forth in this Plan, including new statewide active demand and fuel conversion offerings, the Program Administrators plan to deliver at least another \$6.97 billion in total benefits in 2019-2021.⁹ The benefits delivered under the Program Administrators' programs directly tie to customer savings and other benefits, and always consider short term and long term customer bill impacts. Delivering programs under the GCA provides an optimal framework for delivering broad and innovative programs, while at the same time ensuring a direct benefit for customers. The GCA framework also provides stability for the energy efficiency market and contractors, which help drive innovations and provide high quality, consistent services for customers.

E. Statutory and Regulatory Context and Process

1. Overview

Energy efficiency in Massachusetts is governed by the statutory framework set out in the GCA. The Program Administrators are responsible for administering energy efficiency programs pursuant to the GCA. G.L. c. 25, §§ 19, 21. The GCA requires the Program Administrators to pursue all available energy efficiency and demand reduction resources that are cost-effective or less expensive than supply. G.L. c. 25, § 21(b)(1). The GCA sets up a multi-level framework in which the Program Administrators work with a diverse Council on program development and implementation, and also appear before the Department for Plan approval, reporting, and cost recovery.

2. Roles and Responsibilities

a. *Energy Efficiency Advisory Council*

The Department appoints and convenes the Council, which consists of 15 voting members of diverse backgrounds and expertise.¹⁰ G.L. c. 25, § 22(a). The Council's membership is composed of governmental and non-governmental members. G.L. c. 25, § 22(a). The Council

⁹ The benefit value does not include additional benefits identified by DOER's study of avoided costs of compliance with the Global Warming Solutions Act. When the additional values are taken into consideration, the Plan is expected to deliver \$7.77 billion in benefits.

¹⁰ The 15 voting members include one person representing each of the following: (1) residential customers; (2) the low-income weatherization and fuel assistance program network; (3) the environmental community; (4) businesses, including large C&I end-users; (5) the manufacturing industry; (6) energy efficiency experts; (7) organized labor; (8) the Department of Environmental Protection; (9) the Attorney General; (10) the Executive Office of Housing and Economic Development; (11) the Massachusetts Non-profit Network; (12) a city or town in the Commonwealth; (13) the Massachusetts Association of Realtors; (14) a business employing fewer than 10 persons located in the Commonwealth that performs energy efficiency services; and (15) DOER. The Commissioner of DOER serves as chair of the Council. G.L. c. 25, § 22.

also includes one “non voting, ex-officio member”¹¹ from each of the Program Administrators (composed of Massachusetts electric and natural gas distribution companies and municipal aggregators with certified energy plans). G.L. c. 25, § 22(a). There is also one non-voting member from each of the heating oil industry, energy efficiency businesses, and ISO-NE. G.L. c. 25, § 22(a).

The statutorily defined composition of the Council ensures that the Program Administrators can benefit from a broad range of unique perspectives, such as non-profits, business, manufacturing, and real estate associations, environmental advocates, municipalities, state agencies, and residential and income eligible customers. The expertise of the Council’s diverse membership and consultants allows it to provide strategic, objective advice to the Program Administrators. The Council also provides a forum for coordinating stakeholder feedback on a statewide basis. The Council is tasked with coordinating with the Program Administrators in developing a three-year plan, periodically reviewing program cost-effectiveness, and providing a report to the Legislature regarding the implementation of the Program Administrators’ three-year plan. G.L. c. 25, § 22(b), (c). The Council may retain energy efficiency experts. G.L. c. 25, § 22(c). To conduct its business, the Council holds meetings, which are subject to the open meeting law, typically on a monthly basis. They Council may also create subcommittees to assist with its business (e.g., the Executive Committee). The Council is designed to engage the expertise of its diverse members and consultants to provide strategic, object advice to the Program Administrators and the Council.

b. Department of Public Utilities

The Department is a quasi-judicial regulatory agency with extensive statutory authority over the Program Administrators.¹² The Department is responsible for ensuring that the electric and gas utilities provide safe, reliable, and least-cost service to Massachusetts customers. Having the resources, technical expertise, and the statutory obligation to regulate in the public interest, the Department is uniquely structured to ensure that energy efficiency funds are spent cost-effectively, that customers are receiving energy efficiency services, and that energy savings are being achieved.

Under the GCA, the Department has oversight authority over the Program Administrators and the Council and is responsible for final administrative review of energy efficiency determinations. G.L. c. 25, §§ 19, 21, 22. The Department has ultimate jurisdiction with respect the final plan approval, cost-effectiveness, rates, and cost-recovery.¹³ The Department has

¹¹ The dictionary defines “ex officio” as meaning “by virtue of one’s position or status.” The Oxford English Dictionary (2013). Ex-officio members have exactly the same rights and privileges as do all other members, except as otherwise specified by statute. See <http://www.robertsrules.com/faq.html#2>.

¹² The Department’s authority extends beyond energy efficiency to all aspects of the operations of electric and gas distribution companies including, but not limited to, rate setting, service quality, customer care, and the operation of a safe and reliable utility. See G.L. c. 164, § 76. Since its establishment by the Legislature in 1919, the Department has comprehensively regulated the operations of electric and gas utility companies in Massachusetts pursuant to G.L. c. 25 & 164 to ensure that electric and gas services are provided pursuant to just and reasonable rates.

¹³ The GCA states that, in authorizing energy efficiency programs, the Department “shall ensure that they are delivered in a cost effective manner capturing all available efficiency opportunities, minimizing

established Guidelines that set forth the requirements for energy efficiency, including the elements, review process, and mid-term modifications related to the Three-Year Plan, the method for determining cost-effectiveness, and the mechanisms for cost recovery. The Department conducts its review of Three-Year Plans and Program Administrator performance through individual adjudicatory proceedings consistent with the Massachusetts Administrative Procedure Act, G.L. c. 30A, which requires the Department to maintain standards of fair procedure such as notice, an opportunity to be heard, and the ability to appeal decisions.¹⁴ Funding for the programs is also approved by the Department and reconciled annually through separate proceedings discussed in Section V.B below.

The Department is also responsible for determining the effectiveness of the Three-Year Plan annually consistent with G.L. c. 25, § 21(d)(2). Annually, the Program Administrators submit detailed reports to the Department documenting program participation, savings, benefits, and expenditures, summarizing and providing completed evaluation studies, and explaining any variances from anticipated performance levels. Plan-Year Reports filed following the initial two years of a term are not adjudicated; however, if a Program Administrator has not reasonably complied with its Three-Year Plan, the Department may open an investigation into the Program Administrator's performance. G.L. c. 25, § 21(e). At the conclusion of the program term, each Program Administrator files a detailed Term Report demonstrating compliance with the requirements of the GCA and Department Guidelines and directives. The Department reviews the Term Report through an adjudicatory proceeding and provides final approval of costs and performance incentives.

3. Three-Year Plan Process

a. Development of the Plan

The process established by the GCA for developing the energy efficiency plans is designed to provide extensive and meaningful stakeholder input into the design and implementation of the Three-Year Plans. The Program Administrators engage with the Council on the development of each new Plan, including through regular meetings, topic-specific Council workshops, and through regular communications with the Council's consultants. In 2017 and 2018, the Program Administrators actively participated in six sector-specific workshops convened by the Council. Following the workshops in 2018, the Council issued a resolution on February 28, 2018 memorializing certain strategic and tactical recommendations to the Program Administrators from the Council workshops. See Appendix D. The Program Administrators also participated in eight

administrative costs to the fullest extent practicable and utilizing competitive procurement processes to the fullest extent practicable." G.L. c. 25, § 19(a, b). To mitigate capacity and energy costs for all customers, the GCA also requires the Department to ensure that electric and natural gas resources are first met "through all available energy efficiency and demand reduction resources that are cost effective or less expensive than supply." G.L. c. 25, § 21(a).

¹⁴ See G.L. c. 30A, §§ 5, 10-12, 14 (outlining adjudicatory proceedings and availability of judicial review). Additionally, to comply with c. 30A, the Department must maintain a record of its adjudicatory proceedings, afford parties the opportunity to present evidence and argument and issue decisions in writing or on the record with a statement of reasons. G.L. c. 30A, §§ 10-11. Finally, Department decisions are subject to appeal to the Supreme Judicial Court on the record formed during the c. 30A adjudicatory proceeding. G.L. c. 30A, § 5.

public comment listening sessions organized by the Council in 2018, as well as listened to and reviewed oral and written public comments at regular Council meetings. The Program Administrators closely reviewed the Council’s recommendations from workshops in the February Resolution, as well as comments from the listening sessions, and incorporated many of the themes and comments into the program designs for this draft Plan.

The submission of the Plan to the Council every three years on or before April 30th commences the formal stakeholder process, which entails opportunities for public comment and formal review and recommendations from the Council. G.L. c. 25, § 21(c). The Council’s formal role in the development of a Three-Year Plan concludes three months after submission of the plan (i.e., end of July), at which time the Council offers its approval or comments to the Program Administrators. G.L. c. 25, § 21(c). In this role, the Council “shall review and approve demand resource program plans and budgets, work with program administrators in preparing energy resource assessments, determine the economic, system reliability, climate and air quality benefits of efficiency and load management resources, conduct and recommend relevant research, and recommend long term efficiency and load management goals to maximize economic savings and achieve environmental goals.” G.L. c. 25, § 22(b). As part of its review of Three-Year Plans, the Council must approve “efficiency and demand resource plans and budgets” with a two-thirds majority vote. G.L. c. 25, § 22(b).

On July 31, 2018, the Council passed a resolution with comments on the April 30, 2018 draft Three-Year Plan. See Appendix E. Since the passage of the July Resolution, the Program Administrators have worked collaboratively with the Council to refine the Plan to address the concerns of the Council and enhance opportunities to provide energy efficiency services to customers.

In addition to the formal and collaborative process with the Council, the Program Administrators also engage myriad stakeholders, including customers, past participants, contractors, energy experts, trade allies, manufacturers, and distributors. Throughout this process, the Program Administrators refine their program designs and goals, based on Council and stakeholder input, and prepare a final Plan for review and approval by the Department of Public Utilities – the next phase of the Three-Year Plan process. The Program Administrators value and appreciate the input and strong interest in energy efficiency from Councilors, stakeholders, and customers.

On or before October 31, every three years, the Program Administrators file their joint energy efficiency plan, together with the Council’s approval or comments and a statement of any unresolved issues, with the Department for its review and approval. G.L. c. 25, § 21(d)(1).

b. Department Review and Approval of the Plan

i. Overview

The Department reviews the plan to ensure that each Program Administrator acquires all cost-effective energy efficiency and demand reduction resources, delivers energy efficiency programs while minimizing administrative costs, and complies with the other requirements of the GCA. Within 90 days after submission, the Department “shall approve, modify and approve, or

reject and require the resubmission of the plan accordingly.” G.L. c. 25, § 21(d)(2).¹⁵ In reviewing the Program Administrators’ Three-Year Plans, the Department reviews the elements set forth below to determine whether the Program Administrators have met their obligations under the GCA and other Department precedent.

ii. All Cost-Effective or Less Expensive than Supply

In approving a Three-Year Plan, the Department seeks to mitigate capacity and energy costs for all customers “through all available energy efficiency and demand reduction resources that are cost effective or less expensive than supply.” G.L. c. 25, § 21(a). The Department is charged with ensuring that the Program Administrators “have identified and shall capture all energy efficiency and demand reduction resources that are cost effective or less expensive than supply.” G. L. c. 25, § 21(d)(2). To comply with the GCA, a Three-Year Plan must provide for the acquisition of these resources “with the lowest reasonable customer contribution.” G.L. c. 25, § 21(b)(1). There is no simple, algebraic method to evaluate whether the mandate of all available cost-effective energy efficiency has been met. 2013-2015 Three-Year Plans Order at 36. The Department weighs (1) the steps the Program Administrators have taken to implement energy efficiency given the current state of energy efficiency supply and demand; (2) the steps the Program Administrators will take to expand future energy efficiency opportunities; and (3) the results of potential studies.¹⁶ 2013-2015 Three-Year Plans Order at 36-37; 2016-2018 Three-Year Plans Order, D.P.U. 15-160 through D.P.U. 15-169 at 24-25.

The Department has determined that the acquisition of these resources, however, must be achieved through a sustained effort. 2013-2015 Plans Order, at 37 (2013); 2010-2012 Gas Order, at 71 citing G.L. c. 25, § 22(b); 2010-2012 Electric Order, at 85. To determine the rate at which Program Administrators must acquire these resources, the GCA requires the Program Administrators, Council, and Department to consider a number of factors.

Determining a reasonable pace for a sustained acquisition requires the Program Administrators and the Council (in developing the Three-Year Plans) and the Department (in reviewing the Three-Year Plans) to strike an appropriate balance between several factors, including: (1) identifying the potential level of cost-effective resource currently available; (2) exploring ways in which this level can be increased; (3) assessing the capability of the energy efficiency vendor and contractor industry to support increased program activity; and (4) assessing the capacity of the Program Administrators to administer increases in program activity

¹⁵ Due to the deadlines set forth in the GCA, the Department does not approve the three-year plan until after the start of the new three-year program term (*i.e.*, the end of January). In recognition of the need for continuity of energy efficiency programs, the Department has allowed for the interim continuation of existing energy efficiency programs, pending approval of proposed new programs under review. See 2013-2015 Three-Year Plans Order, D.P.U. 12-100 through 12-111, at 160-161; Massachusetts Electric Company and Nantucket Electric Company, d/b/a National Grid, D.P.U. 09-116, Order Approving Motion for Interim Continuation (December 30, 2009).

¹⁶ Potential studies are only one component of the planning process, but can help the Program Administrators understand the remaining technical, economic, and achievable energy efficiency opportunities within their service territories, which play a key role in helping Program Administrators set savings goals. 2016-2018 Three-Year Plans Order at 24-25.

efficiently and effectively. The Department must take into consideration an additional factor: the rate and bill impacts that result from increased program activity.

2010-2012 Gas Order, at 71-72 and 2010-2012 Electric Order, at 85-86.

In developing their 2019-2021 Plan, the Program Administrators considered what an optimal pace is for acquiring all cost-effective energy efficiency resources for the period from 2019 to 2021, to ensure long-term sustainability for energy efficiency program offerings. In developing savings goals for 2019-2021, the Program Administrators took into consideration the four factors above, as well as rate and bill impacts on their customers. The Program Administrators provide detailed information on the development of their goals in Section IV.C,¹⁷ demonstrating that they are seeking to acquire all cost-effective energy efficiency and demand reduction resources for the 2019-2021 term.

iii. Program Cost-Effectiveness

The GCA specifically requires cost-effectiveness screening for energy efficiency programs. G.L. c. 25, §§ 19(c), 21(b)(3).¹⁸ The Department has determined that a Total Resource Cost (“TRC”) test that weighs the impact of all benefits and costs associated with each program satisfies this requirement D.P.U. 08-50-A at 14; Guidelines § 3.4.3. A program is cost-effective under the TRC test if the cumulative present value of its benefits is equal to or greater than the cumulative present value of its costs. Guidelines § 3.4.3.1. Benefits calculations include the cost of energy supply that is avoided when energy efficiency efforts are utilized and therefore the TRC test satisfies the GCA’s requirement that energy efficiency programs be less expensive than supply. D.P.U. 08-50-A at 14-15.

Under the updated GCA, for the purpose of cost-effectiveness review, programs are aggregated by sector. If a sector fails the cost-effectiveness test as part of the review process, its component programs shall either be modified so that the sector meets the test or shall be terminated. G.L. c. 25, § 21(b)(3).

For the 2019-2021 Plan, the Program Administrators applied the results of the regional Avoided Energy Supply Components in New England: 2018 Report (“2018 AESC Study”), which was completed on March 30, 2018, and is attached hereto at Appendix F.¹⁹

¹⁷ The Program Administrators will provide their individual benefit/cost ratio (“BCR”) models with the Plan filed with the Department in October, further demonstrating that they are seeking to acquire all cost-effective energy efficiency and demand reduction resources for the 2019-2021 term.

¹⁸ The GCA requires energy efficiency programs included in Program Administrators’ Three-Year Plans to “be screened through cost effectiveness testing which compares the [economic] value of program benefits to the program costs to ensure that the program is designed to obtain energy savings and other benefits with value greater than the costs of the program.” G.L. c. 25, 21(b)(3), as revised by Acts of 2018, c. 227.

¹⁹ DOER conducted an additional study examining avoided costs of compliance with the Global Warming Solutions Act. See Appendix L. The costs of complying with reasonably foreseeable environmental laws and regulations (i.e., those costs that are, or are expected to be, included in electricity or gas prices) may be included in the TRC test. See D.P.U. 08-50-A at 2; see also, Massachusetts Electric Company v. Department of Public Utilities, 419 Mass. 239, 246 (1994). The Program Administrators are reviewing the basis of the DOER study. For this draft Plan, the benefit values provided in this narrative do not include these additional

iv. Program Budgets

A Program Administrator's budget is comprised of its energy efficiency program implementation costs, performance incentives, and recovery of lost base revenue ("LBR"), if any, as approved by the Department. Guidelines § 3.3.1. Program implementation costs include all costs incurred by a Program Administrator to implement its energy efficiency programs, including, but not limited to: (a) program planning and administration ("PP&A"); (b) marketing and advertising; (c) program participant incentives; (d) sales, technical assistance and training ("STAT"); and (e) evaluation and market research. Guidelines §§ 3.3.3, 3.4.5. Performance incentives are included as costs per the Guidelines §§ 3.3.4, 3.6. Program participant costs must include all expenses incurred by a program participant as a result of its participation in an energy efficiency program, including, but not limited to: (a) the net cost of energy efficient equipment; (b) the cost to plan for and install energy efficient equipment; and (c) the cost of energy efficiency services. Guidelines § 3.4.5.3.

In reviewing and authorizing Program Administrator energy efficiency programs, the Department must ensure that: (1) the Program Administrators have minimized administrative costs to the fullest extent practicable; (2) sufficient funding is allocated to income eligible programs; and (3) competitive procurement processes are used to the fullest extent practicable. G.L. c. 25, § 19(a), (b), (c); Guidelines §§ 3.3.6, 3.3.7; 2013-2015 Three-Year Plans Order at 75-76. With respect to the income eligible program budgets, the GCA requires electric and gas Program Administrators to spend at least 10 percent and 20 percent, respectively, of their total energy efficiency budget on comprehensive income eligible demand side management and education programs. G.L. c. 25, § 19(c).

The Program Administrators have addressed each one of these issues throughout the Plan, and specifically in Section IV.E, below. In addition, the Program Administrators seek to minimize bill impacts when setting their respective budgets. From a statewide perspective, the Program Administrators' three-year budget is relatively level compared the 2016-2018 Plan budget.

v. Bill Impacts

As discussed previously, the GCA requires the acquisition of all available cost-effective energy efficiency resources. G.L. c. 25, § 21(b)(1). However, the pace at which the Program Administrators must acquire these resources is informed by the associated rate increases on residential and commercial customers' bills. See 08-50-D at 9-10 and n.11; see also 2013-2015 Three-Year Plans Order at 122-124; Gas Three-Year Plans Order at 71-72 and n.63; Electric Three-Year Plans Order at 84-86 and n.77; G.L. c. 25, § 19(a). The Department has determined that a bill impact analysis with a short-term perspective that isolates the effect of a proposed change in the energy efficiency surcharge ("EES") is appropriate because it provides an accurate and understandable assessment of the impact that customers will experience on their bills. 2013-2015 Three-Year Plans Order at 122; D.P.U. 08-50-D at 11-12. The Department has recognized, however, that when considering the reasonableness of a short-term bill impact, it is also important

benefit values identified in the DOER study; however, the Energy Efficiency Data Tables are provided with and without these additional values for reference purposes.

to look at the long-term benefits that energy efficiency will provide because, unlike some other activities that cause rate increases, investments in energy efficiency will result in direct customer benefits, in terms of reduced consumption and reduced costs, which will persist for the lives of the energy efficiency measures installed. 2013-2015 Three-Year Plans Order at 122; see also D.P.U. 08-50-D at 11-12.

The Program Administrators discuss consideration of bill impacts throughout the Plan, and specifically in Section V.C, below

vi. Program Funding

The GCA authorizes the Department to review the funding of energy efficiency programs administered by the Program Administrators. G.L. c. 25, § 19. For electric Program Administrators, the GCA identifies four specific funding sources for energy efficiency programs: (1) revenues collected from ratepayers through the System Benefit Charge (“SBC”); (2) proceeds from the Program Administrators’ participation in the Forward Capacity Market (“FCM”); (3) proceeds from cap and trade pollution control programs, including but not limited to the Regional Greenhouse Gas Initiative (“RGGI”); and (4) other funding as approved by the Department, including revenues to be recovered from ratepayers through a fully reconciling funding mechanism (i.e., EES). G.L. c. 25, §§ 19(a); 21(b)(2)(vii). The Guidelines specify the method the electric Program Administrators must use to allocate revenue from each funding source and the manner in which the Program Administrators calculate the EES for each customer sector. Guidelines §§ 3.2.1.2 through 3.2.1.6.

For gas Program Administrators, the GCA does not identify multiple funding sources for energy efficiency programs and instead requires the gas Program Administrators to include a fully reconciling funding mechanism to collect energy efficiency program costs from customers (i.e., EES). G.L. c. 25, § 21(b)(2)(vii); see also G.L. c. 25, § 21(d)(2). The gas EES is included in each gas Program Administrator’s Local Distribution Adjustment Clause tariff (the “LDAC”). Guidelines § 3.2.2. Funding from sources other than the gas Program Administrator LDAC are to be allocated to the gas Program Administrator’s residential, low income and commercial and industrial customer (“C&I”) sectors in proportion to the sector’s therm consumption. Guidelines § 3.2.2.1. The Department must consider the effect of bill impacts when approving customer funds to support energy efficiency programs. G.L. c. 25, § 19; 2016-2018 Three-Year Plans Order at 93; D.P.U. 08-50-A at 58; Guidelines §§ 3.2.1.5, 3.2.1.6.3, 3.2.2.1, 3.2.2.2.

For a detailed discussion of the funding sources that are currently available to the Program Administrators, please refer to Section V.B, below.

III. STATEWIDE PROGRAMS

Statewide Programs

A. Strategic Overview of Residential, Income Eligible, and C&I Programs

The 2019-2021 Energy Efficiency Plan sets an ambitious agenda to continue to drive energy saving benefits for Massachusetts residential and commercial energy consumers, while proposing new approaches to meet the challenges of the rapidly changing energy landscape.

A History of Customer Engagement and Market Transformation

Over the past three plan cycles, Program Administrators have become ever more accomplished at working with customers to encourage adoption of efficient measures for homes and businesses. The major challenges were finding the best channels and entry points to engage all customers and devising effective combinations of incentives and support to encourage efficiency sales. The Program Administrators' continued focus on developing clear, uncomplicated participation pathways has helped to improve the equitable distribution of benefits by making it easier for all customers to engage in their programs. This has been done by making transactions easier, communicating the benefits to customers more compellingly, and incorporating customer benefits, such as employee productivity, comfort, and health, as part of the efficiency sale. This is a major achievement.

Program Administrators have taken advantage of data analytics to look at both customer demographics and marketplace trends to better understand Massachusetts energy use. Program Administrators have continuously applied this learning to build program enhancements and deliver energy efficiency solutions through more targeted and refined go-to-market strategies. This continuous innovation cycle has allowed for the introduction and scaling of efficient technologies and the successful spread of energy efficiency measures in new markets.

The 2016-2018 Plan drove unprecedented levels of savings for Massachusetts energy consumers. Massachusetts' success in driving energy efficiency for homes and businesses has in many instances transformed the market, ensuring that the baseline efficiency of Massachusetts homes and businesses is high. Massachusetts has been recognized with multiple awards for nation-leading energy efficiency programs, both by federal agencies and national non-governmental energy organizations.

LED Lighting: A Success Story

Beginning with the 2013-2015 Plan, and refined in the 2016-2018 Plan, the Program Administrators developed initiatives to drive the lighting revolution. The intentional transformation of the lighting market with light-emitting diode ("LED") technology is a signature achievement of the prior plans' design and implementation. LED lighting was an emerging technology only a few years ago. The Program Administrators quickly recognized this valuable opportunity for customers and pushed for rapid adoption through a multichannel approach,

harnessing upstream and retail channels and direct-install opportunities across the portfolio while leveraging the power of mature programs to drive volume and pricing.

The Challenge

High Efficiency residential lighting adoption and associated program savings reached their highest levels in 2016 and 2017. But program-related savings is falling in the first half of 2018, a trend expected to continue. There is considerably less opportunity going forward for savings in connection with residential lighting, and for screw-in LEDs in the commercial and industrial sector. We therefore anticipate a substantial decline in savings associated with high efficiency lighting beginning in 2019. Residential Lighting provided an irreplaceable low-cost electric energy saving opportunity within the Program Administrators' energy efficiency portfolio. Program Administrators must now find new ways to continue to achieve the efficiency savings residential lighting programs have delivered in recent years.

The challenge of maintaining high levels of savings attributable to the efficiency programs is intensified by the success to date the Program Administrators have had in supporting broad adoption of high efficiency technologies across the residential and commercial and industrial sectors. Program Administrators are now experiencing significant deterioration in claimable savings for HVAC and water heating measures, as success in scaling technologies and supporting customer acceptance results in the standard practice, or default consumer choice, of high efficiency equipment, which has had the effect of raising the baseline from which savings are calculated. Saturation of high efficiency equipment has also reduced the opportunities Program Administrators have for upgrading equipment. The problem is further compounded by the recent relatively low gas prices, which have suppressed customer interest in energy efficiency savings.

The Response

For Massachusetts to remain the nationwide energy efficiency leader Program Administrators must innovate and create new models. The comprehensive projects the Program Administrators must pursue will have longer development cycles. Newer technologies and integrated systems come with significant product, design, and training costs, even as the lower incremental savings constrain incentive budgets. Structural barriers facing customer market segments like moderate-income customers and renters must be addressed. The Program Administrators' high historic penetration rates with customers mean the Program Administrators must go deeper and broader to secure the next unit of efficiency. Program Administrators must now focus on projects with leaner savings and greater barriers, and engage customers who, to this point, have been less inclined to pursue energy efficiency.

The core value of the 2019-2021 program design, across both the residential and commercial sectors, **is to keep the customer at the center of program design and evolution.** This means organizing and presenting efficiency measures to customers as easy-to-understand and easy-to-implement improvements to their homes and businesses. The Program Administrators firmly believe that serving all customers, with a particular focus on addressing the needs of moderate-income customers and small businesses, requires programs that are simple to communicate, take time-constraints into account and are easy to access. This requires flexible

design that helps customers to see energy efficiency as making their lives better and their businesses more successful.

The next step in the evolution of cost-effective energy efficiency program design will not be scaling new efficient technology (like LED lighting), but implementing new systems for incrementally ramping down or turning off equipment, and new techniques for minimizing energy use through passive building systems utilizing daylighting, insulation, and optimized scheduling of use. The new paradigm requires more investment in training and education at every stage. Program Administrators will be working with manufacturers to make interoperable systems and controls that offer greater efficiency and to ensure that distributors stock and support these new systems. Program Administrators will help property owners, vendors, contractors, and builders understand the connection between energy-conservation measures and improved building operation and provide businesses and homeowners with the education and tools they need to control and manage their energy future.

To meet the challenges of the next decade the Program Administrators are proposing a strategic set of programs and initiatives that are both flexible and targeted. Navigating this transition to a greatly changed energy efficiency landscape will not happen quickly or easily. It will require intensive trial and error and leaps of innovation, followed by retrenchment and refinement.

2019-2021 Priorities and Highlights

The Program Administrators' primary strategy to continue to deliver savings and benefits over the coming three-year term is to implement strategic enhancements to existing designs that increase the breadth and depth of the portfolios' reach. This includes multiple enhancements to drive weatherization and high efficiency HVAC, and to ensure optimal operation of building energy systems. The Program Administrators are using an [*Energy Optimization approach*](#) that provides customers with enhanced education regarding energy use and related costs and helps customers reduce total energy use based on their individual needs and goals.

The Program Administrators are also redoubling efforts to expand the portfolios' reach with special attention to hard-to-reach populations including small businesses, renters, moderate-income customers, and non-English speaking customers. Program Administrators are developing a statewide municipal and community partnership strategy to target communities identified as having lower participation and to work more intensively with municipalities to secure additional savings for municipalities including continued efforts to convert municipal owned street lights.

Program Administrators are also deploying multiple forward-looking strategies and innovations that pivot the portfolio to ensure continued robust savings and benefits for customers. The innovations in this Plan include new active demand reduction efforts that will have an impact on summer peak demand and winter reliability, while strongly supporting the Commonwealth's greenhouse gas reduction goals. New Active Demand offerings are included for all customers. A new Passive House offer, an expanded Zero-Net Energy Ready offer and expanded support for the development of enhanced energy codes and product standards at the state and national levels are

being added to continue to drive Massachusetts buildings and the energy systems within them to the highest levels of energy efficiency.

The charts below provide a detailed listing of the many strategic enhancements and innovations, which are further described in the Residential and Commercial and Industrial Program sections which follow.

Residential Programs and Initiatives

Strategic Enhancements and Innovations	
<p>Pivoting to the Future</p> <ul style="list-style-type: none"> • Zero Energy and Zero Energy Ready • Passive House Offer • Point-of-Purchase Instant-Rebate Platform • Broadened Partnerships with Distributors and Contractors • Tailored Energy Savings Packages • Active Demand Reduction Offering • Pay for Savings • Temperature Optimization • Heat Pump Trials 	<p>Serving All Customers</p> <ul style="list-style-type: none"> • Additions and Renovations • Special Attention to Customers with Language Barriers – Customer Journey for Non-English Speakers • Proactive Engagement of Municipalities and Communities and Collaboration on Targeted Strategies to Serve All Residents • Better Alignment between Income Eligible and Market Rate Protocols and Services
<p>Driving Increased Conversions to Weatherization</p> <ul style="list-style-type: none"> – Expanded online assessments and program enrollment options – One residential phone number to simplify access – Enhanced support at customer intake, capturing and connecting additional detail to triage customers to targeted program offerings – Leveraging the in-home assessment to provide deeper customer education and more facilitated options to support customer adoption of major measure savings opportunities (i.e., weatherization and HVAC Measures) including an expedited pathway to resolve knob and tube and combustion safety issues and increased financing for pre-weatherization barrier resolution – Enhanced relationships with trade allies (HVAC, electrical, and insulation contractors) to capture customers at all entry points and help them to secure ancillary services – Enhanced relationship management for customers, with tracking of the adoption of measures and continuous re-engagement with additional opportunities 	
<p>Facilitating Workforce Retention, Recruitment, and Development</p>	

Commercial and Industrial Programs and Initiatives

Strategic Enhancements and Innovations	
<p>Pivoting to the Future</p> <ul style="list-style-type: none"> • Enhanced Technical Assistance and Design Support for Whole Building New Construction • New Passive House Offer and Market Development Strategy • Addition of an Active Demand Reduction Initiative • Investigating and Testing New Approaches to Whole-Building Projects • Expanded Support for the Development of Enhanced Energy Codes and Product Standards at the State and National levels. • Expanded Advanced Systems Training for HVAC and Lighting controls. 	<p>Serving All Customers</p> <ul style="list-style-type: none"> • Small Business Enhancements • Expanding Upstream Offerings • Customized Services to Franchise Businesses • Expanded Resource Offer within the Industrial and Process Segment-targeted approach • Expedited Paths to HVAC Optimization including Operations & Maintenance (“O&M”) Savings and Retro-Commissioning (“RCx”) • Testing Strategic Energy Management Cohort Approach
<p>Implementation of Mass Save Application Portal (“MAP”)</p>	
<p>Increased leveraging of training and workforce development to transition to an era of integration of energy efficiency strategies, smart technologies and energy using equipment.</p>	

B. Residential and Income-Eligible Programs

Residential & Income-Eligible Programs

Overview

The Massachusetts Program Administrators' residential sector portfolio is one of the most successful home energy saving programs in the nation, reaching over 225,000 homes with in-home assessments and weatherizing over 75,000 over the 2016-2018 Plan term. The Program Administrators have successfully driven a rapid, market-transforming consumer adoption of high efficiency lighting in homes and have pioneered multiple first-in-the-nation delivery innovations, including fully integrated gas and electric efficiency programs for multi-family buildings. The Program Administrators have accomplished this while simultaneously maintaining an award-winning partnership with the Low-Income Affordability Network ("LEAN") to serve Massachusetts' most vulnerable energy consumers.

Now, the Massachusetts residential energy efficiency market is at a turning point. In part due to the Program Administrators' success, and in part due to additional market and regulatory factors, the claimable savings available for residential lighting are in rapid decline. Residential lighting provided an irreplaceable low-cost, electric, energy saving opportunity within the Program Administrators' energy efficiency portfolio. Claimable savings per bulb will decline 50% from 2018 to 2019 and continue to decline by 10% each year. This decrease is compounded by a loss of potential, as 50% of Massachusetts homes are saturated with long-life efficient bulbs and these efficient bulbs further decrease the future opportunities to support customers' installation of new efficient bulbs. In addition to the significant reduction in claimable electric savings, the residential programs are at risk of losing significant visibility to customers as lighting becomes a diminishing portion of the efficiency portfolio. High efficiency bulbs directly installed in customers' homes during home energy assessments provided an instant value for customers, a simple and tangible energy savings. Similarly, program-supported discounting of high efficiency lighting options in retail settings provided a strong anchor to help Program Administrators work with partners in the retail market to showcase energy efficiency opportunities directly to customers. The substantial loss of residential lighting requires Program Administrators to pivot and begin the process of transforming our programs to meet a changing landscape.

The Program Administrators' 2019-2021 Residential Plan builds on our history of successful innovation. The program design represents a major 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 anticipated results include:

- ✓ **Increased number of weatherized homes**
- ✓ **Enhanced targeted efforts to reach renters, moderate-income customers, and non-English speaking customers**

- ✓ **Streamlined pathways and new technologies for participation**
- ✓ **Improvements in winter reliability and reductions in summer demand**
- ✓ **Increased support for emerging technologies and innovative approaches, such as Passive House, Zero-Net Energy Ready buildings, and central and cold climate heat pumps**
- ✓ **Deployment of an Energy Optimization approach to maximize customer value**

Driving Increased Conversions to Weatherization

The Plan includes multiple integrated enhancements that are designed to increase the number of weatherized homes in Massachusetts. The Program Administrators examined each point along the customer’s journey to weatherization and worked to optimize the experience and remove existing barriers.

Significant enhancements are being made to ease customer access to the Program Administrators’ weatherization offer, including promotion of the 24/7 available online home energy assessment as an initial entry point and simplification of customer entry with one Mass Save Residential phone number that lets customers access all Program Administrator efficiency offers. The background support systems—both online and call center—are being transitioned to use industry best practices, integrate customer and public data, and employ algorithms and human resources to match customers effectively to comprehensive energy savings offers that are specific to opportunities in their home.

These intake enhancements described above will support Program Administrators efforts to better target in-home energy assessments to customers with weatherization opportunities. The new, optimized systems will likely reduce the total number of customers who receive an in-home assessment, as customers who don’t identify as candidates for weatherization opportunities will be encouraged to receive other Program Administrator offers that are more appropriate to their specific needs. This means that wait times and other inefficiencies created by using an in-home energy assessment as the default intervention will be reduced, and the overall customer experience improved. The information collected through the optimized intake process will be provided to the Mass Save energy specialist prior to entering the customer’s home. This will allow energy specialists, during the in-home assessment, more time to concentrate on homeowner education and support services.

The Program Administrators are adding no cost knob-and-tube-assessment and combustion safety testing along with remediation of minor combustion safety issues for customers who sign a contract committing to install weatherization measures, thus providing an expedited pathway for resolving the most frequent causes of customers not completing weatherization recommendations after an in-home assessment.

Program Administrators are also increasing the allowable financing amount and expanding the list of barriers eligible for financing through the Mass Save HEAT Loan® to include the most common pre-weatherization barriers identified during the Home Energy Assessment. Barriers

eligible for financing include knob-and-tube wiring, combustion safety issues, mold, vermiculite and asbestos, and certain structural concerns.

The Program Administrators also recognize that customers who are engaging in traditional renovations have similar energy savings opportunities and follow a similar process of contracting with a builder to complete their projects. As a result, the Program Administrators are adding a tailored offer that leverages the existing new construction delivery path. This new offer for additions and renovations will help maximize the capture of efficiency opportunities that exist when there is a builder on site, including installation of highest-efficiency systems and maximization of shell improvement opportunities. This new offer combines the unique opportunities to secure energy efficiency measures during new construction and renovation activity with the potential for securing all of the traditional energy upgrades, including weatherization and other envelope improvements, for the portions of the home that are not undergoing renovation.

Serving All Customers

The Program Administrators remain committed to ensuring equitable access to energy efficiency programs for all Massachusetts customers across all demographics. By committing to meet our customers where they are, Program Administrators are taking a focused approach to identify the specific barriers and challenges faced by customer sub-segments that are frequently highlighted as “hard to serve”. The Program Administrators have systematically responded to these challenges, with multiple program enhancements and innovations across the Plan, focused on simplifying access, tailoring offers to overcome barriers, and increasing opportunities for overall program participation.

As Program Administrators address specific access barriers for sub-segments currently considered hard to serve, access for all customers improves.

Special Attention to Customers with Language Barriers

The Program Administrators are committed to serving all customers with energy efficiency services and incentives and understand that there are challenges non-English speakers have when accessing or participating in the programs. In order to support non-English speakers, 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).

The Program Administrators are also reviewing the customer journey from the perspective of non-English speakers to ensure we are communicating with customers in their preferred language from beginning to end. Suggested improvements include the review of the transfer protocols from the statewide line to the vendor/Program Administrator call centers to ensure continuity in the customer’s selected language preference. Additionally, the Program Administrators are working to ensure that all follow-up written communications are also sent to the customer in their preferred language. The Program Administrators continue to translate marketing material into multiple languages, which is in turn used by local community groups,

municipalities, vendors and contractors. The Program Administrators have launched various marketing campaigns in languages other than English and will continue to implement these campaigns over the next term.

Increased Target Marketing and Partnerships with Communities

Over the past several plan cycles, the Program Administrators have worked with municipalities and community stakeholders to test various strategies for community-wide engagement. During the planning period for the 2019-2021 Term, the Program Administrators closely reviewed the elements of different community and municipal partnership efforts and attended sessions with stakeholders interested in providing input into how Program Administrators work with municipalities and communities. A consensus emerged that partnering with municipalities and communities is a critical pathway, particularly to gain insights on reaching renters/landlords and multilingual populations. Program Administrators are focused on developing a statewide municipal and community partnership strategy (“Partnership Strategy”) to target communities identified as having lower program participation.

The new statewide Partnership Strategy will include a stronger connection to municipal governments, whose local knowledge and trusted relationships can be a valuable connection point for increasing awareness and participation in Program Administrator efficiency offers. The Partnership Strategy will support municipally led outreach for cities and towns of all sizes to enroll local participants. As a core element, Program Administrators will establish a two-way communication channel for municipalities by offering regular check-in calls, periodic trainings, and a suite of marketing materials. The two-way communication channel will provide a forum for Program Administrators and municipal staff to share program updates and communicate strategies for targeting hard-to-reach populations.

Improving Renter Access to Program Savings and Benefit

The Program Administrators are committed to ensuring equitable access to program savings and benefits for renters. The Program Administrators designed the first-in-the-nation statewide renter offer in the 2016-2018 Three-Year Plan and gained unique insight about the challenges renters face in participating in energy efficiency programs.

The Program Administrators learned that we have good success in targeting landlords, and that when landlords are successfully engaged, Program Administrators successfully deliver the whole building comprehensive weatherization work that produces the greatest energy benefits for renters. Data from the renter offer indicates that landlords are very interested in energy efficiency upgrades for their properties (8,733 full HEAs provided to landlords in 1-4-unit buildings from April 2016 to March 2018²⁰). The efficiency upgrades that can be delivered to renters without landlord engagement remain limited, as most major energy efficiency upgrades require landlord permission for the replacement of equipment, changes to the building envelope, or other enhancement to the property. The programs acknowledge this challenge by delivering as many

²⁰ Data from the renter & moderate income offer 2016-2017

renter benefits as possible while targeting the landlord for measures like heating systems and weatherization.

Program Administrators are planning to offer scaled incentives to encourage landlords of buildings under four stories, to install energy efficiency measures for all units in a building, with a 90% insulation incentive for landlords willing to complete all recommended insulation and air sealing.

The new Residential Coordinated Delivery initiative creates greater flexibility for Program Administrators to provide a more customized path for larger or more complex multi-unit buildings, with custom incentives and savings methodologies that allow Program Administrators to best capture the unique opportunities of larger and mixed-use multi-family structures. Using a more customized approach for the complex multi-unit properties also allows Program Administrators to provide property owners with a tailored business case that makes energy efficiency upgrades for residents an easier decision.

Program Administrators recognize that situations remain in which renters do not wish to engage with their landlords, or where the property in which they live is not a candidate for major measures (e.g., HVAC or weatherization). Program Administrators are increasing the scope and sophistication of online assessments and telephone intake to better connect customers to additional solutions, particularly for those customers who do not have opportunities for major measure adoption. For renters who do not wish to have a traditional in-home assessment, or who live in a home that does not have major measure opportunities, the enhanced online systems and enhanced information captured at intake will allow Program Administrators to provide the renter with a tailored energy savings package that responds to remaining savings opportunities. While renters may prove to be a receptive audience for these tailored energy savings packages, the Program Administrators' priority is to drive whole building energy efficiency upgrades, including weatherization and heating systems upgrades, along with the full complement of in-unit measures, as these comprehensive, whole building upgrades provide residents with the greatest savings and benefits.

Reducing barriers to participation for Moderate-Income Customers

Program Administrators recognize that moderate-income customers may also face difficulty in paying energy bills, which represent a greater percentage of their income than for higher income customers. Program Administrators will continue to offer enhanced incentives for moderate-income customers.

In addition, a recent evaluation of the current moderate income offer 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.”²¹ Many of the program enhancements that simplify access and streamline the customer experience will reduce the time

²¹ 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>

commitment required of customers and provide additional information, directly addressing the primary barriers moderate-income customers face.

Innovations

Increasing winter reliability and reducing summer demand

The Program Administrators intend to offer winter temperature optimization in 2019-2021. Temperature optimization uses wi-fi thermostats connected to gas heating equipment to lower customer energy consumption throughout the winter heating season and is later described in detail under the Residential Behavior Initiative. This active demand approach to winter gas savings, combined with the plan's aggressive weatherization focus, will improve winter reliability.

A statewide active demand offer has been added to the Behavior Initiative. The offer is focused on reducing cooling demand during summer peak events. Customers who enroll will receive financial incentives for participating in summer peak demand reduction events. Customers with eligible communicating thermostats controlling central air conditioning units will be the first to be targeted for enrollment. Program Administrators will promote this opportunity to customers with existing eligible technology and to customers installing eligible technology through the Residential Coordinated Delivery and Retail initiatives. Over time, the Program Administrators will review the possibility of adding additional devices, such as water heaters and pool pumps.

The electric Program Administrators will also offer demand response with battery storage during the 2019-2021 term. Rather than targeting a limited number of peak hours each summer, the battery storage model will be designed around call events (when customers are asked to shift to electricity stored in the battery) during both summer and winter. To support investment in this technology, battery storage will be added to HEAT Loan eligible equipment for customers who agree to participate in the active demand offer.

Supporting emerging technologies and new approaches

The Program Administrators are deploying an “**Energy Optimization**” approach that shifts the programs from a focus on reducing electric and gas energy usage to a new focus on helping customers reduce total energy use. The Plan introduces an overarching Energy Optimization philosophy across all sectors. For the residential programs this means customers will be offered more information and technology choices to support their personal energy savings goals. In some instances, this may mean increasing electric or gas usage in order to help customers utilize energy more efficiently, for example, through the adoption of high-efficiency air source heat pumps.

Program Administrators are excited to launch a new **Passive House** offer. The statewide effort will provide incentives to residential new construction design teams and owners at critical stages, including modeling subsidies, design charette support, pay for savings incentives for energy performance, and an adder per unit for achieving certification.

The Program Administrators will continue to offer, in partnership with the Massachusetts Clean Energy Center, Zero-Net Energy trainings, including a more intensive series that moves beyond the basics of Zero-Net Energy to training on how to incorporate high-efficiency heat

pumps in new construction homes. The Program Administrators will also add a per-unit incentive to support enrollment in the U.S. Department of Energy Zero-Net Energy Ready Home Programs.

These enhancements, innovations, and new approaches will help Massachusetts meet its climate and energy goals, while continuing to deliver direct energy savings to customers through reliable programs that customers, contractors, and other market actors have learned to rely on since the Program Administrators' first Three-Year Plan.

Residential New Buildings Program



1. Residential New Homes and Renovations Initiative

Overview and Objectives

The primary objective of the Residential New Homes and Renovation initiative is to reduce energy use and demand in construction of new homes and existing homes undergoing renovation. The secondary objective is to support the transition of the residential new-construction market toward the highest-efficiency building standards and equipment installations.

The greatest opportunities to maximize the performance of a home, particularly its shell (the exterior walls, foundation, and roof), comes during the initial construction and when the home is undergoing a renovation. The Residential New Homes and Renovations initiative provides financial incentives, coupled with education, training, and technical support to builders and home owners, to help residential new construction and renovation projects meet the highest energy performance standards, including ENERGY STAR® certification and Zero-Net Energy Ready status. In the 2019-2021 Plan, the Program Administrators will also introduce additional technical assistance and an enhanced incentive structure to help customers achieve Passive House certification.

The Residential New Homes and Renovations initiative also supports the development, adoption and implementation of increasingly stringent codes and standards and the demonstration and normalization of the highest-efficiency practices. The initiative supports the training of municipal code officials to continue to increase compliance with existing code and to prepare for future codes and standards.

Strategic Enhancements and Major Innovations

- ✓ **Pay for Savings**
- ✓ **Additions and Renovations**
- ✓ **Zero Energy and Zero Energy Ready**
- ✓ **New Passive House Offer**

Initiative Design

The Residential New Homes and Renovations initiative promotes comprehensive integrated design that maximizes the use of insulation and other high-performance materials, building orientation, and other passive measures to minimize the overall energy consumption. This approach focuses builders on right-sizing energy equipment and incorporating highest-efficiency heating, cooling, water heating, lighting, and appliances.

The initiative provides two pathways. There is a Low-Rise pathway for homes three stories and under, including single-family and multi-unit projects, and a Master-Metered/High-Rise pathway for residential master-metered buildings and/or those with four or more stories. The pathways provide tailored technical support, outreach, recruitment, training, verification, and incentive structures that encourage and support participation from all residential new construction and renovation projects in the Commonwealth.

Residential New Homes and Renovations Initiative

Incentives are directly tied to a dwelling's modeled energy performance or installed prescriptive measures, and all participating homes must pass a final verification inspection. Overall energy savings are determined by modeling the electric savings and fuel savings and comparing them to the average new home in Massachusetts, the User Defined Reference Home ("UDRH"). The pay-for-savings incentive structure rewards builders and customers for each unit of energy savings secured, driving participants to capture each additional incremental savings opportunity.

For the Low-Rise pathway, the Program Administrators will continue working with the Home Energy Rating System ("HERS") rater infrastructure. HERS raters play a critical role in recruiting builders to enroll projects in the Low-Rise pathway. HERS raters can directly enroll projects into the initiative via an online intake tool and provide verification of savings at project completion.

The new additions-and-renovation offer provides customers with all the technical support of the Residential New Homes and Renovation initiative, including training and education for builders and connection of builders to the HERS raters. This enables customers to leverage the most advanced building science and efficiency technology and push for highest efficiency in both the existing and renovated portions of their projects. For this offering, customers will have the opportunity, while their builder and rater support are in place, to add traditional retrofit energy savings measures to their project, securing the maximum energy savings presented by the renovation opportunity. The savings will be modeled, and incentives will continue to reward participants for each unit of energy savings secured.

In the Master-Metered/High-Rise pathway, account managers from the lead vendor work directly with larger developers and builders to enroll projects. The High-Performance Housing Working Group (formerly the Joint Management Committee or "JMC"), includes residential and commercial new-construction technical experts from Program Administrator staff and the initiative's lead vendor. This working group will assist in recruiting and defining performance targets while providing guidance on maximizing incentives, energy efficient construction practices, and highest-efficiency technologies and systems.

Strategic Enhancement - Pay for Savings

In the 2016-2018 Plan, the program transitioned from using tiered savings thresholds to a pay-for-savings model. The pay-for-savings incentive structure rewards builders and customers for each unit of energy savings secured, based on energy modeling. The pay-for-savings incentive structure is being closely monitored for any potential impacts to participation and savings. Program Administrators will have a fully optimized pay-for-savings incentive structure for the Residential New Homes and Renovation initiative for the 2019-2021 plan. Early results suggest that the design is pushing builders to seek additional incremental savings, resulting in higher average project savings.

Innovation - Additions and Renovations

An Additions and Renovations offer is being added to the Residential New Homes and Renovations initiative. While total gut renovations have long been part of the program, the new

Residential New Homes and Renovations Initiative

offer provides a pathway for customers who are engaging in a partial renovation and/or building an addition to their existing home, thus leveraging the program's effective model of supporting builders and verifiers during design and construction to secure energy savings and avoid lost opportunities.

Recognizing that customers who engage in traditional renovations have similar energy savings opportunities and work through a similar process of contracting with a builder to complete their projects, the initiative will add a tailored offering that leverages the existing new construction delivery path. The new Additions and Renovations offer will help maximize the opportunities that exist when there is a builder on site, including installing the highest-efficiency systems and maximizing shell improvement opportunities. This new offer combines the unique opportunities to secure energy efficiency measures during new construction and renovation activity with the potential for securing all the traditional energy upgrades, including weatherization and other envelope improvements, for the portions of the home that are not otherwise undergoing renovation. The new offer provides a streamlined process for customers to access holistic and comprehensive energy efficiency.

Innovation – Zero-Net Energy Ready

Program Administrators are continuing their partnership with the Massachusetts Clean Energy Center for Net-Zero Energy training and education. A more intensive training series led by the Massachusetts Clean Energy Center to move beyond the basics of Net-Zero Energy, offers continuing education credits, and includes training on how to incorporate heat pumps in new construction. The Program Administrators will also be offering a per unit incentive to support participant enrollment within the U.S. Department of Energy Zero-Net Energy Ready Home program for both low-rise and high-rise multi-unit buildings.

Innovation – Passive House

Program Administrators are excited to launch a forward-looking Passive House offer within the Residential New Homes and Renovations initiative. Passive House offers the ultimate goal in high efficiency design; a building that uses little or no energy with additional resiliency benefits. As a result, the Program Administrators are committed to supporting Passive House new construction in Massachusetts through a combination of targeted outreach and education, training and certification (also described under workforce development), and technical support and incentives. To begin these efforts Program Administrators will focus on low-rise multi-unit construction projects in the Residential Sector, and mixed use and/or high-rise multi-unit projects in the Commercial Sector, as Passive House techniques are shown to be best applied to larger facilities. The Passive House Institute US (“PHIUS”) and the Passive House Institute (“PHI”) establish standards and provide certifications for such homes. The Program Administrators will support certification through either organization.

Passive House techniques offer an evolved approach that focuses on super-efficient shell or building envelope and optimized energy systems. The Passive House approach also manages solar gain to take advantage of the sun's energy for heating and to minimize overheating during the cooling season. These fundamental design considerations require intervention at the earliest stages of project conception to achieve Passive House certification.

Residential New Homes and Renovations Initiative

To ensure early intervention and guarantee more design teams and owners are ready to make a commitment to Passive House projects, the Program Administrators plan to nearly double the number of trained and certified Passive House professionals across the state over the next three years, with a target of adding approximately 90 Passive House professionals. As part of this workforce development effort, the Program Administrators will offer subsidized trainings and certifications to develop the expertise needed to achieve certified buildings, including Certified Passive House Consultant (“CPHC”), Certified Passive House Designer/Consultant, Certified Passive House Builder, Certified Passive House Tradesperson (“CPHT-E”, “CPHT-MBS”), Rater and Verifier certifications. The Program Administrators will require a small cost share from participants for these trainings and certifications. Additionally, the Program Administrators will provide Passive House outreach and education to other project stakeholders, such as architects and lenders, and provide hands-on building science technical trainings to installation contractors to ensure that all involved in a Passive House project have the information and skills necessary to achieve Passive House certification.

The Program Administrators also plan to provide additional Passive House project support and incentives including:

- An early modeling subsidy for building owners to motivate design teams, architects and engineers, to take the time to integrate energy efficiency into building plans from the start.
- Support and incentives for architects and design teams to bring building owners, architects, and design teams to the table early to consider efficiency as integral to the project design and provide independent review of the strategies through precertification.
- Certification incentives for owners to ensure follow-through on Passive House enhancements.
- \$/kWh and \$/therm performance incentives for owners to motivate the inclusion of more efficiency into the design. The more energy saved, the more the building owner is incentivized.

Passive House Incentives		
Incentives	Recipient	Details
Modeling Subsidy	Owner	Cost-share of Warme Und Feuchte Instationar or Passive House Planning Package modeling costs or early feasibility study
Design Team Incentive	Architect, Design Team	\$/kWh and \$/therm incentives for projects achieving precertification and certification (if applicable)

Residential New Homes and Renovations Initiative

Design Charrette	Architect, Design Team	Sustainability charrette incentive in either Programming and Schematic or Design Development design phases, directed to design team lead
Certification Subsidy	Owner	Adder per multi-family unit for achieving PHIUS or PHI certification
Performance Incentive	Owner	\$/kWh and \$/therm incentives for savings where projects are performing more efficient than the User Defined Reference Home for the residential portion and Mass Save baseline for the commercial spaces.

Statewide Coordination

A working group of residential and commercial sector experts from each Program Administrator collaborate to oversee the Low-Rise and Master-Metered/High-Rise implementation strategies with the statewide lead vendor. The lead vendor provides the direct field implementation.

The lead vendor is responsible for developing and deploying training, education, and outreach efforts, as well as tracking and reporting program activity to each Program Administrator. The lead vendor has principal responsibility for recruiting and enrolling projects. Many Program Administrators maintain additional account representatives and field personnel that also help support project recruitment and maintain relationships with the target market and allies. HERS raters, as noted above, play a key role in the Low-Rise path for recruiting and enrolling projects.

Marketing

The Residential New Homes and Renovation initiative targets marketing and outreach efforts to homebuilders, developers, and contractors. Program Administrators also provide outreach to the associated market actors that interact with program participants, such as architects, designers, and trade allies. A third critical focus in marketing the initiative is on key decision makers and influencers in the residential real estate market, including homebuyers, real estate professionals, code officials, appraisers, and mortgage bankers. This multi-pronged strategy guarantees that at each touch point in the new home construction and delivery process, Program Administrators build awareness and demand for highest efficiency homes and provide potential participants clear and easy access to the residential new homes offerings.

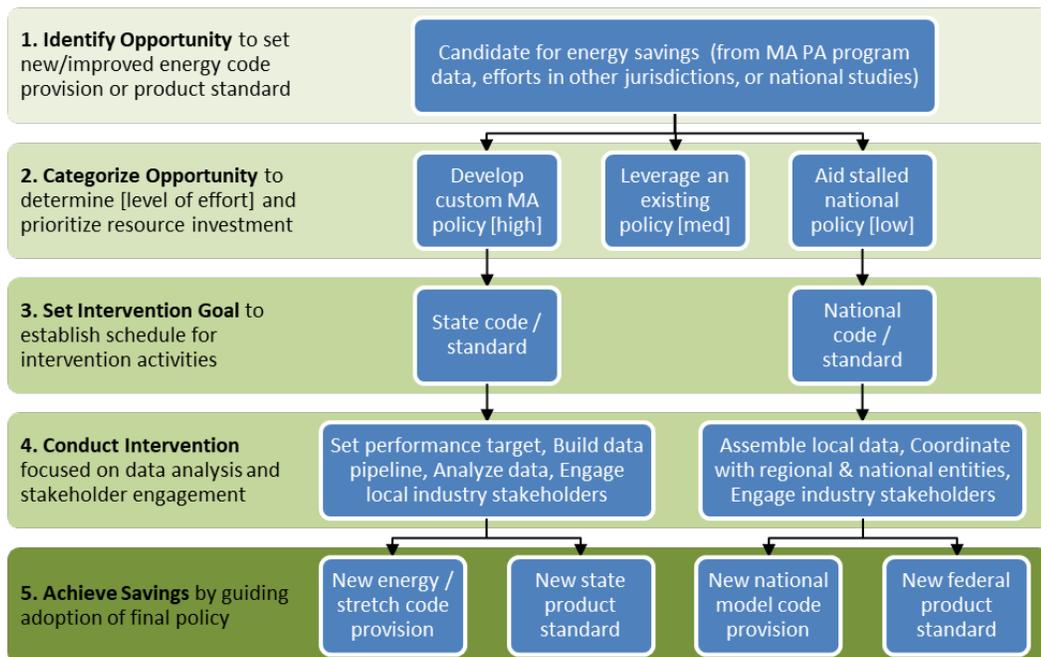
Residential New Homes and Renovations Initiative

Codes & Standards

The Program Administrators will continue to focus on improving compliance with the current energy code for both new construction and renovation projects by conducting code trainings and offering technical assistance for project specific code questions. The Program Administrators will expand this effort to advance the adoption of progressively more efficient energy codes, including stretch codes, and efficiency standards for appliances and equipment.

Innovation - State and National Equipment Standards

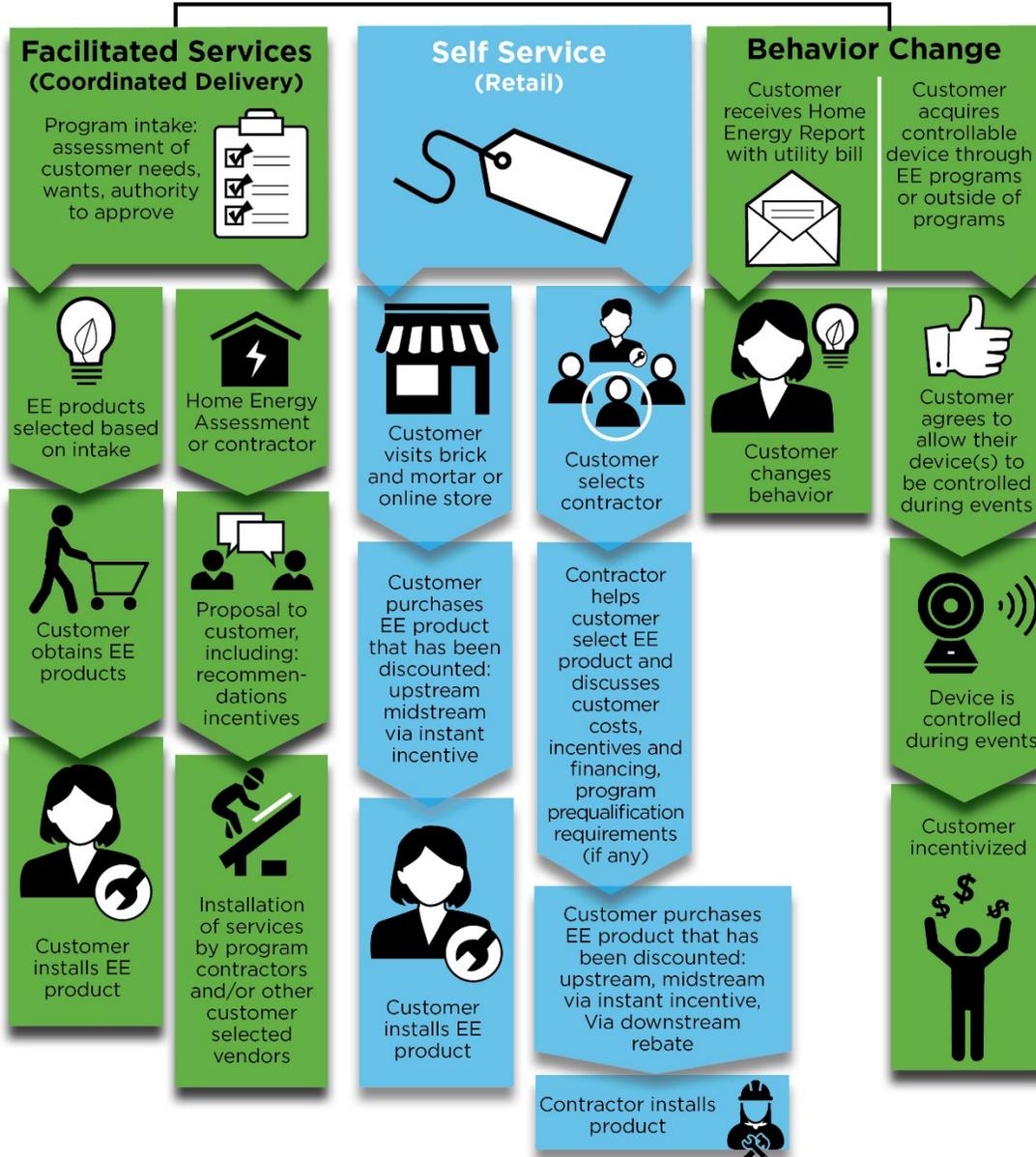
The Program Administrators will research the energy savings opportunity to support the development of enhanced energy codes and product standards at the state and national levels. Program Administrators will implement a formulaic, multi-year approach based on information collection, data analysis, and stakeholder engagement, described in the programs overview as a cross cutting effort encompassing both commercial and residential programs. The expansion of the Program Administrators' codes work to include equipment standards and to work both at the state and national level is a significant element of the Programs Administrators' overarching strategy to proactively move markets to increasingly high levels of energy efficiency and to continue to build a culture that moves the Commonwealth forward on a path of maximizing clean energy from energy efficiency.



Residential Existing Buildings Program



RESIDENTIAL EXISTING BUILDINGS



2. Residential Coordinated Delivery Initiative

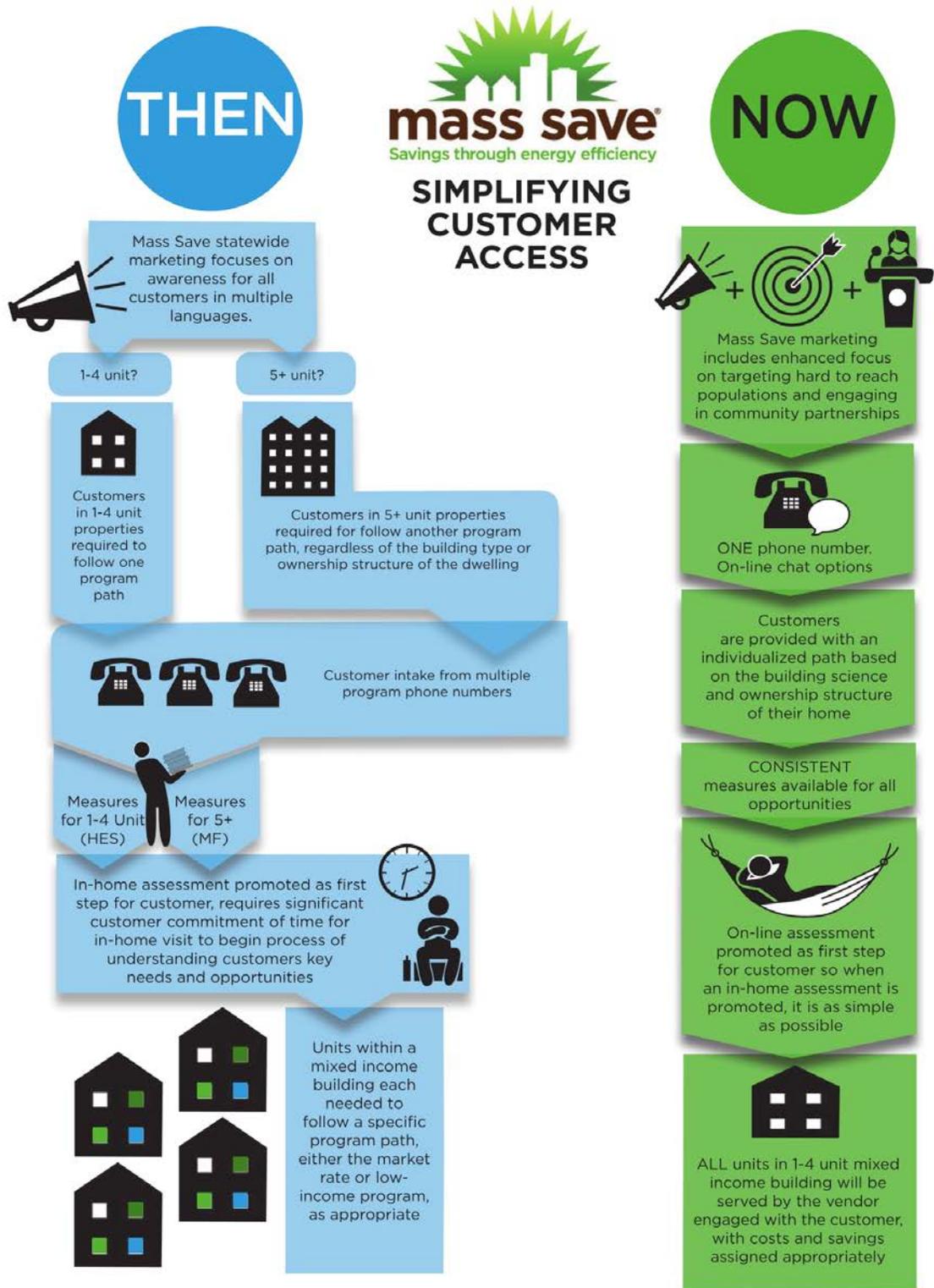
Overview and Objectives

Residential Coordinated Delivery (“RCD”) 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 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. The Residential Coordinated Delivery initiative will help establish the Program Administrators as the customer’s trusted energy advisor, building long-term relationships that lead to ongoing, comprehensive energy-efficiency upgrades to Massachusetts’ homes.

Strategic Enhancements and Major Innovations

- ✓ **Expanded online assessments and program enrollment options**
- ✓ **Enhanced support at customer intake, capturing and connecting additional detail to triage customers to targeted program offerings**
- ✓ **Leveraging the in-home assessment to provide deeper customer education and more facilitated options to support customer adoption of major measure savings opportunities (i.e., weatherization and HVAC Measures) including an expedited pathway to resolve knob and tube and combustion safety issues and increased financing for pre-weatherization barrier resolution**
- ✓ **Enhanced relationships with trade allies (HVAC, electrical, and insulation contractors) to capture customers at all entry points and help them to secure ancillary services**
- ✓ **Tailored energy savings packages designed for direct delivery to consumers**
- ✓ **Enhanced relationship management for customers, with tracking of the adoption of measures and continuous re-engagement with additional opportunities**
- ✓ **Proactive engagement of municipalities and communities and collaboration on targeted strategies to serve all residents**



Initiative Design

The Residential Coordinated Delivery initiative helps customers acquire comprehensive home energy efficiency upgrades, with a focus on weatherization and heating and cooling systems. The initiative uses incentives, financing, outreach and education, and relationships with trade ally partners to make it easy, clear, cost-effective and compelling for customers to implement energy efficiency upgrades.

RCD will continue to deliver services using a team of highly skilled and coordinated lead vendors, energy specialists, insulation contractors, electricians and HVAC contractors who use a systems approach, considering all components of the home (base load, envelope, mechanical) to support customers in achieving deeper energy savings.

Single-family homes, including free-standing town homes, will use the delivery and incentive structure of the former Home Energy Services (“HES”) initiative. Smaller multi-unit buildings, such as those with three stories or less, will also be directed through an HES-style delivery process. These buildings will be directed to qualified vendors and contractors according to specific building types and will be offered a scaled set of prescriptive incentives based on the number of units participating to encourage landlords and condo associations to install energy efficiency measures for all units in a building.

Larger multi-unit buildings, such as those with four stories or more, or with a centralized heating system, will follow a more customized path that builds on the Project Point of Contact (“PPC”) model established during the 2016-2018 Energy Efficiency Plan via the former Multi-Family Retrofit initiative. The PPC will provide property owners an individualized path with custom incentives and savings, using a Pay for Savings incentive structure. This approach will maximize capture of the unique opportunities of larger and mixed-use multi-unit structures, and provide a strong business proposition that makes energy efficiency upgrades an easy decision. Program Administrators will work with larger multi-unit customers who are not ready to undertake this whole building approach but have an immediate need or desire to install a specific energy savings measure. Program Administrator representatives will follow up with these customers to promote more comprehensive savings and work to enroll the customer in the comprehensive whole building process.

All energy savings measures will be facilitated for customers through the Residential Coordinated Delivery path, regardless of the customer’s building type. Eligible measures include lighting, water saving devices, weatherization (i.e., air sealing and insulation), duct sealing, heating, cooling, and water heating equipment and other qualified efficient products. Since multi-unit buildings may contain residential and/or commercial metering, with building-level systems more traditionally found in commercial facilities, a number of measures more often found in the C&I Retrofit program will also be available for upgrades in these multi-unit buildings, as appropriate. Energy-efficiency measure costs and savings will be allocated to the appropriate sector when both residential and commercial meters are present in a building. These measures may include:

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- Heating Ventilation and Air Conditioning (“HVAC”) high-efficiency equipment upgrades and controls;
- Variable speed drives and motors;
- Chillers;
- Air compressors;
- Water heating equipment;
- Energy-management systems; and
- Custom measures.

Energy Assessments

The Residential Coordinated Delivery initiative will provide all customers an opportunity to take advantage of an energy assessment. The goal in the 2019-2021 term is to tailor the assessment to the customer. Program Administrators are working to expand the usefulness and precision of online assessments available through the initiative for customers choosing to pursue this option. Increasing the use of online assessments will help bring more customers into the initiative and better direct customers to the most appropriate pathway for their home’s energy upgrades. Online assessments and digital pathways are critical to providing time-constrained customers the 24/7 access to opportunities and education that consumers have come to expect. The data collected from the online assessment will help support tailored follow up with customers. In-home assessments/site visits will be strongly encouraged for customers who are seeking major measures (i.e., weatherization and HVAC upgrades).

The Program Administrators will provide a comprehensive intake screening and promote the type of assessment that is most appropriate for each customer’s situation. All customers will be offered some means to participate in our programs, and their participation will be facilitated, even in instances in which the involvement of other parties (landlords, other unit owners, etc.) is a priority.

Program Administrators will offer customers who lack the ability to implement major-measure opportunities (e.g., weatherization or HVAC measures) tailored energy savings suggestions, through an online assessment process, including recommendations for any measures they may be eligible to receive. These measures could include a selection of eligible energy savings measures, such as lighting, water-saving devices, and other efficiency products that respond to specific opportunities to increase the efficiency of their home. Through the web portal, customers can select the measures they will install, and a tailored package, with instant incentives applied, will be sent directly to the customer.

Costs related to energy assessments/site visits will be charged to the Residential Conservation Services (“RCS”) budget line, in accordance with the Department’s directives and the RCS statute. See 220 C.M.R. § 7.02; St.2012, c. 209, § 32.

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Innovation - Expanded intake and assessment

The Residential Coordinated Delivery initiative enables Program Administrators to create a more integrated experience for residential customers. The integration will be supported by an enhanced intake and assessment experience that provides solutions based on a customer's interests, opportunity, decision-making authority, and building type. The Program Administrators will support a single statewide phone intake line that serves as a clearing house for all residential customer calls. The clearinghouse will be managed by a vendor(s) who will handle interactions with customers interested in the Residential Coordinated Delivery services.

In all customer interactions, the goal of the intake process will be to resolve as many customer inquiries as possible without the need for transfers. This includes answering questions about the full portfolio of the Program Administrators' services. In instances in which transferring a customer is required, a warm transfer, in the customer's preferred language will be made whenever possible. Intake representatives will also be able to assist customers through other communication channels, including online chat.

For customers interested in RCD, the intake process will include screening for opportunity and interest, and scheduling the customer for an in-home visit, or connecting them with a savings package, as appropriate. The Multifamily Market Integrator ("MMI") role of the 2016-2018 Plan will be folded into this new intake process. Additionally, the intake process will include:

- Tracking all customer interactions. This includes maintaining databases that track project history, current project stats, and other relevant information;
- Enrolling additional units within a facility, when applicable;
- Managing a "primary" vendor for each facility;
- Using the customer's online assessment results to inform services offered and reduce redundant information collection;
- Assessing whether a customer is eligible for income-based incentives or programs; and
- Coordinating across Program Administrators in instances of facilities or buildings with multiple heating fuels.

Strategic Enhancement -Customer Journey for Non-English Speakers

The highly marketed Mass Save residential telephone number will continue to be the primary public facing residential phone-intake system. Currently the language options include English, Spanish and Portuguese. The language options are being expanded to include Russian, and Mandarin.

The Program Administrators are currently reviewing the customer journey from a language perspective to identify and close any existing gaps to ensure we are communicating with customers in their preferred language throughout their entire experience. Suggested improvements include the review of the transfer protocols from the statewide line to supplementary vendor call centers to ensure fluidity in the customers' selected language preference. Additionally, the Program Administrators would like to ensure all follow up communications are also sent to the customer in their preferred language.

Increased customization of the in-home assessments

Program Administrators have learned, through program evaluations²² and consultations with program vendors, that a primary challenge during in-home assessments has been having time to fully educate the customer about their energy-saving opportunities. By capturing key information on customer opportunities through the enhanced intake screening and focusing on those measures that require in-home visits, Energy Specialists will have more time to spend educating the customer. This education is not limited to the specific energy efficiency opportunities available and the potential financial savings and incentives. Many customers have concerns about the time, disruption, and risks that may be associated with the installation of some major measures, such as insulation and air-sealing. Increasing the time spent on education and customer support during an in-home assessment will allow customers to be more in control of their energy decisions and give them a trusted partner to help navigate major energy savings opportunities. The Energy Specialist can dedicate time to help customers understand how the actual implementation of weatherization and heating systems upgrades will unfold. Energy Specialists will be encouraged to facilitate the connection to heating contactors and prepare customers for major-measure installation, including working with trade allies to address the mitigation of pre-weatherization barriers.

In order to receive weatherization incentives, customers are required to have an in-home assessment through a Program Administrator approved contractor. The initiative continues to implement set pricing for weatherization. The set pricing model provides certainty regarding cost-effective energy-efficiency upgrades for customers, contractors, and Program Administrators alike. This prevents claims or concerns of price gouging by customers, provides ease of participation (e.g., no requirement of the customer to solicit multiple bids), allows for the application of instant incentives and helps generate and support further business within the market. Set pricing also allows contractors and Program Administrators to plan more accurately and ensure that measures remain cost-effective. Without set pricing, the in-home energy assessment could not result in the production of an executable weatherization contract for the customer, which is a unique and valuable program design within the Massachusetts Residential Coordinated Delivery initiative. The Program Administrators carefully select weatherization materials and measures based on energy savings, customer costs, total costs, scalability/ease of installation, and other pertinent characteristics. A strong focus on weatherization during in-home assessments, in addition to having set pricing, eases participation for homeowners.

Strategic Enhancement - Driving Increased Conversions to Weatherization

Program Administrators have analyzed the factors that most frequently prohibit customers' completion of the weatherization recommendations provided after an in-home energy assessment. Knob and tube wiring as well as combustion safety issues continue to dominate the pre-weatherization issues that prevent customers from continuing on their path to implementing weatherization. In many cases, the effort needed to overcome this barrier is modest, but the sense of complication and time for customers is sufficient to create a stopping point on their journey. To

²² 2018 Home Energy Services Process Evaluation, Effectiveness of Home Energy Assessments, Finding 2

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overcome this obstacle, Program Administrators are adding an expedited pathway for the two most common barriers to weatherization: knob and tube assessment and combustion safety testing.

For customers who sign a contract committing to install weatherization measures, the program will offer to facilitate a visit from an electrician to provide knob and tube evaluation at no charge. For customers with identified minor combustion safety issues, the program will offer to facilitate a visit by a qualified HVAC technician to address those issues at no charge. The Program Administrators will continue to offer the incentive to those customers who wish to work with a contractor of their own choosing. Customers are offered an incentive of up to \$250 for all other additional pre-weatherization barriers such as attic storage or moisture to assist the customer in assessing/rectifying the barrier. The Program Administrators will continue to enhance and evolve the facilitation of pre-weatherization barrier mitigation over the course of the term. To further assist with the mitigation of pre-weatherization barriers, the Program Administrators are expanding the list of eligible barriers allowed for financing through the HEAT Loan to include the most common pre-weatherization barriers identified during the in-home Energy Assessment and raising the allowable financing caps on pre-weatherization barriers. Barriers eligible for financing include knob and tube wiring, combustion safety issues, mold, vermiculite and asbestos, and certain structural concerns.

The Program Administrators are excited to add pre-weatherization financing to the HEAT Loan, given that pre-weatherization barriers can be costly to remediate. Customers with identified pre-weatherization barriers will still be eligible for the pre-weatherization barrier incentive of up to \$250 to evaluate the barrier; however, if it is determined that the barrier is unable to be corrected at that time, customers will be able to finance the costs associated with remediation of the barrier through the HEAT Loan. Customers will be required to move forward with their recommended weatherization installation in order to be eligible for the pre-weatherization HEAT Loan financing. The anticipated updated barriers and financing amounts are noted below.

Pre-Weatherization Barrier	Financing Amount
Asbestos*	Up to \$4,000
Knob & Tube Wiring	Up to \$10,000
Vermiculite	Up to \$10,000
Mold Abatement	Up to \$4,000
Structural Concerns	Up to \$1,000
Combustion Safety	Up to \$1,000

*to enable heating equipment improvements

Innovation – Exploration of Municipal and Community Partnership Strategy

The Program Administrators have worked with municipalities and community stakeholders to test multiple strategies for community wide engagement over the past several plan cycles. During the planning period for the 2019-2021 Term, the Program Administrators have closely reviewed the elements of different community and municipal partnership efforts and have attended sessions with stakeholders interested in providing input into how Program Administrators work with municipalities and communities. Partnering with municipalities and communities is a critical pathway, particularly to gain insights on reaching renters/landlords and multilingual

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populations. Program Administrators are focused on developing a statewide Municipal and Community Partnership strategy, to target communities identified as having lower participation.

The new statewide Partnership strategy will include a stronger connection to municipal governments, whose local knowledge and trusted relationships can be a valuable connection point for increasing awareness and participation in the Program Administrators' efficiency offerings. The Partnership strategy will support municipally-led outreach for cities and towns of all sizes to enroll local participants. As a core element, Program Administrators will establish a two-way communication channel for municipalities by offering check-in calls, periodic trainings, and a suite of co-branded marketing materials. The two-way communication channel will provide a forum for Program Administrators and municipal staff to share program updates and communicate strategies for targeting hard-to-reach populations. Program Administrators will also explore inclusion of a similar strategy for Non-Governmental Organizations whose municipalities have not yet joined the statewide Partnership strategy.

Serving all Customers

The Program Administrators remain fully committed to ensuring that all customers have access to the benefits of energy efficiency. While the economic, environmental, comfort, and health impacts of our programs benefit all participants, lower income households have the potential to gain the most.

The Program Administrators' dedication to delivering the benefits of energy efficiency to all is evident through the many initiatives the Program Administrators have implemented to help ensure equitable distribution of energy efficiency benefits. Past examples include partnerships with municipalities and community organizations, targeted outreach and events to landlords, the Efficient Neighborhoods+[®] initiative. Efficient Neighborhoods+ included tailored creative pieces geared towards each specific community, and more personalized tactics including door to door marketing and the use of lawn signs. Geographic areas were pre-qualified for Efficient Neighborhoods+ based on income levels, and population of 2-4 buildings. Customers were provided special enhanced incentives as part of the initiative. Initiatives within the 2016-2018 Plan continue to demonstrate the Program Administrators commitment to equitable distribution through the moderate income and renter offers, and trial with LEAN to serve moderate-income customers in a similar delivery structure to the Income Eligible Program. With each effort, the Program Administrators learn more and use these experiences to improve processes and offerings to reach every household.

The moderate income and renter offers in the 2016-2018 Plan were premised on the assumption that money is the primary barrier for this customer segment, and incentive levels are the most critical motivational levers to secure customer participation. Recent evaluations require the Program Administrators to take a broader view of the factors influencing participation of different targeted populations. For example, a recent evaluation²³ suggests that time is the greatest challenge moderate-income customers face in participating in the Programs. This finding aligns with the Program Administrators' extensive experience in delivering the programs to all customers

²³ <http://ma-eeac.org/wordpress/wp-content/uploads/Moderate-Income-Market-Characterization-Report-Final-16Mar2018.pdf>

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and closely working with stakeholders. It demands a reexamination of the current approach to more effectively reach all customers.

The Program Administrators fully understand that financial burdens remain a challenge among moderate-income households and therefore will continue to offer this segment of customers weatherization upgrades and income verification services at no cost. However, taking an exclusive focus on income has come at the expense of addressing more fundamental barriers to participation such as time and complexity.

Ensuring simplicity and ease of participation for customers is the core principle underlying the realignment of the residential programs, which drives out unnecessary roadblocks, and focuses on ensuring each customer is afforded a positive experience where their needs are the primary focus of every interaction. The new alignment allows for increased accessibility to all programs for all customers by expanding pathways for entry and increasing presence in referred customer channels while continuing Program Administrators' unwavering commitment to deliver ever greater access to customer segments that have been highlighted in the past, such as moderate income and renters. Program Administrators are redoubling efforts to use evaluations and market research, along with community partner and stakeholder input, to ensure we are continuously learning and expanding to equitably serve all customers. While maintaining a focus on delivering clear and accessible programs, the Program Administrators will continue to look for innovative, data-driven ways to ensure all customers are able to access the programs.

Consistency in offerings, eligibility, and incentives is fundamental to all Program Administrator program design and delivery. Consistency assures customers that they will receive uniform services no matter where their home or facilities are located in the Commonwealth and ensures that the benefits of ratepayer-funded programs are distributed both widely and equitably. That said, it is important to recognize that innovation by individual Program Administrators in program design and delivery is equally important. The flexibility of individual innovation allows Program Administrators to respond to the variations of local markets and market conditions, but more importantly it is through this experimentation – be it in program design, product promotion, or a unique focus on distinct market segments of local importance – that concepts that might have statewide applicability can be tested and evaluated in a limited low-risk/low-cost environment, with the results then shared and scaled up statewide as appropriate and practicable.²⁴

To help respond to specific council and public comments, Eversource is currently reviewing moderate and lower-income customers, in hopes of creating a more holistic and integrated approach to serving these customers and communities under the Green Communities Act. The focus be on three interrelated initiatives:

1. Understanding low- and moderate-income customers and their journey including the personal and emotional impact of authentic customer engagement.

²⁴ A good example of an innovation that transferred from a subset of Program Administrators to statewide deployment is when electric Program Administrators experimented with using an online store which then was expanded to include all Program Administrators. An example of learning in one geography that was used to not expend resources with a statewide deployment was Cape Light Compact's testing of a behavior model which while initially quite successful as a small pilot, was found to be too difficult to deploy at scale.

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2. Examining the energy efficiency career pipeline and providing a direct pathway that fosters both economic development and careers in these communities as well as ensuring a skilled and knowledgeable energy efficiency workforce.
3. Reviewing supplier diversity applicable to the procurement of energy efficiency services to offer best practices to further advance supplier diversity in energy efficiency vendor networks.

The findings will be reviewed and shared with all Program Administrators, and depending on an assessment of its effectiveness, an approach may be expanded statewide.

Enhanced relationships with trade allies to increase weatherization and HVAC system upgrades

In 2019 and early 2020 Program Administrators will explore new ways of partnering with trade allies, including HVAC contractors and electricians. Based on these explorations, the Program Administrators will develop new and improved tools and pathways to help customers who have identified opportunities take the next step in implementing recommended energy upgrades. Our delivery teams can help customers with the next step, such as evaluation of knob-and-tube wiring or supporting customers in linking to HVAC providers to install a new heating, cooling, or hot water system. Vendor responsibilities will need to include coordination across these partners to provide customers with a more tailored and connected experience.

Program Administrators are also leveraging their relationships with HVAC contractors and electricians facilitate their ability to serve customers who participate in the Residential Coordinated Delivery initiative. Similar to helping lead vendors and contracted partners make connections to trade allies, Program Administrators are examining similar inducements for HVAC contractors and electricians to connect their customers to the additional facilitated solutions Residential Coordinated Delivery can offer.

Enhanced Heating Equipment Education

The energy marketplace has evolved quickly and is becoming increasingly complex. This complexity is especially apparent in heating equipment decisions, with many choices available to customers, including systems that provide both heating and cooling functions (e.g., heat pumps), new Wi-Fi and automated control systems, and alternative fuel options. To assist customers in moving forward with energy efficiency and meeting their energy goals, the Program Administrators are seeking to help educate customers, so they can make informed decisions.

For the 2019-2021 term, the Program Administrators will provide education about all heating options available to help customers optimize energy consumption at their premises. Customers will receive information regarding the costs, financial incentives, other government agency incentives, estimated payback periods, energy savings, and emissions reductions of various heating options, regardless of fuel type, that are offered through the programs and are appropriate to their premises. If a customer chooses to install a cold climate heat pump, Program

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Administrators will also provide information on the implications of retaining or removing the prior heating system and the options to address concerns of prolonged extreme cold weather.

Program Administrators will educate customers and encourage the use of available technology, as appropriate, to help customers operate their new systems optimally and efficiently. This effort focuses on fostering informed customer choices. While the Program Administrators will not be recommending specific or preferred technologies beyond Program Administrator-specific trial offerings, the Program Administrators are expecting the increased education will result in some customers electing to convert from oil or propane to highly efficient cold climate heat pumps or highly efficient clean heating equipment when those choices are cleaner and less expensive than their current system. Incentives will continue to be set to encourage greater efficiency and energy reductions at the customer's home. Customers may also leverage incentives offered by other government entities, such as DOER and the Massachusetts Clean Energy Center ("Mass CEC"), which are designed to encourage adoption of specific technologies. The Program Administrators will include MMBTu savings from the reductions in usage of the original fuel (including oil and propane) in their claimed savings and account for the increase in primary fuel usage. This new focus is intended to be a holistic approach to lowering a customer's total energy use and costs and providing additional value to customers through education efforts.

Energy Optimization of Heating Systems for Residential Customers

As discussed above, Energy Optimization is a more holistic and integrated approach to helping customers address their energy use and associated costs based on their individual needs and goals. Consistent with the GCA and DPU precedent, the objective of Energy Optimization is to move customers toward lower total energy usage and increased environmental benefits. In the context of addressing heating systems under Energy Optimization, the Program Administrators will provide customers with cost effective, economic, fuel blind options for heating their homes beyond increasing the efficiency of their existing equipment using their existing primary heating fuel.

Program Administrators propose to educate customers about converting from delivered heating fuels or electric baseboard heat to either electric air source heat pumps or high efficiency natural gas equipment. The Program Administrators will not recommend one fuel over another; however, Program Administrators would provide information that allows customers to compare the installed costs, operating costs, and environmental impact of their primary heating fuels with other available options. Program Administrators will also be able to provide customers links to resources to help them take the next step whether it be upgrading their existing equipment on their existing fuel, converting to electric air source heat pumps, or converting to natural gas. The ultimate decision remains, of course, with the customer, but the customer will be armed with information to make an informed decision. The Program Administrators will also encourage customers to adopt weatherization measures in order to obtain additional efficiency, minimize the impacts if a customer converts to an alternative energy source, and "right size" new heating equipment.

By educating customers on available fuel choices, cost, and environmental impacts, some customers may choose to change their existing heating fuel and install high efficiency equipment utilizing a different fuel. More specifically, oil or propane customers will be provided with information about the installed cost, cost/energy savings and environmental benefits of converting

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from a standard efficiency oil or propane system to a high efficiency oil, propane, electric or gas system. The Program Administrators will provide an incentive to encourage adoption of high efficiency equipment. The Program Administrators will not provide a separate or special energy efficiency incentive for heating system conversions, unless for strategic electrification or to renewable or clean energy technologies, in all instances that are cost-effective, reduce greenhouse gasses and minimize ratepayer costs.

Information will be provided to customers through several avenues. The Program Administrators are exploring the development of an online calculator to be available on MassSave.com with the intention of allowing users to estimate and make comparisons of oil, propane, electric and natural gas heating equipment. Use of the online calculator is intended to be available to the public. The Mass Save website will provide additional information and instructions about the process of converting to more efficient heating.

Consistent with the 2016-2018 Retail Products initiative, customers will not be required to have an on-site home energy assessment to receive incentives provided that existing fuel and equipment information can be confirmed prior to installation. Program Administrators are investigating strategies other than an onsite visit to confirm a customer's existing fuel and heating equipment. An example could include customers submitting past heating fuel bills in order to confirm their existing fuel, or installation contractors documenting existing equipment. Communications and materials will however, recommend that weatherization opportunities are considered prior to a heating system upgrade should a customer decide to convert to a new system without obtaining a home energy assessment.

In addition to the availability of an online calculator, the Program Administrators will provide guidance and tools to energy specialists to allow them to present customers with education about available fuel choices. The Program Administrators will support customers interested in switching with the appropriate next steps, including by providing Program Administrator gas conversion contacts and qualified manufacturer heat pump contractor contacts.

3. Residential Retail Initiative

Overview and Objectives

The goal of the Residential Retail initiative is to provide a broader integrated marketplace where energy efficient products are positioned as attractive, primary choices for customers making purchasing decisions, whether online, in-store, or through independent contractors.

The Residential Retail initiative ensures that all residential customers can access high-efficiency lighting, heating, cooling, and water heating equipment, including thermostats, lighting controls, appliances and other energy efficient products. The initiative works to place the most energy efficient options in front of customers who prefer to navigate their energy efficiency journey themselves or with their contractors, rather than participating through the Program Administrators' highly facilitated Residential Coordinated Delivery Path.

Strategic Enhancements and Major Innovations

- ✓ **Point-of-Purchase Instant-Rebate Platform**
- ✓ **Broadened Partnerships with Distributors and Contractors**
- ✓ **Tailored Energy Savings Packages**

Initiative Design

The Residential Retail initiative helps customers acquire a full complement of energy saving equipment, from simple self-install items (such as LED light bulbs and shower heads), to products that are selected by consumers but often installed and serviced by specialized technicians (such as appliances and lighting fixtures), to larger equipment that requires professional installation (such as heating equipment). Energy saving products that the Residential Retail initiative support include lighting and associated controls, smart strips, water saving devices (such as shower heads and faucet aerators), appliances, efficient electric heating and cooling equipment, water heating equipment, heat-pump water heating technologies, gas heating (hot water boilers and warm air furnaces), and associated controls such as wireless and programmable thermostats and outdoor reset controls. Additional products are continuously being evaluated and added to the portfolio.

To successfully influence consumer choices for this broad portfolio of products, Program Administrators will use a multi-channel strategy supported by extensive marketing to and training of trade allies and retail partners. Trade ally training plays a significant role in driving product placement and acceptance. Customer-facing rebates are also critical to building demand for and acceptance of high-efficiency products. Rebates and incentives may be upstream, midstream, or downstream.

Product Placement

The initiative seeks to create opportunities for customers to access efficient options by working with big box and other retailers, with manufacturers, distributors, and supply houses, and through the Mass Save online store. In addition to working with traditional retail outlets, a major

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focus of program activity is to provide support to plumbing, and heating and cooling contractors and others in the supply chain (manufacturers, distributors, and suppliers) to ensure the availability, promotion, and proper installation of the highest efficiency equipment.

Program Administrators continuously engage their partners. Program Administrators recruit and train retailers (including discount retail outlets) to participate midstream. Retailers are reimbursed by Program Administrators for incentives provided to customers at check out, and provide and support placement of point of purchase materials in retail stores. Program Administrators also work closely with supply houses and support trade allies' education.

The purchase and installation of heating and water heating equipment in customers' homes is heavily influenced by the installing contractor and the supply chain behind them. For this reason, a major focus of this initiative is to work with influential market actors, including plumbing and HVAC contractors and technicians to promote and install efficient equipment and ultimately engage them as true partners with Program Administrators in moving customers to adopt more comprehensive energy efficiency.

The installation and service practices of these same key trade allies further influence how well energy efficient equipment performs once it is installed. Therefore, Program Administrators promote installation best practices for a wide assortment of energy efficient equipment, including central-air-conditioning equipment and air-source heat pumps, hot water boilers, warm air furnaces (with electronically commutated motor or equivalent advanced furnace fan systems), select heating system controls (including after-market boiler reset controls and programmable and wireless-enabled thermostats), water heating equipment, and heat-recovery ventilator equipment ("HRV"). This contractor education is done through online and in-person classes, as well as manufacturer and distributor trainings offered at the GasNetworks® conference and in supply houses. Program Administrators also own the GasNetworks® website, which is a valuable channel for reaching plumbing and heating contractors.

Incentives

The Program Administrators have offered generous incentives to customers to help offset the higher cost of their investments in high-efficiency lighting, products, heating, cooling, and water heating equipment for many years. Available incentives and rebates are listed on Masssave.com. In addition to the direct financial support to help customers make the purchase, the highly visible incentives help customers to recognize efficient products and to position efficient products as premium products. These efforts will continue in the 2019-2021 Plan, even as the methods to provide customers with incentives evolve.

Innovation – Point-of-Purchase Rebates Platform

A central strategic priority for the 2019-2021 plan is to meet our customers where they normally seek goods and services. This approach will provide a customer experience that is more tailored to the individual customer, reduce customer effort, and build a customer's long-term relationship with energy efficiency programs. The Program Administrators' remarkable success in driving lighting savings and the diminished retail lighting savings that the Program Administrators can claim moving forward requires innovations to continue to capture customers' interest and engagement in retail settings.

The rebate process itself – submitting an application and waiting for reimbursement – does not make effective use of the evolution of modern digital platforms, including smart phones, home computers, and retail marketplace point-of-purchase digital systems.

Program Administrators have been working in 2018 with their rebate processing vendor to trial systems that improve the customer experience and ensure that energy efficiency remains a prominent message in brick-and-mortar retail spaces. Program Administrators plan to release a request for proposals in the first half of 2019 to develop an “instant rebate” system across the majority of energy efficiency measures in retail stores. In the longer term, Program Administrators are working to ensure that as customers move back and forth between brick-and-mortar and online shopping our retail engagement platforms can seamlessly serve them.

The instant rebate system will allow customers to validate and redeem rebates at point of sale in brick-and-mortar retail stores for the majority of retail energy efficiency measures purchased directly by residential consumers. This system will connect a purchase to the customer's utility account quickly and with minimal customer inputs, ensuring that only eligible customers receive incentives and that customer activity is tracked for future outreach to support a continuing customer engagement. Customers will be able to enter their information either on a smart phone in the store or on a computer at home, to validate their eligibility. Customers will then receive a bar code to scan at the register during checkout to have their incentive instantly applied to their purchase.

While conceptually simple, there is a considerable amount of fine tuning and testing to ensure the system has sufficient accuracy and all qualified products are tailored for each retailer that is added. Retailers have individualized point-of-sale systems and instant rebates must be integrated to each system. There must also be an effective mechanism of data transfer and payment to retailers for the rebates they have honored. A significant factor in the success of instant rebates will be enrollment of major retailers in the program, so designing a system that is fast and easy for them to use is important to gain their participation. Additionally, education of store managers and associates at each retailer is crucial, so they can accurately respond to customer questions in the moment and ensure a smooth transaction.

Program Administrators will explore expanding instant rebates to allow contractors to offer them to customers when working in the field, and for online channels such as Amazon.com, BestBuy.com, and Lowes.com, to offer them

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Strategic Enhancement – Broadened Partnerships with Distributors and Contractors

Program Administrators are increasingly working with distributors in a midstream channel strategy to support stocking and promotion of larger residential energy efficient equipment. As new energy saving products come on the market, a midstream approach provides an effective mechanism to increase measure volume and savings for items not yet well known to customers and contractors. For example, in the 2016-2018 term, Program Administrators began offering ECM pumps as a residential midstream measure. In 2019-2021, Program Administrators plan to expand to other measures and align with Commercial and Industrial midstream efforts in order to increase supply house participation.

Program Administrators will continue to evaluate opportunities for midstream offerings via the same point-of-purchase instant-rebate platform, as is planned for retail stores, or an alternative platform targeted to supply houses and contractors. A system that digitally captures customer information and allows for instant rebates allows collection of better customer information for evaluation and follow-up outreach.

Mass Save Online Marketplace

As social media and online marketing have grown in influence for consumer products, Program Administrators have successfully leveraged online marketing opportunities to promote residential energy efficiency. This marketing is supported by a branded online Mass Save store which provides instant incentives on energy efficient products. Only verified customers of a Program Administrator can receive discounts on energy efficient products through the Mass Save online store. The Program Administrators will continue to maintain a stock of energy efficient products offered through the Mass Save online store, staff a toll-free line for customers, and process purchases, as well as conduct short-term promotional pricing and related marketing in partnership with retailers, which has proven very successful in the past.

Program Administrators plan to more fully leverage this channel to supply tailored packages to customers from the comfort of their keyboard directly to their home.

Innovation – Tailored Energy Savings Packages

The Program Administrators plan to expand and enhance the existing Mass Save online store to include customized packages for customers who may be identified through the intake process as having no opportunity for major measures installation. Through the web portal, the customer can select the measures they will install, an instant incentive will be applied, and the tailored package of measures will be sent directly to the customer. The majority of these products will mirror the instant-savings products that would be installed through an in-home energy assessment and provided at no cost to the customer. For a customer without major opportunity, or the ability to approve installation of those measures, this process is a convenient and connects them with the energy savings solutions they are seeking.

4. Residential Behavior Initiative

Overview and Objectives

The primary goal of the Residential Behavior core initiative is to encourage customers to engage in behavior that will result in energy conservation or demand reduction. The Residential Behavior core initiative seeks to leverage the motivational factors that cause residential customers to actively employ personal energy saving actions or participate in energy efficiency and demand reduction offerings.

Program Administrators engage in extensive education, marketing, and workforce development and training activities, all of which are focused on building a climate of energy efficiency awareness and conservation. The Program Administrators' behavioral offerings must be able to accurately capture the direct impact in measured energy savings or demand reductions that result from promoting behavioral actions. Customers must therefore be actively targeted for behavioral interventions, and their specific behavior or action must be rigorously connected to measured savings or demand reduction outcomes.

Customers may participate in the program activity through passive receipt of program treatment or active enrollment in a specific behavioral program offering. Behavioral programs do not claim savings that result from decisions by customers to upgrade or install energy efficient equipment, as those savings are captured in the Residential Coordinated Delivery and Retail initiatives.

Not all residential customers can participate in Residential Behavior offerings given the requirement for a control group against which to compare the treatment group. In addition, certain customers are better candidates for treatment than others given the amount of seasonal or annual usage or the specific installed technology that is required by the intervention.

Strategic Enhancements and Major Innovations

- ✓ **Active Demand Reduction Offering**
- ✓ **Temperature Optimization**

Initiative Design

Home Energy Reports

In previous plan terms several Program Administrators introduced and evaluated behavior-based designs to promote energy conservation within their respective territories. The Home Energy Report ("HER") model remains the mainstay behavior model with proven evaluation results. It provides reliable and predictable savings.

The HER model assigns qualifying customers to treatment and control groups. The treatment groups receive electronic and/or mailed reports on a regular basis and have access to an online portal showing details about their home's energy usage. The control groups are retained as untreated to allow for comparison and identification of the savings impact of the treatment on the

Residential Behavior Initiative

treated group (*i.e.*, the difference in energy savings experienced by the treated group over the untreated control group). Customers in the treatment group are treated as a group indefinitely, or until the Program Administrators decide to stop treating customers with HERs.

The HER design promotes energy savings through two primary paths:

- Educational reports
- Educational reports *and* customer interaction with their online portal.

The HER details and benchmarks customers' energy usage against their past usage and against similar homes in their area. Customers have the option of opting in to an online portal to get more specific feedback on their energy usage. Data collected from the Program Administrators' third-party datasets and customers are used to provide behavioral tips specific to the customer. In addition, these reports cross-market other energy efficiency programs offered by the Program Administrators, spurring greater participation in those programs.

The HER model requires a substantial upfront financial and time investment in mapping information-technology systems (from Program Administrator to vendor and back) to allow for data transfer. This critical infrastructure development is a prerequisite for being able to develop effective treatment groups and tailored HERs.

There is limited flexibility in influencing the design. For Program Administrators with smaller populations available for treatment, it has been challenging to start or implement an HER model program cost-effectively. Several Program Administrators have been told directly by the leading vendors that they cannot provide the HER for their service territory at a reasonable cost (*i.e.*, that would meet regulatory cost-effectiveness requirements).

A statewide request for proposals would not increase availability, as the required investment is specific to Program Administrators' internal billing and usage monitoring systems. These large upfront costs cannot be reduced by aggregating Program Administrator customers into one contract because the required investment is specific and unique to each Program Administrators' internal systems. That said, the majority of Massachusetts customers are treated with HERs, because the largest Program Administrators have fully operational offers.

Innovation - Active Demand Reduction offers

Background

During the 2019-2021 term, the Program Administrators will enhance ongoing efforts to reduce system peak demand by implementing active demand reduction initiatives. The proposed initiatives are based on the extensive work by the Program Administrators' Demand Savings Working Group and the lessons learned from recent evaluated demonstration efforts. The initiative is available to all residential and low-income customers and includes a direct load control offering and a storage performance offering.

Residential Behavior Initiative

National Grid and Cape Light Compact conducted residential active demand reduction demonstrations in the summer of 2016, 2017, and 2018 targeting summer cooling loads. Unitil plans to run the demonstration approved by the Department in D.P.U. 16-184 in the summer of 2019. National Grid and Cape Light Compact shared evaluations of their demonstrations with Eversource and Unitil, and collectively, the electric Program Administrators have designed a new active demand offering for residential customers incorporating the lessons learned from the demonstrations. Program Administrators believe the modifications will allow the program to reach scale and operate cost-effectively.

Residential active demand offerings present unique challenges for recruitment and implementation. Unlike large C&I customers, residential customers currently do not pay demand charges or time varying rates, and therefore have no inherent, direct incentive to decrease usage during specific peak demand periods. Further, some active demand technologies, such as thermostat adjustments and storage, can actually increase monthly kWh consumption due to snapbacks from load shifting and energy loss due to the roundtrip efficiency of storage. Since most residential customers' electric rates are fixed, use of active demand technologies for peak load reductions may increase customer bills. Accordingly, there is no beneficial value proposition for individual residential customers to participate in active demand offerings absent Program Administrator incentives. However, peak demand reductions through active demand management can have a system benefit that reduces overall capacity and temporal-energy costs for all customers, and therefore, the Program Administrators have designed a model for residential active demand offerings that provides incentives for peak demand reductions to capture these system benefits.

Residential Active Demand Reduction Approach

Residential Direct Load Control

The core model for the residential direct load control offering remains focused on reducing demand during summer peak load, typically targeting twenty hours per summer. The design is a bring-your-own-device model, starting first with communicating thermostats controlling central air conditioning units and cooling loads. Additional eligible connected devices may include water heaters, pool pumps, and other devices. Incorporation of additional devices will depend on device saturation, manufacturer concentration, and the costs associated with integrating and enabling load control on each type of device. Eligible customers' devices will be connected to a demand response management platform through an application programming interface ("API"), a mechanism that allows two different electronic systems to exchange core data and interact in a common language. Program Administrators, through the demand response management platform, will send a signal to the device during an event that causes the controller to reduce the demand of the connected device. Events will be called in advance, primarily in the months of June, July, August, and September. Customers can opt-out of events; however, they will be removed from the program if they regularly do not participate.

Delivery Pathways for Residential Direct Load Control Offerings

Customers with eligible technology (controllable communicating device) will be offered the opportunity to enroll in the active demand offering and incentivized to participate in demand

Residential Behavior Initiative

reduction during summer peak events. Program Administrators will seek to enroll both customers with devices already installed and customers installing devices through the energy efficiency delivery pathways during the 2019-2021 plan period. By targeting customers with devices already installed, the Program Administrators can seek to ramp up enrollment by recruiting adopters of technology already incentivized by efficiency efforts or other means, while also seeking to expand the pool of eligible devices through energy efficiency efforts. When an eligible device (e.g., communicating thermostat) is incentivized or installed through the energy efficiency programs, the Program Administrators will seek to simultaneously market and enroll that customer into the active demand direct load control offering. This co-marketing and integrated approach will help customers fully understand the potential benefits of new active demand reduction technologies, streamline the customer acquisition process, and increase enrollment in active demand reduction offerings.

The primary method of customer recruitment will be through the communicating device manufacturers, which was shown to be a successful method during the 2016-2018 demonstration offerings.

Residential Storage Performance

The Program Administrators proposed residential storage performance offering is specifically tailored to build on the lessons learned from successful pay for performance active demand demonstrations and encourage the performance of energy storage by providing higher incentives than the Direct Load Control offering assuming storage that does not impact customer comfort will be more robust, more available, and less likely to be overridden. By using a pay for performance approach, the Program Administrators will be able to utilize ratepayer funds in a manner that maximizes the benefits of peak demand reduction, while providing a predictable revenue stream to customers. The enhanced incentive levels under this option are designed to encourage performance of storage, which comparatively has a high upfront cost but also provides opportunities for demand reduction without significant interference with customer comfort and operations. To further assist residential customers seeking to install energy storage, the Program Administrators will allow customers who agree to participate in demand response to finance the costs of the energy storage system through the HEAT Loan, thereby mitigating some of the significant upfront investment for storage which is a barrier for many customers.

Under this offering, customers will be incentivized to decrease demand through the discharge of energy from storage in response to a signal or communication from the Program Administrators during daily peak hours in the summer and some targeted hours in winter months. Lowering daily summer peak demand will have an impact on overall capacity requirements and provides substantially higher system benefits compared to targeting the top peak demand hours alone. Storage provides an opportunity to secure predictable daily demand reductions without the potentially significant and adverse impacts on customers of shedding demand on a daily basis through other means.

Delivery Pathways for Residential Storage Offerings

The Residential Storage Performance offering recognizes that residential customers do not have the same value proposition for storage as a Large C&I customer with demand charges, direct capacity costs, and time of use rates. The Program Administrators anticipate that most energy storage installed by a residential customer will be paired with solar PV systems. Since residential customers can receive retail value net metering credits for any net exports of energy, residential and low-income customers are generally financially better off if they net meter rather than utilize storage due to the round-trip efficiency losses associated with storage. However, the Program Administrator incentives can offset some of the financial losses from storage cycling and provide the customer with an additional revenue stream that complements other state programs, such as SMART, which offers adders for combining solar and storage. Customers may also choose storage for personal resiliency benefits, in addition to offsetting energy costs. The overall offering balances giving customers flexibility in using energy storage systems for multiple purposes and ensuring that ratepayer funds are used in a manner that provides substantial peak demand reductions.

Innovations – Electric Vehicle Demand Control

The Program Administrators continue to explore additional cost-effective opportunities that seek to minimize the peak demand impacts of various strategic electrification policies advanced by the Commonwealth. The Commonwealth has established the goal of 300,000 zero emission vehicles registered in Massachusetts by 2025. The increase in electric vehicles, spurred in part by DOER’s MOR-EV rebate program, will reduce the greenhouse gas emissions associated with the transportation sector but will add load to the electric system.

During the 2019-2021 term, the Program Administrators are exploring ways to cost-effectively mitigate the peak demand impacts associated with the growth of electric vehicle ownership by potentially offering a performance-based incentive. Please see PA-specific proposals in Appendix H.

Innovation – Temperature Optimization

The Program Administrators are excited to offer a new statewide offering – temperature optimization – that leverages connected Wi-Fi thermostats to help customers reduce energy use and demand. Temperature optimization involves manufacturers adjusting thermostat setpoint schedules based on outside temperatures and user behavior to save energy and reduce demand over an entire season. Customers opt in currently by answering a yes/no question on the thermostat.

Currently, only one manufacturer that offers temperature optimization (branded by the manufacturer as “Seasonal Savings”). It is important to note that the manufacturer does not share customer identifying information with the Program Administrators but does provide the number of customers enrolled in the Program Administrator’s service territory. While it is relatively simple for the manufacturer to identify a customer’s Program Administrator for summer temperature optimization, identifying the fuel type for winter temperature optimization is more difficult. Program Administrators are actively working with the manufacturer to determine a reliable way to correctly determine each customer’s fuel type so that the costs and energy savings may be appropriately allocated among PAs.

Residential Behavior Initiative

While there is no incentive payment to customers for enrolling in temperature optimization, they will have modest savings on their energy bills. National Grid offered summer temperature optimization in 2017, and based on the evaluation of that demonstration, all electric Program Administrators will offer it in the 2019-2021 period. All Program Administrators expect to offer winter temperature optimization in 2019-2021. Program Administrators will also pursue other opportunities with additional manufacturers as they arise to ensure a competitive marketplace as temperature optimization is scaled.

Income-Eligible Existing Buildings Program

5. Income-Eligible Coordinated Delivery Initiative

The Income Eligible Coordinated Delivery initiative provides cost-effective, energy efficiency products and services to income eligible residential customers in a fuel blind approach. Income eligible is defined as at or below 60 percent of the state median income level for 1-4 unit buildings and at or below 60 percent of the area median income level for 5+ unit buildings. Customers that qualify for the utility discount rate are also considered income eligible. Customers qualify for the utility discount rate by meeting low-income home energy assistance (“LIHEAP”) eligibility or by meeting the eligibility requirements for other means-tested programs, such as Chapter 115 Veterans’ Service Benefits, Supplemental Security Income, and Supplemental Nutrition Assistance Program services. The initiative is administered in coordination with LEAN and implemented by local Community Action Program (“CAP”) Agencies. Revenue streams are leveraged with the Department of Housing and Community Development (“DHCD”) Weatherization Assistance Program (“WAP”) and the Heating System Repair and Replacement program (“HEARTWAP”). This approach provides a seamless, integrated experience leveraging all applicable revenue streams for income eligible participants with no co-payments required from customers.

Strategic Enhancements and Major Innovations

- ✓ **Better Alignment between Income Eligible and Market Rate Protocols and Services**
- ✓ **Heat Pump Trials Communicating Thermostats and Active Demand Management**
- ✓ **Facilitate workforce retention, recruitment, and development**

Initiative Design

The initiative is implemented by local Community Action Program (“CAP”) Agencies and integrated with resources from the Department of Housing and Community Development Weatherization Assistance Program and the Heating System Repair and Replacement program. To continue to align with leveraged funding sources and as stated within the Green Communities Act, the Income Eligible Coordinated Delivery initiative will preserve existing implementation strategies.

1-4 Unit Buildings

Income Eligible Coordinated Delivery serves residential customers living in one to four-unit dwellings who are at or below 60 percent of the state median income level and/or are qualified to receive fuel assistance and/or utility discount rates. Once customers are deemed eligible, they will receive an in-home energy assessment from their local CAP agency. The assessment evaluates the building shell, efficiency, and (for electric Program Administrators only), the appliance conditions. All assessments include an evaluation of home health and safety. The lead vendor/CAP agency will then arrange for all applicable measures and services to be installed by a qualified contractor.

Income-Eligible Coordinated Delivery

The initiative is seamlessly offered in conjunction with the current DHCD WAP and HEARTWAP programs. All applicable revenue streams available are leveraged to enhance services. Federal money will primarily be used to address health and safety issues, as well as repairs, to allow for cost-effective energy efficient measures to be installed safely and cost-effectively. Program Administrator energy efficiency funds can be used to push for deeper measures on the cost-effective priority list, including approved weatherization-related repairs. As federal support has decreased over recent years, an increasing portion of both repair and energy efficiency measures are covered solely by the Mass Save energy efficiency budgets.

The Program Administrators will fund 100 percent of the cost of installed measures. All applicable revenue streams from each program are leveraged and offered jointly to income eligible residents.

As mandated by DHCD, all projects that receive Department of Energy (“DOE”) funding, must receive CAP agency post-installation quality assurance inspections to ensure that all work is performed to the program guidelines. The CAP agencies also perform a minimum of 50 percent in-process inspection of projects.

Because the Program Administrator initiative is run on top of the DHCD program, many weatherization jobs have multiple funding streams with associated requirements; therefore, quality control is completed for both DOE and Program Administrator-funded projects at the same time. DHCD performs another level of visual inspection for 20 percent of all DOE-funded projects. During these inspections, DHCD reviews both DOE and Program Administrator-funded work. Additionally, the Program Administrators have an independent third-party vendor perform quality assurance inspections on up to 5 percent of all jobs, which are exclusively funded by the Program Administrators.

5+ Unit Buildings

Income Eligible Coordinated Delivery also serves properties that have five or more units in which at least 50 percent of the occupants are at or below 60 percent of the area median income level, including properties owned by public housing authorities, non-profit organizations and for-profit organizations. Eligibility for the initiative measures and services is based on the established cost-effectiveness of measures and services, which includes agreed upon non-energy benefit calculations specific to income eligible populations and is not restricted by the rate class associated with the meter(s) for the facility. The program also offers the opportunity for multi-unit property applicants to participate in benchmarking their building’s energy usage pre- and post-improvement. The program covers the cost of this service for the initial year.

The Income Eligible Coordinated Delivery initiative is structured to ensure 5+ unit buildings are provided with a whole building, fully integrated offering that targets both gas and electric end uses. Assessments and services for buildings that are going through the refinance process will be coordinated with relevant stakeholders.

Once a property is deemed eligible, an energy assessment is performed by the local CAP agency. The assessment evaluates the building shell, efficiency, and (for electric Program Administrators only), the appliance conditions. All assessments include a building health and

Income-Eligible Coordinated Delivery

safety evaluation. The CAP agency will then arrange for all applicable measures and services to be installed by a qualified contractor. Savings will be deepened by installing additional energy efficiency measures, to the extent the overall project remains cost-effective.

Energy efficiency products and services are implemented within the common interior and exterior areas of the building as well as directly within the dwellings of residential customers, benefiting both income eligible occupants and owners of multi-unit buildings. The Program Administrators will provide up to 100 percent of the funding for cost-effective projects with established limits based on projected savings. All available and applicable revenue streams from each program are leveraged and offered jointly to income eligible residents.

Measures promoted

Measures are provided at no cost to 1-4 unit customers with established limits. For 5+ unit buildings, Program Administrators will pay 100 percent of the project cost with established dollar limits where applicable. The measures available to Income Eligible Coordinated Delivery properties include:

- Insulation (attic, wall, pipe, and duct)
- Air sealing
- Heating system repair and replacement
- Efficient thermostats
- Domestic water heating, including low-flow showerheads, faucet aerators, pipe wrap, heat pump water heater (electric)
- Lighting, including LEDs, lighting fixtures, and torchieres
- Appliances, including refrigerator and freezer replacement, second refrigerator removal, advanced power strips, clothes washer replacement, dehumidifier replacement, and window air conditioner replacement
- HVAC/mechanical systems, including Energy Management System (“EMS”), motors and drives, chillers, air compressors, ventilation system repair adjustment or replacement, heat recovery ventilation/energy recovery ventilation, redistribution systems, temperature building controls
- Some repairs required for weatherization (electrical, roofs, etc.)
- Health and safety testing and improvements (combustion safety testing, ventilation, etc.)

In coordination with LEAN, the Program Administrators will work with the Massachusetts Technology Assessment Committee (“MTAC”) to include new measures or technologies as appropriate.

Income-Eligible Coordinated Delivery

Customer Education

Energy efficiency education and information is provided to all participating customers. The primary form of energy education is verbal communication between the energy specialist and the customer accompanied by leave-behind materials. Educational materials have been translated into multiple languages and will continue to be updated and provided to customers as applicable. Additionally, the CAPs notify all customers verified for fuel assistance of the energy efficiency programs available to them and to encourage enrollment in the program.

The Program Administrators will work in collaboration with the Low-Income Best Practices working group, including LEAN, DHCD, lead vendors (where applicable), and CAP agencies to coordinate statewide on all aspects of Income Eligible Coordinated Delivery initiative, including but not limited to planning, delivery, implementation, education, marketing, training, cost-effectiveness, evaluation, and quality assurance.

Innovation – Heat Pump Trials

LEAN is conducting trials on the installation of air source heat pumps for income eligible single-family homes. Findings to-date indicate that housing type/stock influences the cost-effectiveness of heat pumps. To-date, air source heat pumps have not proven to be a cost-effective opportunity for the single-family income eligible market segment but decreasing system costs and increased market knowledge of best practices for installation may make them a viable heating and cooling solution.

Innovation – Communicating Thermostats and Active Demand

Program Administrators and LEAN will conduct a demonstration for the direct installation of communicating thermostats through the income eligible initiatives. These same customers will be given the opportunity to enroll in the Program Administrators' active demand management offer. Program Administrators and LEAN hope the demonstration will lead to similar rates of energy efficiency savings and active demand reductions as market rate customers.

Strategic Enhancement- Better Alignment between Income Eligible and Market Rate Protocols and Services

The Program Administrators and LEAN are collaborating to identify and deploy more coordinated solutions and partnerships between the Income Eligible and Market Rate programs to support increased awareness and drive customer participation for both income eligible and market rate customers.

Initial Program Administrator and LEAN efforts will focus on implementing a new procedure for 1-4 unit mixed income buildings (buildings that include both income eligible and market rate customers). The Program Administrators and LEAN are committed to maximizing weatherization opportunities and streamlining the customer experience in these buildings through new coordination guidelines between income eligible and market rate contractors. The coordination guidelines will allow for insulation and air sealing services to be delivered by a single contractor, with the appropriate division of costs and savings allocated to the respective initiative on the back end. As a part of this process, the Program Administrators and LEAN are aligning, to

Income-Eligible Coordinated Delivery

the extent possible, all assessment and weatherization protocols to ensure that energy specialists and contractors can count on consistency between the two initiatives.

Strategic Enhancement - Facilitate Workforce Retention, Recruitment, and Development

In collaboration with LEAN, the Program Administrators will develop and implement new workforce retention, recruitment, and training strategies to ensure a knowledgeable and sustainable workforce for income eligible weatherization. CAP agencies are trusted energy service providers in communities across Massachusetts. Program Administrators and LEAN want to ensure their continued on-the-ground success through an increased investment in the professionals that provide these valued services.

C. Commercial & Industrial Programs

Commercial & Industrial Programs

Overview

The Commercial and Industrial (“C&I”) portfolio has driven unprecedented energy efficiency savings while suppressing the overall costs of achieving Program Administrator’s efficiency portfolio, providing Massachusetts ratepayers with extraordinary value for their energy efficiency investments. The Program Administrators’ 2019-2021 Commercial & Industrial portfolio leverages the leadership and maturity in program design to continue to harvest remaining available savings through strategic enhancements to existing designs and cutting-edge innovations that expand to harvest emerging savings opportunities and penetrate new markets.

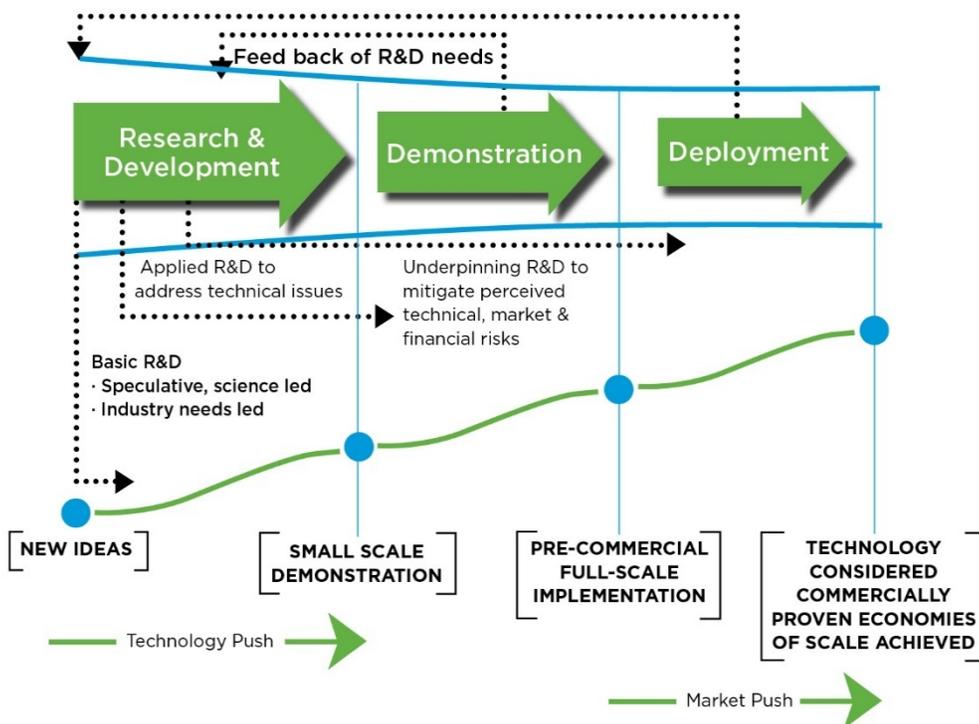
The vision of the Program Administrators is to increase overall program awareness, customer and vendor engagement and participation to enable businesses within the Commonwealth to be more sustainable and stable, thus improving regional competitiveness.

This Plan positions Program Administrators for the future employing strategies that keep customers at the center of program design and evolution while maintaining their commitment to supporting all customers. The Program Administrators will undertake additional targeting and support to populations identified by the Energy Efficiency Advisory Council as *hard to reach* including small businesses and municipal customers. The innovations in this Plan include new demand reduction efforts that will have an impact on peak demand and help winter reliability while strongly supporting the Commonwealth’s greenhouse gas reduction goals. The Plan also includes an increasing emphasis on training as well as customer and business partner support services that will enhance the culture of efficiency that exists in Massachusetts and support transformations necessary to ensure energy efficiency remains the bedrock of a robust Massachusetts clean energy economy.

Leveraging Our Strengths – Innovation Framework

The Massachusetts Program Administrators have been in the unique position of leading the nation on program design and evolution. There is a continuous engagement with efficiency programs across the country to find novel approaches and enhancements while recognizing limitations based on regulatory differences across jurisdictions. Program Administrators have leveraged their position as leaders and the unique structure of having multiple Administrators to actively use Massachusetts as an innovation laboratory. With a concentration of expertise in Massachusetts Program Administrator implementation teams and the vendor and allied contractor community, there is a constant feedback loop - seeking and offering enhancements and innovations. Ideas whether generated in-house, in collaboration with other states, or via discussions with vendors and distributors or stakeholders, are vetted and broader research is conducted to determine likely efficacy. Additionally, independent evaluations, industry best practices review and research into programs throughout the country serve to inform the Program Administrators in this early stage of the innovation process. As an idea evolves it is translated into an application or design that can be implemented in the field. These early design forms are often

tested by individual Program Administrators or a subset of the larger group. Often simultaneous trials by different Program Administrators allow for testing of modest variations in the concept execution. This trial stage maximizes learning while minimizing disruption and confusion on the part of our customers, supporting vendors and contractors regarding the statewide core offerings. As trials run learning and refinements take place until the innovation has evolved to a clear best practice that can be moved to common deployment. Program Administrators must ensure that the enhancement or innovation can scale to full deployment and be delivered cost effectively, protecting and maximizing rate payer investments. Once an innovation is fully deployed at scale as a core element of the statewide programs, there is a process of continuous review, evaluation, and improvement.



Based on Non-Linear Innovation Framework (Energy Research Partnership, 2007)

Program improvements rarely happen quickly, and successful offerings must go through iterations before reaching performance levels that match the potential opportunity. These program improvements tend to follow a thoughtful process to research, test, design and then deliver using existing or completely new energy efficiency program delivery methods. The evolution of innovations that have taken place over time include delivery models for small businesses that leverage or solve customer challenges, direct multi-year customer partnerships (“MOUs”), application of proven approaches into new customer subsets (such as taking the MOU approach pioneered for use with large customers and applying to New Construction in the *Whole Building Solution*) and incorporating technological improvements.

Strategic Evolution from Technology Centric to Customer Centric

As the programs have matured, the need to drive comprehensive, system-based savings has increased. The Program Administrators' approach to lighting is a prime example of the evolution over time from simple equipment, in this case bulb for bulb replacement (incandescent to CFLs to LEDs) to integrated, dynamic control offerings available through multiple pathways. Capitalizing on the existing lighting go-to-market infrastructure, the expansion of the Upstream-delivery model equally demonstrates the Program Administrators' drive towards beneficial partnerships that results in ever-increasing participation volumes while supporting the growth of local businesses and the economy.

The Program Administrators increasingly look to streamline customers' entry, increase customer engagement and modify programs to maximize customer value and ultimately transform markets. Program design and delivery improvements seek to address customer barriers and maximize engagement opportunities with the goal of successful acceptance and adoption of high efficiency technologies and transformation of the market. There is increasing evidence of success in driving customer adoption of energy efficiency. This market transformation raises the baseline against which savings are measured, which in turn leads to reductions in claimable savings for the Program Administrator efficiency efforts.

Program Administrators are increasingly focused on ways to drive increased customer engagement and marketplace innovations to influence and ensure maximally efficient outcomes and less on singular technologies. While the need to continue promoting individual measures is an important element of achieving savings, in many ways the complexity of designing and delivering programs as markets transform requires innovation focused on integrating technology, advanced data, controls and operations into a comprehensive systems-based offering to customers.

Streamlined Programs

The C&I programs are being reorganized and simplified for the 2019-2021 plan period. All layers of detail remain. The Program Administrators will continue to be able to provide the same level of detail on participation as in previous terms, such as through the small business turnkey pathway.

There are two overarching programs corresponding to the types of building efficiency opportunities found in the C&I sector: New Buildings and Major Renovations, and Existing Buildings. The program initiatives have been reconfigured to reflect the way customers identify with and access energy efficiency services. The model respects the customer's role as the primary partner with the Program Administrators in pursuing energy efficiency and active demand-reduction strategies.

The Program Administrators work with a broad base of trade allies to offer every participating customer a compelling value proposition that is easily understood, that meets the customer's business needs and objectives, and that can be implemented in a streamlined manner. Organizing the portfolio this way ensures that Program Administrators can focus on efficient paths to the deepest savings for each customer, addressing each customer's immediate circumstances

while building a long-term relationship that allows the Program Administrators to continue to help customers harvest energy efficiency and active demand reduction opportunities as their businesses, technology solutions, and energy markets evolve.

The C&I sector is inherently complex, including many types and sizes of customers, buildings, business types, and ownership structures. Unlike the residential sector, where buildings have greater homogeneity, commercial buildings often host multiple uses (*i.e.*, manufacturing, offices, storage, parking, food service, laboratories), and some have multiple uses housed in the same structure. Commercial buildings also have opportunities across the full spectrum of end uses (HVAC, lighting, domestic hot water, process), and customers can operate in existing buildings while expanding and constructing or renovating new ones. The more open structure of this Plan helps to clarify the main delivery strategies, while recognizing that Program Administrators can work simultaneously with customers across multiple initiatives and savings activities.

For simplicity, program pathways and delivery channels such as the managed account approach and segment-targeted delivery have been explained under the Existing Buildings Retrofit initiative, but these structures also support and inform delivery to existing customers engaging in New Construction. Similarly, the New and Replacement Equipment Initiative has been placed under the Existing Building Program, as most new and replacement equipment is installed in existing buildings, but this initiative supports and informs delivery of new equipment being deployed in the new construction market, albeit to a smaller extent, because new buildings represent a small fraction of all buildings in Massachusetts. A strength of the Program Administrators' implementation is minimizing the silo effect between programs and initiatives, which ensures efficient interaction with our market partners as we serve C&I customers.

Program Design Highlights

This plan maintains the Program Administrators' leadership in energy efficiency program design and delivery by continuing to optimize programs and offerings, increasing the clarity and consistency of offers while expanding and further tailoring solutions for customers. The plan also includes an increasing emphasis on training and customer support services to continue to enhance the culture of efficiency that exists in Massachusetts.

The singular transformative technologies that were the initial foundation of efficiency programming are becoming increasingly rare. As a result, Program Administrators are focused on developing more innovative and creative methods to drive increased customer engagement and market interventions. Together these will work synergistically to maximize availability, awareness, adoption and installation of the broadest and most impactful array of energy savings measures possible by the nearly 200,000 C&I customers in the Commonwealth.

The C&I programs have been remarkably successful in engaging customers directly, as well as intervening strategically with manufacturers and distributors to increase the availability of high-efficiency technologies. The Program Administrators have worked with designers, engineers, and code officials to increase the efficiency of commercial buildings to deliver cost-effective and cost-efficient energy savings for Massachusetts businesses. The programs' success has also resulted in ever-increasing baselines that the Program Administrators offerings must continually

exceed in order to harvest additional incremental efficiency savings. In the face of these rising baselines and more limited opportunities to secure savings from the increasing efficiency of industry standard equipment, Program Administrators have designed a plan that sets the foundation for a renewed and aggressive drive for energy efficiency in the coming decade. It is based on a customer-first focus centered on two primary strategic imperatives – to serve all customers by expanding our reach and depth of engagement with our customers, and pivoting programs to put our customers in position for a rapidly changing energy marketplace.

Strategic Enhancements and Innovations	
Pivoting to the Future	Serving All Customers
Enhanced Technical Assistance and Design Support for Whole Building New Construction	Small Business Enhancements
New Passive House Offer and Market Development Strategy	Expanding Upstream Offerings
Addition of an Active Demand Reduction Initiative	Customized Services to Franchise Businesses
Investigating and Testing New Approaches to Whole-Building Projects	Expanded Resource Offer within the Industrial and Process Segment-targeted approach
Expanded Support for the Development of Enhanced Energy Codes and Product Standards at the State and National levels.	Expedited Paths to HVAC Optimization including Operations & Maintenance (“O&M”) Savings and Retro-Commissioning (“RCx”)
Expanded Advanced Systems Training for HVAC and Lighting controls.	Testing Strategic Energy Management Cohort Approach
Implementation of Mass Save Application Portal (“MAP”)	
Increased leveraging of training and workforce development to transition to an era of integration of energy efficiency strategies, smart technologies and energy using equipment.	

C&I New Buildings Program

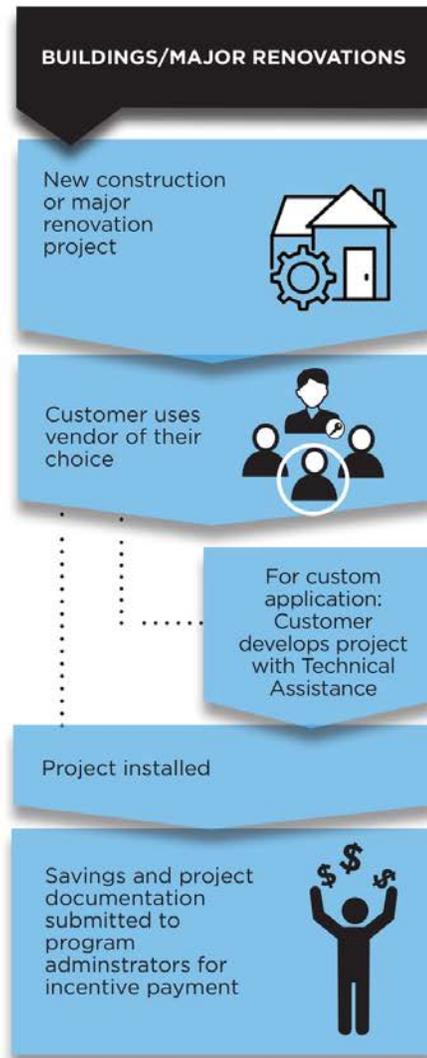


C&I NEW BUILDINGS & MAJOR RENOVATIONS

Whole Buildings Approach



Systems Approach



1. C&I New Buildings & Major Renovations Initiative

Overview and Objectives

The goal of the New Buildings and Major Renovations initiative is to capture energy saving opportunities in new commercial, industrial, institutional, and municipal construction projects. These projects include ground-up new construction of whole buildings or additions, major renovations that trigger the energy code, or substantial alterations in connection with events like tenant or space-use changes. The initiative is the Program Administrators' primary vehicle for leading the Massachusetts construction industry toward higher-performing buildings, including developer attainment of LEED, Energy Star, Zero-Net Energy Ready, and Passive House certifications for commercial buildings.

The Program Administrators' vision is to empower building developers, design teams, and end-use customers to create buildings that deliver exceptional performance and have the most efficient energy systems, lowered operating costs, and work environments that support happier and healthier occupants and higher productivity for the Commonwealth's businesses.

The initiative targets property owners and managers, developers, architects, and engineers who are involved in the initial stages of either new construction or major renovation projects. Through this initiative Program Administrators also influence the market conditions by promoting continuous improvement in energy codes and standards (as well as compliance) to move markets to greater efficiency. This is done through targeted training of market participants on exceeding minimum codes and standards and working to promote improvements to statewide energy codes and appliance standards.

Strategic Enhancements and Major Innovations

- ✓ **Enhanced Technical Assistance and Design Support for New Construction.**
- ✓ **New Passive House Offer and Market Development Strategy**
- ✓ **Investigating and Testing New Approaches to Whole-Building Projects**
- ✓ **Expanded Support for the Development of Enhanced Energy Codes and Product Standards at the State and National levels**

Initiative Design

The New Buildings and Major Renovations initiative offers developers of new buildings and owners conducting significant renovations (such as gut rehabs) or expanding their existing buildings a suite of efficiency services and incentives tailored to their unique ownership objectives and investment criteria. The initiative is designed to add value regardless of where a building is on the continuum from planning to design to construction, and without impeding the design/build schedule.

The greatest opportunity to secure deep cost-effective energy savings exists at the earliest stage of new construction design, therefore Program Administrators aggressively seek to recruit owners and designers at the earliest stage of project development, typically before schematic

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design. This requires multiple strategies, because early stages of development take place largely out of the public eye years in advance of the first obvious signs of site work. The Program Administrators' use multiple industry sources of information, such as networks of architects and engineers, construction lead services, industry trade groups, and strong relationships with existing customers to gain market intelligence. This allows Program Administrator representatives to engage with customers as early as possible in their process and influence the fundamental design decisions that most impact lifecycle energy use.

Whole Building Solution

The Program Administrators have created an enhanced and optimized integrated design path to engage new construction projects at the earliest stages of development. The refined whole building path is an evolution of the C&I New construction program. Resulting improvements are based on responding to the market dynamics of increasingly stringent building code and equipment standards and years of successful market development by the Program Administrators, which has resulted standard adoption of higher efficiency options by Massachusetts customers as standard, thereby elevating Massachusetts' baselines. The path has been refined based on the strong two-way communication Program Administrators have built with our customers and design teams, including architects and engineers. Program Administrators have worked collaboratively across geographies and delivery experiences to emphasize the best practices, create a consistent offer and customer experience, and ensure that all customers - no matter size or geography - are benefiting from the cumulative expertise gained by the Program Administrator and their partners over the years.

The offer provides a clear, consistent, and transparent approach to the design and development community, outlined in two standard packages:

- ✓ Small Buildings Whole Building Solution for all new construction projects between 20,000 and 100,000 square feet; and
- ✓ Large Buildings Whole Building Solution for all new construction projects greater than 100,000 square feet.

Both the Small and Large Building Solution paths provide a consistent set of technical assistance support and customer and design team incentives structure statewide. Both require customers and their designers to review and sign a Memorandum of Understanding, which clearly articulates the program offering, but more critically *creates mutual commitments among the owners, designers, and Program Administrators to engage in the integrated design process*. This commitment to an integrated design process is essential to the Programs Administrators' strategy to motivate owners and design teams to pivot to adopt the high-performance building techniques and technologies that allow more net zero and Passive House and other highest-performing buildings.

Both the Small and Large Buildings Whole Building Solutions have incentive structures to

- ✓ reward owners and designers,
- ✓ provide support for design charrettes, and

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- ✓ connect customers with subsidized technical and design assistance.

Each Solution also requires a minimum beyond-code energy performance and has a performance-based incentive structure to push higher levels of achievement. The Small Building path has additional flexibility for customers to rely on the Program Administrator technical teams for energy modeling. It also offers a more streamlined design exploration commensurate with the potential savings opportunities, and design/engineering investment limits typical of smaller projects. These additional enhancements in the Small Buildings path are aimed at supporting smaller customers and providing the highest quality early design investments that allow for high performance outcomes. This exemplifies the Program Administrators' overarching strategy to offer all our customers more tailored services that meet their unique circumstances and motivate deeper energy savings.

The development of the statewide MOUs promotes the consistency of the offering statewide and strives towards consistent policies across all Program Administrators for reviewing and approving projects.

Strategic Enhancement - Technical Assistance and Design Support

When Program Administrators can engage with design teams in the early concept phase of projects, they can provide comprehensive project review, design assistance, guide scenario modeling, and support for whole-building equipment specification. Program Administrators partner with a team of energy design experts to provide these comprehensive support services. Building orientation and site considerations, envelope improvements, motors and drives, HVAC equipment and system design, lighting design and controls, and equipment selection can all be considered.

Even when a customer's interests are focused on single systems like lighting, early engagement with designers and engineers is still highly encouraged. In these instances, the Program Administrators provide support through the recently expanded Lighting Design Initiative ("LDI") in order to ensure deeper energy savings opportunities are considered and optimized. 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. Advanced lighting controls are an area of focus in this Plan. Specifically, the Program Administrators have included 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 maximum 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 intensive design collaboration with owners, designers, engineers and contractors

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provided by new buildings engagement is a central mechanism for Program Administrators to introduce and promote adoption of cutting-edge equipment and integrated solutions (i.e., systems design, equipment and controls) to the Massachusetts new construction market. Program Administrators are 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.

Innovation - Passive House for Multi-family New Construction Offer

Program Administrators are excited to be launching an innovative forward-looking Passive House offer within the C&I New Construction Initiative using the Whole Building Solution approach in coordination with the Residential New Construction team. In the prior Plan the modeling subsidy, design team incentives, and charrette stipends that were included in the Whole Buildings approach tended to be utilized by the largest multifamily projects (over 10 stories or 100,000 sq ft). The Passive House for Multi-family New Construction offer will give this level of support to all Passive House projects enrolling with our multi-family High-Rise and Low-Rise pathways. Because achievement of Passive House certification requires attention at the earliest stages of project conception, Program Administrators have an aligned outreach and marketing, and workforce development strategy (further described in the overview and workforce development sections). The outreach and training are designed to result in more design teams and owners coming into the Whole Building Solutions path with a commitment to Passive House certification. In addition to all the support offered through the Whole Buildings Solutions path, the Passive House offer provides additional support and incentives including:

- an early modeling subsidy for owners,
- support to design teams for sustainability charrette in either the schematic design (“SD”) or design development (“DD”) design phases,
- certification incentives for owners, and
- \$/kWh and \$/therm performance incentives for both owners and design teams.

Passive House Incentives		
Incentives	Recipient	Details
Modeling Subsidy	Owner	Cost-share of Warme Und Feuchte Instationar or Passive House Planning Package modeling costs or early feasibility study
Design Team Incentive	Architect, Design Team	\$/kWh and \$/therm incentives for projects achieving

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		precertification and certification (if applicable)
Design Charrette	Architect, Design Team	Sustainability charrette incentive in either Programming and Schematic or Design Development design phases, directed to design team lead
Certification Subsidy	Owner	Adder per multi-family unit for achieving PHIUS or PHI certification
Performance Incentive	Owner	\$/kWh and \$/therm incentives for savings where projects are performing more efficient than the User Defined Reference Home for the residential portion and Mass Save baseline for the commercial spaces.

The Program Administrators will support various certifications including the Passive House Institute US (“PHIUS”) and Passive House Institute (“PHI”) certifications. The Program Administrators, as part of the aligned workforce development effort, will be offering training and subsidized certification to develop the workforce needed to achieve certified buildings including offering Certified Passive House Consultant (“CPHC”), Certified Passive House Designer/Consultant, Certified Passive House Builder, Certified Passive House Tradesperson (“CPHT-E”, “CPHT-MBS”), Rater, and Verifiers training and certification, with a small cost share from participants. Program Administrators have a goal of doubling the number of trained and certified Passive House Professionals within Massachusetts, resulting in 95 additional Passive House professionals over the next three years. This will include adding approximately 10 Verifiers and Raters who are critical to the certification process.

Innovation - Investigating and Testing New Approaches to Whole Building Projects

The traditional new construction framework, which focused on incentivizing energy efficiency measures, will become increasingly challenging to support as available incremental savings decline, driven by code or industry standard practice progress. The shift during this three-year plan cycle to a focus on integrated design will be complemented by an investigation and testing of more far-reaching design innovations in anticipation of continued market evolution. The Program Administrators will explore approaches to capture whole building efficiency improvements that include:

- ✓ Engaging with design teams early to encourage the designers and customers to set energy use intensity (“EUI”) targets that can lead to more Zero-Net Energy Ready or Passive House criteria projects.

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- ✓ Considering performance-based incentives for new construction based on actual-versus-modeled building performance while balancing the capital needs of the construction cycle.

As each successive energy code becomes increasingly stringent, the claimable savings for Program Administrators' New Construction offerings grows increasing thin, necessitating new and creative approaches to driving deeper savings, while still supporting code improvements. While driving energy efficiency above code continues to be an important effort given that the Program Administrators have only one chance to avoid missing an opportunity to influence energy efficiency construction practices, it will become increasingly difficult to capture a building's full potential with an equipment-focused delivery model. In recognition of this fact, over the next three years the Program Administrators will be investigating and testing an outcome-based approach to whole building projects. The Program Administrators will test this approach with a select group of projects (approximately 6 across National Grid and Eversource territories) while the standard program remains in place for the majority of projects. These initial projects will provide a base of understanding that inform whether the approach warrants deployment more broadly. Best practices and winning strategies from a larger set of demonstrations over this plan cycle will form the basis of the program design in the next plan cycle (2022-2024) of the Whole Buildings Solutions delivery model.

The new approach involves collaborating with customers to establish performance goals for their new construction project (e.g., Energy Use Intensity or kBtu/sf/yr goals) prior to the commencement of design. A design team, once selected by the developer, would proceed with the Energy Use Intensity ("EUI") target in mind from day one. The approach provides additional technical assistance throughout design to support teams in meeting these performance targets. Program Administrators will also work with customers to establish a measure and verification ("M&V") plan so that actual building performance is measured and checked against the performance goals. With this approach, design teams must find creative ways to achieve energy targets and prove that the goals were met post commissioning.

Program Administrators will investigate tying incentives to EUI reductions and actual measured outcomes after occupancy. Because it will be "building-occupied" energy consumption that is measured, designers will be motivated to examine loads that they may have ignored – such as plug loads and plug load management.

There are many challenges to setting EUI targets and establishing EUI baselines for buildings. EUI target setting will be unique to each building. Measurement and verification standards are still evolving. The entire concept is new to developers, designers, and owners alike. Over the next three-year period the Program Administrators will explore ways to test this concept and to help bring the market along to an understanding of its benefits, rewards, and challenges, as it represents a fundamentally different way of designing buildings and measuring building performance.

Systems and Equipment Solutions

Once a new construction or major renovation project is beyond the design development or

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construction document phase, a more prescriptive approach to individual systems, or a custom approach to discrete building systems, can still capture considerable energy savings, so there should be no opportunity lost. This path is also the primary mechanism for serving new-building and major renovation projects under 20,000 square feet, where a more intensive design process may hold less potential to uncover additional savings or performance benefits while at the same time increasing design costs for developers. Medium and large buildings can also use this system and equipment-solutions approach when buildings are undergoing equipment or lighting replacement and the planned improvements do not affect the building envelope.

There is substantial overlap between the C&I New and Replacement Equipment Initiative found under the C&I Existing Building programs. The Program Administrators use many cross-cutting strategies to ensure the highest efficiency technologies and the associated best installation and operations strategies are available to our customers regardless of which entry point customers have taken into efficiency offers.

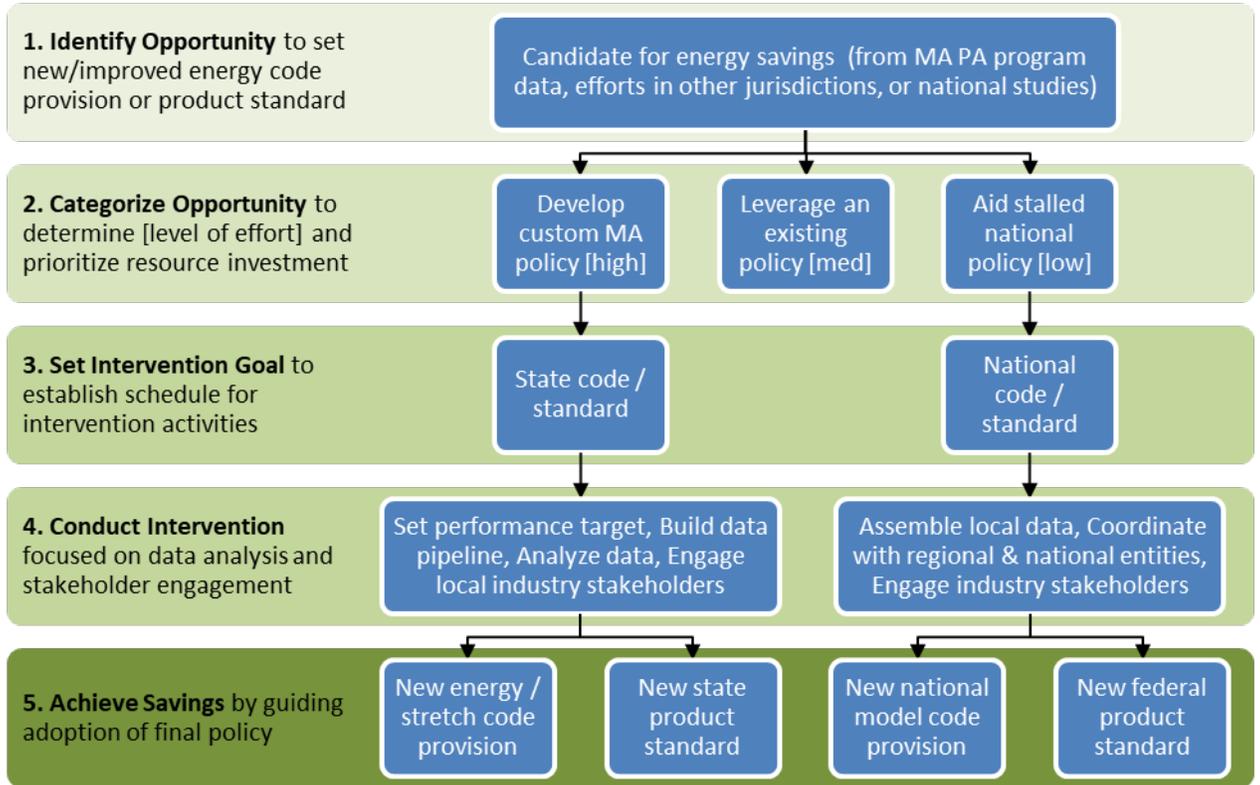
Codes & Standards

The Program Administrators will continue to focus on improving and supporting compliance with the current energy code for both new construction and renovation projects by conducting code trainings and offering technical assistance for project specific code questions. The Program Administrators will also expand this effort to advance the adoption of progressively more efficient energy codes, including stretch codes, and efficiency standards for appliances and equipment.

Innovation - State and National Equipment Standards

The Program Administrators will research the opportunity to support the development of enhanced energy codes and product standards at the state and national levels. The program Administrators will implement a formulaic, multi-year approach based on information collection, data analysis, and stakeholder engagement, described in the programs overview as a cross cutting effort encompassing both commercial and residential programs. The Program Administrators' work with code compliance will expand to include equipment standards and engagement at both the state and national level to develop the next generation of codes and standards. This is a significant element of the Programs Administrators' overarching strategy to proactively move markets to ever high levels of energy efficiency and to continue to build a culture that moves the Commonwealth forward on a path of maximizing clean energy from energy efficiency.

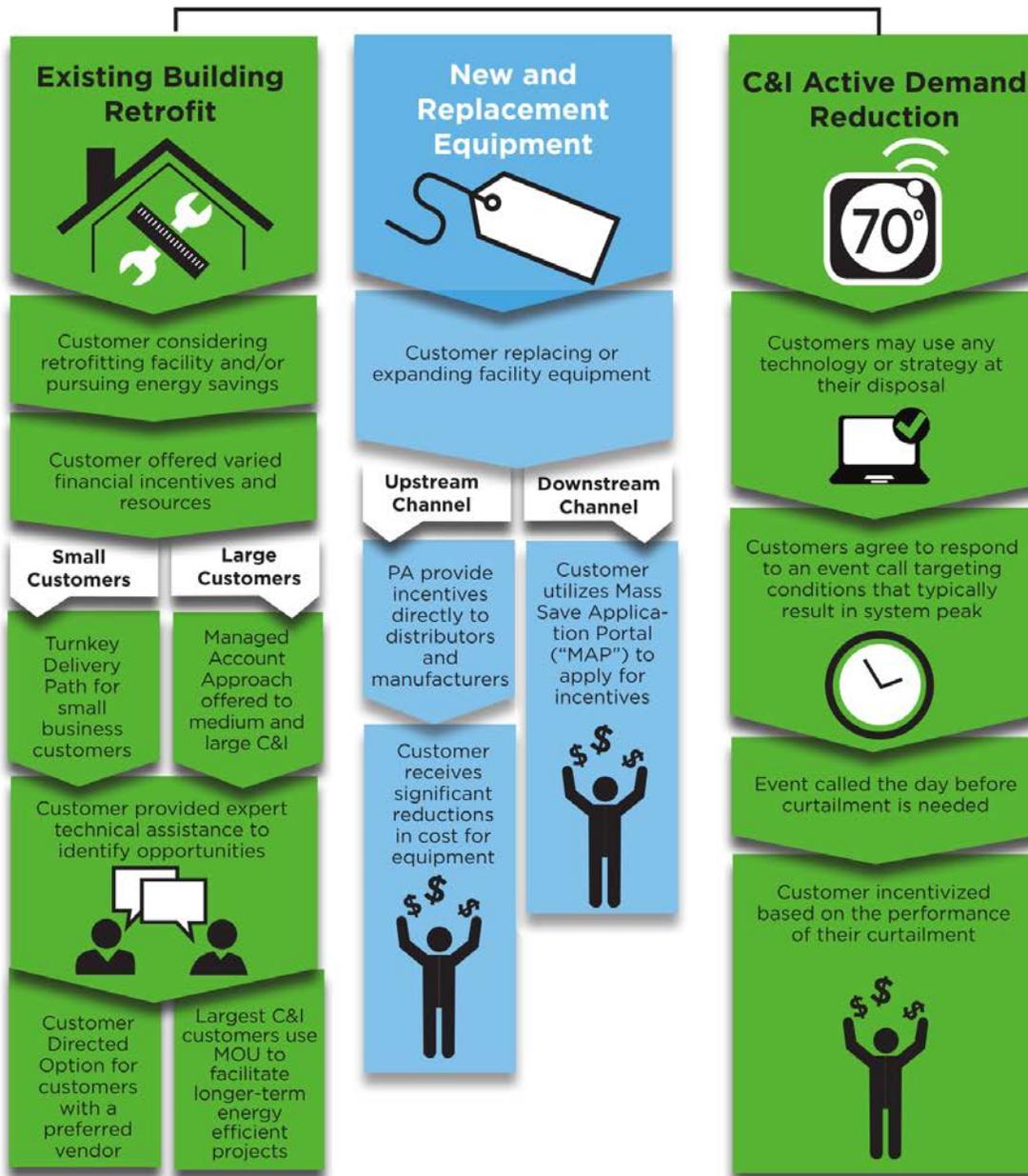
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C&I Existing Buildings Program



C&I EXISTING BUILDINGS



2. C&I Existing Building Retrofit Initiative

Overview and Objectives

The Existing Buildings Retrofit initiative is available to all non-residential customers and supports efficiency and demand-reduction opportunities for all types of commercial, industrial, institutional, and municipal buildings and operations. The initiative works with customers to pursuing energy and demand-reduction measures and strategies to optimize their operations, manage their energy and capacity expenses, and improve their workplaces.

The initiative promotes a menu of incentives and technical services to encourage building owners to replace inefficient equipment with more efficient options and to optimize systems and processes to reduce energy consumption and demand. The goal is to give customers confidence in estimates of project savings, and equipment reliability and performance to justify investments, and then to support the upgrades as simply and seamlessly as possible.

The Program Administrators have recently adopted innovations and enhancements that allow Program Administrators to offer a suite of aligned services to non-residential customers, including training for building operators, to ensure that equipment and facilities operate as designed, and that low-cost/no-cost opportunities for optimized building operations that result in energy and electrical demand savings are fully exploited.

The Program Administrators further tailor their offers and marketing to respond to the unique barriers diverse customers face. This includes providing pathways that respond to customer size, geography, the needs of particular industry segments, and specific energy end uses (e.g., lighting, HVAC, Combined Heat and Power (“CHP”). The Program Administrators are testing ways to leverage these end-use strategies alongside the segment-targeted approach discussed below within the *Tailored Approaches for Segments*. For example, Program Administrators are working with key customer partners in the franchise restaurant segment to explore the impacts, benefits and challenges to implement micro-CHP systems.

Strategic Enhancements and Major Innovations for the 2019-2021 Plan

- ✓ **Expedited Paths to HVAC Optimization including Operations & Maintenance (“O&M”) Savings and Retro-Commissioning (“RCx”)**
- ✓ **Expanded Advanced Systems Training**
- ✓ **Expanded Resource offer within the Industrial and Process segment-targeted approach**
- ✓ **Customized Services to Franchise Businesses**
- ✓ **Small Business Enhancements**
- ✓ **Strategic Energy Management Cohort Demonstration**

Initiative Design

The Existing Building Retrofit initiative offers prescriptive incentives for efficient electric and gas technologies, and custom incentives when a unique characteristic of the customer, site, or process requires a custom approach whereby savings estimates are calculated. All cost-effective opportunities to save gas and electric energy and demand are considered.

Prescriptive incentives are offered for measures that provide predictable energy savings, which exceed industry standard practice and result in cost-effective savings over the life of the measure, in all applications where they replace a similar technology. Incentives are available for a long list of electric and gas technologies, including lighting equipment and controls, HVAC controls, motors and variable frequency drives, spray valves, and steam traps. Prescriptive incentives often serve as the customer's initial exposure to the Program Administrators' efficiency program and may lead to more complex custom projects. Prescriptive measures have achieved predictable savings across a wide universe of applications and can therefore be offered to customers through a simplified application and approval process.

As a mature efficiency delivery approach with established and trusted customer relationships, the Existing Building Retrofit initiative is seeing an increase in the number of custom projects. Many larger customers are more sophisticated in their understanding of their facilities' energy use and the potential for additional savings. The Program Administrators have matched these elevated expectations by encouraging customers to engage in a thoughtful series of building upgrades.

To identify and quantify custom opportunities, the Program Administrators provide customers with access to expert technical assistance, using both their own technical staff, preferred engineering vendors (independent energy advisors), and subject-matter experts drawn from a pool of private-sector engineering consultants that meet the Program Administrators' criteria for expertise and experience. To move customers to action once opportunities have been identified, the Program Administrators offer various financial incentives and resources that are calibrated to match customer investment criteria and reduce barriers to adoption, while maintaining cost-effectiveness and minimizing Program Administrator costs of acquisition.

Delivery Pathways for Existing Buildings

Serving Medium and Large Customers - Managed Account Approach

The managed account approach is focused on learning the customers' unique needs and opportunities and connecting customers to the resources and offerings best suited to their circumstances. All Program Administrators offer managed account services for some sub-set of larger C&I customers. Most medium and large customers have access to Program Administrator representatives. Smaller customers have access to turnkey, upstream and downstream prescriptive pathways which offer more tailored simplified pathways targeted to provide these customers a smooth onramp to the wide variety of Program Administrator offerings.

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Program Administrators have built up internal staff with direct experience or engaged vendors expert in the manufacturing and industrial space, commercial real estate, healthcare, hospitality, grocery and other distinct business segments. Program Administrators have continued to learn the language of their customers, improving the experience for customers while deepening our ability to work with facility managers across the spectrum of sectors and segments to identify, scope, and specify projects.

Strategic Enhancement - Expedited Paths to HVAC Optimization including Operations & Maintenance Savings and Retro-Commissioning

The Program Administrators have targeted HVAC Optimization, along with other operations-based opportunities as a key area to achieve improved savings. A pay-for-performance pathway has, historically, been used as a primary pathway for customers pursuing retro-commissioning and monitoring-based commissioning (“MBCx”). The process allows customers to hire an appropriate technical resource and then identify and implement energy efficiency measures. Once appropriate documentation is submitted, Program Administrators verify the savings and pay an incentive based on the demonstrated performance. As approaches to retro-commissioning, including monitoring-based commissioning, have evolved, and as Program Administrators have been able to identify and quantify savings from specific operations and maintenance (“O&M”) interventions, Program Administrators see an opportunity to provide more tailored guidance and an expedited pathway for customers to pursue these savings.

The O&M offering will provide a simplified approach to implementing common low-cost/no-cost measures or actions with predictable savings that can be captured through a prescriptive incentive. Program Administrators are actively reviewing the property-management and equipment-tuning strategies that have been deployed through the pay-for-performance path, in MOU plans, and through broader research, to identify a package of opportunities that customers can implement quickly and easily to achieve consistent verifiable savings. By leveraging this historic data, Program Administrators can create a streamlined path that dramatically reduces documentation requirements and shortens the time it takes to reward customers with their earned incentive. This eliminates two major barriers to participation while also improving the customer experience.

For customers interested in more resource-intensive, longer-term approaches to pursuing deeper savings, including monitoring-based or continuous-commissioning platforms, Program Administrators are investigating design options that can offer more up-front technical guidance and predictable incentives to encourage customers to choose technical resources and adopt platforms that allow for monitoring or continuous commissioning. By developing more predictable incentive structures with earlier or periodic payment schedules, this offer can encourage customers to commit to these systems by giving them greater confidence that they will realize a return on their investment if they implement the identified energy saving measures.

Customers will continue to have the option to participate in the current pay-for-performance pathway. The redesign work has begun and is expected to continue into the 2019-2021 Plan cycle, with estimated implementation of the completed O&M prescriptive pathway in

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the third quarter of 2019, and completed design planned for a streamlined deeper retro-commissioning offering in 2021.

Memoranda of Understanding (“MOU”)

For the very largest customers, including large manufacturers, university campuses, and large healthcare systems, the Program Administrators encourage the use of multiyear MOUs to facilitate longer-term energy efficiency projects that achieve greater depth and comprehensiveness and align with customer long-term goals and vision. The MOU identifies shared goals, defines the relationship between the customer and the Program Administrators, and outlines a plan to achieve the goals. It may also specify incentive structures. These large customers have human and financial resources and management-planning horizons that allow for this more intensive shared partnership. Often there are larger complex opportunities available in these customers’ facilities that offer significant energy and cost savings opportunities. The maturity of the relationships and the multiple projects completed with these larger customers over preceding plan periods means much of the savings potential from these customers facilities may already have been secured. The relationship continues to offer opportunity for pioneering the systems-based approaches and optimization that Program Administrators see as the pivot required to continue to squeeze out additional savings within a pool of ever scarcer savings.

The success of MOUs translates into savings for these large customers. In addition, the creative and innovative approach that is inherent in shared explorations and project development with these large customers provide Program Administrators with insights that can be applied to medium-sized and smaller customers in the same segments whether through the account management pathway or a tailored segment-delivery path. There can even be payoffs for businesses that use the small business pathways as new technologies are proven in the field and are added as prescriptive offerings to turnkey delivery.

Innovation - Strategic Energy Management Cohort Approach

Program Administrators conducted a comprehensive review of Strategic Energy Management (“SEM”) approaches in practice in other jurisdictions. SEM was revealed to be an evolving concept with no definable set of consistent program-design elements or method of delivery. While the examined programs did produce real energy savings through a combination of O&M actions and incremental new measures, Program Administrators identified some significant drawbacks to SEM as a program offering:

- ✓ SEM is narrowly applicable to small numbers of very large customers and expensive to deliver, and the costs-per-customer do not effectively scale to other business customers.
- ✓ Evaluation data does not clearly establish that SEM succeeds in instilling a culture of continuing efficient practices when program support ends.
- ✓ Most of the program administrators deploying SEM offerings do not have long histories of engagement with their large and mid-sized customers.

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The Program Administrators plan to take lessons learned from this evaluation and implement enhancements that offer opportunities to secure additional savings in the two areas targeted by SEM offers: O&M and incremental-measure adoption. Program Administrators' O&M enhancements are described above under *Expedited Paths to Capture Operations & Maintenance Savings and Retro-Commissioning*.

The Program Administrators plan to investigate an SEM Cohort approach, where a group of customers work together to adopt a more strategic approach to energy management in their facilities. The Program Administrators' objective in studying a SEM Cohort approach is to test a whether the drawbacks identified above, *i.e.*, inability to scale to medium and smaller customers, and failure to instill a lasting culture of efficiency among participants, can be effectively addressed.

Program Administrators are currently developing an RFP to secure a partner to support delivery of this SEM cohort approach. The SEM cohort approach is expected to conclude in Q4 of 2020, and the results will be reviewed in the context of the critical questions listed above. The design, scale, and timing of future SEM cohort approach will take place in the context of this review and in consultation with customers and other stakeholders.

Serving Small Businesses

The Program Administrators use a suite of approaches to deliver services to small businesses. In addition to the turnkey approach, the Program Administrators work through distributors at a point-of-sale where customers, or contractors doing work for customers, can essentially self-serve. Small business customers are eligible to participate in all Program Administrator retrofit and replace-on-failure offerings for specific measures, as long as the equipment meets the eligibility requirements. Small business energy savings will be advanced by targeting energy efficiency measures that are most prevalent in small business customer facilities, including energy efficient lighting systems, controls, and HVAC systems. Additionally, other energy efficiency measures including, but are not limited to, energy optimization controls and strategies, envelope measures, and other prescriptive and site-specific energy efficiency measures are available for small business customers when they have applicable opportunities.

Small Business customers are also eligible for the tailored approaches offered to specific segments. Maintaining an array of approaches allows the Program Administrators to deliver efficient solutions to the tens of thousands of smaller customers in the Commonwealth, solutions that effectively respond to the customer's unique circumstances and preferred engagement model. Program Administrators regularly review and reflect on what is working and take lessons from one delivery path and apply it to others. This broad approach using turnkey, upstream, and downstream delivery pathways serves thousands of smaller customers, well more than those served through the traditional "small business program", which remains an important delivery pathway that is constantly being improved and expanded over time. The flexibility of approaches serves customer needs efficiently.

Small businesses face significant barriers when considering and implementing energy efficiency measures. Owners often have limited time, focus, and know-how to analyze options, and are averse to even short interruptions of business operations. The small business pathway

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provides two statewide unified offers: a turnkey delivery model implemented by vendors subcontracted to the Program Administrators, and a Customer Directed Option (“CDO”), which allows customers to choose their own installation vendor who meet specific criteria for technology and installation. These offers address the barriers small businesses face and maximize their uptake of comprehensive retrofit measures (lighting and controls, HVAC controls, Demand Hot Water Heating controls, weatherization, among others).

Turnkey and Customer Directed Option Pathways for Small Businesses:

Turnkey, sometimes referred to as direct install delivery, is the traditional form of energy efficiency delivery to small business customers. The approach consists of a no-cost assessment, a customer-specific proposal, installation, and recycling or post-installation cleanup for customer-selected measures. The turnkey-delivery path offers electric and gas measures (as applicable) and is intended to help customers navigate efficiency options, mostly retrofit-type measures that improve the operations of their existing buildings in a streamlined manner. The vendors working for the Program Administrators conduct thousands of these projects each year and have done so throughout the long history of this delivery pathway. The activity and savings from this pathway are recorded in the Small Business Core initiative for 2016-2018.

The turnkey small business common offer includes:

- ✓ No-cost energy assessments that can occur while the business maintains operations;
- ✓ A simple-to-understand proposal outlining key opportunities and costs for energy retrofit upgrades;
- ✓ A proposal with recommendations for efficiency measures and the opportunity for direct installation of certain measures and facilitation of professional installation for more complex measures;
- ✓ Incentives covering generally up to 70% of equipment and installation.
- ✓ Financing options and
- ✓ Quality assurance and quality control through randomized on-site project verification.

After the assessment is complete, participants choose which measures to install. The vendors install the measures then invoice the Program Administrators for the incentive amounts. Electric and gas Program Administrators conduct quality control (“QC”) checks on a limited number of sites. Although the turnkey model is a statewide small business delivery method, certain service-area characteristics do require customization. Tailored approaches are therefore offered to enhance and customize specific opportunities to customer needs.

Customer Directed Option is a delivery path recently offered to customers and other trade allies not under contract to the Program Administrators to allow customers to choose the installation vendor with which they are most comfortable. This pathway has been welcomed by customers and trade allies and has grown over the past few years. The activity and savings from this pathway are recorded in the Small Business Core initiative for 2016-2018.

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The Customer Directed small business common offer includes:

- ✓ A standard participation pathway for measures and incentives typically offered via turnkey vendors for all other interested trade allies;
- ✓ Common specifications of technology, installation, and quality assurance;
- ✓ Incentives (generally covering up to 70% of equipment and installation);
- ✓ Financing options
- ✓ Quality assurance and quality control through randomized on-site project verification.

Main Streets Outreach Approach Targeting Small Businesses

Very small businesses, sometimes referred to as micro-businesses, the classic “main street” businesses such as a small local bakery or hardware store are particularly challenging to reach because energy use is low while effort is generally high. It is imperative to increase the volume of projects to overcome the resource costs of labor, trucks, and other equipment needed to perform the installations. One approach that Program Administrators use is to work collaboratively with cities and towns, through the community and economic development offices, with local chambers of commerce and other local business associations to create multiple touchpoints to encourage these customers to take part in the small business turnkey pathway.

Program Administrators can, with local input, tailor the offering and provide a dedicated team of turnkey implementers. Program Administrators work to include materials that are translated into local languages and may offer special Main Street days or other approaches to meet these small customers effectively and efficiently. By leveraging community connections and tailoring to this micro business market, Program Administrators are able to ensure even the smallest of small business customers are provided a path to energy efficiency savings. The Main Street approach to marketing the turnkey delivery pathway is one of many participation pathways for very small businesses to participate in efficiency offerings.

Strategic Enhancement - Small Business

The Program Administrators conducted a comprehensive review of small business turnkey delivery programs offered by program administrators across North America. The research found two critical elements that improve savings:

- Segmentation in either program design or marketing; and
- Allowing negotiated incentives to help secure more comprehensive projects.

These elements—segmentation and negotiated incentives—are core components of the small business pathways. Program Administrators are focused on continuing to enhance these aspects of the small business turnkey pathway, adding additional tailored segment-specific

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packages and increasing training and direction for vendors to support comprehensive projects. Currently the restaurant and lodging segments are being targeted for customized offerings.

Based upon the past research and in-field experience, the Program Administrators continue to provide tailored and localized delivery. As discussed earlier, each territory has some demographic differences, and this can be an opportunity for shared learning in answering the unique needs of disparate parts of the state. All of the PAs are planning on increasing marketing efforts to target specific segments within their territories in coordination with their vendors and partnerships with local organizations. For example, Cape Light Compact plans to target seasonal businesses and year-round cottage industries while Liberty Utilities will focus on office spaces and residential style businesses. Berkshire Gas will increase efforts to approach non-profit, religious and municipal buildings, which fit the small business profile while Until will utilize partnerships with local business and community groups to increase awareness. National Grid will be revisiting sales skills training with vendors to help them find compelling ways to drive uptake of more comprehensive projects. Eversource is continuing to expand the use of Main Streets approach looking to apply it to “business parks” with multiple small businesses. All of these efforts focus on the key partners in each territory to create familiarity with the offerings and increase participation.

The variety of approaches offer a laboratory for new innovations in delivery, and these can be shared across all Program Administrators through integration into the statewide common offer. This laboratory allows for rapid testing and retooling to the next concept without major disruption to the core common statewide small business offer and pathways. Hard-to-reach customers are a focus for this next three years. For example, Columbia Gas of Massachusetts has created a strategic partnership with the Merrimack Valley Chamber of Commerce to increase visibility with an eye toward expanding outreach to and participation among Spanish speaking small businesses. Likewise, Eversource is looking to address the split incentives of the tenant-landlord relationship working with landlords, property managers and tenants to approach the market. The actions within this initiative will include: framing the value proposition to tenants around improved environment and productivity, structuring incentives that facilitate passing savings to small business tenants and making strategic engagements with landlords and property managers to bring offerings to tenants. These tests will provide some lessons to improve service as the PAs continue to best address these customers.

Innovation – Statewide Small Business Targeted Marketing and Community Partnership Strategy

At a statewide level, the Program Administrators plan to engage a marketing agency for novel, statewide small business marketing strategy and tactics. The objective will be to expand outreach strategies to target and engage a wider range of small business customers and owners of buildings occupied by small businesses. As a statewide initiative, Program Administrators are also exploring additional trainings and certifications for our turnkey vendors for improving energy audit quality. Program Administrators will continue to coordinate incentives and grants with the Massachusetts Clean Energy Center to support the uptake of comprehensive technologies like solar thermal and heat pump technologies.

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The new statewide Community Partnership strategy under development, with the residential sector, will include a stronger connection to local municipal governments whose local economic development and small business connections can be a valuable connection point for increasing awareness and participation in Program Administrator efficiency offerings. As part of the Community Partnership strategy exploration Program Administrators are developing an additional regular connection point beyond the municipal connection targeting very small business customers (“micro-businesses”) to provide a forum for Program Administrators to share updates to programs as well as simply be available to help these smaller businesses navigate the programs, and for small businesses to share their feedback with Program Administrators including specific issues in program design that may present barriers for these smaller businesses.

Tailored Approaches for Segments

Program Administrators regularly engage in market segmentation, a process of subdividing customers into segments with similar characteristics. This process allows Program Administrators to create segment-tailored marketing, mixes of prescriptive and custom measures, and package them with outreach and delivery that speaks to customer’s specific business priorities.

Market segmentation is both an art and a science. Each Program Administrator uses multiple market segmentation strategies as needed in their respective service areas. For instance, Eversource has used a quartile analysis segmentation strategy for years, National Grid was early-to-market with a differentiated technical assistance offering for grocery customers, and Cape Light Compact has deep experience with the lodging market based on their unique geography.

Each Program Administrator follows multiple sub-markets, based on their service area firmographics. A Program Administrator may have as many as 50 or more sub-segments for which they track market intelligence and connect it with customer firmographic data, to provide optimized offerings to customers in their territory. Through their common management and technical committees and EM&V studies, Program Administrators have continuously shared and pooled their learning from their independent market-segmentation strategies. They have created common marketing materials for eight market segments. Program Administrators continue to share intelligence on advances in energy saving technology and systems-design approaches specific to each segment.

Data Centers



- High energy intensity
- Flat load characteristics
- Custom, complex supply systems with common end-use loads
- High savings potential, challenging engagement due to varied lessee contract structure within each leased area

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<p>Grocery</p> 	<ul style="list-style-type: none">• Common measures, business model (low margin), and barriers• Can benefit from provision of industry-expert technical assistance• Potential for economies of scale in marketing and delivery• Homogenous and concentrated usage
<p>Hospital</p> 	<ul style="list-style-type: none">• Energy intensive• Sensitive to costs, non-energy related drivers heavily impact capital deployment• Scalable to other customers of varying sizes
<p>Hospitality</p> 	<ul style="list-style-type: none">• Common measures, business model, and barriers• More gas opportunities relative to other segments
<p>Laboratories</p> 	<ul style="list-style-type: none">• Require specialized technical expertise• High savings potential
<p>Manufacturing</p> 	<ul style="list-style-type: none">• Typically energy intensive, though energy costs not necessarily a primary driver of cost of goods sold• Heterogeneous, requiring specialized technical expertise• Common implementation barriers, exacerbated with small and medium size manufacturing base

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<p>Municipal</p> 	<ul style="list-style-type: none">• Have unique budgeting process and require one-on-one attention from the PA• Common barriers
<p>Multi-Family</p> 	<ul style="list-style-type: none">• Mixed customer types with differing engagement expectations and decision-making processes
<p>Property Management</p> 	<ul style="list-style-type: none">• Common barriers• Lower participation rates

Industrial and Process

The Program Administrators have collaborated and coordinated to create a model of resource offerings that brings high value services to this subset of customers. Not only are the Program Administrators utilizing a uniform model of service, they are coordinating amongst each other in overlapping territories so as to provide a seamless customer experience, a sharing of best practices and to ensure an efficient use of program funds.

The primary challenges for industrial customers fit into a consistent set of themes, which are laid out in the chart below. For individual customers the priority or influence of the barrier or challenge may be higher or lower. In general, as customer size decreases, the challenges are amplified and savings potential per customer may be lower for similar projects. A critical insight gained from these close relationships and experience with the Massachusetts manufacturing market is understanding that information and technical documentation of opportunity and savings are rarely the primary barriers to getting manufacturing customers engaged in energy efficiency projects. The chart also offers the high-level approaches to overcoming these specific barriers that Program administrators regularly employ.

Overcoming Industrial Customer's Barriers		
Challenge	Barriers	Approach to Overcome Barriers
Customer risk, inertia, and uncertainty.	Businesses whose profitability relies on producing goods are reluctant to interrupt or change established production processes. Regardless of the true level of risk the perceived risk for such customers is very high.	Engaging customer quality control staff early, thorough customer-centric risk assessment and planning around customer production cycles can assist. Downside= even longer project completion times.
Customer focus on business growth, profitability, capital funds use	Growth and increased profitability are the overarching goals of the industrial and manufacturing customers. Depending on where energy costs sits in the operating expense stacking, potential energy savings may not be a primary focus for investment.	PA staff works with the customer over time to translate EE value to a customer's long-term business growth and as necessary works to assist capital planning, facilitating third party financing where appropriate.
	Competitive sources of project funding are a challenge when an EE project is a substantial capital outlay relative to the size (i.e., medium and small manufacturers) or health of a company.	
Limited human resources and time required for effective engagement	The need for highly technical evaluation and project development and personnel who can engage through an energy efficiency project presents considerable challenges to program participation. Customer resources are scarce for managing the implementation of energy efficiency upgrades.	Identifying customers whose resource constraints could put a project at risk and subsequently selectively deploying project management services can keep a project from getting lost.
Complexity and constructability of site-specific EE equipment	Much of the equipment used in industrial facilities is highly specialized with site-specific configuration, requiring custom, comprehensive solutions. The bench of available technical assistance vendors and installation contractors capable of functioning in that space is small relative to HVAC and lighting.	Program Administrators are working directly with vendor business partners to expand staffing, train new employees and have sought additional qualified partners.

Program Administrators offer multiple strategic pathways and targeted offerings to overcome barriers and increase the reach to the smaller-to-medium industrial base. Program Administrators respond to our customers' risk perception and need for greater certainty by making a broader business case for efficiency to our customers including providing information and support that demonstrates not only the cost savings but measurable additional benefits to product

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quality, waste reduction and/or equipment reliability. This more expansive approach to engaging with our customers on efficiency upgrades provides customers with the most compelling and accurate case for participation which can greatly reduce their risk and uncertainty barriers. Similarly, Program Administrators provide investment information including return on investment and provide our customers with accessible financing that allows energy efficiency investments to compete favorably amongst our customers' capital investment priorities.

Program Administrators are doubling our efforts to provide education, training and technical assistance support, including engineering support (discussed under *Strategic Enhancement – Industrial and Process Enhanced Resource Offer* above) to alleviate our customers' project management constraints and provide streamlined engagement respectful of customer time limitations. Program Administrators are creating simplified decision paths with full supporting information to support critical customer C-suite and other decision makers' ability to engage effectively and participate in the benefits of Program Administrators energy efficiency offers. Program Administrators are investing in making available a strong bench of technical assistance vendors and installation contractors capable of functioning in the manufacturing space who can deliver site specific configurations and custom solutions.

Municipal

Cities and towns represent a key segment of the C&I market and critical partners in Program Administrator service areas. Cities and towns own and operate a wide array of buildings and infrastructure and have many unique operational aspects. The Program Administrators offer a standardized pathway for municipalities to build long-term relationships with the Program Administrators. All Program Administrators have dedicated points of contact for municipalities and maintain a "continuous engagement approach" with municipal customers and offer a mix of standard prescriptive offerings and the option for custom measure offerings.

Each Program Administrator tailors their implementation strategy to reflect and best serve their unique geographies. Each Program Administrator has dedicated vendors and/or staff to support each municipality with a customized approach, which starts with technical assistance to identify opportunities for efficiency measures and works with the municipality to determine the best path forward. The municipal vendor or staff working with municipalities is familiar with the process for DOER's Green Communities as the designation and can support municipalities in securing these designations. The designations and competitive grants require working with the Program Administrator's efficiency programs as part of the process. Similarly, the Program Administrators collaborate with the Massachusetts Clean Energy Center, which recommends working with the efficiency programs on any project as well.

The Program Administrators have also been actively involved in conversations with the Massachusetts School Building Authority, which recently issued a Project Advisory in April 2018, regarding the school's ability to get incentives for energy efficiency measures without reducing the funding from the MSBA. This clarification of third-party funding is an excellent example of collaboration between school personnel, the building community and the Program Administrators to ensure that the incentive dollars could be used to help improve the building efficiency without harm to the overall project funding.

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A small Program Administrator such as Berkshire Gas utilizes a dedicated vendor resource whereas other small Program Administrators such as Cape Light Compact and Liberty Utilities have dedicated Program Managers as the “point” people for the municipalities within their territories. Similarly, Unitil has a Manager of Municipal and Community Services.

Larger Program Administrators utilize teams to accomplish the same goals. Columbia Gas of Massachusetts, Eversource, and National Grid have staff with specific geographic territories to serve as liaisons to the cities, towns, and other municipal entities to provide technical assistance and access to vendors for implementation. Eversource and National Grid also maintain lists of vendors that are pre-approved firms that municipalities can utilize under the M.G.L. Ch. 25A streamlined procurement pathways.

In addition to the Energy Efficiency personnel, many Program Administrators also have staff that work with customer affairs in areas like streetlighting, billing and distribution systems. While the Program Administrators always strive for continuous improvement in their strategic partnerships, there has been a lot of effort by each Program Administrator to understand the municipal bidding, contracting and funding process. As new grants and funding sources are made available to the municipalities, the Program Administrators will continue to work with each of these communities to get a common understanding of the needs of the communities.

Strategic Enhancement – Educational Webinar for Municipalities

Program Administrators are committed to working with Regional Planning Entities to provide a participatory webinar targeted to municipalities that walks through the Program Administrators offerings and clarifies the pathways and resources available to support municipalities working to increase their energy efficiency and participate in Program Administrator offerings.

The Program Administrators work directly with municipalities to address unique barriers and opportunities. The C&I program offerings are the foundation or starting point for most other statewide incentive programs such as the Massachusetts Building Authority (“MSBA”), The Department of Energy Resources (“DOER”), Green Communities and Massachusetts Clean energy Center (“MassCEC”) programs. Most of these programs collaborate closely with the Program Administrators to ensure offers are well aligned. Many require or strongly encourage participating municipalities to start with the Program Administrators services. As such, the Program Administrators, through dedicated staff or representatives, are adept at working with stakeholders and state agencies including the Green Communities Division of the Massachusetts Department of Energy Resources and the Massachusetts Department of Environmental Protection. The Program Administrators are also highly familiar with various grants and the funding cycles (such as Town Meeting votes) in each community, and this segmented approach aids in implementation of the projects.

Innovation – Exploring Statewide Municipal Outreach Partnership

Program Administrators recognize the unique role municipalities can have in supporting community outreach and are exploring a statewide community partnership strategy with municipal

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partnerships at the heart of the effort. The partnership is envisioned to provide opportunities to partner directly with municipalities to advance the shared goal of promoting energy efficiency, particularly with harder to serve customers including small businesses.

LED Streetlight Conversion

Program Administrators work with municipalities and other owners of exterior lighting to review costs and savings for applicable streetlights for LED conversions, for both customer-owned and company-owned lighting systems. Each community requires a case-by-case approach based upon the existing lighting ownership structure, project costs, existing lighting and metering configurations and the available technology options.

Many Massachusetts communities are already reaping the many benefits of LED streetlights, having either purchased their streetlights from their electric utility and converted them or simply having them converted with the utility retaining ownership. Nearly 40% of all streetlights statewide, roughly 157,000 of the 410,000 total, have already been converted to LED mainly as a result of larger communities having purchased their streetlights and converted them prior to an LED tariff for utility-owned streetlights being approved by the Department. Since such tariffs have been put in place, mainly in the last one to two years, more and more communities have been requesting conversion of their streetlights. The Program Administrators are confident that by continuing to work closely with these communities, a considerable portion of this additional savings potential can be realized during this Plan term.

The level of municipal interest in streetlight conversion remains very high and shows no sign of abating. At any moment in time, there are roughly 10-20 communities involved in some stage of the conversion process from requesting the inventory of streetlights from their utility, deciding (on their own or with the assistance of a lighting design consultant) which fixtures to be replaced and with what wattages, reviewing the cost proposal from the utility based on their selections, gaining budgetary approval from their city or town, notifying the utility of their final choices and authorizing the conversion, materials being ordered by the utility, and scheduling of implementation. Cape Light Compact, Eversource and Unitil have successfully deployed greater than 50% LED street across their territories. National Grid has greatest remaining conversion potential. In just the National Grid territory, since the Department approved a utility-owned LED tariff at the end of 2016, 27 different communities have formally requested an inventory of their streetlights and of those, 17 have thus far authorized conversion and have been completed or are in progress.

The Program Administrators continue to actively promote streetlight conversions as part of their overall engagement with municipalities regarding energy efficiency opportunities and will continue to do so throughout the course of the 2019-2021 Three Year Plan. As described earlier in this document, the Program Administrators have a multifaceted approach to serving municipalities and fully expect that the continuation of those efforts will strive to continue the conversion pace or even accelerate it over the next few years.

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Multi-Family Properties

Program Administrators will continue to integrate residential and commercial implementation teams to support delivery of services to multi-unit buildings with both residential and commercial meters. The Program Administrators have made significant modifications to how they segment residential multi-unit buildings, fully described in the Residential Coordinated Delivery initiative within the Residential Programs section of this Plan. A major shift is to provide larger multi-unit buildings, such as those with 4 stories or more, or with a centralized heating system, a more customized path that builds on the Project Point of Contact (“PPC”) model established during the 2016-2018 Energy Efficiency Plan via the former Multi-Family Retrofit initiative. The PPC will provide property owners an individualized path with custom incentives and savings, using a Pay for Savings incentive structure, to maximize capture of the unique opportunities of larger and mixed-use multi-unit structures, and provide a strong business proposition that makes energy efficiency upgrades an easy decision. Program Administrators will work with larger multi-unit customers who are not ready to implement a whole building upgrade but have an immediate need or desire to install a specific energy savings measure Program Administrator representative will continue to promote more comprehensive savings and work to enroll the customer in the comprehensive whole building process.

Multi-unit buildings may contain building-level systems more traditionally found in commercial facilities, and therefore a number of measures more often found in the C&I Retrofit program will also be available for upgrades in these multi-unit buildings, as appropriate, even if there is no commercial meter. This is a value of having an integrated approach and shared implementation teams working on multi-family energy efficiency implementation. Energy measure costs and savings will be allocated to the appropriate sector when both residential and commercial meters are present in a building. These measures may include:

- ✓ HVAC high-efficiency equipment upgrades and controls;
- ✓ Variable speed drives and motors;
- ✓ Chillers;
- ✓ Air compressors;
- ✓ Water heating equipment;
- ✓ Lighting and lighting controls;
- ✓ Energy-management systems; and
- ✓ Custom measures.

Property Management & Commercial Real Estate

Commercial Real Estate (“CRE”) is a key segment that is prevalent in the Commercial & Industrial customer groups. The CRE customer group has varied models including building owner-occupied, landlord-lessee, and professionally managed versus owner managed. Additionally, the CRE sector dynamics are sub-regional in nature with the characteristics of Boston, for example, being different from that of outlying cities and communities of the Commonwealth. In order to facilitate improved participation in this space, the Program Administrators are continuing to support many training including Building Operator Certification (“BOC”), a nationally

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recognized, competency-based training and certification program. BOC is designed to give facility staff practical skills and knowledge that they can apply to make their buildings more comfortable, energy-efficient, and environmentally friendly.

Common barriers that have limited full participation in prior plan years remain, such as, identifying and working with individual tenants (and associated decision makers) in buildings with multiple tenants, cost effectively engaging multiple, sometimes small, tenants leasing space in a single building, identifying decision makers in buildings with one property management entity and a different ownership entity, split incentives between the customer paying the bill and the entity actually using the energy, and identifying single building LLCs that may be part of larger ownership entity. Over recent plan years, the Program Administrators have undertaken several efforts to try and break through several of these barriers to drive increased participation.

CRE is generally comprised of three primary entities – the Landlord, the Property Manager and the Tenant – with varying needs, concerns and interests. Over the 2016-2018 plan years, the Program Administrators worked to refine the approach and strategic framework considering relevant business models and primary-engagement entities. Initially, Program Administrators targeted small, multi-tenant property management where metered tenants were served through small business. This initial outreach served to assist the Program Administrators in identifying opportunities and work through delivery challenges. The effort was then extended to engage more closely with property managers. Meanwhile Program Administrators worked to identify a list of CRE tenanted spaces, such as mixed retail and office space management. In those spaces, the delivered projects for metered tenants were served through small business and shared facilities were served through the C&I program, creating challenges not only from an administrative as well as customer engagement standpoint. These challenges and other barriers were identified such that in the third year of engagement the strategic framework was refined, and high potential targets were identified including property owners/managers and Class B&C property portfolios. Additionally, these entities are subject to policy pressures related to Boston Building Energy Reporting and Disclosure Ordinance (“BERDO”) compliance, prompting a further need for support and engagement. Further refining of engagement strategies for the CRE segment will to help drive participation in the CRE segment.

Innovation – Customized Services to Franchise Businesses

Most casual dining and Quick Service Restaurants (“QSRs”), are independently owned. They represent a significant and growing business segment that present unique challenges and opportunities for energy efficiency program savings. In addition to the traditional obstacles to serving small restaurants (e.g., modest savings potential with high transaction costs), QSRs that are franchisees face two additional barriers: owners are averse to any changes that could compromise the customer experience or the franchise relationship, and owners are rarely on-site.

To address these issues, Program Administrators have partnered with a major national QSR franchise, headquartered and with over 1,200 QSRs within Massachusetts, to develop a more targeted strategy to support efficiency across their franchisees. The franchise owner brought franchisee representatives, corporate operations specialists, and construction and finance experts to the partnership effort. The Program Administrators brought account executives, evaluation

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analysts, program engineers, and senior leadership to work with franchise owners to develop solutions. Together the group developed and piloted a package of energy management systems that included control-enabled LED lighting, refrigeration controls, and water savings devices. The combination of measures was vetted in a six-store test. The package of measures is now offered through a joint Program Administrator/Franchise owner presentation at quarterly franchisee meetings. After the first such meeting approximately one-third of these “hard to serve” small business franchisees signed on to participate in this statewide comprehensive offer, and over 80% of that initial group has completed or will soon complete whole-store projects with comprehensive measures.

Program Administrators are now engaged in discussions with several other multi-facility operators, including QSRs, convenience stores, gas stations, and mini marts to broaden this highly successful approach to franchise businesses.

Technology Focused Strategies

Energy Efficient Lighting

The Massachusetts commercial lighting market has undergone drastic changes over the last decade, with Program Administrator efforts driving rapid market transformation. The Program Administrators took on an effort to improve program delivery to all lighting customers by considering alternative program delivery models, including an upstream/midstream model whereby the incremental cost of high efficiency products was reduced to alleviate cost constraints in the customer decision making process. Program Administrators launched the upstream delivery model (described further in the New and Replacement Equipment Initiative) later in 2012 with the inclusion of high performance T8s and T5 linear fluorescent lamps. The success of these efforts solidified the upstream approach as a viable delivery model, and in subsequent years it was leveraged for a variety of other lighting products, including reflector lamps, screw-in lighting products, and decorative lamps. Today, by offering viable and diverse participation pathways for customers to participate, Program Administrators have provided robust access to energy efficiency lighting systems that offer a broad reach to all C&I customers as well as to market actors working on behalf of customers.

Over the last few years, linear LED products have also shown drastic improvements in quality and were therefore more broadly introduced. While the LED screw-in market shows very high degrees of market adoption headed toward saturation, the TLED technology has as of late shown higher degrees of adoption especially for small businesses. While TLEDs offer substantial benefit to small business customers in the form of reduced wattages, aggressive marketing of these products is somewhat shortsighted as it negates the benefit of controls technologies. Consequently, for the 2019-2021 period, Program Administrators have chosen to put less focus on the “plug and play” TLED products for small business customers in favor of the longer-term benefits of marketing linear LED fixtures where controls savings can be realized. Focusing on these products provides a considerable, incremental savings benefit to these customers. The Program Administrators will continue however to provide support for TLED products in the small business segment, recognizing there is no “one size fits all” strategy, and consistent with an effort to continue providing our customers with a menu of options to suit their energy needs.

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The focus on fixtures and controls in the 2019-2021 plan speaks to a bigger issue which the Program Administrators recognize and have started to address. In the wake of increasing federal energy codes and coincident increases to baseline “standard practices,” the Program Administrators recognize the need to look beyond equipment-based wattage reductions to a larger PA focus on controls savings. As previously mentioned, controls measures have shown poor evaluation results in the past and more recent evaluations have supported a broader PA belief that education needs to be a consideration when implementing controls projects to reduce light levels and achieve optimal efficiency²⁵. Consequently, Program Administrators have designed a number of educational efforts with various market actors including manufacturers/distributors, lighting designers, and installers/contractors. The structure of the trainings is varied and generally tailored to the target trainee. Each training module is intended to achieve the same result: increase controls awareness, understanding, and installation practices thereby ensuring customer value creation and savings persistence. While some of these education and training efforts are standalone, others are partnered with existing program delivery mechanisms where synergies exist. For instance, training for installers and contractors will piggyback on upstream efforts to incent and install controlled LED fixtures. Understanding and leveraging the potential benefits of trainings and access to commission agents to verify proper installation of systems is expected to allow for proper implementation of these systems by market actors who work in that space and afford the opportunity for customers to properly utilize lighting control systems in their facilities.

Advanced Lighting Controls continues to be a measure that the Massachusetts Program Administrators will target and continue to prioritize for the 2019-2021 Plan. Incentives for Advanced Lighting controls are currently being offered under the equipment-based prescriptive forms, the Performance Lighting application, Sustainable Office Design Program, and the Custom application processes for Existing Buildings and New Buildings. In addition, a new comprehensive & multi-tiered training program (*described under Strategic Enhancement - Expanded Advanced Systems Training*) is also being developed to increase the knowledge and awareness of advanced lighting control systems and to ensure their successful installation and use.

Additional linear lighting products have recently been added to the Upstream Program in order to expand the Program Administrators delivery strategy. Similar to both the prescriptive and custom participation pathways, these new products offer additional incentives for products with integrated controls and for higher efficiency fixtures that are DLC Premium rated. The Program Administrators will continue to evaluate new products to add to Upstream to maintain a broad and comprehensive product selection.

The Program Administrators will continue their collaboration on the DLC Technical Committee to expand the list of product categories on the published Qualifying Products List (“QPL”) as new product groups come into the market.

Additionally, the Program Administrators have expanded lighting design service support, for customers and designers/engineers, through a lighting design initiative. The Lighting Designer Initiative (“LDI”) has been expanded throughout the initiatives. Currently, LDI is included and referenced in both the PA prescriptive Performance Lighting and Sustainable Office Design

²⁵ *Impact Evaluation of PY2016 Massachusetts Commercial & Industrial Small Business Initiative: Phase I*, DNV GL (2018)

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offerings. In addition, LDI is an option as a stand-alone offering under our Engineering Services offering. For the 2019-2021 plan, the Program Administrators will continue to promote and leverage the LDI offering to assist customers and to develop higher energy-saving projects. This is one streamlined and intuitive pathway that promotes customer to use lighting design professionals engaged in the market.

The Program Administrators will continue to work proactively with customers interested in converting customer-owned and IOU-owned streetlights. A full discussion of streetlight conversions is included in the *Tailored Approaches for Segments- Municipal*.

Custom Express Tools

In addition to identifying new technologies and defining measure mixes, Program Administrators actively develop tools that allow more customized offerings to be rapidly taken up by medium and smaller customers. Program Administrators actively collaborate and engage with stakeholders to develop customized engineering calculator tools. These engineering calculators, also known as custom express tools, streamline, simplify and standardize analysis of similar energy conservation measures. These tools are developed for technologies/measures where implementation is replicated easily based on potential for rapidly penetrating various market segments. The tools are a mechanism to maximize the limited customer touch points and move quickly from initial engagement to defined measure and incentive offer. *Example:* Program Administrators collaborated with vendors and industry partners to develop a custom express calculator tool for Grocery Stores where the savings and incentive offers can be presented in a customized menu-like fashion to Grocers. The simplified, laymen friendly tool allows the Program Administrators to distill a complex set of energy efficiency measures in a simple to use, quick set of potential outcomes in language that resonates with these types of businesses. An additional example is the Roof Top Unit Optimizer product. The technology was identified as an applicable technology for small and medium customers and the developed tool resulted in simplifying data collection requirements, standardizing calculation methodology and streamlining of deliverables. Program Administrators followed up with internal and external stakeholder training to ensure smoother delivery to vendors and customers. The tool is currently being used extensively by installers (input section only) and vendors/internal Program Administrator engineers (entire tool) to calculate energy savings.

Energy Optimization of Heating for Commercial, Industrial, and Municipal Customers

C&I customers come in all shapes and sizes, from mom and pop pizza places to major manufacturers with 100,000s square feet of conditioned space. The PAs believe it is up to the customer for choice of heating, water heating, and cooling equipment and what fuel (electricity, oil, propane, or natural gas) will drive that equipment. The PAs will drive awareness through existing marketing channels, education of customers, trade ally direct outreach, and trade shows in order to encourage customers to convert from inefficient electric baseboard or standard heat pumps, oil, and propane systems to cold climate heat pumps or natural gas systems. The Program Administrators will provide an incentive to encourage adoption of high efficiency equipment. However, the Program Administrator will not provide a separate or special energy efficiency incentive for heating system conversions, unless for strategic electrification or to renewable or

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clean energy technologies, in all instances that are cost-effective, reduce greenhouse gasses and minimize ratepayer costs.

Designing the proper heating, water heating, and cooling system is paramount for reaching the highest level of comfort and efficiency. The PAs plan to provide customers general information regarding the types of equipment available in the market so that they can make the best holistic decision for their businesses. And in providing this information, show the customers what savings can be achieved in CO₂, MMBtus, gallons of fuel, kWhs and in dollars. Along with installed costs and incentives to buy down these costs, customers can then run their own economic analysis (payback, life cycle cost, etc.) or utilize the PA's proforma tool in order to determine if the investment in converting their heating system is worthwhile.

In order for this to be accomplished, each project needs to be analyzed/modelled on a custom basis, which would include hours of operation, internal heat gain, cooling needs, and information about the building envelope, basically, a heat load/cooling load calculation. Prescriptive offerings may be warranted in future years if patterns of usage, savings, and equipment sizing can be established. One example might be that small to medium restaurants have patterns based on required heat load (MMBTus) on a square footage basis.

Combined Heat and Power

During the 2019-2021 Plan term the Program Administrators will aggressively explore more ways to increase CHP installations in Massachusetts while maintaining the high standards for project screening, qualification, and performance for which Program Administrator programs are known. The Program Administrators have developed a network of over 50 vendors, developers, and installers who want to sell CHP in the Commonwealth. Program Administrators have enhanced the education campaign for CHP technology, including providing technical assistance on determining cost effectiveness and navigating the DEP permitting process, when applicable. The success of the technology over the years has been, in part, a direct result of this network and the strategies to raise awareness and education, to provide clear and complete information regarding the process to achieve a successful CHP project and qualify for an incentive through the CHP guidebook. The lessons learned from long-served, deep engagement in delivering CHP serve is a core foundation to improving program delivery. Additionally, the Program Administrators conducted a third-party study to identify market barriers facing CHP systems and to help identify ways that these barriers can be mitigated²⁶. To improve on past successes, the Program Administrators continue to look for ways to improve interconnection process management and to streamline the incentive application process.

As the Program Administrators achieve success with the typical sweet spots where significant thermal load exists, such as higher education, waste water treatment, hospitals and large industrial customers with process heat loads, opportunities to look to even smaller units have become a focus. The knowledge and lessons learned over prior plan terms, where typical "good" candidates have a year-round thermal load requirement in excess of 5,000 hours, remain as the optimal CHP candidates. Program Administrators have increasingly been targeting smaller units

²⁶ Combined Heat and Power Process Evaluation: Final Report, DNV GL (2017)

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to a wider array of segments including restaurants, multifamily complexes, and hospitality in addition to the typical sweet spots of higher education, waste water treatment, hospitals, and large industrial customers with process heat loads. The Program Administrators are working to understand technology and performance impacts of going to the small and micro-CHP scale. Smaller units can be applicable to a wide array of segments including restaurants, multifamily complexes, and hospitality where sufficient coincident thermal load exists. While the volume of potential customers increases with this approach, the challenges and barriers shift, while the known barriers and risks - significant time and capital, as well as integration and operations risk remain. In addition, as customers move toward potential islanding, they may become ineligible for any future additional Program Administrator supported energy efficiency offers, which means it is best to undertake as much efficiency in the facility as possible to then be able to right-size the CHP and capture more efficiency.

While economics is a primary driver of most CHP installations, reliability and resiliency are increasingly moving up in terms of importance to customers as they look to invest in their campuses and facilities for years to come. The impacts of this to efficient performance is being examined, particularly where situations arise where the traditional thermal load following approach moves to electric load following, requiring additional thermal equipment, such as absorption chillers, which also increases the capital cost per delivered kWh. Enduring interruptions and outages due to storms has significantly impacted the psyche of businesses where back-up power capability is moving to the forefront of the CHP industry. As an example, the Program Administrators worked with several large hospitals to access DOER funds made funds available for CHP installations that should include Island Mode or back up capabilities. Customers received over \$4,000,000 in DOER resiliency grants as a result of this combined support and awareness campaign. Moving forward Program Administrators staff will continue to provide active assistance to the customer throughout the process, further driving the success and broadening applicability of this end-use strategy. The Program Administrators focus remains on promoting and providing incentives for CHP where it provide energy-efficiency and demand reduction benefits.

Customer Focused Technical Assistance and Resources

Customers have multiple pathways to receive technical support in adopting more energy efficient practices. The managed account approach, the small business pathways, and segment-specific approaches (all discussed above) all offer customers facility assessments and skilled professionals who can provide advice and help in selecting energy efficient options. Program Administrators also support specialized trainings to give customers and trade allies technical knowledge and keep energy and demand savings at the forefront of their thinking when selling related products and services to customers. This includes technical sessions with information targeted at those in charge of making the financial and facility decisions.

There are instances where customers can benefit from additional technical or engineering study beyond what is offered through the standard customer support and trainings. Program Administrators have created a system that allows customers to pursue additional engineering and technical support in a shared investment model, sometimes referred to as a cost-share, with Program Administrators. Any customer may propose a study or technical-support project via a simple-to-follow online engineering services application. The Program Administrators support a

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team of engineers and technical experts, both in-house and under contract, who review applications and approve a scope-of-study or technical assistance. Program Administrators will work with customer's preferred engineering consultant, with the consultant under contract with the customer. In instances where the consultant is under contract to the customer the cost-share is limited and at Program Administrators discretion. In either scenario, the customer's investment in the study helps ensure that they are committed to implementing its recommendations resulting in savings.

All customers have access to the technical assistance application process, and all applications are given a comprehensive review and support to scope and implement studies or assistance projects. It is a common practice for technical assistance vendors and account managers working with customers to identify study opportunities and work with customers to submit applications. A vendor may see a significant opportunity for custom measures but need to do a study to more clearly define the savings. The vendor can propose the study and help the customer submit the application. Program Administrator representatives working with customers may see an opportunity that needs better definition or may recognize that the customer needs help with prioritizing multiple opportunities to reach an investment decision and staged upgrade plan that works for their specific business operation and facility. In these cases, the Program Administrator representative may suggest the customer use the engineering-services pathway and support the customer's submission of an application. In all cases, the Program Administrators' objective is to actively promote technical support as a critical tool to help customers understand their energy saving opportunities and act on them.

Strategic Enhancement – Industrial and Process Enhanced Resource Offer

The Program Administrators have implemented an enhanced resource offer targeted to industrial customers providing both technical and project management services. The offer is also available to other customers with process end-use in other segments such as hospitals, laboratories with process loads. The Program Administrators provide our customers access to a suite of contracted engineering firms that specialize in industrial or process-related energy efficiency. The contracted firms also have expertise in management of efficiency projects in the manufacturing environment and can provide this additional technical knowledge and service. The Program Administrators have targeted process-end use customers as an area to potentially achieve improved portfolio savings levels.

The industrial and process resource assistance offer has been specifically designed to overcome the time barriers industrial customers have experienced with traditional technical assistance models, *i.e.*, long investigation and report preparation cycles. Vendors are deployed strategically to expeditiously identify and analyze targeted energy conservation measures, which results in quicker turnaround and prompt implementation.

The use of vendors with the ability to provide project-management support has been instrumental in overcoming customer resourcing constraints. This is particularly critical in overcoming these constraints for medium and small manufacturers. Being smaller does increase relative costs compared to savings, because while the fixed costs of finding efficiency opportunities are the same in smaller manufacturing settings, the potential savings are less. But the

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efficiency of the program design has secured cost-effective savings even for small manufacturing customers.

The offer makes it easy for Program Administrators to coordinate gas and electric offerings. Contracted firms provide comprehensive technical support, including the identification and delivery of opportunities for gas and electric projects. The approach enables the coordination and back-end processing of associated costs and incentive delivery where multiple Program Administrators serve the same customer, without any interruption of service. From a customer perspective, they have one engineering-support partner who can provide tailored high-impact strategies that are responsive to their unique business priorities and constraints. During the testing of this element of the platform with larger customers, Program Administrators discovered that an extra benefit of the integrated design and delivery is increased instances of shared knowledge and savings delivery between Program Administrators.

Training

As the tools available for Program Administrators to achieve savings evolve, the Program Administrators are adjusting their programmatic offerings to help customers not only adopt integrated systems, but properly install, commission, and operate them to maximize energy and demand savings. To capture *and maintain* the savings inherent in these sophisticated new systems, the Program Administrators will need to rely to an even greater degree on the skillsets of facility managers and trade allies who provide services in the field. Trades like electrician and HVAC installer and technician will not only require enhanced entry-level skillsets, but also access to continuing training opportunities as these professions encounter an increasing range and complexity of end uses that are always changing.

The Program Administrators have been working with the industry experts to provide an annual training for the plumbers and HVAC contractors installing high efficiency furnaces, boilers, water heaters and other instant savings gas measures such as aerators and spray valves. Program Administrators will be offering training on how to properly size furnaces and boilers, including how to conduct heating and cooling load calculations, which helps contractors determine optimal heating system and duct system sizing. Program Administrators will offer sessions on how to service and set up condensing boilers because condensing boilers and furnaces have different specifications than the equipment they generally are replacing. Program Administrators are also supporting trade allies in completing the efficiency sale by offering training that helps present the efficiency and financial benefits to customers in a manner that creates a winning sales proposal that moves customers to action.

Strategic Enhancement - Expanded Advanced Systems Training

As equipment baselines and codes rise, an increasing share of energy efficiency program savings will need to be derived from a systemic approach that focuses on optimizing the specification and installation of energy efficient equipment combined with sophisticated controls and management systems that ensure that savings are maintained. Lighting will increasingly be designed and installed to be an interactive network, capable of sensing customer lighting needs, using dimming and on-off cycles and incorporating daylighting-sensor information and

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information about occupant activity and location. HVAC systems will similarly become “smarter,” responding to customer ventilation and temperature needs in real time by combining data on outside conditions with information about the number and location of occupants. Lighting and HVAC systems will increasingly create opportunities for customers to participate in active demand reduction without compromising the functionality of their equipment or disrupting their operations.

Program Administrators plan to include two new training offers to support advanced lighting controls. The Program Administrators will implement the National Advanced Lighting Controls Training Program (“NALCTP”) which trains and certifies electrical contractors and electricians in the installation, calibration, programming, commissioning, and maintenance of advanced lighting-controls systems. The Program Administrators are partnering with Massachusetts Energy Efficiency Partnership (“MAEEP”) to develop and deliver a day-long seminar on Advanced Lighting Controls Systems (“ALCS”). The session targets lighting designers and specifiers, engineers, major property owners, vendors, and contractors. The training introduces attendees to the newest enhancements to Advanced Lighting Controls Systems, such as Luminaire Level Lighting Control (“LLLC”) and new software.

Innovation - Experiments in Facility Operator Training

Eversource has been testing an innovative customer training program that allows for facility staff to train on the customer’s operating building systems including lighting, HVAC, process, and building energy management systems. The intent is to deliver targeted and customized on-site training for customer facility staff and the vendors who supply and service their equipment and energy management systems.

The goal of the training is to ensure that these systems remain optimized. Delivery would be accomplished through: (1) an initial scoping/walk-through audit to identify and assess potential opportunities. The assessment would be conducted by a skilled Eversource contractor in cooperation with the facility operator and would yield a brief report summarizing the opportunities and a proposed plan of attack; (2) one or more on-site working sessions with the facility manager, the appropriate Eversource technical support contractors, and technicians from the firms responsible for supplying/maintaining building operating systems (EMS, HVAC, etc.). Eversource will also offer one or more follow-up visits to verify ongoing system operations and provide training and technical assistance updates for staff. It is expected that Eversource will collaborate with all PA regarding the results of the effort and explore expansion.

Financing Energy Efficiency Investments

The Program Administrators have partnered with the Massachusetts Bankers Association to make available financing for business, multi-family, and non-profit commercial customers who need capital beyond the value of the Program Administrator incentive to implement a project. Customers can elect to use project incentives to apply to the interest on the loans or use the incentives to reduce the capital needs of the project. Loans can range from \$5,000 to \$500,000 and can extend to 7 years. For the Program Administrators, the ability to link customers to capital where that is a barrier to project execution is an invaluable sales tool. For participating lenders, the

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partnership opens up a new market to attract new customers, with the assurance of receiving a market rate interest payment from the Program Administrators.

Mass Save Financing for Business has had a modest uptake, and is best viewed as a useful, but niche tool in the energy efficiency sales toolkit. Larger-sized businesses in the Commonwealth have indicated that access to outside capital financing is not a primary barrier to program participation. The Massachusetts experience is consistent with the financing experience of most other program administrators. There remains continued interest in investigating alternative and creative financing vehicles, such as the newly created commercial Property Assessed Clean Energy (“PACE”) offering in the Commonwealth and options for third-party financing. These alternative financing options may have the potential to improve customer uptake of project financing and reach more customers who may not have participated in energy efficiency programs due to capital constraints. The Program Administrators will continue to review new studies and proposed mechanisms as they emerge. Program Administrators will continue to closely watch financing pilots and initiatives being conducted in other jurisdictions to determine which emerging models, if any, show promise for replication in the Commonwealth.

Innovation - Experiments in Financing Energy Efficiency

The Program Administrators experiment with different forms of financing to open greater efficiency investment options to customers. Between renewables, clean energy investments, and energy efficiency there are multiple financial assistance paths to help customers complete projects, some older and well established like the Energy Services Company (“ESCO”) performance contracting model and others more transactional such as financing for a particular piece of equipment. Some Program Administrators use turnkey vendors who extend financing to customers and others look to incorporate available financing products in the energy marketplace.

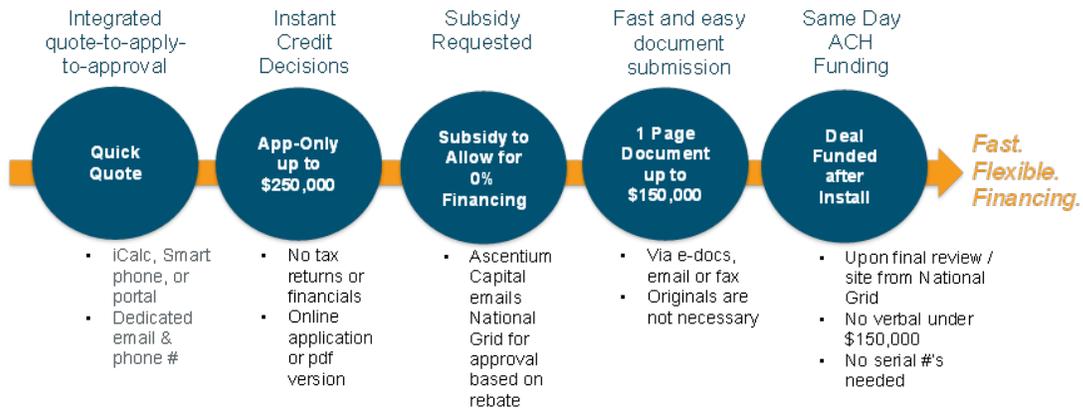
One Program Administrator, National Grid, is experimenting with an external financing option for electric and gas customers pursuing retrofit or new or replacement equipment projects, which uses the energy efficiency incentive to buy down the interest of the loan. This new streamlined online submittal offering (the loan application is online and can be processed in two hours) is expected to provide flexible financing up to \$1.5 million with terms up to 60 months. The process is intended to speed up the project decision process by using a simple online tool to develop a quote and provide a financing proposal back in two-hours or less. The flexible financing offer is expected to support the following selling strategies for National Grid sales personnel:

- ✓ Offer the payment that provides a cash flow positive situation from day 1.
- ✓ Highlight that the energy savings will cover the cost of the measures.
- ✓ Show them how much they will save after the term is completed.
- ✓ Calculate their “Cost of Waiting” and break it down per year, month, and day.

National Grid is using this financing solution to a limited extent now and plans to expand, if successful, in the 2019-2021 term. The Program Administrators will continue to follow this effort and be regularly updated through the knowledge-sharing forum of the C&I Management

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Committee and assess for applicability to each individual Program Administrator on a case by case basis.



3. C&I New & Replacement Equipment Initiative

Overview and Objectives

The New and Replacement Equipment initiative encourages customers who are buying new equipment, or replacing equipment that has worn out or failed, to opt for the most efficient alternative in the market. Initial or replacement on failure equipment-purchase decisions establish energy-consumption patterns for decades and lock in operating costs for the end-user. Most major commercial equipment will continue to be used until it fails or needs to be replaced, or a retrofit project is proposed and economical. The goal of the New and Replacement Equipment initiative is to ensure that no opportunity to place the highest-efficiency equipment in service is lost.

Strategic Enhancements and Major Innovations

- ✓ **Expanding Upstream Offerings**
- ✓ **Implementation of Mass Save Application Portal (“MAP”)**
- ✓ **Increased leveraging of training and workforce development to transition to an era of integration of energy efficiency strategies, smart technologies and energy using equipment.**

Initiative Design

When purchasing a new piece of equipment or replacing a failed one, customers have a choice between standard, generally code dictated, and high-efficiency options. By incentivizing purchases of high-efficiency equipment Program Administrators can make such purchases easier, by reducing the up-front costs to the customer. Program Administrators generally attempt to incentivize the incremental costs only, *i.e.*, the price difference between the standard or code-compliant equipment and the higher-efficiency equipment, and balancing that against the incremental savings, *i.e.*, the savings between the operation of the standard or code-compliant equipment and the high-efficiency equipment over the expected life of the equipment.

The types of equipment include gas heating and water heating equipment, electric HVAC including heat pumps, and food service equipment,

Prescriptive downstream and upstream incentives are available for a wide array of energy and demand saving equipment. Prescriptive incentives are most effective when the customer or the trade ally serving the customer can be actively engaged at the time of purchase (initial or replacement). Program Administrators are able to exert influence over customer and trade ally purchasing through account and program managers, training of trade allies, and building awareness across customers and industry regarding more efficient options.

While the prescriptive application process and upstream incentives offer customers a streamlined participation pathway for common energy efficiency measures, the custom application pathway provides customers an opportunity to put forth more complex and/or customer site specific energy efficiency measures for consideration within the programs. Typically, these energy

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efficiency measures require detailed energy efficiency savings analysis, measure-specific implementation costs, and, in some instances, inputs from modelling programs. This information is required by the Program Administrators in order to determine if the proposed energy efficiency measures meet the benefit-cost screening and other pertinent program guidelines. The custom pathway allows the customer and Program Administrators the flexibility to consider new technology and advance other cost-effective energy efficiency measures and strategies not captured through the prescriptive application process. As increasingly stringent code adoption, rising standard practice, customer awareness and the success of our energy efficiency programs continues to put pressure on Program Administrators ability to claim savings for simple equipment replacement, the custom incentive process is a key tool to create integrated solutions that create new energy efficiency savings.

The addition of MAP is the type of effort that helps contractors operating independently in the market deliver energy efficient options directly to customers. MAP is designed to help customers understand what energy efficiency opportunities are available and enables customers to create and submit applications for financial incentives or services in support of energy efficiency projects in Massachusetts. This new Portal greatly simplifies the process of creating and submitting applications by combining all offers and incentives in a single, simple to use, online system.

Upstream Channel

The upstream model leverages existing distributor networks and infrastructure to influence the thousands of equipment-purchasing decisions that customers and contractors make every day. Under the upstream model, the Program Administrators provide incentives directly to distributors and manufacturers, rather than to end users, with the end users benefiting from the significant reductions in retail costs that this enables. The incentives are structured to remove the price premium between conventional and high-efficiency products at the point of purchase, thereby placing efficient products in direct competition with conventional products based on quality and efficiency alone.

For the upstream model to succeed, a special set of special circumstances are required:

- ✓ the higher-efficiency equipment must be a direct replacement for less efficient equipment;
- ✓ the equipment-purchase decision must be primarily driven by first cost, with no real reliability or performance distinctions between the products;
- ✓ the high-efficiency equipment must be stocked and available at distributors at the time the purchase decision is made; and
- ✓ there must be no, or minimal, additional or unique installation requirements that distinguish it from the product for which it is substituted.

Building on early success in the linear fluorescent market, the Program Administrators have broadened the application of this approach to additional lighting products, including LED fixtures and a variety of other LED products. The Program Administrators also now offer upstream pathways for many non-lighting measures that are amenable to the upstream approach (e.g.,

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efficient technologies that can be substituted for less efficient options without any adaptation or technical or performance limitation). In addition to lighting lamps and some select fixture types, upstream incentives are now available for ECM circulator pumps, natural gas water heaters, electric HVAC (including air-source and ground-source heat pumps and variable refrigerant flow) measures, and qualified natural gas and electric commercial kitchen measures.

Upstream offers fewer measures, primarily because it is limited to equipment types where the efficient alternative is a direct and comparable substitute for the standard equipment in all circumstances, without any requirement for program verification. But for the measures that are offered, market uptake is high and broad, due to minimal price and administrative barriers to customer access. Because upstream engages many customers who would otherwise not participate, it both captures additional savings and addresses equity concerns.

4. C&I Active Demand Reduction Initiative

Overview and Objectives

The electric Program Administrators will be implementing active demand reduction offerings based on the recent evaluated demonstration efforts. During the summer of 2017 and 2018, National Grid and Eversource (2018 only) deployed a C&I demand reduction demonstration. Customers with interval meters, time of use rates, and demand charges, with demand of 250 kW or higher, typically, and the ability to curtail 50 kW, were eligible for the demonstration. Under this active demand reduction approach customers agree to respond to an event call targeting conditions that typically result in system peak through curtailment service providers (“CSPs”). The customer is incentivized to respond to event calls using performance based incentives and measuring performance against a baseline in alignment with ISO New England methodology. This approach is technology agnostic and can utilize single end use control strategies or a multitude of approaches that can dramatically reduce demand when an event is called. In the demonstrations customers have used lighting with both manual and automated controls, HVAC with both manual and automated controls, process loads, scheduling changes, excess CHP capacity, and even energy storage.

Based on the success of the demonstration efforts, the Program Administrators will offer customers offerings to incentivize them to reduce demand at key points to realize customer value and system benefits mainly tied to avoided peak demand, transmission, and distribution investments. The Program Administrators can add a new service offering to the portfolio to provide value to Large C&I customers and generate claimable benefits, primarily avoided capacity, transmission, distribution, and capacity DRIPE.

The electric Program Administrators will also review the results of new demonstrations proposed by Eversource and approved by the Department in D.P.U. 16-178. In 2018 and 2019, Eversource will deploy demand reduction demonstration offerings for battery storage, thermal storage, software and controls, and active demand response, some including upfront incentives for equipment installations. These demonstrations are designed to test the ability of the projects to deliver cost-effective benefits to customers at scale. After the evaluation of the demonstrations, Eversource will submit a report to the Department with an analysis of the actual costs and benefits of each demonstration project. Each electric Program Administrator will use the results of the demonstration offerings to assist in analyzing whether a program based on the demonstration projects can be deployed cost-effectively at scale. Any new program design will be implemented at the earliest appropriate time, as determined by each PA.

Strategic Enhancements and Major Innovations for the 2019-2021 Plan

- ✓ **New Statewide Active Demand Offer for Customers**

C&I Active Demand Reduction Initiative Design

C&I Interruptible Load Curtailment

The 2016-2018 C&I Interruptible Load Curtailment demonstration projects targeting summer peak demand will serve as the basis for a new statewide C&I curtailment active demand reduction offering in 2019-2021. This offering is technology agnostic and provides an incentive for verifiable shedding of load in response to a signal or communication from the Program Administrators coinciding with system peak conditions. Customers are incentivized based on their average performance and the typical technologies or strategies used to curtail load may include:

- energy management systems,
- building management systems,
- software and controls,
- HVAC controls,
- lighting with controls (manual, networked system or integrated),
- process offsets,
- any open ADR compliant technology,
- startup sequencing, and
- other customer facility specific approaches.

Since the offering is technology-agnostic and performance-based, the Program Administrators will be able to incent the performance of customers adopting innovative and emerging demand reduction technologies, including energy storage technologies (see later section). Customers can use any technology or strategy at their disposal and earn an incentive based on their curtailment performance. In essence, the incentive equals the customers' opportunity cost – if it makes sense for a customer to shed load for the incentive price offered by the Program Administrator, then the customer will curtail.

Large C&I customers that are subject to demand charges and/or direct capacity charges (determined by ICAP tags) with the ability to control lighting, comfort, and/or process loads, can use this demand reduction performance offering to generate revenue by altering their operations a few times per year. The Program Administrator incentive, combined with any ISO-NE capacity supply obligation reduction and demand charge reduction, round out a compelling package for customers to adjust operations a few times per year.

The Program Administrators will also be incentivizing active demand reduction strategies during winter. The goal is to help promote winter resiliency by finding customers that can reduce electric usage during times of high winter system load. The PAs will recruit customers that participate in the summer reduction program and sign them up for a winter reduction obligation as well. These customers will receive two payments – one for summer and one for winter, based on their seasonal performance relative to an agreed upon target. The seasonal payment for winter demand response will be incentivized at a different rate than summer as nearly the entirety of claimable benefits for a resource of this type is tied to summer peak demand reduction. The

Program Administrators will test customer acceptance to respond to winter dispatch signals and continue exploring claimable values that may result from winter demand response performance.

C&I Storage Performance Approach

The C&I Storage Performance offering recognizes that Large C&I customers with demand charges, direct capacity costs, and time of use rates have a different value proposition from residential and small and medium C&I customers. Program Administrator incentives are just one of many accessible revenue streams customers and developers could use to stack for a financially viable project (ISO-NE markets revenue, ICAP tag avoidance, demand charge management). Due to the increased capital and operating costs, customer and developer risk, and lack of current clear access to or mutual exclusivity of revenue streams for energy storage technologies that the Program Administrators are proposing increased performance incentives for C&I storage performance, significantly above the proposed technology-agnostic Interruptible Curtailment performance incentives proposed above.

The Program Administrations have conducted extensive market actor outreach through:

- Multiple discussions with market actors and customers during the 2016-2018 demonstrations, and
- Eversource’s demonstration is investigating customer acceptance of storage, and the ability of energy storage to respond to more events independent of customer loads.

The Program Administrators recognize that there is multiple programs and funding efforts in the State currently targeting storage (ACES, SMART, Clean Peak Standard) and believe this overall offering balances customer flexibility in using energy storage systems for multiple purposes and ensuring that ratepayer funds are used in a manner that provides substantial peak demand reductions for years to come.

Delivery Pathways for C&I Active Demand Reduction Initiative

This fully-integrated initiative uses Curtailment Service Providers (“CSPs”) and the Program Administrator’s existing energy efficiency sales teams to assess curtailment opportunities at a facility and deliver curtailment services to enrolled customers. CSPs identify curtailment opportunities for deployment under the Program Administrators’ initiative, as well as demand charge and ICAP tag management opportunities, and present a complete curtailment proposal to the customer. The demand charge and ICAP tag management provide opportunities for direct bill savings to customers.

This fully integrated approach relies on sales delivery teams promoting efficiency and active demand offerings to customers as they assess opportunities at customer facilities. This approach of using the existing efficiency delivery apparatus is key to the growth of C&I active demand reduction. The robust relationships the Program Administrators have with the target customers (typically large electric customers with interval meters, TOU rates, and demand

charges) have been critical to the demonstration success and are believed to be the source of forward progress on this new initiative.

Customers and CSPs respond to dispatch signals or criteria specified by the Program Administrators, generally using a system peak trigger. Events will be called the day before curtailment as needed. The core model remains focused on reducing demand during summer peak events typically targeting fewer than twenty hours per summer. In the case of energy storage additional hours will be sought. The goal of the offering is to call events at times of peak energy use, however daily peak calls may be able to access greater system benefits. For customers participating in ISO-NE demand response markets, ISO-NE event days will be excluded from baseline calculations. The approach is structured to avoid interfering with the ISO-NE programs or penalizing customers for participating in both programs.

For energy storage resources, or technology not impacting customer comfort or operations, there is an expectation of daily availability. The Program Administrators believe, from our interpretation of the AESC 2018 study, that there are more claimable benefits, specifically from avoided capacity and avoided capacity DRIPE from daily peak calls than just system peak benefits. It is our hypothesis that customers would opt to dispatch daily during the summer months of July and August and maximize revenue from these types of technology if their comfort or operations are not impacted. To this end the Program Administrators propose justifying the significantly increased performance-based incentive for daily dispatch devices.

D. Hard-to-Measure Efforts and Pilots

1. Hard-to-Measure Efforts

a. Statewide Marketing (Residential, Income Eligible, C&I)

i. Introduction

The budget in the Statewide Marketing hard-to-measure initiative is used to support general statewide marketing efforts and the statewide brands, including Mass Save[®]. Program marketing is included in program budgets.

By creating powerful, engaging and motivating education and marketing strategies, Program Administrators can increase awareness of the benefits of energy efficiency and drive increased participation in energy efficiency programs and services. Proposed marketing strategies will consider the unique motivational differences among residential and non-residential customers.

Building on the success of digital and social marketing platforms will continue to be a key focus in the 2019-2021 term. The Mass Save website has become a critical focal point in the comprehensive marketing program, providing a consolidated one stop shop for residents and businesses to learn about energy efficiency, program offerings and opportunities. MassSave.com received over 1.2 million unique visitors in 2017. MassSave.com and the strategies that drive customers to the website will continue to be refined to ensure the highest quality customer

experience. Marketing will continue to leverage the strong social media presence built over the 2013-2015 and 2016-2018 terms. With over 133,000 Facebook fans (www.facebook.com/MassSavers) and nearly 24,000 Twitter followers (www.twitter.com/MassSave), PA marketing and education is able to reach an ever broadening audience. The social media platforms support effective peer to peer marketing, allowing customers to become brand ambassadors.

Reaching out to customers who have not yet participated in Mass Save branded programs remains a fundamental commitment of the Program Administrators. The Mass Save website is currently accessible in English, Spanish and Portuguese, the most common languages spoken across the Commonwealth, and may be translated into additional languages in the future to expand access to diverse linguistic populations. The statewide Mass Save phone line offers five different language options (English, Spanish, Portuguese, Russian, and Mandarin). In 2016-2018, the Program Administrators executed specific educational outreach to reach targeted audiences including Spanish and Portuguese speakers, renters, income-eligible customers, and small business owners, and will continue to target specific audiences in 2019-2021. The Program Administrators will explore affinity marketing opportunities to expand the reach to new market segments while offering the added benefit of supporting the community beyond energy efficiency. For example, Program Administrators are currently engaged in an ongoing awareness study to specifically gauge awareness in Latino and income eligible communities. The results of this study will provide Program Administrators with data to identify areas of high and low customer participation, enabling Program Administrators to deploy targeted community engagement strategies to build Mass Save program awareness and drive participation in these segments. The key themes for the Statewide Marketing efforts for the 2019-2021 Plan are as follows:

- Define who and what Mass Save is and what it means to the customer.
- Increase the message that associates Mass Save with “A way to lower your energy bills” to both residential and business customers.
- Message and graphically tie in the Program Administrator brand logos with the Mass Save mark to create a strong association and clarity of message.
- Utilize the segmentation work identified by the RMC and C&IMC so Program Administrators can better and more consistently target customers.
- Create awareness and understanding of Mass Save as a trusted statewide resource for all customers’ energy efficiency needs.
- Educate customers about the opportunities to save energy and motivate them to act.
- Ensure cross-promotion and broader and deeper program participation through a number of strategies including featuring all energy efficiency programs on social media, driving from Facebook and Twitter to MassSave.com blog articles, etc.

During the 2019-2021 Plan term, the Statewide Marketing Committee will continue to meet monthly and update DOER, through informal discussions, on any new developments concerning the Program Administrators’ statewide marketing efforts. From a market research perspective, the

Program Administrators will continue to conduct campaign studies and track campaign effectiveness in terms of driving customers to the website.

ii. Marketing Plan Overview

The ultimate goal of all educational, community outreach, and marketing efforts is to build a culture of efficiency. It is necessary for a rapidly evolving energy marketplace to be able to utilize a system of effective communication with Massachusetts residents and businesses. This system is a critical tool to support customer awareness, understanding and participation in the Program Administrators' comprehensive energy efficiency programs. Independent evaluation studies and a review of the marketing activities from 2010 to date illustrate the extraordinary growth and success of the coordinated marketing efforts among the Program Administrators and provide insights for Program Administrators to better understand where improvements can be made.

For the 2019-2021 Plan, core objectives of the Program Administrators' public education and promotion campaign include:

- Maximizing reach to ensure *all* residential and business customers are provided access to information and connection to resources.
- Providing compelling and accessible messages, which clearly describe the benefits of energy efficiency without excess jargon or overly technical language.
- Exploring and deploying targeted marketing to unique or specific communities throughout the state (including communities where English is not the primary language).
- Utilizing diverse media (e.g., internet, radio, public transit, social media, bill inserts) to disseminate consistent and clear messages.
- Ensuring that the various strategies work together to ultimately achieve deeper and broader savings.
- Ensuring that customers understand who their local Mass Save sponsor is and increasing the awareness of Program Administrators' commitment to their customers.

Through an extensive array of effective messages and an all-inclusive media strategy, the Program Administrators commit to engaging with the broadest cross section of residential and business customers with tailored, targeted, and actionable information. The careful balancing of breadth, depth, and understanding of customer motivation in the campaigns will drive value to customers and support obtaining the aggressive energy efficiency goals set forth in this Plan.

iii. Mass Save[®]

In 2010, the Program Administrators joined together to promote energy efficiency programs to the Commonwealth through a statewide PA brand. As sponsors of the Mass Save word service mark, the intent of the Program Administrators was to complement their individual PA brands when communicating with residential and business customers about energy efficiency programs.

The Program Administrators are the owners of the Mass Save word service mark. A trademark or service mark identifies goods and services as originating from a single source. Trademarks, in effect, represent the goodwill that a business has built up through its history of offering quality goods and services. A word mark is the most common form of trademark and simply consists of a word or group of words. The Program Administrators have rights to the word mark Mass Save, having obtained federal registration of it on August 29, 2006.

Under trademark law, the Program Administrators monitor and control the use of their marks in order to maintain them and to prevent inferior energy efficiency services from diminishing them. Throughout the past three plan periods, the Program Administrators have overseen significant monitoring efforts with respect to the Mass Save mark to identify unauthorized uses of the service mark. Legal measures have been successful to stop such unauthorized uses and thus the integrity of the mark has been protected.

iv. Marketing for 2019-2021

The Program Administrators maintain a joint statewide website, MassSave.com, which is designed to educate customers and provide access to energy efficiency program information and participation. The website provides the Program Administrators an opportunity to offer streamlined information, including the online home energy assessment and online rebate processing, which offer substantial customer experience benefits. The centrality of this website to the Program Administrators' marketing efforts demonstrates the commitment of the Program Administrators to working together for the benefit of customers throughout the Commonwealth.

In May 2017, the Program Administrators launched a refreshed, improved, modernized MassSave.com website. Upgrades included:

- Optimizing the site for mobile visitors (in addition to customers accessing the site from desktops, laptops, and tablets). Mobile traffic to MassSave.com continues to increase year-over-year; in fact, it accounted for 41% of total traffic to the site in 2017.
- Refreshing each page's content, ensuring it is customer-friendly, compelling, and succinct.
- Consolidating the number of pages on the site, enabling customers to find what they are looking for in fewer clicks.
- Leveraging lifestyle imagery and icons throughout the site, adding visual interest while maintaining a clean look-and-feel.
- Creating interactive tools, enabling customers to simply enter their 5 digit zip codes to find a custom list of participating contractors, retailers, vendors, etc. who serve their area. Tools include listings of:
 - Home Performance Contractors
 - Independent Installation Contractors
 - AC Check Contractors

- Community Action Programs
 - Retailers for Lighting and Products
 - C&I Upstream HVAC Distributors
 - C&I Upstream Lighting Distributors
 - C&I Food Service Vendors
- Introducing personalization variables such as homepage hero images, welcome text, and program promotional content customized to residential, multi-family, and business audiences by zip code. Personalization encourages higher engagement and ultimately improved conversion rates (i.e., online rebate application completions; PDF downloads, product purchases; etc.).
 - Launched homepage hero images and welcome text specific to returning visitors (distinct from what first-time visitors to the site see). Returning visitors receive custom creative based on their customer segment (residential, multi-family, or business) which encourages their further exploration of the site.
 - Ensured all high-traffic program pages are accessible through easy-to-remember vanity URLs such as MassSave.com/Thermostats, MassSave.com/Eligible, MassSave.com/NewHome, MassSave.com/Business, and MassSave.com/Contractors, etc.

While the Program Administrators have recently completed these significant updates, MassSave.com will continue to be evaluated for content and usability and improvements that can be made. The Program Administrators' focus on total customer experience recognizes the entry of the customer through the website as a critical component of that experience. The Program Administrators will continue to feature all the PAs' brands in conjunction with the Mass Save marks per the findings from the Massachusetts Statewide Marketing Campaign Evaluation Report and consistent with their goal to convey who and what Mass Save is.

In addition to optimizing the website, Mass Save uses consistent, succinct, effective campaign messaging: "It's easy to save energy and money with Mass Save."

The Program Administrators use marketing campaigns to increase awareness of energy efficiency and Mass Save across the Commonwealth. The Program Administrators promote the programs across many forms of media, including radio, internet banner ads, social media, smartphone and tablet ads, pre-roll video, native advertising, and print ads.

The marketing efforts include: (1) updating and optimizing the MassSave.com website; (2) posting customer-facing videos on the Mass Save website that share customers' positive experiences with home energy assessments and energy efficiency technologies; (3) leveraging of social media outlets like Facebook and Twitter to launch creative campaigns; (4) reviewing marketing materials and rebate forms across programs to ensure they leverage a consistent look and feel and follow best practices; (5) using an integrated out-of-home advertising campaign,

including platforms such as commuter rail, subway, bus, and billboard ads across the state; and (6) using native advertising and infographics to the mix of promotional strategies.²⁷

The Program Administrators also execute annual and post-campaign studies, allowing the Program Administrators to benchmark and evaluate the effectiveness of their messaging and media planning and adapt the marketing strategies to take into account the results. In reviewing campaigns, Program Administrators review key findings regarding: (1) customer awareness of the Mass Save brand; (2) customer awareness of www.MassSave.com and self-reported website usage; (3) web traffic; (4) clarity and resonance of campaign messaging to residential and commercial customers; (5) self-reported exposure to Mass Save messaging; and (6) depth of knowledge about program offerings among residential and commercial customers. The most recent Mass Save Awareness Campaign showed increases in customer awareness in each of these areas and showed that customers found the messaging to be clear and resonant.

v. Maintenance of Complementary Individual Efforts

While working diligently on the statewide public education efforts, the Program Administrators will also continue individually to maintain customer awareness, satisfaction, and participation goals. Accordingly, the Program Administrators will continue outreach efforts utilizing customer representatives and account executives (who enjoy one-on-one/person-to-person relationships that are especially important in the C&I sector) and PA-specific efforts that complement and are consistent with statewide marketing and outreach efforts.

b. *Statewide Database*
(Residential, Income Eligible, C&I)

The budget in this category is used to support database and data review and sharing efforts, including costs associated with vendors developing and improving Mass Save Data, the Program Administrators' statewide energy efficiency database. Statewide database efforts will affect all sectors, with funds budgeted for each sector. Please see Section IV.I.5 for more information on Mass Save Data.

c. *DOER Assessment*
(Residential, Income Eligible, C&I)

The DOER Assessment represents an annual budget for DOER that is assessed per G.L. c. 25A, § 11H.

²⁷ Native advertising enables the Program Administrators to present educational messages seamlessly within the surrounding website environment, engaging audiences rather than disrupting the user experience. Mass Save also offers educational information on a variety of topics, in a variety of formats.

*d. Council Consultants
(Residential, Income Eligible, C&I)*

The Council consultants budget is managed by DOER and used to support the retention of expert consultants by the Council and reasonable administrative costs, in accordance with G.L. c. 25, § 22(c). The Council must annually submit to the Department a proposed budget for the “retention of expert consultants and reasonable administrative costs.” G.L. c. 25, § 22(c).

*e. Sponsorships & Subscriptions
(Residential, Income Eligible, C&I)*

Costs included on the Sponsorships and Subscriptions hard-to-measure line items provide direct benefits to customers, but are not directly linked to specific in-the-field energy efficiency measures or services. Sponsorships and subscriptions support the energy efficiency market, encourage workforce education, attract skilled employees to Massachusetts, and promote innovation in both service delivery and the development and testing of energy efficient technologies. In accordance with the Order of the Department of Public Utilities regarding the 2019-2021 Three-Year Energy Efficiency Plan and general accepted practice, each sponsorship and subscription expense must be reasonable, prudently incurred, and provide a direct benefit to Massachusetts customers. Detailed definitions are as follows:

- **Sponsorship:** Payment by or on behalf of a Program Administrator to financially support an organization, event, or project directed by a non-PA person or group, in order to gain participation or access to a benefit of sponsorship. The purpose of these costs may include, without limitation, sharing of regional and national best practices, transformation of energy efficiency markets, influencing manufacturers, furthering energy efficiency evaluation techniques and standards, and the ability to network (with customers, contractors, evaluators, or other experts) to learn about additional energy efficiency opportunities and ways in which to improve offered energy efficiency services. These activities all provide benefits to customers and programs generally, but do not focus on a specific initiative. Specific categories of sponsorships enumerated by the Department include:
 1. Energy efficiency forums
 2. Trade associations
 3. National industry associations
 4. Groups that target specific industry sectors
 5. Universities and organizations that develop new technologies
 6. Residential focused groups to educate and engage with the community

Costs reported in the hard-to-measure line items will be limited to sponsorships that are anticipated to provide benefits to customers but are not associated with a specific program or initiative. Conversely, expenses related to the above categories that directly impact programs will be included in the appropriate program budget.

- **Subscription:** Payment by or on behalf of a Program Administrator to receive or use something related to energy efficiency over a fixed period, such as a periodical, a book series, or an informational service.

Costs will be categorized in the appropriate cost category. For additional information on Sponsorships & Subscriptions, please see the policy set forth at Appendix G.

*f. Residential HEAT Loan
(Residential)*

The Residential HEAT Loan budget includes costs to buy down the interest due on the loan and the cost to administer the loans.

The highly successful Mass Save HEAT Loan offers zero percent interest financing to help customers finance the purchase and installation of qualified energy efficiency technologies. For some customers, raising sufficient capital to pay for their upfront customer contribution is a barrier to installing energy efficiency. Financing allows these customers to borrow funds, without having to also bear the cost of the interest on the loan, in order to invest in energy efficiency. Customers may qualify for loans up to \$25,000 with terms up to 7 years, depending on the Program Administrator and the loan provider.

Additionally, some pre-weatherization repair costs may be eligible for financing if the repair removes the barrier to installing insulation measures. As discussed above, the Program Administrators are expanding the list of barriers eligible for financing through the Mass Save HEAT Loan® to include the most common pre-weatherization barriers identified during the Home Energy Assessment. Barriers include knob-and-tube wiring, combustion safety issues, mold, vermiculite and asbestos, and certain structural concerns. Additionally, the Program Administrators are increasing the allowable financing amount for mitigating pre-weatherization barriers.

As part of the new active demand reduction offering, battery storage will also be added to HEAT loan eligible equipment, if customers agree to participate in the active demand offer.

Any savings or costs associated with installing energy efficiency measures due to availability of the HEAT Loan are included in the core initiative under which the measure was installed, for example, in Residential Coordinated Delivery. HEAT Loans are generally administered by the electric Program Administrator, except for instances in which a gas Program Administrator serves a customer in a municipal light plant territory, in which case the gas Program Administrator would offer the loan. Program Administrators have worked with the Massachusetts Bankers Association to provide procedures for banks to participate in the program.

The process for applying for a HEAT Loan is described in detail on <https://www.masssave.com/en/saving/residential-rebates/heat-loan-program/>.

*g. Workforce Development
(Residential, Income Eligible, C&I)*

The Program Administrators continue to monitor and support trainings in order to contribute to building and maintaining a qualified workforce that will meet the demand for energy efficiency. Trainings provided under Workforce Development provide general skills not specific to a certain program, including topics such as building science, energy efficient new construction, heating and cooling technologies and techniques, and marketing. Trainings can help promote cross-training across different areas of expertise. Program Administrators consistently look for collaborative ways to improve the communication and delivery of trainings to address the demands of the market. This effort is ongoing within the respective management groups and best practices group, as exemplified by the Low-Income Best Practices Working Group chaired by LEAN, and the Contractor Best Practices Working Group, as well as through ongoing communication with key trade allies. In 2019-2021, all Program Administrators will be charging only external (non-employee) general training to this hard-to-measure category.

*h. Research and Development (“R&D”) and Demonstration
(Residential, C&I)*

In the continued efforts to explore new technologies and measures, Program Administrators set forth this budget to pursue new technologies, processes, and strategies that may not immediately lead to savings. This allows the Program Administrators to be proactive, and to be leaders in innovation. Costs associated with the MTAC, as well as research and development into areas of interest, are charged to this category.

*i. Residential Education
(Residential)*

The budget in the Residential Education hard-to-measure effort is used to support public education efforts.

The key objective of the Residential Education effort is to offer an array of K-12+ educational outreach programs and enhanced consumer education. The focus will be to create powerful, engaging, and motivating education and marketing strategies that will increase awareness of the benefits of energy efficiency and drive increased participation in Mass Save energy efficiency programs and services. The strategies developed for statewide energy efficiency education, outreach and marketing will augment the efforts already in use by several Program Administrators.

The Program Administrators’ support of educators, students, and parents through program opportunities, curriculum, and materials on energy efficiency and conservation is a critical component in fostering an energy efficiency literate society. Students are the Program Administrators’ future customers and staff, and instilling positive energy behaviors in them will prove to be a positive outcome for society.

Several Program Administrators collaborate with the National Energy Education Development (“NEED”) Project, bringing energy efficiency curriculum and training to teachers in Massachusetts. Teachers also receive ongoing support for implementing energy efficiency programming in the classroom.

Additional efforts directed at consumers focus on educating customers on the benefits of investing in energy efficiency products and services and the multitude of energy efficiency initiatives available to them. Collaborative efforts for consumer education in the 2013-2015 and 2016-2018 plans included the Energy Savvy online energy assessment tool on the Mass Save website and kits containing “Kill A Watt” meters available through libraries. These efforts will be continued in 2019-2021.

Some Program Administrators also conduct additional direct outreach and provide additional in-school programming to schools in their service territories. These programs will continue to evolve and expand to reach more students. Many of these programs have earned local and national awards for energy education programs.

The Program Administrators plan to work with DOER, educational institutions, the statewide marketing working group, and PA education and/or marketing departments to continue to develop educational and promotional strategies. Efforts for school-aged education will focus on expanding the existing, in many cases award-winning, PA school programs. Educational outreach strategies for 2019-2021 may include:

- Provide energy efficiency related classroom presentations and activities to K-12+ schools.
- Direct educators and children to online educational resources to help educate children about energy safety and conservation.
- Aid with science fairs, teacher training workshops, and other elementary and secondary educational opportunities in collaboration with DOER, Massachusetts Department of Education, and schools throughout the Commonwealth.
- Encourage schools and informal education programs to participate in the annual NEED Project’s Youth Awards Program held in April of each year, with follow-up awards program and ceremony in June in Washington, D.C.
- Partner with youth group summer camps promoting energy conservation and behavioral change.
- Partner with communities to educate and promote energy efficiency through energy fairs and community-specific outreach.
- Participate in various energy efficiency employee awareness events.
- Conduct school fundraisers promoting energy-efficient technologies.
- Offer prompt-based contests for students to showcase their energy and energy efficiency knowledge.

- Direct customers to online calculators and web tools to learn more about home energy usage and to offer energy saving recommendations, including information on available energy efficiency incentives.
- Partner with vocational high schools to promote green jobs by providing training and curriculum.

The Program Administrators will work to develop energy efficiency marketing messages aimed at residential customers, educators, students, parent/teacher organizations, and community groups. Proposed collateral will highlight the many benefits of investing in energy efficiency, savings that can be generated by individual efficiency measure upgrades, behavioral changes, and testimonials from past program participants. The Program Administrators will employ a variety of media sources for messaging, which may include bill inserts, bill messages, customer newsletters, www.masssave.com, direct mail, employee and business partnerships, newspapers, social media outlets, and educator workshops.

*j. Low-Income Energy Affordability Network
(Income Eligible)*

LEAN works with the Program Administrators to comprehensively serve income eligible households. LEAN delivers income eligible energy programs and represents income eligible Program Administrator customers in legislative discussions and regulatory proceedings. The LEAN budget is used to pay for their administrative and personnel costs related to income eligible implementation.

*k. Evaluation and Market Research
(Residential, Income Eligible, C&I)*

Starting in 2019-2021 the Program Administrators propose to charge all EM&V costs to a hard-to-measure line item called Evaluation and Market Research, rather than to individual programs. This change aligns more effectively with current EM&V efforts, which apply to multiple program areas. In fact, the lessons learned from EM&V studies are often applicable to many or all of the programs. Given that EM&V costs are necessary and important, but do not directly lead to savings opportunities, they are appropriately categorized as hard-to-measure. This change will also allow reviewers to better evaluate the actual costs of implementing the program, without comingling the costs of evaluating the program. This budget category will include costs associated with the EM&V budget, potential studies, the avoided energy supply cost study (“AESC Study”), the Technical Reference Library (“TRL”), acquisition of data sets, related labor costs, and other evaluation and market research costs. Evaluation and Market Research costs will be allocated to one or more sectors as appropriate to the activity.

2. Pilots

The Program Administrators are not proposing any new pilot programs or initiatives for the 2019-2021 Plan term.

E. **PA-Specific Programming**

The Program Administrators strive for consistency in program offerings with the goal that customers across the Commonwealth can take advantage of comprehensive energy efficiency services. In some instances, however, individual Program Administrators may provide additional services or unique incentive structures that are specific to their territory. These offerings may be specifically related to the unique characteristics of a service area, or may be developed based on unique conditions in that territory, such as gas constraints or reduction in expense related to very large capital improvement projects. They may also be based on the governing structure of a Program Administrator, such as the Compact, which has a distinct role as a municipal aggregator. Finally, these efforts may be run as a test case by one Program Administrator, with the idea that the programming could be rolled out across Program Administrators if proven successful and cost-effective.

The PA-specific initiatives set forth in Appendix H represent proposals of only the Program Administrator making the proposal. They do not constitute proposals that have been reviewed and agreed to by all Program Administrators, and Program Administrators may have divergent views on the materials contained therein. All Program Administrators reserve their right to comment on these proposals in the future, and the inclusion of these materials does not constitute the consent of any Program Administrator to any other Program Administrator's specific initiatives or proposals.

F. **Coordination and Best Practices**

1. **Management Committees and Working Groups**

a. Overview

Consistent with the GCA, the Program Administrators work together to jointly develop and implement the Three-Year Plan. The Program Administrators have maintained their commitment to work collaboratively on a daily basis to ensure that all eligible customers in Massachusetts experience seamless programs, with consistent application procedures, incentives, and supportive educational and technical services. The Program Administrators consistently develop and share best practices and seek continuous improvement to provide the best possible service to their customers. The Program Administrators have developed management committees, working groups, and best practices committees to have structured channels for sharing best practices. Additionally, the PA Leads, which consists of the individuals responsible for overseeing their respective Program Administrator's energy efficiency activities, collaborate extensively to ensure that the overall strategy and vision remains consistent and in the best interests of customers. The PA Leads meet at least monthly to discuss and set statewide objectives, share challenges and opportunities, and management practices. The PA Leads provide guidance and directives, as needed, to the various management committees.

b. Residential and C&I Management Committees

The Program Administrators maintain working groups that bring together experts from every gas and electric company and energy efficiency service provider in the Commonwealth. These working groups provide for seamless program delivery across fuels and across service territories, and help maintain consistent messaging to customers, trade allies, manufacturers, market actors, and market channels. Chief among these groups is the Residential Management Committee (“RMC”) and the Commercial & Industrial Management Committee (“C&IMC”), which work together and with the Council’s consultants to plan and deliver programming in their respective sectors. Managing and delivering a statewide portfolio of programs is an ongoing and dynamic exercise, and the management committees are a venue for the program managers to discuss consumer dynamics and expectations, new efficiency technologies, price and baseline changes, effects of evaluation studies on the programs, and changes in the market. In addition to enhancements to existing programs and initiatives, new programs and initiatives are primarily designed by the management committees.

Each management committee works to ensure that: (a) all Program Administrators remain up-to-date on the key activities of other Program Administrators; (b) implementation activities and efforts by all Program Administrators are integrated and coordinated to the optimal extent; (c) program implementation and the Statewide Marketing Committee is coordinated; (d) evaluation and market assessment studies are reviewed and appropriate recommendations are implemented in the programs; (e) program policy and implementation issues are resolved collectively, and decisions are communicated to each PA’s staff to ensure uniform application; and (f) program best practices, technology innovations, and integration and coordination efforts in other jurisdictions are reviewed and incorporated as appropriate.

The RMC, C&IMC, and Evaluation Management Committee (described below) meet altogether quarterly in Tri-Management Committee (“Tri-MC”) meetings to discuss topics of interest to all management committees. The Tri-MC provides a unique forum for the Program Administrators to communicate and coordinate on topics affecting the statewide programs.

These Management Committees provide an essential function for the Program Administrators to maintain the statewide collaboration and consistent programs that are the hallmark of the nation-leading Massachusetts energy efficiency programs.

c. Low-Income Best Practices

With respect to income eligible efforts, LEAN has convened the highly effective Low-Income Best Practices Group to coordinate practices across all Program Administrators and agencies. The Low-Income Best Practices group meets regularly, and continues to offer opportunities for various stakeholders to discuss program implementation, new measures, innovative strategies, and other matters related to the Program Administrators’ income eligible programs.

d. Evaluation Management Committee

The Evaluation Management Committee (“EMC”), established by the Program Administrators and the EM&V Consultant, serves as a steering committee for statewide evaluation activities and issues, providing guidance and direction to each of the evaluation research areas. The EMC works to plan, prioritize and delineate the research studies to be undertaken over the Three-Year Plan term. For more information about the EMC, please see Section H.2.

e. The Massachusetts Technology Assessment Committee

MTAC reviews new technologies that have the potential to cost-effectively save energy. MTAC is both a proactive and a reactive body, and consists of key PA technical staff. The committee addresses residential, commercial and industrial technologies, drawing on the subject matter experts from the committee, PA staff, or outside expertise as necessary. It establishes and publishes threshold technical requirements that must be met to qualify products or processes as eligible for program incentives. It documents its findings in a standardized manner and disseminates them to the PA program managers, technical staff, account managers, and outside parties such as vendors, customers, and other interested parties, as appropriate.

The MTAC is the authority for consistent program interpretation of technical matters relating to emerging technologies and provides information, documented technical interpretations, and technology assessments to the Program Administrators. The committee has developed a set of protocols for the content of their review and procedures for documenting and disseminating their conclusions and technical interpretations. These protocols are publicly available on MassSave.com.²⁸ The MTAC meets as needed, either as a whole committee or in ad hoc technology or issue-specific subgroups, and more regularly during the annual program review and planning period.

f. Other Committees and Working Groups

The Program Administrators convene other long-term and short-term working groups. Some are discussed below.

Statewide Marketing Committee organizes statewide marketing and media campaigns, manages www.MassSave.com, updates social media campaigns, and works to ensure that communications are presented in multiple channels to reach highly diverse customer bases. The Combined Heat and Power Group sets standards required for projects including efficiency levels and incentives. The Common Assumptions Group works to maintain consistent application, calculation, and presentation of savings, benefits and costs. The Demand Working Group works on initiatives related to reducing customer demand, including pilot programs, cost-effectiveness review, and statewide strategies. The Program Administrators also have groups that review tables, specific costs, codes & standards, and education efforts, among other aspects of the energy efficiency programs.

²⁸ MTAC materials can be found here: <https://www.masssave.com/en/learn/partners/assessing-new-efficiency-technologies/>.

2. Community, Stakeholder, and Third-Party Engagement

The Program Administrators are continuously engaged with a variety of stakeholders. Every day the Program Administrators communicate with residential and commercial customers, program participants, contractors, service providers, equipment manufacturers and distributors, trade and professional associations, legislators and regulators, environmental and community advocates, civic leaders, business owners and organizations, media and marketers, and other interested parties. Every citizen and every business has an interest and a stake in the effectiveness of the portfolio of Massachusetts energy efficiency programs because energy costs touch and affect every person and business in the Commonwealth.

Massachusetts residents and other interested parties can voice their views through existing and established public oversight processes. The Council, which represents a broad spectrum of stakeholder interests, has facilitated additional organized venues for individual and organizational input specific to the energy efficiency programs through regular public comment periods at Council meetings, and additional sessions during the Plan development time period. All the comments and input collected from these various forums are reviewed closely by the Program Administrators.

On a continuing basis, there are a variety of other structured or semi-structured events, venues, or processes through which stakeholder input is encouraged. For example:

- **Annual open houses for trade allies.** Every year the Program Administrators host several large statewide events for the express purpose of presenting and explaining program changes and updates to the business partners the Program Administrators depend on to deliver their various programs to customers. Attendees have ample opportunity to network with each other and PA staff, and to engage in a dialog about program design and operations.
- **Best Practices Working Group.** This group is constituted of a subset of the residential contractors elected annually by their peers, as well as the Program Administrators, and the Lead Vendors. The members meet monthly to provide continuous feedback for the improvement of the program across the state. Topics discussed have ranged from refining the QA/QC process, to adopting new measures such as spray foam, to pricing and training.
- **The Proposal process.** The Program Administrators provide a structured process by which any third-party organization can propose to a management committee a program concept or proposal to supplement or enhance the Program Administrators' approved programs. The criteria and two-step process for considering a proposal is clearly articulated. This process, while open, is rigorous and applicants must demonstrate that their concept can demonstrate and produce cost-effective and incremental energy savings beyond the work being performed by the Program Administrators.²⁹

²⁹

The documents related to the proposal process are available at:
<https://www.masssave.com/en/learn/partners/process-for-managing-proposals/>

- **The Massachusetts Technology Assessment Committee process.** The clearly-articulated and open process by which MTAC reviews submitted technologies provides a level playing field. Any manufacturer or vendor of an emerging or newly-commercialized efficiency technology can make a science-based case for acceptance of their product into the Program Administrator offerings.
- **Informal Program Administrator speakers' bureau.** Program Administrator representatives are regularly called upon to represent and explain the programs to trade and civic associations. Industry associations, like the Massachusetts Restaurant Association and the Massachusetts Lodging Association, seek knowledgeable speakers to explain how the programs can work for their members and provide relevant case study examples from their industry.
- **Proactively solicit input from customer and industry experts.** The Program Administrators routinely seek input from key constituencies when they are considering program design changes or considering new product innovations. For example, a Program Administrator may need to establish that a product meets a customer's priority business need before promoting the energy saving attributes.
- **Input and advice from peer programs.** The delivery of energy efficiency programs throughout the country is largely a collaborative and congenial enterprise. PA program managers have come to know their peers in other jurisdictions around the country, and consider each other colleagues in a shared mission of improving the efficiency of homes and businesses in the United States. This means that emerging program ideas and best practices are freely shared. Massachusetts program managers test program concepts and share evaluation results and technical information with their counterparts, and receive feedback that is built into new program designs or improvements to existing ones.
- **Provide collateral materials for customer events.** Individual Program Administrators routinely offer stakeholders significant volumes of energy efficiency program collateral for distribution at local community and trade association meetings.

IV. STATEWIDE BUDGETS, SAVINGS, AND BENEFITS

A. Summary of Budgets, Lifetime Savings, and Benefits

1. Introduction

The program budgets, savings, and benefits set forth in this Plan are presented on an aggregate, statewide basis. In the Energy Efficiency Data tables, each Program Administrator provides its individual recommended savings and budget levels for the three-year term commencing January 1, 2019, consistent with the statewide program designs and energy efficiency framework. Please also see Appendix C for statewide Energy Efficiency Data Tables for budgets, savings, benefits, and cost-effectiveness.

As described above, the Program Administrators have set forth four key savings metrics in this Plan designed to measure success and support their overall holistic approach to reducing energy use for customers. The key savings metrics are:

- Net lifetime all-fuel savings (MMBTu) (excluding MMBTus associated with combined heat and power, and active demand reduction efforts)
- Demand savings (kW) (excluding fuel conversions) for electric Program Administrators
- Net lifetime electric savings (MWh) (excluding fuel conversions and active demand reduction efforts) for electric Program Administrators
- Net lifetime gas savings (therms) (excluding fuel conversions) for gas Program Administrators

Please see Section II.C for more details regarding the use of these core savings metrics for measuring success in 2019-2021.

Following historic aggregate savings achievements, the goals set forth in this Plan reflect the current market after years of energy efficiency programming in Massachusetts, the unique characteristics of each Program Administrator's service area, the specific needs of each Program Administrator's customers, and Massachusetts state policy goals related to energy. These programs provide benefits for customers related to avoided costs, non-energy impacts, greenhouse gas reductions, and job growth and retention.

2. Statewide Combined, Electric, and Gas Data

a. *Statewide Electric Data*

Electric PA Budgets (\$)				
	2019	2020	2021	2019-2021
Residential	269,011,553	260,466,776	254,715,345	784,193,673
Income Eligible	73,740,929	76,871,449	77,682,718	228,295,096
Commercial & Industrial	277,485,070	289,798,994	309,325,061	876,609,125
Total	620,237,552	627,137,219	641,723,124	1,889,097,894

Electric PA Net Lifetime Savings All Fuels (MMBTu) (excluding CHP and ADR)				
	2019	2020	2021	2019-2021
Residential	12,563,018	12,976,711	13,175,257	38,714,986
Income Eligible	2,884,987	2,908,533	2,951,754	8,745,274
Commercial & Industrial	20,460,685	20,548,627	20,384,018	61,393,329
Total	35,908,690	36,433,871	36,511,028	108,853,589

Electric PA Lifetime Electric Energy Savings (MWh) (excluding fuel conversions and ADR)				
	2019	2020	2021	2019-2021
Residential	1,848,327	1,580,733	1,188,543	4,617,603
Income Eligible	380,683	376,365	380,288	1,137,336
Commercial & Industrial	7,782,886	7,748,678	12,234,924	27,766,488
Total	10,011,896	9,705,776	13,803,754	33,521,427

Electric PA Summer Peak Demand Reductions (kW) (excluding fuel conversion)				
	2019	2020	2021	2019-2021
Residential	63,771	63,161	60,276	163,935
Income Eligible	4,527	4,563	4,569	13,660
Commercial & Industrial	178,312	215,447	274,743	436,200
Total	246,610	283,172	339,589	613,795

Statewide tables reflect aggregated proposals of the individual electric Program Administrators.

b. Statewide Gas Data

Gas PA Budgets (\$)				
	2019	2020	2021	2019-2021
Residential	152,047,107	154,937,374	160,044,442	467,028,923
Income Eligible	52,716,005	53,127,721	51,639,105	157,482,831
Commercial & Industrial	45,165,665	46,752,879	47,616,966	139,535,510
Total	249,928,777	254,817,975	259,300,513	764,047,264

Gas PA Net Lifetime Savings All Fuels (MMBTu)				
	2019	2020	2021	2019-2021
Residential	16,449,284	16,711,841	17,213,159	50,374,284
Income Eligible	4,606,447	4,685,657	4,444,439	13,736,543
Commercial & Industrial	14,470,756	14,592,348	14,908,657	43,971,762
Total	35,526,487	35,989,846	36,566,256	108,082,589

Gas PA Lifetime Gas Savings (therms) (excluding fuel conversions)				
	2019	2020	2021	2019-2021
Residential	161,007,427	161,427,010	165,830,965	488,265,402
Income Eligible	45,561,686	46,352,861	43,939,524	135,854,070
Commercial & Industrial	144,686,347	145,903,140	149,066,002	439,655,489
Total	351,255,460	353,683,011	358,836,490	1,063,774,961

Statewide tables reflect aggregated proposals of the individual gas Program Administrators.

B. Common Assumptions and Technical Reference Library

The Program Administrators continuously work together to develop and apply common assumptions. Consistent collaboration and structured review of common assumptions through the working groups, such as the Common Assumptions Working Group, allows the Program Administrators to collectively provide the best available data in the most consistent manner. The Program Administrators work together to harmonize assumptions and approaches to various cost, savings, and benefits data. Program Administrators collectively determine way the avoided costs from the AESC Studies and evaluation results are applied, including non-energy impacts.

Additionally, Program Administrators have worked together to include similar data, measure IDs, and naming conventions in the screening models and TRL.

Specific program assumptions are accounted for uniformly, and algorithms are applied in the same manner across Program Administrators, as set forth in the TRL. The TRL documents how the energy efficiency Program Administrators consistently, reliably, and transparently calculate savings resulting from the installation of prescriptive energy efficiency measures. The TRL provides methods, formulas, and default assumptions for estimating energy, peak demand, and other resource impacts from energy efficiency measures. The TRL is an excellent example of how the Program Administrators work together, share data and best practices and work to develop common assumptions that reflect state-of-the-art EM&V results. The Program Administrators have transitioned the former technical reference manual into an electronic version, which is available publicly and provides additional search functions to aid users. The TRL reports are available at <http://www.masssavedata.com/Public/TechnicalReferenceLibrary>. The Program Administrators are working on improvements to the electronic TRL in order to provide a more user-friendly experience.

Under the GCA, the Program Administrators implement common programs. Therefore, in order to be able to review participants in a consistent manner, the Program Administrators develop a set of common definitions to guide each Program Administrator's participant calculation. These definitions are designed to reflect unique participants in each program and initiative. The programs have been re-imagined for this Plan, and therefore, the participant definitions must be redefined. The Program Administrators are refining common participant definitions, which will be submitted with the October 31, 2018 Plan.

C. **Development of Goals**

1. **Introduction**

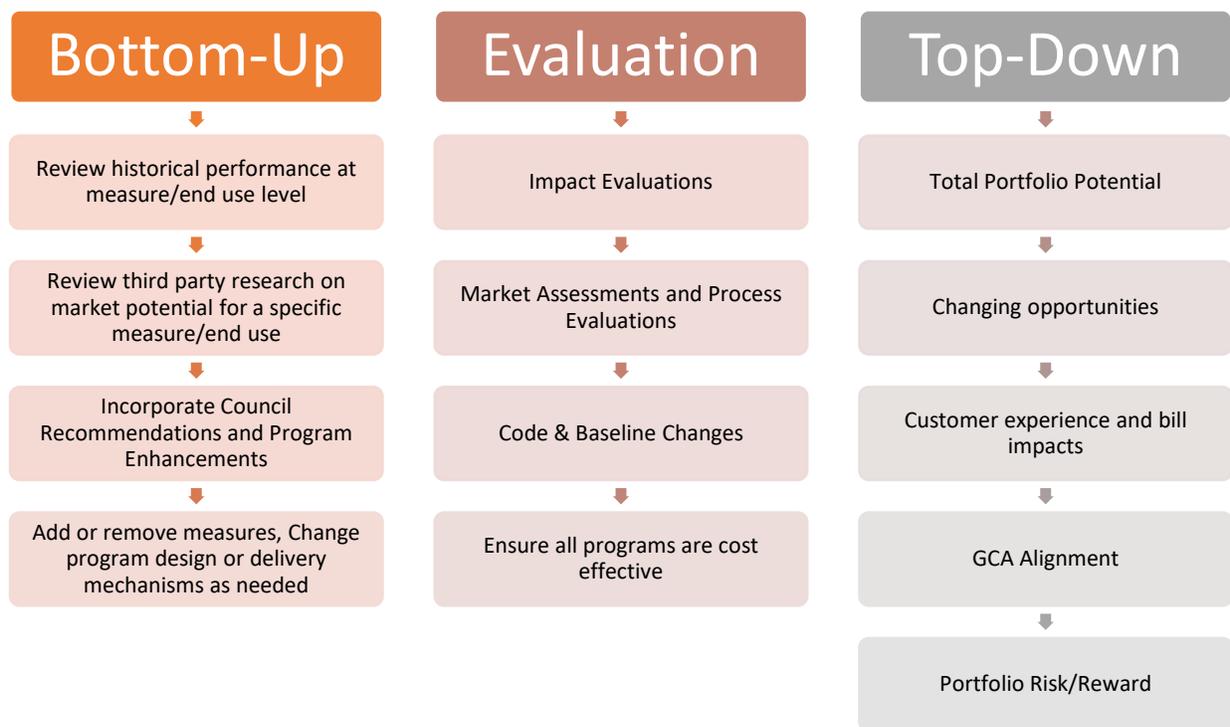
The Program Administrators engage in a highly collaborative and detailed planning process for setting savings goals and budgets. Programmatic decisions that inform savings goals and budgets are made both at the individual PA level and at the statewide level, including work by the respective management committees, which facilitate ongoing stakeholder input, continuous sharing of best practices, and consistency of offerings among the Program Administrators. While ultimately the results associated with development of a Program Administrator's plan are PA-specific and the planning process for savings varies for each program and initiative, certain common processes apply to inform the development and to facilitate regulatory review.

2. **Process to Determine Goals**

a. Overview

The development and determination of the proposed statewide and Program Administrator-specific savings goals involves many considerations, and there is no simple, algebraic method to develop goals to meet the requirements of the GCA. The Program Administrators' process considers many factors, including the assessment of savings opportunities in individual PA service

areas (bottom-up), incorporation of recent evaluation study findings, and a collaborative consideration of statewide policy objectives that balances savings goals with the total cost of capturing energy efficiency (top-down). The bottom-up process involves determining savings by measure, including projected quantities and customer incentive amounts for every piece of energy efficient equipment, and the type of technology or program service. The top-down process looks at the portfolio as a whole, evaluating the potential for achieving savings given the mature markets in which the programs are operating, subject to overall cost. The impact of evaluation results, including process and market assessment studies, are considered in both bottom-up and top-down planning and may drive other adjustments. The process to determine goals is appropriately fluid, flexible and iterative, incorporating information that the Program Administrators learn throughout the planning process related to program design, evaluation, market conditions, costs and other factors.



The 2019-2021 Plan accounts for many interacting considerations, including, but not limited to, bill impacts, cost-efficiency, integrated program delivery, economic and environmental benefits, efforts focused on innovation, customer experience, changing market conditions, and the need to establish an “integrated” effort that can be “sustained” over time, as mandated by the GCA. G.L. c. 25, § 22(b). In assessing the level of energy efficiency savings that is possible and sustainable for this Plan, the Program Administrators considered a number of factors. These factors include: (1) quality of program implementation; (2) customer economic conditions; (3) bill impacts; (4) market conditions/seasonality for various measures; (5) lower avoided costs; (6) market barriers; (7) equity concerns; (8) the need to avoid “stops/starts” that send negative messages to the contractor community; (9) the capacity and reach of vendors and contractors; (10) the need to provide consistency over time to be able to capture time-dependent opportunities such

as renovations and new construction; and (11) the need to accommodate new technologies over time. Ensuring sustainability requires the Program Administrators to examine all of these considerations when developing their energy efficiency goals.

The planning process for the 2019-2021 period began with a focus on customers' experience with the suite of energy efficiency programs. Significant effort and expertise was dedicated to reviewing the hierarchy of both residential and C&I programs and initiatives. As a result, the Program Administrators have refined the design of programs to better reflect how energy efficiency services are accessed from the perspective of customers. Refocusing Program Administrator efforts to enhance the customer-centric program design will help to promote flexibility in delivery models, and drive maximum achievement of energy efficiency savings and benefits.

b. Bottom-Up Planning

The bottom-up planning process includes a combination of PA-specific and statewide activities, is iterative, and is often impacted by changes to program design and delivery models. The enhanced focus on a customer-centric approach affects bottom-up planning in that the budgeting process will now be driven more strongly through multiple channels. For example, the budgeting process in the Residential Retail initiative is driven by the number of rebates expected to be delivered through mass market, while the Residential Coordinated Delivery initiative is planned based on the projected number of assessments undertaken, homes weatherized, and customers served.

The Program Administrators typically begin each planning process by examining historical data to gain insight into participation trends, savings achieved, and costs to achieve annual and lifetime savings. The Program Administrators also consider recent or pending changes in federal efficiency standards, as well as other third-party research on consumer adoption of new technology. In parallel to each Program Administrator assessing what they can achieve over the next three years, the Program Administrators collaborate to decide what changes, if any, need to be made to program offerings. For example, the Program Administrators may decide to discontinue measures that have become standard efficiency practice, or to add new measures and services in response to improved technologies or identified consumer needs, subject to consideration of cost-effectiveness. The value of energy benefits is determined through a regional AESC Study, which also guides the Program Administrators as they look to achieve all cost-effective energy efficiency opportunity. See Appendix F.

The statewide planning work is undertaken at the respective management committees and working groups, ensuring input from all stakeholders, continuous sharing of best practices, and facilitating consistency of offerings among the Program Administrators. Each Program Administrator uses this information to develop a forecast of energy efficiency that can be achieved in its unique service territory. Program Administrators also consult with their own or statewide vendors to support or augment their forecasts based on their own market intelligence. Manufacturers and contractors may also be consulted for insight into workforce capacity and technology availability and limitations.

c. Top-Down Planning

While bottom-up planning focuses on individual measures within each Program Administrator's service territory, top-down planning considers what is reasonable and achievable for the energy efficiency portfolio as a whole. This planning effort involves the examination of impacts to the markets the programs are targeting, as well as cost implications to the Program Administrator, its participating and non-participating customers.

One of the tools that Program Administrators use in top-down planning is potential studies, which help Program Administrators to better understand the overall opportunity to achieve energy efficiency savings within their territory. Potential studies typically provide the Program Administrator with insight into three types of energy efficiency potential:

- *Technical Potential* is defined as the *complete* saturation of energy efficiency measures that are technologically feasible without consideration of cost or likely consumer acceptance.
- *Economic Potential* is a subset of *technical potential* consisting only of that technology that results in more benefits than costs over the life of the measure.
- *Achievable Potential* is a further subset of economic potential and is limited to that which is attainable given barriers faced by real-world program infrastructure and customer, market or other limitations.³⁰

The Program Administrators use the results of potential studies to gain valuable insight into the achievable, cost-effective energy efficiency potential over a period of years. This information helps guide the Program Administrators to set term savings goals that consider not only what is available and cost-effective, but also how willing and able customers are to adopt energy efficiency measures. Each of the Program Administrators has performed a territory-specific potential studies in advance of the 2019-2021 Plan filing in accordance with the Department's directive. 2016-2018 Three-Year Plans Order at 24-25. The results of those studies, and the lessons learned, have been shared among all Program Administrators so that each PA can learn from these studies. Each of the potential studies, in addition to providing technical, economic, and achievable scenarios as described above, looks at several different scenarios of achievable potential in order to understand the sensitivity of achievable savings to inputs such as increased incentive levels and higher levels of spending on marketing and program awareness. The studies generally include statements of potential that range from looking at the "business as usual" case, up to a scenario in which 100 percent incentives are assumed. The Program Administrators review these scenarios with an understanding of the need to minimize customer bill impacts, and the need to maintain sustainable energy efficiency efforts over time. The Program Administrators also take into account any changes in market conditions or other information that may impact the recommendations from the potential studies. The PA-specific potential study materials are attached at Appendix I.

³⁰ Potential definitions are based on ACEEE definitions available at <http://aceee.org/topics/efficiency-potential-and-market-analysis>.

d. Evaluation Results

As noted above, Program Administrators also utilize the results of third party evaluation to inform proposed goals. As part of the statewide EM&V framework, the Program Administrators collectively conduct many different types of evaluation studies, including impact evaluations, baseline studies, net-to-gross studies, market effects evaluation, non-energy impact studies, cost and measure life studies, market characterization, and process evaluations. For more information on each type of study please see Section IV.H.4.

e. Cost Drivers

A final step in energy efficiency goal setting for the three year term is to develop budgets to deliver the energy efficiency programs to the marketplace. This involves assessing the cost impact of the programs on participating and non-participating ratepayers in support of “right sizing” proposed budgets. The Program Administrators’ statewide energy efficiency programs have matured significantly since the development of the first Three-Year Plan in 2009, as have the technologies that are promoted through the programs. In the 2019-2021 term, the Program Administrators face new challenges in pursuing all cost-effective energy efficiency, including more robust lighting and equipment baselines, stretch code adoption in most of Commonwealth towns and cities, and widespread adoption of the easiest and least expensive energy efficient technologies such as LED lighting. The cost of marketing, delivering and evaluating ever more sophisticated programs is also expected to increase in order to capture more complex and deeper opportunities, such as controls and demand reduction.

To address these challenges and deliver cost-effective energy efficiency programs to their customers, the Program Administrators have developed a thorough understanding of current and future cost drivers for their proposed energy efficiency programs. Because each Program Administrator is affected to a different degree by each cost driver, variations in savings goals and the cost to achieve these goals are to be expected. Customer demographics, fuel mixes, economic conditions, differences in the built environment and even contractor wages vary widely across the Commonwealth and impact each Program Administrator’s service territory differently. Each Program Administrator sets its goals based on their own unique service territory.

From 2009-2011, the cost to achieve savings for electric energy efficiency programs throughout the state was trending downwards.³¹ During that same period, the cost to achieve savings for gas programs was trending upwards. From 2012-2014, the cost to achieve savings for electric and gas energy efficiency programs throughout the state was relatively stable with a modest increase in the cost of delivering gas programs. During the 2016-2018 there was an upward trend in cost to achieve savings from 2013-2015, though thanks to cost-effective implementation

³¹ The Program Administrators note that the costs and savings of large, one-time projects can skew the historical costs to achieve savings, often making the costs appear lower than the average. Because large projects are not typical or replicable, they should not be included in the planning process to estimate budgets or savings, or when calculating costs to achieve savings, without careful analysis and appropriate adjustments. For example, some Program Administrators had large CHP projects in 2011, making the cost per kWh appear to decrease in 2011 compared to previous years. When excluded, however, costs were relatively flat.

practices, the increase was not as great as Program Administrators anticipated.³² Although the number of customers to be served in 2019-2021 is expected to remain steady, the average claimable savings per participant will be lower due to naturally-occurring energy efficiency and past participation, as well as more stringent local, state and federal codes and standards. As a result, the Program Administrators anticipate that costs will increase due to a shift to a shorter-lived and more expensive measure mix. Additional details on key cost driver considerations include the following:

- **Codes and Standards** – As federal and state codes and standards become increasingly rigorous, the amount of incremental savings from installing energy efficiency measures decreases (unless the efficiency of the program measures rise as well). This decrease in savings results in a higher cost per unit of savings. The Energy Independence and Security Act (“EISA”) lighting standards continue to raise the bar for program delivery, as do federal water heater standards, the highly efficient new construction practices in the Commonwealth driven both by the GCA requirement that member communities adopt stretch codes, as well as by aggressive outreach by Program Administrators, and increasing federal standards for many different kinds of equipment. While these changes still drive real savings for customers in the Commonwealth, these factors reduce the incremental energy savings the Program Administrators can capture and claim through their programs.
- **Going Deeper and Broader** – Another factor that is impacting the cost to achieve in this Plan is the planned implementation of new program delivery models, including the enhanced customer-centric approach. As certain programs begin to saturate markets, Program Administrators seek to reach more difficult to reach customers,³² which requires more creative, and often more expensive marketing efforts, as well as deep savings, such as Passive House. During the 2019-2021 term, the Program Administrators have restructured programs and initiatives to provide multiple points of entry for customers, regardless of the services or equipment sought, which may be more expensive than previous strategies. Some initiatives proposed for 2019-2021, such as Residential Coordinated Delivery, are designed to be more comprehensive in scope than the previous initiatives. This reflects more seamless, more comprehensive, and more supportive approach to program design and delivery. Program Administrators incorporated findings of process and market evaluations to adjust programs to further penetrate already deeply penetrated markets.
- **Cost-Effectiveness Limitations** – The 2018 AESC Study projected a continued decline in wholesale natural gas prices as well as electricity and summer demand prices. As a result, the energy-related benefits of energy efficiency programs are lower than they have been in prior terms, challenging Program Administrators to minimize costs and maximize benefits to maintain cost-effective program delivery. Some traditional measures may become non-cost-effective. The Program Administrators are pursuing new delivery options as well as new technologies to capture untapped energy efficiency potential. These efforts are not without cost, however, which puts pressure on programs in the short term. For example,

³² “Cost to achieve” is typically discussed in terms of net savings. Net to gross factors are only updated at the beginning of a three-year term and their impact may therefore be more pronounced when looking at differences between two different Three-Year Plans.

new active demand reduction initiatives provide benefits to the energy system but have significant upfront and ongoing costs, and the 2018 AESC Study projects declining capacity benefits.

- **Unique Service Area Drivers** – Despite consistent program offerings, variations among Program Administrators in savings goals and costs to achieve naturally result due to each Program Administrator’s unique service territory. Each Program Administrator’s territory has a distinct mix of customers, markets, and vendors. Contributing to these differences are varying customer demographics, different mixes of building and business types, penetration of natural gas and delivered fuels, economic conditions, depth of community engagement, and population density. Each Program Administrator has unique commercial and residential demographics, which may result in differences in how each Program Administrator approaches program delivery. For example, the service territory of one Program Administrator may have a smaller percentage of commercial customers than the statewide average, and thus may not be able to benefit from the higher savings opportunities that tend to correspond with that customer segment. Similarly, a Program Administrator may have a higher proportion of lower-income residents, requiring greater coordination with the community and higher costs to serve. Unique characteristics of smaller territories are more apparent than in larger territories, which represent a broader array of customers and communities that make these unique characteristics less visible. Variances among Program Administrators are appropriate, consistent with sound regulatory policy, the GCA, and previous recognition of Program Administrator differences. In setting their goals, each Program Administrator has used their knowledge of their unique service territory, as well as inputs and insights from their independent energy efficiency Potential Study, to design programs that best meet the needs of their customers. All Program Administrators are committed to achieving all available cost-effective energy efficiency in accordance with the GCA.

f. Summary of Savings Goals Development

In developing the proposed savings goals, the Program Administrators undertook, individually and collectively, a detailed review of energy efficiency opportunities and costs, with a particular emphasis on customer barriers and opportunities. This analysis included a bottom-up approach to assess savings opportunities by measure and initiative, a top-down look at overall savings potential and cost to achieve savings, and careful consideration of evaluation study findings, potential studies, and market changes. Development of the 2019-2021 Plan was influenced by collaborative discussions with the Council and stakeholders to better understand key savings and cost drivers across the Commonwealth, considering sustainability of delivery efforts and bill impacts.

D. Cost Categorization

1. Overview

The Program Administrators have developed consistent definitions and methods of assigning costs. The Program Administrators developed common definitions to assign budget costs across all five program implementation cost categories. With respect to salaries and

overhead, each Program Administrator has developed a method to allocate these costs to appropriate cost categories. With respect to vendor costs, the Program Administrators utilize uniform practices to assign these costs based on cost causation principles.

2. Program Implementation Budget Cost Category Definitions

Program Administrators developed and refined the program implementation cost category definitions over several years. The categories below are consistent with the implementation of the 2016-2018 Plan. The statewide definitions used by all Program Administrators in this Plan are as follows.

Program Planning and Administration - includes costs associated with developing program plans, including market transformation plans, R&D (excluding R&D assigned to Evaluation and Market Research), day-to-day program administration, including labor, benefits, expenses, materials, supplies, overhead costs, any regulatory costs associated with energy efficiency activities, database/data repository development and maintenance, and energy efficiency services contracted to non-affiliated companies, e.g., outside consultants used to prepare plans, screen programs, improve databases and perform legal services. This category also includes internal salaries for administrative employees/ tasks, including program managers who do not have direct sales and technical assistance contact with customers.

Marketing and Advertising - includes costs for the development and implementation of marketing strategies and costs to advertise – through television, radio, billboards, brochures, telemarketing, web-sites and mailings – regarding the existence and availability of energy efficiency programs or technologies, and to induce customers or trade allies to participate in energy efficiency programs. These costs include internal salaries for employee functions related to marketing and advertising.

Participant Incentives - includes funds paid by the reporting Program Administrator to or on behalf of customers or trade allies as rebates or in other forms. Participant incentives include costs that directly benefit customers, including permit fees, pre-weatherization expenses, repairs, and interest buy-down.

Sales, Technical Assistance & Training - includes administration, sales technical assistance and training costs to motivate: (1) customers to install energy efficiency products and services; (2) retailers to stock energy efficiency products; (3) trade professionals to offer energy efficiency services; (4) manufactures to make energy efficiency products; and (5) use of vendor services and suppliers that demonstrate benefits of energy efficiency. This category also includes costs not directly tied to savings, including residential assessments, technical assistance studies, contractor fees and performance bonuses, vendor cost of money; lead vendor fees and internal salaries for employees with direct customer sales and technical assistance contact.

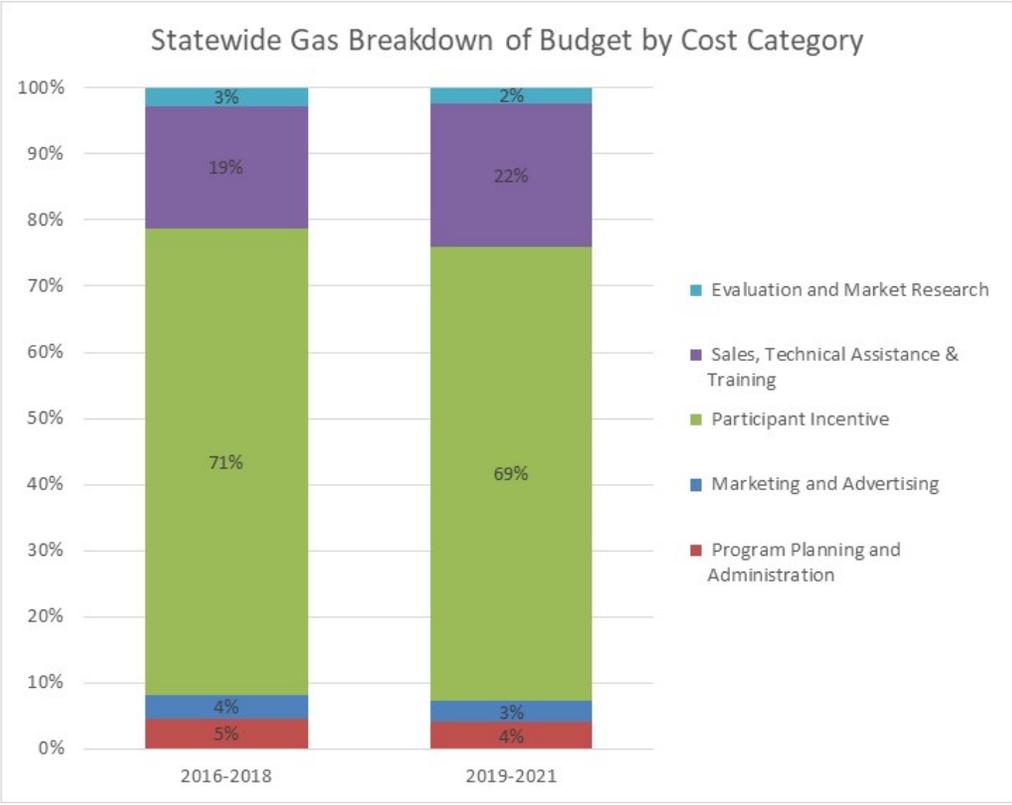
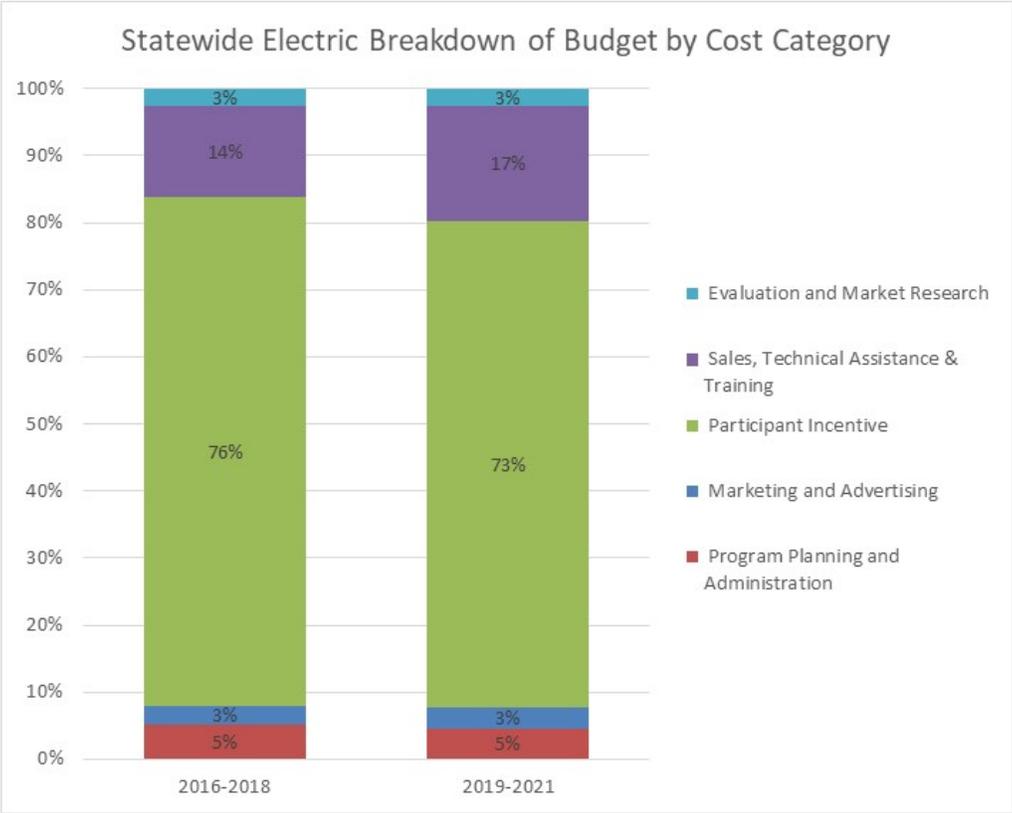
Evaluation and Market Research - includes costs associated with cost-effectiveness evaluation, market research (e.g., baseline studies, market assessments and surveys, technical potential studies), impact and process evaluation reports, tracking and reporting program inputs and outputs, funding studies, TRL, and other costs related to evaluations and market research. This category also includes internal salaries for employee functions related to evaluating the programs.

These cost categories have remained consistent since the last three-year plan, except for one cost, Potential Studies. These costs were originally classified as PP&A because they were done as part of a planning process, but were moved to the cost category of Evaluation and Market Research during 2016-2018 based on cost causation principles. While potential studies continue to be a planning tool for the Program Administrators, these studies are more appropriately categorized as market research costs and therefore charged to Evaluation and Market Research. All Program Administrators have made this change consistently.

At this time, the Program Administrators have not encountered any costs that are difficult to assign to one of the five cost categories. Costs are assigned to the relevant category within the relevant program, core initiative, or hard-to-measure program. Costs that are not appropriately assigned directly to a program are allocated among relevant programs on an appropriate basis and tracked accordingly. Costs related to Evaluation and Market Research are assigned to the hard-to-measure line item, as described in Section III.D.1.k and Section IV.H.6, below.

3. Breakdown of Program Implementation Budget by Cost Category

The majority of energy efficiency program implementation budgets are delivered directly to customers in the form of incentives that are intended to overcome the financial barrier to investment. In the 2019-2021 Plan, 73 percent of the electric and 69 percent of the gas budget is delivered directly to customers through use of participant incentives. Participant incentives help customers adopt high efficiency measures and is one of the primary drivers of historic and continuing energy savings. Approximately 17-21.5 percent of the Program Administrators' costs are budgeted in the Sales, Technical Assistance & Training cost category, supporting the activities of vendors, contractors and other industry professionals. These investments are driving job creation and the evolution of a green economy in the Commonwealth. Approximately 2.5 percent of the statewide budget is dedicated to the rigorous Evaluation and Market Research efforts. Other administrative functions, like Program Planning and Administration and Marketing and Advertising, make up approximately 7-8 percent of the statewide program budget. These percentages are in line with historical averages, demonstrating that the Program Administrators have been able to significantly grow their energy efficiency portfolios while keeping administrative costs low and maximizing the value of the programs for participating customers.



4. Salaries

Consistent with Department precedent, all Program Administrators have developed allocation methods based upon cost causation principles to assign expenses to the appropriate budget category.

For PA staff performing multiple functions, employee salaries are allocated across the appropriate budget categories based on the percentage of employee time spent on various functions within energy efficiency. Program Administrators treat salaries as follows: (1) assign salaries of staff performing a single function to the appropriate cost category in the appropriate program/sector; and (2) assign salaries of staff performing multiple functions to multiple cost categories in multiple programs/sectors, as appropriate, based on an allocation for each employee in accordance with assigned job tasks. Salaries of program managers with direct sales and technical assistance customer contact are allocated to STAT, while salaries of program managers without direct contact are allocated to PP&A.

5. Vendor Cost Categories

The Program Administrators also collaborate to use consistent vendor cost categories. The Program Administrators consistently review new costs to determine the appropriate category. Program Administrators maintain a chart, attached at Appendix J, showing vendor cost types and the related cost category to support consistency and serve as a guide. Since the 2016-2018 Plan, the only change on this list is the Statewide Database, which was previously charged to Evaluation and Market Research to enable separate cost tracking that could not be done at that time, but is now appropriately charged to PP&A.

6. Sponsorships & Subscriptions Costs

Sponsorships and subscriptions support the energy efficiency market, encourage workforce education, attract skilled employees to Massachusetts, and promote innovation in both service delivery and the development and testing of energy efficient technologies. Consistent with Department directives, the Program Administrators developed a methodology for assigning costs related to sponsorships and subscriptions. Expenses paid to directly support a program are considered program expenses and are allocated to the appropriate programs/initiatives where benefits are expected to be realized. Sponsorship and subscription costs that are not directly linked to specific in-the-field energy efficiency measures or services are allocated the Sponsorship and Subscription hard-to-measure program. A cost may be included in program line items even if called a sponsorship or subscription because the expense is directly related to the program. Please see Sponsorships and Subscriptions Policy at Appendix G for more information.

7. Evaluation and Market Research Costs

As discussed in Section III.D.1.k, above, starting in 2019-2021 the Program Administrators propose to charge all EM&V costs to a hard-to-measure line item called Evaluation and Market Research. There will be no EM&V costs allocated to individual programs. This budget category will include costs associated the EM&V budget, potential studies, the AESC Study, the TRL,

acquisition of data sets, and other evaluation and market research costs. Evaluation and Market Research costs will be allocated to one or more sectors as appropriate to the cost.

E. Statutory Budget Requirements

1. Minimizing Administrative Cost

In accordance with the GCA, the Program Administrators seek to minimize administrative costs to the fullest extent practicable. Administrative costs, also commonly referred to as PP&A costs, include costs associated with:

- Developing program plans, including market transformation plans, R&D activities (excluding R&D assigned to Evaluation and Market Research).
- Day-to-day program administration, including labor, benefits, expenses, materials, supplies, and overhead costs.
- Any regulatory costs associated with energy efficiency activities.
- Costs for energy efficiency services contracted to non-affiliated companies such as outside consultants used to prepare plans, screen programs, improve databases, and perform legal services.
- Internal salaries for administrative employees/tasks, including program managers that do not have direct sales and technical assistance contact with customers.

For the 2019-2021 Plan, 4-5 percent of the statewide electric and gas Program Administrators' costs are assigned to Program Planning and Administration. These percentages are in line with the budget allocations approved by the Department historically, demonstrating that the Program Administrators have been able to provide direct benefits to customers and contractors and grow the energy efficiency portfolios while minimizing costs. Importantly, the majority of energy efficiency budgets are returned to customers in the form of incentives that are intended to overcome the financial barrier to investment.

The most significant factor in the Program Administrator approach to minimizing administrative costs is the statewide collaborative process, which is used by the Program Administrators to coordinate planning, the adoption of consistent programs and processes, program design, EM&V studies, statewide marketing, regulatory proceedings, and the development and sharing of all best practices. Sharing of these costs, which would otherwise be borne by each Program Administrator individually, results in economies of scale that reduce the cost for each Program Administrator. For example, joint releases of RFPs lead to minimization of administrative costs in that the cost for preparation and release of the RFP are shared by the Program Administrators. The Program Administrators also minimize administrative costs by coordinating energy efficiency program delivery, where appropriate, with other customer service activities such as customer acquisition, key account management and trade ally relationships.

Notwithstanding any appropriate coordination with other customer service departments, it is necessary and appropriate for all Program Administrators to maintain a skilled and dedicated

administrative staff to ensure successful delivery of programs, compliance with the GCA, timely responses to the requests of the Council, Department, and DOER, and documentation and achievement of substantial savings. The Program Administrators seek to balance the need to minimize administrative costs to the extent prudent with the need to maximize program quality and oversight. Councilors have emphasized the need to devote sufficient administrative resources to successfully implement the aggressive programs called for in the Three-Year Plans.

While the economies of scale and other steps taken by the Program Administrators to minimize costs are effective, and administrative costs incurred by the Program Administrators are transparent, exact quantification of the minimization of administrative costs is not possible in a meaningful way. This is because the continuous scaling up and evolution of the plans make it impractical to establish a solid baseline for a comparison. When the variables are constantly (and necessarily) shifting, there is no opportunity to make a meaningful quantitative comparison. Further, a direct quantitative comparison would not be useful because it would only provide a comparison of two points in time. The mandate of the GCA is to seek administrative efficiencies, which is a continuous process that evolves along with energy efficiency planning and programming. Program needs and opportunities for administrative efficiency are always changing. The Program Administrators seek to minimize costs at all available opportunities, and not just from one point in time to another. By collaborating, creating consistent programming, and optimizing staffing needs, the Program Administrators can minimize administrative costs to the extent practicable while providing quality energy efficiency services for customers. Consistent with the Department's directives in the 2016-2018 Plan Order, the Program Administrators are working with a third-party vendor to study best practices for minimizing administrative costs. The report is expected to: (1) identify best practices, both in Massachusetts and nationwide, for tracking and assessing administrative costs; (2) identify potential benchmarks, metrics, and/or indicators for measuring administrative costs; and (3) provide specific recommendations, as appropriate, for reducing administrative costs. The report will be completed and filed with the Department on October 31, 2018.

2. Allocation of Funds for Income Eligible Programs and Education

Energy efficiency funds shall be allocated to customer classes in proportion to their contributions to those funds, and, "at least 10 percent of the amount expended for electric energy efficiency programs and at least 20 percent of the amount expended for gas energy efficiency programs shall be spent on comprehensive low-income residential demand side management and education programs." G.L. c. 25, § 19(c). Based on the budget figures set forth in this Plan, for electric Program Administrators, 12.08 percent of the total budget will be allocated to the electric income eligible programs. Based on the budget figures set forth in this Plan, for gas Program Administrators, approximately 20.61 percent of the total budget will be allocated to the gas income eligible programs.

3. Competitive Procurement

The Program Administrators utilize competitive procurement processes to engage and retain contractors and vendors to perform activities including, but not limited to assessment delivery, quality control, rebate processing, monitoring and evaluation, potential studies, and

marketing. The Program Administrators are committed to continuing to utilize competitive procurement practices to the fullest extent practicable throughout the implementation of the Plan. Therefore, consistent with past practice, the Program Administrators anticipate that they will continue to issue RFPs to engage appropriate third-party vendors to provide energy efficiency services and work collaboratively to ensure that energy efficiency services have been procured in a manner that minimizes costs to ratepayers, while maximizing the associated benefits of those investments. The Program Administrators will continue to seek to expand the pool of qualified program vendors, promote the entry of new market actors into contractor and subcontractor roles, and ensure the transparency of the contractor bidding process and selection criteria used to evaluate proposals.

F. **Performance Incentives**

1. **Summary of Relevant Precedent and Guidelines**

Pursuant to the GCA, the Three-Year Plan must include a proposed mechanism designed to provide an incentive to distribution companies based on their success in meeting or exceeding certain performance goals.³³ G.L. c. 25 § B.2.v. The Department has established Guidelines outlining the principles and requirements for the design of a performance incentive mechanism. Guidelines § 3.6.2. Pursuant to the Guidelines, an incentive mechanism must: (1) be designed to encourage Program Administrators to pursue all available cost-effective energy efficiency; (2) be designed to encourage energy efficiency programs that will best achieve the Commonwealth's energy goals; (3) be based on clearly defined goals and activities that can be sufficiently monitored, quantified, and verified after the fact; (4) be available only for activities in which the Program Administrator plays a distinct and clear role in bringing about the desired outcome; (5) be as consistent as possible across all electric and gas Program Administrators; and (6) avoid any perverse incentives. Guidelines § 3.6.2. Further, the Guidelines specify that the amount of funds available for performance incentives should be kept as low as possible to minimize the costs to electricity and gas customers, while still providing appropriate incentives for the Program Administrators. Guidelines §§ 3.6.2, 3.6.3.

All Program Administrators must calculate design level incentive payments based on projections of performance for the entire three-year term, not based on annual projections.³⁴ Guidelines § 3.6.4; D.P.U. 11-120-A, Phase II at 7-8. Both electric and gas Program Administrators collect performance incentives through the EES at the design level during the three-year term. D.P.U. 11-12-A, Phase II at 13 n.16. The Department reviews each Program Administrator's performance based on the entire three-year term of the plan and approves final performance incentives through the Term Report proceeding. See D.P.U. 11-120-A, Phase II at 13. Each Program Administrator reconciles actual and design performance incentive payments at the end of each term as part of their respective EES filings. Guidelines § 3.6.4.2.

³³ The Compact, as a municipal aggregator, does not receive a performance incentive. D.P.U. 08-50-A at 51.

³⁴ Design level performance is defined as 100 percent of the Program Administrator's projected benefits and net benefits multiplied by the appropriate payout rate.

The Department has approved performance incentive mechanisms that include savings and value components based on benefits and net benefits. See 2016-2018 Three-Year Plans Order at 67. Specifically, the Department has found that uniform statewide payout rates for the savings and value components is consistent with the goals of the GCA and Department precedent, and, because the rates do not vary by year, found that the payout rates were consistent with the D.P.U. 11-120-A, Phase II Order.

The Department requires that a proposed performance incentive mechanism must encourage Program Administrators to achieve savings where they exist to reach portfolio goals. 2016-2018 Three-Year Plans Order at 69. The Department has rejected proposals that do not comply with this principle. In 2016, the Department specifically rejected a split performance incentives proposal finding that it would not encourage Program Administrators to seek all available cost-effective savings opportunities wherever they exist, but rather may encourage Program Administrators to focus on only the sector in which performance incentives remain available. 2016-2018 Three-Year Plans Order at 69.

Also in D.P.U. 13-67, the Department determined that performance metrics (*i.e.*, an incentive model designed to encourage Program Administrators to undertake specific actions or meet specific goals) were no longer appropriate under the GCA because the Program Administrators are obligated to undertake activities targeted by performance metrics to satisfy the mandates of the GCA. D.P.U. 13-67, at 14-15. Further, the Department found that preparing and verifying performance of these metrics would divert Program Administrator and stakeholders focus from the successful implementation of the Three-Year Plans and is inconsistent with the Department's obligation to fulfill its oversight responsibilities in an administratively efficient and effective manner. D.P.U. 13-67, at 13.

2. Performance Incentive Mechanism

Based upon the well-developed principles and precedent described above, the Program Administrators propose an incentive mechanism for 2019-2021 that is comprised of a Savings Mechanism and a Value Mechanism with common payout rates in each component applicable to the electric and gas Program Administrators, respectively with performance assessed at the portfolio level using cumulative three-year results. In 2019-2021, the incentive payments for the savings and value components are based on total benefits and net benefits,³⁵ respectively. Program Administrators propose to earn performance incentives based on achievements starting at achieving 65 percent of benefits/net benefits (threshold) up to 125 percent of benefits/net benefits (exemplary). The 125 percent limit acts as a cap. The total incentive for each Program Administrator is the sum of the two components.

For this Plan, the Program Administrators are proposing that for calculating the performance incentive associated with the value component, the Program Administrators will use actual spending as opposed to total resource costs, which include calculated or estimated participant costs that are not within the Program Administrators' control. Using actual spending

³⁵ For the purpose of performance incentives, net benefits will be determined by subtracting actual program costs from benefits.

will avoid the circular use of including performance incentive dollars in the costs used in calculating performance incentives. In addition, this approach will encourage Program Administrators to minimize actual spending.

3. Calculation of Incentives for September 12, 2018 Draft Plan

The Program Administrators propose to adopt a statewide performance incentive pool that will be used to determine payout rates for the Savings and Value components discussed above. The Program Administrators are not proposing a specific pool at this time, but will continue to consult with DOER and the Attorney General, as well as the Council, in order to determine an appropriate statewide performance incentive pool. The Program Administrators believe the pool should reflect the challenge of continuing to adopt aggressive savings goals in 2019-2021 in light of increased challenges to achieving claimable benefits, lower avoided costs, the remaining savings opportunities identified in each service territory, and the success the Program Administrators have had in transforming markets. In addition, the 2019-2021 Plan incorporates new technologies and less tested strategies that create increased risk, and the proposed incentive pool should consider these additional risks and provide an appropriate level of incentives to undertake the additional risk.

For calculating total resource costs for cost-effectiveness purposes, the Program Administrators are including placeholder performance incentive payout rates and levels.

4. Alternative Performance Incentive Proposal for Electric Program Administrators

The Program Administrators recognize the Council's desire to link performance incentives to achievement of specific goals, particularly through performance metrics. The goal of performance incentives is to encourage the Program Administrators to pursue cost-effective energy efficiency and demand reduction wherever it may be, and not encourage Program Administrators to focus on achievement of specific activities. D.P.U. 13-67, at 14; D.P.U. 15-160 through D.P.U. 15-169, at 68-69. The Department has found that metrics divert the Program Administrators' attention from achieving the overall goals of the Plan and the GCA. D.P.U. 13-67, at 13-14. Further performance metrics hinder the Program Administrators ability to improve performance and pursue all cost-effective energy efficiency and demand reduction because incentives are only earned by satisfying strict requirements of the metrics without regard to the possibility that a better result could be achieved through alternative approaches that arise during the term.

On August 29, 2018, in recognition of the Council's strong desire to link performance incentives with conversions to heat pumps and deployment of active demand reduction, the electric Program Administrators presented a proposal for a performance incentive model that offers enhanced incentive levels for pursuing these two types of measures. This model correctly recognizes that the current savings and value mechanism provide incentives for the Program Administrators to pursue total and net benefits arising from cost-effective energy efficiency and demand reduction opportunities, including conversions to heat pumps and active demand reduction. The Program Administrators noted during their presentation that active demand and conversion to heat pumps do require the Program Administrators to undertake additional efforts to

increase adoption of these relatively newer strategies. The enhanced payout concept is specifically designed, consistent with Department Guidelines, to encourage the electric Program Administrators to pursue these strategies, despite greater risk and effort, while also not being prescriptive or discouraging pursuit of alternative approaches that may provide greater savings and value for customers, like performance metrics.

While the Program Administrators are not proposing this approach at this time, the PAs will continue discussing this proposal with stakeholders to determine whether the performance incentive model can be adjusted to satisfy the general desire of the Council while providing appropriate incentives for the Program Administrators to pursue all available cost-effective energy efficiency and provide savings and value to customers. Please see slides from the August 29, 2018 Council meeting related to this proposal at Appendix K.

5. Reconciliation of Performance Incentives

Currently Program Administrators are required to collect performance incentives at the design level during the term, and reconcile actual performance incentives following approval of their Term Reports. Guidelines § 3.6.4.2. To support the goal of rate continuity, the Program Administrators propose to modify this schedule, and reconcile actual performance incentives in their EES filing following the filing of the Term Report (e.g., the 2022 peak LDAC for gas Program Administrators). This proposal will allow the Program Administrators to reconcile over- and under-recoveries of performance incentives in a timelier manner and minimize interest associated with delayed collections. The Program Administrators would continue to make any needed adjustments after the Term Report is approved.

G. Cost-Effectiveness and Benefits

1. Cost-Effectiveness

The Program Administrators have projected the expected benefits and costs associated with this statewide 2019-2021 Plan consistent with the requirements of the Guidelines and D.P.U. 08-50-A, in which the Department reaffirmed that “the Total Resource Cost test is the appropriate test for evaluation of the cost-effectiveness of ratepayer-funded energy efficiency programs.” D.P.U. 08-50-A at 14. A program is cost-effective under the TRC test if the cumulative present value of its benefits is equal to or greater than the cumulative present value of its costs. Guidelines § 3.4.3.1. Under the updated GCA, for the purposes of cost-effectiveness screening, programs are aggregated by sector. G.L. c. 25, § 21(b)(3), as revised by Acts of 2018, c. 227. To conduct the TRC test, the Program Administrators have developed detailed benefit/cost screening models, and use these models to reflect assumptions relating to program costs and benefits, the discount rate, the general rate of inflation, and avoided costs.

The Program Administrators identify and quantify costs and benefits needed to calculate the cost-effectiveness of programs consistent with the TRC test. Costs included in the TRC test include all Program Administrator costs and program participant costs. Program Administrator costs include program implementation expenses, evaluation costs, proposed performance

incentives, and tax liability for performance incentives. Program-participant costs include initial costs incurred by customers as a result of their participation in the program.

Benefits included in the TRC test are the value of avoided costs and non-energy impacts (“NEIs”) resulting from a program over the lifetime of the measures. Benefit categories include resource benefits and NEIs (sometimes referred to as non-resource benefits). Resource benefits include avoided energy valued at different times, avoided capacity valued at peaking periods, avoided transmission, avoided distribution, and effects on energy market prices. Specifically, the Program Administrators calculate the benefits associated with positive or negative electric, natural gas, oil, propane, water savings, and capacity savings, and energy DRIPE.³⁶ NEIs are the values associated with the positive or negative effects attributable to energy efficiency programs apart from energy savings, such as reduced costs for operation and maintenance, longer equipment replacement cycles and productivity improvements, reductions in costs associated with reduced customer arrearages, service terminations, and reconnections, and other measureable benefits due to the installation of the energy efficiency.

The benefit/cost screening model uses this data to calculate the present value of the program benefits and costs, and then calculates ratios of these values to produce BCRs. The present value of costs and benefits is calculated over the expected duration of the useful life of the measures installed in the program.

2. Benefit Analysis Components

a. Overview

The Program Administrators developed methods to determine the appropriate manner to measure and verify the benefits associated with the energy efficiency programs. Important elements of this analysis include using the AESC Study, and assessing NEIs, market effects, and new demand reduction initiatives, each of which are described further below.

b. Avoided Energy Supply Cost Study

To develop avoided supply costs, the Program Administrators participate in the AESC Study process, which is a well-established regional and collaborative process. The AESC Study determines projections of marginal energy supply costs that will be avoided due to reductions in the use of electricity, natural gas, and other fuels, as well as avoided environmental compliance costs resulting from energy efficiency programs. The AESC study is prepared every three years for the AESC Study group, which is comprised of the Program Administrators, as well as utilities throughout New England and other interested non-utility parties. In order to inform the initial draft of the 2019-2021 Plan, which must be submitted to the Council by April 30, 2018, the 2018 AESC Study was completed on March 30, 2018.

³⁶ Demand Reduction-Induced Price Effect (“DRIPE”) is a measurement of the value of demand reductions in terms of the decrease in wholesale energy prices, resulting in lower total expenditures on electricity or natural gas across a given system.

The AESC Study provides projections of avoided costs of energy in each New England state for a hypothetical future, the “Base Case,” in which no new energy efficiency programs are implemented in New England. The 2018 AESC Study provides an updated assessment of avoided electricity and natural gas costs using a model that simulates the operation of the New England wholesale energy and capacity markets in an iterative, integrated manner. In the 2018 AESC Study, there were several factors that changed significantly from the previous study, resulting in lower overall natural gas, electric energy, and electric capacity costs. Lower Henry Hub natural gas prices, and the resulting avoided natural gas supply costs, are driven by higher shale gas production and lower breakeven drilling and operating costs relative to the 2015 AESC Study. Estimates for avoided electric energy costs are lower than in the 2015 AESC Study due to a number of factors, such as lower overall demand for electricity, lower natural gas supply prices, lower RGGI prices, increased renewable energy generation, and a new transmission line from Canada; while avoided electric capacity costs are 44 percent lower than in the 2015 AESC Study due to recent declines in the Forward Capacity Market auction prices and a change in the capacity modeling methodology. The 2018 AESC Study estimates electric energy DRIPE benefits to be higher than those in the 2015 AESC Study, and estimates electric capacity DRIPE benefits, where the 2015 AESC Study identified no capacity DRIPE benefits, due to a change in the modeling approach for DRIPE, new commodity and capacity forecasts, and changes in the market conditions. The 2018 AESC Study also includes a new avoided transmission cost component to account for avoided costs of pooled transmission facilities (“PTF”), as well as a new benefit component to value the improved effect of increased reserve margins resulting from energy efficiency on generation reliability. The overall avoided costs in the 2018 AESC Study are lower than those in the 2015 AESC Study and tend to decrease benefits and cost-effectiveness relative to the previous Plan Term, making goals harder to achieve. The 2018 AESC Study is available at Appendix F.

c. Non-Energy Impacts

A NEI is a benefit (positive or negative) for participants in energy efficiency beyond the energy savings gained from installing energy efficient measures. NEIs include benefits such as reduced costs for operation and maintenance associated with efficient equipment or practices, or reduced environmental and safety costs. The Department has stated that NEIs are “a well-established component of the program cost-effectiveness analyses conducted by the Program Administrators” and found that the benefits of the NEIs are quantifiable and flow to Massachusetts ratepayers. 2013-2015 Order at 61. The Department has specifically stated that non-resource benefits (“NEIs”) should be included in cost-effectiveness. Guidelines at §§ 3.4.4.1, 3.4.4.2. Consistent with Department precedent, the Program Administrators have included the benefits associated NEIs established in evaluation studies in the program cost-effectiveness calculations. For 2019-2021, the Program Administrators are including NEIs that were not filed in previous Three-Year Plans and applying pre-existing NEIs to other programs as set forth below:

- Low-income single family health- and safety-related NEIs, August 2016 (filed with 2016 Plan-Year Report, D.P.U. 17-100)
- C&I new construction NEIs, March 2016 (filed with 2013-2015 Term Report, D.P.U. 16-120 through D.P.U. 16-130)

- NEI framework, January 2018: makes recommendations related to property value/rental income NEIs with their underlying non-property value NEIs
- Market-rate multi-family NEI Phase 1, March 2018: recommends Program Administrators apply the existing low-income multi-family owner NEIs to market rate multi-family and existing C&I operations and maintenance NEIs to residential multi-family common area lighting
- NEIs for heat pumps memo, Oct 2017: reconciles and recommends existing NEI values to apply to residential heat pump measures installed in multi-family, low-income multi-family, and low-income single family

d. Demand Reduction

The 2019-2021 Three-Year Plan includes new active demand reduction initiatives. Unlike passive demand reduction measures, active demand savings and benefits accrue during specified and limited time periods. Under the proposed initiatives, active demand reduction measures will be called on to perform during specified events and the claimed savings will be based on customer performance during those called events. Due to these unique characteristics of active demand reduction measures, the Program Administrators developed a methodology for appropriately accounting for costs and benefits in the TRC test.

3. Environmental and Economic Benefits from Energy Efficiency

a. Overview

In advancing the objectives of the GCA, the energy efficiency programs also support the Commonwealth's broader policy objectives. In legislation enacted in parallel with the GCA, the Commonwealth signaled its commitment to being a worldwide leader in developing a green economy through the Global Warming Solutions Act, St. 2008, c. 298 ("GWSA") and the Green Jobs Act, St. 2008, c. 307. The GWSA calls for broad statewide reductions of greenhouse gas ("GHG") emissions in the Commonwealth, spurring innovation and promoting research and development in the area of clean energy. Enacted concurrently, the Green Jobs Act provides a robust funding source for the green technology industry, facilitating economic development and job growth in the clean energy sector. Taken together, these legislative enactments reflect the Commonwealth's commitment to climate protection and its leadership in promoting clean and renewable energy. Reductions in GHG emissions and job creation are important results of energy efficiency programs implemented pursuant to the GCA. Like past plans, the 2019-2021 Plan will continue to fulfill the requirements of the GCA and support the goals of the GWSA and Green Jobs Act, with a focus on meeting customers' energy needs through energy efficiency first and minimizing costs for the benefit of customers.

b. Environmental Benefits and Support of Carbon Reduction

i. Overview

Reduction in the use of electricity, natural gas, and other resources provides significant environmental benefits to Massachusetts and the region. These benefits include reduced air pollution, improved air quality, and beneficial impacts on water systems. Decreasing energy consumption results in less demand for energy from power plants and natural gas pipelines. Reduced plant operating time can lower the volume of emitted air pollutants and greenhouse gases.

Generating electricity or heat from non-renewable fossil fuels (e.g., coal, oil, or natural gas) results in greenhouse gas emissions. Reducing the amount of energy needed to operate Massachusetts homes and businesses through the adoption of energy efficiency improvements reduces these impacts both in Massachusetts and in neighboring states. One particularly impactful measure is the conversion of customers from old, often oil-fired, heating equipment to new, high-efficiency units, which help customers reduce energy use and costs, and can significantly reduce local pollution levels.

Water resources also benefit from energy efficiency programs. With fewer pollutants in the air and acid rain abatement, fresh water resources have less opportunity for particulate contamination or potential acidification. Additionally, some energy efficiency measures offer the co-benefit of reducing water usage and resultant wastewater treatment. For example, low flow aerators reduce the volume of water flowing from a faucet, thus lessening the energy needed to heat the smaller volume of water. Reducing water usage limits stress on reservoirs and water treatment facilities. The 2019-2021 Plan projects saving over 589 million gallons of water annually and over five billion gallons over the lifetime of installed measures. Five billion gallons of water is equivalent to the water needed to do 135 million loads of laundry for the average household.³⁷

Investment in energy efficiency is recognized as an effective cost-containment and climate protection tool of the Commonwealth, which is one strategy to help the Commonwealth achieve the goals of the GWSA. While other programs, such as DOER's Alternative Portfolio Standard and MassCEC's grant programs, encourage adoption of renewable technologies, energy efficiency lowers energy consumption, which reduces emissions by avoiding the use of a unit of energy in the first place and delivers those reductions for the full lifetime of the energy efficiency measure. Further, consistent with the updated GCA, the Program Administrators will identify opportunities to lower overall energy use and greenhouse gas emissions by converting customers to alternative and renewable energy sources. By delivering on the goals in their Three-Year Plans, the Program Administrators are materially contributing to GHG emissions reductions in the Commonwealth, and each Three-Year Plan compounds the GHG emissions reductions from the one before it. Although the GWSA does not govern the Program Administrators energy efficiency efforts,³⁸ the

³⁷ Equivalency calculation based on the equivalency information available on the Department of Environmental Protection's WaterSense website, <https://www.epa.gov/watersense/start-saving>.

³⁸ The GCA governs the Program Administrators' energy efficiency efforts and requires them to seek to acquire all available cost-effective energy efficiency and demand reduction resources. The specified purpose of

Program Administrators remain committed to achieving reductions in GHG emissions through implementation of their Three-Year Plans.

ii. Avoided Cost of Compliance with GWSA

As discussed above, DOER undertook a study to examine the avoided cost of compliance with the Global Warming Solutions Act. The study examined seven potential strategies for GWSA compliance that the study found are currently being deployed in the Commonwealth in the near to medium term under already promulgated legislation and regulations, or as part of the Massachusetts Clean Energy and Climate Plan for 2020. The strategies are: (1) onshore wind, (2) offshore wind, (3) large solar, (4) medium solar, (5) small solar, (6) clean energy imports, and (7) light-duty vehicle electrification infrastructure. The study used a counterfactual approach that presumed no incremental energy efficiency in 2018 and in all later years. The study states that the incremental avoided costs of compliance with the GWSA may be applied to any measure in the 2019-2021 three-year plan, regardless of fuel.

Under the Department's Guidelines, the Program Administrators may include certain avoided costs of complying with environmental laws and regulations as benefits under the TRC test. The avoided costs must be from reasonable foreseeable laws, regulations, or policies that will result in a cost included in electric or gas prices. See 419 Mass. 239; D.P.U. 08-50-A at 2.

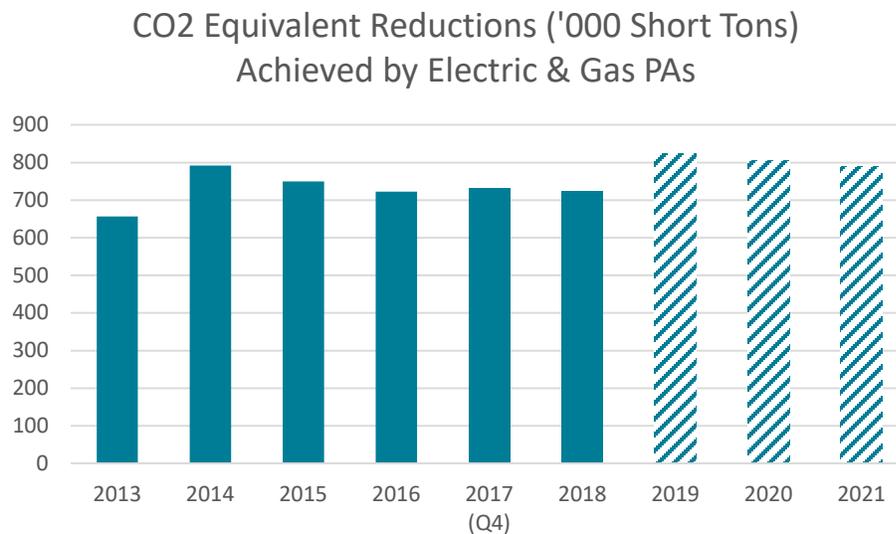
The Program Administrators are currently reviewing the DOER study. For the purpose of this draft Plan, the Program Administrators have provided benefit calculations in the Energy Efficiency Data Tables both with and without the incremental values identified in the study. The study is provided at Appendix L.

iii. Greenhouse Gas Emissions Reductions in Plan

GHG emissions calculations are based on adjusted gross savings. Adjusted gross savings are the actual savings achieved due to the installation of energy efficiency measures, as adjusted by impact factors but without factors related to program attribution. Adjusted gross savings take into account the full energy reductions associated with the programs, including non-electric savings (such as gas and oil savings) achieved by electric Program Administrators, and non-gas savings (such as electric and oil savings) achieved by the gas Program Administrators. Adjusted gross savings do not subtract savings associated with free-ridership, which are savings that are real, but are not attributable to the Program Administrators. For the purpose of Program Administrator calculations, net savings are used to show the impact of the Program Administrator programs on the market; for the purposes of calculating GHG emissions, however, the attribution is not relevant. Calculating GHG emissions using adjusted gross savings more accurately demonstrates the contributions of energy efficiency to the Commonwealth's total GHG emission reductions.

energy efficiency under the GCA is to encourage the efficient use of energy. St. 2008, c. 169 § 11; G.L. c. 164, § 1. The GWSA does not supersede or abrogate the Department's regulatory authority or the Council's role with respect to Three-Year Plans under the GCA.

Since 2013, the Program Administrators' energy efficiency programs have resulted in significant carbon dioxide equivalents reductions, as shown in the chart below.



*CO₂e = carbon dioxide equivalents

Collectively, the programs contained in the 2019-2021 Plan are expected to provide greenhouse gas emission reductions that are equivalent to the amount of emissions from 463,969 cars for a year.

The 2019-2021 Plan reports climate benefits resulting from the programs in the form of reduced emissions of nitrogen oxide, sulfur dioxide, and carbon dioxide equivalents. Information on the reductions in these emissions from energy efficiency is available in the energy efficiency data tables and on the GHG Reductions tab of Mass Save Data, the Program Administrators' energy efficiency database (<http://www.masssavedata.com/Public/GHGReductions>). The GHG Reductions tab allows for conversions between metric and short tons and displays conversion factors and sources.

The Program Administrators use the most current emission factors provided by DEP to convert savings to GHG emission reductions. These factors were updated for the Program Administrators in August 2018.

The Program Administrators are proud to be material actors in helping the Commonwealth achieve its GHG emission reduction goals, and to be proposing a savings goal for the 2019-2021 Plan that will support the Commonwealth's obligations under the GWSA.

c. Economic Development and Job Growth and Retention

Another positive effect of the energy efficiency programs in Massachusetts has been green job growth and retention. The MassCEC has tracked the growth of the Commonwealth's clean energy economy on an annual basis. The 2017 Clean Energy Industry Report looks at



Massachusetts-wide employment of people in a broad category of “Energy Efficiency, Demand Management, and Clean Heating and Cooling.”³⁹ MassCEC’s most recent report provides the following information on employees and establishments in energy efficiency related fields.

	2015 Employees	2016 Employees	2017 Employees	2015 Establishments	2016 Establishments	2017 Establishments
Energy Efficiency, Demand Management, and Clean Heating and Cooling	72,651	73,370	77,899	3,414	3,396	3,788

The Program Administrators carefully develop programs and savings goals to foster and sustain a robust energy efficiency contractor and vendor community. As the programs continue to drive market transformation, energy efficiency businesses continue to serve customers and drive deeper energy savings.

H. Evaluation, Measurement & Verification

1. EM&V Framework

Consistent with past Three-Year Plans and Department precedent, the Program Administrators propose to continue the evaluation framework that has been successfully used to promote high quality third-party EM&V efforts. It is critical that the programs be evaluated, measured, and verified in a way that provides confidence to the public at large in the results of the programs. The EM&V efforts enable the Program Administrators to report savings to the Department with full confidence. Additionally, there is a need to ensure both the reality and the perception of the independence and objectivity of EM&V activities. Accordingly, the Council will continue to have an oversight role over the EM&V activities of the Program Administrators, which will help ensure consistency, timeliness, and credibility of the results. The Council’s oversight role will be accomplished through the Council’s EM&V consultant (“EM&V Consultant”), a third-party expert consultant who has primary responsibility for working with the Program Administrators to plan and implement high-quality EM&V in Massachusetts.

While Program Administrators and the EM&V Consultant will continue to work diligently to reach a consensus on evaluation issues, if there are areas of difference that arise that cannot be resolved through consensus during the ongoing interactive process between the EM&V Consultant and the PA evaluation staff, authority for decision-making will reside with the EM&V Consultant and the Council.

To enable the Program Administrators to fulfill their responsibility to report program savings to the Department with full confidence, an appeals process has been established, through which the Program Administrators may bring decisions made by the EM&V Consultant or the

³⁹ <http://www.masscec.com/2017-massachusetts-clean-energy-industry-report>



Council for review and resolution. This process will be implemented through the formation of an evaluation appeals committee (“Appeals Committee”) of the Council, whose responsibility in this area will be to hear the matter under dispute and rule so that the study may proceed in a timely way. In general, it is expected that this review process will be completed within 72 hours once an issue is elevated to the Appeals Committee. This Appeals Committee will consist of three voting members of the Council, including DOER. Consistent with general Council proceedings, the Appeals Committee will include and consult with, in both deliberations and decision-making, a representative of both the Program Administrators and the Council’s consultant team, neither of whom shall have a vote in the Appeals Committee. The Appeals Committee will review the issues related to the disputed matter, hear from the PA evaluation staff and EM&V Consultant, and make a determination on the outcome of the matter. The decision will be recorded, along with a description of the applicable issues. The participants in the appeal will sign the record of the decision, indicating their acceptance of, the representation of the issues and of the decision. In exceptional cases, where the Program Administrators perceive there to be significant risk to their ability to manage the energy efficiency programs in the near term, the Program Administrators will note their disagreement with the decision of the Appeals Committee on the record of the decision and reserve the right to immediately petition the Department on the Appeals Committee’s decision. The Program Administrators shall be able to submit any such documents to the Department in conjunction with the filing of the Three-Year Plans, mid-term modifications, and term reports. The Department will be able to review the record of this decision in its review of Three-Year Plans, mid-term modifications, plan-year reports, and term reports.

To date, the EM&V Consultant and PA evaluation staff have been able to resolve all areas of differences without proceeding to the Appeals Committee. This is a testament to the professionalism, hard work and collaborative engagement of the Program Administrators and the EM&V Consultant.

The Program Administrators will maintain a statewide focus to the maximum extent possible, will review EM&V budgets with the EM&V Consultant, and will integrate electric and gas evaluation efforts to the maximum extent possible. The Program Administrators will be responsible for contracting with the independent evaluation contractors, and will work with evaluation contractors to maintain privacy of customer data.

2. Evaluation Management Committee

The Program Administrators and the EM&V Consultant established the EMC to be similar to other management committees discussed above in Section III.F.1. The EMC serves as a steering committee for statewide evaluation issues, providing guidance and direction to each of the evaluation research areas. The EMC works to plan, prioritize, and delineate the research studies to be undertaken over the Three-Year Plan term.

The Program Administrators and the EM&V Consultant have worked to consistently improve the EM&V process over time. As issues arise, the EMC has established working groups to review and address new topics, areas of concern, or disagreement. The EMC will continue to do so, in order to keep the EM&V process running transparently, efficiently, and effectively.

3. Descriptions of Research Areas

Consistent with the experience since the establishment of the GCA, the EMC worked collaboratively to develop and refine three market research areas. These research areas are organized primarily by target markets, which design is intended to help maximize the statewide effectiveness of EM&V, while presenting minimal overlap among areas. The research areas identified are as follows: Residential, C&I, and Special and Cross-Cutting. The Special and Cross-Cutting research area covers topics that do not fit cleanly into either the Residential or C&I research areas, as well as additional specialized topics in which it is particularly important to ensure consistency across research areas and markets. Examples of topics within this research are codes and standards, education and training, market effects, top-down modeling, program and portfolio marketing, customer profile report, and demand reduction.

More details regarding these research areas and specific research topics can be found in the Strategic Evaluation Plan, which is attached at Appendix M.

4. Types of Evaluation Functions

EM&V refers to the systematic collection and analysis of information to document the impacts of energy efficiency programs and improve the effectiveness of these programs. EM&V includes the following types of studies:

- *Impact evaluation* refers to the measurement of gross energy and demand (electric and natural gas) savings achieved within overall program populations. Impact evaluations may also include the study of key impact factors to estimate savings, such as in-service rates and other resource savings, including water and non-utility fuels (e.g., propane and oil).
- *Baseline studies* refer to specific research to determine baselines, such as industry-standard practice baselines. Baseline research is sometimes conducted at the same time as impact evaluation studies.
- *Net-to-gross (“NTG”) studies* refer to specific research that estimates free-ridership and the various components of spillover (e.g., participant and/or non-participant spillover).
- *Market effects evaluation* refers to the measurement of the effects that programs have on the structure and functioning of their target markets.
- *NEI studies* refer to research that estimates NEIs of demand side management measures, including participant and utility benefits. These benefits include O&M, comfort, productivity, avoided arrearages, etc.
- *Cost and measure life studies* include research to determine the total and incremental costs and lifetime of demand side management measures.
- *Market characterization* refers to the systematic assessment of demand side management markets for the purpose of improving the effectiveness of programs targeting those markets.

- *Process evaluation* refers to the systematic assessment of programs for the purpose of documenting their operations and developing recommendations to improve their effectiveness and design. It may also include marketing studies to understand the effectiveness of various marketing approaches.

5. Evaluation Planning and Strategic Evaluation Plan

The EMC has sought to establish a long-term strategic view of EM&V for the 2019-2021 Plan, including developing evaluation strategy and determining priorities that the EMC expects to research during the three-year term. These priorities were developed based on the findings of current research, a multi-day Strategic Evaluation Planning Summit in December 2017, and discussions in the EMC and with Councilors and other stakeholders. The Strategic Evaluation Plan expands upon and prioritizes the important research topics that were discussed and established at the summit and during EMC and other discussions. These details and priorities are attached at Appendix M.

6. Evaluation Budgets

The EM&V evaluation study budget for the 2019–2021 Plan is projected to be in line with historical program budget levels. Twenty percent of each sector’s available evaluation budget is allocated to the Special and Cross-Cutting research area.

In 2017, EM&V evaluation study expenditures (not including potential studies and internal labor costs) totaled approximately \$17.2 million (\$12.8 million for electric and \$4.4 million for gas). Therefore, for the three years of the 2019-2021 Plan, the Program Administrators recommend an EM&V study-specific expenditure of \$51.6 million (*i.e.*, the 2017 expenditures multiplied by three). As mentioned above, this budget does not include potential study costs or internal staffing costs.

The EM&V budget is included in the Evaluation and Market Research hard-to-measure line item, along with other evaluation and market research costs, such as potential studies, the AESC Study, the TRL, and internal PA staffing related to EM&V. See Section III.D.1.k for more information on the hard-to-measure program.

7. Evaluation/Implementation Feedback Loop

One of the purposes of EM&V is to provide information to enhance the energy efficiency programs. The Program Administrators have developed a feedback loop to ensure that the results of evaluations are communicated to program implementers, who can then use those results to enhance and refine the programs.

The feedback loop has many steps, from the initial consideration of a study to completion. Before a study is commenced, multiple teams, including evaluation, implementation, contractors, stakeholders, and consultants, convene to identify researchable questions across the statewide portfolio. The EMC then works with contractors and consultants to create a plan based on the researchable questions. As evaluation studies are scoped and planned out, the work plan may be

shared with implementation to ensure that the EMC is asking the most appropriate researchable questions to help implementation. Evaluators also provide advanced notice of evaluation activity, such as customer on-sites and staff interviews. During a study process, the implementation team is often interviewed as part of evaluation, particularly for process/market studies. Once a draft report is available, the materials are shared with implementation, consultants, evaluation, and other stakeholders to give interested parties the opportunity to review and provide feedback. Once a study is complete, final recommendations are reviewed by the RMC and C&IMC and their respective working groups, which determine whether it is appropriate to adopt and implement a recommendation. If the Program Administrators determine that it is not appropriate to adopt a recommendation, the decision and reasoning will be documented clearly. A chart describing EM&V recommendation decisions is provided to the Department as part of the Term Report filing. Final impact results are also reviewed and incorporated by the Common Assumptions Working Group.

Information on EM&V continuously flows in both directions, from the implementation teams seeking guidance from EM&V, and from the EMC seeking to research topics of importance to the programs. An EMC liaison participates in RMC and C&IMC meetings to inform the management committees of studies about to commence, seek input from implementation when it is needed, and to explain results and recommendations. Also, as discussed above, the management committees meet altogether quarterly in Tri-MC meetings to discuss various topics, including evaluations. Finally, the Program Administrators consistently communicate at meetings and informally on all aspects of the programs, and maintain the flexibility to incorporate new studies and their recommendations over time.

8. Market Effects

The Program Administrators have sought to study both direct and indirect effects of the energy efficiency programs. Market effects studies look at how the energy efficiency programs have successfully reduced market barriers and transformed markets. To quantify program impacts that have translated to market effects, first a baseline must be established, and then changes from that baseline can be determined to be program induced and included in the calculation of net savings. The Program Administrators are in the process of considering the type and manner of studying market effects in 2019-2021 and will work with the Council and the EM&V Consultant on potential proposals for inclusion in the final 2019-2021 Plan.

9. Evaluation Studies Completed in Advance of the 2019-2021 Plan

Studies finalized in advance of the October 31, 2018 filing that have not been filed with previous plans or reports will be filed therewith.

All currently completed studies are available on the Council's website at: <http://ma-eeac.org/studies/>.

I. Reporting

1. Overview

The Program Administrators provide transparent reporting on their energy efficiency activities in multiple presentations, and reports. Providing regular communications allows the public and stakeholders to receive up-to-date information regarding energy efficiency investments and savings directly from the Program Administrators. Program Administrators provide formal reporting required by the GCA and the Department, including the three-year plan, Plan-Year Reports, Term Reports, EES filings, and Quarterly Reports to the Council. Additionally, the Program Administrators provide monthly data dashboards to the Council, present regularly on various topics of interest to the Council, and maintain a detailed energy efficiency database, Mass Save Data (<http://www.masssavedata.com>).

2. Quarterly Report

At the end of each quarter, the Program Administrators provide a detailed report on the implementation, expenditures, savings, and benefits regarding activities during that quarter. The Quarterly Reports include a narrative component with information on energy efficiency activities in each sector, as well as a working spreadsheet. Data is provided by individual Program Administrator and aggregated statewide reflecting costs, participants, savings, benefits, and greenhouse gas emissions reductions. This data is reported on a cumulative basis throughout year (e.g., the Q3 report includes the most up-to-date values from the start of the program year through the end of Q3), as well as cumulatively over the three year term. All data is also available on Mass Save Data.

3. Plan-Year Report

As discussed above, the Program Administrators annually file a Plan-Year Report in order for the Department to fulfill its obligation to review the effectiveness of the programs pursuant to G.L. c. 25, § 21(d)(2). The reports document fully evaluated implementation results for each program year that are then incorporated as part of each Program Administrator's Term Report. The Plan-Year Reports include updated data tables comparing planned, preliminary, and evaluated results. Each Program Administrator provides detailed explanations of variances in budget, lifetime savings, total benefits, and total resource benefits. These reports include information on cost-effectiveness. In the event of a non-cost-effective program, a Program Administrator must provide a detailed explanation of the reasons why the program is not cost-effective, and how the Program Administrator expects to proceed with the program (e.g., modify program implementation, modify program budget, terminate the program, etc.) and why this course of action is appropriate. The Plan-Year Report is filed following the first two program years of a term.

4. Term Report

At the conclusion of the term, the Program Administrators file a Term Report with the Department documenting performance over the entirety of the term. The Term Report contains similar data and variance explanations to the Plan-Year Report, along with other information to demonstrate compliance with the approved plan and statutory requirements. The Department reviews each Program Administrator's Term Report in a publicly noticed adjudicatory proceeding. At the conclusion of the proceeding, the Department provides final approval of program

expenditures, performance incentives, and LBR. As discussed above, the Program Administrators propose that the Department allow the reconciliation of performance incentives in the next EES filing after the submission of the Term Report to support the goal of rate continuity. See Section IV.F.4, above.

5. Database

The Program Administrators developed and maintain a publicly accessible statewide energy efficiency database, Mass Save Data, which is available at <http://www.MassSaveData.com>. Mass Save Data is an online statewide database that improves public and stakeholder access to the extensive data already reported by Program Administrators, as well as provides additional information and presentations of data. It provides a single, reliable and timely data source for currently reported data on an individual Program Administrator and statewide basis that can be accessed at any time. Mass Save Data enables users to export data to Excel or PDF formats for further analysis and queries. The Program Administrators designed Mass Save Data to export data easily for those stakeholders like the Council and DOER who prepare data-driven reports on energy efficiency and, at the same time, to display data in a user-friendly, understandable manner for those users who prefer charts and graphs. Mass Save Data has been implemented in a manner that is cost efficient and protects customer privacy. The platform has been materially expanded over the last two program terms and provides accessible, meaningful information to customers, municipalities, and stakeholders over time.

Mass Save Data provides quantitative data similar to that provided in the Program Administrators' public reports, including information related to participants, expenditures, annual and lifetime savings, electric capacity savings, and benefits. The database includes data at the sector, program, initiative, and measure levels. In addition to the Program-Administrators specific data, Mass Save Data also provides savings, usage, and incentives data on the geographic tab at the county, town, and zip code level. This data allows municipalities to see the effects of energy efficiency in their town and other areas. Following a request from several municipalities, the Program Administrators are now providing usage data by town by individual month on an annual basis. Program Administrators have updated Mass Save Data and provided new information and views based on input from members of the Council and other stakeholders. Mass Save Data tabs and sections include overview sections such as time series, performance overview, monthly reporting, and sales and savings; detailed data such as performance details, cost to deliver, home energy services, HEAT Loan, GHG reductions, and measure details; and geographic information including savings, usage and incentives by county, town, and zip code. There are also reference materials such as a glossary and the link to the TRL.

Mass Save Data appropriately protects customer privacy and reduces the need for expensive data security measures because the website is populated with aggregated rather than customer-specific energy efficiency data.⁴⁰ Protecting customer data is a core database concern

⁴⁰ In Massachusetts, the Program Administrators strictly control access to sensitive customer-specific account information like customer names, account numbers, rate class, location, usage, and demand data. Customer consent is necessary to permit third-party access to sensitive customer-specific account information outside the conduct of regulated Program Administrator business. Disclosure of customer information to a third-party without customer authorization would violate corporate privacy policies and expose a Program

of the Department, Program Administrators and stakeholders. Safeguarding the confidentiality of sensitive customer-specific account data is both a legal obligation and an important corporate responsibility for the Program Administrators.⁴¹

The Program Administrators update Mass Save Data with various data sets monthly, quarterly, and annually.

Administrator to liability under the Massachusetts Right to Privacy Act, M.G.L. c. 214, § 1B or Chapter 93A, and potentially other statutes.

⁴¹ The Program Administrators have each adopted strict corporate privacy policies and safeguards to protect sensitive customer-specific account information. These corporate privacy policies explicitly state that customers' personal information will be safeguarded and only disclosed for a regulated Program Administrator business purpose.

V. COST RECOVERY, FUNDING SOURCES, AND BILL IMPACTS

A. Cost Recovery

Cost recovery is a critical element of the three-year plans. Cost recovery associated with the implementation of energy efficiency programs includes the recovery of a performance incentive,⁴² and, for those Program Administrators without a Department-approved decoupling mechanism, the replacement of revenues that support system operating costs. For the Program Administrators to pursue the aggressive goals set forth in this Plan, it is essential that the Department provide a full and fair opportunity for the Program Administrators to be made economically whole for aggressively pursuing sales-reducing energy efficiency and demand reduction efforts and to earn a reasonable return on this investment based upon their performance and achievement. Although Department approval of the proposed Plan should ensure cost-recovery of reasonable Plan-related costs, performance incentives, and LBR,⁴³ if applicable, the details related to individual Program Administrator cost-recovery mechanisms will be addressed in separate Department proceedings.

Pursuant to the GCA, after reviewing a Program Administrator's proposed Plan, the Department must approve a fully reconciling funding mechanisms, in addition to other statutorily specified sources, if it determines that the Plan ensures that the Program Administrator has identified and will capture all energy efficiency and demand reduction resources that are cost-effective or less expensive than supply. G.L. c. 25, §§ 19, 21(d)(2).

B. Funding Sources

1. Introduction

The Program Administrators seek to leverage available funding sources and financing initiatives to increase the benefits of Three-Year Plans and minimize customer bill impacts. For electric Program Administrators, the GCA identifies four specific funding sources for energy efficiency programs: (1) revenues collected from ratepayers through the SBC; (2) proceeds from the Program Administrators' participation in the FCM; (3) proceeds from cap and trade pollution control programs, including but not limited to the RGGI; and (4) other funding as approved by the Department, including revenues to be recovered from ratepayers through a fully reconciling funding mechanism (*i.e.*, an EES). G.L. c. 25, §§ 19(a); 21(b)(2)(vii). Consistent with the Department's Guidelines, the Program Administrators allocate SBC, FCM, and RGGI revenues to

⁴² For a discussion of performance incentives, please *see supra* Section IV.F.

⁴³ The Department determined in D.P.U. 07-50-A that, electric and gas distribution companies would be allowed to recover LBR resulting from their incremental efficiency savings, until they begin operating under a decoupling plan. D.P.U. 07-50A at 83-84, n.24. As of the proposed effective date of the present three year plan (*i.e.*, January 1, 2019), Berkshire does not have a Department-approved decoupling mechanism. Berkshire has proposed a decoupling plan in D.P.U. 18-40. As such, until decoupling is implemented, Berkshire intends to seek Department approval of LBR recovery in connection with this Three-Year Plan, supported by evidence of how incremental energy efficiency savings will be achieved and accounted for and a calculation of the LBR requested for approval. Information regarding Berkshire LBR is included in its Energy Efficiency Data Tables.

each customer sector in proportion to the kWh consumption of each class.⁴⁴ In approving other funding for electric Program Administrators, the Department must consider: (1) the availability of other private or public funds; (2) whether past programs have lowered the cost of electricity to customers; and (3) the effect of any rate increases on customers. G.L. c. 25, § 19(a). The Department has determined that a bill impact analysis with a short-term perspective that isolates the effect of a proposed change in the energy efficiency surcharge (“EES”) is appropriate because it provides an accurate and understandable assessment of the impact that customers will experience on their bills. 2013-2015 Three-Year Plans Order at 122; D.P.U. 08-50-D at 11-12.

For gas Program Administrators, the GCA does not identify multiple funding sources for energy efficiency programs and instead requires the gas Program Administrators to include a fully reconciling funding mechanism to collect energy efficiency program costs from customers (*i.e.*, EES). G.L. c. 25, § 21(b)(2)(vii); *see also* G.L. c. 25, § 21(d)(2). In approving funding for gas Program Administrators, the Department considers the effect of any rate increases on customers. Guidelines § 3.2.2.2.

Below is a description of each funding source currently available to the Program Administrators.

2. Non-EES Revenues

a. *System Benefit Charge (electric only)*

The SBC is calculated consistent with G.L. c. 25, § 19(a) which states: “The [D]epartment shall require a mandatory charge of 2.5 mills per kilowatt-hour for all customers, except those served by a municipal lighting plant, to fund energy efficiency programs including, but not limited to, demand side management programs.” Specifically, each electric Program Administrator calculates projected SBC revenues as the product of the statutorily mandated SBC of \$0.0025 per kWh and projected sales for the applicable year.

b. *Forward Capacity Market Proceeds (electric only)*

Pursuant to G.L. c. 25, § 19(a), the Three-Year Plans of electric Program Administrators shall be funded in part by “amounts generated by the distribution companies and municipal aggregators under the Forward Capacity Market program administered by ISO-NE, as defined in section 1 of chapter 164.” Specifically, each Program Administrator calculates projected FCM revenues as the product of the clearing prices of the FCM in the applicable year and the energy efficiency capacity that is designated by ISO-NE as an FCM capacity resource for the year. The Program Administrators propose to apply all net proceeds from the FCM to energy efficiency programs.

To minimize ratepayer funding for energy efficiency efforts, each electric Program Administrator seeks to maximize FCM revenues for its customers. FCM bidding strategies are

⁴⁴ The income eligible sector is allocated at least ten percent of the funds for electric energy efficiency programs and 20 percent of the funds for gas energy efficiency programs pursuant to G.L. c. 25, § 19(c).

designed to strike an appropriate balance between maximizing revenues through participation in the FCM and avoiding the risks associated with FCM penalties for failure to deliver their capacity-supply obligations. In addition, demand reduction resources must participate in the energy market if the resource has a capacity supply obligation in the FCM, which adds potential for additional revenues but carries the risk of penalties. Each Program Administrator employs its own individual strategy in bidding future capacity into the FCM. For more information on Program Administrator bidding strategy see each electric PA's testimony.

The Department has recognized the challenges Program Administrators face in projecting with precision over the term of a Three-Year Plan the level of planned energy efficiency resources that will be installed before and during each FCM commitment period. 2013-2015 Order at 119. One of these challenges is driven by the timing of the FCM auction cycles, which are conducted three years ahead and begin with a "show-of-interest" submission almost four years before the capacity-commitment period.⁴⁵ Another is that there are financial penalties for failing to deliver on FCM supply obligations. However, each Program Administrator takes all reasonable steps to maximize FCM revenues during the term.

In developing a bid, each Program Administrator uses the best information available at the time. Each Program Administrator considers historic achieved annual peak period MW reductions from their energy efficiency programs, as well as ongoing studies and evaluations that may affect future savings potential. Given the difficulty in estimating the actual energy efficiency savings that will be eligible to participate in the FCM and the potential penalties, Program Administrators typically do not bid into future FCM commitment periods the total amount of energy efficiency savings they expect to achieve. In making conservative FCM bids, the Program Administrators avoid overpromising and thereby compromising future system reliability. In addition, the reconciling nature of the EES ensures that customers are made whole if Program Administrator FCM revenue projections are overly conservative and the Program Administrators ultimately collect additional FCM revenues.

c. Regional Greenhouse Gas Initiative Proceeds (electric only)

Pursuant to G.L. c. 25, § 19(a), the Three-Year Plans of electric Program Administrators shall be funded in part by "not less than 80 per cent of amounts generated by the carbon dioxide allowance trading mechanism established under the Regional Greenhouse Gas Initiative Memorandum of Understanding, as defined in subsection (a) of section 22 of chapter 21A, and the NOx Allowance Trading Program." As described further below, the electric Program Administrators typically calculate projected RGGI revenues by multiplying projected RGGI clearing prices by a projection of allowances sales in each RGGI auction, with 80 percent of the revenues allocated to electric efficiency programs. RGGI allowances prices are derived from the AESC Study. The electric Program Administrators will consult with DOER about how best to forecast RGGI proceeds for the 2019-2021 Plan.

⁴⁵ The next forward capacity auction, in February 2019, will be for capacity delivery in July 2022.

3. EES Revenues⁴⁶

The EES is a fully reconciling funding mechanism that the Department approves for funding the Three-Year Plans. G.L. c. 25, § 21(d)(2). On an annual basis, each Program Administrator submits an updated EES for Department review, based on: (1) the Program Administrator's most recent projections of budgets, revenues for non-EES funding sources (for electric Program Administrators), and sales for the current year; and (2) a reconciliation of any under- or over-recovery of costs from the previous year. 2016-2018 Three-Year Plans Order at 114.⁴⁷ Electric Program Administrators collect the EES through EERF tariffs. Guidelines §§ 2(9), 3.2.1.6. For gas Program Administrators, the EES is collected through the LDAC tariff in accordance with established Department practice. Guidelines §§ 2(9), 3.2.2. The EERF and LDAC filings of the Program Administrators are separate proceedings from the Three-Year Plan proceeding and are implemented on schedules that vary among the Program Administrators.⁴⁸

4. Carryover Information

In determining its EES, an electric Program Administrator takes into account funds carried over from the previous year's program, whether positive or negative. These "fund balances" are used to adjust projected funding levels in the Plan.

5. Outside Funding Levels

The 2019-2021 Plan does not contain outside funding assumptions at this time given the absence of material viable funding sources. The Program Administrators, as well as Councilors and government agencies, all actively continue to seek new sources of outside funding. The Program Administrators' approach in this regard reflects lessons learned over the course of prior Three-Year Plans. There continues to be a low likelihood that a major new federal "cap and trade" program will be implemented in the foreseeable future as had been anticipated when the 2010-2012 Plans were initially developed and approved by the Council.

⁴⁶ The Program Administrators collect funds related to RCS through their EESs. 220 C.M.R. § 7.00 et seq. The Department reviews the reconciliation of any over and under collections of RCS funds in the LDAC filings for the gas Program Administrators and in the EERF tariff filings for the electric Program Administrators.

⁴⁷ In D.P.U. 17-05-B, the Department approved a single energy efficiency charges tariff for the newly consolidated NSTAR Electric Company d/b/a Eversource Energy (in which the former Western Massachusetts Electric Company was consolidated with the former NSTAR Electric Company as of January 1, 2018). See also D.P.U. 17-05, at 44. (2017). Accordingly, for the 2019-2021 plan term, Eversource will be collecting its energy efficiency costs through class-specific energy efficiency recovery factors applicable to its entire Massachusetts service territory.

⁴⁸ With the exception of the Compact, EERF filings are made coincident with each electric Program Administrators' residential basic service rate change, creating a lag between energy efficiency program spending and collection. The Compact's rates are effective January 1 of each year, consistent with the 2013-2015 Order at 125, n.106. The gas Program Administrators' LDAC filings are approved for effect November 1st each year. Due to the timing of these filings, the budget and revenue projections are based on the twelve month period starting on the effective date of each EES, rather than on a calendar year. Therefore, projected expenditures and revenues included in the respective EERF and LDAC filings will differ from the amounts included in the Plan.

As part of the Program Administrators' holistic, integrated approach, the Program Administrators will seek to educate customers about other funding offered through other government programs. One example of this is a DOER grant designed to assist moderate income customers with pre-weatherization barriers. Another example is funding designed to promote conversion to and adoption of renewable technologies, as defined by DOER. MassCEC has historically offered generous incentives, in addition to the incentives offered under the Plan, for air source heat pumps, ground source heat pumps, wood heating, and solar hot water. In addition, MassCEC and DOER have partnered to develop the HeatSmart Mass Residential program designed to encourage customers to use clean heating and cooling technologies. DOER's Alternative Portfolio Standard for Renewable Thermal offers an opportunity for customers to obtain revenue for installing eligible solar thermal, air source heat pumps, and ground source heat pumps based on the size of the unit installed. While the objectives of these programs differ from the goals of the energy efficiency programs, customers may leverage the multiple funding sources to reduce the customer contribution cost, removing barriers to adoption of measures that provide both energy efficiency benefits and advance other state policies, including meeting the requirements of the GWSA.

C. **Bill Impacts**

Consistent with directives of the GCA and the goal of the 2019-2021 Plan to provide for the acquisition of all available energy efficiency and demand reduction resources that are cost-effective or less expensive than supply, the Program Administrators have sought to develop a statewide energy efficiency plan that acquires these resources with the lowest reasonable customer contribution. G.L. c. 25, § 21(b). The Department has determined that a bill impact analysis with a short-term perspective that isolates the effect of a proposed change in the EES is appropriate because it provides an accurate and understandable assessment of the impact that customers will experience on their bills. 2013-2015 Three-Year Plans Order at 122; D.P.U. 08-50-D at 11-12.

The Department requires the Program Administrators to submit traditional bill impacts for non-participants under the following scenarios:

1. the current (e.g., 2018) EES to the proposed EES for the first year of the three-year plan (e.g., 2019);
2. the EES from the first year of the three-year plan (e.g., 2019) to the proposed EES for the second year of the three-year plan (e.g., 2020);
3. the EES from the second year of the three-year plan (e.g., 2020) to the proposed EES for the third year of the three-year plan (e.g., 2021);
4. the current EES (e.g., 2018) to the proposed EES for the third year of the three-year plan (e.g., 2021).

D.P.U. 08-50-D at 12. The Department also directed the Program Administrators to submit bill impacts for participants, "where consumption is reduced for three levels of savings -- low, medium, and high -- and [to] provide a description of how these savings levels were determined." Id. The Department later clarified the bill impact requirements for non-participants by providing a

spreadsheet to the Program Administrators, directing them to use average monthly usage levels under the first and fourth scenarios listed above.

Accordingly, to calculate bill impacts for participants, the Program Administrators will populate the Department’s spreadsheet (with peak and off-peak rates on separate sheets), using the average monthly kWh and/or therm usage for non-participants for each rate class, and the percentages set forth in the table below. To best approximate low, medium and high annual savings consistent with the Department’s directive in D.P.U. 08-50-D, the Program Administrators collaborated on appropriate assumptions for residential, income eligible and C&I programs to develop statewide percentages that best approximate savings for those types of participants. The Program Administrators determined that the percentages in the table below will provide directional information on the bill impacts that a residential, income eligible or C&I participant may experience.

The Program Administrators determined that there is no low, medium and high savings scenario for income eligible participants. These participants typically receive a comprehensive “whole house” energy efficiency approach, meaning potential measures are installed in most cases (the work that can be done is done). Similarly, the Program Administrators determined that there is no low, medium and high savings scenario for residential and income eligible gas non-heating participants and street lighting. Accordingly, the Program Administrators determined that the percentages in the table below best approximate savings for those types of participants.

	Low	Medium	High
Residential- Electric:	2%	10%	30%
Residential- Gas:	2%	15%	30%
Residential Gas Non-Heating:	2%		
Income Eligible Gas Non-Heating:	2%		
Income Eligible:	25%		
Street Lighting:	10%		
C&I- Electric:	1%	10%	20%
C&I- Gas:	1%	10%	20%

At this September 14, 2018 submission date, several key components that are necessary to finalize the most accurate bill impact calculations consistent with the Department’s requirements have yet to be determined or finalized. Each Program Administrator will provide bill impacts for all rate classes in its individual filing to be made at the Department in October 2018.

While the Program Administrators cannot provide bill impacts at this time, comparing the proposed 2019-2021 budget to the 2016-2018 budget provides high level directional information on potential bill impacts. The proposed statewide electric budgets for the income eligible and C&I sectors are about \$28 million (13%) and \$60 million (6%), respectively, higher than the statewide budget for 2016-2018. The statewide electric budget for the residential sector is about \$34 million (4%) lower than statewide budget for 2016-2018. The proposed statewide gas budgets for residential, income eligible, and C&I sectors are about \$73 million (18%), \$23.5 million (17%),

and \$5.25 million (3.7%), respectively, higher than the statewide budgets for 2016-2018. The income eligible sector budget is collected from all customer sectors. The direction and magnitude of bill impacts will vary by Program Administrator.

It is important to emphasize that actual rate and bill impacts for customers associated with the 2019-2021 Plan will vary based upon a multiplicity of factors, such as the cost of service in a particular Program Administrator's service territory, the customer's actual individual usage, the level and quality of measure installation, and the availability of public or private funds other than those collected through the SBC for application towards energy efficiency expenditures, such as proceeds realized from the FCM or from cap-and-trade programs (e.g., RGGI). Finally, bill and rate impacts will vary from the bill and rate impacts included in each Program Administrator's EES filings, which are done on a different time schedule from this filing, and include up-to-date over- and under-collections.

Appendices

VI. APPENDICES

Appendices

A. **Glossary**

GLOSSARY OF TERMS AND ABBREVIATIONS

2010-2012 Orders	Orders issued by the Department on January 28, 2010 for the 2010-2012 Plans in dockets D.P.U. 09-121 through D.P.U. 09-128 and D.P.U. 09-116 through D.P.U. 09-120
2012-2012 Plans	2010-2012 Electric Three-Year Energy Efficiency Plan, D.P.U. 09-116 through D.P.U. 09-120; 2010-2012 Gas Three-Year Energy Efficiency Plan, D.P.U. 09-121 through D.P.U. 09-128
2013-2015 Order	Order issued by the Department on January 31, 2013 for the 2013-2015 Plans in dockets D.P.U. 12-100 through 12-111
2013-2015 Plan	2013-2015 Three-Year Energy Efficiency Plan, D.P.U. 12-100 through D.P.U. 12-111
2015 AESC	Avoided Energy Supply Costs in New England: 2015 Report
2016-2018 Order	Order issued by the Department on January 28, 2016 for the 2016-2018 Plans in dockets D.P.U. 15-160 through D.P.U. 15-169
2016-2018 Plan	2016-2018 Three-Year Energy Efficiency Plan
2018 AESC Study	Avoided Energy Supply Components in New England: 2018 Report (March 30, 2018)
2019-2021 Plan	2019-2021 Three-Year Energy Efficiency Plan
ACEEE	American Council for an Energy-Efficient Economy
Act Relative to Competitively Priced Electricity in the Commonwealth	Chapter 209 of the Acts of 2012. Signed into law on August 23, 2012.
AESC	Avoided Energy Supply Costs
AFUE	Annual Fuel Utilization Efficiency
AG	Office of the Attorney General of Massachusetts
ALCS	Advanced Lighting Controls Systems
API	Application programming interface
Appeals Committee	Evaluation appeals committee of the Council
Attorney General	Office of the Attorney General
BCR	Benefit/Cost Ratio
C&I	Commercial and Industrial
C&IMC	Commercial and Industrial Management Committee
CAP	Community Action Program
CELT	Capacity, Energy, Loads, and Transmission
CDO	Customer Directed Option
CHP	Combined Heat and Power
Consultants	Consultants employed by the Energy Efficiency Advisory Council
Council	Energy Efficiency Advisory Council
CSP	Curtailment Service Provider

Department	Massachusetts Department of Public Utilities
DEP	Massachusetts Department of Environmental Protection
DHCD	Massachusetts Department of Housing and Community Development
DOE	Department of Energy
DOER	Massachusetts Department of Energy Resources
DPU	Massachusetts Department of Public Utilities
D.P.U. 08-50	<u>Energy Efficiency Guidelines</u> , D.P.U. 08-50 (2008)
D.P.U. 08-50-B Guidelines	Energy efficiency guidelines established in D.P.U. 08-50-B (2009)
D.T.E. 98-100 Guidelines	Energy efficiency guidelines established in <u>Investigation to Establish Methods and Procedures to Evaluate and Approve Energy Efficiency Programs</u> , D.T.E. 98-100 (2000)
D.P.U. 11-120 Guidelines	Energy efficiency guidelines established in D.P.U. 11-120-A, Phase II (2013)
DRIPE	Demand Reduction Induced Price Effect
DSM	Demand-Side Management
ECM	Electronically Commutated Motor
EEAC	Energy Efficiency Advisory Council
EERF	Energy Efficiency Reconciliation Factor
EES	Energy Efficiency Surcharge
EISA	Energy Independence and Security Act
Energy Act of 2012	Act Relative to Competitively Priced Electricity in the Commonwealth
EMC	Evaluation Management Committee
EMS	Energy Management System
EM&V	Evaluation, Measurement and Verification
EM&V Consultant	A third-party expert consultant who has primary responsibility for working with the PAs to plan and implement high-quality EM&V in Massachusetts.
ENERGY STAR[®]	Brand name for the voluntary energy efficiency labeling initiative sponsored by the U.S. Environmental Protection Agency and Department of Energy.
EPA	U.S. Environmental Protection Agency
EUI	Energy use intensity
FCM	Forward Capacity Market
Free Riders	Customers who participate in an energy efficiency program but would have installed the same measure(s) on their own if the program had not been available.
Free-Ridership Rate	The percent of savings attributable to Free Riders.
FTE	Full-Time Employee

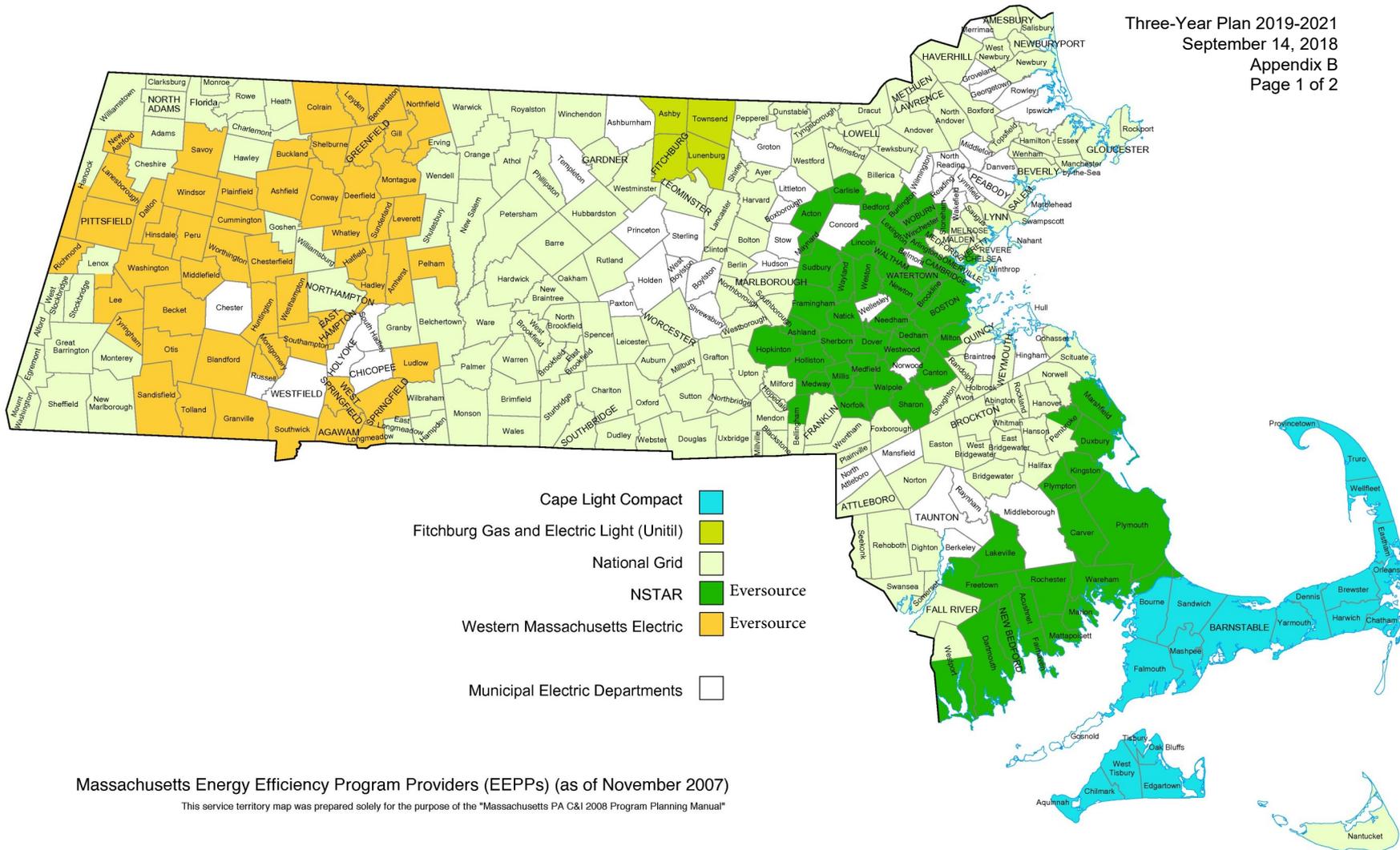
GCA	Green Communities Act
GHG	Greenhouse Gas
Green Communities Act	An Act Relative to Green Communities, Chapter 169 of the Acts of 2008. Signed into law on July 2, 2008.
Guidelines	Department's D.P.U. 11-120 Guidelines
GWSA	Global Warming Solutions Act, St. 2008, c. 298
HEARTWAP	Heating System Repair and Replacement program
HER	Home Energy Report
HERS	Home Energy Rating System
HES	Home Energy Services
HPCs	Home Performance Contractors
HRV	Home Recovery Ventilator
HVAC	Heating, Ventilation, and Air Conditioning
ICAP	Installed Capacity
IIC	Independent Installation Contractors
Impact Factor	Generic term for persistence, realization rates, in-service rates, non-coincident connected demand factors, etc., developed during the evaluation of energy efficiency programs and used to calculate net savings.
ISO-NE	Independent System Operator – New England
JMC	Joint Management Committee of PA and non-PA parties that manages the Residential and Low-Income New Construction Core Initiatives
LBR	Lost Base Revenue (for PAs not operating under decoupled rate structure, these costs account for revenues not collected by the PA's distribution business as a result of the energy efficiency undertaken during the program year)
LDAF	Local Distribution Adjustment Factor
LDAC	Local Distribution Adjustment Clause
LEAN	The Low-Income Energy Affordability Network
LED	Light Emitting Diode
Lifetime	The expected length of time, in years, that an installed measure will be in service and producing savings.
LLLC	Luminaire Level Lighting Control
MAEEP	Massachusetts Energy Efficiency Partnership
MAP	Mass Save Application Portal
MassCEC	Massachusetts Clean Energy Center
MBCx	Monitoring Based Commissioning
Measure	Specific technology or practice that produces energy and/or demand savings for which the PA provides financial incentives.
Mid-Term Modification	Modification to approved Three-Year Plan during term of Plan.

MMBTU	Millions of British Thermal Units
MOU	Memorandum of Understanding
MSD	Mass Save Data
MTAC	Massachusetts Technical Assessment Committee
MTM	Mid-Term Modification
NALCTP	National Advanced Lighting Controls Training Program
NEED	National Energy Education Development
Net to Gross Ratio or NTGR	A factor representing net program savings divided by gross program savings that is applied to gross program impacts to convert them into net program load impacts.
NEI	Non-Energy Impacts
Network	Low-Income Weatherization and Fuel Assistance Program Network
NTG	Net-to-Gross
O&M	Operations and Maintenance
PA	Program Administrator
Participant Cost	The total cost of a project or measure less the customer incentive.
Performance Incentive	Compensation for the Company's successful execution of the energy efficiency programs during the program year as determined by Massachusetts Department of Public Utilities.
PI	Performance Incentive
Plan	Three-Year Energy Efficiency Plan
PP&A	Program Planning and Administration
Program Administrators	Utilities and municipal aggregators that offer energy efficiency programs.
QA/QC	Quality Assurance/Quality Control
QC	Quality Control
QSRs	Quick Service Restaurants
R&D	Research and Development
RCD	Residential Coordinated Delivery
RCS	Residential Conservation Service, established in An Act Establishing The Massachusetts Residential Conservation Service, Chapter 465 of the Acts of 1980, July 11, 1980.
RCx	Retrocommissioning
RFP	Request For Proposal
RGGI	Regional Greenhouse Gas Initiative
RMC	Residential Management Committee
SBC	System Benefit Charge
SEM	Strategic Energy Management

SEMP	Strategic Energy Management Plan
STAT	Sales, Technical Assistance & Training
Spillover	Additional energy efficient equipment installed by customers that was influenced by the PA's sponsored program, but without direct financial or technical assistance from the program. Spillover is separated into Participant and Non-participant factors. Non-participating customers may be influenced by product availability, publicity, education and other factors that are affected by the program.
Spillover Rate	Estimate of energy savings attributable to spillover effects expressed as a percent of savings installed by participants through an energy efficiency program.
TA	Technical Assistance
T&D	Transmission and Distribution
Term	Three-year term of the energy efficiency plan
Three-Year Plan	Energy Efficiency Investment Plans required by the GCA every three years.
TRC	Total Resource Cost
Tri-MC	Tri-Management Committee
TRL	Technical Resource Library
WAP	Weatherization Assistance Program

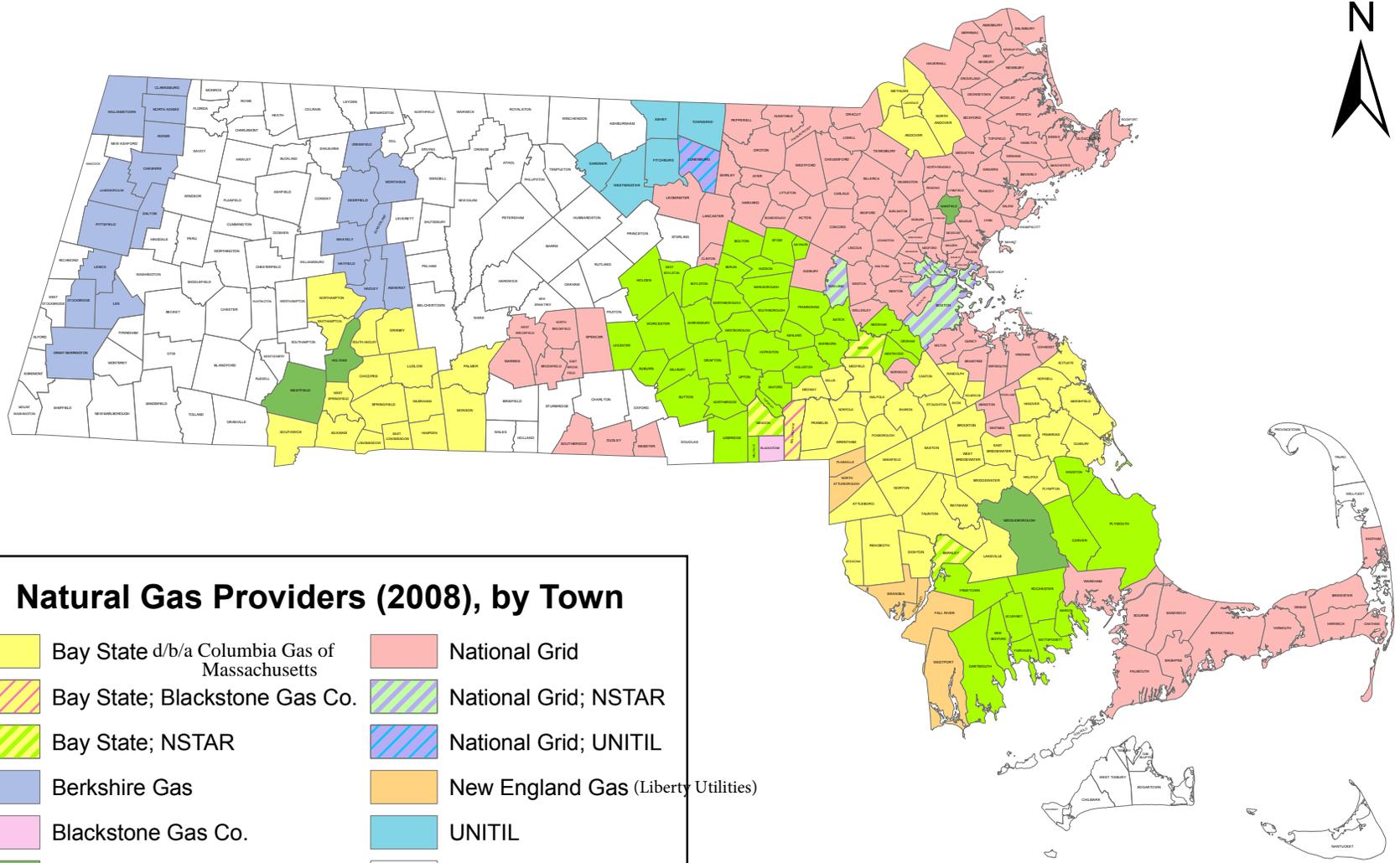
Appendices

B. Maps of Service Areas



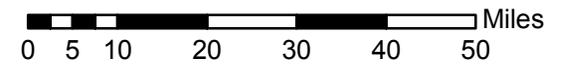
Massachusetts Energy Efficiency Program Providers (EPPs) (as of November 2007)

This service territory map was prepared solely for the purpose of the "Massachusetts PA C&I 2008 Program Planning Manual"



Natural Gas Providers (2008), by Town

- | | | | |
|---|---|---|-------------------------------------|
|  | Bay State d/b/a Columbia Gas of Massachusetts |  | National Grid |
|  | Bay State; Blackstone Gas Co. |  | National Grid; NSTAR |
|  | Bay State; NSTAR |  | National Grid; UNITIL |
|  | Berkshire Gas |  | New England Gas (Liberty Utilities) |
|  | Blackstone Gas Co. |  | UNITIL |
|  | Municipal |  | None |
|  | NSTAR (Eversource) | | |



Appendices

C. Statewide Energy Efficiency Data Tables

IV.C. Program Administrator Budgets

1. Summary Table

Statewide Electric
 September 14, 2018

2019 Program Administrator Budget										
Program	Program Costs						Performance Incentive	Total Program Administrator Budget	Program Cost per Participant	Energy 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	11,695,370	13,314,113	184,130,372	52,418,311	7,453,386	269,011,553	9,219,146	278,230,699	47	1.84
A1 - Residential New Buildings	811,756	206,056	13,819,661	1,583,048	-	16,420,521	910,606	17,331,126	1,366	2.87
A1a - Residential New Homes & Renovations	811,756	206,056	13,819,661	1,583,048	-	16,420,521	910,606	17,331,126	1,366	2.87
A2 - Residential Existing Buildings	8,730,212	10,061,501	150,234,910	46,859,457	21,000	215,907,080	8,308,541	224,215,621	38	2.07
A2a - Residential Coordinated Delivery	4,041,171	2,445,945	78,341,252	13,320,050	-	98,148,418	4,464,008	102,612,426	2,508	2.43
A2b - Residential Conservation Services (RCS)	788,823	1,176,399	-	16,330,957	-	18,296,180	-	18,296,180	-	-
A2c - Residential Retail	3,276,268	6,306,373	70,966,104	6,468,359	-	87,017,104	3,480,809	90,497,914	19	2.14
A2d - Residential Behavior	326,284	60,856	-	9,082,606	-	9,469,745	304,855	9,774,601	8	2.09
A2e - Residential Active Demand Reduction	297,665	71,928	927,555	1,657,484	21,000	2,975,632	58,869	3,034,501	191	1.28
A3 - Residential Hard-to-Measure	2,153,403	3,046,556	20,075,801	3,975,807	7,432,386	36,683,952	-	36,683,952	-	-
A3a - Residential Statewide Marketing	-	1,821,152	-	-	-	1,821,152	-	1,821,152	-	-
A3b - Residential Statewide Database	107,928	-	-	-	-	107,928	-	107,928	-	-
A3c - Residential DOER Assessment	1,573,947	-	-	-	-	1,573,947	-	1,573,947	-	-
A3d - Residential EEAC Consultants	60,000	-	-	-	-	60,000	-	60,000	-	-
A3e - Residential Sponsorships & Subscriptions	111,580	20,139	-	25,441	1,313	158,472	-	158,472	-	-
A3f - Residential HEAT Loan	120,059	186,080	19,858,411	1,897,667	-	22,062,216	-	22,062,216	-	-
A3g - Residential Workforce Development	-	-	-	330,025	-	330,025	-	330,025	-	-
A3h - Residential R&D and Demonstration	114,889	-	217,390	672,674	-	1,004,953	-	1,004,953	-	-
A3i - Residential Education	65,000	1,019,185	-	1,050,000	-	2,134,185	-	2,134,185	-	-
A3j - Residential Evaluation and Market Research	-	-	-	-	7,431,073	7,431,073	-	7,431,073	-	-
B - Income Eligible	3,643,544	876,280	54,172,796	13,198,676	1,849,632	73,740,929	2,596,311	76,337,240	2,694	1.27
B1 - Income Eligible Existing Buildings	2,827,369	580,497	54,172,796	13,139,141	-	70,719,803	2,596,311	73,316,114	2,584	1.33
B1a - Income Eligible Coordinated Delivery	2,827,369	580,497	54,172,796	13,139,141	-	70,719,803	2,596,311	73,316,114	2,584	1.33
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-	-
B2 - Income Eligible Hard-to-Measure	816,176	295,784	-	59,535	1,849,632	3,021,126	-	3,021,126	-	-
B2a - Income Eligible Statewide Marketing	-	292,423	-	-	-	292,423	-	292,423	-	-
B2b - Income Eligible Statewide Database	23,134	-	-	-	-	23,134	-	23,134	-	-
B2c - Income Eligible DOER Assessment	411,133	-	-	-	-	411,133	-	411,133	-	-
B2d - Income Eligible Energy Affordability Network	354,005	-	-	-	-	354,005	-	354,005	-	-
B2e - Income Eligible Sponsorships & Subscriptions	27,903	3,361	-	7,035	363	38,661	-	38,661	-	-
B2f - Income Eligible Evaluation and Market Research	-	-	-	-	1,849,269	1,849,269	-	1,849,269	-	-
B2g - Income Eligible Workforce Development	-	-	-	52,500	-	52,500	-	52,500	-	-
C - Commercial & Industrial	12,982,565	4,584,074	213,398,519	39,666,562	6,853,350	277,485,070	25,599,627	303,084,697	15,798	3.68
C1 - C&I New Buildings	794,193	691,930	12,267,667	4,300,721	-	18,054,510	1,796,348	19,850,858	24,236	4.48
C1a - C&I New Buildings & Major Renovations	794,193	691,930	12,267,667	4,300,721	-	18,054,510	1,796,348	19,850,858	24,236	4.48
C2 - C&I Existing Buildings	10,203,994	2,874,592	200,950,810	34,392,855	31,000	248,453,251	23,803,279	272,256,530	14,772	3.78
C2a - C&I Existing Building Retrofit	8,271,578	2,595,856	161,969,264	22,704,596	-	195,541,293	18,450,135	213,991,428	27,172	3.57
C2b - C&I New & Replacement Equipment	1,711,293	231,370	33,633,627	10,586,420	-	46,162,710	4,300,530	50,463,240	5,040	4.37
C2c - C&I Active Demand Reduction	221,123	47,366	5,347,919	1,101,840	31,000	6,749,248	1,052,614	7,801,862	14,546	6.05
C3 - C&I Hard-to-Measure	1,984,378	1,017,552	180,043	972,986	6,822,350	10,977,309	-	10,977,309	-	-
C3a - C&I Statewide Marketing	-	986,409	-	-	-	986,409	-	986,409	-	-
C3b - C&I Statewide Database	52,465	-	-	-	-	52,465	-	52,465	-	-
C3c - C&I DOER Assessment	1,636,541	-	-	-	-	1,636,541	-	1,636,541	-	-
C3d - C&I EEAC Consultants	60,000	-	-	-	-	60,000	-	60,000	-	-
C3e - C&I Sponsorships & Subscriptions	184,235	26,143	-	23,197	1,197	234,771	-	234,771	-	-
C3f - C&I Workforce Development	-	5,000	-	480,516	-	485,516	-	485,516	-	-
C3g - C&I R&D and Demonstration	51,138	-	180,043	469,273	-	700,454	-	700,454	-	-
C3h - C&I Evaluation and Market Research	-	-	-	-	6,821,153	6,821,153	-	6,821,153	-	-
Grand Total	28,321,480	18,774,468	451,701,687	105,283,549	16,156,367	620,237,552	37,415,084	657,652,636	107	2.60

IV.C. Program Administrator Budgets

1. Summary Table

Statewide Electric

September 14, 2018

2020 Program Administrator Budget										Program Cost per Participant	Energy Benefit per Program Cost
Program	Program Costs						Performance Incentive	Total Program Administrator Budget			
	Program Planning and Administration	Marketing and Advertising	Participant Incentive	Sales, Technical Assistance & Training	Evaluation and Market Research	Total Program Costs					
A - Residential	11,791,581	13,588,515	175,656,569	51,859,375	7,570,735	260,466,776	9,602,168	270,068,944	52	1.92	
A1 - Residential New Buildings	864,442	225,322	14,117,790	1,636,819	-	16,844,373	939,790	17,784,164	1,364	2.80	
A1a - Residential New Homes & Renovations	864,442	225,322	14,117,790	1,636,819	-	16,844,373	939,790	17,784,164	1,364	2.80	
A2 - Residential Existing Buildings	8,677,049	10,261,212	138,646,856	46,126,223	42,000	203,753,340	8,662,377	212,415,717	41	2.22	
A2a - Residential Coordinated Delivery	4,101,079	2,472,449	76,776,552	13,434,388	-	96,784,468	4,417,093	101,201,561	2,500	2.47	
A2b - Residential Conservation Services (RCS)	921,418	1,202,412	-	16,533,855	-	18,657,685	-	18,657,685	-	-	
A2c - Residential Retail	2,978,929	6,410,779	56,469,328	5,567,883	-	71,426,920	3,819,818	75,246,738	19	2.56	
A2d - Residential Behavior	326,727	61,152	-	9,082,606	-	9,470,485	324,669	9,795,154	8	2.00	
A2e - Residential Active Demand Reduction	348,895	114,420	5,400,976	1,507,490	42,000	7,413,782	100,797	7,514,579	337	1.47	
A3 - Residential Hard-to-Measure	2,250,090	3,101,981	22,891,923	4,096,334	7,528,735	39,869,063	-	39,869,063	-	-	
A3a - Residential Statewide Marketing	-	1,826,642	-	-	-	1,826,642	-	1,826,642	-	-	
A3b - Residential Statewide Database	105,597	-	-	-	-	105,597	-	105,597	-	-	
A3c - Residential DOER Assessment	1,588,762	-	-	-	-	1,588,762	-	1,588,762	-	-	
A3d - Residential EEAC Consultants	60,000	-	-	-	-	60,000	-	60,000	-	-	
A3e - Residential Sponsorships & Subscriptions	112,073	21,107	-	25,238	1,302	159,719	-	159,719	-	-	
A3f - Residential HEAT Loan	193,583	203,471	22,621,367	1,956,264	-	24,974,685	-	24,974,685	-	-	
A3g - Residential Workforce Development	-	-	-	336,976	-	336,976	-	336,976	-	-	
A3h - Residential R&D and Demonstration	125,076	-	270,557	697,855	-	1,093,488	-	1,093,488	-	-	
A3i - Residential Education	65,000	1,050,761	-	1,080,000	-	2,195,761	-	2,195,761	-	-	
A3j - Residential Evaluation and Market Research	-	-	-	-	7,527,433	7,527,433	-	7,527,433	-	-	
B - Income Eligible	3,998,314	976,423	56,480,427	13,522,500	1,893,784	76,871,449	2,623,830	79,495,278	2,799	1.26	
B1 - Income Eligible Existing Buildings	3,139,726	669,586	56,480,427	13,445,021	-	73,734,761	2,623,830	76,358,590	2,685	1.31	
B1a - Income Eligible Coordinated Delivery	3,115,475	664,374	55,980,427	13,436,282	-	73,196,558	2,623,830	75,820,388	2,670	1.31	
B1b - Income Eligible Active Demand Reduction	24,252	5,212	500,000	8,739	-	538,202	-	538,202	10,764	1.25	
B2 - Income Eligible Hard-to-Measure	858,587	306,837	-	77,479	1,893,784	3,136,688	-	3,136,688	-	-	
B2a - Income Eligible Statewide Marketing	-	303,407	-	-	-	303,407	-	303,407	-	-	
B2b - Income Eligible Statewide Database	30,132	-	-	-	-	30,132	-	30,132	-	-	
B2c - Income Eligible DOER Assessment	435,436	-	-	-	-	435,436	-	435,436	-	-	
B2d - Income Eligible Energy Affordability Network	364,005	-	-	-	-	364,005	-	364,005	-	-	
B2e - Income Eligible Sponsorships & Subscriptions	29,014	3,430	-	7,479	386	40,310	-	40,310	-	-	
B2f - Income Eligible Evaluation and Market Research	-	-	-	-	1,893,398	1,893,398	-	1,893,398	-	-	
B2g - Income Eligible Workforce Development	-	-	-	70,000	-	70,000	-	70,000	-	-	
C - Commercial & Industrial	13,353,354	4,572,040	222,270,182	42,409,031	7,194,388	289,798,994	26,241,406	316,040,400	16,352	3.49	
C1 - C&I New Buildings	796,874	641,824	11,228,893	4,419,062	-	17,086,654	1,807,535	18,894,189	22,937	4.45	
C1a - C&I New Buildings & Major Renovations	796,874	641,824	11,228,893	4,419,062	-	17,086,654	1,807,535	18,894,189	22,937	4.45	
C2 - C&I Existing Buildings	10,452,207	2,864,885	210,838,371	37,009,213	63,000	261,227,675	24,433,871	285,661,546	15,386	3.58	
C2a - C&I Existing Building Retrofit	8,401,077	2,576,347	167,027,473	23,577,723	-	201,582,620	18,885,131	220,467,751	27,292	3.43	
C2b - C&I New & Replacement Equipment	1,797,604	234,660	33,706,189	11,957,568	-	47,696,020	4,078,654	51,774,675	5,385	3.93	
C2c - C&I Active Demand Reduction	253,525	53,878	10,104,710	1,473,922	63,000	11,949,035	1,470,085	13,419,120	16,279	4.77	
C3 - C&I Hard-to-Measure	2,104,273	1,065,330	202,917	980,756	7,131,388	11,484,665	-	11,484,665	-	-	
C3a - C&I Statewide Marketing	-	1,017,862	-	-	-	1,017,862	-	1,017,862	-	-	
C3b - C&I Statewide Database	62,799	-	-	-	-	62,799	-	62,799	-	-	
C3c - C&I DOER Assessment	1,725,867	-	-	-	-	1,725,867	-	1,725,867	-	-	
C3d - C&I EEAC Consultants	60,000	-	-	-	-	60,000	-	60,000	-	-	
C3e - C&I Sponsorships & Subscriptions	194,429	31,468	-	25,276	1,304	252,477	-	252,477	-	-	
C3f - C&I Workforce Development	-	5,000	-	480,516	-	485,516	-	485,516	-	-	
C3g - C&I R&D and Demonstration	61,178	11,000	202,917	474,964	-	750,060	-	750,060	-	-	
C3h - C&I Evaluation and Market Research	-	-	-	-	7,130,084	7,130,084	-	7,130,084	-	-	
Grand Total	29,143,248	19,136,978	454,407,178	107,790,907	16,658,907	627,137,219	38,467,403	665,604,622	124	2.56	

IV.C. Program Administrator Budgets

1. Summary Table

Statewide Electric

September 14, 2018

2021 Program Administrator Budget										
Program	Program Costs						Performance Incentive	Total Program Administrator Budget	Program Cost per Participant	Energy 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	11,531,108	13,519,075	169,154,822	52,754,374	7,755,967	254,715,345	9,650,135	264,365,479	70	1.95
A1 - Residential New Buildings	763,306	227,161	14,425,608	1,669,887	-	17,085,962	976,180	18,062,141		2.78
A1a - Residential New Homes & Renovations	763,306	227,161	14,425,608	1,669,887	-	17,085,962	976,180	18,062,141	5	2.78
A2 - Residential Existing Buildings	8,457,792	10,124,449	131,642,751	46,878,508	65,000	197,168,500	8,673,955	205,842,455	15,606	2.28
A2a - Residential Coordinated Delivery	4,170,471	2,224,937	76,370,071	13,640,781	-	96,406,260	4,593,097	100,999,356	7,631	2.59
A2b - Residential Conservation Services (RCS)	965,297	1,237,556	-	16,738,490	-	18,941,343	-	18,941,343	5	-
A2c - Residential Retail	2,645,202	6,484,237	49,384,023	5,650,496	-	64,163,957	3,608,118	67,772,075	1,670	2.62
A2d - Residential Behavior	346,722	61,148	-	9,082,606	-	9,490,477	336,732	9,827,209		1.99
A2e - Residential Active Demand Reduction	330,101	116,570	5,888,657	1,766,135	65,000	8,166,463	136,009	8,302,472	3	1.53
A3 - Residential Hard-to-Measure	2,310,010	3,167,466	23,086,462	4,205,979	7,690,967	40,460,883	-	40,460,883		
A3a - Residential Statewide Marketing	-	1,860,529	-	-	-	1,860,529	-	1,860,529		
A3b - Residential Statewide Database	104,428	-	-	-	-	104,428	-	104,428		
A3c - Residential DOER Assessment	1,636,205	-	-	-	-	1,636,205	-	1,636,205		
A3d - Residential EEAC Consultants	60,000	-	-	-	-	60,000	-	60,000		
A3e - Residential Sponsorships & Subscriptions	117,421	25,191	-	25,778	1,330	169,720	-	169,720		
A3f - Residential HEAT Loan	196,686	203,762	22,800,895	1,990,180	-	25,191,523	-	25,191,523		
A3g - Residential Workforce Development	-	-	-	341,976	-	341,976	-	341,976		
A3h - Residential R&D and Demonstration	125,269	-	285,568	698,044	-	1,108,881	-	1,108,881		
A3i - Residential Education	70,000	1,077,984	-	1,150,000	-	2,297,984	-	2,297,984		
A3j - Residential Evaluation and Market Research	-	-	-	-	7,689,637	7,689,637	-	7,689,637		
B - Income Eligible	3,754,678	1,048,318	57,220,358	13,536,506	2,122,858	77,682,718	2,707,012	80,389,730	2,824	1.30
B1 - Income Eligible Existing Buildings	2,876,152	726,103	57,220,358	13,483,497	-	74,306,110	2,707,012	77,013,122	2,702	1.36
B1a - Income Eligible Coordinated Delivery	2,853,014	721,085	56,720,358	13,475,819	-	73,770,276	2,707,012	76,477,288	2,687	1.36
B1b - Income Eligible Active Demand Reduction	23,138	5,018	500,000	7,678	-	535,834	-	535,834	10,717	1.26
B2 - Income Eligible Hard-to-Measure	878,526	322,215	-	53,009	2,122,858	3,376,608	-	3,376,608		
B2a - Income Eligible Statewide Marketing	-	318,702	-	-	-	318,702	-	318,702		
B2b - Income Eligible Statewide Database	31,871	-	-	-	-	31,871	-	31,871		
B2c - Income Eligible DOER Assessment	452,313	-	-	-	-	452,313	-	452,313		
B2d - Income Eligible Energy Affordability Network	364,005	-	-	-	-	364,005	-	364,005		
B2e - Income Eligible Sponsorships & Subscriptions	30,337	3,513	-	8,009	413	42,272	-	42,272		
B2f - Income Eligible Evaluation and Market Research	-	-	-	-	2,122,444	2,122,444	-	2,122,444		
B2g - Income Eligible Workforce Development	-	-	-	45,000	-	45,000	-	45,000		
C - Commercial & Industrial	14,374,630	4,706,408	239,554,806	43,238,901	7,450,316	309,325,061	37,375,224	346,700,285	17,272	4.67
C1 - C&I New Buildings	831,323	721,987	11,905,131	4,239,365	-	17,697,807	1,873,182	19,570,989	23,630	4.31
C1a - C&I New Buildings & Major Renovations	831,323	721,987	11,905,131	4,239,365	-	17,697,807	1,873,182	19,570,989	23,630	4.31
C2 - C&I Existing Buildings	11,358,604	2,901,809	227,435,499	38,006,528	95,000	279,797,440	35,502,042	315,299,482	16,305	4.89
C2a - C&I Existing Building Retrofit	8,600,819	2,594,497	178,508,441	24,487,583	-	214,191,341	19,337,621	233,528,962	28,540	3.21
C2b - C&I New & Replacement Equipment	2,498,873	250,850	34,505,189	11,845,874	-	49,100,785	14,333,848	63,434,633	5,601	12.47
C2c - C&I Active Demand Reduction	258,913	56,462	14,421,870	1,673,070	95,000	16,505,314	1,830,574	18,335,888	18,566	4.22
C3 - C&I Hard-to-Measure	2,184,703	1,082,612	214,176	993,008	7,355,316	11,829,814	-	11,829,814		
C3a - C&I Statewide Marketing	-	1,040,144	-	-	-	1,040,144	-	1,040,144		
C3b - C&I Statewide Database	117,229	-	-	-	-	117,229	-	117,229		
C3c - C&I DOER Assessment	1,751,867	-	-	-	-	1,751,867	-	1,751,867		
C3d - C&I EEAC Consultants	60,000	-	-	-	-	60,000	-	60,000		
C3e - C&I Sponsorships & Subscriptions	194,429	26,468	-	25,276	1,304	247,477	-	247,477		
C3f - C&I Workforce Development	-	5,000	-	490,516	-	495,516	-	495,516		
C3g - C&I R&D and Demonstration	61,178	11,000	214,176	477,216	-	763,570	-	763,570		
C3h - C&I Evaluation and Market Research	-	-	-	-	7,354,012	7,354,012	-	7,354,012		
Grand Total	29,660,416	19,273,801	465,929,986	109,529,780	17,329,140	641,723,124	49,732,371	691,455,495	174	3.18

IV.C. Program Administrator Budgets

1. Summary Table

Statewide Electric

September 14, 2018

2019-2021 Program Administrator Budget										
Program	Program Costs						Performance Incentive	Total Program Administrator Budget	Program Cost per Participant	Energy 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	35,018,059	40,421,704	528,941,762	157,032,060	22,780,088	784,193,673	28,471,449	812,665,122	55	1.90
A1 - Residential New Buildings	2,439,504	658,539	42,363,059	4,889,754	-	50,350,856	2,826,576	53,177,431	1,361	2.81
A1a - Residential New Homes & Renovations	2,439,504	658,539	42,363,059	4,889,754	-	50,350,856	2,826,576	53,177,431	1,361	2.81
A2 - Residential Existing Buildings	25,865,052	30,447,162	420,524,518	139,864,187	128,000	616,828,919	25,644,873	642,473,793	43	2.19
A2a - Residential Coordinated Delivery	12,312,721	7,143,331	231,487,875	40,395,220	-	291,339,146	13,474,197	304,813,343	2,506	2.50
A2b - Residential Conservation Services (RCS)	2,675,538	3,616,368	-	49,603,302	-	55,895,208	-	55,895,208	-	-
A2c - Residential Retail	8,900,399	19,201,390	176,819,454	17,686,738	-	222,607,982	10,908,745	233,516,726	21	2.41
A2d - Residential Behavior	999,733	183,156	-	27,247,818	-	28,430,707	966,257	29,396,963	8	2.03
A2e - Residential Active Demand Reduction	976,661	302,918	12,217,188	4,931,109	128,000	18,555,877	295,675	18,851,552	284	1.47
A3 - Residential Hard-to-Measure	6,713,503	9,316,002	66,054,186	12,278,119	22,652,088	117,013,898	-	117,013,898	-	-
A3a - Residential Statewide Marketing	-	5,508,322	-	-	-	5,508,322	-	5,508,322	-	-
A3b - Residential Statewide Database	317,954	-	-	-	-	317,954	-	317,954	-	-
A3c - Residential DOER Assessment	4,798,915	-	-	-	-	4,798,915	-	4,798,915	-	-
A3d - Residential EEAC Consultants	180,000	-	-	-	-	180,000	-	180,000	-	-
A3e - Residential Sponsorships & Subscriptions	341,074	66,437	-	76,456	3,945	487,911	-	487,911	-	-
A3f - Residential HEAT Loan	510,327	593,313	65,280,672	5,844,111	-	72,228,423	-	72,228,423	-	-
A3g - Residential Workforce Development	-	-	-	1,008,978	-	1,008,978	-	1,008,978	-	-
A3h - Residential R&D and Demonstration	365,234	-	773,515	2,068,574	-	3,207,322	-	3,207,322	-	-
A3i - Residential Education	200,000	3,147,930	-	3,280,000	-	6,627,930	-	6,627,930	-	-
A3j - Residential Evaluation and Market Research	-	-	-	-	22,648,143	22,648,143	-	22,648,143	-	-
B - Income Eligible	11,396,537	2,901,022	167,873,582	40,257,682	5,866,274	228,295,096	7,927,153	236,222,248	2,773	1.28
B1 - Income Eligible Existing Buildings	8,843,248	1,976,185	167,873,582	40,067,659	-	218,760,674	7,927,153	226,687,826	2,657	1.33
B1a - Income Eligible Coordinated Delivery	8,795,858	1,965,956	166,873,582	40,051,242	-	217,686,638	7,927,153	225,613,790	2,647	1.33
B1b - Income Eligible Active Demand Reduction	47,390	10,230	1,000,000	16,417	-	1,074,036	-	1,074,036	10,740	1.26
B2 - Income Eligible Hard-to-Measure	2,553,289	924,836	-	190,023	5,866,274	9,534,422	-	9,534,422	-	-
B2a - Income Eligible Statewide Marketing	-	914,533	-	-	-	914,533	-	914,533	-	-
B2b - Income Eligible Statewide Database	85,137	-	-	-	-	85,137	-	85,137	-	-
B2c - Income Eligible DOER Assessment	1,298,882	-	-	-	-	1,298,882	-	1,298,882	-	-
B2d - Income Eligible Energy Affordability Network	1,082,016	-	-	-	-	1,082,016	-	1,082,016	-	-
B2e - Income Eligible Sponsorships & Subscriptions	87,254	10,304	-	22,523	1,162	121,243	-	121,243	-	-
B2f - Income Eligible Evaluation and Market Research	-	-	-	-	5,865,112	5,865,112	-	5,865,112	-	-
B2g - Income Eligible Workforce Development	-	-	-	167,500	-	167,500	-	167,500	-	-
C - Commercial & Industrial	40,710,548	13,862,522	675,223,507	125,314,493	21,498,054	876,609,125	89,216,257	965,825,382	16,479	3.97
C1 - C&I New Buildings	2,422,390	2,055,741	35,401,691	12,959,148	-	52,838,971	5,477,065	58,316,036	23,601	4.41
C1a - C&I New Buildings & Major Renovations	2,422,390	2,055,741	35,401,691	12,959,148	-	52,838,971	5,477,065	58,316,036	23,601	4.41
C2 - C&I Existing Buildings	32,014,804	8,641,286	639,224,680	109,408,596	189,000	789,478,366	83,739,192	873,217,558	15,493	4.11
C2a - C&I Existing Building Retrofit	25,273,473	7,766,701	507,505,178	70,769,902	-	611,315,254	56,672,887	667,988,141	27,677	3.39
C2b - C&I New & Replacement Equipment	6,007,770	716,880	101,845,004	34,389,862	-	142,959,516	22,713,032	165,672,548	5,338	7.00
C2c - C&I Active Demand Reduction	733,561	157,705	29,874,499	4,248,832	189,000	35,203,597	4,353,273	39,556,869	16,868	4.76
C3 - C&I Hard-to-Measure	6,273,354	3,165,495	597,136	2,946,749	21,309,054	34,291,788	-	34,291,788	-	-
C3a - C&I Statewide Marketing	-	3,044,416	-	-	-	3,044,416	-	3,044,416	-	-
C3b - C&I Statewide Database	232,493	-	-	-	-	232,493	-	232,493	-	-
C3c - C&I DOER Assessment	5,114,274	-	-	-	-	5,114,274	-	5,114,274	-	-
C3d - C&I EEAC Consultants	180,000	-	-	-	-	180,000	-	180,000	-	-
C3e - C&I Sponsorships & Subscriptions	573,093	84,079	-	73,749	3,805	734,725	-	734,725	-	-
C3f - C&I Workforce Development	-	15,000	-	1,451,547	-	1,466,547	-	1,466,547	-	-
C3g - C&I R&D and Demonstration	173,494	22,000	597,136	1,421,454	-	2,214,083	-	2,214,083	-	-
C3h - C&I Evaluation and Market Research	-	-	-	-	21,305,249	21,305,249	-	21,305,249	-	-
Grand Total	87,125,144	57,185,247	1,372,038,852	322,604,236	50,144,415	1,889,097,894	125,614,858	2,014,712,753	130	2.78

Notes:

Budgets for each year are represented in nominal dollars (2019\$, 2020\$, 2021\$).

Refer to common definitions for allocation of costs.

The electric Program Administrators do not budget for the EEAC Consultant fees, as these costs are paid by the DOER using RGGI proceeds.

IV.D. Cost-Effectiveness

1. Summary Table

Statewide Electric

September 14, 2018

2019 Total Resource Cost Test (2019\$)										
Program	With GWSA Benefits			Without GWSA Benefits			Costs			
	Benefit-Cost Ratio	Net Benefits	Total TRC Test Benefits	Benefit-Cost Ratio	Net Benefits	Total TRC Test Benefits	Total Program Costs	Performance Incentive	Participant Costs	Total TRC Test Costs
A - Residential	1.63	211,419,246	545,202,983	1	154,239,477	488,023,214	269,011,553	9,219,146	55,553,038	333,783,737
A1 - Residential New Buildings	1.44	15,521,820	50,407,596	1	12,037,465	46,923,240	16,420,521	910,606	17,554,649	34,885,775
A1a - Residential New Homes & Renovations	1.44	15,521,820	50,407,596	1	12,037,465	46,923,240	16,420,521	910,606	17,554,649	34,885,775
A2 - Residential Existing Buildings	1.89	232,581,378	494,795,387	2	178,885,965	441,099,974	215,907,080	8,308,541	37,998,389	262,214,009
A2a - Residential Coordinated Delivery	2.08	139,198,656	268,237,641	2	114,325,292	243,364,277	98,148,418	4,464,008	26,426,559	129,038,985
A2b - Residential Conservation Services (RCS)	0.00	-18,296,180	0	-	(18,296,180)	-	18,296,180	-	-	18,296,180
A2c - Residential Retail	1.99	100,882,637	202,952,380	2	76,177,477	178,247,221	87,017,104	3,480,809	11,571,830	102,069,744
A2d - Residential Behavior	2.03	10,019,233	19,793,834	2	5,907,191	15,681,791	9,469,745	304,855	-	9,774,601
A2e - Residential Active Demand Reduction	1.26	777,032	3,811,532	1	772,184	3,806,685	2,975,632	58,869	-	3,034,501
A3 - Residential Hard-to-Measure	0.00	-36,683,952	0	-	(36,683,952)	-	36,683,952	-	-	36,683,952
B - Income Eligible	1.89	68,217,916	144,555,156	2	56,587,636	132,924,876	73,740,929	2,596,311	-	76,337,240
B1 - Income Eligible Existing Buildings	1.97	71,239,043	144,555,156	2	59,608,762	132,924,876	70,719,803	2,596,311	-	73,316,114
B1a - Income Eligible Coordinated Delivery	1.97	71,239,043	144,555,156	2	59,608,762	132,924,876	70,719,803	2,596,311	-	73,316,114
B1b - Income Eligible Active Demand Reduction	0.00	0	0	-	-	-	-	-	-	-
B2 - Income Eligible Hard-to-Measure	0.00	-3,021,126	0	-	(3,021,126)	-	3,021,126	-	-	3,021,126
C - Commercial & Industrial	2.58	719,459,892	1,175,298,345	2	580,412,199	1,036,250,651	277,485,070	25,599,627	152,753,756	455,838,453
C1 - C&I New Buildings	3.49	59,610,149	83,548,762	3	47,507,900	71,446,513	18,054,510	1,796,348	4,087,755	23,938,613
C1a - C&I New Buildings & Major Renovations	3.49	59,610,149	83,548,762	3	47,507,900	71,446,513	18,054,510	1,796,348	4,087,755	23,938,613
C2 - C&I Existing Buildings	2.59	670,827,052	1,091,749,583	2	543,881,608	964,804,139	248,453,251	23,803,279	148,666,001	420,922,531
C2a - C&I Existing Building Retrofit	2.45	501,799,248	847,985,277	2	405,011,372	751,197,401	195,541,293	18,450,135	132,194,601	346,186,029
C2b - C&I New & Replacement Equipment	3.03	135,963,328	202,897,969	3	105,870,688	172,805,328	46,162,710	4,300,530	16,471,400	66,934,640
C2c - C&I Active Demand Reduction	5.24	33,064,476	40,866,337	5	32,999,548	40,801,409	6,749,248	1,052,614	-	7,801,862
C3 - C&I Hard-to-Measure	0.00	-10,977,309	0	-	(10,977,309)	-	10,977,309	-	-	10,977,309
Grand Total	2.15	999,097,055	1,865,056,484	2	791,239,312	1,657,198,741	620,237,552	37,415,084	208,306,793	865,959,429

2020 Total Resource Cost Test (2019\$)										
Program	With GWSA Benefits			Without GWSA Benefits			Costs			
	Benefit-Cost Ratio	Net Benefits	Total TRC Test Benefits	Benefit-Cost Ratio	Net Benefits	Total TRC Test Benefits	Total Program Costs	Performance Incentive	Participant Costs	Total TRC Test Costs
A - Residential	1.67	219,429,275	548,294,570	2	171,758,089	500,623,383	254,536,085	9,383,531	64,945,678	328,865,294
A1 - Residential New Buildings	1.47	16,072,914	50,576,128	1	12,779,977	47,283,191	16,460,836	918,392	17,123,986	34,503,214
A1a - Residential New Homes & Renovations	1.47	16,072,914	50,576,128	1	12,779,977	47,283,191	16,460,836	918,392	17,123,986	34,503,214
A2 - Residential Existing Buildings	1.95	242,317,627	497,718,442	2	197,939,377	453,340,192	199,113,984	8,465,140	47,821,692	255,400,815
A2a - Residential Coordinated Delivery	2.08	139,506,192	268,918,724	2	118,291,254	247,703,787	94,580,737	4,316,518	30,515,278	129,412,533
A2b - Residential Conservation Services (RCS)	0.00	-18,232,859	0	-	(18,232,859)	-	18,232,859	-	-	18,232,859
A2c - Residential Retail	2.19	108,129,146	198,968,969	2	87,852,149	178,691,972	69,800,567	3,732,842	17,306,414	90,839,823
A2d - Residential Behavior	1.98	9,343,916	18,916,039	2	6,442,691	16,014,815	9,254,847	317,277	-	9,572,124
A2e - Residential Active Demand Reduction	1.49	3,571,232	10,914,709	1	3,586,143	10,929,620	7,244,974	98,502	-	7,343,476
A3 - Residential Hard-to-Measure	0.00	-38,961,265	0	-	(38,961,265)	-	38,961,265	-	-	38,961,265
B - Income Eligible	1.90	69,689,071	147,373,600	2	59,051,324	136,735,852	75,121,127	2,564,086	(684)	77,684,529
B1 - Income Eligible Existing Buildings	1.98	72,754,338	147,373,600	2	62,116,591	136,735,852	72,055,859	2,564,086	(684)	74,619,261
B1a - Income Eligible Coordinated Delivery	1.98	72,605,755	146,699,068	2	61,965,514	136,058,827	71,529,911	2,564,086	(684)	74,093,314
B1b - Income Eligible Active Demand Reduction	1.28	148,584	674,531	1	151,078	677,025	525,948	-	-	525,948
B2 - Income Eligible Hard-to-Measure	0.00	-3,065,268	0	-	(3,065,268)	-	3,065,268	-	-	3,065,268
C - Commercial & Industrial	2.56	713,102,361	1,169,238,122	2	586,601,232	1,042,736,993	283,200,424	25,643,903	147,291,434	456,135,761
C1 - C&I New Buildings	3.64	58,222,049	80,289,621	3	47,712,489	69,780,062	16,697,600	1,766,378	3,603,594	22,067,573
C1a - C&I New Buildings & Major Renovations	3.64	58,222,049	80,289,621	3	47,712,489	69,780,062	16,697,600	1,766,378	3,603,594	22,067,573
C2 - C&I Existing Buildings	2.58	666,103,478	1,088,948,501	2	550,111,908	972,956,931	255,279,659	23,877,524	143,687,839	422,845,023
C2a - C&I Existing Building Retrofit	2.41	493,236,115	844,044,229	2	403,249,905	754,058,020	196,992,690	18,455,127	135,360,297	350,808,114
C2b - C&I New & Replacement Equipment	3.19	129,027,402	187,950,737	3	103,093,145	162,016,480	46,610,007	3,985,785	8,327,542	58,923,335
C2c - C&I Active Demand Reduction	4.34	43,839,960	56,953,534	4	43,768,858	56,882,431	11,676,962	1,436,612	-	13,113,574
C3 - C&I Hard-to-Measure	0.00	-11,223,165	0	-	(11,223,165)	-	11,223,165	-	-	11,223,165
Grand Total	2.16	1,002,220,707	1,864,906,291	2	817,410,644	1,680,096,229	612,857,636	37,591,521	212,236,428	862,685,584

IV.D. Cost-Effectiveness

1. Summary Table

Statewide Electric

September 14, 2018

2021 Total Resource Cost Test (2019\$)										
Program	With GWSA Benefits			Without GWSA Benefits			Costs			
	Benefit-Cost Ratio	Net Benefits	Total TRC Test Benefits	Benefit-Cost Ratio	Net Benefits	Total TRC Test Benefits	Total Program Costs	Performance Incentive	Participant Costs	Total TRC Test Costs
A - Residential	1.61	203,126,415	538,325,952	1	162,736,341	497,935,878	243,247,934	9,215,681	82,735,922	335,199,537
A1 - Residential New Buildings	1.50	17,050,614	51,018,088	1	13,906,334	47,873,807	16,316,743	932,231	16,718,499	33,967,474
A1a - Residential New Homes & Renovations	1.50	17,050,614	51,018,088	1	13,906,334	47,873,807	16,316,743	932,231	16,718,499	33,967,474
A2 - Residential Existing Buildings	1.86	224,715,115	487,307,864	2	187,469,321	450,062,070	188,291,877	8,283,449	66,017,423	262,592,749
A2a - Residential Coordinated Delivery	2.17	150,826,544	279,588,621	2	130,696,851	259,458,928	92,066,002	4,386,313	32,309,761	128,762,077
A2b - Residential Conservation Services (RCS)	0.00	-18,088,594	0	-	(18,088,594)	-	18,088,594	-	-	18,088,594
A2c - Residential Retail	1.79	77,888,497	176,317,101	2	63,573,062	162,001,667	61,275,264	3,445,679	33,707,662	98,428,605
A2d - Residential Behavior	2.01	9,520,553	18,905,336	2	6,707,110	16,091,893	9,063,211	321,572	-	9,384,783
A2e - Residential Active Demand Reduction	1.58	4,568,115	12,496,805	2	4,580,892	12,509,582	7,798,805	129,885	-	7,928,690
A3 - Residential Hard-to-Measure	0.00	-38,639,314	0	-	(38,639,314)	-	38,639,314	-	-	38,639,314
B - Income Eligible	1.98	75,145,290	151,915,835	2	64,857,202	141,627,747	74,185,403	2,585,141	-	76,770,545
B1 - Income Eligible Existing Buildings	2.07	78,369,881	151,915,835	2	68,081,794	141,627,747	70,960,812	2,585,141	-	73,545,953
B1a - Income Eligible Coordinated Delivery	2.07	78,206,358	151,240,601	2	67,915,866	140,950,109	70,449,102	2,585,141	-	73,034,243
B1b - Income Eligible Active Demand Reduction	1.32	163,524	675,234	1	165,928	677,638	511,710	-	-	511,710
B2 - Income Eligible Hard-to-Measure	0.00	-3,224,591	0	-	(3,224,591)	-	3,224,591	-	-	3,224,591
C - Commercial & Industrial	3.24	1,066,723,987	1,543,961,143	3	916,131,539	1,393,368,696	295,399,094	35,692,573	146,145,489	477,237,157
C1 - C&I New Buildings	3.65	58,570,749	80,707,505	3	48,414,329	70,551,086	16,901,043	1,788,851	3,446,863	22,136,756
C1a - C&I New Buildings & Major Renovations	3.65	58,570,749	80,707,505	3	48,414,329	70,551,086	16,901,043	1,788,851	3,446,863	22,136,756
C2 - C&I Existing Buildings	3.30	1,019,450,468	1,463,253,638	3	879,014,440	1,322,817,610	267,200,821	33,903,723	142,698,626	443,803,170
C2a - C&I Existing Building Retrofit	2.36	486,431,475	844,627,810	2	399,332,601	757,528,936	204,548,341	18,467,032	135,180,963	358,196,335
C2b - C&I New & Replacement Equipment	8.06	480,901,405	548,997,843	7	427,642,289	495,738,726	46,890,244	13,688,531	7,517,663	68,096,438
C2c - C&I Active Demand Reduction	3.98	52,117,588	69,627,985	4	52,039,551	69,549,947	15,762,237	1,748,160	-	17,510,397
C3 - C&I Hard-to-Measure	0.00	-11,297,230	0	-	(11,297,230)	-	11,297,230	-	-	11,297,230
Grand Total	2.51	1,344,995,692	2,234,202,930	2	1,143,725,083	2,032,932,321	612,832,432	47,493,395	228,881,411	889,207,238

2019-2021 Total Resource Cost Test (2019\$)										
Program	With GWSA Benefits			Without GWSA Benefits			Costs			
	Benefit-Cost Ratio	Net Benefits	Total TRC Test Benefits	Benefit-Cost Ratio	Net Benefits	Total TRC Test Benefits	Total Program Costs	Performance Incentive	Participant Costs	Total TRC Test Costs
A - Residential	1.64	633,974,937	1,631,823,505	1	488,733,907	1,486,582,474	766,795,572	27,818,359	203,234,637	997,848,568
A1 - Residential New Buildings	1.47	48,645,349	152,001,812	1	38,723,775	142,080,238	49,198,100	2,761,229	51,397,134	103,356,463
A1a - Residential New Homes & Renovations	1.47	48,645,349	152,001,812	1	38,723,775	142,080,238	49,198,100	2,761,229	51,397,134	103,356,463
A2 - Residential Existing Buildings	1.90	699,614,120	1,479,821,693	2	564,294,664	1,344,502,237	603,312,940	25,057,130	151,837,503	780,207,573
A2a - Residential Coordinated Delivery	2.11	429,531,393	816,744,987	2	363,313,398	750,526,992	284,795,157	13,166,839	89,251,598	387,213,594
A2b - Residential Conservation Services (RCS)	0.00	-54,617,634	0	-	(54,617,634)	-	54,617,634	-	-	54,617,634
A2c - Residential Retail	1.98	286,900,280	578,238,451	2	227,602,688	518,940,859	218,092,935	10,659,330	62,585,905	291,338,171
A2d - Residential Behavior	2.01	28,883,702	57,615,209	2	19,056,992	47,788,499	27,787,803	943,704	-	28,731,507
A2e - Residential Active Demand Reduction	1.49	8,916,379	27,223,046	1	8,939,219	27,245,887	18,019,411	287,256	-	18,306,667
A3 - Residential Hard-to-Measure	0.00	-114,284,532	0	-	(114,284,532)	-	114,284,532	-	-	114,284,532
B - Income Eligible	1.92	213,052,277	443,844,591	2	180,496,162	411,288,476	223,047,459	7,745,538	(684)	230,792,314
B1 - Income Eligible Existing Buildings	2.00	222,363,262	443,844,591	2	189,807,147	411,288,476	213,736,474	7,745,538	(684)	221,481,329
B1a - Income Eligible Coordinated Delivery	2.01	222,051,155	442,494,825	2	189,490,141	409,933,812	212,698,817	7,745,538	(684)	220,443,671
B1b - Income Eligible Active Demand Reduction	1.30	312,108	1,349,765	1	317,006	1,354,663	1,037,658	-	-	1,037,658
B2 - Income Eligible Hard-to-Measure	0.00	-9,310,985	0	-	(9,310,985)	-	9,310,985	-	-	9,310,985
C - Commercial & Industrial	2.80	2,499,286,240	3,888,497,610	2	2,083,144,970	3,472,356,341	856,084,588	86,936,103	446,190,679	1,389,211,370
C1 - C&I New Buildings	3.59	176,402,946	244,545,888	3	143,634,719	211,777,661	51,653,153	5,351,577	11,138,212	68,142,942
C1a - C&I New Buildings & Major Renovations	3.59	176,402,946	244,545,888	3	143,634,719	211,777,661	51,653,153	5,351,577	11,138,212	68,142,942
C2 - C&I Existing Buildings	2.83	2,356,380,998	3,643,951,722	3	1,973,007,956	3,260,578,680	770,933,731	81,584,526	435,052,467	1,287,570,724
C2a - C&I Existing Building Retrofit	2.40	1,481,466,837	2,536,657,316	2	1,207,593,878	2,262,784,357	597,082,324	55,372,293	402,735,861	1,055,190,479
C2b - C&I New & Replacement Equipment	4.85	745,892,136	939,846,549	4	636,606,122	830,560,535	139,662,961	21,974,847	32,316,605	193,954,413
C2c - C&I Active Demand Reduction	4.36	129,022,024	167,447,857	4	128,807,956	167,233,788	34,188,446	4,237,386	-	38,425,832
C3 - C&I Hard-to-Measure	0.00	-33,497,704	0	-	(33,497,704)	-	33,497,704	-	-	33,497,704
Grand Total	2.28	3,346,313,454	5,964,165,705	2	2,752,375,039	5,370,227,291	1,845,927,619	122,500,000	649,424,632	2,617,852,252

Notes:

The Benefit-Cost Ratio is the Total TRC Test Benefits divided by the Total TRC Test Costs.

The Net Benefits are the Total TRC Test Benefits minus the Total TRC Test Costs.

For supporting information on the Total TRC Test Benefits, see Table IV.D.3.1.1.

For supporting information on the Total Program Costs, see Table IV.C.1.

For supporting information on the Performance Incentive, refer to the Performance Incentive Model.

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

IV.D Cost-Effectiveness
 3.1.1 Benefits Summary Table
 Statewide Electric
 September 14, 2018

Program	2019 Benefits													
	Electric						Natural Gas							
	Summer Generation	Capacity DRIPE	Capacity			Total Capacity	Electric Energy			Total Electric Energy	Natural Gas	Natural Gas DRIPE	Natural Gas GWSA	Total Natural Gas
A - Residential	23,212,135	3,413,806	30,174,380	47,517,609	652,090		104,970,020	114,613,268	47,932,505					
A1 - Residential New Buildings	3,883,283	13,385	4,209,756	6,690,665	39,483	14,836,573	9,062,885	2,011,439	2,493,757	13,568,080	(242,329)	(98,437)	(69,618)	(410,385)
A1a - Residential New Homes & Renovations	3,883,283	13,385	4,209,756	6,690,665	39,483	14,836,573	9,062,885	2,011,439	2,493,757	13,568,080	(242,329)	(98,437)	(69,618)	(410,385)
A2 - Residential Existing Buildings	19,328,852	3,400,421	25,964,624	40,826,944	612,607	90,133,448	105,550,383	45,921,065	40,482,056	191,953,504	(3,450,965)	(2,595,203)	(1,420,801)	(7,466,969)
A2a - Residential Coordinated Delivery	5,040,756	310,567	6,174,959	10,203,052	108,481	21,837,816	27,225,737	10,020,858	9,556,666	46,803,261	4,807,744	527,626	903,530	6,238,900
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	12,999,981	525,593	17,653,943	26,914,312	328,010	58,421,840	71,163,059	33,447,109	26,808,499	131,418,668	(8,258,710)	(3,122,828)	(2,324,331)	(13,705,869)
A2d - Residential Behavior	1,198,511	1,818,538	1,227,111	1,793,364	5,658	6,091,182	7,146,010	2,444,600	4,112,042	13,702,652	-	-	-	-
A2e - Residential Active Demand Reduction	89,604	745,723	908,610	1,916,215	122,458	3,782,609	15,578	8,498	4,848	28,923	-	-	-	-
B - Income Eligible	2,754,869	168,117	3,441,613	5,964,028	56,402	12,385,028	23,611,429	7,022,306	7,739,427	38,373,163	430,761	68,388	97,277	596,426
B1 - Income Eligible Existing Buildings	2,754,869	168,117	3,441,613	5,964,028	56,402	12,385,028	23,611,429	7,022,306	7,739,427	38,373,163	430,761	68,388	97,277	596,426
B1a - Income Eligible Coordinated Delivery	2,754,869	168,117	3,441,613	5,964,028	56,402	12,385,028	23,611,429	7,022,306	7,739,427	38,373,163	430,761	68,388	97,277	596,426
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	79,306,596	11,137,893	105,204,150	169,000,799	2,690,938	367,340,376	466,967,308	142,348,977	156,687,501	766,003,786	(59,002,783)	(8,929,358)	(13,304,882)	(81,237,023)
C1 - C&I New Buildings	5,409,152	37,035	6,329,316	11,271,286	79,441	23,126,229	42,212,438	10,587,579	13,447,121	66,247,138	(4,410,517)	(683,817)	(1,017,668)	(6,112,002)
C1a - C&I New Buildings & Major Renovations	5,409,152	37,035	6,329,316	11,271,286	79,441	23,126,229	42,212,438	10,587,579	13,447,121	66,247,138	(4,410,517)	(683,817)	(1,017,668)	(6,112,002)
C2 - C&I Existing Buildings	73,897,445	11,100,858	98,874,834	157,729,513	2,611,498	344,214,147	424,754,870	131,761,398	143,240,380	699,756,648	(54,592,265)	(8,245,541)	(12,287,214)	(75,125,021)
C2a - C&I Existing Building Retrofit	59,747,211	2,537,147	72,929,500	111,907,068	1,076,762	248,197,688	334,807,691	102,581,008	112,586,941	549,975,639	(54,087,257)	(8,118,594)	(12,152,893)	(74,358,744)
C2b - C&I New & Replacement Equipment	13,194,828	835,287	16,319,214	25,541,157	254,999	56,145,485	89,390,828	28,806,307	30,588,511	148,785,646	(505,008)	(126,947)	(134,321)	(766,277)
C2c - C&I Active Demand Reduction	955,407	7,728,423	9,626,120	20,281,288	1,279,736	39,870,974	556,352	374,083	64,928	995,363	-	-	-	-
Grand Total	105,273,600	14,719,816	138,820,142	222,482,435	3,399,430	484,695,425	605,192,005	197,303,787	207,402,741	1,009,898,533	(62,265,316)	(11,554,611)	(14,698,025)	(88,517,951)

Program	2020 Benefits													
	Electric						Natural Gas							
	Summer Generation	Capacity DRIPE	Capacity			Total Capacity	Electric Energy			Total Electric Energy	Natural Gas	Natural Gas DRIPE	Natural Gas GWSA	Total Natural Gas
A - Residential	22,580,794	4,977,182	31,043,152	50,930,375	776,878		110,308,382	96,556,245	37,049,094					
A1 - Residential New Buildings	3,692,272	12,074	3,986,697	6,448,807	37,160	14,177,010	9,494,899	1,940,888	2,332,122	13,767,909	(216,015)	(74,236)	(53,487)	(343,738)
A1a - Residential New Homes & Renovations	3,692,272	12,074	3,986,697	6,448,807	37,160	14,177,010	9,494,899	1,940,888	2,332,122	13,767,909	(216,015)	(74,236)	(53,487)	(343,738)
A2 - Residential Existing Buildings	18,888,522	4,965,108	27,056,455	44,481,569	739,718	96,131,371	87,061,345	35,108,206	28,419,769	150,589,321	(832,202)	(1,426,713)	(551,694)	(2,810,610)
A2a - Residential Coordinated Delivery	6,160,012	1,034,327	7,300,006	13,160,555	105,048	27,759,948	23,227,765	6,947,474	6,724,622	36,899,861	4,836,150	437,446	841,147	6,114,743
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	11,546,277	503,593	15,771,374	23,714,731	276,887	51,812,861	55,909,340	25,699,101	18,808,833	100,417,274	(5,668,352)	(1,864,159)	(1,392,841)	(8,925,353)
A2d - Residential Behavior	887,193	1,823,018	1,230,134	1,800,523	53,790	5,794,658	7,769,489	2,450,668	2,901,325	13,121,381	-	-	-	-
A2e - Residential Active Demand Reduction	295,040	1,604,170	2,754,941	5,805,760	303,993	10,763,904	154,752	10,963	(14,911)	150,804	-	-	-	-
B - Income Eligible	3,137,637	365,085	3,991,373	7,211,850	72,050	14,777,995	23,582,219	6,538,670	6,883,022	37,003,912	437,741	57,185	90,458	585,384
B1 - Income Eligible Existing Buildings	3,137,637	365,085	3,991,373	7,211,850	72,050	14,777,995	23,582,219	6,538,670	6,883,022	37,003,912	437,741	57,185	90,458	585,384
B1a - Income Eligible Coordinated Delivery	3,116,963	299,436	3,811,337	6,832,626	56,199	14,116,561	23,566,230	6,539,068	6,885,516	36,990,814	437,741	57,185	90,458	585,384
B1b - Income Eligible Active Demand Reduction	20,674	65,649	180,036	379,224	15,851	661,434	15,989	(398)	(2,494)	13,098	-	-	-	-
C - Commercial & Industrial	78,413,328	14,495,892	107,342,048	176,445,074	3,171,342	379,867,684	470,375,615	143,032,925	144,853,255	758,261,795	(60,378,728)	(7,424,135)	(12,458,629)	(80,261,492)
C1 - C&I New Buildings	5,076,442	38,897	5,921,786	10,818,604	74,627	21,930,356	38,311,069	9,488,017	11,146,127	58,945,212	(538,866)	(88,959)	(123,030)	(750,854)
C1a - C&I New Buildings & Major Renovations	5,076,442	38,897	5,921,786	10,818,604	74,627	21,930,356	38,311,069	9,488,017	11,146,127	58,945,212	(538,866)	(88,959)	(123,030)	(750,854)
C2 - C&I Existing Buildings	73,336,886	14,456,995	101,420,262	165,626,470	3,096,716	357,937,328	432,064,546	133,544,908	133,707,128	699,316,583	(59,839,862)	(7,335,177)	(12,335,599)	(79,510,638)
C2a - C&I Existing Building Retrofit	59,494,506	2,756,148	72,465,510	113,436,530	1,072,595	249,225,289	346,961,936	105,854,847	107,177,083	559,993,866	(59,374,254)	(7,239,143)	(12,224,146)	(78,837,543)
C2b - C&I New & Replacement Equipment	12,509,601	938,170	15,531,561	23,903,081	241,047	53,123,460	84,297,651	27,201,167	26,458,942	137,957,761	(465,608)	(96,034)	(111,453)	(673,095)
C2c - C&I Active Demand Reduction	1,332,779	10,762,677	13,423,190	28,286,859	1,783,073	55,588,579	80,959	488,894	71,103	1,364,956	-	-	-	-
Grand Total	104,131,758	19,838,160	142,376,572	234,587,299	4,020,271	504,954,061	590,514,079	186,620,689	182,488,169	959,622,937	(60,989,204)	(8,867,900)	(12,973,353)	(82,830,457)

IV.D Cost-Effectiveness
 3.1.i. Benefits Summary Table
 Statewide Electric
 September 14, 2018

Program	2019 Benefits															Total Energy Benefits per Participant
	Oil				Propane Benefits			Wood	Water	Total Energy Benefits	Total GWSA Benefits	Non-Energy Impacts	Total TRC Test Benefits	Total TRC Test Benefits w/o GWSA		
	Oil	Oil DRPE	Oil GWSA	Total Oil	Propane	Propane GWSA	Total Propane Benefits									
A - Residential	130,127,698	374,366	13,231,774	143,733,838	39,389,818	2,462,603	41,852,421	-	6,817,559	495,018,069	57,179,769	50,184,913	545,202,983	488,023,214	86	
A1 - Residential New Buildings	36,638	506	(26,379)	10,765	17,967,389	1,086,596	19,053,985	-	-	47,059,019	3,484,356	3,348,577	50,407,596	46,923,240	3,914	
A1a - Residential New Homes & Renovations	36,638	506	(26,379)	10,765	17,967,389	1,086,596	19,053,985	-	-	47,059,019	3,484,356	3,348,577	50,407,596	46,923,240	3,914	
A2 - Residential Existing Buildings	130,091,060	373,860	13,258,152	143,723,072	21,422,430	3,376,006	22,798,436	-	6,817,559	447,959,051	53,695,413	46,836,337	494,795,387	441,099,974	78	
A2a - Residential Coordinated Delivery	126,419,899	362,347	13,343,515	140,125,761	15,653,319	1,069,652	16,722,971	-	6,616,049	238,344,760	24,873,364	29,892,881	268,237,641	243,364,277	6,089	
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
A2c - Residential Retail	3,671,161	11,513	(85,363)	3,597,311	5,769,111	306,354	6,075,465	-	201,510	186,008,925	24,705,160	16,943,455	202,952,380	178,247,221	41	
A2d - Residential Behavior	-	-	-	-	-	-	-	-	19,793,834	4,112,042	-	-	19,793,834	15,681,791	18	
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	3,811,532	4,848	-	-	3,811,532	3,806,685	245	
B - Income Eligible	32,955,816	94,642	3,514,430	36,564,888	4,199,723	279,146	4,478,869	-	1,500,960	93,899,333	11,630,280	50,655,823	144,555,156	132,924,876	3,431	
B1 - Income Eligible Existing Buildings	32,955,816	94,642	3,514,430	36,564,888	4,199,723	279,146	4,478,869	-	1,500,960	93,899,333	11,630,280	50,655,823	144,555,156	132,924,876	3,431	
B1a - Income Eligible Coordinated Delivery	32,955,816	94,642	3,514,430	36,564,888	4,199,723	279,146	4,478,869	-	1,500,960	93,899,333	11,630,280	50,655,823	144,555,156	132,924,876	3,431	
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
C - Commercial & Industrial	(26,991,825)	(65,110)	(4,335,718)	(31,392,654)	8,712	793	9,504	-	67,075	1,020,791,064	139,047,693	154,507,280	1,175,298,345	1,036,250,651	58,116	
C1 - C&I New Buildings	(2,111,088)	(5,584)	(327,204)	(2,443,875)	-	-	-	-	80,817,489	12,102,249	2,731,272	83,548,762	71,446,513	108,487		
C1a - C&I New Buildings & Major Renovations	(2,111,088)	(5,584)	(327,204)	(2,443,875)	-	-	-	-	80,817,489	12,102,249	2,731,272	83,548,762	71,446,513	108,487		
C2 - C&I Existing Buildings	(24,880,738)	(59,527)	(4,008,514)	(28,948,778)	8,712	793	9,504	-	67,075	939,973,575	126,945,444	151,776,008	1,091,749,583	964,804,139	55,885	
C2a - C&I Existing Building Retrofit	(22,711,279)	(54,335)	(3,646,965)	(26,412,578)	8,712	793	9,504	-	7,055	697,418,564	96,787,876	150,566,713	847,985,277	751,197,401	96,912	
C2b - C&I New & Replacement Equipment	(2,169,459)	(5,192)	(361,549)	(2,536,200)	-	-	-	-	60,020	201,688,673	30,092,641	1,209,295	202,897,969	172,805,328	22,020	
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-	40,866,337	64,928	-	-	40,866,337	40,801,409	88,074	
Grand Total	136,091,688	403,899	12,410,486	148,906,073	43,598,253	2,742,541	46,340,794	-	8,385,594	1,609,708,467	207,857,743	255,346,017	1,865,056,484	1,657,198,741	279	

Program	2020 Benefits															Total Energy Benefits per Participant
	Oil				Propane Benefits			Wood	Water	Total Energy Benefits	Total GWSA Benefits	Non-Energy Impacts	Total TRC Test Benefits	Total TRC Test Benefits w/o GWSA		
	Oil	Oil DRPE	Oil GWSA	Total Oil	Propane	Propane GWSA	Total Propane Benefits									
A - Residential	154,579,251	458,282	14,678,354	169,715,887	47,974,130	2,846,123	50,820,253	-	6,796,601	498,844,005	47,671,187	49,450,565	548,294,570	500,623,383	100	
A1 - Residential New Buildings	73,396	651	(13,776)	60,272	18,451,378	1,028,078	19,479,456	-	-	47,140,909	3,292,937	3,435,219	50,576,128	47,283,191	3,817	
A1a - Residential New Homes & Renovations	73,396	651	(13,776)	60,272	18,451,378	1,028,078	19,479,456	-	-	47,140,909	3,292,937	3,435,219	50,576,128	47,283,191	3,817	
A2 - Residential Existing Buildings	154,505,855	457,631	14,692,130	169,655,615	29,522,752	1,818,045	31,340,797	-	6,796,601	451,703,096	44,378,249	46,015,346	497,718,442	453,340,192	91	
A2a - Residential Coordinated Delivery	130,053,489	383,623	12,532,652	142,969,764	17,701,057	1,116,516	18,817,573	-	6,574,943	239,136,832	21,214,938	29,781,893	268,918,724	247,703,787	6,176	
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
A2c - Residential Retail	24,452,367	74,008	2,159,477	26,685,852	11,821,696	701,528	12,523,224	-	221,658	182,735,516	20,276,998	16,233,453	198,968,969	178,691,972	48	
A2d - Residential Behavior	-	-	-	-	-	-	-	-	-	18,916,039	2,901,225	-	18,916,039	16,014,815	17	
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	-	10,914,709	(14,911)	-	10,914,709	10,929,620	497	
B - Income Eligible	34,659,157	102,416	3,388,701	38,150,273	4,494,087	275,567	4,769,653	-	1,500,960	96,788,177	10,637,747	50,585,423	147,373,600	136,735,852	3,524	
B1 - Income Eligible Existing Buildings	34,659,157	102,416	3,388,701	38,150,273	4,494,087	275,567	4,769,653	-	1,500,960	96,788,177	10,637,747	50,585,423	147,373,600	136,735,852	3,524	
B1a - Income Eligible Coordinated Delivery	34,659,157	102,416	3,388,701	38,150,273	4,494,087	275,567	4,769,653	-	1,500,960	96,113,645	10,640,241	50,585,423	146,699,068	136,058,827	3,506	
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-	674,531	(2,494)	-	674,531	677,025	13,491	
C - Commercial & Industrial	(41,405,686)	(70,046)	(5,894,226)	(47,369,959)	9,027	729	9,756	-	140,282	1,010,648,067	126,501,129	158,590,055	1,169,238,122	1,042,736,993	57,025	
C1 - C&I New Buildings	(3,709,039)	(6,721)	(513,537)	(4,229,298)	-	-	-	-	77,491	75,972,907	10,509,559	4,316,715	80,289,621	69,780,062	101,983	
C1a - C&I New Buildings & Major Renovations	(3,709,039)	(6,721)	(513,537)	(4,229,298)	-	-	-	-	77,491	75,972,907	10,509,559	4,316,715	80,289,621	69,780,062	101,983	
C2 - C&I Existing Buildings	(37,696,647)	(63,326)	(5,380,688)	(43,140,661)	9,027	729	9,756	-	62,792	934,675,160	115,991,570	154,273,341	1,088,948,501	972,956,931	35,052	
C2a - C&I Existing Building Retrofit	(34,897,446)	(58,300)	(4,967,457)	(39,923,202)	9,027	729	9,756	-	1,351	690,469,518	89,986,209	153,574,711	844,044,229	754,058,020	93,480	
C2b - C&I New & Replacement Equipment	(2,799,201)	(5,026)	(413,232)	(3,217,459)	-	-	-	-	61,441	187,252,108	25,934,257	698,629	187,950,737	162,016,480	21,140	
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-	-	56,953,534	71,103	-	56,953,534	56,822,431	77,959	
Grand Total	147,832,722	490,651	12,172,829	166,496,202	52,477,244	3,122,419	55,599,663	-	8,437,843	1,606,280,249	184,810,063	258,626,043	1,864,906,291	1,680,096,229	319	

IV.D. Cost-Effectiveness
 3.1.1. Benefits Summary Table
 Statewide Electric
 September 14, 2018

Program	2021 Benefits													
	Electric						Natural Gas							
	Summer Generation	Capacity DRIPE	Capacity			Total Capacity	Electric Energy			Total Electric Energy	Natural Gas	Natural Gas DRIPE	Natural Gas GWSA	Total Natural Gas
Transmission	Distribution	Reliability	Electric Energy DRIPE	Electric Energy GWSA										
A - Residential	24,161,859	4,851,213	31,547,098	53,385,439	782,283	114,727,891	66,156,689	22,302,323	19,512,471	107,971,483	2,390,310	(377,828)	224,987	2,237,468
A1 - Residential New Buildings	3,737,625	15,043	3,919,773	6,342,373	35,430	14,050,244	9,624,436	1,740,755	2,179,400	13,544,592	(146,183)	(46,133)	(34,974)	(227,290)
A1a - Residential New Homes & Renovations	3,737,625	15,043	3,919,773	6,342,373	35,430	14,050,244	9,624,436	1,740,755	2,179,400	13,544,592	(146,183)	(46,133)	(34,974)	(227,290)
A2 - Residential Existing Buildings	20,424,234	4,836,170	27,627,325	47,043,066	746,853	100,677,647	56,532,252	20,561,568	17,333,070	94,436,891	2,536,493	(331,694)	259,963	2,464,759
A2a - Residential Coordinated Delivery	7,863,716	660,224	8,859,512	16,517,359	109,520	34,010,330	21,885,041	6,006,213	5,804,023	33,695,277	4,858,219	339,647	805,610	6,003,476
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	11,508,598	444,008	14,412,011	22,137,777	229,651	48,732,045	26,448,422	12,087,941	8,728,381	47,264,745	(2,321,726)	(671,341)	(545,650)	(3,538,717)
A2d - Residential Behavior	720,393	1,824,101	1,230,865	1,802,252	5,822	5,631,433	8,008,326	2,452,134	2,813,443	13,733,903	-	-	-	-
A2e - Residential Active Demand Reduction	331,528	1,907,837	3,124,938	6,585,676	353,860	12,303,839	190,463	15,280	(12,777)	192,966	-	-	-	-
B - Income Eligible	3,833,904	315,486	4,616,110	8,608,054	75,959	17,449,514	23,914,485	6,411,420	6,597,652	36,923,557	442,197	44,554	87,059	573,810
B1 - Income Eligible Existing Buildings	3,833,904	315,486	4,616,110	8,608,054	75,959	17,449,514	23,914,485	6,411,420	6,597,652	36,923,557	442,197	44,554	87,059	573,810
B1a - Income Eligible Coordinated Delivery	3,813,230	249,837	4,436,074	8,228,830	60,108	16,788,080	23,897,883	6,411,818	6,600,056	36,909,757	442,197	44,554	87,059	573,810
B1b - Income Eligible Active Demand Reduction	20,674	65,649	180,036	379,224	15,851	661,434	16,602	(398)	(2,404)	13,800	-	-	-	-
C - Commercial & Industrial	143,486,241	17,372,905	174,422,968	318,221,878	4,080,337	657,584,331	782,816,126	190,788,558	204,753,749	1,178,358,433	(271,597,678)	(19,807,686)	(48,084,994)	(339,490,359)
C1 - C&I New Buildings	5,239,575	45,410	5,966,817	10,851,922	75,493	22,179,218	39,362,254	9,696,698	10,887,760	59,946,712	(690,625)	(91,073)	(152,083)	(933,782)
C1a - C&I New Buildings & Major Renovations	5,239,575	45,410	5,966,817	10,851,922	75,493	22,179,218	39,362,254	9,696,698	10,887,760	59,946,712	(690,625)	(91,073)	(152,083)	(933,782)
C2 - C&I Existing Buildings	138,246,666	17,327,495	168,456,152	307,369,956	4,004,844	635,405,113	743,453,872	181,091,860	193,865,989	1,118,411,721	(270,907,053)	(19,716,614)	(47,932,911)	(338,556,577)
C2a - C&I Existing Building Retrofit	59,655,514	3,208,531	71,028,447	110,416,253	1,062,322	245,371,068	346,375,254	108,562,236	103,363,105	558,300,596	(56,656,863)	(5,469,227)	(11,159,730)	(73,285,819)
C2b - C&I New & Replacement Equipment	76,975,494	1,002,040	81,136,031	162,624,720	772,848	322,511,134	395,622,355	71,958,850	90,424,846	558,006,051	(214,250,190)	(14,247,387)	(36,773,181)	(265,270,758)
C2c - C&I Active Demand Reduction	1,615,657	13,116,924	16,291,673	34,328,983	2,169,673	67,522,911	1,456,263	570,774	78,038	2,105,075	-	-	-	-
Grand Total	171,482,005	22,539,604	210,586,176	380,215,371	4,938,580	789,761,736	872,887,300	219,502,301	230,863,871	1,323,253,472	(268,765,171)	(20,140,961)	(47,772,948)	(336,679,080)

Program	2019-2021 Benefits													
	Electric						Natural Gas							
	Summer Generation	Capacity DRIPE	Capacity			Total Capacity	Electric Energy			Total Electric Energy	Natural Gas	Natural Gas DRIPE	Natural Gas GWSA	Total Natural Gas
Transmission	Distribution	Reliability	Electric Energy DRIPE	Electric Energy GWSA										
A - Residential	69,954,788	13,242,201	92,764,630	151,833,422	2,211,252	330,006,294	277,326,201	107,283,922	93,240,174	477,850,297	(2,351,201)	(4,572,418)	(1,870,614)	(8,794,233)
A1 - Residential New Buildings	11,313,180	40,502	12,116,226	19,481,845	112,074	43,063,828	28,182,220	5,693,082	7,005,279	40,880,581	(604,527)	(218,807)	(158,080)	(981,414)
A1a - Residential New Homes & Renovations	11,313,180	40,502	12,116,226	19,481,845	112,074	43,063,828	28,182,220	5,693,082	7,005,279	40,880,581	(604,527)	(218,807)	(158,080)	(981,414)
A2 - Residential Existing Buildings	58,641,608	13,201,699	80,648,404	132,351,577	2,099,178	286,942,466	249,143,981	101,590,840	86,234,895	436,969,716	(1,746,674)	(4,353,613)	(1,712,535)	(7,812,820)
A2a - Residential Coordinated Delivery	19,064,484	2,005,118	22,334,477	39,880,966	323,049	83,608,094	72,338,543	22,974,545	22,085,312	117,398,400	14,502,113	1,304,718	2,550,287	18,357,119
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	36,054,856	1,473,194	47,837,328	72,766,820	834,548	158,966,746	153,520,821	71,234,152	54,345,713	279,100,687	(16,248,788)	(5,658,329)	(4,262,822)	(26,169,938)
A2d - Residential Behavior	2,806,097	5,465,657	3,688,110	5,396,140	161,270	17,517,273	22,923,824	7,347,402	9,826,710	40,097,936	-	-	-	-
A2e - Residential Active Demand Reduction	716,171	4,257,730	6,788,489	14,307,652	780,311	26,850,353	360,792	-34,742	(22,840)	372,694	-	-	-	-
B - Income Eligible	9,726,410	848,689	12,049,095	21,783,932	204,411	44,612,537	71,108,134	19,972,396	21,220,101	112,300,631	1,310,699	170,126	274,794	1,755,620
B1 - Income Eligible Existing Buildings	9,726,410	848,689	12,049,095	21,783,932	204,411	44,612,537	71,108,134	19,972,396	21,220,101	112,300,631	1,310,699	170,126	274,794	1,755,620
B1a - Income Eligible Coordinated Delivery	9,685,061	717,391	11,689,024	21,025,484	172,709	43,289,669	71,075,543	19,973,192	21,224,999	112,273,734	1,310,699	170,126	274,794	1,755,620
B1b - Income Eligible Active Demand Reduction	41,348	131,298	360,071	758,447	31,703	1,322,868	32,591	(796)	(4,898)	26,898	-	-	-	-
C - Commercial & Industrial	301,206,165	43,006,690	386,969,166	663,667,752	9,942,618	1,404,792,391	1,720,159,049	476,170,459	506,294,505	2,702,624,014	(390,979,188)	(36,161,180)	(73,848,506)	(500,988,874)
C1 - C&I New Buildings	15,725,169	121,342	18,217,919	32,941,812	229,561	67,235,803	119,885,761	29,772,293	35,481,008	185,139,062	(5,640,008)	(863,848)	(1,292,781)	(7,796,638)
C1a - C&I New Buildings & Major Renovations	15,725,169	121,342	18,217,919	32,941,812	229,561	67,235,803	119,885,761	29,772,293	35,481,008	185,139,062	(5,640,008)	(863,848)	(1,292,781)	(7,796,638)
C2 - C&I Existing Buildings	285,480,996	42,885,348	368,751,247	630,725,939	9,713,057	1,337,556,588	1,600,273,289	446,398,166	470,813,497	2,517,484,952	(385,339,186)	(35,297,331)	(72,555,725)	(493,192,236)
C2a - C&I Existing Building Retrofit	178,897,231	8,501,826	216,423,458	335,759,851	3,211,679	742,794,045	1,028,144,881	316,998,090	323,127,129	1,668,270,101	(170,118,373)	(20,826,964)	(35,536,769)	(226,882,106)
C2b - C&I New & Replacement Equipment	102,679,923	2,775,497	112,986,806	212,068,958	1,268,895	431,780,079	569,310,834	127,966,325	147,472,299	844,749,458	(215,220,800)	(14,470,368)	(37,018,956)	(266,710,130)
C2c - C&I Active Demand Reduction	3,903,842	31,608,024	39,340,984	82,907,130	5,232,483	162,982,463	2,817,574	1,433,751	214,069	4,465,393	-	-	-	-
Grand Total	380,887,363	57,097,580	491,782,891	837,285,105	12,358,281	1,779,411,221	2,068,593,384	603,426,778	620,754,781	3,292,774,943	(392,019,690)	(40,563,471)	(75,444,326)	(508,027,487)

IV.D Cost-Effectiveness
 3.1.i. Benefits Summary Table
 Statewide Electric
 September 14, 2018

Program	2021 Benefits															Total Energy Benefits per Participant
	Oil				Propane Benefits			Wood	Water	Total Energy Benefits	Total GWSA Benefits	Non-Energy Impacts	Total TRC Test Benefits	Total TRC Test Benefits w/o GWSA		
	Oil	Oil DRPE	Oil GWSA	Total Oil	Propane	Propane GWSA	Total Propane Benefits									
A - Residential	181,001,290	533,473	16,929,255	198,464,018	62,894,995	3,723,362	66,618,357	-	6,758,138	496,777,356	40,390,074	41,548,596	538,325,952	497,935,878	137	
A1 - Residential New Buildings	184,323	918	1,988	187,229	18,943,794	997,867	19,941,661	-	-	47,496,436	3,144,281	3,521,652	51,018,088	47,873,807	3,759	
A1a - Residential New Homes & Renovations	184,323	918	1,988	187,229	18,943,794	997,867	19,941,661	-	-	47,496,436	3,144,281	3,521,652	51,018,088	47,873,807	3,759	
A2 - Residential Existing Buildings	180,816,967	532,554	16,927,268	198,276,789	43,951,201	2,725,495	46,676,696	-	6,758,138	449,280,920	37,245,794	38,026,944	487,307,864	450,062,070	124	
A2a - Residential Coordinated Delivery	135,613,157	411,663	12,313,391	148,338,211	20,117,207	1,208,668	21,323,875	-	-	6,536,805	249,907,974	20,129,693	29,680,647	279,588,621	259,458,928	6,508
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
A2c - Residential Retail	45,203,810	120,891	4,613,876	49,938,578	23,833,994	1,518,827	25,352,821	-	221,333	167,970,804	14,315,434	8,346,297	176,317,101	162,001,667	69	
A2d - Residential Behavior	-	-	-	-	-	-	-	-	-	18,905,336	2,813,443	-	18,905,336	16,091,893	17	
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	-	12,496,805	(12,777)	-	12,496,805	12,509,582	450	
B - Income Eligible	36,101,503	109,893	3,328,821	39,540,217	4,726,673	274,555	5,001,229	-	1,500,960	100,989,286	10,288,088	50,926,548	151,915,835	141,627,747	3,672	
B1 - Income Eligible Existing Buildings	36,101,503	109,893	3,328,821	39,540,217	4,726,673	274,555	5,001,229	-	1,500,960	100,989,286	10,288,088	50,926,548	151,915,835	141,627,747	3,672	
B1a - Income Eligible Coordinated Delivery	36,101,503	109,893	3,328,821	39,540,217	4,726,673	274,555	5,001,229	-	1,500,960	100,314,052	10,290,492	50,926,548	151,240,601	140,950,109	3,654	
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-	675,234	(2,404)	-	675,234	677,638	13,505	
C - Commercial & Industrial	(45,219,824)	(80,499)	(6,077,011)	(51,377,334)	9,297	703	10,000	-	66,800	1,445,151,870	150,592,447	98,809,273	1,543,961,143	1,393,368,696	80,693	
C1 - C&I New Buildings	(4,414,488)	(8,500)	(579,258)	(5,002,246)	-	-	-	-	-	76,189,902	10,156,419	4,517,603	80,707,505	70,551,086	101,728	
C1a - C&I New Buildings & Major Renovations	(4,414,488)	(8,500)	(579,258)	(5,002,246)	-	-	-	-	-	76,189,902	10,156,419	4,517,603	80,707,505	70,551,086	101,728	
C2 - C&I Existing Buildings	(40,805,335)	(72,000)	(5,497,753)	(46,375,088)	9,297	703	10,000	-	66,800	1,368,961,968	140,438,028	94,291,670	1,463,253,638	1,322,817,610	79,775	
C2a - C&I Existing Building Retrofit	(37,962,214)	(67,020)	(5,105,205)	(43,134,439)	9,297	703	10,000	-	4,233	687,265,639	87,098,874	157,362,171	844,627,810	757,528,936	91,575	
C2b - C&I New & Replacement Equipment	(2,843,122)	(4,979)	(392,548)	(3,240,650)	-	-	-	-	62,566	612,068,344	53,259,116	(63,070,501)	548,997,843	495,738,726	69,820	
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-	-	69,627,985	78,038	-	69,627,985	69,549,947	78,322	
Grand Total	171,882,969	562,866	14,181,065	186,626,901	67,630,965	3,996,621	71,629,586	-	8,325,898	2,042,918,513	201,270,609	191,284,417	2,234,202,930	2,032,932,321	555	

Program	2019-2021 Benefits															Total Energy Benefits per Participant
	Oil				Propane Benefits			Wood	Water	Total Energy Benefits	Total GWSA Benefits	Non-Energy Impacts	Total TRC Test Benefits	Total TRC Test Benefits w/o GWSA		
	Oil	Oil DRPE	Oil GWSA	Total Oil	Propane	Propane GWSA	Total Propane Benefits									
A - Residential	465,708,240	1,366,121	44,839,383	511,913,743	150,258,943	9,032,088	159,291,031	-	20,372,298	1,490,639,430	145,241,030	141,184,074	1,631,823,505	1,486,582,474	104	
A1 - Residential New Buildings	294,357	2,076	(38,167)	258,266	55,362,561	3,112,542	58,475,103	-	-	141,696,364	9,921,574	10,305,447	152,001,812	142,080,238	3,829	
A1a - Residential New Homes & Renovations	294,357	2,076	(38,167)	258,266	55,362,561	3,112,542	58,475,103	-	-	141,696,364	9,921,574	10,305,447	152,001,812	142,080,238	3,829	
A2 - Residential Existing Buildings	465,413,882	1,364,045	44,877,549	511,655,477	94,896,383	5,919,546	100,815,929	-	20,372,298	1,348,943,066	135,319,456	130,878,627	1,479,821,693	1,344,502,237	94	
A2a - Residential Coordinated Delivery	392,086,545	1,157,632	38,189,559	431,433,736	53,471,582	3,392,837	56,864,419	-	19,727,797	727,389,565	66,217,995	89,355,421	816,744,987	750,526,992	6,256	
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
A2c - Residential Retail	73,327,338	206,412	6,687,991	80,221,741	41,424,800	2,526,709	43,951,509	-	644,501	536,715,245	59,297,591	41,523,206	578,238,451	518,940,859	50	
A2d - Residential Behavior	-	-	-	-	-	-	-	-	-	57,515,209	9,826,710	-	57,515,209	47,788,499	17	
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	-	27,223,046	(22,840)	-	27,223,046	27,245,887	417	
B - Income Eligible	103,716,475	306,951	10,231,952	114,255,378	13,420,483	829,268	14,249,751	-	4,502,880	291,676,797	32,556,115	152,167,794	443,844,591	411,288,476	3,542	
B1 - Income Eligible Existing Buildings	103,716,475	306,951	10,231,952	114,255,378	13,420,483	829,268	14,249,751	-	4,502,880	291,676,797	32,556,115	152,167,794	443,844,591	411,288,476	3,542	
B1a - Income Eligible Coordinated Delivery	103,716,475	306,951	10,231,952	114,255,378	13,420,483	829,268	14,249,751	-	4,502,880	290,327,031	32,561,013	152,167,794	442,494,825	409,933,812	3,530	
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-	1,349,765	(4,898)	-	1,349,765	1,354,663	13,498	
C - Commercial & Industrial	(113,617,336)	(215,656)	(16,306,955)	(130,139,946)	27,036	2,225	29,260	-	274,157	3,476,591,001	416,141,269	411,906,609	3,888,497,610	3,472,356,341	65,353	
C1 - C&I New Buildings	(10,234,616)	(20,804)	(1,419,999)	(11,675,419)	-	-	-	-	77,491	232,980,298	32,768,227	11,565,590	244,545,888	211,777,661	104,062	
C1a - C&I New Buildings & Major Renovations	(10,234,616)	(20,804)	(1,419,999)	(11,675,419)	-	-	-	-	77,491	232,980,298	32,768,227	11,565,590	244,545,888	211,777,661	104,062	
C2 - C&I Existing Buildings	(103,382,720)	(194,852)	(14,886,955)	(118,464,527)	27,036	2,225	29,260	-	196,666	3,243,610,703	383,373,042	400,341,019	3,643,951,722	3,260,578,680	63,652	
C2a - C&I Existing Building Retrofit	(95,570,938)	(179,655)	(13,719,626)	(109,470,219)	27,036	2,225	29,260	-	12,640	2,075,133,721	273,872,959	461,503,595	2,536,657,316	2,262,784,357	93,951	
C2b - C&I New & Replacement Equipment	(7,811,782)	(15,197)	(1,167,329)	(8,994,309)	-	-	-	-	184,026	1,001,009,125	109,286,014	(61,162,576)	939,846,549	830,560,535	37,374	
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-	-	167,447,857	214,069	-	167,447,857	167,233,788	80,234	
Grand Total	455,807,379	1,457,416	38,764,380	496,029,175	163,706,462	9,863,580	173,570,042	-	25,149,334	5,258,907,228	593,938,415	705,258,477	5,964,165,705	5,370,227,291	363	

IV.D. Cost-Effectiveness
 3.2.i. Savings Summary Table
 Statewide Electric
 September 14, 2018

		2019 Net Savings																			
Program	# of Participants	Annual Capacity (kW)		Electric Energy (MWh)		Electric Energy (MMBTU)		Natural Gas (Therms)		Oil (MMBTU)		Propane (MMBTU)		Wood (MMBTU)		Other		Total Savings			
		Summer	Winter	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	MMBTU	
		A - Residential	5,731,354	54,259	58,581	395,208	1,820,490	1,348,448	6,211,511	(1,548,388)	(4,823,096)	227,280	5,566,405	44,271	1,217,411	-	-	-	-	58,789,028	417,616,919
A1 - Residential New Buildings	12,073	2,624	1,549	10,341	139,768	35,285	476,889	(5,893)	(272,036)	10,072	11,608	23,216	514,264	-	-	-	-	-	-	49,859	1,002,241
A1a - Residential New Homes & Renovations	12,073	2,524	1,549	10,341	139,768	35,285	476,889	(5,893)	(272,036)	10,072	11,608	23,216	514,264	-	-	-	-	-	-	49,859	1,002,241
A2 - Residential Existing Buildings	5,719,331	51,735	57,033	384,866	1,680,722	1,313,163	5,734,622	(1,492,495)	(4,551,060)	217,208	5,554,813	21,055	683,147	-	-	-	-	58,799,078	417,616,919	1,415,901	11,560,777
A2a - Residential Coordinated Delivery	39,141	11,051	13,818	78,961	425,234	272,832	1,450,899	248,275	5,264,269	287,934	5,467,674	27,884	492,289	-	-	-	-	57,024,983	405,282,604	613,478	7,937,290
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Behavior	4,533,962	27,839	24,124	184,895	1,135,443	630,739	3,874,132	(1,737,700)	(9,314,329)	(87,303)	100,338	(6,829)	170,858	-	-	-	-	1,762,045	12,334,315	392,832	3,213,885
A2d - Residential Active Demand Reduction	1,130,650	12,845	18,870	120,044	120,044	409,592	409,592	-	-	-	-	-	-	-	-	-	-	-	-	409,592	409,592
A2e - Residential Active Demand Reduction	15,577	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B - Income Eligible	27,379	4,527	7,455	38,461	375,262	131,227	1,280,395	35,602	478,174	72,443	1,425,313	6,754	131,462	-	-	-	-	9,436,848	92,594,171	213,284	2,884,987
B1 - Income Eligible Existing Buildings	27,379	4,527	7,455	38,461	375,262	131,227	1,280,395	35,602	478,174	72,443	1,425,313	6,754	131,462	-	-	-	-	9,436,848	92,594,171	213,284	2,884,987
B1a - Income Eligible Coordinated Delivery	27,379	4,527	7,455	38,461	375,262	131,227	1,280,395	35,602	478,174	72,443	1,425,313	6,754	131,462	-	-	-	-	9,436,848	92,594,171	213,284	2,884,987
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	17,565	81,992	68,676	616,365	7,792,896	2,113,275	26,555,208	(4,196,633)	(70,764,608)	(124,467)	(1,480,171)	34	290	-	-	-	-	343,724	4,169,528	1,569,188	17,998,866
C1 - C&I New Buildings	745	4,359	3,508	43,933	714,228	149,899	2,436,945	(31,328)	(5,281,141)	(8,866)	(114,550)	-	-	-	-	-	-	-	-	108,901	1,794,280
C1a - C&I New Buildings & Major Renovations	745	4,359	3,508	43,933	714,228	149,899	2,436,945	(31,328)	(5,281,141)	(8,866)	(114,550)	-	-	-	-	-	-	-	-	108,901	1,794,280
C2 - C&I Existing Buildings	16,820	76,733	65,168	572,432	7,078,668	1,963,376	24,118,263	(1,875,305)	(65,483,467)	(115,601)	(1,365,621)	34	290	-	-	-	-	343,724	4,169,528	1,460,287	16,204,586
C2a - C&I Existing Building Retrofits	7,386	61,441	54,586	448,141	5,538,397	1,529,097	18,964,909	(3,811,640)	(64,872,515)	(104,003)	(1,245,066)	34	290	-	-	-	-	343,724	4,169,528	1,460,287	16,204,586
C2b - C&I New & Replacement Equipment	9,434	15,292	10,582	127,292	1,540,362	434,310	5,153,354	(83,665)	(610,951)	(11,598)	(120,555)	-	-	-	-	-	-	-	-	108,901	1,794,280
C2c - C&I Active Demand Reduction	464	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grand Total	5,779,290	139,879	134,712	1,051,034	9,978,639	3,693,950	34,047,114	(5,206,419)	(76,609,530)	175,566	5,511,548	51,058	1,349,163	-	-	-	-	68,569,691	514,880,618	3,248,939	33,446,871

		2020 Net Savings																			
Program	# of Participants	Annual Capacity (kW)		Electric Energy (MWh)		Electric Energy (MMBTU)		Natural Gas (Therms)		Oil (MMBTU)		Propane (MMBTU)		Wood (MMBTU)		Other		Total Savings			
		Summer	Winter	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	MMBTU	
		A - Residential	4,993,243	49,400	51,244	340,807	1,502,874	1,162,832	5,127,908	(1,015,398)	(1,378,280)	293,266	6,499,322	63,149	1,464,192	-	-	-	-	59,578,276	416,343,780
A1 - Residential New Buildings	12,349	2,361	1,430	9,829	143,234	35,537	488,716	(48,443)	(234,278)	12,530	1,014	23,439	558,986	-	-	-	-	-	-	49,631	1,025,289
A1a - Residential New Homes & Renovations	12,349	2,361	1,430	9,829	143,234	35,537	488,716	(48,443)	(234,278)	12,530	1,014	23,439	558,986	-	-	-	-	-	-	49,631	1,025,289
A2 - Residential Existing Buildings	4,980,894	47,038	49,814	330,978	1,359,640	1,127,295	4,639,192	(967,257)	(1,144,002)	280,736	6,488,308	39,710	905,206	-	-	-	-	58,578,776	416,343,780	1,368,077	11,948,204
A2a - Residential Coordinated Delivery	38,721	10,136	12,025	65,427	355,500	223,238	1,212,987	246,438	5,232,313	288,510	5,493,668	31,408	545,667	-	-	-	-	56,640,555	409,776,436	568,199	7,776,034
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Behavior	3,789,554	22,487	17,333	145,302	884,740	495,771	3,018,734	(1,213,650)	(6,181,314)	6,887	1,004,638	8,302	359,539	-	-	-	-	1,938,220	13,667,643	389,591	3,764,779
A2d - Residential Active Demand Reduction	1,130,650	12,877	18,917	120,342	120,342	410,609	410,609	-	-	-	-	-	-	-	-	-	-	-	-	410,609	410,609
A2e - Residential Active Demand Reduction	17,969	1,539	1,539	961	961	961	961	-	-	-	-	-	-	-	-	-	-	-	-	961	961
B - Income Eligible	27,485	4,563	7,600	36,174	368,413	123,424	1,257,207	35,602	478,174	74,985	1,464,633	7,188	137,973	-	-	-	-	9,436,848	92,594,171	209,157	2,908,131
B1 - Income Eligible Existing Buildings	27,485	4,563	7,600	36,174	368,413	123,424	1,257,207	35,602	478,174	74,985	1,464,633	7,188	137,973	-	-	-	-	9,436,848	92,594,171	209,157	2,908,131
B1a - Income Eligible Coordinated Delivery	27,415	4,371	7,407	36,183	368,731	123,424	1,257,207	35,602	478,174	74,985	1,464,633	7,188	137,973	-	-	-	-	9,436,848	92,594,171	209,157	2,908,131
B1b - Income Eligible Active Demand Reduction	69	192	192	192	192	192	192	-	-	-	-	-	-	-	-	-	-	-	-	192	192
C - Commercial & Industrial	17,723	80,364	67,168	622,095	7,748,560	2,122,587	26,438,087	(4,179,981)	(71,329,637)	(121,625)	(1,453,345)	34	290	-	-	-	-	379,453	4,774,174	1,582,997	17,862,068
C1 - C&I New Buildings	745	4,096	2,779	39,244	635,204	133,902	2,166,635	(10,234)	(634,266)	(10,187)	(129,641)	-	-	-	-	-	-	275,861	4,866,388	118,692	1,973,567
C1a - C&I New Buildings & Major Renovations	745	4,096	2,779	39,244	635,204	133,902	2,166,635	(10,234)	(634,266)	(10,187)	(129,641)	-	-	-	-	-	-	275,861	4,866,388	118,692	1,973,567
C2 - C&I Existing Buildings	16,978	76,368	64,389	582,851	7,113,356	1,988,685	24,271,452	(14,392,747)	(70,695,371)	(111,438)	(1,323,704)	34	290	-	-	-	-	303,611	3,907,786	1,461,305	15,878,501
C2a - C&I Existing Building Retrofits	7,386	61,575	54,480	461,818	5,694,885	1,584,545	19,430,948	(4,073,693)	(70,145,933)	(100,791)	(1,213,183)	34	290	-	-	-	-	11,816	82,712	1,074,419	11,003,741
C2b - C&I New & Replacement Equipment	8,592	14,801	9,706	119,044	1,418,788	406,180	4,840,506	(16,054)	(549,439)	(10,647)	(110,520)	-	-	-	-	-	-	291,795	3,825,074	389,927	4,675,442
C2c - C&I Active Demand Reduction	724	192	192	192	192	192	192	-	-	-	-	-	-	-	-	-	-	-	-	192	192
Grand Total	5,038,431	134,328	126,612	999,075	8,820,047	3,408,844	32,823,662	(5,199,777)	(73,029,744)	346,626	6,510,610	70,371	1,602,454	-	-	-	-	68,959,076	517,712,625	3,209,863	33,733,692

IV.D. Cost-Effectiveness
 3.2.i. Savings Summary Table
 Statewide Electric
 September 14, 2018

Program	# of Participants	2021 Net Savings																	
		Annual Capacity (kW)		Electric (MWh)		Electric Energy (MMBtu)		Natural Gas (Therms)		Deliverable Fuels				Other		Total Savings			
		Summer	Winter	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Oil (MMBtu)	Propane (MMBtu)	Wood (MMBtu)	Water (Gallons)	Annual	Lifetime	Annual	Lifetime		
		Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime		
A - Residential	3,633,163	42,641	39,620	254,293	1,024,203	867,647	3,494,581	(385,031)	2,587,447	397,265	7,517,480	100,628	1,901,233	-	-	58,213,282	414,000,026	1,327,337	13,172,039
A1 - Residential New Buildings	12,634	2,257	1,315	9,291	147,355	31,680	485,717	(40,426)	(154,636)	(2,011)	6,391	23,695	364,279	-	-	-	-	49,322	1,041,173
A1a - Residential New Homes & Renovations	12,634	2,257	1,315	9,291	147,355	31,680	485,717	(40,426)	(154,636)	(2,011)	6,391	23,695	364,279	-	-	-	-	49,322	1,041,173
A2 - Residential Existing Buildings	3,620,529	40,384	38,285	245,008	881,848	835,967	3,009,865	(144,604)	2,742,081	399,576	7,511,089	76,933	1,536,954	-	-	58,213,282	414,000,026	1,278,015	12,130,865
A2a - Residential Coordinated Delivery	38,414	8,934	9,904	49,116	333,217	167,582	1,136,936	245,280	5,221,105	294,217	5,613,728	35,443	609,167	-	-	56,277,903	400,452,373	521,790	7,882,142
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Behavior	2,433,720	17,026	7,813	75,752	429,360	252,852	1,664,292	(589,855)	(2,481,022)	105,338	1,897,360	41,490	727,336	-	-	1,935,379	13,547,652	345,693	3,840,887
A2d - Residential Active Demand Reduction	1,130,659	12,885	18,029	120,414	410,854	410,854	410,854	-	-	-	-	-	-	-	-	-	-	410,854	410,854
A2e - Residential Active Demand Reduction	27,745	1,539	1,539	(94)	(94)	(32)	(9 218)	35,608	478,174	76,837	1,494,830	7,486	142,585	-	-	9,436,848	92,594,171	(327)	(9 218)
B - Income Eligible	27,586	4,569	7,675	34,243	371,078	116,837	1,266,119	35,602	478,174	76,837	1,494,830	7,486	142,585	-	-	9,436,848	92,594,171	204,723	2,953,351
B1 - Income Eligible Existing Buildings	27,586	4,569	7,675	34,243	371,078	116,837	1,266,119	35,602	478,174	76,837	1,494,830	7,486	142,585	-	-	9,436,848	92,594,171	204,723	2,953,351
B1a - Income Eligible Coordinated Delivery	27,455	4,377	7,483	34,255	371,196	116,877	1,266,511	35,602	478,174	76,837	1,494,830	7,486	142,585	-	-	9,436,848	92,594,171	204,761	2,951,754
B1b - Income Eligible Active Demand Reduction	131	92	92	(12)	(12)	(40)	(40)	40	40	40	40	40	40	-	-	-	-	40	40
C - Commercial & Industrial	17,909	109,633	80,175	815,094	12,534,006	2,780,894	41,745,157	(14,123,562)	(316,693,962)	(37,323)	(1,574,091)	34	290	-	-	336,311	4,153,466	1,233,248	8,301,970
C1 - C&I New Buildings	749	4,150	2,825	48,153	643,389	137,000	2,195,245	(66,811)	(805,749)	(13,287)	(160,644)	-	-	-	-	-	-	137,000	1,954,026
C1a - C&I New Buildings & Major Renovations	749	4,150	2,825	48,153	643,389	137,000	2,195,245	(66,811)	(805,749)	(13,287)	(160,644)	-	-	-	-	-	-	137,000	1,954,026
C2 - C&I Existing Buildings	17,160	105,483	80,350	774,941	11,890,617	2,643,894	39,549,912	(14,056,752)	(317,988,113)	(124,040)	(1,413,447)	34	290	-	-	336,311	4,153,466	1,136,247	8,347,944
C2a - C&I Existing Building Retrofits	7,565	61,834	53,866	474,202	5,631,774	1,637,976	19,181,490	(3,960,831)	(66,293,510)	(113,703)	(1,306,617)	34	290	-	-	37,015	539,105	1,108,224	11,246,013
C2b - C&I New & Replacement Equipment	8,766	43,458	32,212	300,693	5,869,761	1,025,958	20,368,423	(10,095,917)	(251,936,603)	(10,333)	(106,830)	-	-	-	-	299,295	3,814,360	6,033	(4,897,667)
C2c - C&I Active Demand Reduction	889	192	192	(12)	(12)	(40)	(40)	40	40	40	40	40	40	-	-	-	-	40	40
Grand Total	3,678,237	156,844	136,420	1,103,669	13,839,897	3,766,378	46,995,858	(14,472,991)	(315,628,241)	337,079	7,438,219	108,149	2,044,107	-	-	67,886,441	510,747,682	3,768,397	24,425,360

Program	# of Participants	2019-2021 Net Savings																	
		Annual Capacity (kW)		Electric (MWh)		Electric Energy (MMBtu)		Natural Gas (Therms)		Deliverable Fuels				Other		Total Savings			
		Summer	Winter	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Oil (MMBtu)	Propane (MMBtu)	Wood (MMBtu)	Water (Gallons)	Annual	Lifetime	Annual	Lifetime		
		Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime		
A - Residential	14,357,760	146,300	149,446	990,307	4,947,567	3,378,928	14,833,900	(2,945,817)	(9,913,929)	918,411	19,583,207	208,048	4,582,835	-	-	175,581,086	1,247,960,724	4,210,806	38,708,550
A1 - Residential New Buildings	37,066	7,143	4,314	29,455	425,358	100,503	1,451,321	(144,460)	(661,958)	(7,540)	5,799	70,350	1,677,978	-	-	-	-	148,823	3,068,904
A1a - Residential New Homes & Renovations	37,066	7,143	4,314	29,455	425,358	100,503	1,451,321	(144,460)	(661,958)	(7,540)	5,799	70,350	1,677,978	-	-	-	-	148,823	3,068,904
A2 - Residential Existing Buildings	14,320,754	139,158	145,132	960,852	3,922,209	3,278,426	13,382,579	(2,801,357)	(12,251,979)	926,005	19,577,408	137,699	2,904,857	-	-	175,581,086	1,247,960,724	4,061,984	35,639,646
A2a - Residential Coordinated Delivery	116,276	30,121	35,767	194,505	1,113,951	663,653	3,800,809	739,993	15,724,687	871,081	16,575,071	94,735	1,647,124	-	-	169,945,442	1,208,511,214	1,703,468	23,695,646
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Behavior	10,747,238	67,352	49,570	405,733	2,449,343	1,384,362	8,937,158	(1,541,330)	(17,976,665)	54,925	3,002,337	42,864	1,287,733	-	-	5,635,646	39,449,510	1,128,111	10,819,561
A2d - Residential Active Demand Reduction	3,391,950	38,607	56,717	360,801	1,231,054	1,231,054	1,231,054	-	-	-	-	-	-	-	-	-	-	1,231,054	1,231,054
A2e - Residential Active Demand Reduction	85,251	3,078	3,078	(199)	(199)	(64)	(6 450)	11,860	150,877	24,245	4,384,777	21,428	412,019	-	-	28,310,544	277,782,513	(640)	(6 450)
B - Income Eligible	82,340	13,660	22,729	108,877	1,114,953	371,488	3,804,221	106,806	1,434,522	224,265	4,384,777	21,428	412,019	-	-	28,310,544	277,782,513	627,862	8,744,469
B1 - Income Eligible Existing Buildings	82,340	13,660	22,729	108,877	1,114,953	371,488	3,804,221	106,806	1,434,522	224,265	4,384,777	21,428	412,019	-	-	28,310,544	277,782,513	627,862	8,744,469
B1a - Income Eligible Coordinated Delivery	82,240	13,275	22,344	108,901	1,115,189	371,569	3,805,026	106,806	1,434,522	224,265	4,384,777	21,428	412,019	-	-	28,310,544	277,782,513	627,942	8,745,274
B1b - Income Eligible Active Demand Reduction	100	85	85	(14)	(14)	(80)	(80)	80	80	80	80	80	80	-	-	-	-	80	80
C - Commercial & Industrial	53,197	271,090	225,019	2,054,484	27,766,252	7,016,756	94,738,452	(22,900,176)	(460,788,108)	(83,400)	(4,507,606)	102	870	-	-	1,259,488	17,097,568	4,383,433	44,152,904
C1 - C&I New Buildings	2,239	12,604	9,112	121,330	1,992,421	420,802	6,798,824	(418,173)	(6,721,155)	(32,340)	(404,838)	-	-	-	-	275,841	4,866,388	344,625	5,721,873
C1a - C&I New Buildings & Major Renovations	2,239	12,604	9,112	121,330	1,992,421	420,802	6,798,824	(418,173)	(6,721,155)	(32,340)	(404,838)	-	-	-	-	275,841	4,866,388	344,625	5,721,873
C2 - C&I Existing Buildings	50,958	258,486	215,907	1,933,154	25,773,831	6,595,954	87,939,628	(22,961,803)	(454,066,953)	(51,060)	(4,102,768)	102	870	-	-	983,646	12,231,180	4,038,808	38,431,031
C2a - C&I Existing Building Retrofits	22,088	184,850	163,022	1,386,160	16,874,956	4,729,578	57,577,349	(11,846,167)	(201,309,957)	(118,490)	(1,764,866)	102	870	-	-	110,523	773,660	3,226,567	33,682,336
C2b - C&I New & Replacement Equipment	28,783	73,251	52,500	547,027	8,898,911	1,866,456	30,363,083	(10,215,636)	(252,756,995)	(32,570)	(337,904)	-	-	-	-	873,124	11,457,120	812,323	4,749,479
C2c - C&I Active Demand Reduction	2,087	395	395	(24)	(24)	(80)	(80)	80	80	80	80	80	80	-	-	-	-	80	80
Grand Total	14,493,297	431,050	397,194	3,155,678	33,228,773	10,787,172	113,376,973	(25,339,187)	(462,262,915)	759,271	19,460,377	225,578	4,995,724	-	-	205,151,118	1,542,840,405	9,222,102	91,605,932

Note:
 The Cape Light Compact's storage offering is included as part of the active demand reduction core initiatives.

IV.D. Cost-Effectiveness

3.2.i. Savings Summary Table

Statewide Electric
 September 14, 2018

Program	2019 Net Savings					
	Electric Energy, no Fuel Switching or ADR (MWh)		Natural Gas, no Fuel Switching (Therms)		Total Savings, no CHP or ADR (MMBtu)	
	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential	397,138	1,848,327	(1,545,388)	(4,323,096)	1,465,761	12,563,018
A1 - Residential New Buildings	10,341	119,718	(5,897)	(273,036)	49,859	1,002,241
A1a - Residential New Homes & Renovations	10,341	119,718	(5,897)	(273,036)	49,859	1,002,241
A2 - Residential Existing Buildings	386,797	1,728,609	(1,489,491)	(4,050,060)	1,415,902	11,560,777
A2a - Residential Coordinated Delivery	80,319	430,310	248,275	5,264,269	613,478	7,937,290
A2b - Residential Construction Services (RCS)	-	-	-	-	-	-
A2c - Residential Retail	186,433	1,158,185	(1,737,770)	(9,314,329)	392,832	3,213,895
A2d - Residential Behavior	120,044	120,044	-	-	409,592	409,592
A2e - Residential Active Demand Reduction	-	-	-	-	-	-
B - Income Eligible	38,822	380,683	35,602	478,174	213,984	2,884,987
B1 - Income Eligible Existing Buildings	38,822	380,683	35,602	478,174	213,984	2,884,987
B1a - Income Eligible Coordinated Delivery	38,822	380,683	35,602	478,174	213,984	2,884,987
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-
C - Commercial & Industrial	619,365	7,282,896	(4,196,633)	(70,784,698)	1,693,528	20,460,685
C1 - C&I New Buildings	43,933	714,278	(321,328)	(5,281,141)	115,524	1,906,867
C1a - C&I New Buildings & Major Renovations	43,933	714,278	(321,328)	(5,281,141)	115,524	1,906,867
C2 - C&I Existing Buildings	575,432	7,068,618	(3,875,305)	(65,493,557)	1,578,004	18,553,818
C2a - C&I Existing Building Retrofits	448,161	5,558,297	(3,381,460)	(66,872,515)	1,163,661	13,582,114
C2b - C&I New & Replacement Equipment	127,271	1,510,321	(61,665)	(610,953)	414,343	4,971,704
C2c - C&I Active Demand Reduction	-	-	-	-	-	-
Grand Total	1,095,225	10,011,896	(5,796,419)	(76,609,530)	3,273,272	35,909,690

Program	2020 Net Savings					
	Electric Energy, no Fuel Switching or ADR (MWh)		Natural Gas, no Fuel Switching (Therms)		Total Savings, no CHP or ADR (MMBtu)	
	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential	346,190	1,580,733	(1,015,398)	(1,178,298)	1,418,090	12,076,711
A1 - Residential New Buildings	9,929	143,234	(48,141)	(234,278)	49,631	1,025,289
A1a - Residential New Homes & Renovations	9,929	143,234	(48,141)	(234,278)	49,631	1,025,289
A2 - Residential Existing Buildings	336,261	1,437,499	(967,257)	(944,020)	1,368,399	11,051,422
A2a - Residential Coordinated Delivery	66,604	372,921	246,438	5,237,813	568,199	7,776,034
A2b - Residential Construction Services (RCS)	-	-	-	-	-	-
A2c - Residential Retail	149,355	944,235	(1,213,695)	(6,181,314)	389,591	3,764,779
A2d - Residential Behavior	120,342	120,342	-	-	410,609	410,609
A2e - Residential Active Demand Reduction	-	-	-	-	-	-
B - Income Eligible	36,694	376,365	35,602	478,174	209,197	2,908,533
B1 - Income Eligible Existing Buildings	36,694	376,365	35,602	478,174	209,197	2,908,533
B1a - Income Eligible Coordinated Delivery	36,694	376,365	35,602	478,174	209,197	2,908,533
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-
C - Commercial & Industrial	622,106	7,748,678	(4,179,981)	(71,329,637)	1,718,101	20,549,827
C1 - C&I New Buildings	39,244	635,004	(50,234)	(634,266)	118,692	1,973,567
C1a - C&I New Buildings & Major Renovations	39,244	635,004	(50,234)	(634,266)	118,692	1,973,567
C2 - C&I Existing Buildings	582,862	7,113,674	(3,629,747)	(70,695,371)	1,599,409	18,576,260
C2a - C&I Existing Building Retrofits	463,818	5,694,885	(4,071,693)	(70,145,933)	1,209,482	13,899,618
C2b - C&I New & Replacement Equipment	119,044	1,418,789	(16,054)	(169,438)	389,927	4,676,642
C2c - C&I Active Demand Reduction	-	-	-	-	-	-
Grand Total	1,004,931	9,705,776	(5,159,777)	(72,029,744)	3,245,328	36,483,871

IV.D. Cost-Effectiveness

3.2.i. Savings Summary Table

Statewide Electric
 September 14, 2018

Program	2021 Net Savings					
	Electric Energy, no Fuel Switching or ADR (MWh)		Natural Gas, no Fuel Switching (Therms)		Total Savings, no CHP or ADR (MMBTU)	
	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential	265,455	1,188,543	(885,031)	2,587,447	1,327,659	13,175,257
A1 - Residential New Buildings	9,285	142,315	(40,420)	(154,636)	49,322	1,041,373
A1a - Residential New Homes & Renovations	2,281	142,315	(40,420)	(154,636)	49,322	1,041,373
A2 - Residential Existing Buildings	256,170	1,046,187	(844,610)	2,742,083	1,278,337	12,133,883
A2a - Residential Coordinated Delivery	51,060	362,207	245,280	5,223,105	521,790	7,882,142
A2b - Residential Construction Services (RCS)	-	-	-	-	-	-
A2c - Residential Retail	84,693	561,585	(589,885)	(7,481,023)	345,693	3,840,887
A2d - Residential Behavior	120,414	120,414	-	-	410,854	410,854
A2e - Residential Active Demand Reduction	-	-	-	-	-	-
B - Income Eligible	34,861	380,288	35,602	478,174	204,761	2,951,754
B1 - Income Eligible Existing Buildings	34,861	380,288	35,602	478,174	204,761	2,951,754
B1a - Income Eligible Coordinated Delivery	34,861	380,288	35,602	478,174	204,761	2,951,754
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-
C - Commercial & Industrial	815,045	12,234,824	(14,123,562)	(318,493,867)	1,740,310	20,384,018
C1 - C&I New Buildings	40,153	643,389	(66,811)	(805,749)	117,032	1,954,026
C1a - C&I New Buildings & Major Renovations	40,153	643,389	(66,811)	(805,749)	117,032	1,954,026
C2 - C&I Existing Buildings	774,892	11,591,435	(14,056,751)	(317,688,118)	1,623,278	18,429,992
C2a - C&I Existing Building Retrofits	475,202	5,631,714	(5,960,835)	(66,291,510)	1,235,976	13,795,938
C2b - C&I New & Replacement Equipment	300,691	5,959,721	(10,095,917)	(251,096,603)	387,302	4,634,053
C2c - C&I Active Demand Reduction	-	-	-	-	-	-
Grand Total	1,115,361	13,803,754	(14,473,891)	(315,478,241)	3,272,729	36,511,028

Program	2019-2021 Net Savings					
	Electric Energy, no Fuel Switching or ADR (MWh)		Natural Gas, no Fuel Switching (Therms)		Total Savings, no CHP or ADR (MMBTU)	
	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential	1,008,724	4,617,609	(2,945,817)	(2,813,929)	4,211,449	38,714,986
A1 - Residential New Buildings	29,455	425,338	(144,460)	(661,950)	148,812	3,068,904
A1a - Residential New Homes & Renovations	29,455	425,338	(144,460)	(661,950)	148,812	3,068,904
A2 - Residential Existing Buildings	979,268	4,192,245	(2,801,357)	(2,151,979)	4,062,637	35,646,082
A2a - Residential Coordinated Delivery	197,984	1,165,478	739,893	15,724,687	1,709,468	23,695,466
A2b - Residential Construction Services (RCS)	-	-	-	-	-	-
A2c - Residential Retail	420,483	2,665,985	(1,541,350)	(17,076,665)	1,128,115	10,819,561
A2d - Residential Behavior	360,801	360,801	-	-	1,231,054	1,231,054
A2e - Residential Active Demand Reduction	-	-	-	-	-	-
B - Income Eligible	110,377	1,137,336	106,806	1,434,522	627,942	8,745,274
B1 - Income Eligible Existing Buildings	110,377	1,137,336	106,806	1,434,522	627,942	8,745,274
B1a - Income Eligible Coordinated Delivery	110,377	1,137,336	106,806	1,434,522	627,942	8,745,274
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-
C - Commercial & Industrial	2,056,517	27,764,488	(22,500,176)	(446,788,108)	5,151,938	61,393,329
C1 - C&I New Buildings	121,330	1,992,471	(418,373)	(6,721,155)	351,248	5,834,460
C1a - C&I New Buildings & Major Renovations	121,330	1,992,471	(418,373)	(6,721,155)	351,248	5,834,460
C2 - C&I Existing Buildings	1,935,187	25,772,016	(22,081,803)	(439,066,953)	4,800,690	55,558,870
C2a - C&I Existing Building Retrofits	1,386,160	16,874,956	(11,846,167)	(201,309,957)	3,607,099	41,777,670
C2b - C&I New & Replacement Equipment	547,027	8,897,061	(10,215,636)	(237,756,995)	1,193,592	14,281,199
C2c - C&I Active Demand Reduction	-	-	-	-	-	-
Grand Total	3,175,618	33,521,427	(25,339,187)	(462,367,515)	9,991,330	108,853,589

IV.D. Cost-Effectiveness

3.2.i. Savings Summary Table, Active Demand Reduction Measures

Statewide Electric
 September 14, 2018

2019 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	12,810	9,511	1,202	(43)	(43)	-	-	-	-
A2 - Residential Existing Buildings	12,810	9,511	1,202	(43)	(43)	-	-	-	-
A2e - Residential Active Demand Reduction	12,810	9,511	1,202	(43)	(43)	-	-	-	-
B - Income Eligible	-	-	-	-	-	-	-	-	-
B1 - Income Eligible Existing Buildings	-	-	-	-	-	-	-	-	-
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	459	97,220	5,250	5,348	5,348	-	-	-	-
C2 - C&I Existing Buildings	459	97,220	5,250	5,348	5,348	-	-	-	-
C2c - C&I Active Demand Reduction	459	97,220	5,250	5,348	5,348	-	-	-	-
Grand Total	13,269	106,731	6,452	5,305	5,305	-	-	-	-

2020 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	19,079	13,762	2,242	(83)	(83)	-	-	-	-
A2 - Residential Existing Buildings	19,079	13,762	2,242	(83)	(83)	-	-	-	-
A2e - Residential Active Demand Reduction	19,079	13,762	2,242	(83)	(83)	-	-	-	-
B - Income Eligible	-	-	-	-	-	-	-	-	-
B1 - Income Eligible Existing Buildings	-	-	-	-	-	-	-	-	-
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	860	135,083	10,300	5,896	5,896	-	-	-	-
C2 - C&I Existing Buildings	860	135,083	10,300	5,896	5,896	-	-	-	-
C2c - C&I Active Demand Reduction	860	135,083	10,300	5,896	5,896	-	-	-	-
Grand Total	19,939	148,845	12,542	5,812	5,812	-	-	-	-

2021 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	24,941	17,635	3,356	(128)	(128)	-	-	-	-
A2 - Residential Existing Buildings	24,941	17,635	3,356	(128)	(128)	-	-	-	-
A2e - Residential Active Demand Reduction	24,941	17,635	3,356	(128)	(128)	-	-	-	-
B - Income Eligible	-	-	-	-	-	-	-	-	-
B1 - Income Eligible Existing Buildings	-	-	-	-	-	-	-	-	-
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	1,105	165,110	13,700	6,733	6,733	-	-	-	-
C2 - C&I Existing Buildings	1,105	165,110	13,700	6,733	6,733	-	-	-	-
C2c - C&I Active Demand Reduction	1,105	165,110	13,700	6,733	6,733	-	-	-	-
Grand Total	26,046	182,745	17,056	6,605	6,605	-	-	-	-

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 that are included in the previous savings table.

V.B. Allocation of Funds

1. Low-Income Minimum

Statewide Electric

September 14, 2018

2019 Sector Cost Allocation		
Sector	Program Budget	
	(\$)	(% of Total)
A - Residential	269,011,553	43.4%
B - Income Eligible	73,740,929	11.89%
C - Commercial & Industrial	277,485,070	44.7%
Grand Total	620,237,552	100%

2020 Sector Cost Allocation		
Sector	Program Budget	
	(\$)	(% of Total)
A - Residential	260,466,776	41.5%
B - Income Eligible	76,871,449	12.26%
C - Commercial & Industrial	289,798,994	46.2%
Grand Total	627,137,219	100%

2021 Sector Cost Allocation		
Sector	Program Budget	
	(\$)	(% of Total)
A - Residential	254,715,345	39.7%
B - Income Eligible	77,682,718	12.11%
C - Commercial & Industrial	309,325,061	48.2%
Grand Total	641,723,124	100%

2019-2021 Sector Cost Allocation		
Sector	Program Budget	
	(\$)	(% of Total)
A - Residential	784,193,673	41.5%
B - Income Eligible	228,295,096	12.08%
C - Commercial & Industrial	876,609,125	46.4%
Grand Total	1,889,097,894	100%

Notes:

General Laws c. 25, § 19(c) requires that at least 10 percent of the amount expended for electric energy efficiency programs and at least 20 percent of the amount expended for gas energy efficiency programs be spent on low-income programs.

VII. Appendix
B.2. Summary of Activities
 Statewide Electric
 September 14, 2018

2019-2021 Summary															
Sector	TRC Benefits (2019\$)						TRC Costs (2019\$)			TRC Cost-Effectiveness		Cost of Saved Energy (PA Budget per annual savings unit)			
	Capacity	Electric Energy	Natural Gas	Deliverable Fuels & Other	Non-Energy Impacts	Total Benefits	PA Budget	Participant Costs	Total TRC Test Costs	B/C Ratio	Net Benefits	Summer Capacity (\$/kW)	Electric Energy (\$/MWh)	Natural Gas Costs (\$/Therm)	Total Savings (\$/MMBTU)
2019	484,695,425	1,009,898,533	(88,517,951)	203,632,460	255,348,017	1,865,056,484	657,652,636	208,306,793	865,959,429	2.15	999,097,055	4,702			202
A - Residential	104,970,020	205,521,585	(7,877,354)	192,403,818	50,184,913	545,202,983	278,230,699	55,553,038	333,783,737	1.63	211,419,246	5,128			190
B - Income Eligible	12,385,028	38,373,163	596,426	42,544,717	50,655,823	144,555,156	76,337,240	-	76,337,240	1.89	68,217,916	16,861			357
C - Commercial & Industrial	367,340,376	766,003,786	(81,237,023)	(31,316,075)	154,507,280	1,175,298,345	303,084,697	152,753,756	455,838,453	2.58	719,459,892	3,738			193
2020	504,954,061	959,622,937	(82,830,457)	224,533,708	258,626,943	1,864,906,291	650,449,157	212,236,428	862,685,584	2.16	1,002,220,707	4,842			203
A - Residential	110,308,382	164,357,230	(3,154,348)	227,332,741	49,450,565	548,294,570	263,919,617	64,945,678	328,865,294	1.67	219,429,275	5,343			186
B - Income Eligible	14,777,995	37,003,912	585,384	44,420,887	50,585,423	147,373,600	77,685,213	(684)	77,684,529	1.90	69,689,071	17,024			371
C - Commercial & Industrial	379,867,684	758,261,795	(80,261,492)	(47,219,920)	158,590,055	1,169,238,122	308,844,327	147,291,434	456,135,761	2.56	713,102,361	3,843			195
2021	789,761,736	1,323,253,472	(336,679,080)	266,582,384	191,284,417	2,234,202,930	660,325,827	228,881,411	889,207,238	2.51	1,344,995,692	4,210			239
A - Residential	114,727,891	107,971,483	2,237,468	271,840,513	41,548,596	538,325,952	252,463,615	82,735,922	335,199,537	1.61	203,126,415	5,921			190
B - Income Eligible	17,449,514	36,923,557	573,810	46,042,405	50,926,548	151,915,835	76,770,545	-	76,770,545	1.98	75,145,290	16,801			375
C - Commercial & Industrial	657,584,331	1,178,358,433	(339,490,359)	(51,300,535)	98,809,273	1,543,961,143	331,091,667	146,145,489	477,237,157	3.24	1,066,723,987	3,020			269
Grand Total	1,779,411,221	3,292,774,943	(508,027,487)	694,748,552	705,258,477	5,964,165,705	1,968,427,619	649,424,632	2,617,852,252	2.28	3,346,313,454	4,567			213
A - Residential	330,006,294	477,850,297	(6,794,233)	691,577,073	141,184,074	1,631,823,505	794,613,931	203,234,637	997,848,568	1.64	633,974,937	16,391			566
B - Income Eligible	44,612,537	112,300,631	1,755,600	133,008,009	152,167,754	443,844,591	230,792,988	(684)	230,792,314	1.92	213,052,277	50,686			1,103
C - Commercial & Industrial	1,404,792,391	2,702,624,014	(500,988,874)	(129,836,530)	411,906,609	3,888,497,610	943,020,691	446,190,679	1,389,211,370	2.79	2,499,286,240	10,601			657

2019-2021 Summary													
Sector	Net Annual Savings								Participants	Avg Measure Life (yrs.)	Annual Emissions Reductions (Short Tons)		
	Summer Capacity (kW)	Electric Energy (MWh)	Natural Gas (Therms)	Oil (MMBTU)	Propane (MMBTU)	Wood (MMBTU)	Water (Gallons)	Total Savings (MMBTU)			NOX	SO2	CO2
2019	139,879	1,053,034	(5,706,419)	175,566	51,058	-	68,569,601	3,248,933	5,776,288	10	228.9	59.1	634,899
A - Residential	54,259	395,208	(1,545,388)	227,580	44,271	-	58,789,028	1,465,761	5,731,354	9	109.3	28.2	306,633
B - Income Eligible	4,527	38,461	35,602	72,443	6,754	-	9,436,848	213,984	27,370	13	6.3	1.6	25,523
C - Commercial & Industrial	81,092	619,365	(4,196,633)	(124,457)	34	-	343,724	1,569,188	17,565	11	113.2	29.2	302,743
2020	134,328	999,075	(5,159,777)	246,626	70,371	-	68,595,076	3,209,863	5,038,431	11	217.9	56.2	616,637
A - Residential	49,400	340,807	(1,015,398)	293,266	63,149	-	58,578,776	1,417,708	4,993,243	9	96.8	25.0	283,125
B - Income Eligible	4,563	36,174	35,602	74,985	7,188	-	9,436,848	209,157	27,465	14	5.9	1.5	24,629
C - Commercial & Industrial	80,364	622,095	(4,179,981)	(121,625)	34	-	379,453	1,582,997	17,723	11	115.2	29.7	308,883
2021	156,844	1,103,569	(4,472,991)	337,079	108,149	-	67,986,441	2,763,307	3,678,577	9	224.1	57.8	596,318
A - Residential	42,641	254,293	(385,031)	397,565	100,628	-	58,213,282	1,327,337	3,633,163	10	66.9	17.3	219,492
B - Income Eligible	4,569	34,243	35,602	76,837	7,486	-	9,436,848	204,721	27,505	14	5.6	1.5	23,845
C - Commercial & Industrial	109,633	815,034	(14,123,562)	(137,323)	34	-	336,311	1,231,249	17,909	7	151.6	39.1	352,980
Grand Total	431,050	3,155,678	(25,339,187)	759,271	229,578	-	205,151,118	9,222,102	14,493,297	10	670.9	173.1	1,847,854
A - Residential	146,300	990,307	(2,945,817)	918,411	208,048	-	175,581,086	4,210,806	14,357,760	9	273.0	70.4	809,250
B - Income Eligible	13,660	108,877	106,806	224,265	21,428	-	28,310,944	627,862	82,340	14	17.9	4.6	73,998
C - Commercial & Industrial	271,090	2,056,494	(22,500,176)	(383,406)	102	-	1,259,488	4,383,435	53,197	10	380.1	98.1	964,606

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

VII. Appendix

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

Statewide Electric

September 14, 2018

2019 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	665,174	(4,337,850)	38,064	4,911	109.3	28.2	306,633
B - Income Eligible	38,461	35,602	72,443	6,754	6.3	1.6	25,523
C - Commercial & Industrial	688,991	(4,550,370)	(136,338)	31	113.2	29.2	302,743
Grand Total	1,392,625	(8,852,619)	(25,831)	11,695	228.9	59.1	634,899

2020 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	588,627	(3,430,945)	127,391	30,678	96.8	25.0	283,125
B - Income Eligible	36,174	35,602	74,985	7,188	5.9	1.5	24,629
C - Commercial & Industrial	700,991	(4,526,279)	(135,453)	31	115.2	29.7	308,883
Grand Total	1,325,792	(7,921,622)	66,923	37,897	217.9	56.2	616,637

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	406,862	(1,867,850)	290,952	85,523	66.9	17.3	219,492
B - Income Eligible	34,243	35,602	76,837	7,486	5.6	1.5	23,845
C - Commercial & Industrial	922,242	(15,422,411)	(153,525)	31	151.6	39.1	352,980
Grand Total	1,363,347	(17,254,660)	214,264	93,041	224.1	57.8	596,318

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	1,660,663	(9,636,646)	456,406	121,112	273.0	70.4	809,250
B - Income Eligible	108,877	106,806	224,265	21,428	17.9	4.6	73,998
C - Commercial & Industrial	2,312,224	(24,499,061)	(425,316)	94	380.1	98.1	964,606
Grand Total	4,081,765	(34,028,901)	255,356	142,633	670.9	173.1	1,847,854

Notes:

The Program Administrators are working with DEP to determine the best method for properly and precisely capturing the full impact of energy efficiency measures on GHG emissions. As part of this process, the Program Administrators have included this additional table on greenhouse gas reductions, based on continuing discussions with the DEP. These reductions are calculated using factors proposed by DEP, which are based on adjusted gross annual electric energy, natural gas, and oil savings. The Program Administrators look forward to discussing these proposed factors with DEP and are committed to ensuring that the full impact of energy efficiency measures on GHG emissions are captured.

IV.C. Program Administrator Budgets

1. Summary Table

Statewide Gas

September 14, 2018

2019 Program Administrator Budget										
Program	Program Costs						Performance Incentive	Total Program Administrator Budget	Program Cost per Participant	Energy 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	5,898,654	4,279,762	104,197,275	34,339,697	3,331,720	152,047,107	3,298,335	155,345,442	236	1.47
A1 - Residential New Buildings	413,114	87,536	10,475,908	1,062,849	-	12,039,407	351,112	12,390,519	1,722	2.57
A1a - Residential New Homes & Renovations	413,114	87,536	10,475,908	1,062,849	-	12,039,407	351,112	12,390,519	1,722	2.57
A2 - Residential Existing Buildings	4,233,854	3,026,997	92,458,887	32,776,905	-	132,496,643	2,947,223	135,443,865	208	1.45
A2a - Residential Coordinated Delivery	2,472,720	1,359,970	64,720,245	10,895,644	-	79,448,578	2,113,894	81,562,472	1,224	1.70
A2b - Residential Conservation Services (RCS)	618,670	436,301	-	17,130,496	-	18,185,467	-	18,185,467	-	-
A2c - Residential Retail	987,960	1,198,762	27,737,937	1,486,027	-	31,410,686	752,436	32,163,122	715	1.51
A2d - Residential Behavior	154,503	31,964	706	3,264,739	-	3,451,912	80,892	3,532,804	7	2.73
A3 - Residential Hard-to-Measure	1,251,687	1,165,228	1,262,480	499,943	3,331,720	7,511,058	-	7,511,058	-	-
A3a - Residential Statewide Marketing	1,767	940,289	-	-	-	942,055	-	942,055	-	-
A3b - Residential Statewide Database	73,802	-	-	-	-	73,802	-	73,802	-	-
A3c - Residential DOER Assessment	754,108	-	-	-	-	754,108	-	754,108	-	-
A3d - Residential EEAC Consultants	332,453	-	-	-	-	332,453	-	332,453	-	-
A3e - Residential Sponsorships & Subscriptions	53,731	8,814	-	1,187	5,000	68,732	-	68,732	-	-
A3f - Residential HEAT Loan	7,777	53,199	1,262,480	134,159	-	1,457,615	-	1,457,615	-	-
A3g - Residential Workforce Development	-	-	-	217,710	-	217,710	-	217,710	-	-
A3h - Residential R&D and Demonstration	28,049	-	-	127,486	-	155,536	-	155,536	-	-
A3i - Residential Education	-	162,926	-	19,400	-	182,326	-	182,326	-	-
A3j - Residential Evaluation and Market Research	-	-	-	-	3,326,720	3,326,720	-	3,326,720	-	-
B - Income Eligible	2,161,471	932,191	39,801,398	8,716,026	1,104,919	52,716,005	1,286,755	54,002,760	3,023	1.07
B1 - Income Eligible Existing Buildings	1,683,753	625,139	39,801,398	8,680,053	-	50,790,342	1,283,118	52,073,460	2,912	1.11
B1a - Income Eligible Coordinated Delivery	1,683,753	625,139	39,801,398	8,680,053	-	50,790,342	1,283,118	52,073,460	2,912	1.11
B2 - Income Eligible Hard-to-Measure	477,717	307,053	-	35,973	1,104,919	1,925,662	3,638	1,929,300	-	-
B2a - Income Eligible Statewide Marketing	651	304,501	-	-	-	305,152	-	305,152	-	-
B2b - Income Eligible Statewide Database	24,881	-	-	-	-	24,881	-	24,881	-	-
B2c - Income Eligible DOER Assessment	261,918	-	-	-	-	261,918	-	261,918	-	-
B2d - Income Eligible Energy Affordability Network	171,250	-	-	-	-	171,250	-	171,250	-	-
B2e - Income Eligible Sponsorships & Subscriptions	19,017	2,552	-	473	-	22,042	-	22,042	-	-
B2f - Income Eligible Evaluation and Market Research	-	-	-	-	1,104,919	1,104,919	-	1,104,919	-	-
B2g - Income Eligible Workforce Development	-	-	-	35,500	-	35,500	3,638	39,138	-	-
C - Commercial & Industrial	2,235,607	2,619,098	27,729,759	11,259,310	1,321,891	45,165,665	2,594,356	47,760,021	6,706	3.95
C1 - C&I New Buildings	312,792	493,891	5,611,743	2,209,790	-	8,628,217	555,145	9,183,361	13,073	4.78
C1a - C&I New Buildings & Major Renovations	312,792	493,891	5,611,743	2,209,790	-	8,628,217	555,145	9,183,361	13,073	4.78
C2 - C&I Existing Buildings	1,449,673	1,828,114	22,118,016	8,725,635	-	34,121,439	2,001,989	36,123,428	5,617	4.02
C2a - C&I Existing Building Retrofit	1,037,804	1,476,188	15,614,675	6,314,699	-	24,443,366	1,460,846	25,904,212	6,612	3.90
C2b - C&I New & Replacement Equipment	411,870	351,926	6,503,341	2,410,936	-	9,678,073	541,143	10,219,216	4,070	4.34
C3 - C&I Hard-to-Measure	473,141	297,092	-	323,884	1,321,891	2,416,009	37,223	2,453,232	-	-
C3a - C&I Statewide Marketing	2,668	291,030	-	-	-	293,698	-	293,698	-	-
C3b - C&I Statewide Database	19,218	-	-	-	-	19,218	-	19,218	-	-
C3c - C&I DOER Assessment	315,592	-	-	-	-	315,592	-	315,592	-	-
C3d - C&I EEAC Consultants	72,838	-	-	-	-	72,838	-	72,838	-	-
C3e - C&I Sponsorships & Subscriptions	26,083	3,595	-	488	2,000	32,166	-	32,166	-	-
C3f - C&I Workforce Development	-	-	-	138,277	-	138,277	-	138,277	-	-
C3g - C&I R&D and Demonstration	36,742	2,468	-	185,120	-	224,330	5,643	229,973	-	-
C3h - C&I Evaluation and Market Research	-	-	-	-	1,319,891	1,319,891	31,580	1,351,471	-	-
Grand Total	10,295,731	7,831,051	171,728,431	54,315,033	5,758,531	249,928,777	7,179,446	257,108,223	374	1.83

IV.C. Program Administrator Budgets

1. Summary Table

Statewide Gas

September 14, 2018

2020 Program Administrator Budget										Program Cost per Participant	Energy Benefit per Program Cost
Program	Program Costs						Performance Incentive	Total Program Administrator Budget			
	Program Planning and Administration	Marketing and Advertising	Participant Incentive	Sales, Technical Assistance & Training	Evaluation and Market Research	Total Program Costs					
A - Residential	5,905,457	4,386,807	106,325,047	34,764,036	3,556,027	154,937,374	3,768,305	158,705,679	240	1.56	
A1 - Residential New Buildings	412,412	95,222	10,723,835	943,337	17,890	12,192,695	387,160	12,579,855	1,712	2.58	
A1a - Residential New Homes & Renovations	412,412	95,222	10,723,835	943,337	17,890	12,192,695	387,160	12,579,855	1,712	2.58	
A2 - Residential Existing Buildings	4,200,384	3,107,832	94,348,733	33,299,427	224,522	135,180,898	3,349,877	138,530,775	212	1.56	
A2a - Residential Coordinated Delivery	2,429,094	1,410,358	66,225,100	11,284,460	173,640	81,522,650	2,383,506	83,906,156	1,251	1.87	
A2b - Residential Conservation Services (RCS)	611,801	454,343	-	17,255,270	32,474	18,353,887	3,356	18,357,243	-	-	
A2c - Residential Retail	1,000,303	1,211,049	28,122,857	1,477,697	18,223	31,830,128	869,855	32,699,982	721	1.51	
A2d - Residential Behavior	159,187	32,082	777	3,282,000	186	3,474,232	93,161	3,567,393	7	2.87	
A3 - Residential Hard-to-Measure	1,292,662	1,183,754	1,252,480	521,272	3,313,615	7,563,781	31,268	7,595,049	-	-	
A3a - Residential Statewide Marketing	1,767	952,456	-	-	-	954,223	-	954,223	-	-	
A3b - Residential Statewide Database	76,233	-	-	-	-	76,233	-	76,233	-	-	
A3c - Residential DOER Assessment	776,179	-	-	-	-	776,179	-	776,179	-	-	
A3d - Residential EEAC Consultants	344,714	-	-	-	-	344,714	-	344,714	-	-	
A3e - Residential Sponsorships & Subscriptions	55,972	8,888	-	1,207	5,000	71,067	-	71,067	-	-	
A3f - Residential HEAT Loan	7,507	54,597	1,252,480	138,202	1,006	1,453,792	-	1,453,792	-	-	
A3g - Residential Workforce Development	-	-	-	217,386	-	217,386	-	217,386	-	-	
A3h - Residential R&D and Demonstration	30,291	-	-	144,627	-	174,918	-	174,918	-	-	
A3i - Residential Education	-	167,812	-	19,850	-	187,662	31,268	218,931	-	-	
A3j - Residential Evaluation and Market Research	-	-	-	-	3,307,609	3,307,609	-	3,307,609	-	-	
B - Income Eligible	2,139,744	989,395	39,914,240	8,890,797	1,193,545	53,127,721	1,363,449	54,491,170	2,371	1.08	
B1 - Income Eligible Existing Buildings	1,656,892	679,916	39,914,240	8,854,816	96,398	51,202,262	1,320,497	52,522,759	2,286	1.12	
B1a - Income Eligible Coordinated Delivery	1,656,892	679,916	39,914,240	8,854,816	96,398	51,202,262	1,320,497	52,522,759	2,286	1.12	
B2 - Income Eligible Hard-to-Measure	482,852	309,479	-	35,981	1,097,147	1,925,459	42,952	1,968,411	-	-	
B2a - Income Eligible Statewide Marketing	651	306,748	-	-	-	307,399	-	307,399	-	-	
B2b - Income Eligible Statewide Database	25,319	-	-	-	-	25,319	-	25,319	-	-	
B2c - Income Eligible DOER Assessment	269,677	-	-	-	-	269,677	-	269,677	-	-	
B2d - Income Eligible Energy Affordability Network	167,450	-	-	-	-	167,450	-	167,450	-	-	
B2e - Income Eligible Sponsorships & Subscriptions	19,755	2,731	-	481	-	22,967	3,668	26,636	-	-	
B2f - Income Eligible Evaluation and Market Research	-	-	-	-	1,097,147	1,097,147	25,065	1,122,212	-	-	
B2g - Income Eligible Workforce Development	-	-	-	35,500	-	35,500	14,219	49,719	-	-	
C - Commercial & Industrial	2,236,431	2,798,573	29,056,105	11,228,007	1,433,763	46,752,879	2,603,511	49,356,390	6,889	3.75	
C1 - C&I New Buildings	296,789	505,702	5,638,563	2,203,482	11,814	8,656,351	517,155	9,173,506	13,256	4.65	
C1a - C&I New Buildings & Major Renovations	296,789	505,702	5,638,563	2,203,482	11,814	8,656,351	517,155	9,173,506	13,256	4.65	
C2 - C&I Existing Buildings	1,428,920	1,986,589	23,417,542	8,689,510	51,527	35,574,088	2,030,249	37,604,337	5,800	3.79	
C2a - C&I Existing Building Retrofit	987,927	1,577,583	16,302,121	5,885,139	18,812	24,771,583	1,417,549	26,189,131	6,697	3.65	
C2b - C&I New & Replacement Equipment	440,993	409,006	7,115,420	2,804,371	32,715	10,802,506	612,700	11,415,206	4,437	4.12	
C3 - C&I Hard-to-Measure	510,721	306,282	-	335,015	1,370,422	2,522,440	56,107	2,578,547	-	-	
C3a - C&I Statewide Marketing	2,668	298,919	-	-	-	301,587	-	301,587	-	-	
C3b - C&I Statewide Database	20,148	-	-	-	-	20,148	-	20,148	-	-	
C3c - C&I DOER Assessment	327,752	-	-	-	-	327,752	-	327,752	-	-	
C3d - C&I EEAC Consultants	73,448	-	-	-	-	73,448	-	73,448	-	-	
C3e - C&I Sponsorships & Subscriptions	27,760	4,821	-	494	2,000	35,075	5,926	41,001	-	-	
C3f - C&I Workforce Development	-	-	-	141,977	-	141,977	32,996	174,973	-	-	
C3g - C&I R&D and Demonstration	58,944	2,542	-	192,544	-	254,031	-	254,031	-	-	
C3h - C&I Evaluation and Market Research	-	-	-	-	1,368,422	1,368,422	17,185	1,385,608	-	-	
Grand Total	10,281,632	8,174,775	175,295,392	54,882,840	6,183,335	254,817,975	7,735,265	262,553,239	377	1.86	

IV.C. Program Administrator Budgets

1. Summary Table

Statewide Gas

September 14, 2018

2021 Program Administrator Budget										
Program	Program Costs						Performance Incentive	Total Program Administrator Budget	Program Cost per Participant	Energy 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	6,120,018	4,501,102	110,154,092	35,376,280	3,892,948	160,044,442	4,024,030	164,068,471	247	1.54
A1 - Residential New Buildings	427,667	94,649	10,970,948	967,080	19,539	12,479,882	413,210	12,893,092	1,721	2.55
A1a - Residential New Homes & Renovations	427,667	94,649	10,970,948	967,080	19,539	12,479,882	413,210	12,893,092	1,721	2.55
A2 - Residential Existing Buildings	4,337,609	3,184,804	97,890,665	33,903,032	240,826	139,556,936	3,578,764	143,135,700	218	1.54
A2a - Residential Coordinated Delivery	2,551,225	1,404,565	69,229,353	11,581,963	186,233	84,953,338	2,557,406	87,510,744	1,301	1.83
A2b - Residential Conservation Services (RCS)	640,977	508,747	-	17,531,919	34,732	18,716,375	-	18,716,375	-	-
A2c - Residential Retail	1,036,575	1,239,472	28,660,455	1,505,694	19,721	32,461,918	924,009	33,385,927	720	1.49
A2d - Residential Behavior	108,832	32,021	857	3,283,455	141	3,425,305	97,350	3,522,655	6	3.09
A3 - Residential Hard-to-Measure	1,354,742	1,221,650	1,292,480	506,169	3,632,583	8,007,623	32,056	8,039,680	-	-
A3a - Residential Statewide Marketing	1,767	983,389	-	-	-	985,156	-	985,156	-	-
A3b - Residential Statewide Database	79,256	-	-	-	-	79,256	-	79,256	-	-
A3c - Residential DOER Assessment	819,112	-	-	-	-	819,112	-	819,112	-	-
A3d - Residential EEAC Consultants	354,898	-	-	-	-	354,898	-	354,898	-	-
A3e - Residential Sponsorships & Subscriptions	58,091	9,478	-	1,229	5,000	73,797	-	73,797	-	-
A3f - Residential HEAT Loan	8,079	55,937	1,292,480	122,854	1,144	1,480,494	-	1,480,494	-	-
A3g - Residential Workforce Development	-	-	-	223,431	-	223,431	32,056	255,488	-	-
A3h - Residential R&D and Demonstration	33,540	-	-	138,355	-	171,894	-	171,894	-	-
A3i - Residential Education	-	172,845	-	20,300	-	193,145	-	193,145	-	-
A3j - Residential Evaluation and Market Research	-	-	-	-	3,626,440	3,626,440	-	3,626,440	-	-
B - Income Eligible	2,156,556	988,584	38,528,380	8,748,575	1,217,011	51,639,105	1,339,546	52,978,651	4,121	1.03
B1 - Income Eligible Existing Buildings	1,673,238	688,849	38,528,380	8,712,585	87,322	49,690,374	1,289,394	50,979,769	3,966	1.07
B1a - Income Eligible Coordinated Delivery	1,673,238	688,849	38,528,380	8,712,585	87,322	49,690,374	1,289,394	50,979,769	3,966	1.07
B2 - Income Eligible Hard-to-Measure	483,318	299,735	-	35,990	1,129,688	1,948,731	50,151	1,998,882	-	-
B2a - Income Eligible Statewide Marketing	651	297,099	-	-	-	297,750	-	297,750	-	-
B2b - Income Eligible Statewide Database	25,418	-	-	-	-	25,418	-	25,418	-	-
B2c - Income Eligible DOER Assessment	268,441	-	-	-	-	268,441	4,193	272,634	-	-
B2d - Income Eligible Energy Affordability Network	168,750	-	-	-	-	168,750	28,117	196,867	-	-
B2e - Income Eligible Sponsorships & Subscriptions	20,058	2,636	-	490	-	23,184	17,842	41,026	-	-
B2f - Income Eligible Evaluation and Market Research	-	-	-	-	1,129,688	1,129,688	-	1,129,688	-	-
B2g - Income Eligible Workforce Development	-	-	-	35,500	-	35,500	-	35,500	-	-
C - Commercial & Industrial	2,293,592	2,852,795	29,437,566	11,529,469	1,503,544	47,616,966	2,617,619	50,234,585	6,929	3.69
C1 - C&I New Buildings	339,206	529,332	5,884,532	2,315,597	14,215	9,082,882	540,994	9,623,876	13,952	4.59
C1a - C&I New Buildings & Major Renovations	339,206	529,332	5,884,532	2,315,597	14,215	9,082,882	540,994	9,623,876	13,952	4.59
C2 - C&I Existing Buildings	1,433,070	2,014,154	23,553,034	8,938,612	56,237	35,995,106	2,076,625	38,071,731	5,786	3.73
C2a - C&I Existing Building Retrofit	1,007,459	1,615,496	16,293,399	6,053,138	31,112	25,000,603	1,445,125	26,445,728	6,685	3.56
C2b - C&I New & Replacement Equipment	425,610	398,658	7,259,635	2,885,474	25,125	10,994,503	631,500	11,626,002	4,432	4.10
C3 - C&I Hard-to-Measure	521,317	309,308	-	275,261	1,433,092	2,538,978	-	2,538,978	-	-
C3a - C&I Statewide Marketing	2,668	304,244	-	-	-	306,912	-	306,912	-	-
C3b - C&I Statewide Database	20,860	-	-	-	-	20,860	-	20,860	-	-
C3c - C&I DOER Assessment	341,446	-	-	-	-	341,446	-	341,446	-	-
C3d - C&I EEAC Consultants	77,399	-	-	-	-	77,399	-	77,399	-	-
C3e - C&I Sponsorships & Subscriptions	28,408	5,024	-	500	2,000	35,932	-	35,932	-	-
C3f - C&I Workforce Development	-	-	-	129,425	-	129,425	-	129,425	-	-
C3g - C&I R&D and Demonstration	50,536	40	-	145,336	-	195,912	-	195,912	-	-
C3h - C&I Evaluation and Market Research	-	-	-	-	1,431,092	1,431,092	-	1,431,092	-	-
Grand Total	10,570,167	8,342,481	178,120,038	55,654,325	6,613,503	259,300,513	7,981,195	267,281,707	389	1.83

IV.C. Program Administrator Budgets

1. Summary Table

Statewide Gas

September 14, 2018

2019-2021 Program Administrator Budget										Program Cost per Participant	Energy Benefit per Program Cost
Program	Program Costs					Total Program Costs	Performance Incentive	Total Program Administrator Budget			
	Program Planning and Administration	Marketing and Advertising	Participant Incentive	Sales, Technical Assistance & Training	Evaluation and Market Research						
A - Residential	17,924,129	13,167,672	320,676,414	104,480,013	10,780,696	467,028,923	11,090,669	478,119,592	241	1.52	
A1 - Residential New Buildings	1,253,192	277,407	32,170,690	2,973,266	37,429	36,711,984	1,151,482	37,863,466	1,718	2.57	
A1a - Residential New Homes & Renovations	1,253,192	277,407	32,170,690	2,973,266	37,429	36,711,984	1,151,482	37,863,466	1,718	2.57	
A2 - Residential Existing Buildings	12,771,846	9,319,633	284,698,285	99,979,364	465,348	407,234,476	9,875,863	417,110,340	212	1.52	
A2a - Residential Coordinated Delivery	7,453,038	4,174,892	200,174,697	33,762,067	359,872	245,924,567	7,054,805	252,979,372	1,259	1.80	
A2b - Residential Conservation Services (RCS)	1,871,448	1,399,391	-	51,917,685	67,206	55,255,729	3,356	55,259,085	-	-	
A2c - Residential Retail	3,024,838	3,649,283	84,521,249	4,469,418	37,944	95,702,731	2,546,300	98,249,031	719	1.50	
A2d - Residential Behavior	422,522	96,067	2,339	9,830,195	326	10,351,449	271,403	10,622,852	7	2.90	
A3 - Residential Hard-to-Measure	3,899,090	3,570,632	3,807,439	1,527,383	10,277,918	23,082,462	63,324	23,145,787			
A3a - Residential Statewide Marketing	5,300	2,876,134	-	-	-	2,881,434	-	2,881,434			
A3b - Residential Statewide Database	229,291	-	-	-	-	229,291	-	229,291			
A3c - Residential DOER Assessment	2,349,398	-	-	-	-	2,349,398	-	2,349,398			
A3d - Residential EEAC Consultants	1,032,065	-	-	-	-	1,032,065	-	1,032,065			
A3e - Residential Sponsorships & Subscriptions	167,793	27,180	-	3,623	15,000	213,596	-	213,596			
A3f - Residential HEAT Loan	23,363	163,734	3,807,439	395,215	2,149	4,391,900	-	4,391,900			
A3g - Residential Workforce Development	-	-	-	658,528	-	658,528	32,056	690,584			
A3h - Residential R&D and Demonstration	91,880	-	-	410,468	-	502,348	-	502,348			
A3i - Residential Education	-	503,584	-	59,550	-	563,134	31,268	594,402			
A3j - Residential Evaluation and Market Research	-	-	-	-	10,260,769	10,260,769	-	10,260,769			
B - Income Eligible	6,457,771	2,910,170	118,244,017	26,355,398	3,515,475	157,482,831	3,989,750	161,472,582	3,007	1.06	
B1 - Income Eligible Existing Buildings	5,013,883	1,993,904	118,244,017	26,247,454	183,721	151,682,979	3,893,009	155,575,988	2,896	1.10	
B1a - Income Eligible Coordinated Delivery	5,013,883	1,993,904	118,244,017	26,247,454	183,721	151,682,979	3,893,009	155,575,988	2,896	1.10	
B2 - Income Eligible Hard-to-Measure	1,443,888	916,266	-	107,944	3,331,754	5,799,852	96,741	5,896,594			
B2a - Income Eligible Statewide Marketing	1,953	908,347	-	-	-	910,300	-	910,300			
B2b - Income Eligible Statewide Database	75,618	-	-	-	-	75,618	-	75,618			
B2c - Income Eligible DOER Assessment	800,036	-	-	-	-	800,036	4,193	804,230			
B2d - Income Eligible Energy Affordability Network	507,450	-	-	-	-	507,450	28,117	535,567			
B2e - Income Eligible Sponsorships & Subscriptions	58,830	7,919	-	1,444	-	68,193	21,510	89,703			
B2f - Income Eligible Evaluation and Market Research	-	-	-	-	3,331,754	3,331,754	25,065	3,356,819			
B2g - Income Eligible Workforce Development	-	-	-	106,500	-	106,500	17,857	124,357			
C - Commercial & Industrial	6,765,630	8,270,466	86,223,429	34,016,787	4,259,198	139,535,510	7,815,486	147,350,996	6,842	3.80	
C1 - C&I New Buildings	948,787	1,528,926	17,134,838	6,728,869	26,029	26,367,449	1,613,294	27,980,743	13,425	4.67	
C1a - C&I New Buildings & Major Renovations	948,787	1,528,926	17,134,838	6,728,869	26,029	26,367,449	1,613,294	27,980,743	13,425	4.67	
C2 - C&I Existing Buildings	4,311,663	5,828,858	69,088,591	26,353,758	107,764	105,690,633	6,108,862	111,799,496	5,735	3.85	
C2a - C&I Existing Building Retrofit	3,033,190	4,669,267	48,210,196	18,252,976	49,924	74,215,552	4,323,519	78,539,071	6,664	3.70	
C2b - C&I New & Replacement Equipment	1,278,474	1,159,590	20,878,396	8,100,782	57,840	31,475,082	1,785,343	33,260,424	4,316	4.18	
C3 - C&I Hard-to-Measure	1,505,179	912,683	-	934,160	4,125,406	7,477,428	93,330	7,570,757			
C3a - C&I Statewide Marketing	8,005	894,192	-	-	-	902,197	-	902,197			
C3b - C&I Statewide Database	60,225	-	-	-	-	60,225	-	60,225			
C3c - C&I DOER Assessment	984,790	-	-	-	-	984,790	-	984,790			
C3d - C&I EEAC Consultants	223,685	-	-	-	-	223,685	-	223,685			
C3e - C&I Sponsorships & Subscriptions	82,251	13,440	-	1,481	6,000	103,173	5,926	109,099			
C3f - C&I Workforce Development	-	-	-	409,679	-	409,679	32,996	442,675			
C3g - C&I R&D and Demonstration	146,223	5,050	-	523,000	-	674,272	5,643	679,915			
C3h - C&I Evaluation and Market Research	-	-	-	-	4,119,406	4,119,406	48,765	4,168,171			
Grand Total	31,147,530	24,348,307	525,143,860	164,852,198	18,555,369	764,047,264	22,895,905	786,943,170	380	1.84	

Notes:

Budgets for each year are represented in nominal dollars (2019\$, 2020\$, 2021\$).

Refer to common definitions for allocation of costs.

IV.D. Cost-Effectiveness

1. Summary Table

Statewide Gas

September 14, 2018

2019 Total Resource Cost Test (2019\$)							
Program	With GWSA Benefits			Without GWSA Benefits			Total Program Costs
	Benefit-Cost Ratio	Net Benefits	Total TRC Test Benefits	Benefit-Cost Ratio	Net Benefits	Total TRC Test Benefits	
A - Residential	1.35	74,523,224	290,162,322	1.20	42,249,383	257,888,481	152,047,107
A1 - Residential New Buildings	1.43	13,486,486	44,998,713	1.28	8,821,082	40,333,309	12,039,407
A1a - Residential New Homes & Renovations	1.43	13,486,486	44,998,713	1.28	8,821,082	40,333,309	12,039,407
A2 - Residential Existing Buildings	1.39	68,547,796	245,163,609	1.23	40,939,358	217,555,171	132,496,643
A2a - Residential Coordinated Delivery	1.60	65,519,312	175,313,096	1.43	46,916,419	156,710,203	79,448,578
A2b - Residential Conservation Services (RCS)	0.00	-18,185,467	0	-	(18,185,467)	-	-18,185,467
A2c - Residential Retail	1.34	15,336,455	60,440,212	1.19	8,524,849	53,628,606	31,410,686
A2d - Residential Behavior	2.66	5,877,496	9,410,300	2.04	3,683,558	7,216,362	3,451,912
A3 - Residential Hard-to-Measure	0.00	-7,511,058	0	-	(7,511,058)	-	-7,511,058
B - Income Eligible	1.99	53,331,520	106,942,430	1.83	44,727,070	98,337,981	52,716,005
B1 - Income Eligible Existing Buildings	2.07	55,260,820	106,942,430	1.90	46,656,370	98,337,981	50,790,342
B1a - Income Eligible Coordinated Delivery	2.07	55,260,820	106,942,430	1.90	46,656,370	98,337,981	50,790,342
B2 - Income Eligible Hard-to-Measure	0.00	-1,929,300	0	-	(1,929,300)	-	-1,925,662
C - Commercial & Industrial	2.92	125,420,572	190,738,643	2.45	94,978,732	160,296,802	45,165,665
C1 - C&I New Buildings	3.55	30,099,837	41,883,845	2.93	22,738,617	34,522,624	8,628,217
C1a - C&I New Buildings & Major Renovations	3.55	30,099,837	41,883,845	2.93	22,738,617	34,522,624	8,628,217
C2 - C&I Existing Buildings	2.91	97,773,967	148,854,798	2.46	74,693,347	125,774,178	34,121,439
C2a - C&I Existing Building Retrofit	2.97	70,858,280	106,829,895	2.55	55,767,929	91,739,545	24,443,366
C2b - C&I New & Replacement Equipment	2.78	26,915,687	42,024,903	2.25	18,925,417	34,034,633	9,678,073
C3 - C&I Hard-to-Measure	0.00	-2,453,232	0	-	(2,453,232)	-	-2,416,009
Grand Total	1.76	253,275,316	587,843,395	1.54	181,955,185	516,523,264	249,928,777

2020 Total Resource Cost Test (2019\$)							
Program	With GWSA Benefits			Without GWSA Benefits			Total Program Costs
	Benefit-Cost Ratio	Net Benefits	Total TRC Test Benefits	Benefit-Cost Ratio	Net Benefits	Total TRC Test Benefits	
A - Residential	1.44	95,251,478	310,663,011	1.29	63,333,532	278,745,065	151,409,532
A1 - Residential New Buildings	1.46	14,448,429	45,863,568	1.31	9,829,497	41,244,636	11,915,074
A1a - Residential New Homes & Renovations	1.46	14,448,429	45,863,568	1.31	9,829,497	41,244,636	11,915,074
A2 - Residential Existing Buildings	1.50	88,225,162	264,799,443	1.35	60,926,149	237,500,430	132,102,900
A2a - Residential Coordinated Delivery	1.75	83,077,236	193,494,328	1.58	64,523,581	174,940,674	79,666,423
A2b - Residential Conservation Services (RCS)	0.00	-17,939,258	0	-	(17,939,258)	-	-17,935,979
A2c - Residential Retail	1.37	16,585,403	61,317,167	1.22	9,908,474	54,640,238	31,105,372
A2d - Residential Behavior	2.87	6,501,782	9,987,948	2.27	4,433,352	7,919,518	3,395,126
A3 - Residential Hard-to-Measure	0.00	-7,422,114	0	-	(7,422,114)	-	-7,391,558
B - Income Eligible	2.02	54,625,914	108,064,168	1.86	46,173,302	99,611,557	51,918,031
B1 - Income Eligible Existing Buildings	2.10	56,549,505	108,064,168	1.93	48,096,894	99,611,557	50,036,414
B1a - Income Eligible Coordinated Delivery	2.10	56,549,505	108,064,168	1.93	48,096,894	99,611,557	50,036,414
B2 - Income Eligible Hard-to-Measure	0.00	-1,923,591	0	-	(1,923,591)	-	-1,881,617
C - Commercial & Industrial	2.85	122,188,561	188,307,175	2.41	92,903,599	159,022,213	45,688,341
C1 - C&I New Buildings	3.70	29,865,208	40,906,191	3.07	22,875,684	33,916,668	8,459,250
C1a - C&I New Buildings & Major Renovations	3.70	29,865,208	40,906,191	3.07	22,875,684	33,916,668	8,459,250
C2 - C&I Existing Buildings	2.80	94,843,188	147,400,984	2.38	72,547,750	125,105,545	34,764,085
C2a - C&I Existing Building Retrofit	2.82	66,397,662	102,911,799	2.43	52,341,151	88,855,288	24,207,547
C2b - C&I New & Replacement Equipment	2.77	28,445,526	44,489,185	2.26	20,206,598	36,250,257	10,556,539
C3 - C&I Hard-to-Measure	0.00	-2,519,835	0	-	(2,519,835)	-	-2,465,006
Grand Total	1.81	272,065,953	607,034,354	1.60	202,410,433	537,378,835	249,015,904

IV.D. Cost-Effectiveness

1. Summary Table

Statewide Gas

September 14, 2018

2021 Total Resource Cost Test (2019\$)							
Program	With GWSA Benefits			Without GWSA Benefits			Total Program Costs
	Benefit-Cost Ratio	Net Benefits	Total TRC Test Benefits	Benefit-Cost Ratio	Net Benefits	Total TRC Test Benefits	
A - Residential	1.48	103,941,517	321,229,584	1.33	71,815,987	289,104,054	152,839,162
A1 - Residential New Buildings	1.48	15,151,575	46,508,096	1.34	10,534,693	41,891,214	11,918,032
A1a - Residential New Homes & Renovations	1.48	15,151,575	46,508,096	1.34	10,534,693	41,891,214	11,918,032
A2 - Residential Existing Buildings	1.54	96,467,671	274,721,488	1.39	68,959,023	247,212,840	133,274,014
A2a - Residential Coordinated Delivery	1.80	89,712,911	202,139,346	1.63	70,939,941	183,366,376	81,128,697
A2b - Residential Conservation Services (RCS)	0.00	-17,873,754	0	-	(17,873,754)	-	17,873,754
A2c - Residential Retail	1.39	17,394,168	61,983,732	1.24	10,717,793	55,307,357	31,000,466
A2d - Residential Behavior	3.15	7,234,347	10,598,410	2.54	5,175,043	8,539,106	3,271,096
A3 - Residential Hard-to-Measure	0.00	-7,677,729	0	-	(7,677,729)	-	7,647,116
B - Income Eligible	2.03	52,400,549	103,134,186	1.88	44,530,461	95,264,098	49,314,287
B1 - Income Eligible Existing Buildings	2.11	54,309,441	103,134,186	1.95	46,439,353	95,264,098	47,453,289
B1a - Income Eligible Coordinated Delivery	2.11	54,309,441	103,134,186	1.95	46,439,353	95,264,098	47,453,289
B2 - Income Eligible Hard-to-Measure	0.00	-1,908,892	0	-	(1,908,892)	-	1,860,998
C - Commercial & Industrial	2.88	123,471,558	189,089,408	2.44	94,252,537	159,870,387	45,473,227
C1 - C&I New Buildings	3.73	31,062,496	42,459,863	3.09	23,874,356	35,271,723	8,673,966
C1a - C&I New Buildings & Major Renovations	3.73	31,062,496	42,459,863	3.09	23,874,356	35,271,723	8,673,966
C2 - C&I Existing Buildings	2.83	94,833,733	146,629,544	2.41	72,802,853	124,598,664	34,374,589
C2a - C&I Existing Building Retrofit	2.83	65,656,063	101,500,036	2.45	51,922,001	87,765,971	23,875,064
C2b - C&I New & Replacement Equipment	2.83	29,177,670	45,129,509	2.31	20,880,852	36,832,693	10,499,525
C3 - C&I Hard-to-Measure	0.00	-2,424,672	0	-	(2,424,672)	-	2,424,672
Grand Total	1.84	279,813,624	613,453,177	1.63	210,598,985	544,238,538	247,626,676

2019-2021 Total Resource Cost Test (2019\$)							
Program	With GWSA Benefits			Without GWSA Benefits			Total Program Costs
	Benefit-Cost Ratio	Net Benefits	Total TRC Test Benefits	Benefit-Cost Ratio	Net Benefits	Total TRC Test Benefits	
A - Residential	1.42	273,716,219	922,054,917	1.27	177,398,902	825,737,600	456,295,801
A1 - Residential New Buildings	1.46	43,086,490	137,370,377	1.31	29,185,273	123,469,159	35,872,513
A1a - Residential New Homes & Renovations	1.46	43,086,490	137,370,377	1.31	29,185,273	123,469,159	35,872,513
A2 - Residential Existing Buildings	1.48	253,240,629	784,684,540	1.32	170,824,530	702,268,441	397,873,557
A2a - Residential Coordinated Delivery	1.72	238,309,458	570,946,770	1.55	182,379,941	515,017,253	240,243,698
A2b - Residential Conservation Services (RCS)	0.00	-53,998,480	0	-	(53,998,480)	-	53,995,200
A2c - Residential Retail	1.37	49,316,025	183,741,111	1.22	29,151,116	163,576,202	93,516,524
A2d - Residential Behavior	2.89	19,613,626	29,996,658	2.28	13,291,953	23,674,986	10,118,134
A3 - Residential Hard-to-Measure	0.00	-22,610,901	0	-	(22,610,901)	-	22,549,732
B - Income Eligible	2.02	160,357,982	318,140,784	1.86	135,430,834	293,213,635	153,948,323
B1 - Income Eligible Existing Buildings	2.09	166,119,766	318,140,784	1.93	141,192,617	293,213,635	148,280,045
B1a - Income Eligible Coordinated Delivery	2.09	166,119,766	318,140,784	1.93	141,192,617	293,213,635	148,280,045
B2 - Income Eligible Hard-to-Measure	0.00	-5,761,783	0	-	(5,761,783)	-	5,668,278
C - Commercial & Industrial	2.88	371,080,691	568,135,225	2.43	282,134,867	479,189,402	136,327,232
C1 - C&I New Buildings	3.66	91,027,542	125,249,899	3.03	69,488,657	103,711,015	25,761,432
C1a - C&I New Buildings & Major Renovations	3.66	91,027,542	125,249,899	3.03	69,488,657	103,711,015	25,761,432
C2 - C&I Existing Buildings	2.85	287,450,888	442,885,326	2.42	220,043,949	375,478,387	103,260,113
C2a - C&I Existing Building Retrofit	2.87	202,912,005	311,241,729	2.48	160,031,082	268,360,806	72,525,977
C2b - C&I New & Replacement Equipment	2.79	84,538,883	131,643,597	2.27	60,012,867	107,117,581	30,734,136
C3 - C&I Hard-to-Measure	0.00	-7,397,739	0	-	(7,397,739)	-	7,305,687
Grand Total	1.80	805,154,892	1,808,330,926	1.59	594,964,603	1,598,140,637	746,571,356

Notes:

The Benefit-Cost Ratio is the Total TRC Test Benefits divided by the Total TRC Test Costs.

The Net Benefits are the Total TRC Test Benefits minus the Total TRC Test Costs.

For supporting information on the Total TRC Test Benefits, see Table IV.D.3.1.i.

For supporting information on the Total Program Costs, see Table IV.C.1.

For supporting information on the Performance Incentive, refer to the Performance Incentive Model.

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

IV.D Cost-Effectiveness
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Program	2019 Benefits													
	Electric												Natural Gas	
	Summer Generation	Capacity DRIPE	Capacity			Electric Energy				Natural Gas	Natural Gas DRIPE	Natural Gas GWSA	Total Natural Gas	
		Transmission	Distribution	Reliability	Total Capacity	Electric Energy	Electric Energy DRIPE	Electric Energy GWSA	Total Electric Energy					
A - Residential	1,671,078	10,876	2,128,315	3,111,290	119,256	7,040,816	5,367,258	1,237,575	1,476,756	8,081,588	138,127,836	17,358,890	29,236,467	184,723,193
A1 - Residential New Buildings	79,802	52	101,491	115,224	5,198	301,767	752,905	131,839	182,118	1,066,861	22,954,814	2,191,637	4,483,286	29,629,737
A1a - Residential New Homes & Renovations	79,802	52	101,491	115,224	5,198	301,767	752,905	131,839	182,118	1,066,861	22,954,814	2,191,637	4,483,286	29,629,737
A2 - Residential Existing Buildings	1,591,276	10,824	2,026,825	2,996,066	114,058	6,739,049	4,614,353	1,105,736	1,294,638	7,014,727	115,173,022	15,167,252	24,753,181	155,093,455
A2a - Residential Coordinated Delivery	1,299,946	5,853	1,617,051	2,309,303	85,717	5,317,870	4,257,808	990,152	1,166,642	6,414,602	86,614,802	9,764,517	17,122,372	113,501,691
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	291,331	4,971	409,774	686,764	28,341	1,421,180	356,545	115,584	127,996	600,125	23,642,939	3,101,654	5,436,871	32,181,464
A2d - Residential Behavior	-	-	-	-	-	-	-	-	-	-	4,915,281	2,301,081	2,193,938	9,410,300
B - Income Eligible	130,118	148	154,220	251,602	8,179	544,266	869,792	155,989	228,097	1,253,878	40,771,167	4,591,828	8,314,162	53,677,156
B1 - Income Eligible Existing Buildings	130,118	148	154,220	251,602	8,179	544,266	869,792	155,989	228,097	1,253,878	40,771,167	4,591,828	8,314,162	53,677,156
B1a - Income Eligible Coordinated Delivery	130,118	148	154,220	251,602	8,179	544,266	869,792	155,989	228,097	1,253,878	40,771,167	4,591,828	8,314,162	53,677,156
C - Commercial & Industrial	32,148	545	43,421	64,316	2,859	143,288	32,488	8,983	10,506	51,977	114,373,991	20,904,433	30,431,335	165,909,759
C1 - C&I New Buildings	-	-	-	-	-	-	-	-	-	-	29,977,227	3,908,683	7,361,220	41,247,131
C1a - C&I New Buildings & Major Renovations	-	-	-	-	-	-	-	-	-	-	29,977,227	3,908,683	7,361,220	41,247,131
C2 - C&I Existing Buildings	32,148	545	43,421	64,316	2,859	143,288	32,488	8,983	10,506	51,977	84,596,764	16,995,750	23,070,114	124,662,628
C2a - C&I Existing Building Retrofit	32,148	545	43,421	64,316	2,859	143,288	30,962	8,716	10,073	49,750	55,177,181	12,650,044	15,080,278	82,907,503
C2b - C&I New & Replacement Equipment	-	-	-	-	-	-	1,527	267	433	2,227	29,419,583	4,345,706	7,989,837	41,755,125
Grand Total	1,833,344	11,569	2,325,956	3,427,208	130,294	7,728,371	6,269,538	1,402,546	1,715,359	9,387,443	293,472,994	42,855,150	67,981,964	404,310,108

Program	2020 Benefits													
	Electric												Natural Gas	
	Summer Generation	Capacity DRIPE	Capacity			Electric Energy				Natural Gas	Natural Gas DRIPE	Natural Gas GWSA	Total Natural Gas	
		Transmission	Distribution	Reliability	Total Capacity	Electric Energy	Electric Energy DRIPE	Electric Energy GWSA	Total Electric Energy					
A - Residential	5,687,703	9,758	5,868,060	9,244,662	272,841	21,083,024	9,878,584	1,763,555	2,253,736	13,895,875	140,375,017	15,087,541	28,159,532	183,622,090
A1 - Residential New Buildings	87,707	52	100,587	114,038	5,050	307,434	767,308	128,063	168,385	1,063,756	23,805,165	1,880,923	4,450,547	30,136,635
A1a - Residential New Homes & Renovations	87,707	52	100,587	114,038	5,050	307,434	767,308	128,063	168,385	1,063,756	23,805,165	1,880,923	4,450,547	30,136,635
A2 - Residential Existing Buildings	5,599,996	9,706	5,767,474	9,130,623	267,792	20,775,591	9,111,277	1,635,492	2,085,350	12,832,119	116,569,852	13,206,618	23,708,985	153,485,455
A2a - Residential Coordinated Delivery	5,282,412	4,886	5,366,281	8,457,742	240,044	19,351,365	8,747,091	1,520,167	1,965,860	12,233,119	86,830,799	8,048,404	16,268,848	111,148,051
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	317,585	4,820	401,192	672,882	27,747	1,424,226	364,185	115,325	119,490	599,000	24,365,293	2,612,455	5,371,707	32,349,456
A2d - Residential Behavior	-	-	-	-	-	-	-	-	-	-	5,373,759	2,545,759	2,068,430	9,987,948
B - Income Eligible	137,884	157	150,485	252,205	7,920	548,651	881,205	155,407	211,741	1,248,353	41,973,165	3,897,559	8,182,678	54,053,401
B1 - Income Eligible Existing Buildings	137,884	157	150,485	252,205	7,920	548,651	881,205	155,407	211,741	1,248,353	41,973,165	3,897,559	8,182,678	54,053,401
B1a - Income Eligible Coordinated Delivery	137,884	157	150,485	252,205	7,920	548,651	881,205	155,407	211,741	1,248,353	41,973,165	3,897,559	8,182,678	54,053,401
C - Commercial & Industrial	36,369	560	44,457	66,020	2,930	150,335	33,208	9,110	9,874	52,192	118,021,509	17,462,767	29,275,089	164,759,365
C1 - C&I New Buildings	-	-	-	-	-	-	-	-	-	-	30,033,075	3,233,320	6,989,524	40,255,919
C1a - C&I New Buildings & Major Renovations	-	-	-	-	-	-	-	-	-	-	30,033,075	3,233,320	6,989,524	40,255,919
C2 - C&I Existing Buildings	36,369	560	44,457	66,020	2,930	150,335	33,208	9,110	9,874	52,192	87,988,434	14,229,447	22,285,565	124,503,446
C2a - C&I Existing Building Retrofit	36,369	560	44,457	66,020	2,930	150,335	32,182	8,932	9,609	50,723	55,871,341	10,400,067	14,046,902	80,318,311
C2b - C&I New & Replacement Equipment	-	-	-	-	-	-	1,026	178	265	1,470	32,117,092	3,829,380	8,238,662	44,185,135
Grand Total	5,861,956	10,474	6,063,002	9,562,887	283,692	21,782,011	10,792,998	1,928,072	2,475,351	15,196,420	300,369,691	36,447,867	65,617,299	402,434,856

IV.D Cost-Effectiveness
 3.1.i. Benefits Summary Table
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Program	Oil				Propane Benefits			2019 Benefits							Total Energy Benefits per Participant
	Oil	Oil DRIPE	Oil GWSA	Total Oil	Propane	Propane GWSA	Total Propane Benefits	Wood	Water	Total Energy Benefits	Total GWSA Benefits	Non-Energy Impacts	Total TRC Test Benefits	Total TRC Test Benefits w/o GWSA	
A - Residential	13,522,074	37,985	1,496,929	15,056,987	912,057	63,689	975,745	-	6,908,840	222,787,170	32,273,841	67,375,152	290,162,322	257,888,481	345
A1 - Residential New Buildings	-	-	-	-	-	-	-	-	-	30,998,365	4,665,404	14,000,348	44,998,713	40,333,309	4,434
A1a - Residential New Homes & Renovations	-	-	-	-	-	-	-	-	-	30,998,365	4,665,404	14,000,348	44,998,713	40,333,309	4,434
A2 - Residential Existing Buildings	13,522,074	37,985	1,496,929	15,056,987	912,057	63,689	975,745	-	6,908,840	191,788,805	27,608,437	53,374,804	245,163,609	217,555,171	301
A2a - Residential Coordinated Delivery	2,667,271	7,505	301,132	2,975,908	177,509	12,746	190,256	-	6,561,409	134,961,735	18,602,893	40,351,361	175,313,096	156,710,203	2,080
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	10,854,803	30,479	1,195,797	12,081,079	734,547	50,943	785,490	-	347,432	47,416,769	6,811,606	13,023,443	60,440,212	53,628,606	1,079
A2d - Residential Behavior	-	-	-	-	-	-	-	-	-	9,410,300	2,193,938	-	9,410,300	7,216,362	18
B - Income Eligible	498,495	1,411	54,369	554,275	114,658	7,822	122,479	-	463,029	56,615,083	8,604,449	50,327,347	106,942,430	98,337,981	3,246
B1 - Income Eligible Existing Buildings	498,495	1,411	54,369	554,275	114,658	7,822	122,479	-	463,029	56,615,083	8,604,449	50,327,347	106,942,430	98,337,981	3,246
B1a - Income Eligible Coordinated Delivery	498,495	1,411	54,369	554,275	114,658	7,822	122,479	-	463,029	56,615,083	8,604,449	50,327,347	106,942,430	98,337,981	3,246
C - Commercial & Industrial	-	-	-	-	-	-	-	-	12,445,816	178,550,840	30,441,840	12,187,803	190,738,643	160,296,802	26,512
C1 - C&I New Buildings	-	-	-	-	-	-	-	-	-	41,247,131	7,361,220	636,714	41,883,845	34,522,624	62,496
C1a - C&I New Buildings & Major Renovations	-	-	-	-	-	-	-	-	-	41,247,131	7,361,220	636,714	41,883,845	34,522,624	62,496
C2 - C&I Existing Buildings	-	-	-	-	-	-	-	-	12,445,816	137,303,709	23,080,620	11,551,089	148,854,798	125,774,178	22,603
C2a - C&I Existing Building Retrofit	-	-	-	-	-	-	-	-	12,178,265	95,278,806	15,090,350	11,551,089	106,829,895	91,739,545	25,772
C2b - C&I New & Replacement Equipment	-	-	-	-	-	-	-	-	267,551	42,024,903	7,990,270	-	42,024,903	34,034,633	17,675
Grand Total	14,020,569	39,396	1,551,298	15,611,262	1,026,714	71,511	1,098,225	-	19,817,685	457,953,093	71,320,131	129,890,301	587,843,395	516,523,264	684

Program	Oil				Propane Benefits			2020 Benefits							Total Energy Benefits per Participant
	Oil	Oil DRIPE	Oil GWSA	Total Oil	Propane	Propane GWSA	Total Propane Benefits	Wood	Water	Total Energy Benefits	Total GWSA Benefits	Non-Energy Impacts	Total TRC Test Benefits	Total TRC Test Benefits w/o GWSA	
A - Residential	14,269,839	41,513	1,440,243	15,751,595	1,012,948	64,435	1,077,383	-	6,945,803	242,375,770	31,917,946	68,287,241	310,663,011	278,745,065	375
A1 - Residential New Buildings	-	-	-	-	-	-	-	-	-	31,507,825	4,618,933	14,355,743	45,863,568	41,244,636	4,425
A1a - Residential New Homes & Renovations	-	-	-	-	-	-	-	-	-	31,507,825	4,618,933	14,355,743	45,863,568	41,244,636	4,425
A2 - Residential Existing Buildings	14,269,839	41,513	1,440,243	15,751,595	1,012,948	64,435	1,077,383	-	6,945,803	210,867,945	27,299,013	53,931,498	264,799,443	237,500,430	330
A2a - Residential Coordinated Delivery	2,940,849	8,568	301,875	3,251,292	263,130	17,072	280,201	-	6,579,207	152,843,235	18,553,654	40,651,093	193,494,328	174,940,674	2,346
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	11,328,990	32,945	1,138,369	12,500,303	749,819	47,363	797,182	-	366,596	48,036,763	6,676,929	13,280,404	61,317,167	54,640,238	1,088
A2d - Residential Behavior	-	-	-	-	-	-	-	-	-	9,987,948	2,068,430	-	9,987,948	7,919,518	19
B - Income Eligible	510,860	1,496	50,873	563,229	117,055	7,319	124,374	-	744,267	57,282,276	8,452,611	50,781,891	108,064,168	99,611,557	2,557
B1 - Income Eligible Existing Buildings	510,860	1,496	50,873	563,229	117,055	7,319	124,374	-	744,267	57,282,276	8,452,611	50,781,891	108,064,168	99,611,557	2,557
B1a - Income Eligible Coordinated Delivery	510,860	1,496	50,873	563,229	117,055	7,319	124,374	-	744,267	57,282,276	8,452,611	50,781,891	108,064,168	99,611,557	2,557
C - Commercial & Industrial	-	-	-	-	-	-	-	-	10,210,015	175,171,908	29,284,962	13,135,267	188,307,175	159,022,213	25,811
C1 - C&I New Buildings	-	-	-	-	-	-	-	-	-	40,255,919	6,989,524	650,272	40,906,191	33,916,668	61,648
C1a - C&I New Buildings & Major Renovations	-	-	-	-	-	-	-	-	-	40,255,919	6,989,524	650,272	40,906,191	33,916,668	61,648
C2 - C&I Existing Buildings	-	-	-	-	-	-	-	-	10,210,015	134,915,989	22,295,438	12,484,995	147,400,984	125,105,545	21,996
C2a - C&I Existing Building Retrofit	-	-	-	-	-	-	-	-	9,907,435	90,426,804	14,056,511	12,484,995	102,911,799	88,855,288	24,446
C2b - C&I New & Replacement Equipment	-	-	-	-	-	-	-	-	302,580	44,489,185	8,238,928	-	44,489,185	36,250,257	18,273
Grand Total	14,780,699	43,009	1,491,117	16,314,824	1,130,004	71,754	1,201,757	-	17,900,085	474,829,955	69,655,519	132,204,399	607,034,354	537,378,835	703

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Program	2021 Benefits														
	Electric												Natural Gas		
	Summer Generation	Capacity DRIPE	Capacity				Electric Energy				Natural Gas	Natural Gas DRIPE	Natural Gas GWSA	Total Natural Gas	
		Transmission	Distribution	Reliability	Total Capacity	Electric Energy	Electric Energy DRIPE	Electric Energy GWSA	Total Electric Energy						
A - Residential	5,482,644	7,903	5,212,878	8,318,267	236,513	19,258,205	11,250,743	1,880,449	2,364,724	15,495,916	145,929,258	12,653,937	28,274,194	186,857,389	
A1 - Residential New Buildings	68,826	48	65,422	72,076	2,904	209,276	768,501	118,847	157,180	1,044,529	24,577,163	1,508,921	4,459,701	30,545,785	
A1a - Residential New Homes & Renovations	68,826	48	65,422	72,076	2,904	209,276	768,501	118,847	157,180	1,044,529	24,577,163	1,508,921	4,459,701	30,545,785	
A2 - Residential Existing Buildings	5,413,818	7,854	5,147,456	8,246,191	233,610	19,048,929	10,482,242	1,761,602	2,207,543	14,451,387	121,352,095	11,145,016	23,814,493	155,311,604	
A2a - Residential Coordinated Delivery	5,126,880	3,896	4,821,350	7,703,940	211,159	17,867,225	10,113,136	1,644,878	2,092,398	13,850,411	90,256,204	6,496,968	16,352,001	113,105,172	
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
A2c - Residential Retail	286,938	3,959	326,107	542,251	22,451	1,181,705	369,106	116,724	115,146	600,976	25,123,530	2,081,302	5,403,189	32,608,021	
A2d - Residential Behavior	-	-	-	-	-	-	-	-	-	-	5,972,361	2,566,746	2,059,304	10,598,410	
B - Income Eligible	98,676	121	100,125	170,171	5,292	374,386	894,212	155,803	202,492	1,252,506	40,084,768	2,884,341	7,611,666	50,580,775	
B1 - Income Eligible Existing Buildings	98,676	121	100,125	170,171	5,292	374,386	894,212	155,803	202,492	1,252,506	40,084,768	2,884,341	7,611,666	50,580,775	
B1a - Income Eligible Coordinated Delivery	98,676	121	100,125	170,171	5,292	374,386	894,212	155,803	202,492	1,252,506	40,084,768	2,884,341	7,611,666	50,580,775	
C - Commercial & Industrial	31,319	441	34,793	52,236	2,299	121,087	34,173	9,195	9,581	52,948	121,958,495	13,856,731	29,209,440	165,024,666	
C1 - C&I New Buildings	-	-	-	-	-	-	-	-	-	-	31,846,601	2,634,996	7,188,140	41,669,737	
C1a - C&I New Buildings & Major Renovations	-	-	-	-	-	-	-	-	-	-	31,846,601	2,634,996	7,188,140	41,669,737	
C2 - C&I Existing Buildings	31,319	441	34,793	52,236	2,299	121,087	34,173	9,195	9,581	52,948	90,111,894	11,221,735	22,021,299	123,354,928	
C2a - C&I Existing Building Retrofit	31,319	441	34,793	52,236	2,299	121,087	32,796	8,957	9,250	51,003	56,693,085	8,158,570	13,724,812	78,576,468	
C2b - C&I New & Replacement Equipment	-	-	-	-	-	-	1,376	237	331	1,945	33,418,808	3,063,165	8,296,487	44,778,460	
Grand Total	5,612,639	8,465	5,347,797	8,540,674	244,104	19,753,678	12,179,128	2,045,446	2,576,796	16,801,371	307,972,520	29,395,009	65,095,301	402,462,830	

Program	2019-2021 Benefits														
	Electric												Natural Gas		
	Summer Generation	Capacity DRIPE	Capacity				Electric Energy				Natural Gas	Natural Gas DRIPE	Natural Gas GWSA	Total Natural Gas	
		Transmission	Distribution	Reliability	Total Capacity	Electric Energy	Electric Energy DRIPE	Electric Energy GWSA	Total Electric Energy						
A - Residential	12,841,425	28,537	13,209,254	20,674,219	628,611	47,382,046	26,496,585	4,881,578	6,095,215	37,473,779	424,432,110	45,100,367	85,670,194	555,202,671	
A1 - Residential New Buildings	236,334	153	267,499	301,338	13,152	818,476	2,288,714	378,749	507,683	3,175,146	71,337,142	5,581,481	13,393,535	90,312,158	
A1a - Residential New Homes & Renovations	236,334	153	267,499	301,338	13,152	818,476	2,288,714	378,749	507,683	3,175,146	71,337,142	5,581,481	13,393,535	90,312,158	
A2 - Residential Existing Buildings	12,605,090	28,384	12,941,755	20,372,881	615,460	46,563,570	24,207,871	4,502,830	5,587,532	34,298,233	353,094,968	39,518,886	72,276,659	464,890,514	
A2a - Residential Coordinated Delivery	11,709,237	14,635	11,804,682	18,470,585	536,920	42,536,459	23,118,035	4,155,197	5,224,900	32,498,132	263,701,805	24,309,889	49,743,220	337,754,914	
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
A2c - Residential Retail	895,853	13,749	1,137,073	1,901,896	78,539	4,027,110	1,089,836	347,633	362,632	1,800,101	73,131,763	7,795,412	16,211,767	97,138,941	
A2d - Residential Behavior	-	-	-	-	-	-	-	-	-	-	16,261,401	7,413,586	6,321,672	29,996,658	
B - Income Eligible	366,678	476	404,830	673,978	21,391	1,467,303	2,645,209	467,199	642,330	3,754,737	122,829,100	11,373,728	24,108,506	158,311,333	
B1 - Income Eligible Existing Buildings	366,678	476	404,830	673,978	21,391	1,467,303	2,645,209	467,199	642,330	3,754,737	122,829,100	11,373,728	24,108,506	158,311,333	
B1a - Income Eligible Coordinated Delivery	366,678	476	404,830	673,978	21,391	1,467,303	2,645,209	467,199	642,330	3,754,737	122,829,100	11,373,728	24,108,506	158,311,333	
C - Commercial & Industrial	99,836	1,545	122,670	182,572	8,087	414,711	99,870	27,288	29,961	157,118	354,553,995	52,223,932	88,915,863	495,693,790	
C1 - C&I New Buildings	-	-	-	-	-	-	-	-	-	-	91,856,904	9,776,999	21,538,884	123,172,788	
C1a - C&I New Buildings & Major Renovations	-	-	-	-	-	-	-	-	-	-	91,856,904	9,776,999	21,538,884	123,172,788	
C2 - C&I Existing Buildings	99,836	1,545	122,670	182,572	8,087	414,711	99,870	27,288	29,961	157,118	262,697,091	42,446,932	67,376,979	372,521,002	
C2a - C&I Existing Building Retrofit	99,836	1,545	122,670	182,572	8,087	414,711	95,940	26,605	28,931	151,476	167,741,608	31,208,681	42,851,992	241,802,282	
C2b - C&I New & Replacement Equipment	-	-	-	-	-	-	3,930	683	1,030	5,642	94,955,483	11,238,251	24,524,986	130,718,720	
Grand Total	13,307,939	30,509	13,736,754	21,530,768	658,089	49,264,059	29,241,664	5,376,064	6,767,506	41,385,234	901,815,205	108,698,027	198,694,563	1,209,207,794	

IV.D Cost-Effectiveness
 3.1.i Benefits Summary Table
 Statewide Gas
 September 14, 2018

Program	2021 Benefits							Wood	Water	Total Energy Benefits	Total GWSA Benefits	Non-Energy Impacts	Total TRC Test Benefits	Total TRC Test Benefits w/o GWSA	Total Energy Benefits per Participant
	Oil	Oil DRIPE	Oil GWSA	Total Oil	Propane	Propane GWSA	Total Propane Benefits								
A - Residential	14,998,145	45,124	1,421,149	16,464,418	1,099,963	65,463	1,165,426	-	7,092,026	246,333,379	32,125,530	74,896,205	321,229,584	289,104,054	380
A1 - Residential New Buildings	-	-	-	-	-	-	-	-	-	31,799,589	4,616,882	14,708,506	46,508,096	41,891,214	4,385
A1a - Residential New Homes & Renovations	-	-	-	-	-	-	-	-	-	31,799,589	4,616,882	14,708,506	46,508,096	41,891,214	4,385
A2 - Residential Existing Buildings	14,998,145	45,124	1,421,149	16,464,418	1,099,963	65,463	1,165,426	-	7,092,026	214,533,790	27,508,648	60,187,698	274,721,488	247,212,840	335
A2a - Residential Coordinated Delivery	3,217,976	9,695	308,237	3,535,908	336,269	20,336	356,605	-	6,725,846	155,441,166	18,772,970	46,698,180	202,139,346	183,366,376	2,380
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	11,780,168	35,429	1,112,912	12,928,510	763,694	45,128	808,822	-	366,180	48,494,213	6,676,374	13,489,519	61,983,732	55,307,357	1,076
A2d - Residential Behavior	-	-	-	-	-	-	-	-	-	10,598,410	2,059,304	-	10,598,410	8,539,106	20
B - Income Eligible	521,796	1,579	48,896	572,270	119,238	7,034	126,273	-	176,601	53,082,811	7,870,088	50,051,374	103,134,186	95,264,098	4,236
B1 - Income Eligible Existing Buildings	521,796	1,579	48,896	572,270	119,238	7,034	126,273	-	176,601	53,082,811	7,870,088	50,051,374	103,134,186	95,264,098	4,236
B1a - Income Eligible Coordinated Delivery	521,796	1,579	48,896	572,270	119,238	7,034	126,273	-	176,601	53,082,811	7,870,088	50,051,374	103,134,186	95,264,098	4,236
C - Commercial & Industrial	-	-	-	-	-	-	-	-	10,662,802	175,861,503	29,219,021	13,227,905	189,089,408	159,870,387	25,592
C1 - C&I New Buildings	-	-	-	-	-	-	-	-	-	41,669,737	7,188,140	790,126	42,459,863	35,271,723	64,009
C1a - C&I New Buildings & Major Renovations	-	-	-	-	-	-	-	-	-	41,669,737	7,188,140	790,126	42,459,863	35,271,723	64,009
C2 - C&I Existing Buildings	-	-	-	-	-	-	-	-	10,662,802	134,191,766	22,030,881	12,437,779	146,629,544	124,598,664	21,572
C2a - C&I Existing Building Retrofit	-	-	-	-	-	-	-	-	10,313,698	89,062,257	13,734,062	12,437,779	101,500,036	87,765,973	23,813
C2b - C&I New & Replacement Equipment	-	-	-	-	-	-	-	-	349,104	45,129,509	8,296,818	-	45,129,509	36,832,691	18,192
Grand Total	15,519,940	46,703	1,470,044	17,036,688	1,219,201	72,498	1,291,699	-	17,931,428	475,277,694	69,214,639	138,175,484	613,453,177	544,238,538	713

Program	2019-2021 Benefits							Wood	Water	Total Energy Benefits	Total GWSA Benefits	Non-Energy Impacts	Total TRC Test Benefits	Total TRC Test Benefits w/o GWSA	Total Energy Benefits per Participant
	Oil	Oil DRIPE	Oil GWSA	Total Oil	Propane	Propane GWSA	Total Propane Benefits								
A - Residential	42,790,057	124,622	4,358,321	47,273,000	3,024,968	193,587	3,218,555	-	20,946,669	711,496,319	96,317,317	210,558,597	922,054,917	825,737,600	367
A1 - Residential New Buildings	-	-	-	-	-	-	-	-	20,946,669	94,305,780	13,901,218	43,064,597	137,370,377	123,469,159	4,414
A1a - Residential New Homes & Renovations	-	-	-	-	-	-	-	-	-	94,305,780	13,901,218	43,064,597	137,370,377	123,469,159	4,414
A2 - Residential Existing Buildings	42,790,057	124,622	4,358,321	47,273,000	3,024,968	193,587	3,218,555	-	20,946,669	617,190,540	82,416,099	167,494,000	784,684,540	702,268,441	322
A2a - Residential Coordinated Delivery	8,826,097	25,769	911,243	9,763,109	776,908	50,154	827,061	-	19,866,461	443,246,136	55,929,518	127,700,634	570,946,770	515,017,253	2,269
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	33,963,961	98,853	3,447,077	37,509,891	2,248,060	143,433	2,391,493	-	1,080,208	143,947,745	20,164,909	39,793,366	183,741,111	163,576,202	1,081
A2d - Residential Behavior	-	-	-	-	-	-	-	-	-	29,996,658	6,321,672	-	29,996,658	23,674,986	19
B - Income Eligible	1,531,151	4,486	154,138	1,689,775	350,951	22,175	373,126	-	1,383,897	166,980,171	24,927,149	151,160,613	318,140,784	293,213,635	3,188
B1 - Income Eligible Existing Buildings	1,531,151	4,486	154,138	1,689,775	350,951	22,175	373,126	-	1,383,897	166,980,171	24,927,149	151,160,613	318,140,784	293,213,635	3,188
B1a - Income Eligible Coordinated Delivery	1,531,151	4,486	154,138	1,689,775	350,951	22,175	373,126	-	1,383,897	166,980,171	24,927,149	151,160,613	318,140,784	293,213,635	3,188
C - Commercial & Industrial	-	-	-	-	-	-	-	-	33,318,633	529,584,251	88,945,824	38,550,974	568,135,225	479,189,402	25,969
C1 - C&I New Buildings	-	-	-	-	-	-	-	-	-	123,172,788	21,538,884	2,077,112	125,249,899	103,711,015	62,715
C1a - C&I New Buildings & Major Renovations	-	-	-	-	-	-	-	-	-	123,172,788	21,538,884	2,077,112	125,249,899	103,711,015	62,715
C2 - C&I Existing Buildings	-	-	-	-	-	-	-	-	33,318,633	406,411,464	67,406,939	36,473,862	442,885,326	375,478,387	22,053
C2a - C&I Existing Building Retrofit	-	-	-	-	-	-	-	-	32,399,398	274,767,866	42,880,923	36,473,862	311,241,729	268,360,806	24,674
C2b - C&I New & Replacement Equipment	-	-	-	-	-	-	-	-	919,235	131,643,597	24,526,016	-	131,643,597	107,117,581	18,051
Grand Total	44,321,208	129,108	4,512,459	48,962,775	3,375,919	215,762	3,591,681	-	55,649,198	1,408,060,742	210,190,289	400,270,184	1,808,330,926	1,598,140,637	700

IV.D. Cost-Effectiveness
 3.2.i. Savings Summary Table
 Statewide Gas
 September 14, 2018

Program	# of Participants	2019 Net Savings																	
		Annual Capacity (kW)		Electric		Electric Energy (MMBtu)		Natural Gas		Deliverable Fuels				Other		Water (Gallons)		Total Savings	
		Summer	Winter	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Oil (MMBtu)	Propane (MMBtu)	Wood (MMBtu)	Other	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
										(Therms)									
A - Residential	644,908	1,627	1,050	7,750	90,239	26,443	307,897	13,898,746	155,249,563	31,205	587,795	1,466	28,636	-	-	60,412,298	422,886,084	1,449,040	16,449,284
A1 - Residential New Buildings	6,991	76	143	659	11,235	2,248	39,134	1,189,961	25,907,808	-	-	-	-	-	-	-	-	121,264	2,629,115
A1a - Residential New Homes & Renovations	6,991	76	143	659	11,235	2,248	39,134	1,189,961	25,907,808	-	-	-	-	-	-	-	-	121,264	2,629,115
A2 - Residential Existing Buildings	637,917	1,550	907	7,091	79,004	24,195	269,563	12,708,785	129,341,755	31,205	587,795	1,466	28,636	-	-	60,412,298	422,886,084	1,327,776	13,820,169
A2a - Residential Coordinated Delivery	64,811	1,253	927	6,378	68,574	21,761	233,973	4,716,000	95,238,732	6,144	115,909	286	5,571	-	-	57,374,284	401,619,986	501,796	9,879,327
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	43,953	297	120	713	10,431	2,434	35,589	1,683,333	27,813,541	25,111	473,886	1,181	23,062	-	-	3,038,014	21,764,098	397,050	3,311,892
A2d - Residential Behavior	529,073	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B - Income Eligible	17,439	86	124	684	13,482	2,336	46,002	2,284,746	45,352,005	1,134	21,639	189	3,606	-	-	4,042,535	28,343,765	232,133	4,606,447
B1 - Income Eligible Existing Buildings	17,439	86	124	684	13,482	2,336	46,002	2,284,746	45,352,005	1,134	21,639	189	3,606	-	-	4,042,535	28,343,765	232,133	4,606,447
B1a - Income Eligible Coordinated Delivery	17,439	86	124	684	13,482	2,336	46,002	2,284,746	45,352,005	1,134	21,639	189	3,606	-	-	4,042,535	28,343,765	232,133	4,606,447
C - Commercial & Industrial	6,735	30	26	40	622	135	2,121	11,389,789	144,686,347	-	-	-	-	-	-	78,553,451	766,734,308	1,139,114	14,479,756
C1 - C&I New Buildings	660	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1a - C&I New Buildings & Major Renovations	660	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1b - C&I Existing Buildings	6,075	30	26	40	622	135	2,121	11,389,789	144,686,347	-	-	-	-	-	-	78,553,451	766,734,308	1,139,114	14,479,756
C2 - C&I Existing Building Retrofits	3,697	30	25	38	599	131	2,044	6,480,724	67,730,291	-	-	-	-	-	-	-	-	-	-
C2a - C&I Existing Building Retrofits	3,697	30	25	38	599	131	2,044	6,480,724	67,730,291	-	-	-	-	-	-	-	-	-	-
C2b - C&I New & Replacement Equipment	2,378	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,500,004	15,000,000	277,276	2,914,189
Grand Total	669,881	1,743	1,199	8,474	104,363	28,934	356,020	27,973,281	345,397,915	32,339	609,434	1,655	32,241	-	-	143,008,384	1,217,966,157	2,820,887	35,256,487

Program	# of Participants	2020 Net Savings																	
		Annual Capacity (kW)		Electric		Electric Energy (MMBtu)		Natural Gas		Deliverable Fuels				Other		Water (Gallons)		Total Savings	
		Summer	Winter	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Oil (MMBtu)	Propane (MMBtu)	Wood (MMBtu)	Other	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
										(Therms)									
A - Residential	645,932	3,172	902	9,388	154,502	39,032	527,161	13,884,929	155,483,769	32,178	605,145	1,598	31,158	-	-	60,735,505	425,148,533	1,454,201	16,711,841
A1 - Residential New Buildings	7,221	72	140	634	11,270	2,164	38,455	1,217,668	26,552,069	-	-	-	-	-	-	-	-	123,900	2,693,662
A1a - Residential New Homes & Renovations	7,221	72	140	634	11,270	2,164	38,455	1,217,668	26,552,069	-	-	-	-	-	-	-	-	123,900	2,693,662
A2 - Residential Existing Buildings	638,711	3,101	762	8,754	143,232	29,868	488,706	12,667,271	128,931,700	32,178	605,145	1,598	31,158	-	-	60,735,505	425,148,533	1,330,371	14,018,180
A2a - Residential Coordinated Delivery	65,140	2,810	778	8,277	136,338	28,241	465,186	5,674,338	94,934,793	6,609	124,681	417	8,096	-	-	57,529,813	402,709,389	502,699	10,037,442
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	46,130	291	110	477	6,493	1,627	23,020	1,699,037	28,242,992	25,570	480,464	1,181	23,062	-	-	3,205,692	22,439,144	198,281	3,351,346
A2d - Residential Behavior	529,521	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B - Income Eligible	22,469	83	125	682	13,451	2,328	45,894	2,327,231	46,145,180	1,134	21,639	189	3,606	-	-	6,508,024	45,556,168	236,374	4,685,607
B1 - Income Eligible Existing Buildings	22,469	83	125	682	13,451	2,328	45,894	2,327,231	46,145,180	1,134	21,639	189	3,606	-	-	6,508,024	45,556,168	236,374	4,685,607
B1a - Income Eligible Coordinated Delivery	22,469	83	125	682	13,451	2,328	45,894	2,327,231	46,145,180	1,134	21,639	189	3,606	-	-	6,508,024	45,556,168	236,374	4,685,607
C - Commercial & Industrial	6,747	31	26	38	596	129	2,034	11,305,883	145,903,140	-	-	-	-	-	-	64,500,903	628,997,348	1,130,819	14,592,348
C1 - C&I New Buildings	660	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1a - C&I New Buildings & Major Renovations	660	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1b - C&I Existing Buildings	6,134	31	26	38	596	129	2,034	11,305,883	145,903,140	-	-	-	-	-	-	64,500,903	628,997,348	1,130,819	14,592,348
C2 - C&I Existing Building Retrofits	3,699	31	26	37	581	127	1,983	6,270,640	66,807,280	-	-	-	-	-	-	-	-	-	-
C2a - C&I Existing Building Retrofits	3,699	31	26	37	581	127	1,983	6,270,640	66,807,280	-	-	-	-	-	-	-	-	-	-
C2b - C&I New & Replacement Equipment	2,455	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,561,077	15,724,927	293,312	4,185,083
Grand Total	675,122	3,286	1,053	10,108	168,549	34,489	375,089	27,519,042	347,532,089	33,312	626,784	1,787	34,764	-	-	131,744,432	1,059,702,048	2,821,493	35,889,846

IV.D. Cost-Effectiveness
 3.2.i. Savings Summary Table
 Statewide Gas
 September 14, 2018

Program	# of Participants	2021 Net Savings																			
		Annual Capacity (kW)		Electric				Natural Gas				Deliverable Fuels				Other				Total Savings	
		Summer	Winter	Electric Energy (MWh)		Electric Energy (MMBTU)		Natural Gas (Therms)		Oil (MMBTU)		Propane (MMBTU)		Wood (MMBTU)		Water (Gallons)		MMBTU			
		Annual	LifeTime	Annual	LifeTime	Annual	LifeTime	Annual	LifeTime	Annual	LifeTime	Annual	LifeTime	Annual	LifeTime	Annual	LifeTime	Annual	LifeTime		
A - Residential	647,591	2,521	397	9,306	171,991	31,752	586,834	14,137,346	159,705,085	38,104	622,592	1,708	33,225	-	-	62,014,107	434,098,748	1,478,299	37,213,159		
A1 - Residential New Buildings	2,752	32	12	606	11,128	2,068	37,969	1,245,140	27,193,447	-	-	-	-	-	-	-	-	126,582	2,757,314		
A1a - Residential New Homes & Renovations	2,752	32	12	606	11,128	2,068	37,969	1,245,140	27,193,447	-	-	-	-	-	-	-	-	126,582	2,757,314		
A2 - Residential Existing Buildings	640,139	2,489	375	8,700	160,863	29,684	548,865	12,872,206	132,511,638	38,104	622,592	1,708	33,225	-	-	62,014,107	434,098,748	1,351,217	34,455,845		
A2a - Residential Coordinated Delivery	65,309	2,253	327	8,218	153,935	28,040	525,227	4,839,381	97,376,110	7,076	133,550	527	10,161	-	-	58,812,158	411,685,105	519,581	10,406,551		
A2b - Residential Conservation Services (RCS)	45,062	276	121	482	6,928	1,644	23,638	1,734,498	28,837,200	26,028	489,042	1,181	23,062	-	-	3,201,949	22,413,643	202,303	3,419,462		
A2c - Residential Behavior	529,968	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
B - Income Eligible	12,530	56	74	684	13,485	2,334	46,010	2,202,122	43,731,843	1,134	21,639	189	3,606	-	-	1,544,233	10,809,631	223,869	4,444,439		
B1 - Income Eligible Existing Buildings	12,530	56	74	684	13,485	2,334	46,010	2,202,122	43,731,843	1,134	21,639	189	3,606	-	-	1,544,233	10,809,631	223,869	4,444,439		
B1a - Income Eligible Coordinated Delivery	12,530	56	74	684	13,485	2,334	46,010	2,202,122	43,731,843	1,134	21,639	189	3,606	-	-	1,544,233	10,809,631	223,869	4,444,439		
C - Commercial & Industrial	6,872	24	21	38	603	131	2,057	11,508,890	149,066,002	-	-	-	-	-	-	67,278,726	656,909,492	1,151,017	34,908,657		
C1 - C&I New Buildings	691	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
C1a - C&I New Buildings & Major Renovations	691	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
C2 - C&I Existing Buildings	6,221	24	21	38	603	131	2,057	9,294,747	109,863,992	-	-	-	-	-	-	67,278,726	656,909,492	1,151,017	34,908,657		
C2a - C&I Existing Building Retrofits	3,740	24	20	37	583	127	1,988	6,284,170	66,854,181	-	-	-	-	-	-	65,477,624	635,296,276	628,544	6,687,406		
C2b - C&I New & Replacement Equipment	2,481	-	0	1	20	4	69	3,010,577	43,009,811	-	-	-	-	-	-	1,801,101	21,613,216	522,473	4,931,050		
Grand Total	669,991	2,601	452	10,028	186,479	34,216	634,901	37,693,268	325,902,939	34,238	644,231	1,887	36,830	-	-	136,937,065	1,101,817,971	2,853,185	36,566,256		

Program	# of Participants	2019-2021 Net Savings																			
		Annual Capacity (kW)		Electric				Natural Gas				Deliverable Fuels				Other				Total Savings	
		Summer	Winter	Electric Energy (MWh)		Electric Energy (MMBTU)		Natural Gas (Therms)		Oil (MMBTU)		Propane (MMBTU)		Wood (MMBTU)		Water (Gallons)		MMBTU			
		Annual	LifeTime	Annual	LifeTime	Annual	LifeTime	Annual	LifeTime	Annual	LifeTime	Annual	LifeTime	Annual	LifeTime	Annual	LifeTime	Annual	LifeTime		
A - Residential	1,938,431	7,320	2,308	26,444	416,732	90,227	1,421,931	41,901,021	470,438,416	96,538	1,815,533	4,772	93,018	-	-	183,161,909	1,282,133,364	4,381,640	50,374,284		
A1 - Residential New Buildings	21,364	180	315	1,099	33,634	6,480	114,758	3,652,299	79,653,324	-	-	-	-	-	-	-	-	371,756	8,080,090		
A1a - Residential New Homes & Renovations	21,364	180	315	1,099	33,634	6,480	114,758	3,652,299	79,653,324	-	-	-	-	-	-	-	-	371,756	8,080,090		
A2 - Residential Existing Buildings	1,917,067	7,140	1,994	24,545	383,099	83,747	1,307,134	38,248,262	390,785,093	96,538	1,815,533	4,772	93,018	-	-	183,161,909	1,282,133,364	4,009,884	42,294,194		
A2a - Residential Coordinated Delivery	195,340	6,316	2,032	22,873	358,847	78,042	1,224,386	14,249,740	287,009,615	10,820	374,140	1,230	23,832	-	-	173,716,934	1,216,014,478	1,524,076	30,323,320		
A2b - Residential Conservation Services (RCS)	133,165	824	180	1,672	24,252	5,705	82,747	5,116,747	84,893,733	76,709	1,441,393	3,543	69,186	-	-	9,445,555	66,118,885	597,633	10,082,700		
A2c - Residential Behavior	1,588,562	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
B - Income Eligible	52,372	225	323	2,091	40,418	6,997	137,907	6,814,099	135,229,028	3,402	64,916	967	10,817	-	-	12,054,792	84,709,564	692,376	13,736,543		
B1 - Income Eligible Existing Buildings	52,372	225	323	2,091	40,418	6,997	137,907	6,814,099	135,229,028	3,402	64,916	967	10,817	-	-	12,054,792	84,709,564	692,376	13,736,543		
B1a - Income Eligible Coordinated Delivery	52,372	225	323	2,091	40,418	6,997	137,907	6,814,099	135,229,028	3,402	64,916	967	10,817	-	-	12,054,792	84,709,564	692,376	13,736,543		
C - Commercial & Industrial	20,393	85	73	116	1,821	395	6,213	34,205,532	439,655,489	-	-	-	-	-	-	210,333,080	2,052,641,148	3,420,948	43,971,762		
C1 - C&I New Buildings	1,964	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
C1a - C&I New Buildings & Major Renovations	1,964	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
C2 - C&I Existing Buildings	18,429	85	73	116	1,821	395	6,213	27,751,412	325,392,965	-	-	-	-	-	-	210,333,080	2,052,641,148	3,420,948	43,971,762		
C2a - C&I Existing Building Retrofits	11,136	85	72	113	1,763	384	6,015	19,025,524	201,391,753	-	-	-	-	-	-	205,590,547	1,995,730,738	3,403,937	40,145,190		
C2b - C&I New & Replacement Equipment	7,293	-	0	3	58	11	198	8,725,888	124,001,212	-	-	-	-	-	-	4,742,533	56,910,410	717,011	13,826,572		
Grand Total	2,011,196	7,629	2,704	28,611	468,071	97,619	1,566,010	82,820,651	1,045,322,933	99,940	1,880,449	5,739	103,836	-	-	405,589,781	3,419,484,076	8,494,964	108,082,589		

IV.D. Cost-Effectiveness
 3.2.i. Savings Summary Table
 Statewide Gas
 September 14, 2018

Program	2019 Net Savings					
	Electric Energy, no Fuel Switching or ADR (MWh)		Natural Gas, no Fuel Switching (Therms)		Total Savings, no CHP or ADR (MMBTU)	
	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A. Residential	7,750	90,239	14,204,278	161,007,427	1,449,040	16,449,284
A1 - Residential New Buildings	659	112,215	1,189,961	25,907,809	121,244	2,629,115
A1a - Residential New Homes & Renovations	659	112,215	1,189,961	25,907,809	121,244	2,629,115
A2 - Residential Existing Buildings	7,091	79,024	13,014,317	135,099,619	1,327,795	13,820,169
A2a - Residential Coordinated Delivery	6,378	68,574	4,796,120	96,374,135	501,796	9,879,127
A2b - Residential Construction Services (RCS)	-	-	-	-	-	-
A2c - Residential Retail	713	10,451	1,928,095	37,435,982	197,050	3,311,892
A2d - Residential Behavior	-	-	6,289,502	6,289,502	628,950	628,950
B. Income Eligible	684	13,482	2,295,727	45,561,686	232,133	4,606,447
B1 - Income Eligible Existing Buildings	684	13,482	2,295,727	45,561,686	232,133	4,606,447
B1a - Income Eligible Coordinated Delivery	684	13,482	2,295,727	45,561,686	232,133	4,606,447
C. Commercial & Industrial	40	622	11,889,789	144,686,347	1,139,114	14,470,756
C1 - C&I New Buildings	-	-	2,135,858	37,814,944	219,585	3,781,484
C1a - C&I New Buildings & Major Renovations	-	-	2,135,858	37,814,944	219,585	3,781,484
C2 - C&I Existing Buildings	40	622	9,753,932	106,871,403	925,529	10,689,272
C2a - C&I Existing Building Retrofits	38	599	6,480,724	67,730,291	648,203	6,775,073
C2b - C&I New & Replacement Equipment	2	23	3,273,207	39,141,112	277,326	3,914,199
Grand Total	8,474	104,343	27,889,795	353,295,460	2,820,937	35,526,487

Program	2020 Net Savings					
	Electric Energy, no Fuel Switching or ADR (MWh)		Natural Gas, no Fuel Switching (Therms)		Total Savings, no CHP or ADR (MMBTU)	
	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A. Residential	9,388	154,502	14,200,293	163,427,010	1,454,901	16,711,841
A1 - Residential New Buildings	634	112,270	1,217,658	26,552,069	123,930	2,693,662
A1a - Residential New Homes & Renovations	634	112,270	1,217,658	26,552,069	123,930	2,693,662
A2 - Residential Existing Buildings	8,754	143,232	12,982,635	134,874,942	1,330,971	14,018,180
A2a - Residential Coordinated Delivery	8,277	136,338	4,739,937	95,635,394	502,699	10,037,442
A2b - Residential Construction Services (RCS)	-	-	-	-	-	-
A2c - Residential Retail	477	6,893	1,948,782	33,945,632	198,281	3,311,346
A2d - Residential Behavior	-	-	6,293,916	6,293,916	629,392	629,392
B. Income Eligible	682	13,451	2,338,113	46,932,893	236,974	4,685,657
B1 - Income Eligible Existing Buildings	682	13,451	2,338,113	46,932,893	236,974	4,685,657
B1a - Income Eligible Coordinated Delivery	682	13,451	2,338,113	46,932,893	236,974	4,685,657
C. Commercial & Industrial	38	596	11,300,893	145,909,140	1,130,818	14,592,348
C1 - C&I New Buildings	-	-	2,104,159	37,245,570	219,616	3,724,557
C1a - C&I New Buildings & Major Renovations	-	-	2,104,159	37,245,570	219,616	3,724,557
C2 - C&I Existing Buildings	38	596	9,200,724	108,663,570	920,402	10,867,791
C2a - C&I Existing Building Retrofits	37	581	6,270,630	66,907,390	627,190	6,682,711
C2b - C&I New & Replacement Equipment	1	15	2,929,094	41,856,280	293,212	4,184,980
Grand Total	10,108	168,549	27,845,288	353,643,611	2,821,493	35,889,846

IV.D. Cost-Effectiveness
 3.2.i. Savings Summary Table
 Statewide Gas
 September 14, 2018

Program	2021 Net Savings					
	Electric Energy, no Fuel Switching or ADR (MWh)		Natural Gas, no Fuel Switching (Therms)		Total Savings, no CHP or ADR (MMBTU)	
	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential	9,306	171,991	14,442,406	165,830,965	1,478,299	17,213,159
A1 - Residential New Buildings	606	11,178	1,265,140	27,191,447	126,582	2,707,314
A1a - Residential New Homes & Renovations	406	11,128	1,245,140	27,158,447	126,582	2,707,314
A2 - Residential Existing Buildings	8,700	160,813	13,177,266	138,637,518	1,351,717	14,505,845
A2a - Residential Coordinated Delivery	8,218	153,935	4,910,411	98,719,151	119,181	10,406,551
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-
A2c - Residential Retail	482	6,878	1,988,527	33,620,039	202,803	3,418,442
A2d - Residential Behavior	-	-	6,298,328	6,298,328	629,833	629,833
B - Income Eligible	684	13,485	2,213,003	43,939,524	223,869	4,444,439
B1 - Income Eligible Existing Buildings	684	13,485	2,213,003	43,939,524	223,869	4,444,439
B1a - Income Eligible Coordinated Delivery	684	13,485	2,213,003	43,939,524	223,869	4,444,439
C - Commercial & Industrial	38	693	11,508,860	149,066,002	1,151,017	14,908,657
C1 - C&I New Buildings	-	-	2,214,113	39,200,010	223,411	3,820,201
C1a - C&I New Buildings & Major Renovations	-	-	2,214,113	39,200,010	223,411	3,820,201
C2 - C&I Existing Buildings	38	693	9,294,747	109,865,992	927,605	10,928,456
C2a - C&I Existing Building Retrofits	37	583	6,284,170	66,854,181	628,544	6,687,406
C2b - C&I New & Replacement Equipment	1	10	3,010,577	43,000,811	299,061	4,241,050
Grand Total	10,028	186,079	28,166,269	358,836,490	2,853,189	36,566,256

Program	2019-2021 Net Savings					
	Electric Energy, no Fuel Switching or ADR (MWh)		Natural Gas, no Fuel Switching (Therms)		Total Savings, no CHP or ADR (MMBTU)	
	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential	26,444	416,732	47,846,978	488,265,402	4,381,640	50,374,284
A1 - Residential New Buildings	1,999	33,634	3,652,759	79,651,324	371,756	8,080,090
A1a - Residential New Homes & Renovations	1,899	33,634	3,652,759	79,651,324	371,756	8,080,090
A2 - Residential Existing Buildings	24,545	383,099	39,194,218	408,612,078	4,009,884	42,294,194
A2a - Residential Coordinated Delivery	22,873	358,847	14,446,469	290,728,680	1,624,076	30,273,320
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-
A2c - Residential Retail	1,672	24,252	5,866,004	89,001,653	587,633	10,020,700
A2d - Residential Behavior	-	-	18,881,745	18,881,745	1,888,175	1,888,175
B - Income Eligible	2,051	40,418	6,846,844	115,834,070	692,376	13,716,543
B1 - Income Eligible Existing Buildings	2,051	40,418	6,846,844	115,834,070	692,376	13,716,543
B1a - Income Eligible Coordinated Delivery	2,051	40,418	6,846,844	115,834,070	692,376	13,716,543
C - Commercial & Industrial	116	1,821	34,209,532	439,655,489	3,420,948	43,971,742
C1 - C&I New Buildings	-	-	6,454,120	114,262,524	645,412	11,426,272
C1a - C&I New Buildings & Major Renovations	-	-	6,454,120	114,262,524	645,412	11,426,272
C2 - C&I Existing Buildings	116	1,821	27,755,412	325,392,965	2,775,536	32,545,470
C2a - C&I Existing Building Retrofits	113	1,763	19,015,244	201,191,793	1,903,917	20,145,190
C2b - C&I New & Replacement Equipment	3	58	8,740,168	124,201,212	871,619	12,400,280
Grand Total	28,611	458,971	83,899,353	1,063,774,961	8,494,964	108,082,589

V.B. Allocation of Funds

1. Low-Income Minimum

Statewide Gas

September 14, 2018

2019 Sector Cost Allocation		
Sector	Program Budget	
	(\$)	(% of Total)
A - Residential	152,047,107	60.8%
B - Income Eligible	52,716,005	21.09%
C - Commercial & Industrial	45,165,665	18.1%
Grand Total	249,928,777	100%

2020 Sector Cost Allocation		
Sector	Program Budget	
	(\$)	(% of Total)
A - Residential	154,937,374	60.8%
B - Income Eligible	53,127,721	20.85%
C - Commercial & Industrial	46,752,879	18.3%
Grand Total	254,817,975	100%

2021 Sector Cost Allocation		
Sector	Program Budget	
	(\$)	(% of Total)
A - Residential	160,044,442	61.7%
B - Income Eligible	51,639,105	19.91%
C - Commercial & Industrial	47,616,966	18.4%
Grand Total	259,300,513	100%

2019-2021 Sector Cost Allocation		
Sector	Program Budget	
	(\$)	(% of Total)
A - Residential	467,028,923	61.1%
B - Income Eligible	157,482,831	20.61%
C - Commercial & Industrial	139,535,510	18.3%
Grand Total	764,047,264	100%

Notes:

General Laws c. 25, § 19(c) requires that at least 10 percent of the amount expended for electric energy efficiency programs and at least 20 percent of the amount expended for gas energy efficiency programs be spent on low-income programs.

VII. Appendix
B.2. Summary of Activities
 Statewide Gas
 September 14, 2018

2019-2021 Summary															
Sector	TRC Benefits (2019\$)						TRC Costs (2019\$)			TRC Cost-Effectiveness		Cost of Saved Energy (PA Budget per annual savings unit)			
	Capacity	Electric Energy	Natural Gas	Deliverable Fuels & Other	Non-Energy Impacts	Total Benefits	PA Budget	Participant Costs	Total TRC Test Costs	B/C Ratio	Net Benefits	Summer Capacity (\$/kW)	Electric Energy (\$/MWh)	Natural Gas Costs (\$/Therm)	Total Savings (\$/MMBTU)
2019	7,728,371	9,387,443	404,310,108	36,527,172	129,890,301	587,843,395	257,108,223	77,459,856	334,568,079	1.76	253,275,316	147,550			91
A - Residential	7,040,816	8,081,588	184,723,193	22,941,573	67,375,152	290,162,322	155,345,442	60,293,656	215,639,098	1.35	74,523,224				107
B - Income Eligible	544,266	1,253,878	53,677,156	1,139,783	50,327,347	106,942,430	54,002,760	(391,850)	53,610,911	1.99	53,331,520				233
C - Commercial & Industrial	143,288	51,977	165,909,759	12,445,816	12,187,803	190,738,643	47,760,021	17,558,050	65,318,071	2.92	125,420,572	1,591,721			42
2020	21,782,011	15,196,420	402,434,856	35,416,667	132,204,399	607,034,354	256,575,041	78,393,361	334,968,401	1.81	272,065,958	78,073			91
A - Residential	21,085,024	13,895,875	183,622,090	23,774,781	68,287,241	310,663,011	155,092,035	60,319,499	215,411,534	1.44	95,251,478				107
B - Income Eligible	548,651	1,248,353	54,053,401	1,431,871	50,781,891	108,064,168	53,250,435	187,819	53,438,254	2.02	54,625,914				225
C - Commercial & Industrial	150,335	52,192	164,759,365	10,210,015	13,135,267	188,307,175	48,232,571	17,886,042	66,118,614	2.85	122,188,561	1,568,453			43
2021	19,753,678	16,801,371	402,462,830	36,259,815	138,175,484	613,453,177	255,248,553	78,391,000	333,639,553	1.84	279,813,624	98,153			89
A - Residential	19,258,205	15,495,916	186,857,389	24,721,869	74,896,205	321,229,584	156,682,028	60,606,039	217,288,066	1.48	103,941,517	62,155			106
B - Income Eligible	374,386	1,252,506	50,580,775	875,144	50,051,374	103,134,186	50,593,526	140,110	50,733,637	2.03	52,400,549	910,480			226
C - Commercial & Industrial	121,087	52,948	165,024,666	10,662,802	13,227,905	189,089,408	47,972,999	17,644,851	65,617,850	2.88	123,471,558	1,988,287			42
Grand Total	49,264,059	41,385,234	1,209,207,794	108,203,654	400,270,184	1,808,330,926	768,931,817	234,244,217	1,008,176,034	1.80	805,154,892	100,786			91
A - Residential	47,382,046	37,473,379	555,202,671	71,438,224	210,558,597	922,054,917	467,119,504	181,219,193	648,338,698	1.42	273,716,219	206,543			320
B - Income Eligible	1,467,303	3,754,737	158,311,333	3,446,798	151,160,613	318,140,784	157,846,721	(63,920)	157,782,801	2.02	160,357,982	-			684
C - Commercial & Industrial	414,711	157,118	495,693,790	33,318,633	38,550,974	568,135,225	143,965,591	53,088,943	197,054,534	2.88	371,080,691	5,148,460			126

2019-2021 Summary													
Sector	Net Annual Savings								Participants	Avg Measure Life (yrs.)	Annual Emissions Reductions (Short Tons)		
	Summer Capacity (kW)	Electric Energy (MWh)	Natural Gas (Therms)	Oil (MMBTU)	Propane (MMBTU)	Wood (MMBTU)	Water (Gallons)	Total Savings (MMBTU)			NOX	SO2	CO2
2019	1,743	8,474	27,573,281	32,389	1,655	-	143,008,284	2,820,287	669,082	13	1.5	0.4	188,406
A - Residential	1,627	7,750	13,898,746	31,255	1,466	-	60,412,298	1,449,040	644,908	11	1.4	0.4	90,711
B - Income Eligible	86	684	2,284,746	1,134	189	-	4,042,535	232,133	17,439	20	0.1	0.0	13,809
C - Commercial & Industrial	30	40	11,389,789	-	-	-	78,553,451	1,139,114	6,735	13	0.0	0.0	83,886
2020	3,286	10,108	27,519,042	33,312	1,787	-	131,744,432	2,821,493	675,122	13	1.8	0.5	189,265
A - Residential	3,172	9,388	13,894,929	32,178	1,598	-	60,735,505	1,454,301	645,932	11	1.6	0.4	91,528
B - Income Eligible	83	682	2,327,231	1,134	189	-	6,508,024	236,374	22,403	20	0.1	0.0	14,056
C - Commercial & Industrial	31	38	11,306,883	-	-	-	64,500,903	1,130,818	6,787	13	0.0	0.0	83,681
2021	2,601	10,028	27,828,328	34,238	1,897	-	130,837,065	2,853,185	666,993	13	1.8	0.5	191,751
A - Residential	2,521	9,306	14,117,346	33,104	1,708	-	62,014,107	1,478,299	647,591	12	1.6	0.4	92,981
B - Income Eligible	56	684	2,202,122	1,134	189	-	1,544,233	223,869	12,530	20	0.1	0.0	13,325
C - Commercial & Industrial	24	38	11,508,860	-	-	-	67,278,726	1,151,017	6,872	13	0.0	0.0	85,445
Grand Total	7,629	28,611	82,920,651	99,940	5,339	-	405,589,781	8,494,964	2,011,196	13	5.0	1.3	569,422
A - Residential	7,320	26,444	41,901,021	96,538	4,772	-	183,161,909	4,381,640	1,938,431	11	4.7	1.2	275,221
B - Income Eligible	225	2,051	6,814,099	3,402	567	-	12,094,792	692,376	52,372	20	0.3	0.1	41,190
C - Commercial & Industrial	85	116	34,205,532	-	-	-	210,333,080	3,420,948	20,393	13	0.0	0.0	253,012

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

VII. Appendix

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

Statewide Gas

September 14, 2018

2019 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	8,448	12,549,990	156,277	7,332	1.4	0.4	90,711
B - Income Eligible	684	2,284,746	1,134	189	0.1	0.0	13,809
C - Commercial & Industrial	38	14,336,288	-	-	0.0	0.0	83,886
Grand Total	9,171	29,171,024	157,411	7,521	1.5	0.4	188,406

2020 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	9,949	12,491,444	160,892	7,989	1.6	0.4	91,528
B - Income Eligible	682	2,327,231	1,134	189	0.1	0.0	14,056
C - Commercial & Industrial	36	14,301,387	-	-	0.0	0.0	83,681
Grand Total	10,667	29,120,062	162,026	8,178	1.8	0.5	189,265

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	9,987	12,666,122	165,522	8,540	1.6	0.4	92,981
B - Income Eligible	684	2,202,122	1,134	189	0.1	0.0	13,325
C - Commercial & Industrial	37	14,602,805	-	-	0.0	0.0	85,445
Grand Total	10,708	29,471,049	166,656	8,729	1.8	0.5	191,751

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	28,384	37,707,557	482,691	23,861	4.7	1.2	275,221
B - Income Eligible	2,051	6,814,099	3,402	567	0.3	0.1	41,190
C - Commercial & Industrial	111	43,240,480	-	-	0.0	0.0	253,012
Grand Total	30,545	87,762,135	486,093	24,428	5.0	1.3	569,422

Notes:

The Program Administrators are working with DEP to determine the best method for properly and precisely capturing the full impact of energy efficiency measures on GHG emissions. As part of this process, the Program Administrators have included this additional table on greenhouse gas reductions, based on continuing discussions with the DEP. These reductions are calculated using factors proposed by DEP, which are based on adjusted gross annual electric energy, natural gas, and oil savings. The Program Administrators look forward to discussing these proposed factors with DEP and are committed to ensuring that the full impact of energy efficiency measures on GHG emissions are captured.

Appendices

D. **Council's Resolution of February 28, 2018**

EEAC Resolution Concerning Its Priorities for the Development, Implementation, and Evaluation of the 2019-2021 Three-Year Energy Efficiency Plan

February 28, 2018

Introduction

Under the Green Communities Act (“GCA”), the Energy Efficiency Advisory Council (“EEAC” or “Council”) is charged with reviewing the Massachusetts Program Administrators’ (“PAs”) energy efficiency investment plans and budgets, which are prepared in coordination with the EEAC. The Council looks forward to continuing its collaboration with the PAs and interested stakeholders as the PAs develop a fourth robust, innovative, and cost-effective electric and natural gas statewide Plan.

This resolution articulates the EEAC’s priorities for the upcoming 2019-2021 Plan, which were gathered and refined over the course of six collaborative planning workshops conducted by the Council between September 26, 2017 and January 30, 2018. Detailed briefing documents on priority topics were circulated before each workshop. During the workshops, Councilors engaged in discussion, with input from the PAs and Council Consultants, in order to develop the list of informed recommendations that is attached to this resolution..

In addition to the Council’s own input at the workshops, the stakeholder perspectives received during the upcoming public listening sessions will be an important consideration in developing the 2019-2021 Plan.

Priorities

The EEAC affirms the PAs’ obligation to acquire “all available energy efficiency and demand reduction resources that are cost effective or less expensive than supply,” as stipulated in the GCA. In striving to meet this statutory requirement, the EEAC is requesting a 2019-2021 Plan that builds on prior Plans’ achievements, notwithstanding the expected decline in claimable electric savings from residential lighting initiatives. It is the Council’s strong sense that, in order to meet the requirements of the GCA, the PAs must approach the development of the 2019-2021 Plan with a willingness to implement innovative new energy efficiency and demand reduction measures and strategies, particularly in the residential, multi-family, and low-income electric sectors.

It is the Council’s sense that energy efficiency investments planned under the GCA should reflect the Commonwealth’s long-term greenhouse gas reduction requirements as established in the Global Warming Solutions Act (“GWSA”). This will require prioritizing from among cost-effective energy efficiency and demand reduction resources those measures and strategies that lead to greater lifetime emissions reductions. To this end, the Council wants in the plan strategic electrification of space heating and water heating equipment and other innovative approaches for achieving GWSA-supportive emissions reductions via the programs’ resource acquisition framework.

The Council will prioritize continuous improvement in lifetime savings, benefits, and customer experience, in order to ensure delivery of cost-effective programs that:

1. Increase participation by, and savings from, hard-to-reach and underserved populations and geographies, including moderate income, renters, small business, and non-profits.
2. Include goals specific to active demand management and integrate the delivery of active demand management offerings within the EE programs in the 2019-2021 Plan.

3. Promote & incentivize fuel switching strategies, in all sectors, that support the Commonwealth's long term greenhouse gas reduction requirements, as established under the Global Warming Solutions Act.
4. Provide a new, integrated residential program design that maintains strong savings and benefits for all residential homeowner and rental initiatives by:
 - a. Increasing customer capture,
 - b. Providing new methods for realizing savings,
 - c. Expanding HVAC, behavioral, financing, and upstream offerings, and
 - d. Increasing conversion rates for HVAC and weatherization measures.
5. Increase program savings in the C&I sector from HVAC, process, lighting, and CHP measures.
6. Actively promote zero energy ready buildings (ZEBs) & Passivehouse for new construction and major renovations in all sectors.
7. Establish a multi-family framework that better integrates residential and commercial offerings and is cost-effective.
8. Review low-income programs for potential improvements in participation and achievement of savings, and seek additional savings & cost-efficiency opportunities, to ensure continued success.
9. Modernize data management across all PAs and sectors, enhance accessibility to and usefulness of the data to the public, and leverage additional data sources to accomplish items 1-8 above.

Recommendations

The EEAC's initial recommendations regarding priority elements of the 2019-2021 Plan are listed below. These are the result of a collaborative and deliberative process during which the Council took care to focus its attention at a strategic level, allowing the PAs the flexibility to discern the most appropriate tactics for realizing the recommendations.

The Council appreciates that the cost-effectiveness and budgeting implications of each of these recommendations, individually and in total, will be carefully considered by the PAs. The Council looks forward to continued collaboration with the PAs, and to reviewing the draft 2019-2021 Plan and the PAs' written response to these recommendations.

Cross-Sector Recommendations

Active Demand Management

Include goals specific to active demand management and integrate the delivery of active demand management offerings within the EE programs in the 2019-2021 Plan.

- Move beyond the current demand demonstrations and scale up ADM activities fully in the 2019- 2021 Plan, including claiming demand savings and quantifying impacts.
- Integrate the delivery of ADM offerings with energy efficiency program delivery.
- Develop a goal for ADM that is separate and distinct from goals for traditional EE/passive demand reduction. Plan, track, and report the capabilities, performance, and costs of active demand management separately and in a manner that will enable development of and tracking towards the active demand management goal.

Commercial and Industrial Sector Recommendations

Combined Heat and Power

The electric PAs should set a clear and increasing target to grow CHP savings by:

- Utilizing EM&V and Council feedback to streamline participation, test alternative outreach models (e.g. circuit riders with an emphasis on small/medium customers), and increase collaboration with CHP vendors.
- Addressing potential for CHP in New Construction and small CHP systems
- Continuing to explore and seek to deploy resiliency (e.g. islanding) and ownership innovations (e.g. third party or other)

C&I Process Savings

The PAs should continue to increase process savings goals (electric and gas), in addition to other end use savings from industrial customers by:

- Increasing technical assistance and support to overcome barriers and increase savings
- Demonstrating that the PAs are sharing best practices and developing statewide initiatives on common end uses
- Providing additional energy consumption data to customers, including incentives for EMIS and benchmarking of different processes

Data-Driven Customer Acquisition and Engagement Strategies; and Big Data

The PAs should create a framework and incentives to increase the presence and use of market-driven data acquisition including software, granular energy usage measurement, and monitoring based commissioning services, including adjustments to the M&V framework to facilitate this activity.

Small Business

The PAs should increase savings in the Small Business Initiative (SBI) by:

- Unifying a SBI delivery model statewide (including statewide PA-led marketing)
- Promoting uptake of comprehensive measures

- Expanding outreach strategies and committed resources to target and engage a wider range of small business customers and owners of buildings occupied by small businesses
- Establishing a statewide small business and non-profit ambassador position that can act as an ombudsman for customers

New Construction

The PAs should seek opportunities and increase resources to drive continuous improvement and effective feedback loops in the new construction and major renovation market so that a higher percentage of buildings are served and low-energy use/low-GHG buildings are measured, recognized, promoted, and emulated in the market. Specifically, actively promote zero energy ready buildings (ZEBs) & Passivehouse for new construction and major renovations. Also pay particular attention to the commercial real estate sub-sector including new construction, major renovations, and tenant fit-outs.

Lighting & Controls

The PAs should maximize C&I lighting savings by emphasizing the linear lighting market and incentivizing active demand management-enabled controls. The PAs should increase the percent of lighting opportunities used as lead generation for non-lighting projects. Methods to consider include:

- Increasing participation in lighting initiatives (including upstream) by expanding marketing, outreach and technical support to customers, contractors, and trade associations
- A new offering, including education and training, to increase the penetration and successful use of advanced lighting controls
- Expanding lighting design service support for customers and designers/engineers, through a lighting design initiative.
- Converting all company owned streetlights to LEDs by the end of the next three-year plan including strategies that incentivize use of controls to capture greater energy savings.

HVAC & Controls

The PAs should increase HVAC savings and build market capacity for future HVAC savings growth. The PAs should work toward HVAC market transformation to make right-sized energy efficient HVAC systems the norm, and take a system optimization approach for existing and new systems in order to build a long-term upward savings trajectory for the next two three-year-plans. The PAs should:

- Conduct a market baseline study that includes recommendations to increase HVAC savings in the 2022-2024 three-year plan, and lays the groundwork for potential future efforts to assess market effects.
- Promote optimized building automation systems, including retro-commissioning and persistent commissioning of existing systems and rigorous design review and commissioning of new control systems.
- Address known market barriers to upfront investment in the engineering services necessary for system optimization through innovative program offerings. Incentivize performance verification and ongoing system tuning.
- Substantially increase ongoing education and training programs for building operators.

Fuel Switching

The Council recommends that the 2019-2021 Plan include fuel switching strategies that are consistent with and support the Global Warming Solutions Act. These include opportunities to strategically electrify energy use, and to switch from inefficient equipment to more efficient fuel and/or equipment, where cost-effective. A customer should be able to choose energy efficiency services regardless of current fuel, as long as the equipment or upgrade is to efficient equipment and is cost-effective.

Municipal

PAs should seek opportunities and increase dedicated resources to align relevant programs with municipal processes, timelines and financing streams, and to enhance savings and participation.

Residential Sector Recommendations

Heating and Cooling Equipment

- Emphasize an integrated, systems-based approach to HVAC equipment promotion and installation, particularly for heat pumps and condensing boilers
- Streamline the customer experience and ensure seamless and comprehensive delivery of all measures
- Ensure service providers are broadly knowledgeable and compensated appropriately, and/or prescreen customer projects to match them with service providers with appropriate expertise
- Expand HVAC efforts by providing new active demand management and fuel switching measures along with the appropriate education of the consumer
- Expand water heating and HVAC upstream offerings, leveraging best practices and lessons learned from the C&I sector
- Enhance connections between HVAC, weatherization, and other whole-house offerings, enabling customers to engage in more holistic improvements in a single transaction or over time
- Weatherization should remain a high priority and focal point

Serving Hard to Reach and Underserved Populations and Geographies

Increase participation and savings for hard to reach populations by:

- Implementing a stakeholder engagement process to reassess program design and improve participation in renter and moderate income customer initiatives
- Identifying underserved demographic groups, developing new segmented approaches to serve them, identifying best marketing and sales approaches to reach them, and adequately funding and incentivizing these approaches
- Increasing outreach and partnerships with community based organizations and social networks, municipalities, employers, and other organizations
- Applying lessons learned from low income programs
- Using data more effectively to better target customers – specifically geo-targeting and identification of areas with linguistic barriers
- Developing new delivery models to increase participation rate of households between 60 and 80 percent median income

- Implement methods to increase access to and use of financing across all customer segments

Behavior Programs

Broaden current behavioral program strategies to include cost-efficient new approaches for customers of all Massachusetts PAs – for example, using a statewide procurement and integrating customer data for better customization

New Construction

- Offer specific low energy path(s) such as net zero energy ready and Passivehouse (multi-family) to better align with the stretch code and to drive construction of low energy buildings and market transformation
- Integrate active demand management measures that promote load shifting opportunities of solar photovoltaics, electric vehicles and chargers, and storage
- Explore opportunities to capture additional savings via major renovations

Integrated Residential Program Design

Increase participation levels and maintain strong program savings and benefits achievements for all residential homeowner and rental initiatives by providing a new integrated residential program design that:

1. **Increases customer capture**
 - Segment, target, prioritize, and customize marketing and offers to customers by leveraging remotely accessible data, third-party sources, and real-time site data
 - Increase the points of entry into the Mass Save program for customers during home improvement, financing, and other transactions, linked to incentives that meet a wider range of customer needs
 - Cultivate, diversify, and expand market channel and community partnerships to inform, recruit, and enroll customers in the program
2. **Provides new methods of realizing savings**
 - Promote cost-effective new fuel switching measures that are consistent with and support the Global Warming Solutions Act
 - Integrate new active demand management measures (e.g. EV charging) and storage into EE programs, in addition to achieving passive demand reductions through efficiency
 - Co-deliver and coordinate electric vehicles/charging, distributed energy resources, and other related services with EE programs, while ensuring primacy of energy efficiency measures
3. **Increases conversion rates for existing measures** (especially weatherization, heating and cooling)
 - Develop new audit approaches, including data-driven remote options
 - Provide an easier path and reduce barriers for customers – require fewer steps, automate and expedite the approval processes, and improve access to financing
 - Improve feedback loop and increase targeted reengagement to close on recommendations
 - Cultivate and expand trusted, long-term relationships with customers
 - Offer greater customization to customers using single measure, comprehensive, incremental, and performance-based options
 - Support sales training and recognition for individuals who are in contact with the customer.

Multi-Family Program

- Establish a multi-family retrofit program framework that seamlessly integrates residential and commercial metered savings opportunities into whole building solutions, and increases uptake of whole building measures
- Enable program tracking and energy benchmarking by building/facility to support improved customer service and provide customizable levels of service appropriate to varying customer and building types including incremental paths to whole building improvements
- Identify and present options to address market and regulatory barriers to serving multifamily properties, including a blended benefit cost ratio for multifamily core initiative
- Leverage key points in the building life cycle including refinancing
- Reexamine a pay for performance program for market rate multifamily

Low-Income Sector Recommendations

- Identify and support new and enhanced electric and gas measures and innovative strategies
- Review program model strategies to achieve additional cost efficiencies
- Identify and implement continuous improvement opportunities and document in the 2019-2021 Plan
- Assess whether there are gaps in participation and take steps to deliver equivalent and proportional services across the Commonwealth, if necessary
- Develop and demonstrate alternative measure packages and service delivery models to serve a wider and diverse range of customer needs and interests
- Ensure communication between the market rate and Low-Income Programs to identify and coordinate program innovations when applicable
- Increase outreach and partnerships with community based organizations and social networks, municipalities, employers, and other organizations

Appendices

E. **Council's Resolution of July 31, 2018**

Massachusetts Energy Efficiency Advisory Council
Resolution Regarding the April 30th Draft of the 2019-2021 Three-Year Energy Efficiency Plan

July 31, 2018

1. Introduction

Under the Green Communities Act (“GCA”), the Energy Efficiency Advisory Council (“EEAC” or “Council”) is charged with reviewing the Massachusetts Program Administrators’ (“PAs”) draft Statewide Electric and Gas Energy Efficiency Plan (“the Draft Plan”), submitted to the EEAC on April 30, 2018. Having reviewed the Draft Plan, the EEAC, by this Resolution, provides the following comments on the Draft Plan to the Department of Public Utilities (“the Department”) and the PAs.¹ The EEAC recognizes and commends the PAs on their past energy efficiency achievements, particularly in the electric sector, made during the first two years of the current 2016-2018 Plan. The Council looks forward to building on that success by leveraging the parties’ collective experiences and shared commitment to design and deliver programs to achieve all available, cost-effective energy efficiency and demand management savings, for both electricity and natural gas, consistent with the GCA goals. In its February 28, 2018 Resolution, the EEAC stated its firm assessment that program innovation was needed and outlined the Council’s priorities on which it expected the 2019-2021 programs to deliver. Unfortunately, while the Draft Plan mentions these priorities, the lack of program details and analytical support provided in the Draft Plan renders the Draft Plan largely non-responsive to these priorities and call for innovation.

Recognizing the PAs’ ongoing commitment to energy efficiency, the Council looks forward to continuing collaboration and exchange of information among the PAs, the EEAC and its Consultants², and interested stakeholders throughout the summer and fall. It is the EEAC’s expectation that the PAs will work with the EEAC and its Consultants to refine and improve the Draft Plan, through timely interim updates that respond to this Resolution. The Council expects to receive a much improved and stronger Revised Plan from the PAs no later than September 14th, leading to filing a Final Plan with the Department in October. In this spirit of collaboration, the Council provides the following comments on the Draft Plan in its role in shaping a 2019-2021 Final Plan that merits the concurrence and support of the EEAC.

2. Savings Goals and Program Costs

The EEAC’s initial priority in evaluating the Draft Plan is to consider the level of targeted, cost-effective lifetime energy savings and related benefits achieved by the programs. The Draft Plan does not build on the programs’ prior savings and benefits achieved and does not meet the GCA’s mandate to acquire all available cost-effective energy efficiency and demand management resources. The PAs’ proposed efficiency savings goals for gas and electric in the Draft Plan are too low and well below both the level of current achieved savings and analyzed energy efficiency potential. Consistent with the GCA, the PAs must also seek to acquire all cost-effective innovations in managing energy demand, especially at times of system peak load conditions and times when clean energy sources are constrained.

¹ Only voting members of the EEAC may vote to approve this Resolution, therefore this Resolution does not necessarily represent the individual views of all parties who have participated in the 2019-2021 Draft Plan development.

² “Consultant” here refers to the consultant team led by Optimal Energy, Inc., acting on behalf of the EEAC, pursuant RFR-ENE-2016-019, as amended March, 2018.

The EEAC, informed by its Consultants, supports savings goals substantially higher than those proposed in the Draft Plan, in line with the March 15th Consultants' Assessment of Potential presentation. The EEAC Consultants recommended targeting average annual electric savings goals of 3.15% of retail sales and approximately 11,500 gigawatt hours (GWh) of lifetime savings. For gas, the Consultants recommended average annual gas savings of 1.65% of retail sales and approximately 565 million therms of lifetime savings are achievable. The EEAC also supports the active electric demand savings goals in line with those recommended by the Consultants at the April 25th EEAC meeting: namely, 4.6% of total peak demand, or 437 MW by 2021, including not less than 75 MW of peak load reduction stemming from behind-the-meter energy storage.

The EEAC sees many indications that the PAs can pursue and achieve additional energy savings and benefits, beyond those reflected in the Draft Plan. Among the more significant indications of higher achievable savings are:

- The historical PA achievements, including the evaluated level of savings in 2017 (for electric: annual savings as a percentage of retail sales of 3.18%, and 14,419,888 MWh of lifetime savings; and for gas: annual savings as a percentage of retail sales of 1.20%, and 371,288,182 therms of lifetime gas savings)
- The historical PA achievements of 213 MW of summer capacity savings in 2017 from energy efficiency programs alone;
- The EEAC Consultants' March 10th Assessment of Potential for achievable energy efficiency savings (3.15% of annual sales for electric and 1.65% for gas);
- The EEAC Consultants' April 25th Assessment of Potential for active electric demand management including storage (electric demand savings of 4.6% of total peak demand, or 437 MW by 2021, including at least 75 MW of peak load reduction stemming from behind-the-meter energy storage)
- The energy efficiency savings goals needed to align with the Massachusetts Clean Energy and Climate Plan for 2020 and longer term GWSA targets for 2030;
- Individual PA potential studies showing portfolio electric savings as high as 3.63% of retail sales and portfolio gas savings as high as 2.95% of retail sales; and
- The benefit/cost ratios for the programs in the PAs' Draft Plan (2.03 electric and 1.72 for gas).

The EEAC recognizes the significance of the electric energy efficiency programs' serving oil and propane consumers in a fuel-neutral manner and supports the PAs' proposal to utilize MMBtus as a common measurement of achievement for the electric programs. However, the EEAC will continue to rely on, and expects the PAs to report lifetime and annual electric, oil, and propane savings in parallel to MMBTUs for the electric PAs. The EEAC will also continue to rely on the PA reporting quarterly on all fuel metrics provided in the D.P.U. 08-50 Tables along with reductions in annual and lifetime greenhouse gas emissions. The EEAC will continue to rely on lifetime and annual Therms saved as the measurement of achievement for the gas programs, and the EEAC does not see a need for considering MMBtus as a measurement of achievement for the gas programs because the gas PAs, unlike the electric PAs, do not serve oil or propane customers.

Given the marked differences in achievable savings goals and program costs between the Council's Consultants and the Draft Plan, it is apparent that some of the planning assumptions made by the PAs in the Draft Plan differ from those assumptions made by the EEAC Consultants in their March 15th recommendation. The EEAC appreciates the collaborative effort that the PAs and Consultants have expended in recent weeks exploring the main assumptions that account for these differences and expects that the "key drivers" process will conclude in August, with results presented at the August EEAC

Meeting. The EEAC anticipates that these results will include detailed information from the Consultants and PAs on each of the identified Key Drivers, differences in initial assumptions, updates to planning assumptions, and the impact of those updates on 2019-2021 forecasted energy savings and program costs.

The EEAC notes that, in 2017, the PAs achieved electric savings substantially above plan year goals while spending close to budgeted costs. The PAs' hard work in overcoming sector level challenges to achieve these nation-leading levels of savings is noteworthy and appreciated. 2017 also saw achieved gas savings near plan year goals while 2017 spending by the PAs came in significantly below budgeted costs. The 2019-2021 Three-year plan will mark a decade of gas efficiency programs under an all cost-effective mandate in Massachusetts. The Council reasonably expects to see these mature programs deliver increasing savings in line with the assessment of potential and historical costs to achieve. The Council looks forward to a Revised and Final Plan that builds on the Draft Plan to maximize allocation of funding for programs that directly benefit ratepayers including participant incentives, outreach, education, and technical assistance.

Notwithstanding the potential for assumptions to change through the "key drivers" process, the PAs' most recent results indicate that the steep increase in proposed program costs to achieve in the Draft Plan are not merited. The Council requires a more detailed understanding of the PAs' planning assumptions including detailed and reasonable justification of costs to achieve savings. This justification should include factual support linked to program redesign, participation levels, specific baseline changes, new initiatives, deeper savings, or incorporation of the EEAC's recommendations.

The EEAC expects that the Revised Plan will provide significantly higher savings goals at similar or lower costs to achieve, while clearly demonstrating that the PAs seek to acquire all available cost-effective energy efficiency consistent with the GCA. Natural gas constraints in recent winters have resulted in significant cost impacts to electric and gas ratepayers, and underscore the need for the Revised Plan to achieve greater and better targeted energy savings across both the electric and gas programs. The EEAC expects the PAs to consider additional cost-effective measures that directly address winter peaks, including comprehensive streetlight and other outdoor lighting retrofits and winter gas demand management. The EEAC requires that the Revised Draft provide more specificity and back-up data for the proposed goals in general, and, more specifically, a complete and updated cost-benefit screening tool data from each PA. The updated cost-benefit screening tools should include updated 2018 Avoided Energy Supply Costs (AESC) values, including forthcoming Massachusetts-specific Avoided Cost of Compliance with GWSA³.

3. Priorities, Comments, and Recommendations

The following section contains the Council's detailed review and feedback on the responsiveness of the Draft Plan to the Council's February Resolution. The Council appreciates the PAs' recognition of certain Council priorities, but the Draft Plan does not sufficiently address any of the recommendations.

Therefore, all the Council's priorities and recommendations in its February Resolution remain a present concern, and the Council thus reiterates its priorities below. The Council expects that the Revised Plan will provide significantly more detail, in terms of narrative, supporting data, and assumptions, which demonstrate how the PAs propose to address each of the Council priorities and recommendations throughout 2019-2021. The Council proposes below Key Indicators for each recommendation and expects the Revised Plan to specifically describe how the PAs will address and monitor each one.

³ The Council expects results from the Avoided Cost of Compliance with GWSA study as a supplement to the 2018 New England AESC study in August.

a. Underserved Populations and Geographies

Priority:

Increase participation by, and savings from, hard-to-reach and underserved populations and geographies, including moderate income, renters, small business, and non-profits.

Council Assessment of Draft Plan

Ensuring that customers have equitable access to energy efficiency programs has been a consistent priority of the Council. Based on data available, efforts to target and increase services to moderate income customers, renters, and small businesses in the 2016-2018 plan period have been generally ineffective. The Council is especially disappointed with participation in the PAs' moderate income initiative. Although the Draft Plan expresses a commitment to reaching underserved customers it lacks detail on how this will be accomplished. In the residential sector, this commitment is supported by broadly stated strategies to increase simplicity, ease of participation, and access, along with using data-driven approaches to reach customers. For C&I customers, the PAs highlight improving small business savings and experience by expanding segmentation and negotiated incentives into the small business category. There is also discussion about expanding the Main Streets approach pioneered by Eversource and the customer directed option pioneered by National Grid to the other PAs. While these strategies appear promising, there are insufficient details in the Draft Plan narrative and supporting data for the EEAC to assess whether these planned enhancements or expansions will lead to increased participation and savings. The Council expects further details and specific commitments in the Revised Plan. The Council would also like to see concrete opportunities for municipalities and non-profits (or organizations representing non-profits) to partner directly with PAs to advance the shared goal of promoting energy efficiency and reaching underserved populations and geographies.

Key indicators associated with priority

- # of participants for specific customer groups
 - 60-80% State Median Income (SMI)
 - Renters
 - Non-English speakers
 - Small businesses
- Ratios of participation, incentive spending and lifetime MMBtu/household savings for specific customer groups vs. market rate participants
- Participants per capita by zip code by sector
- Number of partnerships on energy efficiency campaigns with the municipal seal of approval

b. Active Demand Management

Priority:

Include goals specific to active demand management and integrate the delivery of active demand management offerings within the EE programs in the 2019-2021 Plan.

Council Assessment of Draft Plan:

The EEAC continues to support the development and implementation of effective active demand management (ADM) program offerings, including behind-the-meter energy storage (battery and thermal storage), in 2019-2021. The Draft Plan included a residential direct load control ADM offering targeting customers with connected efficiency equipment (starting with Wi-Fi thermostats), and a large commercial, technology-agnostic, performance-based, load curtailment offering, both of which were proposed

statewide. While these two statewide offerings are useful first steps, the amount of ADM proposed in the Draft Plan is too low. The EEAC Consultants' April 25th Assessment of Potential for active demand management estimated potential demand savings equivalent to 4.6% of total peak demand, or 437 MW by 2021, including at least 75 MW of peak load reductions from behind-the-meter storage, based on the results from two PA demand potential studies, which the Consultants extrapolated to all PAs. The amount of ADM proposed in the Draft Plan is less than 30% of the ADM potential estimated by the EEAC Consultants. The Draft Plan includes significant variation in the volume and scope of ADM across the PAs, with some PAs proposing very low levels. Only one PA (Cape Light Compact) proposed behind-the-meter energy storage in the Draft Plan. In addition, both the Residential and C&I proposed ADM offerings were based on summer electricity peak demand only, leaving opportunities to manage electric and gas winter demand un-addressed. The EEAC does not consider its original recommendation satisfied by the Draft Plan and therefore re-emphasizes its recommendation.

The Revised Plan should include: (1) much higher target levels of peak load ADM, including where cost-effective an upfront rebate program for behind-the-meter storage, as part of every PA's offerings; (2) ADM that addresses opportunities to manage both summer and winter demand; (3) MW savings goals specific to ADM; and (4) programs addressing winter gas demand management. Further, the Revised Plan should include a clear description of how the promotion and delivery of all proposed ADM peak load reduction offerings are fully integrated with the EE program delivery. The EEAC expects the PAs to work with DOER and other stakeholders to ensure coordination across the ADM programs proposed in the Revised Plan with other Massachusetts programs, such as Solar Massachusetts Renewable Target (SMART).

Key indicators associated with priority

- ADM MW in summer, and ADM MW in winter, with sub-categories for battery storage and thermal storage
- Conversion rate (% of all outreach offers that have enrolled)
- Penetration (e.g., % of customers with wifi thermostats who have enrolled)
- Performance by technology or service (% of enrollments that have performed)

c. Fuel Switching

Priority:

Promote & incentivize fuel switching strategies, in all sectors, that support the Commonwealth's long term greenhouse gas reduction requirements, as established under the Global Warming Solutions Act.

Council Assessment of Draft Plan

The Council supports fuel switching strategies that are consistent with and support the greenhouse gas reduction goals of the Global Warming Solutions Act. These include opportunities for electric PAs to strategically electrify energy use by converting oil and propane customers to high efficiency air source heat pumps. The 2019-2021 Plan suggests that the PAs will provide an "energy optimization" approach to program delivery, which is intended to be a more holistic and integrated approach, to help customers make informed decisions to decrease overall energy use. The proposed approach is fuel-neutral and should enable customers to access efficiency services, regardless of current fuel, as long as the customer is upgrading to efficient, cost-effective equipment. However, the Draft Plan and associated Benefit-Cost Ratio (BCR) models do not specify how savings from fuel switching will be counted and incentivized. The Council seeks to ensure alignment of energy efficiency investments and savings goals with the GWSA and needs additional information on the PAs' approach to fuel switching. This should

include calculations for savings from fuel switching, broken down by fuel, and a detailed description of how the PAs' will convert customers from oil and propane to support beneficial electrification and all-electric new construction. The Council expects the PAs to work with the EEAC Consultants on issues related to evaluation, measurement, and verification of fuel switching savings and benefits in advance of the Revised Plan.

Key indicators associated with priority

- Number of heat pump and heat pump water heater installations by initial heating fuel type, sector, and market segment

d. Integrated Residential Program Design

Priority:

Provide a new, integrated residential program design that maintains strong savings and benefits for all residential homeowner and rental initiatives by:

- *Increasing customer capture,*
- *Providing new methods for realizing savings,*
- *Expanding HVAC, behavioral, financing, and upstream offerings, and*
- *Increasing conversion rates for HVAC and weatherization measures.*

Council Assessment of Draft Plan

Given declining claimable electricity savings from residential lighting initiatives and other market developments, the Council continues to support a comprehensive redesign for the residential retrofit and retail programs. The PAs' Draft Plan presents a new program reporting structure with single family (Home Energy Services or HES) and multi-family retrofit offers, previously addressed in two separate initiatives, combined into a single new Residential Coordinated Delivery Initiative. However, the PAs' Draft Plan does not provide sufficient detail regarding how, nor a timeline showing when, this updated retrofit program design will be implemented. Further, BCR model inputs and calculations are similar to that offered in 2016-2018 rather than reflecting an updated approach to delivery of the residential programs. The Council will need additional program design details, a timeline for implementation, and updated BCR model inputs with higher residential savings goals before it is able to consider a favorable recommendation regarding the new residential program. Given the contemplated reduction in emphasis on audits, the PAs should also provide specific details regarding plans to continue to achieve savings and participation from weatherization and major measures including training for public-facing professionals.

Key indicators associated with priority

- Number of Home Energy Assessments planned and Conversion rate for recommended-to-installed weatherization and major measures (separately for single and multi-family)
- Total MMBtu savings per household
- Number of contractor trainings planned and number of people to be trained on new initiative and offerings

e. C&I Sector Savings Measures

Priority:

Increase program savings in the C&I sector from HVAC, process, lighting, and CHP measures.

Council Assessment of Draft Plan

The Draft Plan's proposed savings in the C&I sector are too low and do not meet the GCA mandate of "all cost-effective energy efficiency." The EEAC believes there is still significant opportunity in C&I lighting (including controls), HVAC, and process end uses, based on evidence in: the PA potential studies; the MA onsite study; and the Consultant Assessment of Potential. However, the Draft Plan savings are flat or declining from current achieved levels for those end uses rather than a year over year increase, as recommended by the EEAC and the Consultant Assessment of Potential. The EEAC calls for an increase in program savings targets in the C&I sector from HVAC, process, and lighting measures in the Revised Plan. Since submission of the Draft Plan, the PAs have worked with the Consultants to confirm the details of the CHP projections in the Draft Plan. The Council is pleased with the progress of discussions related to CHP and looks forward to seeing a Revised Plan that reflects an increase to CHP projections for 2019-2021, including additional savings estimates for a known, large CHP project. The Revised Plan should also include more detail on the Commercial Real Estate (CRE) offering, including a description of how all recommendations from the 2015 CRE Working Group report will be rolled out statewide in 2019-2021 to expand to more geographies and CRE business types. The Council also expects further detail and specific commitments in the Revised Plan regarding proposed C&I Market Segmentation, specifically regarding program offerings that address challenges currently faced by the municipal market segment.

Key indicators associated with priority

- Savings from lighting and HVAC controls by PA
- Process savings statewide
- CHP savings and project information in line with current reporting practices
- Savings and participation rates broken out by customer consumption size bin, in line with the C&I Customer Profile
- Square Footage projected to be served, number of individual customers, and energy savings projections by PA for the CRE-specific offering

f. Zero Energy Ready Buildings and Passive House

Priority:

Actively promote zero energy ready buildings (ZEBs) & Passive House for new construction and major renovations in all sectors.

Council Assessment of Draft Plan:

In the Draft Plan, the PAs state support for construction of Zero Energy Ready Buildings (ZEBs) and Passive House-compliant buildings through the delivery of targeted education/trainings, technical support and incentives for both commercial and residential customers. The Council is pleased to see the support for these building types expressed in the Draft Plan. The Council requests additional detail to understand how the PAs' planned efforts will translate into spending and savings, what volume of production is expected, and whether the general strategies presented will yield significant results. The Council requests more specificity in how ZEBs and Passive House will be supported beyond education and trainings.

Key indicators associated with priority

- # and % of planned new construction projects built to ZEB or Passive House standards
- # of trainings planned and # of people to be trained in ZEB construction and Passive House construction techniques

- Average % of building energy savings compared to baseline from New Construction programs

g. Integrated Multi-Family Framework

Priority:

Establish a multi-family framework that better integrates residential and commercial offerings and is cost-effective.

Council Assessment of Draft Plan:

The PAs have provided fully integrated residential and C&I services to the multi-family high rise new construction and low income multi-family market segments for some time. However, integrating retrofit multi-family services for the market rate program has been more challenging. Although the PAs have made incremental improvements to the program in recent years, several factors within the residential sector have prompted the PAs to combine the Multi-family Retrofit and HES Initiatives into a combined Residential Coordinated Delivery Initiative. The Draft Plan indicates that smaller multi-family buildings will receive HES-style services while larger multi-unit buildings will follow a more customized path. While this general approach seems promising, the Council has unanswered questions regarding planned participation levels (in all relevant initiatives), how the general strategies will be specifically implemented and represent full residential and C&I integration, and what savings and costs are expected from multi-family energy efficiency projects. The Council specifically expects the PAs to separately track and report single family and multi-family buildings and multi-family dwelling units served within all initiatives serving both building types (Residential, C&I and Low Income; new and existing buildings).

Key indicators associated with priority

- Close rates (for example, audits to projects)
- Savings and number of participants broken out by residential and multi-family C&I

h. Low Income Programs

Priority:

Review low-income programs for potential improvements in participation and achievement of savings, and seek additional savings & cost-efficiency opportunities, to ensure continued success.

Council Assessment of Draft Plan

The Draft Plan states that the low-income program approach will preserve existing implementation and marketing strategies. Recruiting low-income participants through a partnership with the federal Low-Income Home Energy Assistance Program (LIHEAP) has been effective and the Council supports this continued approach. There are additional opportunities available to recruit participants that the PAs, in coordination with LEAN, should include in their Revised Plan. Further, the Draft Plan does not propose any new electric or gas savings measures, despite indications that Low-income Energy Affordability Network (LEAN) has been actively exploring them. The Draft Plan also does not include participation numbers, nor identify any specific ideas that could reduce the cost to deliver the program. The EEAC expects to see a Revised Plan with low-income programs that actively seek improvements in recruitment, participation and achievement of savings, and that makes a clear commitment to incorporating additional cost-effective savings measures and cost efficiency opportunities such as strategic electrification with cold-climate heat pumps.

Key indicators associated with priority

- Total savings and average total cost and savings per participant household
- # of participants by referral source
- # of participating households receiving each measure
- # of heat pump conversion projects from oil and propane
- # of customers on the low-income rate who have not participated

i. Data Management

Priority:

Modernize data management across all PAs and sectors, enhance accessibility to and usefulness of the data to the public, and leverage additional data sources to accomplish items a-h above.

Council Assessment of Draft Plan:

The delivery of the Mass Save programs would significantly benefit from the adoption of a common data platform across PAs, capable of tracking and motivating customer progress in energy efficiency measures over time and enabling two-way online engagement with customers. The PAs have already adopted a customer segmentation approach to serve large and mid-sized C&I customers. The EEAC believes that it will become increasingly imperative to understand and target specific customer needs in the residential and small business sectors, particularly in light of the expected draw-down in claimable electricity savings from screw-in lighting over 2019-2021. In order to better understand and target customers, PAs should coordinate around a common platform to seamlessly share this data among PAs where customers are served by more than one PA.

This need for better coordinated and more comprehensive customer data management is separate from, but intrinsically related to, the EEAC's desire for improved tracking and reporting of the results of Mass Save ratepayer investments. As noted by the Council in its resolution on the 2016-2018 Plan, the need for, and benefits from, improved tracking and reporting have yet to be satisfactorily resolved by the Mass Save Data website, and a common and modern data platform should be designed to save significant time and costs in tracking and reporting across the program administrators.

Prior to full implementation of a common data platform, the statewide databases constructed by EM&V after the completion of each program year form the best available resource for understanding participation trends. It is therefore critical that EM&V databases be constructed as quickly as possible. The Revised Plan should include a detailed description and timeline for how the PAs will coordinate and implement a common data management platform for customer engagement and comprehensive tracking and reporting of Mass Save investments and results.

j. Performance Incentives

The EEAC continues to support the concept and use of performance incentive payments to the PAs to encourage and reward the achievement of ambitious energy and demand savings goals. Performance incentives for the 2019-2021 Plan were not addressed by the Council during the EEAC workshops, and therefore the EEAC did not include a recommendation on performance incentives in its February, 2018 resolution. The PAs' Draft Plan proposed placeholder performance incentives based on the current performance incentive level and design. The EEAC expects to discuss the need for changes in performance incentive design and the incentive mechanism this summer, and may consider revisions to both the level of incentive payments and the design of the performance incentive mechanism, which it would expect the PAs to address in the Revised Plan.

The EEAC Consultants have suggested that an additional component be added to the performance incentive mechanism for 2019-2021, in addition to the two components in the current mechanism (“savings” based on benefits, and “value” based on net benefits). The additional component would be focused on specific, quantifiable key performance indicators. Performance incentive categories will be discussed prior to the Revised Plan.

Appendices

F. Avoided Energy Supply Components in New England: 2018 Report

Avoided Energy Supply Components in New England: 2018 Report

Available at: <http://www.synapse-energy.com/sites/default/files/AESC-2018-17-080.pdf>

Appendices

G. Sponsorships & Subscriptions Policy

POLICY ON SPONSORSHIPS & SUBSCRIPTIONS

A. Hard-to Measure “Sponsorships and Subscriptions”

Sponsorships and subscriptions are undertaken by the PAs in order to support the goals of the Green Communities Act (“GCA”) and acquire all available cost-effective energy efficiency. Costs included on the Sponsorships and Subscriptions hard-to-measure line items provide direct benefits to customers, but are not directly linked to specific in-the-field energy efficiency measures or services. Sponsorships and subscriptions support the energy efficiency market, encourage workforce education, attract skilled employees to Massachusetts, and promote innovation in both service delivery and the development and testing of energy efficient technologies. In accordance with the Order of the Department of Public Utilities regarding the 2016-2018 Three-Year Energy Efficiency Plan and general accepted practice, each sponsorship and subscription expense must be reasonable, prudently incurred, and provide a direct benefit to Massachusetts customers. Detailed definitions are as follows:

- **Sponsorship:** Payment by or on behalf of a PA to financially support an organization, event, or project directed by a non-PA person or group, in order to gain participation or access to a benefit of sponsorship. The purpose of these costs may include, without limitation, sharing of regional and national best practices, transformation of energy efficiency markets, influencing manufacturers, furthering energy efficiency evaluation techniques and standards, and the ability to network (with customers, contractors, evaluators, or other experts) to learn about additional energy efficiency opportunities and ways in which to improve offered energy efficiency services. These activities all provide benefits to customers and programs generally, but do not focus on a specific initiative. Specific categories of sponsorships enumerated by the Department include:
 1. Energy efficiency forums
 2. Trade associations
 3. National industry associations
 4. Groups that target specific industry sectors
 5. Universities and organizations that develop new technologies
 6. Residential focused groups to educate and engage with the community

Costs reported in the hard-to-measure line items will be limited to sponsorships that are anticipated to provide benefits to customers but are not associated with a specific program or initiative. Conversely, expenses related to the above categories that directly impact programs will be included in the appropriate program budget (see Section B, below).

- **Subscription:** Payment by or on behalf of a PA to receive or use something related to energy efficiency over a fixed period of time, such as a periodical, a book series, or an informational service.

Costs will be categorized in the appropriate cost category.

Examples and Cost Categorization

1. Membership Dues for Consortium for Energy Efficiency (“CEE”) - allows the PAs to provide guidance to manufacturers who make equipment that can be used to increase efficiency or options in the programs, and gives the PAs early insight into new technologies coming to market.
 - *Line item:* Sponsorships & Subscriptions hard-to-measure for each sector
 - *Cost Category:* PP&A(Note that other charges from CEE specifically related to programs may be included as program costs; see Section B, below)

2. Membership in Ally Program of American Council for an Energy-Efficient Economy (“ACEEE”) - allows PAs to bring awareness to the programs generally and advance Massachusetts’ goals throughout the national energy efficiency community. Allies gain access to a national center of expertise as well as unique opportunities to help contribute to and shape the nation’s energy efficiency research and program agenda. Allies also learn from networks of peers and other experts about the latest trends and issues in energy efficiency. Additionally, Allies receive industry-leading information on energy efficiency markets, technology, and policy. Participation in ACEEE’s Ally program allows the PAs to share in the expertise of ACEEE and other Ally members on energy efficiency technologies and opportunities that can influence the programs of the future and help PAs improve program delivery.
 - *Line item:* Sponsorships & Subscriptions hard-to-measure for each sector
 - *Cost Category:* PP&A

3. Sponsorship of International Energy Program Evaluation Conference (“IEPEC”) – allows the PAs to participate in the annual professional conference, which is held for energy program implementers, evaluators of those programs, local, state, national and international representatives, and academic researchers involved in evaluation. The conference provides a forum for the presentation, critique and discussion of objective evaluations of energy programs, and promotes the documentation of unbiased, peer-reviewed evaluations that establish the basis for accurate information and provide credible evidence of program success or failure. In addition, the PAs gain access to information on current issues, market assessments, emerging technologies, and alternatives to traditional centralized supply-side options, as well as educational workshops on relevant topics, including information on evaluation methodologies, vendors, and strategies to continuously improve evaluation of the PAs’ programs. In addition, support of IEPEC provides the PAs with the opportunity to learn about new program efforts and how those innovative approaches are working in other areas. This helps the PAs to effectively deliver energy efficiency solutions to customers.
 - *Line item:* Sponsorships & Subscriptions hard-to-measure for each sector
 - *Cost Category:* Evaluation and Market Research

B. Program Expenses (NOT Hard-to-Measure “Sponsorships and Subscriptions”)

Expenses paid to directly support a program are program expenses and will be included in and allocated to the appropriate programs/core initiatives where benefits are expected to be realized. *A cost may be included in program line items even if called a sponsorship or subscription because the expense is directly related to the program.* These expenses include:

- **Data Purchase:** Payments made to receive data on a one-time or recurring basis will be included in the programs to which the data relates.
- **Memberships / Employee Training:** Membership fees (group or individual) where the fee is not used to sponsor a conference or event, but rather as a cost-efficient way to obtain multiple individual employee memberships, receive tickets to conferences for learning opportunities for employees, advertise energy efficiency programs to customers/contractors, provide direct access to member lists, and advertise energy efficiency job positions. Employee conference and training attendance enhances employee skills and teaches the employee about new technologies and strategies, helping the employee in his or her job/role and improving the programs. The conference/training must provide an energy efficiency related benefit and the PA should determine if the value of the employee’s attendance justifies the costs.
- **Goods or Services:** Expenditures made to pay for a good or service, such as a product table at an event (without otherwise sponsoring the event or organization).

Costs will be categorized in the appropriate cost category.

Examples and Cost Categorization

1. Sponsorship of an HVAC conference where a PA presents on Heating & Cooling energy efficiency in order to market the Mass Save program.
 - *Line item:* Residential Heating & Cooling program core initiatives
 - *Cost Category:* Marketing and Advertising
2. Subscription to or sponsorship of an organization that shares or disseminates data that the PAs use for planning or evaluation.
 - *Line item:* Each affected program/core initiative
 - *Cost Category:* PP&A for planning data or Evaluation and Market Research for evaluation data
3. Sponsorship of a community event at which a PA promotes Mass Save through brochures, banners, and tabling to potential customers.
 - *Line item:* All relevant programs/core initiatives
 - *Cost Category:* Marketing and Advertising

4. Sponsorship of the Design Lights Consortium, which directly impacts the lighting products the PAs offer in C&I programs as well as lighting design practices for C&I customers and program design and implementation.
 - *Line item:* C&I Upstream Lighting and C&I Retrofit core initiatives
 - *Cost Category:* Sales, Technical Assistance & Training

4. Group Membership in Association of Energy Services Professionals, with which the PA gains “points,” and uses these points to assign individual memberships to staff members, allowing staff to improve their skills and learn innovative ideas and best practices to improve program delivery and achieve energy savings.
 - *Line item:* All relevant programs/core initiatives
 - *Cost Category:* PP&A

Documentation of Expenditures Included in Program Costs

In 2016-2018, the PAs will contemporaneously document the benefits to customers of expenditures that are or were previously included in the Sponsorships & Subscriptions hard-to-measure line item in 2013-2015, including any sponsorship or membership payment that is made to directly affect programs and is included in program line items. PAs do not intend to provide a detailed explanation of benefits (or contemporaneously document the benefits) associated with costs that were never included in the Sponsorships & Subscriptions line items, including (1) payments solely for goods and services (e.g., tabling), (2) the purchasing of data, (3) conference fees paid for directly by employees, and (4) costs included in other line items (e.g., Residential Education (in-school programs), Workforce Development (third-party trainings)). The PAs will provide detailed information about all costs in the Term Report in accordance with the Term Report template.

C. Lobbying or Engagement in Legislative Activity

For each sponsorship and subscription expenditure, the PA will determine whether the sponsored organization is a registered lobbyist or engages in legislative activity¹. For all sponsored organizations, whether registered as a lobbyist or not, PAs will seek to obtain a written statement prior to providing monetary support covenanting in substance as follows:

[The Organization] understands that the Massachusetts energy efficiency Program Administrators cannot and do not support lobbying activities by organizations sponsored by the Program Administrators. [The Organization] covenants and agrees that funds provided by [Company] as an energy efficiency or demand savings sponsorship or subscription will not be used for lobbying or other legislative activities.

In the event a PA determines that sponsorship of an organization that is involved in lobbying activities has a direct benefit to Massachusetts customers, the PA will document the benefits and provide evidence of how the funds at issue are used by the sponsored organization. Consistent

¹ In 2016 – 2018, this information will also be obtained for commitments that were included as “Sponsorships and Subscriptions” in 2013-2015 even if the costs are now being directed to specific programs or core initiatives.

with the Department's directives in the 2016-2018 Three-Year Plan Order, the organization must also provide documentation that (1) details the structure and function of the sponsored organization; (2) identifies the percentage of resources devoted to lobbying and legislative activities; and (3) provides the method used to derive the percentage.

PAs expect to sponsor organizations that lobby or advocate for more stringent codes and standards. The PAs will document all spending as noted above, but will work under the presumption that more stringent codes and standards provide a direct benefit to customers.

D. Annual Review Process

Prior to filing the Plan-Year Report or Term Report, each PA will review all sponsorship and subscription spending incurred during the prior program year (including, in 2016-2018, those expenses directly affecting programs and categorized in program line items that were previously included as Sponsorships & Subscriptions hard-to-measure costs in 2013-2015) to determine whether the events or organizations sponsored in the prior year realized the expected benefits (noting that some benefits may take more than a year to accrue, and that many benefits are not quantifiable). Each PA will document actual benefits realized, and verify that each expense was reasonable, prudently incurred, and was intended to provide a direct benefit to customers.

E. Process to Determine Whether to Enter into a Sponsorship or Subscription; Contemporaneous Documentation

- Step 1.** Identify sponsorship or subscription opportunity – may come from staff or vendor.
- Step 2.** Identify and document the **purpose** of the organization or event to assess whether it is **directly related to energy efficiency**.
- Step 3.** Identify and document in detail the expected **direct energy efficiency-related benefit to Massachusetts customers** of the expense, which may include: enhanced energy efficiency program delivery, marketing and education opportunities, reaching key industry sectors, sharing of best practices, access to manufacturers, contractors, and/or data and evaluation materials, assisting the PA in achieving savings or satisfying an energy efficiency related statutory mandate, or other benefits. For sponsorships that are being renewed, identify the benefits that were achieved in prior years and their impact on the decision to renew the sponsorship.
- Step 4.** Assess whether the associated sponsorship costs are **reasonable and prudent** in relation to the expected benefits; determine if the opportunity is the best and most cost-efficient means by which the PA can achieve the expected benefits.
- Step 5.** Determine whether or not the organization is a registered lobbyist or otherwise **engages in lobbying** (note that an organization can be engaged in lobbying even if it is not required to be a formally registered lobbyist). For organizations that do engage in lobbying, additional scrutiny should be used to determine that the sponsorship funds will not be spent for lobbying purposes. If it is determined that the sponsorship is prudent, ensure that the organization seeking sponsorship signs a statement that organization will not use PA funds for lobbying purposes and gather evidence that: (1) details the structure and function of the sponsored organization (e.g., organization

- chart, mission statement); (2) identifies the percentage of resources devoted to lobbying and legislative activities; and (3) provides the method used to derive the percentage.
- Step 6.** Determine and document how the expenditure will be allocated between a PA's **gas and electric operations** (when applicable), based on the benefits to be realized by each fuel type's customers.
- Step 7.** Determine and document the **appropriate line item and cost category**, including: whether the expense (1) is a hard-to-measure Sponsorship or Subscription; or (2) directly affects a program, and if so, determine which programs and how the expense will be allocated among the impacted core initiatives. Determine and document the appropriate budget category (PP&A, Marketing, STAT, or Evaluation and Market Research). When appropriate, coordinate with other PAs for consistency.
- Step 8.** Obtain sign-off from the designated PA staff approving the sponsorship or subscription.
- Step 9.** Obtain documentation from a manager (or equivalent) of the organization stating that it **will not use PA funds for lobbying purposes**. For organizations that engage in lobbying, ensure that the PA has received all information listed in Step 5.
- Step 10.** Confirm that all **logos and marketing** materials used in relation to the sponsorship for which the PA will seek cost recovery from energy efficiency are designed to support and promote energy efficiency programs.
- Step 11.** **Pay invoice** per standard PA procedure.
- Step 12.** **Review** all costs following completion of sponsored event or program and determine whether and how the expected benefits were realized. Determine whether the PA would sponsor or participate in the organization or event again in the future.

Appendices

H. PA-Specific Programming

Introduction

In addition to the statewide plan, which is always the core of the Compact's approved Three-Year Plans, the Compact provides for specific cost-effective program enhancements that have been identified to better meet the needs and demands of its unique customer base.

In developing the drafts of the 2019-2021 Three Year Plan, the Compact staff have identified proposed enhancements and modifications as a result of the Compact's administration of its 2016-2018 Three Year Plan, direction from the Compact's Governing Board and stakeholder input, which included eleven stakeholder meetings over a four-month period. The Compact's proposed enhancements were presented to the Compact's Governing Board, twice in public sessions, and were approved by a vote of the Governing Board for inclusion in the drafts of the Compact's 2019-2021 Three-Year Plan. The Governing Board will make its final review and vote prior to filing with the Department of Public Utilities on October 31, 2018.

The following sections provide a summary of the enhancements to programs proposed for the 2019-2021 Three-Year Plan term.

Residential and Income Eligible Program Enhancements

Residential Coordinated Delivery

For the 2019-2021 term, the Compact proposes to continue without an incentive cap for qualified insulation incentives in a fuel blind manner for homeowners, year-round renters who are responsible for paying the electric bill, customers whose income is within 61-80% of state median income, and customers whose operations are managed by municipalities or other government entities.

As background, during the 2013-2015 plan term, the Compact identified cost-effective enhancements designed to assist customers with identified barriers such as split incentives and difficulty with co-payments. The Compact offered 100% incentives, up to the program cap of \$4,000, for qualified insulation incentives in a fuel blind manner for year-round renters who paid their electric bill, customers whose income was within 61-80% of state median income, and customers whose operations were managed by municipalities or other government entities. The Compact also raised the insulation cap to \$4,000 for market rate customers, after determining the average insulation recommendation surpassed the previous cap of \$2,000. These changes allowed customers to make improvements within one year rather than over several years. The Compact continued this offer through the 2016-2018 term and then, along with all the Program Administrators, supplemented it by removing the insulation incentive cap beginning in mid-2017 through the end of 2018.

Residential Behavior & Demand Management

The Compact is considering and exploring the possibility of implementing a home energy report behavior model (e.g., OPower) in the 2019-2021 Plan period.

Residential Electrification Demonstration Offering

In response to the recent amendments to the Green Communities Act (the “GCA”), the Compact has developed its Residential Electrification Demonstration Offering (the “Offering”). The Offering is designed to serve oil, propane or electric resistance heat customers with the following cost effective tiered services:

- Installation of cold climate heat pumps or pellet stoves, where appropriate
- Installation of solar (photovoltaic/PV) PV system
- Installation of Battery storage as active demand response

The Offering is designed to serve 700 participants over the course of the three-year term. The proposed breakdown includes:

- 175 residential low income customers residing in deed restricted low income residence
- 175 residential moderate income (61-80% SMI) customers
- 175 residential extended moderate income (81-120% SMI) customers
- 175 residential customers

The Offering will include a 100% incentive for low-income participants, and a combination of a sliding scale incentive and utilization of the HEAT Loan for all other participants.

The GCA supports the installation of cold climate heat pumps as part of its mandate for strategic electrification. Similarly, the GCA also supports the installation of photovoltaic systems paired with battery storage as a means for the program administrators to address peak demand and greenhouse gas reductions.

The goal of the Offering is to test this three-prong approach in the achievement of the goals of the GCA, and the minimization of winter and summer peak demands. Cape Cod and Martha’s Vineyard has been identified by the Department of Public Utilities as a constrained area with seasonal spikes. The Compact is well positioned to conduct this Offering as its service territory has some of the highest incidence of electric heat, and both Martha’s Vineyard and the Outer Cape do not have natural gas pipeline/service availability. This Offering is designed to yield invaluable information for other Program Administrators, the Department of Public Utilities and other stakeholders, as well as inform with “real-time” information/data any technical sessions and/or future program designs relating to these three areas.

Residential R&D and Demonstration - Connected Devices

Increasingly, customers are choosing to install in-home connected devices such as smart lighting,

smart appliances, WiFi thermostats, plug load controllers, etc. as their prices fall, more options become available for them to choose from, and the installation and setup process continues to become easier. These connected devices have the potential to enable the “next generation” of energy efficiency, demand response, and load shifting as baseline energy efficiency continues to increase in Massachusetts.

During the 2019-2021 Plan period, the Compact will explore ways to incentivize and leverage connected devices to reduce residential energy usage, enable demand response, and encourage customers to use energy during off-peak hours. These devices may include smart speakers (e.g., Amazon Echo Dot) and/or apps that control load-connected devices (e.g., plug load controllers), “smart” appliances that can be managed remotely and/or shift load to off-peak hours, and other connected devices that can reduce or shift load. If a customer with connected devices chooses to participate in a demand response program, this would also allow the Compact to manage the load of the connected devices during demand response events.

Commercial & Industrial (“C&I”) Program Enhancements

C&I New Buildings

The Compact proposes to continue its enhancements to its new construction and major renovation program to include cost-effective thermal measures designed to save oil, propane and other unregulated fuels.

C&I Existing Buildings

The Compact continues to offer its municipal customers specialized incentives that cover up to 100% of cost-effective measure costs as part of this program.

The Compact also plans to continue two special incentive options first adopted in 2013 to assist small business customers further in overcoming barriers to participation: a 95% incentive option for qualifying small business tenants; and for other small businesses, the zero-interest financing option.

The Compact is also looking to continue several enhancements in its 2019-20212 Plan to its C&I Existing Buildings Program, each designed to further reduce barriers to participation for key customer segments.

First, the Compact proposes to continue enhancements to its commercial and industrial retrofit program to include all cost-effective thermal measures designed to save oil, propane, and other unregulated fuels.

Second, the Compact modeled its small business effort after the HES program and will include a BEA (Business Energy Audit) and a core offering of deemed savings measures, many of which can be installed in the first visit, some at 100% incentive coverage. For its small business customers, the Compact continues to offer higher incentives for standard direct install measures (up to 100% rather than up to 70% as offered in the Statewide Plan).

Third, the Compact will continue offering 100% incentive for all cost-effective measures for up to 100 (first come, first serve) non-profit corporations on Cape Cod and Martha’s Vineyard per year as follows: (a) Non-profit organizations must be a 501(c)(3); (b) Operating more than five years with an unrestricted annual operating revenue of less than \$15M for non-profit serving low income customers and less than \$2M for all other non-profit organizations.

Finally, the Compact will continue the Main Streets initiative.

Residential and C&I Program Enhancements

Demand Management – Energy Storage

The Compact is exploring offering residential battery storage to reduce peak demand in its service territory. Due to its high penetration of residential solar on Cape Cod and Martha's Vineyard, the Compact will initially focus on installing residential batteries in homes that have distributed energy resources.

The Compact's program will be informed by other Program Administrator's demand management efforts, especially Until Electric's 2016-2018 Demand Response Offering. The Compact hopes to learn from Until's marketing experiences; what marketing efforts successfully enrolled and educated customers and what marketing efforts were not so successful. Also, the Compact will incorporate any lessons Until learned relative to the procurement of small scale battery storage (e.g., request for proposal and contract terms and conditions).

R&D and Demonstration – Electric Vehicle Charging

The Cape Light Compact is aware of the observed and projected growth of electric vehicle (EV) ownership. While the Compact recognizes that the electrification of transportation is an important step in reducing the carbon emissions from the transportation sector, this increase in EVs will have major implications for Massachusetts' and New England's electric grid, including a growth in peak demand. Increased peak demand increases costs for all ratepayers due to the need to buy additional capacity in the market and build additional transmission and distribution infrastructure.

During the 2019-2021 period, the Compact will explore ways to help address this issue by shifting EV charging to off-peak hours. This may include enabling demand response at EV charging stations (either home-based or public), working with/through EV manufacturers to shift charging to off-peak hours (through direct dispatch and/or an incentive program), or a behavioral-based program that uses an in-car device to record charging hours and provides an incentive to customers that choose to charge the EVs during off-peak hours (e.g., FleetCarma).

Residential Energy Education

Recognizing that education is key to affecting change in our society, the Compact has made a strong commitment to education outreach and continues to be a nationally recognized leader in the design and implementation of energy education programs. The Compact strives to address the continuing need for greater consumer awareness and encourage the development of deeper and broader community knowledge and commitment of energy efficiency technology and practices.

Using a model for science-based learning, the Compact's energy education program aligns with the Massachusetts State Frameworks for Science and Technology allowing teachers to introduce lessons discussing energy efficiency and conservation as well as emerging renewable energy technologies, including:

- Coordination between other PAs and education agencies for teacher training and graduate level courses for teachers
- Coordination for “Kids Teaching Kids” program at the high school and middle school level
- Support and coordination for school and community-based Energy Clubs
- In-class hands-on presentations on
 1. Science of Energy and Energy Transformations
 2. Energy Sources (renewable and non-renewable)
 3. Electricity
 4. Energy Efficiency and Conservation
 5. Hydrogen Fuel Cells and Biofuels
 6. Climate Change
- Statewide Awards program in conjunction with other PAs, the Division of Energy Resources and the NEED Youth Awards Program
- Support for school-based “Energy” summer camps
- Support for school districts STEM improvements through energy education

Eversource PA-Specific Materials

A. Income-Eligible Coordinated Delivery

Pilgrim Fund

The Pilgrim Fund was established in 1990 in the context of a settlement agreement resolving litigation associated with replacement power costs incurred by Commonwealth Electric Company (“ComElectric”) in connection with an outage at Boston Edison Company’s (“Boston Edison”) Pilgrim Nuclear Power Station. Under the settlement, Boston Edison paid ComElectric funds to be applied for Demand Side Management (“DSM”) programs which would be specified by the Attorney General and filed with the Department of Public Utilities (“Department”) for approval. A further settlement in 1991 allocated one half of the funds to DSM activities, with the balance designated for specification by the Attorney General. A third settlement addressing the use of these funds was approved by the Department in 1996. The settlement funds have been used to support various DSM and energy efficiency programs between 1996 and the present.

In keeping with the original intent of the settlement that created the Pilgrim Fund, the remaining settling parties propose that the remaining funds be used to supplement energy efficient services by funding necessary health and safety repairs within the Income-Eligible Coordinated Delivery Initiative. Eversource and the Low-Income Energy Affordability Network (“LEAN”) believe this is a great opportunity to mitigate the barriers and expenses associated with repairs that typically prohibit the installation of energy efficiency upgrades. Expending the fund balance on such repairs will allow for more energy efficiency services to be implemented and more energy savings to be achieved within the income-eligible population of Eversource’s former ComElectric service territory. Eversource plans to work collaboratively with the Attorney General and LEAN to pursue this great opportunity.

B. Active Demand Reduction

EV Load Management

The Electric Vehicle (“EV”) load management effort is a component of the Company’s active demand offering focused on shifting EV charging away from peak hours. This effort is analogous to demand response focused primarily on residential charging load management, where cost effective. This effort does not provide any incentives for electric vehicles or electrical vehicle chargers. The incentives provided through this effort will be used to shift when EVs charge. Additional opportunities in commercial and municipal EV fleet charging load management may also be considered but the Company’s focus is on residential charging as that is where current research shows the majority of charging is occurring. The Company intends for this effort to evolve, accommodating current types of equipment deployed in its service territory and attracting customers that are considering upgrading or purchasing new charging equipment.

The incentives for enrollment and payment to the customer will be based on the operation of the load control approach, with two control approaches: (1) “throttling”, which involves lowering the charging capacity; or (2) “restricting/scheduling” charging during specific time periods specified

by the program. Either of the control approaches may be implemented based on a fixed schedule or via notification, similar to demand response events which would be limited to program design hours. Customers will be paid an incentive to allow the Company's vendor to either throttle EV charging during specific hours per month (which might vary in the summer cooling season or winter heating season, as applicable), and/or set a defined schedule for when the car charges, with the possibility of a guaranteed minimum state of charge and established preferred time. The preferred approach for the scheduled option would be to restrict charging during peak hours. Customers will have the option to opt out for reduced incentive compensation.

The Company will work with its vendors to determine the needs of each EV owner to ensure they have a sufficient charge by a particular time. The defined schedule (including critical hours when charging should not occur) could be different in the summer cooling months compared to the winter heating season. The EV load management effort will be able to integrate with a control system as an end node and will be OpenADR compliant, meaning that it will be possible to manage EV charging through a centralized control system using open communication protocols.

The EV Load management effort recognizes that there are multiple technical interfaces for charging, including Level I and Level II chargers¹. The effort could include incentivizing customers using Level I and II chargers, depending upon the number of customers with each type of device willing to participate. However, the expectation is customers with higher functioning Level II chargers will be the primary participants, with the possible opportunity to retrofit Level I chargers with "smart" devices to expand the number of individual sites. The Company is also exploring the possibility of working with EV car manufacturers to manage EV charging directly through the vehicle's onboard telematics.

This effort is unique from anything else the Company is currently doing in regards to EVs. This effort does not contain any of the components outlined in D.P.U. 12-95 such as planning studies, technical evaluations of vehicle to home or vehicle to grid capabilities or deploying charging infrastructure (DC fast Chargers or Level II chargers). Similarly, this effort does not overlap with the Company's deployment of its "Make Ready" EV infrastructure program approved in D.P.U. 17-05 as there is no physical improvements or infrastructure proposed as part of this demand reduction effort. The sole purpose of this effort is to mitigate peak demand by controlling an EV's charge through an existing charger or through the car's onboard telematics.

¹ Level I chargers generally refer to using a 120 volt (V) alternating-current (AC) plug with a kW charge rate of up to 2 kW and can be plugged into a household outlet. Level II chargers typically are around 240V and 40 amps, with a charge rate of up to 19 kW but more commonly around 6-7 kW. Level II charges require specialized equipment.

Electric Vehicle Active Demand Reduction

Electric vehicles are a cornerstone of Massachusetts' strategy to reach Global Warming Solutions Act carbon reduction goals, and the number of these vehicles in the state increases every year. However, as with any strategic electrification, transitioning from fossil-fuel powered vehicles to electric vehicles increases the burden on the electric grid. Targeting electric vehicles for active demand reduction can help to reduce that burden.

National Grid will begin offering active demand reduction with electric vehicles in the summer of 2019. Rather than incentivizing the purchase of electric vehicles or charging stations, this offer will be based on a bring-your-own-device model, meaning that customers with eligible technology will be offered the opportunity to enroll in the active demand offering.

Outreach to customers will be done through the vehicle manufacturers, specifically targeting customers who regularly charge during peak periods in the summer and winter months. Once customers have agreed to participate, during peak events manufacturers will automatically change vehicle settings to begin charging after the peak event ends. Customers can override this for immediate charging needs but will be removed from the program if they regularly do not participate.

National Grid anticipates that this offer will have an impact on peak demand and help winter reliability, while strongly supporting the Commonwealth's greenhouse gas reduction goals.

Residential Behavior & Demand Management

Gas and Electric Behavior Offering– Unitil issued a competitive Request for Proposals and selected a vendor to implement a residential Home Energy Report (“HER”) strategy, with a goal of launching in Q4 in New Hampshire in 2018 and in Massachusetts in 2019. The assumptions included in the September 14th draft plan are based on preliminary, vendor-proposed costs and savings per customer. A more detailed design based on Unitil’s customers’ actual usage is being developed by Oracle / OPower, which is now under contract with Unitil. Before the October filing, Unitil will re-calculate estimated costs and benefits of an HER offering.

Electric Active Demand Management Measures – Unitil is currently negotiating with vendors in order to implement the statewide direct load control offering during the 2019-2021 plan period. Unitil used estimated costs from a vendor and savings from National Grid’s evaluated parameters per participant for the WI-FI thermostat demonstration. Unitil will refine its estimates of benefits, costs and participation and will only propose it in October as long as the residential sector remains cost effective.

Appendices

I. Studies of Remaining Potential

Appendices

J. Vendor Cost Categories

Program Administrator Vendor Cost Categories

Row Number	Cost Type	Elec/Gas/Both	Cost Category
1	Statewide Database/Mass Save Data	B	PP&A
2	Builder and Equipment Incentives	B	Incentive
3	Heating System Rebates	B	Incentive
4	Lighting/ISMs	B	Incentive
5	Permits	B	Incentive
6	Pre-weatherization Incentive	B	Incentive
7	Rater Inspection Fees	B	Incentive
8	Rebates/ Incentives (customer)	B	Incentive
9	Refrigerator Costs within Low-Income	E	Incentive
10	Repairs within the Low-Income Initiatives	B	Incentive
11	Total Interest Subsidy	B	Incentive
12	Weatherization Costs	B	Incentive
13	Marketing and Advertising Support	B	Marketing
14	Cost Effectiveness Screening	B	PP&A
15	EEAC Consultants/Regulatory Assessments/LEAN	B	PP&A
16	Legal Services	B	PP&A
17	Planning Support	B	PP&A
18	Tracking System Maintenance	B	PP&A
19	Account Management	B	STAT
20	Audit Fees	B	STAT
21	Call Center Activities	B	STAT
22	Circuit Rider Activities	B	STAT
23	Postage Associated with Rebate Processing	B	STAT
24	Processing Fee	B	STAT
25	Program Administration Fees	B	STAT
26	Quality Assurance and Control activities	B	STAT
27	Reporting	B	STAT
28	Technical Assistance Studies	B	STAT
29	Technical Support for Contractors	B	STAT
30	Travel	B	STAT
31	Contractor Fees	B	STAT (contractor services/fees); Incentive (measure costs/labor)
32	Training	B	STAT (Workforce Development)

Appendices

K. Alternative Payout Rate Slides

PA PROPOSAL FOR 2019-2021 PERFORMANCE INCENTIVES



- In general, PAs are proposing to maintain existing PI mechanism for savings and value components
 - Some minor additional tweaks being considered
- Addition of enhanced payout rate associated with benefits and net benefits associated with:
 - 1) Peak savings from active demand
 - 2) MMBTUs reduced by installations of air source heat pumps associated with switching from unregulated fuel sources.

PA PROPOSAL: ENHANCED PAYOUT RATE



- While existing PI mechanism would incentivize all benefits and net benefits associated with demand and beneficial electrification efforts, PAs recognize the need to:
 - Undertake additional efforts to increase market adoption of newer technologies, products, and services associated with these priorities
 - Simultaneously keep focused on delivering full portfolio level savings and benefits to MA customers
- Additional details on enhanced payout rate:
 - Enhanced payout rate is not separate from the total portfolio earnings. Places added emphasis on priorities without pre-determining or limiting maximum success
 - PAs incentivized to achieve as many benefits as possible using enhanced payout rate in conjunction with other goals
 - Builds on successful mechanism without undoing Department precedent, keeping threshold and max PI levels based on overall portfolio level performance
 - Fully scalable without placing caps or thresholds on individual enhanced components

Appendices

L. **DOER Study on Avoided Cost of Compliance with GWSA**

Analysis of the Avoided Costs of Compliance of the Massachusetts Global Warming Solutions Act

Supplement to 2018 AESC Study

**Prepared for Massachusetts Department of Energy
Resources and Massachusetts Department of
Environmental Protection**

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EXECUTIVE SUMMARY

This document supplements the 2018 Avoided Energy Supply Component (AESC) Study (2018 AESC). Specifically, this document provides estimates of the incremental avoided compliance costs with the Massachusetts Global Warming Solutions Act (GWSA)¹, beyond those already included in the main 2018 AESC study.²

Avoided compliance costs from this study are intended to be added to the avoided costs for energy, capacity, and other values determined in the 2018 AESC. The combined costs provide total avoided costs for demand-side measures installed by Massachusetts energy efficiency program administrators.

This supplemental study was commissioned by Massachusetts Department of Energy Resources (DOER). It includes input from the GWSA Study Group, which includes Massachusetts Department of Environmental Protection (MassDEP), consultants to the Massachusetts Energy Efficiency Advisory Council (EEAC), and members of the Massachusetts energy efficiency program administrators. The GWSA Study Group helped to develop and review methodological approaches, compliance strategies, and other issues related to the development of the avoided cost of GWSA compliance.

This supplemental analysis finds that the incremental 15-year levelized avoided cost of GWSA compliance is 2.09 cents per kWh, expressed in 2018 dollars.³ This represents an 18 percent increase over the 11.69 cents per kWh avoided cost as currently calculated on Table ES-1 of the 2018 AESC study.

Table 1. Illustration of avoided retail summer on-peak electricity cost components, AESC 2018 and GWSA Supplement (2018 cents/kWh, 15-year levelized values from 2018 through 2032)

Total avoided costs in 2018 AESC Study Table ES-1	16.05	(a)
“CO ₂ non-embedded” component (not used in MA)	4.36	(b)
Total avoided costs, less “CO ₂ non-embedded” component ⁴	11.69	(c) = (a) – (b)
Estimated incremental avoided cost of GWSA compliance	2.09	(d)
Total avoided cost with incremental avoided GWSA compliance cost	13.78	(e) = (c) + (d)
Percent difference	18%	(f) = (e)/(c) - 1

Because the Massachusetts energy efficiency program administrators do not use 2018 in their three-year energy efficiency plan for 2019 through 2021, we also calculate the 15-year levelized cost for 2019 through 2033. Under this timeframe, the 15-year levelized avoided cost of GWSA compliance is 1.79

¹ Chapter 298 of the Acts of 2008.

² See <http://www.synapse-energy.com/sites/default/files/AESC-2018-17-080-June-Release.pdf>.

³ This cost is inclusive of an adjustment for distribution losses (8 percent), consistent with the non-embedded environmental cost methodology applied in the 2018 AESC study in Table ES-1.

⁴ Includes embedded Massachusetts regulations 310 CMR 7.70, 7.74, and 7.75 (see page 5 for details).

cents per kWh. This is a 16 percent increase over the avoided cost in the 2018 AESC Study, were it calculated on a 15-year levelized basis between 2019 and 2033 (see Table 2).

Table 2. Illustration of avoided retail summer on-peak electricity cost components, AESC 2018 and GWSA Supplement (2018 cents/kWh, 15-year levelized values from 2019 through 2033)

Total avoided costs in 2018 AESC Study	15.53	(a)
“CO ₂ non-embedded” component (not used in MA)	4.31	(b)
Total avoided costs, less “CO ₂ non-embedded” component ⁵	11.22	(c) = (a) – (b)
Estimated incremental avoided cost of GWSA compliance	1.79	(d)
Total avoided cost with incremental avoided GWSA compliance cost	13.01	(e) = (c) + (d)
Percent difference	16%	(f) = (e)/(c) - 1

We calculated the avoided cost of GWSA compliance using a weighted average of anticipated costs and greenhouse gas (GHG) emission reduction potential for seven strategies. All seven strategies are currently being deployed by the Commonwealth of Massachusetts (Commonwealth) in the near to medium term under already promulgated legislation and regulations, or as part of the *Massachusetts Clean Energy and Climate Plan for 2020 (CECP)* in order to comply with the GWSA.⁶ These strategies include: (1) onshore wind, (2) offshore wind, (3) large solar, (4) medium solar, (5) small solar, (6) clean energy imports, and (7) light-duty vehicle electrification infrastructure.

In the counterfactual AESC case that presumes no incremental energy efficiency in 2018 and all later years, the Commonwealth would not achieve the GWSA limit for 2020 and later years without implementing additional non-efficiency strategies. While the Commonwealth does not develop two CECPs (one with and one without energy efficiency), for this analysis, we have assumed that the counter-factual AESC case of no incremental energy efficiency would rely on an expansion of the above-listed electric-related strategies already in the CECP.

As a result, these incremental avoided costs of GWSA compliance may be applied to any measure in the 2019–2021 three-year plan for energy efficiency. Said another way, any measure in the 2019–2021 three-year plan for energy efficiency (which may include but is not limited to LEDs, heat pumps, insulation, weatherization, energy efficiency appliances, demand response, storage, etc.) will reduce GHG emissions and avoid the cost of GWSA compliance. This may improve the cost-effectiveness of measures in each program administrator’s three-year energy efficiency plan.

Because the “main” AESC case represents a theoretical future in which no new energy efficiency measures are put into place, the 2018 AESC Study and results from this Supplement should not be used to infer information about actual future market conditions, energy prices, or resource builds in New England. Furthermore, actual prices in the future will be different than the long-term prices calculated in

⁵ Includes embedded Massachusetts regulations 310 CMR 7.70, 7.74, and 7.75 (see page 5 for details).

⁶ See <https://www.mass.gov/files/documents/2017/12/06/Clean%20Energy%20and%20Climate%20Plan%20for%202020.pdf>.

this study as actual future prices will be subject to short-term variations in energy markets that are unknowable at this point in time.

The following sections provide detailed findings and a description of the methodology used to derive an avoided cost of compliance with GWSA.

1. BACKGROUND

The Global Warming Solutions Act (GWSA) requires the Commonwealth to reduce greenhouse gas (GHG) emissions by 25 percent in 2020, relative to 1990 levels, and by at least 80 percent in 2050, relative to 1990 levels.⁷ GWSA tasks state agencies with developing regulations that require reporting of GHG emissions by different sources in the Commonwealth, establishing target emission reductions that must be achieved by 2020, and developing a plan for achieving these targets. To this end, Massachusetts agencies published a *Massachusetts Clean Energy and Climate Plan for 2020* in 2010 and an updated version in 2015. These two documents outline the measures or strategies that the Commonwealth is using to achieve the emissions reduction requirements.⁸

In May 2016, the Massachusetts Supreme Judicial Court ruled in *Kain et al.* that the Commonwealth must also promulgate regulations establishing declining annual emissions limits for sources or categories of sources that emit GHGs, enabling the state to comply with the 2020 limit set by the Secretary of Energy and Environmental Affairs.⁹ In response to this decision, MassDEP and EEA issued a set of regulations that would result in compliance with the 2020 emissions limit.¹⁰ As noted in the 2018 AESC Study report, three specific regulations—one pre-*Kain* regulation (310 CMR 7.70) and two post-*Kain* regulations (310 CMR 7.74 and 310 CMR 7.75) as discussed further on page 6—were modeled in the current 2018 AESC Study. Therefore, the costs associated with complying with these regulations are already included in the 2018 AESC avoided energy costs.

However, the 2018 AESC Study does not necessarily represent a future in which compliance with the GWSA emissions reduction requirement is achieved. The 2018 AESC Study models a future in which no energy efficiency is installed in 2018 through 2050. This hypothetical “but-for” case is then used to estimate the costs avoidable by any unit of energy efficiency (or other demand-side measure). Because electric generating resources that emit GHGs are commonly on the margin in New England, the 2018 AESC Study—with its lack of new energy efficiency—represents a future in which emissions in Massachusetts and the rest of New England are higher than they would be in a future that does account for the impact of incremental energy efficiency.

For this reason, the avoided cost of complying with the GWSA is not fully accounted for in the 2018 AESC Study.¹¹ To estimate the avoided cost of compliance under the AESC counter-factual, this supplement assumes that in the absence of energy efficiency, the Commonwealth would pursue an expansion of the strategies outlined in the CECP.

⁷ See <https://www.mass.gov/service-details/global-warming-solutions-act-background>.

⁸ All the measures or strategies in the CECP have GHG benefits. Some may also achieve additional goals such as public health, economic development, or avoiding costs of capacity, transmission, and distribution.

⁹ See <http://masscases.com/cases/sjc/474/474mass278.html>.

¹⁰ See <https://www.mass.gov/guides/reducing-ghg-emissions-under-section-3d-of-the-global-warming-solutions-act>.

¹¹ Note the calculation of the avoided cost of GWSA is not the primary focus of the AESC study. The objective of the AESC study is to calculate a wide range of categories of avoided costs of demand-side measures for the different New England states. Historically, analyses on state-specific avoided costs have been conducted separately from the main AESC study.

2. METHODOLOGY

This section describes the general methodology used to calculate a non-embedded avoided cost of GWSA compliance. Unless otherwise noted, all dollar terms in this analysis are in 2018 dollars.

2.1. Calculating the Avoided Cost of GWSA Compliance

The approach used to calculate preliminary findings involves assembling costs and emission-reducing potentials for seven compliance strategies: onshore wind, offshore wind, large solar, medium solar, small solar, clean energy imports, and light-duty vehicle electrification infrastructure (see Table 3). While this set of strategies may not include all possible strategies eventually employed to reduce GHG emissions, it is our understanding that it represents the strategies that are most likely to produce sizeable GHG emission reductions through the study period.¹²

Six of the seven strategies listed in Table 3 are electric-sector technologies and are calculated first in \$-per-MWh terms and MWh potentials. The expected cost of energy (per the 2018 AESC Study) is then subtracted from these \$-per-MWh terms to estimate the incremental avoided cost of employing a particular strategy, as opposed to an “all-in” cost.¹³ Using a set of seasonal- and temporal-specific emissions rates calculated in the EnCompass electric-sector dispatch model from the 2018 AESC Study, the incremental costs and incremental potentials are then converted into \$-per-short-ton and short-ton values. Because the light-duty vehicle electrification strategy involves switching from fossil fuels to electricity for light-duty vehicles, it increases load on the grid rather than generating electricity.¹⁴ Therefore, the avoided cost of compliance for this strategy is not directly calculated from a \$/MWh cost and GWh potential. Instead, it is converted natively into \$-per-short-ton and short tons.

All incremental avoided costs are averaged and weighted using each strategy’s potential for emission reductions separately for 2018, 2019, 2020, and 2030 (see an example of this calculation in Equation 1).¹⁵ Incremental avoided GWSA costs between 2020 and 2030 are interpolated, with the implied

¹² Again, note that this list specifically does not include energy efficiency or other demand-side measures. This analysis focuses on strategies that could be done in place of demand-side measures. Demand-side measures (as they are installed) would avoid or reduce the cost of compliance, i.e., the deployment of these strategies.

¹³ This step is performed for all strategies except light-duty vehicle electrification infrastructure, which is unaffected by energy prices.

¹⁴ As such, the electric sector will be involved to a significant extent in implementing this strategy.

¹⁵ Although 2018 and 2019 do not have specific emissions reductions requirements, energy efficiency measures installed in these years and which persist through 2020 and later years are able to contribute to future-year emissions reductions and avoid some portion of the cost of GWSA compliance. The load forecast in the 2018 AESC Study is created by using ISO New England’s gross load projections from CELT 2017, which accounts for a future without new energy efficiency beginning in 2018. Note that avoided costs for 2018 are not used by the energy efficiency program administrators in their development of the 2019–2021 three-year plan for energy efficiency, but are calculated as part of this analysis for consistency with the main 2018 AESC Study. See Appendix A for additional detail on calculations for avoided costs in 2018 and 2019.

increase in costs extrapolated through 2031 and all later years.¹⁶ Our analysis indicates that the incremental weighted average avoided costs for 2020 and 2030 are \$41 per short ton and \$28 per short ton, respectively (see Table 3 and Table 4).¹⁷

This methodology results in a single potential avoided cost for each of the analyzed years. This weighted average approach means that no single strategy dominates the calculated compliance value. This is important for two reasons: first, the costs and potentials for each of these values are inherently uncertain. While they represent our best estimate as of August 2018, it is possible that these values may increase or decrease as technologies improve, materials and labor costs change, or as other, different technologies become available.

Second, this approach considers that many different strategies are likely and reasonably foreseeable to be employed to meet the state's emission reduction requirements. Each of the seven strategies is already present in Massachusetts today. Further, each strategy is being employed in the near to medium term under already promulgated legislation and regulations, or as part of the *Massachusetts Clean Energy and Climate Plan for 2020* (CECP).¹⁸ For example, onshore wind, offshore wind, and solar installations are eligible to fulfill Massachusetts' Renewable Portfolio Standard (RPS) requirements, and clean energy imports are regulated under Section 83D of Chapter 169 of the Acts of 2008, as amended by the 2016 Energy Diversity Act ("83D").¹⁹

The 2018 AESC Study already accounts for three strategies or regulations currently in place that steer Massachusetts towards GWSA compliance: (1) 310 CMR 7.70 *Massachusetts CO₂ Budget Trading Program* (also known as Regional Greenhouse Gas Initiative or RGGI); (2) 310 CMR 7.74 *Reducing CO₂ Emissions from Electricity Generating Facilities* (cap on CO₂ emissions from power generators inside Massachusetts); and (3) 310 CMR 7.75 *Clean Energy Standard* (CES) for Massachusetts load-serving entities. These electric-sector regulations (and other regulations that address emissions from other parts of the economy) were designed to yield 2020 GHG emissions at or below the specified annual requirement. In the counterfactual AESC case that presumes no incremental energy efficiency for 2018, 2019, 2020, and all later years through 2050, non-efficiency measures would be needed to replace the emissions reductions from energy efficiency in order to still achieve GWSA-required 2020, 2030, 2040, and 2050 GHG emissions limits. To evaluate the incremental portion of GWSA avoided costs, these

¹⁶ This is similar to the methodology applied in other parts of the 2018 AESC Study. For example, avoided energy costs are calculated for 2018 through 2035, then extrapolated at a specified rate of change for 2036 to 2050. Importantly, because avoided costs in these later years are discounted heavily in the 30-year levelization (and not used at all in the 10- and 15-year levelizations), avoided costs after 2030 have less of an impact on the levelized value than do avoided costs in the nearer term.

¹⁷ Note that the 2018 AESC Study calculates a total environmental avoided cost for CO₂ abatement of \$100 per short ton. Avoided costs in this supplemental analysis generally decline over time as the different strategies become less expensive relative to the energy prices modeled in the 2018 AESC study.

¹⁸ See the following section describing the costs and potentials for each strategy for additional information on specific existing and proposed legislation and regulations associated with each strategy.

¹⁹ Requests for proposals for both 83C and 83D were defined in Chapter 188 of the Acts of 2016 "An Act to Promote Energy Diversity," available at <https://malegislature.gov/Laws/SessionLaws/Acts/2016/Chapter188>. For more information, see <https://macleanenergy.com/83d/> <https://macleanenergy.com/83c/>.

already modeled GWSA avoided costs must be removed from the total avoided cost of GWSA compliance. Because these avoided costs are embedded in the modeled avoided energy cost in the 2018 AESC Study, removing the already modeled avoided energy cost from the total “all-in cost” of compliance functionally removes this double-counting of the already modeled avoided GWSA costs.²⁰

The resulting 15-year levelized avoided cost (over 2018–2032) is about \$41 per short ton, or \$19 per MWh, as shown in Table 5.²¹ Over 2019–2033, the resulting 15-year levelized avoided cost is about \$35 per short ton, or \$17 per MWh. See Appendix B. Avoided GWSA Compliance Costs for 10- and 30-year levelized avoided costs.

²⁰ Note that the 2018 AESC Study is different. It instead calculates a \$100/ton non-embedded avoided cost of environmental compliance, which is based on the incremental cost to install carbon capture and sequestration technology on existing emitting facilities. In the 2018 AESC Study, the already modeled avoided cost of compliance with environmental regulations —e.g., 310 CMR 7.70 (RGGI), 310 CMR 7.74, and 310 CMR 7.75—are subtracted from the \$100/ton value to determine the incremental avoided cost of reducing CO₂ emissions in a future with no additional energy efficiency.

²¹ Note that in some years, a strategy’s potential is estimated to be 0 GWh. This occurs in situations where more energy is assumed to be deployed from this strategy in the existing 2018 AESC Study, in the specified year. This occurs as a result of the 2018 AESC Study being a hypothetical future with no energy efficiency; in this future, energy prices are higher, and total MWh requirements under RPS policies are higher, changing the economic potential of various resources. Also note that in certain years, the estimated “all-in” cost for a particular strategy is less than the projected avoided energy price; in these years, we assume a “floor” price of \$0 per MWh.

Table 3. Calculating the avoided cost of GWSA compliance in 2020

	All-In Costs	Incremental Costs		Incremental Potential		Notes
	2018 \$/MWh	2018 \$/MWh	2018 \$/short ton	GWh	million short tons	
	a	b	c	d	e	
Onshore wind	\$68	\$30	\$64	0	0.0	
Offshore wind	-	-	-	-	-	<i>Assumed none in 2020</i>
Large solar	\$40	\$3	\$5	6,013	2.9	<i>Utility</i>
Medium solar	\$82	\$44	\$93	1,632	0.8	<i>Commercial</i>
Small solar	\$105	\$68	\$142	1,348	0.6	<i>Residential</i>
Clean Energy Imports	-	-	-	-	-	<i>Assumed none in 2020</i>
Light-duty vehicle electrification	-	-	\$0	-	0.1	<i>Public charging infrastructure costs only</i>
2020 Weighted Avg Avoided Cost	-	-	\$41	-	-	

Notes: The weighted average avoided cost is calculated by calculating the average of \$-per-ton values in column "c" using the weights in column "e". Potentials are incremental to the quantity of the strategy that is already modeled within the main 2018 AESC study. This \$-per-ton value is then converted into an incremental \$-per-MWh value (see Table 5) using the summer on-peak emission rate identified in Table 150 of the 2018 AESC Study (June 1 release). This note applies to this table, as well as Table 4.

Table 4. Calculating the avoided cost of GWSA compliance in 2030

	All-In Costs	Incremental Costs		Incremental Potential		Notes
	2018 \$/MWh	2018 \$/MWh	2018 \$/short ton	GWh	million short tons	
	a	b	c	d	e	
Onshore wind	\$69	\$18	\$38	2,279	1.1	
Offshore wind	\$66	\$16	\$33	79,845	38.0	
Large solar	\$35	\$0	\$0	8,883	4.2	<i>Utility</i>
Medium solar	\$58	\$8	\$17	2,143	1.0	<i>Commercial</i>
Small solar	\$73	\$23	\$48	1,788	0.9	<i>Residential</i>
Clean Energy Imports	\$60	\$10	\$20	58,100	27.7	
Light-duty vehicle electrification	-	-	\$151	-	1.2	<i>Public charging infrastructure costs only</i>
2030 Weighted Avg Avoided Cost	-	-	\$28	-	-	

Equation 1. Example of calculating the weighted average avoided cost

$A = \frac{\sum_{i=1}^n w_i c_i}{\sum_{i=1}^n w_i}$, where A is the weighted average avoided cost for 2030, w is the weight (measured in million short tons), and c is the cost (measured in 2018 \$/short ton)

$$A = \frac{(\$38)(1.1)+(\$33)(38)+(\$0)(4.2)+(\$17)(1.0)+(\$48)(0.9)+(\$20)(27.7)+(\$151)(1.2)}{1.1+38+4.2+1.0+0.9+27.7+1.2}$$

$A = \$28 / \text{short ton}$

Table 5. Incremental avoided cost of GWSA compliance

Year	Incremental Avoided MA GWSA Cost (2018 \$/ton) <i>a</i>	Incremental Avoided MA GWSA Cost (2018\$/MWh) <i>b=a*emissions rate</i>
2018	\$104.77	\$49.87
2019	\$58.24	\$27.72
2020	\$40.99	\$19.51
2021	\$39.72	\$18.91
2022	\$38.46	\$18.31
2023	\$37.19	\$17.70
2024	\$35.93	\$17.10
2025	\$34.67	\$16.50
2026	\$33.40	\$15.90
2027	\$32.14	\$15.30
2028	\$30.88	\$14.70
2029	\$29.61	\$14.10
2030	\$28.35	\$13.49
2031	\$27.08	\$12.89
2032	\$25.82	\$12.29
2033	\$24.69	\$11.75
15-Year Levelized Avoided Cost (2018-2032)	\$40.61	\$19.33
15-Year Levelized Avoided Cost (2019-2033)	\$34.89	\$16.61

Note: Real discount rate of 1.34 percent. Values are converted from \$-per-short-ton to \$-per-MWh using the summer on-peak emissions rate identified in Table 150 of the 2018 AESC Study (June 1 Release). Avoided costs in this table have not been adjusted for distribution losses (assumed to be 8 percent).

These avoided costs may then be calculated in terms of \$-per-MMBtu for non-electric fuels. Table 6 converts the 15-year levelized avoided cost values from column (a) in Table 5 into \$-per-MMBtu values using the CO₂ emissions rates developed in the 2018 AESC Study. Compared to the avoided costs calculated in the 2018 AESC Study, these represent a 15 percent increase in the avoided cost of

residential distillate fuel oil and a 36 percent increase in the avoided cost of residential natural gas.²² See Appendix B for additional detail on non-electric avoided fuel costs.

Table 6. Incremental avoided costs of GWSA compliance for non-electric fuels

Fuel	Sector	Incremental avoided GWSA compliance cost 2018–2032 (2018 \$ per MMBtu)	Incremental avoided GWSA compliance cost 2019–2033 (2018 \$ per MMBtu)
Natural Gas	Residential	\$2.38	\$2.04
	Commercial	\$2.38	\$2.04
	Industrial	\$2.38	\$2.04
Distillate fuel oil	Residential	\$3.27	\$2.81
	Commercial	\$3.27	\$2.81
	Industrial	\$3.27	\$2.81
B5 Biofuel	All	\$3.11	\$2.67
B20 Biofuel	All	\$2.62	\$2.25
Kerosene	All	\$3.23	\$2.77
LPG	All	\$2.82	\$2.43
RFO	All	\$3.51	\$3.02
Wood	All	zero	zero
Wood & Waste	All	zero	zero

Notes: CO₂ emissions rates for wood and wood & waste are assumed to be zero (see 2018 AESC Study, June 1 Release, Table 149), resulting in a non-embedded CO₂ avoided cost of zero. As in the 2018 AESC Study, as the emission rates of non-electric fuels do not vary by time of day or season, there is only one set of annual compliance avoided cost values.

2.2. Costs and Potentials of Compliance Strategies

For each of the seven strategies (onshore and offshore wind, large [utility] solar, medium [commercial] solar, small [residential] solar, light-duty vehicle electrification, and clean energy imports), Synapse has conducted a literature review assessing the likely unit cost (in 2018 \$/MWh or \$/short ton) and emissions-reducing potential of each of the compliance strategies.²³ This section describes the specific approaches and sources used to calculate these values for each strategy. Note that some strategies

²² See 2018 AESC Study, June 1 release, Table 117 and Table 130. Comparisons are shown relative to residential avoided costs only for the sake of simplicity. Natural gas percent changes are calculated using an example value of “All” residential natural gas avoided costs with some avoidable retail margin in Southern New England. Distillate fuel oil (DFO) percent changes are calculated using an example value of residential DFO avoided costs.

²³ Note that Synapse originally evaluated an eighth strategy: electrification of commuter rail equipment. However, because recent documentation from the MBTA’s Focus 40 project (see https://static1.squarespace.com/static/57757a3cff7c50f318d8aae0/t/5b5f2ebef950b7feeb9eaf9a/1532964586865/FOCUS40_PRINT_DRAFT_07-30-2018.pdf) does not cite commuter rail electrification as an action it is pursuing before 2040, it was not included in this analysis. Note that the MBTA is launching a separate commuter rail study, which may eventually yield specific information about commuter rail electrification plans and costs (see <https://www.mbta.com/news/2017-06-15/mbta-launching-study-future-needs-commuter-rail> and <https://www.mbta.com/projects/commuter-rail-vision>).

(onshore and offshore wind; large, medium, and small solar) feature similar methodologies or sources, resulting in those strategies being discussed in combination below. This section also includes discussion of existing and proposed legislation and regulation linked with each strategy.

Wind (Onshore and Offshore)

Both onshore and offshore wind are eligible resources under the Massachusetts Class I RPS and the CES.²⁴ In addition to the Class I RPS and CES, both onshore and offshore wind are eligible resources under the Section 83D Clean Energy request for proposals. Offshore wind is the sole resource identified under the Section 83C Clean Energy request for proposals. In addition, both onshore and offshore wind were identified as strategies for meeting compliance with the Massachusetts GWSA in the 2015 update to the *Massachusetts Clean Energy and Climate Plan for 2020*.²⁵ For these reasons, deployment of onshore wind and offshore wind is assumed to be a reasonably foreseeable strategy for reducing GHG emissions in a future lacking incremental energy efficiency in 2018 and later years.

Much of the wind energy literature cites the U.S. Department of Energy's 2015 *Wind Vision* report, which analyzed future scenarios of onshore and offshore wind energy development through 2050.²⁶ However, authors of the *Wind Vision* report did not directly assess the economic potential of wind energy. Instead, they developed future plausible scenarios grounded in wind energy growth projections from the U.S. Energy Information Administration's Annual Energy Outlook and expanded with several sensitivities for future fuel costs and wind costs. As a result, Synapse relied on alternate resources that directly calculate the economic potential of wind energy in the northeastern United States. Synapse used different approaches to calculate the potential economic onshore and offshore wind energy resources, described in detail below.

Onshore wind energy potentials for 2018, 2019, 2020, and 2030 were calculated using results from NREL's 2017 Annual Technology Baseline (ATB) Cost and Performance Summary.²⁷ The annual generation values for the northeastern states reported in the NREL study were reduced by the onshore wind energy quantities already present in the 2018 AESC Study for each year analyzed, yielding an annual incremental amount of potential generation of 1 TWh in 2018, 0 TWh in 2019, 0 TWh in 2020,

²⁴ See 225 CMR 14.00 (RPS) and 310 CMR 7.75 (CES)

²⁵ See www.mass.gov/eea/docs/eea/energy/cecp-for-2020.pdf.

²⁶ U.S. Department of Energy. *Wind Vision: A New Era for Wind Power in the United States*. March 2015. See https://openei.org/apps/wv_viewer/# for data visualization and download.

²⁷ See <https://atb.nrel.gov/electricity/2017/summary.html> and <https://openei.org/apps/reeds/> for more detail. Economic potential data from the 2018 version of this study is not yet available. Economic potentials were aggregated from the 2017 study based on the scenarios that featured onshore wind costs most analogous to the "Mid" case modeled in the 2018 version of this study (available at <https://atb.nrel.gov/electricity/2018/summary.html>).

and 2.3 TWh in 2030.²⁸ Translating this to reduced CO₂ emissions using the 2018 AESC summer on-peak emissions rate yields an incremental reduction of 1.1 million short tons of CO₂ in 2030.²⁹

For onshore wind, Synapse included potential generation data from all six New England states. Any wind energy generation in the region can be utilized as part of the MA Class I RPS, therefore the total wind energy potential in those six states is included in this analysis—less the amount already modeled in the 2018 AESC Study as part of Massachusetts’ RPS and renewable policies in other states.

Onshore wind energy costs for 2018 were adopted using NREL’s latest 2018 ATB Cost and Performance Summary. This approach yields all-in costs for onshore wind between \$65 and \$68 per MWh and \$38 and \$70 per short ton of CO₂ (see Table 7).³⁰

Synapse estimated offshore wind energy generation potential using data derived from NREL’s study “An Assessment of the Economic Potential of Offshore Wind in the United States from 2015 to 2030.”³¹ The original data was screened to only include offshore areas between 12–50 nautical miles offshore in Massachusetts and Rhode Island where it is possible to install fixed turbines.³² These additional filters, after subtracting the quantity of offshore wind energy already modeled in the 2018 AESC Study, yield an offshore potential of about 80 TWh in 2030. Synapse did not calculate potentials for 2018 through 2020 because we assumed large-scale offshore wind deployment in Massachusetts would not be achievable until the early 2020s. Translating this to reduced CO₂ emissions using the AESC summer on-peak emissions rate yields an incremental reduction of 38 million short tons of CO₂.

Offshore energy costs were derived from the MA DOER 83C filing to the Department of Public Utilities, which states the levelized long-term generation cost of the offshore wind energy projects is 6.5 cents

²⁸ The 2018 AESC Study models a total of 5.9 TWh of onshore wind in 2020 (for example), versus the total economic potential of 4.9 TWh cited in the 2017 NREL ATB study. The 2018 AESC Study features a higher quantity of potential generation in this year due to a variety of reasons, including likely differences in assumptions relating to technology costs and differences in terms of market prices for energy (i.e., the 2018 AESC Study features higher-than-otherwise-expected avoided energy costs since it models a future without incremental energy efficiency). This same logic was applied to 2019.

²⁹ During the summer on-peak period, this value is approximately 952 lbs per MWh (see 2018 AESC Study, June 1 Release, Table 150). Note that this value does not vary substantially throughout the year.

³⁰ These cost ranges reflect the changing costs of wind technology based on technological improvements and the phase-out of the production tax credit (PTC), as well as the changing price of energy as calculated in the 2018 AESC Study.

³¹ See <https://www.nrel.gov/docs/fy15osti/64503.pdf>. This data source was chosen as it is a recent analysis that contains a particularly high level of resolution on wind deployment in New England.

³² The range of 12–50 nautical miles offshore was determined to be the economic region by Sustainable Energy Advantage (SEA. Northeast Offshore Wind Regional Market Characterization. 2017). Available at <https://www.cesa.org/assets/Uploads/Northeast-Offshore-Wind-Regional-Market-Characterization.pdf>. While offshore wind resources throughout New England are theoretically eligible to receive credit under the Massachusetts Class I RPS and CES, this analysis focuses on the regions currently associated with offshore wind energy leases: Massachusetts and Rhode Island. This report also deems floating turbines to not yet be a commercial technology; therefore, this assessment further filtered the economic regions to only include areas where fixed turbines can be installed. Note that this “filtering” methodology was used instead of relying on a previous study’s analysis of economic potential because of the rapid changes taking place in the likely costs of offshore wind installed in New England.

per kWh in 2017 dollars.³³ This equates to \$66 per MWh in 2018 dollars in 2030 (see Table 7). Subtracting the estimated cost of energy and converting this value into units of dollars-per-short-ton yields an offshore wind cost of approximately \$33 per short ton of CO₂ in 2030.

Table 7. Onshore and offshore wind energy costs and potentials

Year	Onshore Wind		Offshore Wind	
	All-In Cost (2018 \$/MWh)	Incremental Potential (TWh)	All-In Cost (2018 \$/MWh)	Incremental Potential (TWh)
2018	\$65	1.0	-	-
2019	\$65	0.0	-	-
2020	\$68	0.0	-	-
⋮				
2030	\$69	2.3	\$66	79.8

Note: Only offshore zones in Massachusetts and Rhode Island are considered economic in this study due to the location of offshore wind energy leases.

Solar (Large, Medium, and Small)

This analysis includes large, medium, and small solar categories across all six New England states. For the purposes of this analysis, we define “large” solar as being utility-scale, “medium” solar as being distributed solar at commercial and industrial sites, and “small” solar as being distributed solar at residential sites. As with wind energy, any solar energy generation in the region can be utilized as part of the Massachusetts Class 1 RPS, therefore solar from all six states was included. All solar resources are eligible resources under both Massachusetts’ Class I RPS and CES. Solar was also identified as an eligible resource under the Section 83D Clean Energy request for proposals. In addition, specific types of solar programs are eligible under other programs promulgated by the Commonwealth, including the Class I solar carve-out, and the Solar Massachusetts Renewable Target (SMART) Program.³⁴ Solar resources were also identified as a strategy for meeting compliance with the Massachusetts GWSA in the 2015 update to the *Massachusetts Clean Energy and Climate Plan for 2020*. For these reasons, deployment of large, medium, and small solar is assumed to be a reasonably foreseeable strategy for reducing GHG emissions in a future without incremental energy efficiency in 2018 and later years.

³³ See <https://macleanenergy.files.wordpress.com/2018/08/doer-83c-filing-letter-dpu-18-76-18-77-18-78august-1-2018.pdf>. Note that this cost assumes that the proposed projects under 83C will be eligible for the federal tax credit, which is phasing out. We did not consider the impact of this tax credit phase-out, or the impacts of any potential cost improvements for offshore wind.

³⁴ See <https://www.mass.gov/service-details/development-of-the-solar-massachusetts-renewable-target-smart-program>.

Synapse first calculated the economic potential for all three sizes of solar. As with onshore wind, we relied on NREL's 2017 ATB Cost and Performance Summary.³⁵ To estimate distributed solar independently for both the residential and commercial sectors, we relied on NREL's 2016 study "Rooftop Solar Photovoltaic Technical Potential in the United States."³⁶ This study provides technical potential for all three categories of solar. We calculated the relationship between the technical and economic potential of distributed and utility solar in the two NREL studies and applied this ratio to the technical potential for both commercial and residential solar. We then subtracted the quantity of solar capacity already estimated to be in place in each analyzed year in the 2018 AESC Study from the total economic potential values to determine "residual" values for solar potential.³⁷ This results in the potential generation described in Table 8. When converted into avoided emissions, these resources are estimated to together incrementally avoid 6.1 million short tons in 2030.

We next calculated the levelized cost of solar resources. NREL's 2018 ATB Cost and Performance Summary provides national levelized costs of energy (LCOE) for large, medium, and small solar resources in 2030.³⁸ In 2018, 2019, 2020, and 2030, we estimate a range of "all-in" LCOEs from \$35 to \$115 per MWh; when these costs are converted to dollar-per-short-ton values, and the 2018 cost of energy is subtracted, they yield a range of \$0 to \$175 per short ton of CO₂ (see Table 8).³⁹

³⁵ See <https://atb.nrel.gov/electricity/2017/summary.html> and <https://openei.org/apps/reeds/> for more detail. Economic potential data from the 2018 version of this study is not yet available. Economic potentials were aggregated from the 2017 study based on the scenarios that featured large, medium, and small solar costs most analogous to the "Mid" case modeled in the 2018 version of this study (available at <https://atb.nrel.gov/electricity/2018/summary.html>).

³⁶ Available at <https://www.nrel.gov/docs/fy16osti/65298.pdf>.

³⁷ Note that ISO New England also conducts a solar forecast, the most recent of which is the "2018 PV Forecast" (available at <https://www.iso-ne.com/static-assets/documents/2018/03/a03-2018-pv-forecast.pdf>). Note that the quantities of solar projected by ISO New England's solar forecast are smaller than the solar resources already modeled in the existing 2018 AESC study and therefore are not used in this analysis.

³⁸ Available at <https://atb.nrel.gov/electricity/2018/summary.html>. NREL's ATB study provides levelized costs for a selected number of regions around the United States. While New England is not one such region, we applied the cost values associated with Chicago given that it has the most comparable capacity factors to New England. Note that we also reviewed other studies, such as Lazard's Levelized Cost of Energy Analysis – Version 11.0 (available at <https://www.lazard.com/media/450337/lazard-levelized-cost-of-energy-version-11.0.pdf>); this study and others were used by NREL in its ATB analysis to develop a projection of future costs, making it most appropriate to rely on the NREL ATB study.

³⁹ These costs reflect technological improvements, as well as the phase-out of the investment tax credit (ITC) and the changing price of energy as calculated in the 2018 AESC Study. In 2030, the expected cost of large solar is below the avoided cost of energy modeled in the 2018 AESC Study. As a result, we assume that the incremental cost of pursuing this specific measure is capped at \$0 per MWh, and \$0 per short ton.

Table 8. Estimated solar energy costs and potentials

Year	Large Solar		Medium Solar		Small Solar	
	All-In Cost (2018 \$/MWh)	Incremental Potential (TWh)	All-In Cost (2018 \$/MWh)	Incremental Potential (TWh)	All-In Cost (2018 \$/MWh)	Incremental Potential (TWh)
2018	\$42	1.1	\$86	1.2	\$114	1.7
2019	\$43	5.6	\$86	1.3	\$115	1.1
2020	\$40	6.0	\$82	1.6	\$105	1.3
⋮						
2030	\$35	8.9	\$58	2.1	\$73	1.8

Clean Energy Imports

Clean Energy Imports (defined in this document as energy purchased from large hydroelectric facilities via newly built transmission lines) are an eligible resource under Massachusetts’ CES. Clean Energy Imports were also identified as an eligible resource under the Section 83D Clean Energy request for proposals, and as a strategy for meeting compliance with the Massachusetts GWSA in the 2015 update to the *Massachusetts Clean Energy and Climate Plan for 2020*. For these reasons, deployment of Clean Energy Imports is assumed to be a reasonably foreseeable strategy for reducing GHG emissions in a future lacking incremental energy efficiency in 2018 and later years.

In this analysis, the cost associated with Clean Energy Imports comes directly from the Massachusetts DOER 83D filing to the Department of Public Utilities, which states the levelized long-term generation cost of the New England Clean Energy Connect (NECEC) project is 5.9 cents per kWh in 2017 dollars.⁴⁰ This equates to \$60 per MWh in 2018 dollars.

To estimate energy potential for Clean Energy Imports, we first relied on the annual Clean Energy Import generation modeled in the 2018 AESC Study (8.3 TWh). This value is assumed to represent the potential added generation from a single transmission line carrying clean energy imports from Canada.⁴¹ We assume that the maximum possible annual incremental generation from Clean Energy Imports is limited to one transmission line per year.⁴² Given that 2023 is the first full year Clean Energy Imports are assumed to be operational (Table 9), we calculated the maximum generation potential in 2030 by multiplying the transmission line potential (8.3 TWh) by eight years (2023 to 2030). That value was then reduced by the Clean Energy Imports generation modeled in the 2018 AESC Study, yielding a potential of 58.1 TWh in 2030, or an avoided potential of 27.7 million short tons. Because the first Clean Energy

⁴⁰ See <https://macleanenergy.files.wordpress.com/2018/07/doer-83d-filing-letter-dpu-18-64-18-65-18-66july-23-2018.pdf>.

⁴¹ The majority of the 2018 AESC Study was completed before the winning proposal under 83D was announced. The project ultimately selected under 83D, the New England Clean Energy Connect (NECEC), is proposed to provide 9.55 TWh of energy to Massachusetts beginning in 2023.

⁴² Note that this analysis does not make any assumptions as to the siting or feasibility of any particular CEI project.

Imports line will not be producing electricity until 2023, we do not model any potentials or costs for 2020.

Table 9. Clean Energy Import timeline and potential annual generation in years 2023 to 2030

Clean Energy Import name	Online date	Year fully energized	Generation (TWh)
83D Modeled in AESC 2018	31 Dec 2022	2023	8.3
CEI A	31 Dec 2023	2024	8.3
CEI B	31 Dec 2024	2025	8.3
CEI C	31 Dec 2025	2026	8.3
CEI D	31 Dec 2026	2027	8.3
CEI E	31 Dec 2027	2028	8.3
CEI F	31 Dec 2028	2029	8.3
CEI G	31 Dec 2029	2030	8.3
Total CEI in 2030 (TWh)			66.4
Incremental CEI in 2030, relative to AESC 2018 (TWh)			58.1
Cost of CEI in 2030 (2018 \$/MWh)			\$60

Light-Duty Vehicle Electrification

Light-duty vehicle electrification is identified as a strategy for meeting compliance with the Massachusetts GWSA in the 2015 update to the *Massachusetts Clean Energy and Climate Plan for 2020*. Massachusetts is also a signatory to the zero-emission vehicle memorandum of understanding (i.e., the “ZEV MOU”), a document signed by nine states that commits these states to having at least 3.3 million electric vehicles (EV) operating on their roadways by 2025.⁴³ When this 3.3 million vehicle number is apportioned using vehicle stock or vehicle miles traveled values, it results in approximately 300,000 EVs for Massachusetts in 2025.⁴⁴ In addition, as of August 2018, one Massachusetts electric distribution company (EDC) has already received approval from the Massachusetts Department of Public Utilities to install charging infrastructure to incent the adoption of EVs. The approval creates a precedent wherein electric ratepayers pay for the cost of building publicly sited EV charging infrastructure.⁴⁵ For these reasons, deployment of light-duty vehicle electrification infrastructure is assumed to be a reasonably

⁴³ See <https://www.mass.gov/news/massachusetts-joins-nine-state-coalition-in-releasing-new-zero-emission-vehicle-action-plan>.

⁴⁴ Note that because Massachusetts follows California’s emission standards under Section 177 of the Clean Air Act, the Commonwealth is projected to have 160,000 EVs on the road in 2025 (this is in line with the California Air Resources Board’s (CARB) 2017 report *California’s Advanced Clean Cars Midterm Review*, available at https://www.arb.ca.gov/msprog/acc/mtr/acc_mtr_finalreport_full.pdf). The main scenario modeled in the 2018 AESC Study did not model any incremental EVs in place in Massachusetts or other states.

⁴⁵ See D.P.U. 12-95, D.P.U. 13-182, D.P.U. 17-05, and D.P.U. 17-13.

foreseeable strategy for reducing GHG emissions in a future lacking incremental energy efficiency in 2018 and later years.

This analysis assumes a potential for emissions reductions in Massachusetts linked to its ZEV MOU commitment (300,000 EVs by 2025). Synapse used an in-house EV adoption model to project how many EVs would be on the road in Massachusetts in 2030, given the interim target of 300,000 EVs by 2025. The EV model uses a Bass Diffusion growth curve and projects that approximately 1.2 million EVs will be on the road by 2030.⁴⁶ Additional outputs taken from this model include: annual wholesale electricity usage by EVs, avoided gasoline emissions, and annual EV sales.

For this analysis, Synapse considered only the cost of installing publicly sited, non-residential EV supply equipment (EVSE), or charging stations, to reach the potential EV penetration in 2030.⁴⁷ This analysis includes equipment and installation costs associated with Level 1 chargers, Level 2 chargers, and Direct Current Fast Chargers (DCFC).⁴⁸ NREL's January 2017 study "Infrastructure for Plug-In Electric Vehicles: A Case Study of Massachusetts" estimates the number of charging plugs—Level 1 (L1), Level 2 (L2), and DCFC—required for Massachusetts to reach its 2025 EV goal (see Table 10).⁴⁹

⁴⁶ For this analysis, EVs include battery electric vehicles (BEV) and plug-in hybrid electric vehicles (PHEV). The model assumes that 40 percent of EVs on the road are BEV and 60 percent are PHEVs, based on 2017 sales data from the Auto Alliance. For original EV sales data see: <https://autoalliance.org/energy-environment/advanced-technology-vehicle-sales-dashboard/>. This model also assumes that 50 percent of light-duty vehicles in Massachusetts are cars, with the rest being light trucks, based on 2016 fleet composition data. Massachusetts fleet composition data comes from the Federal Highway Administration's Highway Statistics: <https://www.fhwa.dot.gov/policyinformation/statistics.cfm>. Finally, the model assumes that 50 percent of the vehicle miles traveled by PHEVs is run on electricity, based on the central scenario of the NREL study "National Plug-In Electric Vehicle Infrastructure Analysis" (September 2017).

⁴⁷ The cost of publicly sited, non-residential EVSE is the cost component most likely to be addressed through state-level policymaking or utility incentives, and therefore borne by ratepayers. This is in line with programs like Eversource's "Make Ready" program (described above) wherein MA D.P.U. has approved that electric ratepayers may bear the cost of installing publicly sited electric vehicle charging infrastructure. As a result, the cost of the electric vehicles and home chargers were not included in this analysis. This analysis also does not make any assumptions regarding the economics of EVs relative to conventional vehicles in 2030, which may vary a great deal depending on the assumptions used for upfront cost, fuel savings, and maintenance savings.

⁴⁸ Only non-residential (workplace and public) EV charging stations were considered in this analysis. Generally speaking, workplace chargers are those which are accessible to employees of the company where the charger is sited, whereas public charging stations are available to any EV driver. Level 1 (L1) chargers provide electricity at 1 kW; these chargers may require 8–15 hours for a full charge. Level 2 (L2) chargers provide faster electricity than L1 chargers, at about 6 kW; a full charge may require 3–8 hours. Direct current fast chargers (DCFC) provide electricity at 50 kW and require 20 minutes to an hour for a full charge.

⁴⁹ See <https://www.nrel.gov/docs/fy17osti/67436.pdf>.

Table 10. Number of plugs required to meet the Massachusetts goal of 300,000 EVs on the road by 2025, by charger type

Charger Type	Plugs Required for 2025 EV Goal				
	<i>Low Estimate</i>	<i>High Estimate</i>	<i>Average</i>	<i>Average</i>	<i>Average</i>
	<i>Total Plugs</i>	<i>Total Plugs</i>	<i>Total Plugs</i>	<i>Plugs per 1,000 EV</i>	<i>Total Plugs</i>
Work L1	33,700	40,800	37,250	124	148,985
Public L1	1,000	2,400	1,700	6	6,799
Work L2	3,700	4,500	4,100	14	16,398
Public L2	3,700	40,700	22,200	74	88,791
DCFC	220	1,600	910	3	3,640
Total	42,320	90,000	66,160	221	264,613

Source: NREL. *Infrastructure for Plug-In Electric Vehicles: A Case Study of Massachusetts*. January 2017.

The ratio of plugs per EV was applied to the projected number of EVs on the road in 2030 from the EV model to calculate the total number of plugs required in 2030. That value was then converted from plugs to charging stations, as stations commonly have multiple plugs.⁵⁰ Using EVSE equipment and installation costs from the Department of Energy’s 2015 report “Costs Associated with Non-Residential Electric Vehicle Supply Equipment” (see Table 11), we calculated a total EVSE cost for 2030.⁵¹

Table 11. Equipment and installation costs associated with each type of EV charging station

Charger Type	Equipment Costs			Installation Costs		
	<i>Low</i>	<i>High</i>	<i>Average</i>	<i>Low</i>	<i>High</i>	<i>Average</i>
	<i>2011 \$</i>	<i>2011 \$</i>	<i>2011 \$</i>	<i>2011 \$</i>	<i>2011 \$</i>	<i>2011 \$</i>
Level 1	\$300	\$1,500	\$900	\$0	\$3,000	\$1,500
Level 2	\$400	\$6,500	\$3,450	\$600	\$12,700	\$6,650
DCFC	\$10,000	\$40,000	\$25,000	\$4,000	\$51,000	\$27,500
Total	\$10,700	\$48,000	\$29,350	\$4,600	\$66,700	\$35,650

Source: U.S. DOE. *Costs Associated with Non-Residential Electric Vehicle Supply Equipment*. November 2015.

Because the EVSE costs associated with the 2030 EV goal will be spent incrementally between 2018 and 2030, the total cost was spread over the period of 2018 through 2030, scaled to the number of EV sales

⁵⁰ We assume an average of one plug per station for L1, two plugs per station for L2 (per requirements of MassDEP’s MassEVIP [Electric Vehicle Incentive Program] grant application for Fleets, available at https://www.mass.gov/files/documents/2017/11/08/massevipap_6.pdf), and four plugs per station for DCFC (NREL Sept. 2017, available at <https://www.nrel.gov/docs/fy17osti/69031.pdf>).

⁵¹ These costs are for single-plug charging stations, but they were applied for all chargers due to a lack of data on how cost scales with additional ports. See https://www.afdc.energy.gov/uploads/publication/evse_cost_report_2015.pdf for more information.

estimated for each year. Furthermore, because EVSE funds have already been committed via the Volkswagen Settlement Funds⁵² and the Eversource Make-Ready Program⁵³ and are therefore not paid by ratepayers (VW) or are unavoidable (Eversource), those annual investments were subtracted from 2019 to 2022, yielding the net annual EVSE cost needed to achieve the Massachusetts EV goal in those years. The incremental 2030 costs were used to calculate the all-in costs for EVs in 2030. In 2020, the estimated incremental cost of EVSE deployment is \$0 million. In 2030, the estimated incremental cost of EVSE deployment is \$185 million (see Table 12). Note that reliance on public EVSE decreases as vehicle range improves, meaning that cost estimates may be lower if electric vehicle technological advancements continue.

Synapse calculated emissions impacts by taking the avoided gasoline emissions from the EV model and subtracting the additional emissions from grid electricity usage by EVs. Additional emissions were calculated for each year by multiplying the annual EV grid electricity usage (TWh) from the EV model by the 2018 AESC average summer electricity emissions rate. This yields a potential of 1.2 million short tons of avoided CO₂ emissions in 2030, implying a cost per short ton of \$151 (see Table 12).

Table 12. Incremental costs and avoided emissions from electrification of light-duty vehicles in 2020 and 2030

		2018	2019	2020	2030
Total Incremental EVSE Expenditures	<i>2018 \$ million</i>	\$6	\$9	\$12	\$185
VW Settlement Investment	<i>2018 \$ million</i>	\$0	-\$5	-\$3	\$0
Eversource Makeready Investment	<i>2018 \$ million</i>	\$0	\$0	-\$9	\$0
Net Incremental EVSE Expenditures	<i>2018 \$ million</i>	\$6	\$4	\$0	\$185
Net Avoided Emissions	<i>million short tons</i>	0.05	0.06	0.08	1.22
Incremental EVSE Cost	<i>2018 \$ million / short ton</i>	\$117	\$55	\$0	\$151

Note: In 2020, the net incremental EVSE expenditures is \$0 million because the Volkswagen Funds and the Eversource Make-Ready program together fulfill the required EVSE investment for that year. The same is true for 2021 and 2022 (not shown).

⁵² Massachusetts plans to spend \$5 million (of the \$11.25 million available for EVSE) in 2019, the first year of the program. We assume that remaining available funds are spent equally in the two subsequent years (2020 and 2021). See https://www.mass.gov/files/documents/2018/07/19/vw-draftbmp_0.pdf for more information.

⁵³ Eversource is committing \$45 million from 2020 through 2022 for “make-ready” electric vehicle charging infrastructure, which includes all prep and site work for everything up to, but not including, the charging station (i.e., the Eversource program covers the installation portion of total EVSE costs, but not the equipment costs). In 2022, 100 percent of the required EVSE investment for that year is fulfilled by Eversource Make Ready program; the implicit assumption is that Eversource’s three-year investment front-loads make-ready infrastructure, allowing investments in later years to be directed more towards the accompanying charging stations. See [https://www.eversource.com/content/docs/default-source/investors/d-p-u-17-05-final-order-\(revenue-requirement\)-11-30-17.pdf](https://www.eversource.com/content/docs/default-source/investors/d-p-u-17-05-final-order-(revenue-requirement)-11-30-17.pdf) for more information.

APPENDIX A. AVOIDED COST OF GWSA COMPLIANCE DETAIL

This section provides additional detail on the derivation of avoided costs for 2018 and 2019 in Table 13 and Table 14. The detail in these tables correspond to the detail presented for 2020 and 2030 (see Table 3 and Table 4).

Table 13. Calculating the avoided cost of GWSA compliance in 2018

	All-In Costs	Incremental Costs		Incremental Potential		Notes
	2018 \$/MWh	2018 \$/MWh	2018 \$/short ton	GWh	million short tons	
	a	b	c	d	e	
Onshore wind	\$65	\$33	\$69	1,011	0.5	
Offshore wind	-	-	-	-	-	<i>Assumed none in 2018</i>
Large solar	\$42	\$10	\$21	1,128	0.5	<i>Utility</i>
Medium solar	\$86	\$54	\$114	1,152	0.5	<i>Commercial</i>
Small solar	\$114	\$82	\$172	1,738	0.8	<i>Residential</i>
Clean Energy Imports	-	-	-	-	-	<i>Assumed none in 2018</i>
Light-duty vehicle electrification	-	-	\$117	-	0.1	<i>Public charging infrastructure costs only</i>
2018 Weighted Avg Avoided Cost	-	-	\$105	-	-	

Notes: The weighted average avoided cost is calculated by calculating the average of \$-per-ton values in column "c" using the weights in column "e". Potentials are incremental to the quantity of the strategy that is already modeled within the main 2018 AESC study. This \$-per-ton value is then converted into an incremental \$-per-MWh value (see Table 5) using the summer on-peak emission rate identified in Table 150 of the 2018 AESC Study (June 1 release). This note applies to this table, as well as Table 14.

Table 14. Calculating the avoided cost of GWSA compliance in 2019

	All-In Costs	Incremental Costs		Incremental Potential		Notes
	2018 \$/MWh	2018 \$/MWh	2018 \$/short ton	GWh	million short tons	
	a	b	c	d	e	
Onshore wind	\$65	\$33	\$70	0	0.0	
Offshore wind	-	-	-	-	-	<i>Assumed none in 2019</i>
Large solar	\$43	\$11	\$23	5,614	2.7	<i>Utility</i>
Medium solar	\$86	\$55	\$115	1,303	0.6	<i>Commercial</i>
Small solar	\$115	\$83	\$175	1,073	0.5	<i>Residential</i>
Clean Energy Imports	-	-	-	-	-	<i>Assumed none in 2019</i>
Light-duty vehicle electrification	-	-	\$55	-	0.1	<i>Public charging infrastructure costs only</i>
2019 Weighted Avg Avoided Cost	-	-	\$58	-	-	

APPENDIX B. AVOIDED GWSA COMPLIANCE COSTS

The following tables contain detailed annual information on the avoided costs of Massachusetts GWSA compliance. Table 15 provides information on avoided costs for electric measures in a similar format to Appendix B of the 2018 AESC Study. Table 16 provides information for avoided costs for non-electric measures in a similar format to Table 130 of the 2018 AESC Study.

Table 15. Massachusetts GWSA avoided cost of compliance for electric measures

	Wholesale Incremental GWSA Cost of Compliance				Retail Incremental GWSA Cost of Compliance ¹			
	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
Units:	\$/kWh	\$/kWh	\$/kWh	\$/kWh	\$/kWh	\$/kWh	\$/kWh	\$/kWh
Period:	i	ii	iii	iv	v = i*(1+DL)	vi = ii*(1+DL)	vii = iii*(1+DL)	viii = iv*(1+DL)
2018	0.0512	0.0523	0.0499	0.0502	0.0553	0.0565	0.0539	0.0543
2019	0.0285	0.0291	0.0277	0.0279	0.0308	0.0314	0.0299	0.0302
2020	0.0200	0.0205	0.0195	0.0197	0.0216	0.0221	0.0211	0.0212
2021	0.0194	0.0198	0.0189	0.0190	0.0210	0.0214	0.0204	0.0206
2022	0.0188	0.0192	0.0183	0.0184	0.0203	0.0207	0.0198	0.0199
2023	0.0182	0.0186	0.0177	0.0178	0.0196	0.0201	0.0191	0.0193
2024	0.0176	0.0179	0.0171	0.0172	0.0190	0.0194	0.0185	0.0186
2025	0.0170	0.0173	0.0165	0.0166	0.0183	0.0187	0.0178	0.0180
2026	0.0163	0.0167	0.0159	0.0160	0.0176	0.0180	0.0172	0.0173
2027	0.0157	0.0161	0.0153	0.0154	0.0170	0.0173	0.0165	0.0166
2028	0.0151	0.0154	0.0147	0.0148	0.0163	0.0167	0.0159	0.0160
2029	0.0145	0.0148	0.0141	0.0142	0.0156	0.0160	0.0152	0.0153
2030	0.0139	0.0142	0.0135	0.0136	0.0150	0.0153	0.0146	0.0147
2031	0.0132	0.0135	0.0129	0.0130	0.0143	0.0146	0.0139	0.0140
2032	0.0126	0.0129	0.0123	0.0124	0.0136	0.0139	0.0133	0.0134
2033	0.0121	0.0123	0.0118	0.0118	0.0130	0.0133	0.0127	0.0128
2034	0.0115	0.0118	0.0112	0.0113	0.0125	0.0127	0.0121	0.0122
2035	0.0110	0.0113	0.0107	0.0108	0.0119	0.0122	0.0116	0.0117
2036	0.0106	0.0108	0.0103	0.0104	0.0114	0.0116	0.0111	0.0112
2037	0.0101	0.0103	0.0098	0.0099	0.0109	0.0111	0.0106	0.0107
2038	0.0097	0.0099	0.0094	0.0095	0.0104	0.0107	0.0102	0.0102
2039	0.0092	0.0094	0.0090	0.0091	0.0100	0.0102	0.0097	0.0098
2040	0.0088	0.0090	0.0086	0.0087	0.0095	0.0097	0.0093	0.0094
2041	0.0084	0.0086	0.0082	0.0083	0.0091	0.0093	0.0089	0.0089
2042	0.0081	0.0082	0.0079	0.0079	0.0087	0.0089	0.0085	0.0086
2043	0.0077	0.0079	0.0075	0.0076	0.0083	0.0085	0.0081	0.0082
2044	0.0074	0.0075	0.0072	0.0072	0.0080	0.0081	0.0078	0.0078
2045	0.0071	0.0072	0.0069	0.0069	0.0076	0.0078	0.0074	0.0075
2046	0.0068	0.0069	0.0066	0.0066	0.0073	0.0074	0.0071	0.0072
2047	0.0065	0.0066	0.0063	0.0063	0.0070	0.0071	0.0068	0.0068
2048	0.0062	0.0063	0.0060	0.0061	0.0067	0.0068	0.0065	0.0065
2049	0.0059	0.0060	0.0057	0.0058	0.0064	0.0065	0.0062	0.0063
2050	0.0056	0.0058	0.0055	0.0055	0.0061	0.0062	0.0059	0.0060

Levelized Costs								
10 years (2018-2027)	0.0226	0.0230	0.0220	0.0221	0.0244	0.0249	0.0237	0.0239
15 years (2018-2032)	0.0199	0.0203	0.0193	0.0195	0.0214	0.0219	0.0209	0.0210
30 years (2018-2047)	0.0150	0.0153	0.0146	0.0147	0.0162	0.0166	0.0158	0.0159

Levelized Costs								
10 years (2019-2028)	0.0188	0.0192	0.0183	0.0184	0.0203	0.0207	0.0197	0.0199
15 years (2019-2033)	0.0171	0.0174	0.0166	0.0167	0.0184	0.0188	0.0179	0.0181
30 years (2019-2048)	0.0133	0.0136	0.0129	0.0130	0.0144	0.0147	0.0140	0.0141

Notes: All avoided costs are in 2018 Dollars. ISO New England periods are: Summer is June through September; winter is all other months. Peak hours are Monday through Friday 7 AM–11 PM; Off-Peak Hours are all other hours. Avoided retail cost of GWSA compliance = (wholesale avoided cost) * (1 + Distribution Losses), e.g., $v = i * (1 + 8.0\%)$.

Table 16. Avoided costs of Massachusetts GWSA compliance for natural gas, petroleum fuels, and other fuels by sector

Year	Natural Gas			Fuel Oils						Other Fuels					
	Residential \$/MMBtu	Commercial \$/MMBtu	Industrial \$/MMBtu	Residential	Commercial			Industrial			Residential				Industrial
				Distillate Fuel Oil \$/MMBtu	Distillate Fuel Oil \$/MMBtu	Residual Fuel Oil \$/MMBtu	Weighted Average \$/MMBtu	Distillate Fuel Oil \$/MMBtu	Residual Fuel Oil \$/MMBtu	Weighted Average \$/MMBtu	Cord Wood \$/MMBtu	Pellets \$/MMBtu	Kerosene \$/MMBtu	Propane \$/MMBtu	Kerosene \$/MMBtu
2018	\$6.13	\$6.13	\$6.13	\$8.43	\$8.43	\$9.06	\$8.45	\$8.43	\$9.06	\$8.48	\$0.00	\$0.00	\$8.33	\$7.28	\$8.33
2019	\$3.41	\$3.41	\$3.41	\$4.69	\$4.69	\$5.04	\$4.70	\$4.69	\$5.04	\$4.72	\$0.00	\$0.00	\$4.63	\$4.05	\$4.63
2020	\$2.40	\$2.40	\$2.40	\$3.30	\$3.30	\$3.55	\$3.31	\$3.30	\$3.55	\$3.32	\$0.00	\$0.00	\$3.26	\$2.85	\$3.26
2021	\$2.32	\$2.32	\$2.32	\$3.20	\$3.20	\$3.44	\$3.21	\$3.20	\$3.44	\$3.22	\$0.00	\$0.00	\$3.16	\$2.76	\$3.16
2022	\$2.25	\$2.25	\$2.25	\$3.10	\$3.10	\$3.33	\$3.10	\$3.10	\$3.33	\$3.11	\$0.00	\$0.00	\$3.06	\$2.67	\$3.06
2023	\$2.18	\$2.18	\$2.18	\$2.99	\$2.99	\$3.22	\$3.00	\$2.99	\$3.22	\$3.01	\$0.00	\$0.00	\$2.96	\$2.59	\$2.96
2024	\$2.10	\$2.10	\$2.10	\$2.89	\$2.89	\$3.11	\$2.90	\$2.89	\$3.11	\$2.91	\$0.00	\$0.00	\$2.86	\$2.50	\$2.86
2025	\$2.03	\$2.03	\$2.03	\$2.79	\$2.79	\$3.00	\$2.80	\$2.79	\$3.00	\$2.81	\$0.00	\$0.00	\$2.76	\$2.41	\$2.76
2026	\$1.95	\$1.95	\$1.95	\$2.69	\$2.69	\$2.89	\$2.70	\$2.69	\$2.89	\$2.70	\$0.00	\$0.00	\$2.66	\$2.32	\$2.66
2027	\$1.88	\$1.88	\$1.88	\$2.59	\$2.59	\$2.78	\$2.59	\$2.59	\$2.78	\$2.60	\$0.00	\$0.00	\$2.56	\$2.23	\$2.56
2028	\$1.81	\$1.81	\$1.81	\$2.49	\$2.49	\$2.67	\$2.49	\$2.49	\$2.67	\$2.50	\$0.00	\$0.00	\$2.45	\$2.15	\$2.45
2029	\$1.73	\$1.73	\$1.73	\$2.38	\$2.38	\$2.56	\$2.39	\$2.38	\$2.56	\$2.40	\$0.00	\$0.00	\$2.35	\$2.06	\$2.35
2030	\$1.66	\$1.66	\$1.66	\$2.28	\$2.28	\$2.45	\$2.29	\$2.28	\$2.45	\$2.30	\$0.00	\$0.00	\$2.25	\$1.97	\$2.25
2031	\$1.58	\$1.58	\$1.58	\$2.18	\$2.18	\$2.34	\$2.19	\$2.18	\$2.34	\$2.19	\$0.00	\$0.00	\$2.15	\$1.88	\$2.15
2032	\$1.51	\$1.51	\$1.51	\$2.08	\$2.08	\$2.23	\$2.08	\$2.08	\$2.23	\$2.09	\$0.00	\$0.00	\$2.05	\$1.79	\$2.05
2033	\$1.44	\$1.44	\$1.44	\$1.99	\$1.99	\$2.14	\$1.99	\$1.99	\$2.14	\$2.00	\$0.00	\$0.00	\$1.96	\$1.72	\$1.96
2034	\$1.38	\$1.38	\$1.38	\$1.90	\$1.90	\$2.04	\$1.91	\$1.90	\$2.04	\$1.91	\$0.00	\$0.00	\$1.88	\$1.64	\$1.88
2035	\$1.32	\$1.32	\$1.32	\$1.82	\$1.82	\$1.95	\$1.82	\$1.82	\$1.95	\$1.83	\$0.00	\$0.00	\$1.80	\$1.57	\$1.80
2036	\$1.26	\$1.26	\$1.26	\$1.74	\$1.74	\$1.87	\$1.74	\$1.74	\$1.87	\$1.75	\$0.00	\$0.00	\$1.72	\$1.50	\$1.72
2037	\$1.21	\$1.21	\$1.21	\$1.66	\$1.66	\$1.79	\$1.67	\$1.66	\$1.79	\$1.67	\$0.00	\$0.00	\$1.64	\$1.44	\$1.64
2038	\$1.16	\$1.16	\$1.16	\$1.59	\$1.59	\$1.71	\$1.59	\$1.59	\$1.71	\$1.60	\$0.00	\$0.00	\$1.57	\$1.37	\$1.57
2039	\$1.10	\$1.10	\$1.10	\$1.52	\$1.52	\$1.63	\$1.52	\$1.52	\$1.63	\$1.53	\$0.00	\$0.00	\$1.50	\$1.31	\$1.50
2040	\$1.06	\$1.06	\$1.06	\$1.45	\$1.45	\$1.56	\$1.46	\$1.45	\$1.56	\$1.46	\$0.00	\$0.00	\$1.44	\$1.25	\$1.44
2041	\$1.01	\$1.01	\$1.01	\$1.39	\$1.39	\$1.49	\$1.39	\$1.39	\$1.49	\$1.40	\$0.00	\$0.00	\$1.37	\$1.20	\$1.37
2042	\$0.97	\$0.97	\$0.97	\$1.33	\$1.33	\$1.43	\$1.33	\$1.33	\$1.43	\$1.34	\$0.00	\$0.00	\$1.31	\$1.15	\$1.31
2043	\$0.92	\$0.92	\$0.92	\$1.27	\$1.27	\$1.37	\$1.27	\$1.27	\$1.37	\$1.28	\$0.00	\$0.00	\$1.26	\$1.10	\$1.26
2044	\$0.88	\$0.88	\$0.88	\$1.22	\$1.22	\$1.31	\$1.22	\$1.22	\$1.31	\$1.22	\$0.00	\$0.00	\$1.20	\$1.05	\$1.20
2045	\$0.84	\$0.84	\$0.84	\$1.16	\$1.16	\$1.25	\$1.17	\$1.16	\$1.25	\$1.17	\$0.00	\$0.00	\$1.15	\$1.00	\$1.15
2046	\$0.81	\$0.81	\$0.81	\$1.11	\$1.11	\$1.19	\$1.11	\$1.11	\$1.19	\$1.12	\$0.00	\$0.00	\$1.10	\$0.96	\$1.10
2047	\$0.77	\$0.77	\$0.77	\$1.06	\$1.06	\$1.14	\$1.07	\$1.06	\$1.14	\$1.07	\$0.00	\$0.00	\$1.05	\$0.92	\$1.05
2048	\$0.74	\$0.74	\$0.74	\$1.02	\$1.02	\$1.09	\$1.02	\$1.02	\$1.09	\$1.02	\$0.00	\$0.00	\$1.00	\$0.88	\$1.00
2049	\$0.71	\$0.71	\$0.71	\$0.97	\$0.97	\$1.04	\$0.97	\$0.97	\$1.04	\$0.98	\$0.00	\$0.00	\$0.96	\$0.84	\$0.96
2050	\$0.68	\$0.68	\$0.68	\$0.93	\$0.93	\$1.00	\$0.93	\$0.93	\$1.00	\$0.94	\$0.00	\$0.00	\$0.92	\$0.80	\$0.92
Levelized Costs															
10 years (2018-2027)	\$2.70	\$2.70	\$2.70	\$3.71	\$3.71	\$3.99	\$3.72	\$3.71	\$3.99	\$3.74	\$0.00	\$0.00	\$3.67	\$3.21	\$3.67
15 years (2018-2032)	\$2.38	\$2.38	\$2.38	\$3.27	\$3.27	\$3.51	\$3.28	\$3.27	\$3.51	\$3.29	\$0.00	\$0.00	\$3.23	\$2.82	\$3.23
30 years (2018-2047)	\$1.80	\$1.80	\$1.80	\$2.47	\$2.47	\$2.66	\$2.48	\$2.47	\$2.66	\$2.49	\$0.00	\$0.00	\$2.44	\$2.13	\$2.44
Levelized Costs															
10 years (2019-2028)	\$2.25	\$2.25	\$2.25	\$3.09	\$3.09	\$3.32	\$3.10	\$3.09	\$3.32	\$3.11	\$0.00	\$0.00	\$3.05	\$2.67	\$3.05
15 years (2019-2033)	\$2.04	\$2.04	\$2.04	\$2.81	\$2.81	\$3.02	\$2.82	\$2.81	\$3.02	\$2.83	\$0.00	\$0.00	\$2.77	\$2.43	\$2.77
30 years (2019-2048)	\$1.59	\$1.59	\$1.59	\$2.19	\$2.19	\$2.35	\$2.19	\$2.19	\$2.35	\$2.20	\$0.00	\$0.00	\$2.16	\$1.89	\$2.16

Notes: All avoided costs are in 2018 dollars per MMBtu. Emission rates for wood products are assumed to be zero.

Appendices

M. **Strategic Evaluation Plan**



2019–2021

Massachusetts Joint Statewide Three-Year Energy Efficiency Strategic Evaluation Plan April Draft



April 20, 2018

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1. BACKGROUND OF EM&V

1.1 INTRODUCTION

Evaluation, Measurement and Verification (EM&V) has been an integral component of the efficiency programs in Massachusetts since their inception. The robust EM&V framework has led to verifiable energy efficiency savings and benefits and has supported continuous improvement in the delivery of cost-effective programs. Over time, the EM&V process has become more rigorous and strategic and has incorporated a long-term evaluation planning approach. From 2013 to 2016, the program administrators (PAs) completed 126¹ EM&V studies at a total cost of \$58.4 million².

The Evaluation Management Committee (EMC) is a collaborative group of PAs and the Energy Efficiency Advisory Council (EEAC or “Council”) EM&V consultants. The statewide process for planning energy efficiency activities for 2019-21 represents a good opportunity for the EMC to regroup and think more proactively and comprehensively about EM&V priorities. To that end, this 2019–2021 Strategic Evaluation Plan (SEP) lays out the EMC’s strategy for EM&V activities in 2019–2021, including priorities for research and policies to guide decision making and approaches to EM&V. This April version represents the first draft to correspond with the April draft of the 2019–2021 Energy Efficiency Plan and, as such, does not yet include plans for specific studies. Specific studies will be included in the October 2018 version of the SEP. Additionally, the material in this draft may be updated to reflect changing circumstances (e.g., the scope of programs or budgets change, programs are added or dropped).

This strategic exercise is particularly important given the maturation of programs and rapid changes in markets (e.g., lighting and HVAC). Demand side management (DSM³) programs in the 2019–2021 SEP are expected to experience substantial changes in terms of the types and depth of programs that will be delivered, such as moving upstream, demand response (DR), and energy optimization. The EMC needs to be agile and responsive to program needs as they adjust to changing conditions, and do so in a way that is efficient, reasonable, and valuable. Toward that end, recent experience has uncovered some aspects of the policies and processes of EM&V in Massachusetts that the EMC plans to refine for the next three-year period, as discussed in the sections below.

By improving planning and processes, the EMC will have the ability to carry out and manage well-developed, well-intended, transparent, and rigorous EM&V studies that are useful, practical, and appropriate to DSM programs. These improvements include considerations on how to select new evaluations studies that will provide the most value to programs and ratepayers, as well as changes in policy that will give increased flexibility and confidence to verify savings and make continuous program improvements in a practical, sustainable way.

1.2 EM&V STUDIES

¹ Source: Completed studies from 2012–2016 annual reports and 2016–2018 SEP.

² Source: Mass Save from 2013 to 2016 for both electric and gas EM&V. Includes evaluation staff salaries, which account for approximately 10% to 20% of the total.

³ This document generalizes future efforts to include energy efficiency and demand response.

EM&V refers to the systematic collection and analysis of information to document the impacts of DSM programs and recommend improvements in program design and delivery. In Massachusetts, EM&V is divided into three major research areas: Residential; Commercial and Industrial (C&I); and Special and Cross-Cutting (SCC). These research areas are discussed in Sections 5, 6, and 7 below. EM&V includes the following types of studies, which are often conducted in coordination with each other:

- **Impact evaluation** refers to the measurement of gross energy and demand (electric and natural gas) savings achieved within overall program populations. Impact evaluations may also include the study of key impact factors to estimate savings, such as in-service rates and other resource savings, including water and non-utility fuels (e.g., propane and oil).
- **Baseline studies** refer to specific research to determine baselines, such as industry-standard practice baselines. Baseline research is sometimes conducted at the same time as impact evaluation studies.
- **Net-to-gross (NTG) studies** refer to specific research that estimates free-ridership and the various components of spillover (e.g., participant and/or non-participant spillover).
- **Market effects evaluation** refers to the measurement of the effects that programs or measures have on the structure and functioning of their target markets.
- **Non-energy impact (NEI) studies** refer to research that estimates NEIs of DSM measures, including participant and utility benefits. These benefits include operations and maintenance (O&M), comfort, productivity, avoided arrearages, etc.
- **Cost and measure life studies** include research to determine the total and incremental costs and lifetime of DSM measures.
- **Market characterization** refers to the systematic assessment of DSM markets for the purpose of improving the effectiveness of programs targeting those markets.
- **Process evaluation** refers to the systematic assessment of programs for the purpose of documenting their operations and developing recommendations to improve their effectiveness and design. It may also include marketing studies to understand the effectiveness of various marketing approaches.

1.3 PURPOSES OF EM&V

Fundamentally, EM&V is used to meet regulatory commitments to the Department of Public Utilities (DPU) and the ISO New England (ISO), as well as providing ratepayers and stakeholders confidence that programs are effective and that estimates of claimed savings are credible. The EMC will continue the evaluation framework that has successfully resulted in high-quality, independent EM&V efforts. It is critical that the programs are evaluated, measured, and verified in a way that provides confidence to stakeholders, including the DPU, the ISO, the EEAC, the public, and internal PAS' departments⁴.

The key purposes of EM&V are to ensure accurate and credible impacts, determine cost effectiveness, and support continuous improvement, as shown in Figure 1 below. These purposes are interactive and are all equally important.

⁴ Such as load forecasting, planning, program implementation.

Figure 1: EM&V Purposes



1.3.1 ENSURE ACCURATE AND CREDIBLE IMPACTS

EM&V ensures that program impacts reported to stakeholders are credible and sufficiently accurate for decision-making. Program impacts include gross resource savings, NTG factors, measure lives, and NEIs. These impacts are credible to stakeholders when the results are fact-based and reproducible and when the information is communicated in an understandable, transparent way that identifies actionable steps and key sources of uncertainty and limitations.

The primary studies that support this purpose are impact, NTG, market effects, NEI, and baseline studies (see Section 1.2 . Yet, EM&V research is interactive and other studies also support this purpose, as shown in Table 1 below.

1.3.2 DETERMINE COST EFFECTIVENESS

The determination of cost effectiveness is important for ensuring that the programs are an effective use of ratepayer funds. EM&V calculates the costs associated with DSM programs by researching total and incremental measure costs. Using the credible impacts described above, ratepayer-funded programs are determined to be cost effective if their benefits are greater than their costs (or the ratio of benefits to costs is greater than 1). The primary EM&V studies that support this purpose are cost studies, as well as the impact studies listed above.

1.3.3 SUPPORT CONTINUOUS IMPROVEMENT

EM&V identifies strengths, limitations, and areas for program improvement to ensure that programs are valuable for ratepayers and other stakeholders. These studies help identify if programs are well-designed, well-run, and beneficial to customers. This type of research is focused on the future and how programs can improve to better serve customers, adjust to changing conditions, and achieve program goals. The primary research types for this purpose are process evaluation and market characterization studies, although many other types of research inform continuous improvement, as shown below.

Table 1: EM&V Purposes and Studies

Studies/Purposes	Ensure Accurate, Credible Impacts	Determine Cost Effectiveness	Support Continuous Improvement
Impact Evaluation and NTG Studies	☑	☑	✓
Baseline Studies	☑	✓	✓
Market Effects Evaluation	☑	☑	✓
NEI Studies	☑	☑	✓
Cost Studies		☑	✓
Measure Life Studies	☑	☑	
Market Characterization	✓		☑
Process Evaluation		✓	☑
Legend: Primary Purpose ☑, Secondary Purpose ✓			

1.4 PRINCIPLES OF EM&V

EM&V must meet the purposes described above and uphold the principles of being valuable, high quality, reasonable, and cost efficient. These principles do not have a hierarchy; each principle is equally important and therefore a balance is required to maintain them concurrently. For example, if EM&V raises the expectation of accuracy too high, it can impose unnecessary time and cost burdens on vendors and customers and can result in program barriers, which prevents meaningful projects from moving forward.

1.4.1 VALUABLE

EM&V provides value to all stakeholders, maintaining a key focus on benefits to ratepayers and program implementation. In order to provide value:

- EM&V is communicated effectively, which means the research is transparent, understandable, timely, and actionable.
- EM&V focuses on key information and is inclusive of future needs, recognizing that understanding the past is a way to make improvements for the future.
- EM&V is relevant to the underlying program or measure and consistent with the tracking and reporting approaches of the PAs, whenever possible.

1.4.2 HIGH QUALITY

EM&V is executed with independence and high quality throughout all aspects of its planning, implementing, and reporting. It adheres to standard EM&V methods for conducting EM&V of energy efficiency programs, including leveraging resources like the Uniform Methods Project and International Performance Measurement and Verification Protocols, where relevant. It also adheres to the ISO’s requirements for measuring and verifying reductions in demand, particularly for statistical precision and accuracy, as well as specifications for measurement of equipment. Where existing methods are not sufficient,

development of new EM&V approaches may be considered as long as the other principles are upheld. EM&V methods are clearly documented and defined, which supports consistency (across state, sectors, and programs), reduces evaluation time, and mitigates risk of differences between evaluation and program implementation assumptions.

1.4.3 REASONABLE

EM&V meets its purposes (credible impacts, etc.) in a way that is reasonable and sufficient for decision-making needs. The effort and rigor of studies vary to account for issues such as amount of savings relative to the portfolio, level of uncertainty, participant population sizes, data security, and intended usage of results. Approaches are structured to deliver accurate results but avoid introducing false precision. EM&V is understandable and as simple as possible, being sensitive to unnecessarily increasing complexity in methodology, especially when such complexity (or additional studies) will not add meaningful improvements to accuracy. Generally, EM&V tries to minimize burden (e.g., telephone surveys and site visits) on customers, including financial burden, time, and effort. The number of studies is manageable for the EMC, and the resulting findings and recommendations are actionable and manageable for program implementation staff.

1.4.4 COST EFFICIENT

As with other DSM activities, EM&V must be cost efficient for the ratepayers, ensuring that evaluation resources are spent effectively. This condition means that the effort of EM&V is justified by the value of the information and that, as studies increase in cost, their associated value also rises.

1.5 EM&V FRAMEWORK

Consistent with past three-year plans and the Council's September 8, 2009 EM&V Resolution, the PAs propose to continue the evaluation framework that has successfully allowed the EMC to engage in high-quality third-party EM&V efforts. The Council and the PAs find that it is critical that the programs be evaluated, measured, and verified in a way that provides confidence to the public at large that the savings are real and in a way that enables the PAs to report those savings to the DPU with full confidence. Additionally, the Council stated that there is a need to ensure both the reality and the perception of the independence and objectivity of EM&V activities, as well as a need to help ensure consistency, timeliness, and credibility of the results. Accordingly, the Council will continue to have an oversight role over the EM&V activities of the PAs to ensure the objectivity and independence of those activities (and the perception of such) and to help ensure consistency, timeliness, and credibility. The Council's oversight role will be accomplished through the Council's EM&V consultants ("EM&V Consultants"), a team of third-party expert consultants that has primary responsibility for working with the PAs to plan and implement high-quality EM&V activities in Massachusetts.

The PAs and the EM&V Consultants will continue to work diligently to reach a consensus on evaluation issues. Areas of difference may arise, however, that cannot be resolved through consensus during the ongoing interactive process between the EM&V Consultants and the PA evaluation staff. In this instance, authority for decision-making will reside with the EM&V Consultants and the Council.

An appeals process has been established to enable the PAs to fulfill their responsibility of reporting program savings to the DPU with full confidence. Under the appeals process, the PAs may bring decisions made by the EM&V Consultants or the Council to an Appeals Committee for review and resolution. The Council forms the Appeals Committee, whose responsibility is to hear the matter under dispute and rule so that the study may proceed in a timely way. In general, it is expected that this review process will be completed within 72 hours once an issue is elevated to the Appeals Committee. The Appeals Committee will consist of three voting members of the Council, including the Department of Energy Resources

(DOER). Consistent with general Council proceedings, the Appeals Committee will include and consult with, in both deliberations and decision-making, a representative of both the PAs and the Council's consultant team, neither of whom shall have a vote in the standing committee. The Appeals Committee will review the issues related to the disputed matter, hear from the PA evaluation staff and EM&V Consultants, and make a determination on the outcome of the matter. The decision will be recorded, along with a description of the applicable issues. The participants in the appeal will sign the record of the decision, indicating their acceptance and the representation of the issues and the decision. In exceptional cases, where the PAs perceive there to be significant risk to their ability to manage the energy efficiency programs in the near term, the PAs will note their disagreement with the decision of the Appeals Committee on the record of the decision and reserve the right to immediately petition the DPU on the Appeals Committee's decision. The PAs shall be able to submit any such documents to the DPU in conjunction with the filing of the three-year plans, mid-term modifications, and term reports. The DPU will be able to review the record of this decision in its review of three-year plans, mid-term modifications, plan-year reports, and term reports.

As discussed below, the EMC has been a key component to keeping communication channels open. To date, all major disagreements have been resolved through a data-driven consensus process. It is a testament to the hard work and collaborative engagement of the PAs and the EM&V Consultants that the appeals process has not been invoked to date.

The PAs will maintain a statewide focus to the maximum extent possible, will review EM&V budgets with the EM&V Consultants, and will integrate electric and gas evaluation efforts to the maximum extent possible. The PAs will be the main mechanism for contracting with the independent evaluation contractors and will work with evaluation contractors to maintain privacy of customer data.

1.5.1 EVALUATION MANAGEMENT COMMITTEE (EMC)

The PAs and the EM&V Consultants established the EMC to be similar to other management committees. The EMC serves as a steering committee for statewide evaluation issues, providing guidance and direction to each of the evaluation research areas. The EMC works to plan, prioritize, and delineate the research studies to be undertaken over the three-year plan period.

The PAs and the EM&V Consultants have worked to consistently improve the EM&V process over time. As issues arise, the EMC has established working groups to review and address new topics, areas of concern, or disagreement. For example, in 2017 the EMC realized that DR evaluations were being completed by individual PAs, along with EM&V Consultants, and only final results were shared with the full EMC. In response to that issue, the EMC formed an EM&V DR subcommittee that includes a member of each electric PA and members of the EM&V Consultant team. This group meets bi-weekly and has helped ensure that the EMC is up to speed on all issues. The EMC will continue to establish appropriate working groups to address issues as they arise and keep the EM&V process running smoothly.

2. EM&V SUMMIT AND KEY STRATEGIC ISSUES

2.1 EM&V SUMMIT OVERVIEW AND FINDINGS

To encourage early participation in the evaluation planning process, the PAs hosted a Strategic Evaluation Planning Summit (Summit) in December 2017. The Summit provided a forum for the EMC, DOER, the Residential Management Committee (RMC), C&I Management Committee (C&IMC), evaluation contractor teams, and EM&V Consultants to identify emerging evaluation topics and activities. The following list represents key issues discussed during the Summit:

- It is important to maintain the **collaborative environment** of the EM&V framework.
- Improved **communication and collaboration between evaluation and implementation** is needed, such as presenting evaluation results in a timely manner and providing more Quick Hit (or “fast track”) studies to inform program design.
- Improved **prioritization of studies** would be valuable, such as creating a prioritization framework and having a champion for each study.
- **Reporting improvements** are needed, including clearer definitions, templates for recommendations, and justification for why the recommendation is needed.
- **Baselines** need to be credible, and additional policy and discussion is needed on industry-standard baselines.
- Important **new technologies and emerging issues** should be considered, such as DR, electric vehicles, load shapes, and energy optimization.
- Research and savings claims of **market effects** should be facilitated by including development of program theories, as well as determination of market effects data acquisition and research needs early in the program life cycle.
- The approach to **NTG coordination** should remain flexible. Typically, the SCC research area should serve as an advisor for all NTG studies, but studies are led by the research area (i.e., residential, C&I) contract groups, particularly when the NTG is combined with impact and/or process evaluation. However, complex studies or studies trying new methods are typically completed by the SCC team.

The following sections provide additional insights into key strategic topics. Additionally, the near-term priorities listed in Sections 5.3, 6.3, and 7.3 below were generated through collaborative discussions at the Summit and subsequent discussions with stakeholders. In order to maintain alignment with the three-year planning cycles, it is anticipated that Summits will continue to be held prior to the beginning of each three-year cycle in order to support subsequent planning activities.

2.2 MARKET EFFECTS

The PAs currently implement a number of measures through upstream delivery paths and are considering adding to these offerings in the next program cycle. While these offerings aren’t specifically identified as market transformation programs, all of them have been designed with the goal of impacting availability, pricing, awareness, promotion, and ultimately sales of energy efficiency equipment, which are typically considered market transformation indicators. The PAs have also offered incentives/rebates through downstream strategies for measures where there is potential that the programs helped move standard practice to higher levels of efficient equipment.

The EMC plans to take a more proactive, deliberate, and structured effort to measure market effects and market transformation. The EMC will continue to discuss the research framework and potential approaches with the independent evaluators and other stakeholders. In particular, the EMC is aware that market effects research must be guided by a program theory and the research must begin early in the lifecycle of the measure or program, and there must be sufficient data and evidence to support market effects claims. In addition, the use of Delphi panels to synthesize data and construct the counterfactual has proven helpful for prior market effects studies and will be considered for future studies. The EMC will continue to have a productive dialogue to make it possible for programs to measure and claim savings where they have in fact influenced market transformation.

2.3 BASELINES

Massachusetts has recognized that baselines (i.e., the condition that would have existed absent the installed measure) may differ from relevant state/national codes or standards and therefore has moved towards an Industry Standard Practice (ISP) baseline approach. This is particularly important for electricity savings, which must be consistent with the requirements of

the ISO for the bidding of demand reductions into the Forward Capacity Market. The ISO requires that baseline for efficiency projects be defined by the applicable efficiency code or standard. Where there is no code or standard, or if the ISP is more stringent than the relevant code or standard, the ISP is used as the baseline.

To help clarify the procedures for estimating and applying the proper baseline, Massachusetts has recently commissioned a number of evaluation projects, including a study to help define baseline framework (C&I Project 64) and a study examining the relationship of baseline and NTG (C&I Project 73C). Massachusetts has also commissioned a number of recent ISP studies for residential and commercial lighting, commercial boilers, infrared heaters, and air compressors.

As part of the 2019–2021 program cycle, the EMC expects to continue to conduct ISP studies. In addition, the EMC anticipates selecting measures for ISP research using similar criteria as part of the prioritization framework (see Section 3.2). The EMC will possibly consider other criteria as well, including whether a measure is unique or a commodity measure, the existence of an intermediate efficiency level (i.e., between a code/standard and the program efficiency level), and evidence of non-code or standard practices. In addition, the EMC will try to integrate baseline and NTG research together, in order to mitigate the potential for double counting any shifts in the market or free-ridership effects that may be reflected in both baseline and NTG research. This integration effort may be conducted through a modeled partial net approach, which would explicitly incorporate baseline and NTG together rather than applying both separately.

2.4 EMERGING ISSUES

A number of research areas could rise to importance as part of the 2019–2021 Energy Efficiency Plan but, at the time of this SEP, are still under development. Potential areas include:

- **Energy Optimization:** The PAs may include energy optimization (i.e., the adoption of cost-effective measures across fuels, including fossil fuels to electricity or gas) in the 2019–2021 Energy Efficiency Plan, which may require changes to evaluation practices.
- **Standards Advocacy:** The PAs may initiate an effort to promote higher standards for selected products.
- **Demand Response (DR):** DR programs may be a more prominent component of program offerings in 2019–2021.

The EMC will monitor these areas as they develop and modify updates to this SEP as more information becomes available.

3. PLANNING FOR EVALUATION

3.1 PLANNING PRINCIPLES

Collaboratively, the EMC considers multiple factors in planning EM&V studies, which collectively are utilized to assess potential evaluation activities, identify priorities, and determine the appropriate timing of all evaluation efforts. These factors are consistent with the EM&V principles described in Section 1.4 (i.e., valuable, high quality, reasonable, cost efficient) and are used in the prioritization framework described in Section 3.2. Factors considered by the EMC include:

- **Importance.** The EMC will allocate evaluation resources to research questions that have a significant impact on DSM investments or that directly inform significant policy questions and stakeholder interests. Key indicators of this include:
 - Magnitude of Savings (energy and demand)
 - Expected/Potential Future Savings Trend
 - Implementation Requests

- Regulatory Requirement/Political Sensitivity
- **History.** The EMC will leverage existing research before investing in additional research, including previous evaluation research conducted in Massachusetts and relevant research from other jurisdictions. Key factors include the age of the most recent study and the stability of evaluation results over time.
- **Uncertainty.** The EMC will allocate evaluation resources to research questions with the greatest uncertainty. Uncertainty may be due to shifts in markets, technologies, or baselines; program implementation changes; or uncertainty in impact factors.

In addition to the factors described above, there are three additional considerations when establishing the evaluation research portfolio. These include:

- **Balance.** The EMC undertakes a mix of studies each year, in terms of the evaluation study types (e.g., impact, process, NTG, market effects), fuel types, and programsto be evaluated.
- **Flexibility.** Unanticipated but not yet known or identified evaluation efforts may arise over time. To ensure that these issues may be addressed, the PAs will allocate sufficient resources for unidentified ad hoc evaluation efforts, including Quick Hit studies. The EMC develops evaluation plans with flexibility to add evaluation activities (such as pilot evaluations or assessments of the effectiveness of mid-year program design changes) without compromising the timing and quality of concurrent evaluation work.
- **Differences.** The EMC recognizes that there can be legitimate reasons for variations in findings of statewide studies within small vs. large PAs, gas vs. electric PAs, or within definable economic/demographic areas of the state. When appropriate, evaluation research activities may be implemented in a manner that ensures consideration, identification, and documentation of any such legitimate differences.

In Massachusetts, EM&V is divided into three major research areas: Residential, C&I, and SCC. Strategies used in each of these areas are discussed below.

3.1.1 RESIDENTIAL

For Residential, the specific strategy for planning impact evaluations is dependent on three things: the size of each core initiative or end-use; when each core initiative or end-use was last evaluated; and whether or not the program has undergone recent and significant changes. Particularly large programs or major end-uses within programs are evaluated on a more frequent basis to ensure the largest contributors to savings in the statewide portfolio are accurate. In addition, the PAs and EM&V Consultants consider evaluating smaller programs, even if the program represents only a small portion of the portfolio savings. Finally, if a program undergoes significant changes or is newly developed, the EMC will consider completing an evaluation to understand how well the program is performing and identify any issues with the delivery as early as possible.

3.1.2 COMMERCIAL AND INDUSTRIAL (C&I)

Historically, the strategy for impact planning has largely mirrored that of Residential. However, during the 2016–2018 period, the EMC coordinated on development of a revised impact framework, the goal of which was to ultimately shift impact evaluation planning to a more frequent and/or rolling approach. In doing so, the EMC anticipates feedback from these evaluations to be timelier due to smaller sample sizes and associated ease of execution, while also being of greater benefit to stakeholders such as the PA implementers. Outside of the impact evaluation space, it is the EMC’s intent to adopt a more systematic approach to study planning, which will include adoption of a screening tool and/or process to vet ideas

prior to studies moving forward, consistent with the prioritization framework in Section 3.2 below. This approach will produce a study list that will provide the most value for all stakeholders.

3.1.3 SPECIAL AND CROSS-CUTTING (SCC)

For each SCC topic area, specific planning strategies may vary. Work in this area may cross multiple topics to identify overarching market trends and consumer behavior. When determining whether the EMC should evaluate a specific subject, some of the factors considered include, but are not limited to, the following:

- Ensuring that process and impact evaluations are performed as appropriate based on the defined goals of each delivery model.
- Quantifying market effects where necessary data are available for programs identified as being likely to induce measurable market effects.
- Providing program planning, implementation, and evaluation staff with the market information they need to maximize market effects from program activities.
- Continuing to re-examine the most-appropriate approach for estimating NTG, researching what is driving differences in NTG ratios by end-use and over time, and repeating NTG studies as needed.

Some additional SCC work is typically developed on a short turnaround, ad hoc basis. This work may include literature reviews or surveys of programs in other jurisdictions and other smaller scale work designed to inform implementation efforts or program strategy. Another priority of this research area is to retain the flexibility to respond to new efforts in the field to provide appropriate and timely evaluation support.

3.2 PRIORITIZATION FRAMEWORK

The EMC has developed a study prioritization tool and process to enable the prioritization of studies within a plan term and/or plan year. The tool combines quantitative and qualitative factors to develop an overall score for each study idea. Based upon these scores and subsequent deliberation amongst the working groups and EMC, collective decisions will be made regarding which studies will move ahead.

3.2.1 BACKGROUND

The study prioritization process was developed by the EMC in order to apply a higher degree of rigor and transparency to the process of deciding which evaluation studies will be undertaken under the statewide evaluation framework. Previously, the EMC and research area subgroups considered ideas for studies as they were suggested on an ad hoc basis by various stakeholders. The 2016–2018 SEP established principles regarding the priority of potential evaluation research, but these principles were not integrated into a scoring tool. The study prioritization process described below addresses this challenge by laying out the indicators, scoring, and process to be followed when considering study ideas brought forward during the three-year planning process, as well as ideas that arise during a term.

3.2.2 OVERVIEW OF THE STUDY PRIORITIZATION TOOL

Each proposed study will be described, characterized, and rated on key value factors such as savings, uncertainty, and priorities in the study prioritization tool (Tool). To develop the Tool, the PAs adapted the Massachusetts Commercial and Industrial Gross Impact Evaluation Framework⁵, which uses a spreadsheet-based scoring and prioritization tool that was reviewed and tested by stakeholders. In developing the Tool, the PAs adjusted this framework to account for all sectors and types of studies.

Primary elements of the framework include basic study information, key indicators, scoring, and indicator weights, as described below. Please refer to Appendix E for a complete list of key indicators and weights.

Basic Study Information. Each study is described with basic information such as study name, study type, research area, sector, fuel type, underlying program and initiative, technology type, brief description, and study champion (i.e. someone who is supportive of the study).

Key Indicators. Each study is rated on key indicators of relevance, uncertainty, and priorities. These factors include:

- Magnitude of Savings (energy and demand)
- Age of Most Recent Study
- Expected/Potential Future Savings Trend
- Market/Technology/Baseline Shifts
- Program Implementation Changes
- Uncertainty of Impact Factors
- Regulatory Requirement/Political Sensitivity
- Implementation Requests

Scoring Definition. Studies are scored individually on a 1 to 5 basis, with a score of 5 indicating the highest need for additional research. Guidance is provided on each key indicator to support consistency among users. To account for nuances of fuels and study types, “Not Applicable” (NA) is sometimes allowed.

Indicator Weights. The score for each indicator is weighted to calculate aggregated study scores, which are ranked overall and by fuel type and research area. There are three weighting schemes, which apply to different study types and have different priorities:

- Weight 1 is used for the following studies types: baseline, impact, cost (incremental or total depending on the baseline), market effects, measure life, NEIs, and NTG. Weight 1 is also used for combination studies if a market characterization or process component is integrated into the study. This weighting scheme places highest priority on magnitude of energy savings, expected/potential future savings, and market/technology/baseline shifts.
- Weight 2 is used for market characterization and process studies. This weighting scheme places highest priority on program implementation changes, market/technology/baseline shifts, and expected/potential future savings.
- Weight 3 is used for DR studies. This weighting scheme places highest priority on magnitude of demand savings, expected/potential future savings, and market/technology/baseline shifts.

The PAs will update the Tool and its components on an as-needed basis to remain relevant with current policy priorities.

⁵ DNV-GL, Massachusetts Program Administrators and Energy Efficiency Advisory Council, May 2017.

3.2.3 THE STUDY PRIORITIZATION PROCESS

The following section describes the process by which study ideas will be prioritized.

1. The idea or concept for a study is proposed by a Study Idea Originator. A Study Idea Originator may be a PA evaluator, an EM&V Consultant, an evaluation vendor, program implementation staff or consultant, DOER, or EEAC. Alternatively, the study idea may be generated by reviewing the Tool. The Tool can be populated with quantitative program and measure data by the PAs or EM&V contractors on behalf of PAs. A review of the data in the Tool may bring to light certain programs, initiatives, or measures that are higher priority for evaluation.
2. In order to move the idea forward for consideration, it must have a Study Champion. If the Study Idea Originator (Originator) is not a PA evaluator or EM&V Consultant, then the Originator will hand off the idea to a PA evaluator or EM&V Consultant who is supportive of the research and who will take on the role of Study Champion.
3. The responsibilities of the Study Champion are to populate and rate the study idea in the Tool⁶, submit the Tool to the relevant working group⁷ for consideration, discuss the idea with the working group and/or EMC (see Steps 4 and 5), and communicate back to the Originator as needed.
4. After receiving the Tool populated with the study idea information and ratings, the relevant working group will discuss the idea and decide whether to accept, decline, or table the idea, or to forward the idea to the EMC for further consideration as needed.^{8,9} The group may also adjust the ratings and note any key comments. If considering multiple ideas at one time, the working group may choose to prioritize the ideas based upon their relative ratings, rankings, and other criteria, such as maintaining balance between fuels and study types, likely evaluation approaches and associated costs and timelines, and other salient factors. In contrast, if considering one study idea at a time, the score for the idea can be benchmarked against scores from previously considered study ideas.
5. The EMC will consider the study ideas that are sent by the working groups based upon their ratings and rankings in the Tool as well as other criteria, such as maintaining balance between sectors, fuels, and study types; likely evaluation approaches and associated budgets and timelines; and other salient factors. The decision whether or not to move forward will be made by building consensus through discussion.
6. The Research Area Lead will inform the relevant evaluation vendor(s) that the study concept has been approved and request that a Stage 1 plan be developed.
7. The working groups and EMC will forward all rated study ideas to the PA representative who maintains the Tool, who will in turn add the idea to a list of pre-Stage 1 studies. This list will enable the group to track how many study ideas have been approved and the distribution of study types and programs/initiatives/measures represented.
8. One of the PAs will store a master copy of the Tool. This PA will share it with the group to enable the group to rate study ideas and make corrections and alterations to the Tool as needed.

⁶ If a study idea is proposed as a Quick Hit study, the prioritization step may be skipped if there is consensus among the working group that the study should be pursued. If there is not a clear consensus, then the study idea should go through the rating process.

⁷ The working group should include the topic area lead, PA evaluation representatives, and EM&V Consultants relevant to the proposed study.

⁸ Studies expected to require a budget less than \$500,000 may be decided upon by the working group rather than being forwarded to the EMC.

⁹ In the case of studies that are required for regulatory purposes, the working group and EMC will assign the study as an automatic "Pass" and note the regulatory requirement in the Tool.

3.3 AVAILABLE BUDGET

The EM&V budget available to the research areas for the 2019–2021 Energy Efficiency Plan is projected to be in line with historical program budget levels. Twenty percent of each sector’s available evaluation budget is allocated to the SCC research area.

In 2017, EM&V evaluation study expenditures (not including potential studies and internal labor costs) totaled approximately \$17.2 million (\$12.8 million for electric and \$4.4 million for gas). Therefore, for the three years of the 2019–2021 Energy Efficiency Plan, the EMC recommends an EM&V study-specific expenditure of \$51.6 million (i.e., three times the 2017 expenditures), which includes \$38.4 million for electric and \$13.2 million for gas. As mentioned above, this budget does not include potential study costs or internal staffing costs.

3.4 ASSIGNED STAFF

Across the PAs, there are approximately 18 full-time equivalent employees assigned to Massachusetts evaluations, with approximately 30 PA employees actively engaged in study oversight. The PAs currently contract with several external evaluation experts to supplement staff. External evaluation experts are employed in addition to the evaluation contractors that are responsible for completing the evaluations in each research area.

3.5 STAGES OF EVALUATION

The stages through which a project moves from being an initial idea to being completed are shown in Table 2 below.

Table 2: Stages of Evaluation

Stage	Document Under Review	Description
Stage 1: Conceptual Framework	1 Page Summary	Document provides conceptual framework for the project, including a very high-level budget and timing, as well as the objective or goal. For more detail, see Appendix D.
Stage 2: Preliminary (High-Level) Work Plan	2–3 Page Summary	Work plan provides strategies to meet objective, including more detail on the potential research design, level of effort (number of surveys, site visits), and budget/timing. This step is used only for projects where there were major issues or concerns with the Stage 1 plan.
Stage 3: Detailed Work Plan	3–25 Page Work Plan	Work plan provides detailed sampling and analysis plans, specific staffing needs, and milestone deliverables.
Stage 4: In Progress	Status Report	Status reports are prepared consistently with the work plan; there may be detailed planning occurring simultaneously with execution on early tasks.
Stage 5: Reporting	Draft Report	Reporting includes period from draft report through final report and any review/communications/meetings in between; also includes paperwork for submittal.
Stage 6: Complete	Final Report	Report is finalized and either filed or ready to be filed with the DPU.

There are multiple planning stages since there is a need for projects to proceed incrementally from concept to preliminary work plan to detailed work plan. By proceeding incrementally, the PAs and EM&V Consultants are not only able to better manage the stakeholder review process but effectively stage studies across the three research areas.

The methods in which stakeholders are engaged can vary based on the stage of evaluation. The PAs have hosted strategic evaluation planning meetings to encourage participation in the early stage of the evaluation planning process and solicit input from a wide variety of program stakeholders. Additionally, there is active engagement with both program implementers and policymakers to identify additional key research needs and to further refine project recommendations developed at the strategic evaluation planning meetings.

Much of the stakeholder engagement happens through the RMC and C&IMC. For projects in Stage 1, one-page summaries are developed and shared with the management committees. Progress on projects in Stages 2, 3 and 4 (preliminary and detailed work plans and in progress) is also provided to the management committees. For projects in Stage 5, draft reports are shared with the management committees.

Input from non-utility stakeholders represented on the Council generally flows through the EM&V Consultants. A representative from the EMC attends RMC and C&IMC meetings as frequently as possible in order to facilitate coordination and solicit feedback from the various management councils and working groups.

3.6 QUICK HIT APPROVAL APPROACH

In addition to the standard staged process of decision making, the EMC also has a Quick Hit (or “fast track”) approach to evaluation study review and approval. This approach is used to produce answers to important researchable questions in an expedited manner, and thus provide more timely feedback to program managers and implementation staff. These evaluations are intended to be smaller in scope and therefore can generally be completed more quickly than a standard evaluation.

The following provides a set of parameters that define Quick Hit evaluations. If these parameters cannot be met, the Quick Hit study would revert back to following the staged-study process described above. This list is intended to serve as guidance rather than an exhaustive checklist where every criterion must be met (i.e., studies that generally meet these parameters can qualify).

- **Scope.** Quick Hit evaluations need a very specific, targeted scope with one or two clearly articulated research questions. The study could potentially focus on scoping/reconnaissance studies for larger projects. Quick Hit studies are not suitable for complex or integrated evaluations.
- **Planning.** The planning of Quick Hit studies is limited to improve timeliness of the research. Specifically, the Study Champion proposes the study idea and date by which the information is needed to the working group (e.g., the residential, C&I, or SCC working groups) for approval. If the working group approves, the study skips Stage 1 and Stage 2 and moves directly into an abridged Stage 3 (without going through the prioritization framework and Tool described in Section 3.2). The abridged Stage 3 succinctly captures the goal of the research, the research methodology, the timeline, and the budget. The Research Area Lead is then responsible for approving the Stage 3 plan and may leverage the working group as they see fit. If consensus to proceed with the study is not reached in the working group, however, then the study should go through the prioritization framework to determine whether or not to proceed to Stage 3.
- **Budget.** Quick Hit studies have comparatively smaller budgets as compared to standard evaluations (i.e., \$100,000 or less). The Research Area Lead will define an appropriate budget maximum so that the work can be completed but small enough to dissuade scope creep.

- **Timeline.** The timeline is an abridged timeline that all stakeholders agree to maintain. The aim is to complete Quick Hit studies within six months or less of kick-off. This includes a hard stop on the date for the final report (e.g., study lead to ensure any comments from others arrive on time).
- **Staffing and Project Management.** The project should be staffed with a highly experienced lead contractor that can work autonomously and is familiar with the topics and data involved with answering the researchable question. The contractor should have a strong project manager to ensure no scope creep. The project should avoid use of junior staff that need supervision and could potentially slow down the process and add cost.
- **Reporting and Recommendations.** Output is in memo format to both distinguish from full-fledged studies and spend less time on formalizing a report. The output of the study is flexible and informal so long as the specific research questions are answered. Outcomes may include suggestions, considerations, or limited recommendations. Scoping studies may make recommendations regarding future work.
- **Stakeholder Updates and Comment Processes.** Stakeholders (i.e., research area working group and the EMC), will be updated of the approved Stage 3 workplan and project status during the study process. The comment process will be streamlined to expedite the review process and timely delivery of the research (e.g., only one round of comments). The PA statewide evaluation study lead will send out reminders regarding comment deadlines.

3.7 INTEGRATION OF RESEARCH

To support the principles of reasonableness and cost efficiency, the EMC recommends that, during EM&V planning, staff explicitly consider how and when to integrate similar research components into a single study (e.g., impact, process, NTG, and market characterization on one program). Combining relevant studies can have the following benefits:

- **Increased value and understanding.** Combining topics into a single study can increase stakeholder understanding of the topic, providing both the “what” and the “why” of the research concurrently. There is value to both evaluators and program implementation teams in knowing specifically how program operations **and** delivery can be improved to increase program savings or address deficiencies or poor impact results. It also results in a more comprehensive, but succinct and actionable, set of conclusions and recommendations.
- **Increased study efficiency.** Combining studies can reduce duplication of effort and customer fatigue, as contacts with participants can be integrated. Contact integration can reduce evaluation costs and is an improvement for customers. It also provides a comprehensive, single snapshot of a particular program, rather than disparate snapshots taken at different times.
- **Reduced volume of studies.** Combining studies may be more efficient for evaluation staff management as it reduces the number of study documents requiring review, data requests, contracting efforts, etc.

The EMC recognizes that combining studies could lead to longer study durations and increase study complexity, especially if unrelated tasks are melded into a single study. Additionally, there may be a need for timing to be different among studies (e.g., process evaluations may need to be conducted earlier in the program lifecycle than impact studies). In general, however, combining studies will result in overall lower costs, increased program understanding, more actionable recommendations, and reduced customer burden.

3.8 COLLABORATION WITH IMPLEMENTATION DURING EM&V PLANNING

This section intentionally blank for the April draft. Content will be included for the October version.

3.9 EM&V EARLY INVOLVEMENT

Determining the customer decision-making process is a critical component to determining the baseline, and often customers are faced with multiple, complex options. In addition, pre-treatment conditions are a critical component of many early replacement or retrofit measure impact assessments, and evaluators often struggle with developing savings based upon high-rigor data collection ex-post. This imbalance necessitates assumptions and reliance on verbal reporting and memory, which erode the confidence and accuracy of savings estimation.

Ex-ante evaluation (i.e., evaluation prior to project completion) can help address these challenges, plus offer a number of other benefits, by:

- Reducing downstream uncertainty on site-specific realization rates via early agreement between implementer and evaluator on baseline characterization
- Inspecting pre-retrofit conditions and characteristics that might not be accessible or recalled post-installation
- Educating the implementer about evaluation methods and savings considerations
- Reviewing the EM&V plan and making suggestions to gather desired data (for projects with implementer EM&V)
- Obtaining timely insights to customer motivations and decision making for NTG gross assessment

Custom projects, therefore, will increasingly have the option to be brought in as part of an ex-ante review, particularly for projects with significant savings and/or complex baselines. At the time of this SEP, this process is being piloted and the exact details of this process are still being developed, but the PAs expect that the exact steps and details of the ex-ante review will be more clearly documented prior to 2019. These details include:

- Establishing a method for selecting projects for ex-ante review
- Expediting the review process so as to not cause delays with implementation, as well as to minimize customer burden
- Determining which aspects of the ex-ante review process are binding during the ex-post evaluation process, and which are not
- Developing a method for ex-post evaluation to properly sample and weight projects that received ex-ante review, so as to not bias the final realization rates

4. REPORTING POLICIES

4.1 REPORTING IMPROVEMENT

This section intentionally blank for the April draft. Content will be included for the October version.

4.2 RECOMMENDATIONS TEMPLATE

Evaluation studies produce several types of results that are used to help estimate savings, suggest program improvements, and identify potential future research. Often these results are reported as two types: recommendations and considerations. Recommendations for PAs should serve one of three functions: 1) to clearly describe actionable steps that can be taken to improve programs based on strong evidence from the evaluation findings; 2) to update quantitative parameters used to estimate program savings; or 3) to improve program evaluability, e.g., by improving program tracking. Policy recommendations may be included in the evaluation report in a separate section; the EMC will not track status of their

implementation. Policy recommendations should be addressed to the policy makers with the relevant authority for acting on the recommendation. Considerations should be used to document possible actions that could be taken to improve programs in cases where study findings are not as robust or do not clearly point to the needed course of action.

Historically there have not been guidelines for how and when evaluation contractors should develop recommendations. This lack of guidance has led to a large number of recommendations, some of which are not clear or actionable. The EMC has defined expectations and guidelines for recommendations to ensure they service the functions described above and to clarify the difference between a recommendation and a consideration.

The EMC suggests that evaluation contractors use the following guidelines when developing recommendations.

- Recommendations should be based on strong factual evidence from the evaluation study report. Ideally, recommendations will draw from multiple sources of data when available. If a single source of data is the basis for a recommendation, it should be high-quality data. When crafting the recommendation, the evaluators should point to the specific finding(s) from which the recommendation stems. Not all findings in the report need to have a recommendation.
- Recommendations should be specific and actionable. Each recommendation should be clear about what problem it is seeking to solve or the parameter it will update. Recommendations focused on program improvement should also specify who should take what action to address what finding. If the suggested action is to keep the status quo, this decision should be categorized as a conclusion.
- Recommendations should have consequences. To the extent possible, each recommendation should specifically articulate what desired outcome would be achieved by acting on the recommendation, such as increasing program participation; increasing per-unit savings; or addressing a prominent program or Benefit Cost Ratio (BCR) gap, inconsistency, or discrepancy, and conversely, what is at stake by not acting on the recommendation, such as a low realization rate, loss of customer participation, or a health/safety risk.
- Recommendations should be short and to the point. Recommendations should be bulleted in the executive summary, and they should have a one sentence summary in bold with supporting text that briefly, but explicitly, links the recommendation with the relevant study finding(s) or conclusion(s).

When an evaluation report produces an impact factor or other numerical value that is intended to be incorporated into the Technical Reference Library and/or BCR model, these values will be clearly summarized in the executive summary, and a recommendation describing the new values should be included in the list of recommendations.

These guidelines are intended to lead to recommendations that PAs can effectively implement to achieve meaningful program improvements. To the extent that potential recommendations do not meet these criteria, evaluators should consider alternative approaches to reporting the information. For example, evaluators may continue to use considerations in the report for potential actions that do not rise to the level of a recommendation, or in cases when it is not clear what course of action would best address a finding. Considerations should also be used to identify areas of potential future research, unless there is a gap in essential knowledge that must be addressed to improve the program or update a quantitative parameter, in which case undertaking the research could be considered a recommendation. Considerations will be presented to implementers alongside the recommendations but will not be tracked in the evaluation tracking spreadsheet.

In addition to developing sound recommendations, evaluation contractors will work with PA evaluation staff to communicate recommendations to program implementers before the evaluation report is finalized. This interaction will allow evaluation contractors to get feedback on the feasibility of implementing the recommendations and allow implementers to understand and ask questions about what the evaluators recommend. At a minimum, draft

recommendations will be included in a slide deck shared with program implementers, and PA evaluation staff will arrange an on-line meeting where evaluation contractors and implementers can discuss the recommendations and ask questions. Regardless of feedback from implementers, recommendations included in the report are ultimately up to the independent evaluation team. If an evaluation does not directly impact program implementers (e.g., it is an evaluation focused on evaluation methodologies), this step may be skipped.

The EMC currently works with the RMC and C&IMC to ensure that implementation of each recommendation is considered and will continue to do so. EMC will continue to track the status of all recommendations, specifically whether they have been implemented (and if not why not) and will file this information with the Term Year Report. As is current practice, the EMC will ensure that an individual is assigned to track the status of each recommendation and follow up until it is clear whether the recommendation will be implemented (or if not why not). The EMC will continue to review the status of recommendations under consideration on a quarterly basis at the Tri-Management Committee so that representatives from evaluation and implementation can jointly resolve the status of recommendations as needed.

4.3 REPORTING COLLABORATION WITH IMPLEMENTATION

This section intentionally blank for the April draft. Content will be included for the October version.

5. RESIDENTIAL RESEARCH AREA

5.1 SCOPE OF RESEARCH AREA

The Residential research area consists of four separate topic areas: Residential Retrofit and HVAC, Residential Retail Products, Residential New Construction, and Residential Behavior. The residential evaluation research area includes the following initiatives:

- Residential New Homes and Renovations
- Residential Coordinated Delivery
- Residential Retail
- Residential Behavior and Demand Management¹⁰
- Income-Eligible Coordinated Delivery

The work in this research area is currently led by Navigant Consulting (Retrofit, HVAC, and Behavior) and the NMR Group, Inc. (Retail Products and New Construction). The Navigant evaluation contractor team also includes Cadeo and ILLUME Advising. The NMR Group, Inc. evaluation contractor team also includes DNV-GL and Dorothy Conant.

The evaluation teams were selected through a competitively-procured joint RFP process conducted in the fall of 2015. The current Navigant and NMR teams have been awarded the contract through June 2019. Each research area and study has an assigned PA staff member and EM&V Consultant covering it.

¹⁰ Demand Management evaluation studies are included in the SCC research area.

This research area is currently led by a National Grid employee (i.e., the Research Area Lead). Ten employees representing three PA organizations currently lead studies in this area.

5.2 RESEARCH COMPLETED DURING 2016–2018 PLAN

From 2016 to 2018, the PAs and EM&V Consultants supported over 50 residential evaluation studies in four major study types: impact evaluations, process evaluations, NTG evaluations, and market characterization (see below). In the residential sector, many evaluations include components of each of the four study types, as indicated below. These studies seek to quantify program impacts and provide focused, actionable recommendations to improve the performance and efficiency of residential programs.

1. Impact Evaluations

Impact evaluations provide an independent assessment of the energy savings achieved by a specific population of energy efficiency measures and provide recommendations focused on improving the program and the accuracy of its savings estimates. Sixteen residential impact evaluations were recently completed¹¹ or are currently on-going (see list below). This work includes assessments of incremental costs, baselines, and impact factors such as realization rates, in-service rates, and hours of use.

1. Ductless Mini-Split Impact
2. Heat Pump Water Heater Impact
3. Home Energy Services (HES) Impact
4. Multi-Family Lighting Impact (*includes NTG component*)
5. Mini-Split Heat Pump Incremental Cost
6. HVAC and Water Heating Incremental Cost
7. Single Family Code Compliance Baseline (*includes market characterization component*)
8. Massachusetts Multi-Family High-Rise Baseline (*includes market characterization component*)
9. Residential New Construction (RNC)/Code Compliant Support Initiative (CCSI) Attribution (*includes NTG component*)
10. Massachusetts RNC Incremental Cost
11. Lighting Hours of Use
12. Lighting Interactive Effects
13. Lighting Incremental Cost
14. Smart Power Strip Metering
15. Smart Power Strip Literature Review & Customer Survey (*includes process and NTG components*)
16. Assessment of Combined Behavior and Wi-Fi Thermostat Program (*includes process component*)

2. Process Evaluations

Process evaluations analyze information on a program's operations and, based on that analysis, identify practical approaches to improve the program in relation to program goals. Nine residential process evaluations were undertaken from 2016–2018 (see list below). This work included an expansion of a 2014 High Efficiency Heating Equipment Impact Evaluation to examine reasons why condensing boilers were not condensing and also studies that focused on HES and Low-Income programs and code compliance training.

¹¹ <http://ma-eeac.org/studies/>

1. Low-Income Program Process (single and multi-family)
2. Mini-Split Heat Pump Survey – Follow Up
3. Heating and Cooling Contractor Survey
4. Condensing Boiler Loss and Savings Potential
5. Condensing Heating Equipment Barriers
6. Multi-Family Program Research (*includes impact component*)
7. HES Process Evaluation
8. CCSI Residential Training
9. Understanding the Role of Weather on Air Conditioning Use Behavior and DR Program Participation

3. NTG Evaluations

NTG evaluations estimate energy savings that are specifically attributable to the program under study. Four residential NTG evaluations were undertaken in this research area in the last term. Other NTG evaluations were conducted for residential programs under the SCC research area.

1. Early Retirement HVAC NTG – Heating and Cooling equipment
2. General Products Consumer NTG
3. Sales Data LED NTG Modeling – Lighting
4. Consensus NTG Study – Lighting

4. Market Characterization

Market characterizations assess changes in market conditions for energy efficiency products and provide information to help PAs influence those markets to increase energy savings. Twenty-one residential market characterizations were undertaken in the last contract period, as follows.

1. Moderate Income Market Characterization
2. Heat Loan Analysis
3. WiFi Thermostat Technology and Literature Review
4. Census of Multi-Family Properties
5. HVAC Contractors Interviews (*includes process component*)
6. Residential Baseline Study (*includes impact component*)
7. Residential Single-Family Building Department Document Review
8. Stretch Code Market Effects Study
9. Single-Family Stretch Code Update Compliance and Potential
10. Massachusetts Mini-Baseline Study
11. Lighting Shelf Stocking
12. Lighting Supplier Interviews (*includes process and NTG components*)
13. Lighting Market Scans
14. Lighting On-Sites and Consumer Surveys (*includes process and NTG components*)
15. Lighting Sales Data Analysis (*includes NTG component*)
16. Lighting Logic and Market Model (*includes process component*)
17. Lighting Decision Making
18. Lighting Web Scraping (*includes impact component*)
19. Lighting Distribution Model
20. Lighting Market Adoption Models (*includes impact component*)
21. What's Next for Products

5.3 NEAR-TERM PRIORITIES

Near-term priorities may include:

- Revisiting past impact evaluations to determine appropriate impact factors to apply to the new initiatives until impact evaluation on the new initiatives can be completed. Due to the new structure of the residential initiatives, there will need to be some focus on developing gross savings estimates and impact factors based on the updated design (e.g., single-family detached vs. high-rise multi-family vs. low-rise multi-family, direct install vs. retail). Full impact evaluations will be a longer-term priority as the residential initiatives will need to operate for some time before undergoing evaluation.
- Conducting process evaluations of the new initiatives to measure if the objectives of the new program design are being achieved and provide recommendations to improve the program design and performance.
- Exploring opportunities for new measures and/or services to offer, including emerging technologies, electric vehicles, and new delivery mechanisms.
- Better understanding the characteristics of non-participants and what would motivate them to participate.
- Understanding how evaluation can help with upcoming lighting transitions, determination of sunset years, differences between upstream and downstream lighting programs, and opportunities for lighting controls.
- Understanding where product baselines may be needed and maximizing the opportunities in the current baseline study.
- Considering programs where market effects could and should be tracked, starting early in the lifecycle process.
- Considering new construction evaluation needs, including net-zero energy building practices, baseline measurement, and multi-family opportunities.
- Considering hard-to-reach or underserved customers, including using demographic and geographic data to target customers and considering research for the rental market, community-based organizations and municipal outreach.
- Increasing consistency with the C&I research area in terms of approach to baselines, where relevant.
- Developing estimates of demand savings, including the timing of the savings (load shapes) and ability to control the energy efficiency.
- Understanding the purposes and activities of QA/QC to see if they can be leveraged for evaluation purposes.

5.4 LONGER-TERM PRIORITIES

This section intentionally blank for the April draft. Content will be included for the October version.

5.5 PLANNED RESEARCH AND STRATEGIC ISSUES

This section intentionally blank for the April draft. Content will be included for the October version.

6. C&I RESEARCH AREA

6.1 SCOPE OF RESEARCH AREA

This research area consists of four separate topic areas: Impact, Process, NTG and Market Characterization. The C&I evaluation research area includes the following initiatives:

- C&I New Buildings and Major Renovations
- C&I Existing Buildings Retrofit
- C&I New and Replacement Equipment
- Active Demand¹²

The work in this research area is currently led by DNV-GL for all topic areas. The DNV-GL evaluation contractor team also includes Tetra Tech, NMR, ERS, DMI, SBW, Apprise, ILLUME Advising, and Itron.

The evaluation teams were selected through a competitively-procured joint Request for Proposal (RFP) process conducted in the fall of 2014. The current DNV-GL team has been awarded the contract through June 2018. The EMC recently sent out an RFP for this research area. The winning bidder(s) will start in July 2018 and run through June 2021. Each research area and study have an assigned PA staff member and EM&V Consultant covering them.

This research area is currently led by an Eversource employee. Seven employees representing three PA organizations currently lead studies in this area.

6.2 RESEARCH COMPLETED DURING 2016–2018 PLAN

Since 2016, the PAs and EM&V Consultants have supported over 30 C&I evaluation studies in four major research areas: impact evaluations, process evaluations, NTG evaluations, and market characterizations (see below).

1. Impact Evaluations

Impact evaluations provide an independent assessment of the energy savings achieved by a specific population of energy efficiency measures, and provide recommendations focused on improving the program and the accuracy of its savings estimates. Thirteen impact evaluations were recently completed or are currently ongoing (see list below). This work includes assessments of operating characteristics, including, but not limited to, baselines, hours of use, and in-service rates. These inputs are generally captured and/or reported as realization rates. While all of the studies below pertain to impact work, not all produced impact factors. For instance, some of these were scoped for purposes of policy development related to impact work.

1. Impact Evaluation of 2013 Prescriptive Gas Installations (Steam Traps and Programmable Thermostats)
2. Impact Evaluation of 2013 Custom Electric Installations
3. Impact Evaluation of Upstream Lighting Initiative
4. Prescriptive/Custom Gas Steam Trap Measure Phase II Evaluation

¹² Active Demand evaluation studies are included in the SCC research area.

5. Refinements of Gross Impact Evaluation Framework
6. Articulating Baseline Policy and Practice
7. Custom Comprehensive Design Approach Gas and Electric Evaluation
8. Small Business Impact Evaluation
9. Prescriptive C&I Loadshape of Savings Study
10. Baseline Transition Planning
11. Upstream Water Heater Deemed Savings Impact Evaluation
12. Impact Evaluation of Custom Gas Installations
13. Impact Evaluation of Custom Electric Installations

2. Process Evaluations

Process evaluations analyze information on a program's operations and, on the basis of that analysis, identify practical approaches to improve that program in relation to program goals. Three C&I process evaluations were undertaken in the last contract period (see list below). While work in this segment was relatively scarce during 2016–2018, it was somewhat intentional as stakeholders worked through considerations of a more standardized approach to process evaluation planning.

1. Process Evaluation of Upstream HVAC Initiative
2. Combined Heat and Power Process Evaluation
3. Process Evaluation of C&I Upstream Lighting Initiative

3. NTG Evaluations

NTG evaluations estimate energy savings that are specifically attributable to the program under study. Although some NTG evaluations were conducted for C&I programs under the SCC research area, two C&I NTG evaluations were undertaken in this research area in the last term.

1. Drivers of NTG
2. Upstream LED NTG Analysis

4. Market Characterization

Market characterizations assess changes in market conditions for energy efficiency products and provide information to help PAs influence those markets to increase energy savings. Sixteen C&I market characterizations were undertaken in the last contract period (see list below).

1. Existing Buildings Market Characterization: C&I Customer On-Site Assessments
2. Phase II: Gas Boiler Market Characterization
3. Existing Buildings Market Characterization: Market Share and Sales Trend Study
4. 2015 PA Differences Evaluation
5. 2016 PA Differences Evaluation
6. Upstream HVAC Distributor Data Collection
7. Assessment of the Share of Incentivized High Efficiency Equipment
8. 2015 C&I Customer Profile Study
9. Lighting and Controls Market Effects Study
10. Enhanced Customer-Level Database Capabilities Evaluation
11. 2011–2016 C&I Mid-Sized Customer Needs Assessment
12. C&I Code Compliance Follow-Up Study

13. Methods Development and Evaluation of Controls Measures
14. 2016 C&I Customer Profile Study and Associated Deep Dives (Advanced Lighting, HVAC)
15. LED Market Monitor Study
16. C&I Injection Molding Machine Market Assessment Baseline Study

6.3 NEAR-TERM PRIORITIES

For 2019–2021, near-term priorities may include:

- Further discussion and finalization of a more systematic approach to study planning, which will include adoption of a screening tool and/or process to vet ideas prior to studies moving forward, consistent with the prioritization framework in Section 3.2 .
- Continued focus on market effects from the perspective of understanding principles to identify, what areas are in need of quantification, and, more broadly, how program efforts influence the adoption of new technologies both inside and outside the program.
- Understanding of the NTG rates as they relate to large and/or memorandum of understanding (MOU) customers, as well as determination of what is an appropriate timeframe for considering NTG rates applicable.
- Consideration of specific market sectors with rapidly shifting baselines warranting further research, as well as sectors that stakeholders need to understand better.
- Investigation of potential sources of future program savings due to factors such as new product offerings, gaps in program strategy, or generally just low market penetration.
- Additional understanding of customer characteristics, customer barriers, customer decision making, and customer engagement to improve program execution and the customer experience.
- For baseline analyses, determination of when and for how long ISPs should be applied, key factors triggering ISP/baseline research, defining what constitutes unique vs. non-unique measures, and increasing coordination between evaluation and other stakeholders on ISP/baseline research and implementation in program assumptions.
- Further examination and vetting of measure lives for program offerings.
- Improved coordination on all evaluation activities and results with external stakeholders

6.4 LONGER-TERM PRIORITIES

This section intentionally blank for the April draft. Content will be included for the October version.

6.5 PLANNED RESEARCH AND STRATEGIC ISSUES

This section intentionally blank for the April draft. Content will be included for the October version.

7. SPECIAL AND CROSS-CUTTING (SCC) RESEARCH AREA

7.1 SCOPE OF RESEARCH AREA

The SCC research area covers topics that do not fit cleanly into either the Residential or C&I research areas, as well as additional specialized topics in which it is particularly important to ensure consistency across research areas and markets. Topics within this research area include, but are not limited to:

- Codes and Standards
- Community Mobilization Initiatives, Education, and Training
- Market Effects
- Top-Down Modeling
- Net-to-Gross (NTG)
- Non-Energy Impacts (NEIs)
- Program and Portfolio Marketing
- Customer Profile Report
- Demand Response (DR)
- Additional Work

For each cross-cutting topic area, specific planning strategies may vary. A brief overview of the current strategy for each topic area follows.

- **Codes and Standards** – The Code Compliance Support Initiative (CCSI) evaluation seeks to measure net savings attributable to the CCSI for improving code compliance in Massachusetts through various avenues over the long term, and to gather supporting evidence for those savings. Evaluation activities include implementing immediate surveys after each classroom training and reporting the findings at the end of the contract period, implementing follow-up interviews with training attendees, examining building code compliance documents, and estimating the number of Massachusetts code officials who have attended different types of trainings as a share of the population.
- **Community Mobilization Initiatives, Education, and Training** – For these two topic areas, process and impact evaluations are performed as appropriate based on the defined goals of each delivery model and the planning principles discussed above. Each new in-field effort is reviewed to determine whether a specific evaluation of the effort should occur. Evaluation efforts focus on new or changing delivery models rather than established models, but all efforts are periodically reviewed.
- **Market Effects** – Market effects studies rely on an analysis of program-qualifying equipment sales compared to all equipment sales, as well as self-report data on free-ridership and spillover. These studies measure net spillover savings from program-induced changes in the structure and functioning of the market, as well as seeking evidence of such changes. Market effects measurement recognizes that programs can drive non-participant savings through market effects that are not captured by program tracking (i.e., projects or measures) or participant NTG evaluation.
- **Top-Down Modeling** – Top-down modeling techniques use an econometric approach to estimate program impacts across all energy-efficiency programs in a given geographical region or service territory rather than running separate studies for each program (or measure/end use within a program). Top-down approaches use regression models to measure changes in energy consumption over time that are attributable to programmatic interventions by the PAs. In theory, top-down methods are capable of capturing the full portfolio-level effect, including free-ridership, spillover, market effects, and snapback across multiple programs.
- **Net-to-Gross (NTG)** – Going forward, this topic area will continue to research how NTG results should be integrated with market effects, program design, and claiming savings. It will re-examine the most appropriate approaches for estimating NTG under different circumstances and with different types of customers/program models. Additionally, it will research what is driving the differences in NTG ratios by end-use and over time and repeat NTG studies as needed.
- **Non-Energy Impacts (NEIs)** – Similar to NTG, initial work in the NEI area focused on developing methods for quantifying NEIs attributable to the PA programs. Research in this area continues to quantify appropriate NEIs for

the Multi-Family and Low-Income programs. This topic area also examines additional NEIs that may be appropriate to either study for the first time or further update and/or refine.

- **Program and Portfolio Marketing** – Currently, this area focuses on determining the effectiveness of each statewide marketing campaign. Each year, a post-survey has been completed to measure the impact of the campaign in raising brand and program awareness. Additional work will measure brand effectiveness, as well as support marketing efforts with specific smaller scale evaluations as necessary.
- **Customer Profile Report** – The C&I Customer Profile report has been completed on an annual basis since 2012. The Residential Custom Profile study has been completed on an annual basis since 2015. Each year presents an analysis of Massachusetts PAs’ billing and tracking data, which allows the EMC to accurately quantify and report on trends and time series evolution in the Massachusetts landscape. The reports also develop narratives about these trends and their implications for a variety of stakeholder interests and help to formulate testable hypotheses for future process, market, and impact assessment studies. Finally, the customer profile reports allow the PAs to assess how their standardized data compares to other PAs’ data and to statewide data.
- **Demand Response (DR)** – The PAs continue to explore new demonstration offerings to determine if DR should be implemented on a statewide scale, as a full program or as an element within a program. These demonstration projects are being deployed to assess new technologies and strategies, with PAs using the evaluation findings to improve upon their existing program offerings. The current approach of focusing on broad “umbrella” programs creates the opportunity to refine efforts quickly based on the lessons learned during the demonstration project.
- **Additional Work** – Work in SCC may cross multiple topics to identify overarching market trends and consumer behavior. Some additional cross-cutting work is typically developed on a short turnaround, ad hoc basis. This work may include literature reviews or surveys of programs in other jurisdictions and other smaller scale work designed to inform implementation efforts or program strategy.

In addition to the topics and strategies discussed above, another priority of this research area is to retain the flexibility to respond to new efforts in the field to provide appropriate and timely evaluation support.

Currently, SCC research is served by six different EM&V contracting teams. The evaluation teams were selected through a competitively procured joint RFP process conducted in 2016. The term for this contract will end mid-2020. The research areas and contracting teams are outlined below.

- NTG, Market Effects, Top-Down Modeling, Codes and Standards, and NEIs
 - Prime Contractor: NMR Group, Inc
 - Subcontractor: DNV-GL, Tetra Tech, Three3, The Cadmus Group, EcoMetric, and RMS
- Education, Training, and Community Mobilization Initiatives
 - Prime Contractor: Opinion Dynamics
- Program and Portfolio Marketing
 - Prime Contractor: ILLUME Advising, LLC
 - Subcontractor: Diddio and Grounded Research
- Demand Reduction and Mitigation Strategy – Residential and Small C&I
 - Prime Contractor: Navigant Consulting
- Demand Reduction and Mitigation Strategy – C&I
 - Prime Contractor: Energy and Resources, Inc
 - Subcontractor: DNV-GL

A representative of Cape Light Compact JPE is currently the statewide research area manager, with seven employees from four different PA organizations leading individual study efforts.

7.2 RESEARCH COMPLETED DURING 2016–2018 PLAN

Top-down modeling, market effects, NTG, and Codes and Standards topic areas are all interrelated. In theory, the top-down evaluation area describes the net effect of all the PA programs and efforts on changes in total energy consumption. However, the underlying drivers of these net savings are better understood by using other methods to estimate net savings. These methods include participant NTG surveys, estimation of market effects, and estimation of savings attributable to codes and standards support. Taken together, these four topic areas identify program-driven savings in programs and markets in areas that overlap and provide different explanations for the net savings.

From 2016–2018, the following 12 studies have been supported in the areas of top-down, market effects, NTG, and Codes and Standards.

1. Top-Down Modeling Extended Methods Review
2. NTG Methodology Research
3. CCSI Evaluation of Classroom Trainings
4. CCSI Commercial Code Compliance Documentation Assessment
5. Immediate Surveys for the CCSI Evaluation 2018
6. C&I New Construction CCSI Attribution
7. Residential New Construction CCSI Attribution
8. Stretch Code Market Effects Study
9. Results of Spring 2016 HVAC Manufacturer Panel Maintenance and Pilot Data
10. Residential HVAC Market Share Estimates
11. Lighting Distribution Modeling
12. C&I Upstream HVAC Heat Pump Program NTG and Market Effects Study (includes market effects components)

NEIs include effects beyond energy savings that are attributable to energy efficiency programs. Examples of NEIs include reduced labor or non-labor O&M costs, health, and safety. The goal of NEI studies is to provide guidance to the EMC by quantifying participant NEIs associated with various measures through residential programs. The four studies below have been completed or are in process.

1. Low-Income Single-Family Health- and Safety-Related NEI Study
2. NEI Framework Study
3. Low-Income Health NEI Study
4. Low-Income Multi-Family NEI Study

The Program and Portfolio Marketing area has completed several research activities to evaluate the statewide marketing of energy efficiency programs since 2016. The primary evaluation activity was a series of tracking surveys with residential and commercial customers. The surveys measured customer awareness, knowledge, and associations with the Mass Save brand and the effectiveness of marketing activities. In 2017, the Massachusetts energy efficiency PAs implemented the seventh year of a statewide marketing campaign, under the trademark of Mass Save®. During this planning period, two studies have been completed or are in progress.

1. 2016 Massachusetts Statewide Marketing Campaign: Post Campaign Report
2. 2017 Massachusetts Statewide Marketing Campaign: Post Campaign Report

The Customer Profile Report serves as the vehicle to aggregate and summarize the account- and project-level details contained in the PAs' evaluation database. The Customer Profile report allows the PAs to evaluate how their standardized

data compares to other PAs' standardized data and to data for the state as a whole. The following three Customer Profile studies below have been completed.

1. 2015 C&I Customer Profile
2. 2016 C&I Customer Profile
3. 2013–2015 Residential Customer Profile

DR is a relatively new area of focus for the PAs and, while it is within the statewide EM&V framework, current programming efforts are focused mainly on individual PA demonstrations, so each of the studies to date are mainly PA-specific. EM&V efforts are focused on supporting program development and working with the DR EM&V subcommittee to ensure that findings are shared. In the next program cycle, it is possible there will be more statewide programs, in which case EM&V efforts will more likely resemble current statewide energy efficiency efforts. Four DR studies have been completed from 2016 to 2018.

1. Evaluation Report for Cape Light Compacts 2016 DR Demonstration Offering
2. 2016 Residential Wi-Fi Thermostat DR Evaluation
3. 2017 Seasonal Savings Evaluation
4. 2017 Residential Wi-Fi Thermostat DR Evaluation

7.3 NEAR-TERM PRIORITIES

Over time, program implementers have turned increasingly to integrated-programming efforts that are not specific to either customer sector. Examples include community-based programs, umbrella marketing, and integrating behavioral aspects into existing programs. The SCC research area has been the focal point for evaluation of these efforts. The PAs anticipate leveraging research in the SCC area to help increase program effectiveness and meet aggressive savings goals.

The near-term priorities for SCC are as follows:

Non-Energy Impacts (NEIs):

- Understanding how to best communicate and market NEIs.
- Updating and expanding the C&I Retrofit and New Construction NEIs studies to other measures and characteristics.
- Completing the low-income multifamily health study.
- Quantifying additional market-rate multifamily NEIs.

Program and Portfolio Marketing:

- Understanding the success indicators for energy-efficiency marketing efforts. Is Mass Save effective? Possible indicators include brand awareness, program participation, and energy savings. What is the appropriate timeline for moving from simple customer awareness of the Mass Save brand to energy-efficient action?
- Understanding how PAs should define customer segments. Should it be by demographics, attitudes, community?

NTG and Market Effects:

- Understanding how to use findings from NTG and market effects studies for program planning and design.
- Updating baselines: How do baseline levels of efficiency of energy-using equipment affect NTG and market effects? How do non-energy efficiency market trends affect baselines? Should upstream impacts be measured comprehensively?
- Studying market effects for other types of equipment besides HVAC and lighting.

- Understanding changes in new construction market, including the opportunity to understand program influence on low-energy buildings.
- Assessing the degree to which more consistent methodologies should be developed for self-reported residential NTG and algorithms/methods specific to Massachusetts.

Codes and Standards:

- Establishing a framework for the evaluation of PA influence in advancing state and/or federal standards for high efficiency equipment
- Determining of program viability and evaluability.
- Determining opportunity for Regional Collaboration Effort to spread the cost.

7.4 LONGER-TERM PRIORITIES

This section intentionally blank for the April draft. Content will be included for the October version.

7.5 PLANNED RESEARCH AND STRATEGIC ISSUES

This section intentionally blank for the April draft. Content will be included for the October version.

A. RESIDENTIAL STAGE ONE PLANS

This section intentionally blank for the April draft. Content will be included for the October version.

B. C&I STAGE ONE PLANS

This section intentionally blank for the April draft. Content will be included for the October version.

C. SCC STAGE ONE PLANS

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D. STAGE ONE TEMPLATE

- Study Name:** Clear descriptive title as to what the study is
- Study Champion:** Each study will be assigned a supportive Study Champion to promote and justify moving forward with the study. This person does not necessarily need to be the study lead. Can be either PA Evaluation Staff or EM&V Consultant
- Research Area:** Defines which Research Area will complete the Study
- Type of Study:** Baseline, Cost, Impact, Market Characterization, Market Effects, Measure Life, NEIs, NTG, Process,
- Study Lead:** Person responsible for leading the study on behalf of the PAs. This person will work with the evaluation team on keeping the study moving forward to meet deadlines and respond to questions that do not need approval from all PAs. Normally, this is "TBD" until after approval of the Stage 1 plan and would be PA Evaluation Staff.
- Prioritization:** Overall Score from Prioritization Framework
- Applicable Fuel(s):** Electric/Gas/Electric + Gas/Oil/Propane

Underlying Program/Initiative:

Overall Study Goal:

This section should describe the goals and objectives that define targets for your research in a clear, concise manner that is understandable to the reader. It should be defined in terms of goal(s) and the expected final product, result, or application of the process. This section should be high level, followed by a succinct list of the research questions the study is intended to answer.

Value of Study:

This section should define the audience in an effort to align the study with the defined need. The section includes incorporates input from program staff to ensure need is adequately addressed. This section should explain what the EMC will learn from the study, as well as how and why it will help the PA's implementation and/or evaluation groups. Studies need to make sense and not duplicate of work that has already been/or being done. What are the risks (if any) to the PAs if this study is not done?

High-Level Description of Approach/Methodology:

The methodology and approach should describe in detail how the study will be conducted and the requirements of the project. It should also include the method to be used in performing the various tasks, such as survey work and on-site visits, as well as what specific kinds and age of data the study will need from the PAs. It is also important to note whether the study involves novel or untested methodologies, how to implement the study, and why it is being proposed. Tasks will be written in a clear, concise manner so that the reader will understand what they will learn from the study and why it will help inform programs. In addition, the EMC wants to be clear how the study results will be applied to the programs. This section should be a half page or less.

Implementation Review:

This section is to affirm that we have given implementation a chance to review. Implementation will have one week to respond or provide comments. If comments are received, we will incorporate the comments into the plan; otherwise, we will move forward with the plan as is.

Date sent to implementation: _____ Date comments due: _____

Budget: _____ High Level Estimate

Timeline: _____ Anticipated start and completion dates

E. PRIORITIZATION FRAMEWORK

Indicator	Type	Definition	Scoring Definition: Scale of 1-5	Weight Type		
				1*	2*	3*
Magnitude of Savings (kWh, Therms, or MMBtu-Oil)**	Relevance (Quantitative)	Percent of annual sector savings (kWh, Therms and/or MMBtu***) for most recent year from Mass Save data.	1: <1% of sector 2: 1%–<3% 3: 3%–<5% 4: 5%–<10% 5: =>10% For kWh/MMBTU: NA allowed for SCC, Gas and Demand Response studies; For Therms: NA allowed for SCC, Electric, DR, and Oil studies	10	5	0
Magnitude of Savings (kW-S)	Relevance (Quantitative)	Percent of annual sector savings (kW) for most recent year from Mass Save data.	1: <1% of sector 2: 1–<3% 3: 3%–<5% 4: 5%–<10% 5: =>10% NA allowed for SCC, Gas, and Oil	6	3	10
Age of Most Recent Study	Relevance (Quantitative)	Age of most recent study (same program/same type), based on the year the study was finalized.	1: 2018 2: 2017 3: 2016 4: 2015 or before 5: No prior study NA allowed for Gas	7	4	7
Expected/Potential Future Savings Trend	Relevance (Qualitative)	Expected change in percent of sector savings for study period.	<i>Score from 1 to 5 with following guideposts:</i> 1: Sharply declining 3: Similar to current levels 5: Sharply increasing (no NAs)	9	7	9
Market/Technology/Baseline Shifts	Uncertainty	Expected or recent market, technology, or baseline changes that would lead to need for new research.	<i>Score from 1 to 5 with following guideposts:</i> 1: No market/technology changes 3: Some changes 5: Substantial changes (no NAs)	9	9	9
Program Implementation Changes	Uncertainty	Recent or anticipated changes in program implementation that lead to need for new research (e.g. new program or new delivery mechanism)	<i>Score from 1 to 5 with following guideposts:</i> 1: No program changes 3: Some program changes 5: Substantial program changes, or new program (no NAs)	5	10	5
Impact Factors Uncertainty	Uncertainty	Concerns about uncertainty in impact factors that lead to need for new research (e.g., adjusted gross savings, deemed savings, realization rates, NEIs)	<i>Score from 1 to 5 with following guideposts:</i> 1: Very Low uncertainty (very high confidence) in current value 3: Some uncertainty 5: High uncertainty or no existing value NAs allowed for process and market characterization studies	7	5	7
Regulatory Requirement/Political Sensitivity	Priority	Regulatory or political needs for conducting a study	1: No requirement/sensitivity 3: Medium priority requirement/ sensitivity 5: High priority requirement/sensitivity (no NAs)	6	6	6
Implementation Requests	Priority	Requests from implementation team or other internal organizational need	1: No request 3: Medium priority request 5: High priority request (no NAs)	6	6	6

*Weight 1 used for the following studies types: baseline, impact, cost, market effects, measure life, NEIs, and NTG. It is also used for combination studies if a market characterization or process component is integrated into the study. Weight 2 used for market characterization and process. Weight 3 used for DR studies.

**If both gas and electric, then maximum rating is used for savings magnitude. Oil studies are rated with electric studies, therefore magnitude of savings (% of sector MMBtu) is input in electric column. User may combine both electric and oil into MMBtu if relevant.

*** Scoring will be updated and reassessed as needed, in particular for changes to savings metrics for 2019–2021.